

Special edition



# Environment

of Saint-Petersburg

POLICIES

CIRCULAR ECONOMY

SUSTAINABLE DEVELOPMENT  
and COOPERATION

SYMBIOSIS CASES

OPPORTUNITIES and PERSPECTIVES

TOPIC:

## BALTIC INDUSTRIAL SYMBIOSIS



BALTIC  
INDUSTRIAL  
SYMBIOSIS



Interreg  
Baltic Sea Region



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Susanne Boesen



Kirill Soloveichik

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**Susanne Boesen,  
Project Manager Symbiosis Center Denmark  
Kalundborg Municipality**

As the project manager of the BSR Interreg project Baltic Industrial Symbiosis (BIS), it is a great pleasure that this edition of 'Environment in St. Petersburg' addresses the topic: INDUSTRIAL SYMBIOSIS. Not only is this special kind of partnership very fascinating reading, as the various articles in this magazine show so well – Industrial Symbiosis also holds tremendous potential to create lasting improvements!

Implementing industrial symbiosis gives us a unique opportunity to develop sustainable communities where jobs and economic growth are created along with environmental improvements. In Industrial Symbiosis public-private partnerships and investments are created with the dual purpose of realizing economic and environmental benefits. This happens through resource exchanges that improve efficiency in companies and at the same time benefitting local resilience. Although several sectors of society have started to move towards sustainability there is still a large amount of secondary resources in the form of byproducts from industries and society that remain under-utilized or falsely defined as 'waste'. That includes everything from energy, water, ingredients and materials in various forms. Through the smart specialization that Industrial Symbiosis represents, one company's 'waste' becomes another company's primary resource.

In order to succeed in spreading the 'symbiotic mind set' to many more large and small companies, it is imperative that we collaborate and exchange experiences across regions. Every part of society can contribute, be it private companies, public authorities, knowledge institutions, universities or industry organizations, each with their knowledge, network and experiences.

The BIS project partners cooperate across regions to develop new business models by screening and mapping the resource flows in companies. The project sets up platforms for dialogue and policy learning and training for Industrial Symbiosis practitioners. This combination of a theoretical and practice-based approach builds knowledge and capacity among the involved actors.

With this magazine we would like to share our experiences and show the opportunities that lie ahead. I hope that you will enjoy the stories from different parts of the Baltic Sea Region and find inspiration in the examples of what Industrial Symbiosis can look like.



**K.A. Soloveichik,  
Chairman of the Committee  
for Industrial Policy, Innovations  
and Trade of St. Petersburg**

**I welcome the team and readers of the special issue of the Environment of St. Petersburg journal dedicated to industrial symbiosis and demonstrating the best practices in the application of the models of sustainable development and instruments of circular economy in the Baltic Sea region.**

The Committee for Industrial Policy, Innovation and Trade of St. Petersburg develops and implements the state policy of the city, coordinates the activities of the state executive authorities in the sphere of industrial and innovation policy.

Industry is and has been the basis of the economy of our city, and today a necessary condition for its sustainability is the maximum efficiency of use of all types of resources.

The use of green technologies is one of the important challenges faced by various industries, power engineering and urban economy of St. Petersburg.

In this issue you will be able to get to know examples of cooperation of companies of various orientation for using the waste or overproduction of one enterprise as a resource for another one. Industrial symbiosis involves the use of secondary resources, promotes the development of new businesses, forms new financial models and increases the competitiveness of both individual enterprises and the region as a whole.

I am sure that the development of green technologies will provide a worthy contribution of enterprises to the sustainable development of our region.



# CBSS' work on sustainable development of the Baltic Sea Region

The Council of the Baltic Sea States is an overall political forum for regional cooperation. It consists of 11 Member States (Denmark, Estonia, Finland, Germany, Iceland, Latvia, Lithuania, Norway, Poland, Russia & Sweden), as well as a representative of the European Union, it supports a global perspective on regional issues.



Daria Akhutina, senior Advisor,  
Head of Priority Area: Sustainable  
and Prosperous Region  
Council of the Baltic Sea States  
(CBSS)

CBSS operates through three long-term priorities: Regional Identity, Sustainable & Prosperous Region, Safe & Secure Region.

The prior task of the Priority Area Sustainable & Prosperous Region is to develop the Baltic Sea Region (BSR) as a model region of sustainable societies able to manage and use resources efficiently. It serves to improve the overall competitiveness of the BSR through sustainable economic growth and labour markets, research, and innovation, strengthening capacity to adapt to the climate change, promoting sustainable and green technologies to protect ecosystem and biodiversity of the Region. The work of CBSS in this field includes politically and practically translating and localizing the UN Sustainable Development Goals and the Paris Climate Agreement to the BSR, as well as mainstreaming of sustainable development at all levels and in all policy sectors.

The outgoing point for this work is to provide a support for international cooperation in the Region, which allows to save resources by jointly solving common problems.

To reinforce the cooperation the CBSS has established a number of the expert groups, maintaining the cross sectorial approach by

diverse membership, consisting of ministerial representatives, academia, businesses as well as major pan-Baltic organisations.

A large part of the CBSS' efforts on BSR' sustainability is done within the framework of the United Nations Sustainable Development Goals, with the transition towards a competitive and green economy, which is still an ongoing process. This also includes the research and science area, in which the CBSS engages in several European projects to boost research and innovation excellence in the region.

The CBSS Expert Group on Sustainable Development (EGSD) includes the officials from relevant ministries of the CBSS Member States, as well as representatives of the pan-Baltic organisations as HELCOM, VASAB, BSSSC and Nordic Council of Ministers. Together, the Expert Group has gained more than 20-years of experience in working on sustainability policies within the Baltic Sea Region through knowledge-sharing, outreach, and project work.

There are no borders in nature and the countries in the Baltic Sea Region face the same specific risks and challenges - most of them can only be solved if we work together.

We believe that all levels of society must share responsibility and participate in finding sustainable solutions. That is why

we are continuously building purpose-oriented partnerships, commissioning studies, conducting trainings, facilitating projects, and providing policy input to strengthen sustainability practices and climate adaptation processes. Currently, our main goal is to translate the UN Sustainable Development Goals into local objectives for the Baltic Sea Region. More than 30 publications have been carried out recently by EGSD, just to mention, the Baltic 2030 Bumps on the Road: How the Baltic Sea States are performing on the SDGs (currently under review), the Baltic 2030 Action Plan: Realizing the Vision, The role of local governments adapting to the climate change in BSR.

**The priority of the incoming Lithuanian presidency in the EGSD (2020-2021) will be to support the transition of the BSR towards a low carbon economy with a particular focus on sustainable and green transformations of the resource intensive industry sectors.** With this priority area, Lithuanian Presidency will touch upon such challenging SDG's in the BSR as SDG 12 – responsible consumption and production; 13 – urgent action to combat climate change and its impacts; 15 – life on land and SDG 8 – decent work and economic growth. Lithuania will organise a conference on sustainable and green transformations of the resource intensive industry sectors.

Implementation of the SDG13 Climate Action has a special attention in BSR, as alignment with the European Green Deal and the objective of making the EU climate-neutral by 2050 requires that action to address climate change and promote sustainable development are integrated into the Strategy as a whole. Therefore, all expert groups and initiatives

*The priority of the incoming Lithuanian presidency in the EGSD (2020-2021) will be to support the transition of the BSR towards a low carbon economy with a particular focus on sustainable and green transformations of the resource intensive industry sectors.*

lead by CBSS shall give due regard to EU climate policy objectives. Strengthening the efforts on climate-proofing, resilience building, prevention and preparedness is crucial, and the work on climate adaptation should continue to influence public and private investments.

The CBSS is a coordinator of the Horizontal Action Climate of the EUSBSR and disseminates climate mitigation and adaptation data of regional importance at website [www.haclimate.eu](http://www.haclimate.eu) as well updates BSR region climate adaptation data at European portal Climate Adapt.

The achievement of the SDGs for the Baltic Sea Region is a prior task within the existing microregional strategies in the Region. The European Union Strategy for the Baltic Sea Region and the Strategy for Socio-Economic Development of the North-West Federal District of the Russian Federation- are the first macro-regional strategies developed in Russia and the European Union. Now both strategies are going to be updated. The CBSS during many years supports the interaction between two strategies, mainstreaming the Sustainable Development Goals (SDGs) as a common framework for cooperation. CBSS together with Russian and EU partners facilitates the discussion on how macroregional strategies can complement each other for achieving SDGs and what are the strategic areas of common

concern where the cooperation among stakeholders, coming both from EU and non-EU, can bring the added value in achievement of SDGs for the Baltic Sea Region.

The CBSS is looking forward to continuing this dialogue and encourage therefore all actors, active in the field of SDG's implementation and willing to contribute to the sustainability of the BSR are most welcome to join us! 🌍





# About Baltic Industrial Symbiosis

## Summary of the project

Overall, the project will through PRACTICE-BASED COOPERATION build knowledge and capacity among innovation actors on approaches to support and accelerate Industrial Symbiosis development - and with that BUSINESS/SME DEVELOPMENT through increased cost-effectiveness in production. The project will point a large number of companies (including SMEs) towards new business opportunities, new value chains and new green business models.

More generally the project will furthermore develop the KNOWLEDGE BASE for the current and next generation Industrial Symbiosis practitioners. One key component is this effort will be an Industrial Symbiosis peer-to-peer exchange programme whereby practitioners from one symbiosis will work for shorter intervals of time in a neighbouring symbiosis. Both visitor and host will benefit from experience exchange and mutual learning. A further knowledge building effort will take places through training programmes for Industrial Symbiosis practitioners.

Finally, the project will BUILD POLICY CAPACITY on Industrial Symbiosis development. To facilitate policy learning a “BSR Indus-

trial Symbiosis Council” will be established. It will be composed of, and serve, local, regional and national policy makers. The Council will become a resource for good policy practices on Industrial Symbiosis which will benefit stakeholder also from beyond the BSR, as well as broader policy agendas such as Europe 2020. In neighboring Estonia, Latvia, Lithuania, Poland and Russia the project will implement a BSR Industrial Symbiosis Roadshow toward the end of the project - to directly encourage partners there to also commence Industrial Symbiosis efforts.

## Summary of the partnership

The Project Partners are from six countries with five local and regional proponents of Industrial Symbiosis initiatives in Denmark, Finland, Norway and Sweden (Kalundborg Symbiosis, Næstved Resource City, Digipolis, Paper Province, and Trøndelag County Council) and a Russian partner interested in establishing a new industrial symbiosis (Tyreman Group). Symbiosis investigation and development in the project is supported by three universities (Linköping University, Roskilde University and Gdansk University of Technology), a governmental business development and inno-

vation authority (the Swedish Agency for Economic and Regional Growth), a cluster organisation (The St. Petersburg house property owners association) and a local body governed by public law (SC Mineral).

Associated partners include two local and regional proponents of Industrial Symbiosis initiatives (Eyde Cluster and Hamburg Institute of International Economics), regional and national authorities (SITRA, Voivodeship Inspectorate of Environmental Protection in Gdansk and The Malopolska Region), two intergovernmental organisations (Nordic Council of Ministers and Nordregio) and an innovation driver (Foundation of Innovative Initiatives).

The project Lead Partner, Symbiosis Center Denmark, originates in the Kalundborg Symbiosis where Industrial Symbiosis development began in the 1970s. Symbiosis Center Denmark aims to facilitate capacity building and to inspire more public and private partners to engage in Industrial Symbiosis development efforts. ©



## BALTIC INDUSTRIAL SYMBIOSIS

Promoting industrial symbiosis, a concept for sustainable regional development, across the Baltic Sea region

### ABOUT THE PROJECT

Industrial symbiosis means to connect companies in order to use one company's waste as a resource for another company. The project establishes peer-to-peer exchange for industrial symbiosis practitioners. It develops new business and finance models and sets up the BSR Industrial Symbiosis Council as a platform for dialogue and policy learning.

DURATION: Jan 2019 – Jun 2021

TOTAL BUDGET: EUR 2.5 million

EUROPEAN REGIONAL DEVELOPMENT FUND:

EUR 1.3 million

NORWEGIAN FUNDING: EUR 0.2 million

ENI + RUSSIAN FUNDING: EUR 0.34 million

SymbioseCenter.dk/BIS

LEAD PARTNER: Symbiosis Center Denmark, Kalundborg Municipality (DK)

PROJECT PARTNERS: Kalundborg Symbiosis (DK), Næstved Municipality (DK), The Paper Province economic association (SE), Digipolis (FI), Trøndelag County Council (NO), Tyreman Group LLC (RU), Swedish Agency for Economy and Regional Growth (SE), Gdansk University of Technology (PL), Linköping University (SE), Saint-Petersburg Cluster for urban environment (RU), Saint-Petersburg State Unitary Enterprise “Specialized firm “Mineral” (RU) and Roskilde University (DK)

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# Mapping current policies supporting industrial symbiosis development the Baltic Sea region

## In the frame of Baltic Industrial Symbiosis project of Interreg Baltic Sea Region program.

Industrial symbiosis (IS) specifies constellations where industries, utilities and other stakeholders utilise each other's resource and side-streams in a co-dependency and with mutual benefits. Industrial symbiosis can play a role in a circular economy and can offer significant resource efficiency and climate benefits. Policies can, if appropriately designed, create the right framework conditions for industrial symbioses to emerge and thus unlock the potential of IS.

This review is carried out by PlanMiljø for the Baltic Industrial Symbiosis project of Interreg Baltic Sea Region, explores what policy measures that either directly or indirectly affect the establishment and viability of IS in selected countries surrounding the Baltic Sea – Denmark, Finland, Norway, Poland, Sweden and the Russian Federation. The review then identifies what more can be done by national, regional and local governments to promote IS in the region. The study has been carried out through a literature review and interviews with experts and policy-makers from all six countries. Final report can be found here: [https://symbiosecenter.dk/wp-content/uploads/2020/06/BIS-PlanMiljø-Final-report-on-policies-impacting-industrial-symbiosis\\_d02.pdf](https://symbiosecenter.dk/wp-content/uploads/2020/06/BIS-PlanMiljø-Final-report-on-policies-impacting-industrial-symbiosis_d02.pdf).

The study finds that, with the exception of Finland and Poland, national governments have not explicitly addressed industrial symbiosis at a strategic level. Both Finland and Poland include IS in their circular economy strategies.

National circular economy strategies and policies have been adopted in the region in recent years, but these do not in general recognise the potential of IS. In the Russian Federation and Poland, the focus on CE tend to be limited to targets, whereas in the Nordic countries the governments offer funding and to a varying degree capacity- and relation building measures that are indirectly in support of IS.

A number of functioning industrial symbioses do exist in the region, particularly in the Nordic countries, but many of these have been established by businesses without direct government assistance. In these cases, government may have had an influence, but has not been the initial driver. These frontrunners of IS have subsequently acted as centres for learning and capacity, and in many cases, this bottom up-development has later been supported and developed further by governmental authorities.

Industrial symbiosis should be included in national circular economy strategies to increase awareness and to ensure national measure in

support of IS. Likewise, the agenda on resource scarcity and on climate change offer great potential to promote IS as a tool to ensure resource efficiency and decrease the carbon footprint from production.

In the Nordic countries, some environmental regulations are perceived by practitioners as hindering industrial symbiosis and the circular economy. Insecurity about regulation can also inhibit investment in IS. Environmental regulation in the region needs to be assessed to ensure that it is not inhibiting the recirculation of resources, and in general governments need to support the interpretation of regulation. In addition to long-term funding and supportive regulation, governments can play a key role in establishing a mapping of all side-streams to assist in the identification of potential exchanges.

In the Nordic countries, local and/or regional policies in direct support of IS are typically found in the region or municipality within which an IS cluster has already been established. There are also examples of business development activities

that support industrial symbiosis. The local actors with mandate to support IS constitute a great potential to support companies in IS activities ranging from capacity building, screenings and network facilitation. At the regional and local level, only one policy in support of IS could be found in the Russian Federation and Poland respectively. IS is in general inhibited in these countries by a lack of cooperation and trust between businesses. Here, local and regional governments would do well to focus on information and network building to create a culture of cooperation among companies.

The following concrete recommendations are made for policy to support IS:

1. Communicate the potential of IS in order to put industrial symbiosis on the national political agenda as part of the focus on circular economy
2. Include industrial symbiosis in national circular economy strategies
3. Place the responsibility of promoting IS with a single government agency
4. Offer long-term funding earmarked for industrial symbiosis
5. Create incentives for industrial symbiosis through taxes and subsidies
6. Identify and remove regulatory barriers where this does not compromise environmental protection
7. Increase regional or local

level capacities to support industrial symbiosis and inform on the possibilities of IS when in dialogue with businesses

8. Support companies in carrying out screening of side-streams

9. Build up a national digital platform mapping the side-streams of all companies

10. Establish a national network on industrial symbiosis

11. When having identified companies that can potentially constitute an IS, facilitate match-making

12. Increase coordination between national and local levels of governance

### Conclusion:

The study has mapped policies in support of Industrial Symbiosis in the Baltic Sea Region at local, regional and national level and further discussed commonalities in policy challenges and provided recommendations on how to address these. The policy mapping is not exhaustive, but should rather be seen as examples of policies that can support or inhibit IS. Many environmental policies affect industrial symbiosis, exactly which policies that an IS is subject to depends on the side streams being exchanged.

In general, industrial symbiosis has received relatively little focus from national governments. However, some policy instruments can be found that address IS direct-

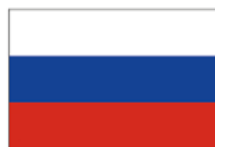
ly or indirectly including funding, cluster and innovation support. National governments should include IS in their circular economy and/or green growth strategies, ensure long-term funding and offer economic incentives for companies to engage in industrial symbiosis. National governments can play a further key role by streamlining environmental regulation, and waste regulation in particular, to ensure that it supports rather than inhibits a circular economy while not increasing risks of environmental pollution.

Local and regional government structures vary across the countries in the Baltic Sea Region, where few municipalities, regions and business hubs offer activities that are in support of IS. The actor with the mandate of business development should build up networks and capacities within and among companies. Capacity building can include awareness raising, information and screenings, while relation building can include networking and match-making facilitation.

The Nordic countries possess much of the business culture and organisational structures to carry out these activities, it is rather question of political priority. In Poland and the Russian Federation more initial steps need to be taken to develop the right systems and a culture of collaboration across companies to support industrial symbiosis. ☺



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# Circular Economy: possible reality or unattainable future?

Elena Shadrina, PhD, Associate Professor, National Research University Higher School of Economics, Perm, expert of Circular Public Procurement Project, INTERREG

Irina Aleynikova, Deputy Director for Centre for Applied Research and Development, National Research University Higher School of Economics, St. Petersburg, expert of Circular Public Procurement Project, INTERREG

With the deficit of natural resources and strikingly rising amount of waste transition to the circular economy is the solution that can lower the negative effects on the environment, optimize the quantity of resources used by businesses, provide companies with new more sustainable business models and stimulate the appearance of new products and services on the markets. For this transition to happen the new technologies, new services, but most importantly, new conscious identification of needs are needed. What are the main principles of circular economy, what business models can be used to implement those principles, what does business think about circular economy and are the customers ready for it? We will discuss in this article.

A closed-loop economy or circular economy is an economic and production system, aimed at the rational consumption of raw materials and restoration of resources, which then circulate again and again in the closed loop. In case of traditional linear economy the production and consumption cycle starts with extraction of raw materials and ends with waste disposal. The idea of a circular economy is to minimize the quantity of raw materials consumed, maximize the efficiency of resources and products usage, reduce the volume of generated waste and landfills area.

The existing linear model of production and consumption is not ideal. According to Global-FootprintNetwork<sup>1</sup> today humanity consumes 50% more resources than could be regenerated, thus the raw materials' deposits are bound to run out at a certain point in time. This trend affects businesses: markets become increasingly unstable, prices of raw materials rise. In addition, this trend negatively affects the environment through climate change, deterioration of natural habitats

of various species and waste generation.

In case of Russian Federation while the scarcity of natural resources cannot be considered an immediate problem, the rapid growth of waste and its disposal certainly should be considered as one. In 2018 the volume of generated waste amounted to 7.2 billion tons, including 54 million tons of communal solid waste (CSW). At the same time the rate of the CSW processing remains low: in 2017 only 7.8% of CSW have been processed, while in European countries up to 99% of CSW are being processed.

According to the Ellen MacArthur Foundation, the transition to the principles of circular economy in Europe could lead to saving of 300 billion worth of resources and creation of 2 million new jobs.<sup>2</sup> Accordingly, in Russia the transition to the principles of circular economy could have an environmental and economic effects.

The idea of the circular economy is not only to reduce waste, but also to modify the entire value chain of products: to use designs and technologies that minimize

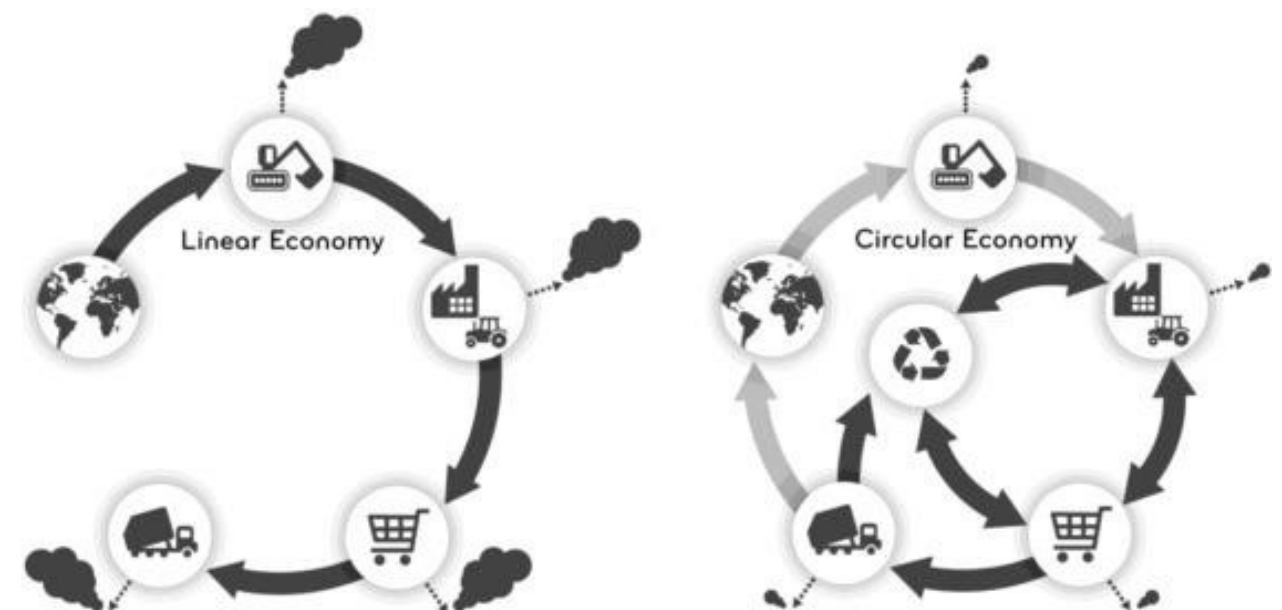
the consumption of new materials and energy resources, increase the share of recycled materials, to create the products that can be disassembled, individual parts of which can be repaired or exchanged (cradle to cradle products) and the product itself can be fully recycled at the end of its life cycle.

Businesses within the circular economy can use the following approaches to production organization:

**1. Transition to renewable and reusable resources.** Companies switch to recyclable, biodegradable and renewable resources. For example, in Groupe Renault vehicles up to 95% of parts are rebuilt and reused after the vehicle's useful life has ended. The company 'Umnaya SREDA' from Sevastopol produces outdoor furniture from recycled materials, processing various kinds of plastics. The Malmö municipality (Sweden) in 2019 made a decision to procure only restored ('non-new') furniture.

**2. Resource recovery.** This model is based on the idea that at the end of the product lifecycle either product itself or its indi-

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vidual parts are returned to the production stage. This is achieved through innovative recycling technologies that allow to turn waste into resources. For example, Apple dismantles its iPhones into individual parts, which then are recycled for reuse. 'Sixinch' company from Moscow with the help of 'FoamCoating' technology produces furniture and décor elements with vandal-resistant coating. At the end of their useful lives the products are subject to complete recycling for reuse. Timberland designed the boots that at the end of their life cycle are disassembled into leather, metal, rubber and textiles and 100% of these individual parts are being processed.

**3. Extension of product life cycle.** Renovation, maintenance, modernization and restoration extend the product life cycle. The product maintains its economic value as long as it can be restored or renewed. At the end of its useful life for one user the product can be sold to another user for further exploitation. For example, the outdoor manufacturer Patagonia gives

a lifetime warranty on all of its products, sends out repair kits, and at the end of the product useful life buys it back from the customers for processing. 'Spasibo' company from Saint Petersburg extends clothing life cycle by collecting, sorting and reselling clothes.

**4. Exchange and shared usage** of any given product, logistics, databases by multiple companies allows to enhance cost-effectiveness of a product. This is a very promising direction of the circular economy. The volume of the 'sharing economy' in Russia in 2019 increased for 50% over the year and reached 770 billion rubles<sup>3</sup>. Prime examples of businesses base on shared usage are BlaBlaCar, Uber, Airbnb. In Russia, the largest part of sharing economy consists of customer to customer (C2C) sales and services offered by freelancers. According to PwC experts the estimated revenues of the global sharing economy have the potential to increase up to \$330 billion by 2025.

**5. Buying a specific product function instead of owner-**

**ship of a product.** Consumers do not buy the product, but rather rent or lease the product or buy a service, thus motivating the producer to create high quality durable products and extend their life cycle to maximum. For example, Xerox provides its copying machines for rent instead of selling them, thus providing 100% return of equipment for further recycling.

For the transition to circular models to happen to following factors should be in place: government support, willingness and readiness of businesses, customers' desire to switch to circular products.

Russia has adopted several strategic documents in ecological sphere. The national project 'Ecology' introduces the notion of 'best available technologies', aimed at acquiring control over resource conservation and environment protection. The ongoing reform of waste management aims to address the issues of waste reduction and disposal, but in its current state it is less focused on the development of circular economy. Thus, with the state ecological policy in



place, the task of transition to the principles of the circular economy is not officially set.

In order to find out the businesses opinion concerning transition to circular economy a series of interviews has been conducted. The survey revealed that the level of awareness about circular economy and its principles varies across business representatives. Companies, operating in chemical, oil and gas industries, whose activities are closely connected to raw material extraction and thus are associated with higher risks for environment, clearly understand the principles of circular economy. These principles are embedded in the strategies and action plans of such companies. For the companies mentioned implementation of circular business models is rather a matter of reputation, since compliance with the principles of sustainable development affects the investment attractiveness. Circular economy principles are also applied in local subsidiaries of international holdings, since within these companies the rules are set by the parent companies.

Small enterprises are in general less interested in introduction of circular business models. This could be explained by the fact that WHLE already operating in difficult economic conditions for the small enterprises it is crucial to stay afloat, and there are no available funds for the conversion of production chains. The lack of a stable demand for circular products also does not facilitate the transition to circular business models.

The lack of unified state policy was unanimously named by busi-

ness representatives as the main obstacle for introduction of circular economy, together with the lack of understanding of importance of circular economy by consumers and underdeveloped waste recycling infrastructure. According to business representatives the factors that could contribute to transition to circular economy are the possibility of obtaining economic benefits, the presence of stable demand for products, governmental support, changes in technical regulations, the presence on the market of organizations supporting the production cycle closure technologies.

Consumer readiness to switch to circular products was studied on the example of furniture consumption. The survey showed that only a part of consumers on the B2B and B2C markets use the furniture, produced from recycled materials (33% and 50%, respectively), less than half of B2B respondents claimed to use the furniture restoration services. When buying furniture, the main selection criteria are low price (B2B), design (B2C) and durability (B2B and B2C), while only one fifth of the representatives of both markets use the restoration possibility and environmental materials as criteria. Nonetheless, it is gratifying to know, that both representatives of B2B and B2C markets expressed their readiness to buy restored furniture (81% and 84%, respectively).

In the sphere of public procurement, the circular criteria are still rarely applied. Criteria such as durability, maintainability, recycled materials, reusable packaging,

biodegradability, the use of the best available technologies, are used in approx. 5% of procurement procedures<sup>4</sup>.

Thus, the circular economy principles, though not being new phenomena, is not yet widely applied in Russian business practices. In European countries, meanwhile, there are a lot of successful examples of circular business models being used, allowing to reduce the amount of waste burned and disposed, to save on new resources and materials. Even partial transition to the principles of resource recovery, life cycle extension, waste minimization will allow to lower the ecological burden and keep the city green. Everything is possible. It is only required to look at ordinary things at a different angle and change the consumer behavior. The transition to resource saving and recovery technologies will happen faster if not only households and businesses, but also the government (in public procurement procedures), will start to apply the circular criteria. Where there is the demand – there will appear the supply.

<sup>1</sup><https://www.footprintnetwork.org>

<sup>2</sup>Ellen MacArthur Foundation. *Towards the circular economy*; Ellen MacArthur Foundation: UK. 2013.

<sup>3</sup> According to RBC <https://trends.rbc.ru/trends/sharing/5ddb-b3279a7947b-01be74c19>

<sup>4</sup> Research of circular criteria application in public procurements in Saint Petersburg in 2019 was conducted within the Circular Public Procurement Project, INTERREG



## Kalundborg Symbiosis

By Lisbeth Randers, Head of Secretariat, Kalundborg Symbiosis - BIS project partner

Situated in the beautiful Danish countryside, one hundred kilometres west from the capital, Copenhagen, you find a minor city with a little less than 20.000 inhabitants. The city is called Kalundborg, and if you stroll now the narrow streets of the old town encircling the magnificent church with five towers you can almost feel the breath of history.

Kalundborg has not only played an important role in Danish history back in ancient days of medieval times but is also today of significant importance for Danish economy, housing some of the largest industrial sites of the country. No doubt the deep-water harbour of Kalundborg defines the centre of growth, allowing many kinds of cargo to be shipped in and out every day. The Port of Kalundborg has five lineal kilometres of quays, as well as cranes and other equipment for freight handling, meaning a perfect infrastructure for rapid expedition of shipping operations.

But let us move from the idyl-

lic old town, trespassing the spectacular and vivid harbour area to move into the industrial zone. Or to be more correct, the industrial area since you side by side with the industrial sites find private houses, green fields, a small castle and even a private school. Taking good care of the environment is not only a textbook lesson here, but indeed also very much a question of having good relations to the members of the local community, a matter of good behaviour in the neighbourhood. This area has been a result of many years of organic development, where the local government, the municipality, has supported the growth

of industry as a targeted strategy called “The green industrial Municipality”. And the proximity and diversity of the companies around the bay have created the most beneficial framework for industrial symbiosis, defined as a local partnership on resources.

On the map you can see the eleven members of Kalundborg Symbiosis: Equinor Refining Denmark, Ørsted running the power plant Asnæsværket, Gyproc Saint-Gobain producing plasterboards for building industry, Novozymes producing industrial enzymes, Novo Nordisk producing insulin and other pharmaceuticals, Avista Green refining waste oil to lubri-



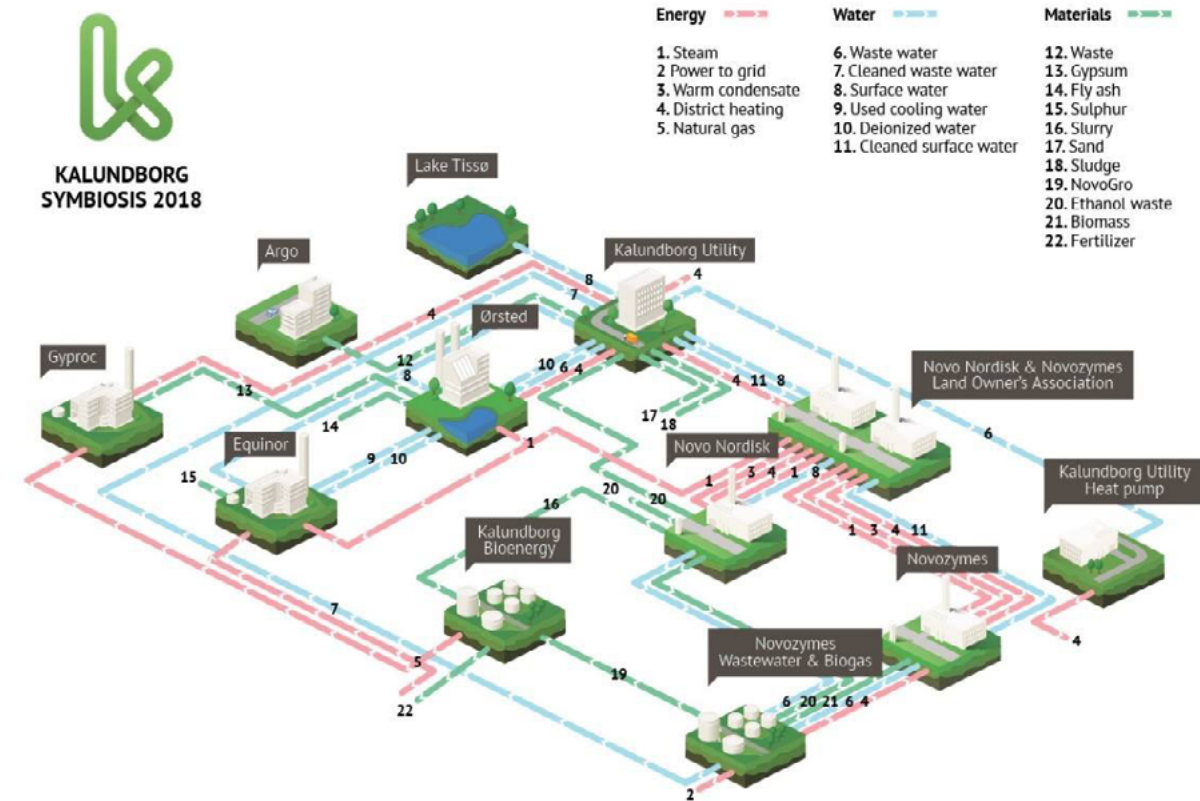


Kalundborg Symbiosis map

cating oil, Kalundborg Bioenergy producing biogas from fermentation slurry, Kalundborg Municipality, Kalundborg Utility providing water and district heating for the community, treating wastewater, Argo handling waste from 9 municipalities in the area, and Unibio transforming protein from natural gas. The members are cooperating with Biopro, a project supporting growth in green hightech start-ups.

Private and public companies are cooperating from the main principle, that a residue from one company becomes a resource at another, benefiting both the environment and the economy. Having a local partnership means that the companies can share and reuse resources, and that way they save money as well as minimize waste. The symbiosis creates local growth and supports the green transition, for instance replacing fossil fuels with renewable energy when it comes to steam production. Industrial symbiosis is an important tool in regard to circular economy, especially in areas of energy heavy industry, where volumes are high.

An example on local cooperation: Kalundborg Bioenergy treats fermentation slurry from the local biochemical plants and turns it into natural gas – a real good show case on how industrial waste is used as a resource in another company, not only transforming waste into energy, but also delivering fertilizer to the local farmers. The new built plant was opened in 2018, but soon a severe odour problem from the plant developed, causing the inhabitants in the area discomfort. The problem was eventually solved as a result from cooperation between the company, the suppliers and the municipality, so in September 2019 Kalundborg Bioenergy could invite the local community to visit the plant, to see and smell for themselves. Today there is no conflict with the inhabitants in the areal and good relations are restored, to produce natural gas continuously.



Since 1972 a total ecosystem has been built, covering three different types of streams:

Hence 635.000 tons of CO<sub>2</sub> is saved every year compared to a similar scenario with out cross sectoral cooperation.

Kalundborg Symbiosis is organized as a private association, running its own secretariat from membership fees. The organization has an ambitious strategy to become the world's leading industrial symbiosis with a circular approach to production. Working hard for the vision to transform into minimum ten new projects before 2025, new ideas and opportunities are being explored in different contexts. Kalundborg Symbiosis is for instance a partner in the project

Baltic Industrial Symbiosis (BIS), financed by Interreg, where experiences are being exchanged between the partners from different countries in Scandinavia and around the Baltic Sea to build up future network and capacity.

In addition to enlarging the local ecosystem, Kalundborg Symbiosis also wants to share the symbiotic mindset, to inspire others to be part of a symbiosis – or to design one in their own community. In 2018 the association received the prestigious Gothenburg Sustainability Award with the following motivation: As a pioneer in the field, Kalundborg Symbiosis has

shown the way for many other industrial clusters, inspiring businesses all around the world.

Let us revisit history, since building a resilient partnership is not something that is being doing overnight: to overcome challenges, changes in frame conditions and to have both short and long term perspectives on investments you need one essential ingredient in your partnership, namely trust. Trust in the fact that we can bake a bigger cake to share, if we do it together, leaving a bigger piece for each of us at the end of day.

Systems make it possible, people make it happen! ☺







# Industrial symbiosis - a short note on facilitation and capacity building

Ph.D. Per Møller, Head of Symbiosis Center Denmark

## Industrial Symbiosis

Symbiosis comes from the Greek *συμβίωσις* i.e. “living together”. In 1879, Heinrich Anton de Bary defined it as “the living together of unlike organisms”, and so the word symbiosis has been added to the pioneering and world famous Kalundborg Symbiosis, where the different partners, be it public or private, work in partnership realizing green circular business models - this is where one company's waste becomes another's resource - please refer to the article “Kalundborg Symbiosis” by Lisbeth Randers. When linking industrial production to symbiosis, it refers to any type of a close and long-term partnership interaction between two or more companies, be it *mutualistic* (all benefit but not necessary equally) or *com-*

*mensalistic* (not all benefit, but no one loses). The companies may be of the same or of different types, the latter being the most common case.

The symbiosis partnership most often is *facultative* (optional) i.e. that they can live independently, also without the partnership, but when they do, they gain a certain advantage. Only very seldom partnerships are *obligatory*, which means that one or more of the companies entirely depend on each other for survival.

Symbiosis is also classified by physical attachment and proximity. When the companies have physical union, it is called *conjunctive* symbiosis, and symbiosis in which they are not in union is called *disjunctive* symbiosis. Furthermore, one could distinguish between *ectosymbio-*

*sis* (operating on the “surface” of another) and *endosymbiosis* (operating inside another). Within the term proximity I like to distinguish between local, regional, national and trans-national symbiosis.

## Facilitation and capacity building

Whether it comes to initiating, developing or maintaining industrial symbiosis, facilitation is crucial to the success, be it short or long term.

The tasks and necessary skills of facilitation are many, and are best ensured by a team of experts within e.g. communication, natural science, engineering, business development, IT and design. These and more competences, do not all have to be readily available in the core team, but should be available within the partnership, or alternatively hired in on demand.

Key competence that must be present however, is skilled communication and the ability to motivate and strengthen the network within and around the partnership. For this to succeed there has to be a great deal of trust between the partners and the facilitator should always be aware of and respect the need for confidentiality, and a sudden need for the companies to continue the process on their own - e.g. discussing sensitive business details and contractual agreements. Having a local knowledge and close relations with the companies is of great importance to identify and realize symbiosis potentials, as technology “only” makes it possible, but it takes good people to make it happen!

Needless to say, it is so much easier to succeed with your local Industrial Symbiosis, once the partnership is in place and the first business models have been implemented. It takes time to develop this, and there is no such thing as a “one size fits all”, but much can be gained by connecting with already active and successful symbiosis examples. In this way, capacity building also transnational is important in order to facilitate implementation and development of urban and industrial symbiosis. As more mature symbiosis partnerships may tend to focus on already established success, they too will gain from this approach. Financing project activities to support this trans-national activity via existing funding schemes is one way to challenge this. One of the latest initiatives is the Interreg BSR project “Baltic Industrial Symbiosis” (BIS), involving partner countries in the

Baltic Sea region (<https://symbiosecenter.dk/en/project/bis/>).

When trying to motivate companies and organizations to engage in industrial symbiosis and capacity building, it is very powerful to be able to refer to and show case real life examples. Therefore, when initiating the facilitation of your own local industrial symbiosis, it is especially important to have access to and be able to share relevant cases. That way it becomes more relevant for the company owner to enter into further dialog that could lead to a new green business model - improving business through an industrial symbiosis. Many cases are out there still, waiting to be documented and shared.

Challenged by the restriction following the outbreak of COVID-19, has also challenged the way facilitators normally interact with stakeholders in a partnership model. Activities where stakeholders and the facilitator used to meet face to face, either had to be cancelled or innovative new ways of facilitating virtually had to be invented. However, in fact having to adapt to existing and new restrictions, legal frame and resource scarcity is already part of the daily challenges a facilitator faces. First hand experiences have in fact shown that many of these activities can be realized through already existing digital platforms, be it live company screenings, workshops and site-visits. Having said that, the relation building and dynamic interaction that you experience in the real life interaction is still of great value - therefore combining the power of both approaches into a new balanced model will save considerable

resources and time for all partners, and would allow more activities on trans-national collaboration.

Symbiosis Center Denmark has recently been working to facilitate this in order to activate urban and industrial symbiosis on a larger geographic scale and with the background in the learnings of the local Kalundborg Symbiosis. Through a range of projects, we have developed tools to facilitate in close collaboration with the local stakeholders and experts in national and international project teams like the BIS project. Dedicated networks have been important for this development and as the need for global solutions increases, so does the need for active and competent networks local and national networks. This realization has e.g. become apparent with the establishment of Nordic Network of Urban and Industrial Symbiosis. All member countries have identified that in order to really make progress on a larger scale, national networks need to be in place and operational.

As a closing remark I would like to encourage any existing or new facilitators, operating with in the field of urban and industrial symbiosis, to engage in capacity building trans-national, but to do so along with solid local, regional and national initiatives and networks. Also, the time is now for a transition towards a more sustainable approach within industrial symbiosis, replacing e.g. fossil based production with sustainable clean technologies - let's support the green transition through smart investments in sustainable Industrial Symbiosis. ☺





# Initiatives of the international consortium «Saint-Petersburg Cleantech Cluster for urban environment» for sustainable development in a context of circular economy

Nikolai Pitirimov,  
Chairman of the Board of Directors of the Saint Petersburg Cluster of Clean Technologies for Urban Consortium International Consortium

In the course of the XVIII All-Russian Forum "Strategic Planning in the Regions and Cities of Russia" in October 2019, «Saint-Petersburg Cleantech Cluster for urban environment» international consortium initiated the flagship project – "Sustainable Development Cluster 2030". The project brings together the best practices of sustainable development and the circular economy projects of the "INTERREG. Baltic Sea Region 2014-2020" and the Sub-Program "Southeast Finland-Russia 2014-2020".

**C**urrently, the total amount of international cooperation projects such as the INTERREG Cross-Border Cooperation Program and the Cross-Border Cooperation Program co-financing of the EU and Russia is more than 97 million euros and 77.5 million euros, respectively. Herein projects involving members of Saint-Petersburg Cleantech Cluster for urban environment international consortium amounted to 23.12 million euros.

"Sustainable Development Cluster 2030" flagship project goal:

To create more innovative, accessible and sustainable Baltic Sea region based on the example of Saint-Petersburg through the implementation of transnational cooperation projects in the Program area.

"Sustainable Development Cluster 2030" flagship project objectives:

To form a joint open innovation international communication platform created in Saint-Petersburg targeted to implement the 17 Sustainable Development Goals (SDGs), including three aspects of sustainable development: social aspects, environmental protection and economy in all countries and regions of this initiative.

The 17 Sustainable Development Goals are indivisible, interdependent and are inherent part of:

- UN 2030 Agenda, including the formation of global economic progress in line with social justice and environmental protection;
- The Baltic 2030 Declaration of the Baltic Sea States Council, including the resumption of the course towards sustainable development in the Baltic Sea Region;

- Environmental Security Strategy of the Russian Federation until 2025, including the environmental security of the Russian Federation, which is recognized as an integral part of national security. The main goal of the strategy is to ensure the quality of the environment necessary for a favourable human life and sustainable development of the economy;
- The Strategy of the socio-economic development of St. Petersburg for 2035, including the provision of a stable improvement in the quality of citizens' lives and Saint-Petersburg global competitiveness increase.

The present day «Sustainable Development Cluster 2030» flagship project combines 6 projects in the field of sustainable development and circular economy for 11.87 million euros as a total.

1) These are the following

projects of the Baltic Sea Region Cross-border Cooperation Program INTERREG RBM 2014-2020:

- Innovation Ecosystem to foster consumer cleantech markets in the Baltic Sea Region (SMARTUP ACCELERATOR),
- Clean Shipping Project Platform (CSHIPP),
- Baltic Industrial Symbiosis (BIS),
- Co-producing and co-financing renewable community energy projects (Co2mmunity).

2) These are the following projects of the Cross-border Cooperation Program "Russia-Southeast Finland 2014-2020":

- Finnish Russian PPP catalyzing new green business" (Cata3Pult),
- Business in Biotechnology and Circular Economy (BBC1).

«Sustainable Development Cluster 2030» flagship project participate 11 representatives from 3 countries:

Denmark: Kalundborg Symbiosis

Russia: Members of «Saint-Petersburg Cleantech Cluster for urban environment» Consortium, including NP City Association of Homeowners, LLC KOSMOS, LLC TYREMEN GROUP and St. Petersburg Foundation for SME Development; as well as Corporate Center of ITMO University, and State Company «Mineral».

Finland: City of Lappeenranta, Green Net Finland (member of the international consortium «Saint-Petersburg Cleantech Cluster for urban environment»), Brahea Centre at the University of Turku, and Miksei Ltd Oy.

*Project – An innovative ecosystem to stimulate the consumer market for clean technology in the Baltic Sea region (SMARTUP ACCELERATOR)*

Total project budget 2.2 million euros.

Project summary:



Today there is a growing interest in environmentally friendly technologies aimed at reducing the environmental impact of the consumption economy, dictated by a lack of resources, rising energy and fuel costs, digitalization (the transition to a digital economy) and automation. The project helps small and medium-sized enterprises, start-ups and service providers in the Baltic Sea region use the business opportunities arising in the field of environmentally friendly technologies through the

use of partnership and cultural cooperation models.

*Project – Clean Shipping Project Platform (CSHIPP)*

Total project budget 1.85 million euros.

Project summary:

The project platform aims to protect the environment and ensure sustainability in maritime transport. It is aimed at improving environmental performance, but at the same time it should guarantee and strengthen the economic



profitability of maritime transport in the harsh conditions of global competition. The platform's activities revolve around two main topics: the environmental effect and the effectiveness of shipping in the Baltic Sea region; net shipping business potential in the Baltic Sea region.

*Project – Baltic Industrial Symbiosis (BIS)*

Total project budget 2.90 million euros.

**Project summary:**

The aim of the project is the creation and development of eco-industrial parks, where the waste from one industrial production of a resident of an industrial park becomes raw material for another resident of the industrial park. Project participants will receive a detailed picture of modern best practices for the development of industrial symbiosis in the Scandinavian region. This experience will be used in the formation of industrial symbiosis in Saint Petersburg on the example of the development of the Industrial Park of Clean Technologies for the Urban Environment with the participation of members and partners of the international consortium «Saint Petersburg cluster of clean technologies for the urban environment».

*Project – Co-production and co-financing of community-based renewable energy projects (Co2m-munity)*

Total project budget 3,15 million euros.

**Project summary:**

The aim of the project is to create new partnerships for renewable energy («RENCOP»), which will initiate and support the projects of the resulting «energy communes». The project will accelerate the spread of renewable

energy in the Baltic Sea region, improving its adoption and development conditions through energy commune models. The project will promote the processes of democratization and participation in the energy sector and further international cooperation in the Baltic Sea region between all levels of target groups.

*Project – The Finnish-Russian PPP is the catalyst for the new Green Business (Cata3Pult)*

Total project budget 0,85 million euros.

**Project summary:**

The project is aimed at expanding the opportunities of those working in the field of clean technologies for SMEs in the program region, as well as at creating new business opportunities and international intercluster cooperation for the development of a sustainable urban environment. Project activities include the creation of a structure and an operational model for a sustainable and long-term Russian-Finnish public-private partnership in the development of green business. Work in the project is focused on environmentally friendly technologies, circular economy, energy efficiency and sustainable development in South Karelia (Lappeenranta), Uusima (Helsinki, Vantaa) and Saint Petersburg

*Project – Business in Biotechnology and Circular Economy (BBC1)*

Total project budget 0.92 million euros.

**Project summary:**

The aim of the project is sustainable economic growth through the development of entrepreneurship and business cooperation in the field of biotechnology and the circular economy. The main activities of the project include

the creation of the concept of cross-border training in a number of business areas, as well as the development of the commercialization of research results and acceleration of spin-offs of companies and startups. The project also develops the digital concept of the RDI EcoSairila platform for testing, studying and piloting innovative ideas and new technologies.

“Saint-Petersburg Cleantech Cluster for urban environment” international consortium was created in October 2014 and today unites enterprises and organizations of Russia (Saint-Petersburg, Leningrad, Kaliningrad, Pskov, and Kurgan Regions, Republic of Tatarstan), Finland, Norway, Denmark, Japan and the Dominican Republic. The cluster has offices in Moscow, Kaliningrad, Leningrad, and Pskov regions, the Republic of Tatarstan and abroad: Finland, Norway, Japan, Italy, Croatia, North, Central and Latin America.

The management company is Noncommercial Partnership «The St. Petersburg House Property Owners Association». The number of participants is 64, including 40 SMEs.

Total revenue is more than 20 billion rubles on the territory of Saint-Petersburg in 2019.

The average number of employees of the organization is 44.5 thousand people in 2019.

The Cluster's mission is to make Saint Petersburg an environmentally friendly and safe city to live in, combine clean technologies in all sectors of the city's economy and its supply chains.

**Cluster subject areas:**

energy conservation, energy efficiency, smart city / smart grids, green building / eco house, waste management, urban transport, IT for clean technologies, clean production processes in an urban

environment, biofuels, solar and wind energy.

The cluster is a member of:

- The Global Cleantech Cluster Association (GCCA), which brings together 55 national clean technology clusters representing more than 10,000 Cleantech companies around the world;

• BALTIC CLEANTECH ALLIANCE, clusters of the Baltic Sea region: Finland, Latvia and Russia;

• All-Russian cluster association Green Clusters of Russia

State support for the cluster is provided by the Center for Cluster Development of Saint-Petersburg as a part of Cooperation Agreement with Technopark of Saint Petersburg JSC dated 07.07.2015.

Today 14 SMEs – members of the Cluster – are also residents of the business incubator INGRIDIA JSC Technopark of Saint Petersburg, which is 41% of the total number of SMEs.

SMR Clusters – residents of INGRIDIA are the leaders in urban cluster projects: LLC INNOKOR – the leader of the Effective Light project, LLC ENVIRO – the leader of the ECOLAND and Reserve Heat from Waste projects, and LLC TYREMAN GROUP- the project leader of “Clean Technologies in Transport” and “Clean Technologies Park”. Moreover, SME Cluster – residents of INGRIDIA actively participate in international projects. The Baltic Industrial Symbiosis project involves TYREMAN Group LLC, which creates the first Living Laboratory and General Development Group LLC in Russia with the project “The Northern Shrimp” as a participant in the screening for the formation of industrial symbiotic chains in the NWFD of the Russian Federation”.

For further development of «Saint-Petersburg Cleantech Cluster for urban environment»

applied for awarding of the “Ecological Cluster” status (November 2019) in the fulfillment of the the Russian Federation President Order dated May 22, 2019 № Пп-922. Within the framework of the Order the Interdepartmental Working Group, based on the Analytical Centre of the Russian Federation Government, elaborates 10-15 pilot cluster programs which make possible to proceed to active stimulative economic policy by means of compliance with measures represented by the Roadmap «Sustainable development of the Russian Federation economy non-oil and gas sectors».

In May 2020, in order to develop the market of clean technologies in Russia «Saint-Petersburg Cleantech Cluster for urban environment» applied for participation in a working group to create a new global technology market, Econet, as a part of The National Technological Initiative of Russia (NTI). NTI is a long-term interdepartmental public-private partnership program aimed to promote the development of new promising markets based on high-tech solutions that will determine the development of the global and Russian economies on the horizon until 2035 and beyond. Organizers of NTI: NTI Platform (a non-profit organization created to engage people in the development of companies that seek to become leaders in fundamentally new technology markets), University 20.35 (University 20.35 was created by the Agency for Strategic Initiatives), RVC JSC (Russian Venture Company), and ASI (the Agency for Strategic Initiatives). Currently within the framework of the NTI the design and creation of new markets is beginning (in addition to the nine approved), which will be carried out in the format of the Foresight NTI 2.0. STI «Econet» is

a technology for in-depth analysis and climate control, the creation of experimental and super local climatic zones, restoration of biodiversity, garbage as a resource.

Previously at the X Saint Petersburg International Innovation Forum in 2017 the Cluster signed a memorandum of understanding on the formation of the GreenNet National Technology Initiative in Russia supported by the Finnish Cleantech Cluster and Green Net Finland GreenNet experience. At that stage the priorities of the initiative by the signatories were identified as following: environmental safety and resource efficiency of the urban environment. The focus of this initiative is to promote the development and implementation of “clean” and resource-saving technologies aimed at reducing the human impact on the environment and improving the quality of life of people in cities.

Consolidation of all the Cluster's initiatives in the field of clean technologies into a circular economy will allow us to analyze global trends, forecast further demand in this market, give recommendations on legislative changes for the development of the green, clean and environmentally friendly technologies market, create a more innovative, affordable and sustainable Baltic Sea region through the implementation of best practices of transnational cooperation projects in the territory of international programs with the participation of Russia. ©





## Cata3Pult - the Finnish-Russian public-private partnership catalyzing new green business

Since 1992, KOSMOS LLC has been successfully working in the field of environmental services in St. Petersburg, the Leningrad Region and other regions of Russia. KOSMOS LLC is a member of the Association for Environmental Partnership at the St. Petersburg Chamber of Commerce and Industry, and is also a member of the Association of «Design Organizations of the North-West», has access to design work in the field of environmental protection. Employees of the company are members of the «Non-Profit Partnership «Environmental Audit Chamber» and have certificates of eco-auditors of Russia. Membership in International Consortium “St.Petersburg Cleantech Cluster for urban environment”. The customers of KOSMOS LLC are enterprises of various industries, services, manufacturers of treatment equipment of flue gas and wastewater, transport organizations and other companies from Russia and other European countries.



The customers of KOSMOS LLC are enterprises of various industries, services, manufacturers of treatment equipment of flue gas and wastewater,

transport organizations and other companies from Russia and other European countries.

An important place in the work of KOSMOS LLC is occupied by

activities on international projects. In 2012, the first Russian-Finnish project «Center for Environmental Information for Enterprises» was launched as part of the cross-bor-

der cooperation program «South-East Finland - Russia ENPI PS 2007-2013». The partners in this project were: Business Promotion Agency «Miset» (Finland); Eastern Finland Business Representation «ISBE» (Finland); Association of Environmental Partnership «AsEP» (Russia). The aim of the project was to develop the exchange of environmental knowledge and technologies between Finland and Russia ([www.ecoprofi.info](http://www.ecoprofi.info), [www.eco812.pro](http://www.eco812.pro))

KOSMOS LLC also took part in the international “Material Exchange” project under the TACIS program together with the Technological University of Lappeenranta (Finland) and the St. Petersburg State Engineering and Economic University ENGECON. The aim of the project was to create a joint Finnish-Russian Internet portal for the exchange of waste, secondary materials and waste processing technologies between the northwestern region of Russia and southeast Finland.

In January 2013, under the program Southeast Finland - Russia, KOSMOS LLC became a partner in a project called «Eco-support SE 670». The aim of this project was to increase environmental literacy through special trainings, publications, recommendations, consultations and the use of modern information technologies. The partners in this project were: St. Petersburg Committee on Nature Use, Environmental Protection and Ecological Safety; Regional Environmental Public Organization «Friends of the Baltic»; Palmenia Continuing Education Center of University of Helsinki (Finland); Kymenlaakso University of Applied Sciences (Finland).

In June 2019, under the Cross-border Cooperation Program “Russia - Southeast Finland 2014-2020”, KOSMOS LLC became



a partner of the international project KS1670 “Cata3Pult - the Finnish-Russian public-private partnership catalyzing new green business”, which launched on 01.06.2019. The project’s Leader partner is City of Lappeenranta (Finland). Other partners are: Non-commercial Partnership «House Property Owners Association» (St. Petersburg), Association Green Net Finland (Helsinki, Finland) and the Metropolitan University of Applied Sciences (Helsinki, Finland).

Specific objective of the project: enhancing the capabilities of clean tech SMEs in the programme area and creating new business opportunities supporting the sustainability of urban environment by international cluster-to-cluster collaboration:

1. Create Finnish-Russian public-private partnership (PPP) catalyzing new business and format

organizations’ common principles of long-term business cooperation in practical level in the themes of clean tech and sustainability of the urban environment between regions of South Karelia (Lappeenranta), Uusimaa (Helsinki and Vantaa) and Saint Petersburg.

2. Organize and promote knowledge sharing of city strategies, public procurement, knowledge sharing through expert panel

3. Develop and promote business and R&D cross-border collaboration through clusters in the fields of eco and resource efficiency, energy efficient; smart mobility; circular economy, sharing economy.

On September 5-6, 2019, as part of the planned project activities, KOSMOS LLC prepared and organized a study visit of St. Petersburg experts to Lappeenranta and Helsinki. KOSMOS LLC selected a





group of experts from the Russian side in the areas of: waste, circular economy, green mobility, resource conservation. Among the participants of the visit were representatives of state regulatory authorities in the field of nature management (Rosprirodnadzor), state unitary enterprises (St. Petersburg Vodokanal), higher education school (ITMO), commercial enterprises of small and medium-sized businesses and the public

During the study visit to Finland, the delegation from St. Petersburg visited the LUT University campus (<https://www.lut.fi/jhc>) and the Jamie Hyneman center at LUT University in Lappeenranta. A technical development laboratory has been established on the LUT campus, where students successfully implement their ideas and test innovative devices. Many aspects of the circular economy could also be found there: for example, 3D printers in the laboratory use plastic fiber to produce parts for inventions, and a special shredder makes fiber for a 3D printer from old plastic parts. In the wood processing

workshop, the remaining unused parts produce beautiful plates on the door, shelves and stands.

Then the delegation visited several high-tech and modern facilities that help Finnish people realize the concept of a green economy. Object 1. Vantaan Energia incinerator (<https://www.vantaanenergia.fi>).

Vantaan Energia's waste-to-energy plant is a modern way to produce energy. This plant was put into operation in 2014. The city of Vantaa owns 60 percent, and the city of Helsinki - 40 percent of the company. The Waste-to-energy plant generates electricity and central heating from mixed waste that cannot be processed, which makes up 50% of all waste.

When burning municipal solid waste, excess heat is generated, which is used to heat the water, which is then fed into the district heating network. The amount of waste used by the waste processing plant covers about half of the heat needed by the entire city of Vantaa in a year. In addition, the plant

also covers about 30% of Vantaa's annual electricity needs. Thanks to the waste-to-energy plant, 40% less imported fossil fuels are used, and carbon dioxide emissions in Vantaa are reduced by about 20%.

A few interesting facts that relate to the operation of the plant:

1. The design capacity of the plant is 374,000 tons of municipal solid waste per year. Amazing, such a huge complex is managed by only 5 workers.

2. The plant operates continuously and stops only to clean the dome from the remaining harmful particles for 2 weeks per year. 200 kg of slag are formed from one ton of burnt waste - up to 20 kg of iron and about two kilograms of other valuable metals are drawn from it. The remaining 178 kg of slag is sent for land reclamation.

3. Waste comes from the territory in which more than 1.5 million people live.

4. The plant does not pay for raw materials - people pay it for disposal.

5. Each boiler is equipped with filters that capture 90% of

small particles. The unit stops operation if the gas levels exceed the permissible emission values

6. The ash that accumulates contains many harmful substances, so it is mixed with concrete and sent for burial. Fly ash and chemical products from flue gas cleaning in total amount is to approximately 60 kg.

Today, Vantaan Energia ranks second in the region in terms of low emissions, almost not exceeding the threshold of 50% of the maximum permissible emissions.

Object 2 - "HSY" the waste collection point (<https://www.hsy.fi>)

It is cheaper to bring rubbish to the HSY waste reception station yourself than to pay for waste export. You can also rent a trailer for the price of 5 € for three hours for self-transportation of waste. The station has several objects where citizens themselves bring bulky waste: old furniture, construction waste, electronics, mercury-containing lamps, etc. Then all waste is sorted, part of it is disposed of, part of it is saved as compost, part is sent to the Energia incinerator.

The prices for waste reception at the sorting stations depend on compliance with the sorting instructions. Additional fees may apply for non-compliance. Self-service is carried out at the stations: the Finns independently unload the waste from the vehicle and place it at the appropriate collection points.

The Finns even bring apples from their cottage area here. It sounds strange, but they don't make apple jam and pay 5 euros regardless of the size of the cargo for their recycling.

Wastes that are taken for free if people are sorted them separately: domestic hazardous waste







- asbestos is received only to the Ämmänsuo Sortti station; electrical and electronic equipment, paper, metal, glass bottles and glass jars, cardboard.

Waste, the reception of which is payable: wood, plastic, old textiles (from February 1, 2020) - 2 € / 200 l, 10 € / m<sup>3</sup>; combustible mixed waste, impregnated wood, gypsum - 5 € / 200 l, 25 € / m<sup>3</sup>; mixed non-combustible waste - 3 € / 50 l, 60 € / m<sup>3</sup>; garden waste and brushwood (garden waste from December to February is accepted at the price of mixed waste) - 5 € regardless of the size of the cargo.

Waste Wood is utilized in energy production.

Mixed waste is not recyclable. It will be burned and turned into energy in the waste-to-energy plant. Mixed waste includes, among others, plastic objects and furniture made of various materials. Small-size mixed waste is considered to be under 50 x 50 x 100 cm in size, large-sized mixed waste is all that is larger, it is transferred to crushing.

Gypsum is recyclable.

Non-combustible wastes are toilet-seats, wash basins, porcelain bathtubs, window glass and mirrors.

Garden waste, brushwood and apples are leaves, grass, plant tops, chopped thickets, other biodegradable garden waste, stumps, rhizomes, clean sawdust, cutter chips, peat and wood chips, without soil and sawdust, garbage bags. To pass a stump and its roots costs five euros. Brushwood and apples are sorted separately from other garden waste.

Branches, coniferous branches, individual trees, tree trunks, bushes are accepted for further disposal for five euros per load. Topsoil is produced from garden waste.

The visit to the HSY site included a presentation on the review of energy, waste and water management in the Helsinki region, a collaboration between the HSY Helsinki Region Environmental Services Department, the cities of Helsinki and Vantaa and their energy companies.

After visiting HSY, the delegation moved to the University of Metropolia UAS, where the tour included a presentation of innovation centers related to the circular economy and green technologies, as well as how Metropolia works with companies. Also the city farm lab located on campus was visit-

ed. Of the most memorable was, perhaps, growing aerial potatoes without land (a reasonable refusal to deplete the fertile layer of soil), cultivating mushrooms in the refrigerators (i.e. reusing equipment) and getting a crop of berries and tomatoes from plants growing in hydroponics using water with a mix of all the necessary substances (saving water resources).

All objects have become the excellent examples of Finnish environmental eco - friendliness and the desire to protect the natural resources and the environment and will serve as examples for Russian enterprises.

All information on the implementation of the project is covered on the website of the Center for Environmental Information for Enterprises - [www.ecoprofi.info](http://www.ecoprofi.info) and in social networks - [www.facebook.com/groups/425389994709099](https://www.facebook.com/groups/425389994709099). Information about the project is available on the Ecological Portal of St. Petersburg - on the website of the St. Petersburg Committee on Nature Use, Environmental Protection and Ecological Safety (section International Cooperation) - [www.infoeco.ru](http://www.infoeco.ru).



Funded by the European Union, the Russian Federation and the Republic of Finland.

## Denmark: Municipalities can be front runners in sustainable growth

By Nadia Lavard, Ressource City - BIS project partner

A municipality can be an exemplary front runner when it comes to sustainable growth. Naestved, the 5th largest city on Zealand, Denmark, has proven to be just that. Last year Naestved was featured in Cities100 – amongst 63 cities from all over the world to be one of the most ambitious and innovative examples of climate change solutions.

It is the glass cluster in Naestved City that has placed Naestved on the “climate world map”. The glass cluster was founded by the glass recycling company Reiling Glasrecycling, the glass production company Ardagh Glass Holmegaard and Naestved Municipality’s environmental initiative Resource City.

The glass cluster is one of Naestved’s best-practice examples of circular economy. It collects and sorts approximately 125.000 tons of glass per year. The glass is then recycled into roughly 700-800 million bottles and jars every year, thereby reducing the need for virgin materials. By doing so they are also reducing 15.000 tons of CO<sub>2</sub> emission annually.

### It is not just glass

Not only does the glass cluster produce new products from used materials, it also distributes surplus heat from the production to the local district heating grid. By doing this the cluster contributes with approximately 50 % of the district heating in the town Fensmark in Naestved Municipality.

*As a project organisation in Naestved Municipality, Resource City takes part in the project Baltic Industrial Symbioses that promotes industrial symbiosis, a concept for sustainable regional development, across the Baltic Sea Region.*

In addition, a biogas plant is being installed to supply the glass cluster with biogas to reduce greenhouse emissions from the current use of natural gas. One of the newest innovations is to turn biproduct glass, that cannot be recycled into new bottles and jars, into cellular glass insulation. Initiatives like this makes the glass cluster innovative and always prepared to seize sustainable growth potentials.

Recycling glass was put into practice in Denmark in the 1970’s – and is now very much part of the Danes’ everyday life.

### The municipality as the front runner

Resource City is the centre of

circular economy; a cluster of innovation, knowledge and inspiration that sets the framework for sustainable business development in Naestved, Denmark.

As a project organisation in Naestved Municipality, Resource City takes part in the project Baltic Industrial Symbioses that promotes industrial symbiosis, a concept for sustainable regional development, across the Baltic Sea Region. With the knowledge and experience from the best-practice example the glass cluster, Resource City is proud to take part in the capacity building and creating new business opportunities together with the ten other project partners.







## Municipal Initiatives: Technologies in the Service of Ecology

*Department of Dvortsovy district intracity municipal unit of St. Petersburg*

There is a stereotype: local self-government makes almost no decisions in environmental issues. This is believed to be in the competence of ministries and relevant committees. While the local government at its level should deal exclusively with problems of local importance.

Meanwhile, the most relevant of them: improvement of the territory, planting yards with trees, garbage collection and removal, are directly related to environmental problems.

For example, this summer, yards and lawns will be repaired, trees, shrubs, and more than 12 thousand flowers will be planted in Dvortsovy district at the expense

of the municipality. The work is financed under the urban land improvement program and will have a multiplier effect, including in terms of improving the environmental situation and increasing the comfort of the urban environment.

Environmental safety issues are the responsibility of local self-government bodies. About 30% of the municipal budget is

spent annually on their solution in one form or another in Dvortsovy district. It is approved and controlled by deputies and the public. In one way or another, each of the 19 municipal programs is tied to environmental issues. Two of them are dedicated to environmental education and the development of a culture of solid waste management.

To become environmental

experts, the employees of the Administration of Dvortsovy district were trained at the Mineral SF State Unitary Enterprise. The knowledge gained helped formulate and implement the program activities: to organize lectures, hold competitions of children's drawings on the topic of environmental protection, with booklets with the works of the winners published based on their results. And even to make a film for the mass audience: a social advertisement about the importance of separate garbage collection, with the residents of Dvortsovy district taking part in it.

Now the agenda of the municipality is the promotion of the idea of separate municipal and food waste collection and utilization. This problem is generally relevant for the whole of St. Petersburg, but it is especially acute for Dvortsovy district due to its special location. Dvortsovy district is a "golden triangle" in the center of St. Petersburg, where all the main attractions of the Northern capital are concentrated: Nevsky Prospect, the Hermitage, the Chapel, the Russian Museum, the Church of the Savior on Spilled Blood, the Fontanka, the Field of Mars. And the largest number of catering facilities in the city are also concentrated here.

In total, more than 100 restaurants, cafes and other catering establishments work in the district. Each of them can produce from 50 to 200 kg of food waste per day on the average. Some of them are drained into the sewage system, clogging and reducing the life of the drainage channels. Others, together with municipal waste, are sent to garbage bins and taken to landfills creating an additional load for them and contributing to the spread of insects and rodents.

This state of affairs does not

suit either the residents or municipal authorities. And the caterers themselves agree that the question is ripe and it is time to consider other options. An alternative to sewage facilities and garbage containers could be recycling of food waste into useful fractions. Such technologies exist. The municipality intends to promote them as part of an educational project in conjunction with the ECOC Ecological Community regional public organization and the International Banking Institute. The choice of partnership is not accidental. The ECOC unites over 20 major St. Petersburg waste recycling operators. And the International Banking Institute, its rector, Maria Sigova, also being a deputy of the municipal council of Dvortsovy district, is implementing the Green Economy program for business.

The idea of partnership, as well as the entire project, belongs to Head of the Administration of Dvortsovy district Dmitry Skoropisov who has extensive experience in managing at the Federal Service for Supervision of Natural Resources. The cooperation will help to consolidate the resources of the government, business, education and professional community of waste managers in solving the common urban problem. In this project, ECOC will act as a technology expert and consultant, and the International Banking Institute will serve as a scientific and educational platform.

Seminars for entrepreneurs are prepared on issues of environmental legislation and waste management, presentations of plants, waste recycling furnaces. They are supposed to include demonstration of the equipment which will show the technology of drying and transformation of organics into biomass and their final product - fertilizers and animal feed

obtained in the drying process. An agreement has been reached with the manufacturer of furnaces for delivery for the work in the test mode.

One of the goals of the project is to stimulate Petersburg residents to convert waste into income. Innovative solutions may interest both restaurateurs and everyone having food production and even an ordinary kitchen. For example, hotels, hospitals, social and educational institutions, and simple households.

Organic waste recycling can be of interest to the city if collection of food waste is organized as a public service. It is also necessary to create a special structure that will deal with this, to adopt the law on the mandatory separation of municipal and food waste and to stimulate their processing with tax benefits.

The adoption of these measures will boost the solution of environmental problems and will save budgetary funds by reducing the volume of garbage taken to landfills. And it may be also profitable if the production of peat and animal feed from organics for sale is organized on an industrial scale. The experience of Europe, where such solutions are widespread, can help in this matter.

Dvortsovy district hopes that its proposals will find support in the Government of St. Petersburg. Deputies of the municipal council are ready to come up with the relevant legislative initiatives.

The municipality expects that its territory will become a pilot site for the development of new waste management technologies which may be scaled and integrated into the action plan of the national Ecology project in the future.

*Sergey Sanne, Chairman of Ecological Community Regional Public*





**Organization (ECOC RPO):**

Our organization was created almost three years ago and unites about 20 market operators for transportation, detoxification, treatment, recycling and burial of waste. Together with business, government and public figures, we are looking for new strategies for the development of the industry which ideally should be understandable and attractive for investors.

We have been recently lobbying for the introduction of separate collection of food waste with a view to its further recycling. St. Petersburg annually produces more than 2 million tons of municipal waste, of which 30 - 50 percent is organic. These are resources that can be used and be profitable with simultaneous prevention of their getting to SMW landfills. Today, the world has developed a huge number of technologies that allow doing this. Wastes are sorted, dried in special plants, and a high-calorie

in-demand product is obtained. 100 kg of organic matter provide 10 kg of raw materials for further use in the energy and agricultural sectors. It is possible to choose portable mobile equipment on wheels with a load of 20 kg per day which moves and is used at several sites. Or stationary complexes with a capacity of 100 tons per day, installed at food industry and waste processing plants.

These technologies are used very actively in the world, but they are almost unknown in Russia. The topic of organic garbage recycling even in megalopolises is still at the stage of discussion of the idea. It is known to be most often delved into by the socially responsible business where waste management and environmental protection are part of the economic strategy and corporate culture of the enterprise. For example, in St. Petersburg several large chain restaurants and bread producers generating a large

amount of waste have already studied similar technologies. However, they are still undecided about investing in the purchase of the equipment. Perhaps the business is in no hurry waiting for signals from the authorities. One of them may be the initiative of the municipality of Dvortsovy district to organize food waste recycling on its territory.

The text was prepared by: Olga Semenova, Head of the Public Relations Department of Dvortsovy district intracity municipal unit of St. Petersburg



МО  
Дворцовый округ

# First steps forward to symbiotic chains

The Baltic Industrial Symbiosis project has entered a new phase. March 2020 was a deadline for companies' free applications for the new phase and Match & Meet stage began. Participants shared their cases needed to be solved – talked about wastes as a result of their production and started to search options for effective use of those. Here is a way of achievement the project goal – to implement symbiotic chains that would allow productions to become more efficient and to lower the impact on the environment.

*“Our company was the first in Russia who started to grow prawns. It is a unique start-up for North-West Russia. We are very encouraged with the symbiotic ideas of doing business – that would allow us to cut the expenses, make our production cheaper and transform it into the greener and more effective one.*

*We met colleagues from the School of Biotechnology and Cryogenic Systems of University ITMO (National Research University), we are interested in technologies of further using a shell of prawns – that needs to be studied and ITMO promises to help us with that issue. Also, we are looking for the latest IT technologies that would allow to automatize aqua farm”.*

**Kirill Kirillov, co-founder of “Severnaya Krevetka” (Northern Prawn) Ltd.**

*“We would like to find consumers for the by-products of malt production – water with yeast and chopped grain. Within the BIS project we had a meeting with Tosno mixed fodder plant – we are going to test a possibility of using brewery these resource for animal feed production. We have passed the*



first samples for testing already to our partners.

**Alexey Golitsin, CEO of Münhell Brewery.**

*“Our company follows the ideas of preservation of all the natural components in animal feed. All our products are eco-friendly and suits well for the farmers who take care of the health of their livestock and poultry and fast gain per grazing day. We are open for partnership with raw materials suppliers and companies who recycle packaging that we use for the animal feed.*

*Within the BIS project we visited “Severnaya Krevetka” (Northern Prawn) industrial site and achieved an agreement of local fish feed production for prawns. We have started a formula development and hope that our experience would help to cut the expenses of aqua farm.*

**Anton Surushkin, Commercial Director of Tosno mixed fodder plant**

*For more information about the Baltic industrial symbiosis project, see the link: [tyreman.ru/bis](http://tyreman.ru/bis)*







## Medical wastes – neutralized. Garbage – double cut

**BIOCAD** is Russia's leading innovative biotechnology company; it combines a world-class research and development center, ultra-modern pharmaceutical and biotechnological manufacturing facilities, as well as preclinical and clinical research infrastructure compliant with international standards. There are about 2 500 employees in the company and almost third of them are scientists.

Recently BIOCAD became a member of the international “Baltic Industrial symbiosis” project to get closer to non-waste production and to exchange an experience with other partners sharing an idea of circular economy. And there is a thing to share. Dariya Belyakova is a chief of corporate culture and social responsibility department of BIOCAD company, we talked about existing recycling practice and sustainable development plans.

*What principles of a circular economy are realized in BIOCAD?*

First of all, sustainable development for BIOCAD – is an inner operations philosophy that combines interests of business community, society and the environment. We are aimed on the achievement of the sustainable development goals. We focus on the specific vectors – high-tech medical care, science and innovations, education, personnel care, environment. The last is the most

important for us. We develop our own initiatives and support partners' projects that is why we are glad to join the “Baltic Industrial Symbiosis” project.

*What are the wastes of your company and how do you process them?*

We have got the *Environmental Policy* enacted from 2019. Main aspects are to decrease an ecological footprint of company's operational processes, to protect a biological diversity and to use the

Special edition

natural sources into the most efficient way.

We have implemented an effective waste management system, we divide medical wastes, biological wastes, industrial wastes and regular garbage. Dividing of wastes allows us to follow the waste processing legislation and to arrange proper waste processing chains. We instated an integrated system for all productions sites of color coding for medical wastes that helped to setup its transferring to licensed companies for processing.

Talking about regular wastes we reached a 50% decline of its volume due to new contracts for proceeding of recycling materials. Major recycling materials in our production are cardboard, wood, polyethene and polystyrene. All this we started to send for proceeding since 2019. In future we would like to proceed also other kinds of polythene wastes (shoe covers and bags from discardable laboratory coats) and spunbond (discardable laboratory coats).

We use fabric buildings on two our production sites for collecting, processing and accumulating of all kinds of waste. There are different sections inside: SMW (solid municipal waste) accumulating, collecting of secondary raw materials, accumulating of HIL (high inflammable liquid) proceeded and HPLC (High performance liquid chromatography) bleeding, and defective drugs and deactivated medical wastes.

Since 2018 we collect galvanic cells (batteries) in all our offices. In 2018-2019 employees collected



382 kilos of used batteries.

We have been collecting used paper for recycling in all offices for 5 years, in 2019 we enclosed a garbage disposal contract that helped us to sell more than 50 tons of cardboard for recycling during the last year.

Together with the department for infrastructure solutions we got an agreement of utilizing and recycling office machines and equipment.

*What are your expectations on industrial symbiosis project?*

For us, the “Baltic Industrial symbiosis” project is a possibility to analyze of activities within circular economy context, to upgrade our existing projects and to contribute to a new international initiative.

*Which production processes could you make more effective by symbiosis with other companies?*

We have been always produced some kinds of waste that we have

just disposed. We did not understand that somebody can use it. By participation on the “Baltic Industrial Symbiosis” project we can make another step forward to a non-waste production and, probably, to use someone's resources for our needs.

*Do you look for a secondary raw materials that could be provided by other participants of the project?*

By the issue of our production we are limited in the use of secondary raw materials. But we know for sure that there are participants in the “Baltic Industrial symbiosis” project that could share not only with their secondary raw materials but also with an experience and practices of circular economy and sustainable development.

*For more information about the Baltic industrial symbiosis project, see the link: [tyreman.ru/bis](http://tyreman.ru/bis)*



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# Living lab – Here the industrial symbiosis' products are born

Living lab idea started at the MIT. It combines research and innovative processes to customize the developing product for the consumer needs. All the different participants in such a laboratory are involved in the joint development process, testing and evaluation for innovative ideas, scenarios and concepts. Related technological solutions are immediately tested in practice.

**L**iving Lab product is always end-user designed. Due to the prototype's proof tests on different stages it is possible to adjust the midline product performance and to get the really needed result.

Laboratory brings together creators of the new products, experts, test persons and potential end users. They change their roles from time to time to cross-check each other and to improve the product performance according to the new input data.

**Living Lab in Saint-Petersburg was opened within the Symbiosis Center of Tyreman Group, located at the southern part of the city. This new co-working site is being a part of the Baltic Industrial Symbiosis project/BIS.** It will combine manufacturing facilities of the city that are interested in efficient and responsible use of resources.

The BIS project intensifies cooperation between region's companies, helps to improve laws and regulations, and implements industrial symbiosis as a sustainable growth pattern. Participants start to align in the symbiotic chains to share products with recycling potential in order to cut the expenses for raw and other materials, optimize processes and to improve the use of resources.

We have made an interview with the Project Manager of BIS

project by Tyreman Group in Russia – Alexander Belykh.

**- Alexander, would you, please, tell us about the Living Lab concept – how it operates?**

*- It is an ecosystem opened for innovations. Participants bring together to search the solutions, do researches, implement tests and experiments. One of our goals is to demonstrate a practice result of industrial symbiosis.*

*All the BIS project participants would be able to use all its infrastructure for free – to test the potential of salvage use for their own or someone's else production. And to test their prototype – a result of industrial symbiosis.*

**- If there are any examples of such products – results of the symbiosis?**

*- Right now, products are under development, there were some meetings in Match & Meet format where companies shared their ideas and needs. We are going to test the results of their collaboration within the Laboratory.*

*For instance, we are looking for the decision how to use a coffee cake of seeds of Bouchee baker's shops and restaurants together with ITMO University (National Research University). We bought the test samples of fuel briquettes made of extruded coffee cake of seeds and analyze the amount of*

*energy that we can get of burning them. Also, we need to determine side issues of using this resource as a fuel and to understand who can use it in production process.*

**- Why do you call the Laboratory "Living"?**

*Its content and functionality can change adjusting to the needs of participants. New equipment, conditions, participant – everything can change and update. Combining raw and other materials companies would create a new product that would be tested right here by end users. They will get immediate feedback and understand whether they can upgrade the result.*

**- How the Living Lab would be organized in Saint-Petersburg?**

*Now the Laboratory in extremely functional – we used recycled materials to minimize construction waste – wood boards, pallets, bobbins. So far it is a unit divided into three modules – production one - is an area for testing of ideas and prototypes, warehouse – is just a warehouse, and office one – is co-working space for resident companies and guest presentation area.*

**- So, the Laboratory is open for public?**

*- Yes, we also think about an educational component – we need*



*an area for presentations with a lecture hall for eco-events and meetings with residents. We have plans to organize scheduled tours to demonstrate technologies and processes being tested. Next to the Laboratory there would be a Center for industrial symbiosis building that would be a place to demonstrate achievements in energy efficient and resource saving technologies.*

**- Would you tell us a bit more about this Center?**

*- The building of the Center would promote an idea of circular economy. We plan to use energy efficient technologies and recycled or*

*re-usable materials for construction.*

*As a basic building block, we will use old sea-cans of different size – that will help to create a cross-ventilation. The design will include maximum south side vitrification to get solar warming in Northern climate and location of engineering facilities at the north side with a minimum opening to protect from a high wind. We plan to use daylighting in building at maximum – that allows to have a comfort conditions and save energy.*

*We also have a wooden terrace in the project – for events and for leisure. Green roof would protect the building from overheating and generate oxygen. Smart landscape*

*gardening should protect from cold winds and provide a nice atmosphere for workers and visitors. Flexible design with moveable partition walls would increase the utilization efficiency of conference hall and canteen.*

*We would like to create a real eco-friendly complex that would emphasize the idea of our Baltic Industrial Symbiosis project – industrial symbiosis for the favorable living environment on our planet.*

*For more information about the Baltic industrial symbiosis project, see the link: [tyreman.ru/bis](http://tyreman.ru/bis)*





# Development of Commercial Fish Farming in the Republic of Karelia

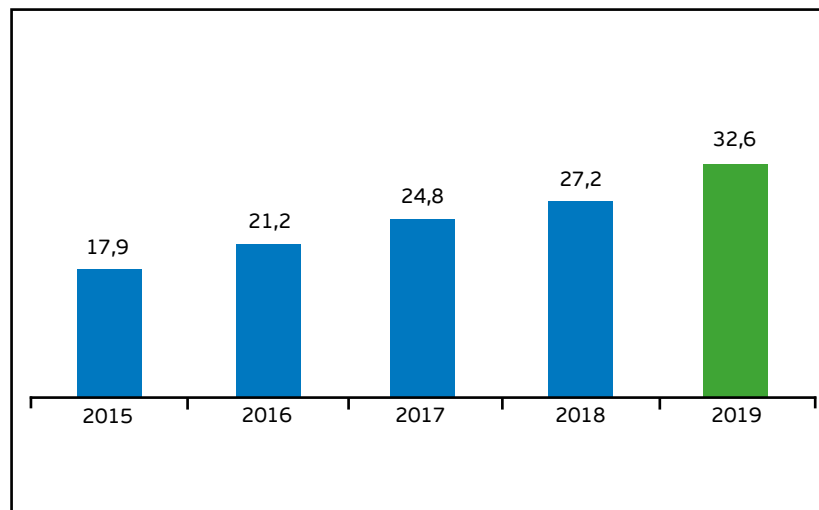
The leading sector in the agro-industrial complex of the Republic of Karelia in terms of growth is the sector of industrial cold water aquaculture. By its natural conditions, the region compares favorably with other regions of the North-West Federal District, where the development of commercial fish farming is also possible. First of all, this is the availability of a large number of deep freshwater basins with clean, high quality water and with optimal temperature conditions (including the largest in Europe Onega and Ladoga lakes and the vast White Sea).

In 2019 the volume of rearing of aquaculture objects amounted to 32.6 thousand tons (120% of the level of the corresponding period of 2018), including 22.2 thousand tons of commercial fish (122% of the level of the corresponding period of 2018). The main object of aquaculture is rainbow trout (99.98%), with whitefish and sturgeon grown in small volumes (0.11%). Mussels are grown in the White Sea.

The reasons for such rates of development of cage culture fishery are related with the economic efficiency of production, fast production of marketable products.

All aquaculture fish grown in the Republic of Karelia and its processed products are currently supplied to the domestic market. The intensification of the volumes of growth of aquaculture products and the development of fish processing facilities allow forecasting and considering future prospects for entering the international market.

The industry development policy being implemented by the Government of the Republic of Karelia is aimed at resolving issues of import substitution and food security, increasing the role of international cooperation, introduction of modern resource-saving



Graph: Dynamics of the volumes of rearing of aquaculture objects in the Republic of Karelia in 2015 – 2019, thousand tons

and environmental technologies. In 2017, an Action Plan for the development of the aquaculture cluster in the Republic of Karelia for 2017-2020 and subsequent years providing for an increase in the rearing volume up to 35 thousand tons by 2025 was developed and approved.

The Ministry of Agriculture and Fisheries of the Republic of Karelia pays special attention to the development and improvement of state support instruments. The work carried out in this direction makes it possible, at the expense of the regional budget, to provide support to enterprises of

the industry in the form of subsidies for reimbursement of some direct costs for the purchase of machinery, new equipment for fish and waste processing, for the creation, reconstruction and (or) modernization of fish selection and breeding farms and specialized lines for the production of fish feed, for the development of design estimate documentation for the construction of complexes for rearing of aquaculture objects in closed water supply facilities, as well as for the reimbursement of part of the interest rate on loan agreements for the purchase of feed and stocking material.

In 2019, the enterprises of the fishery complex were paid 38.3 million rubles of state support measures from the budget of the Republic of Karelia to reimburse part of the costs of acquiring new machinery and equipment.

At the initiative of the Government of the Republic of Karelia, in 2019 Petrozavodsk hosted the first International Trout Forum "Modern Technologies. Security and Legal Regulation" which was attended by more than 350 representatives of Russian and foreign commercial organizations, research and educational institutions, federal and regional executive authorities, and local self-government bodies. The forum was an effective platform for business and government interaction to discuss the key strategic initiatives for developing the industry in the region, working out specific decisions on creating conditions for growth, improving the investment climate, sharing experience of Russian and international practices and strengthening the international cooperation.

In recent years, large fish breeding enterprises with a large rearing volume have inevitably come up with the idea of building their own processing industry. Workshops for primary and/or deep processing of fish operate on the basis of fish farms, such as IE Fedorenko N.V., Kala ya Mariyapoyat LLC, Kala Ranta JSC, enterprises of the Karelian Fish Plants group of companies, and others. Each year, new processing facilities are put into operation or modernized.

The development of processing and the release of products with a high added value can significantly improve the stability of enterprises in the market and free up funds for further investment. At the same time, the state support is an effective "locomotive" of stim-

*The Ministry of Agriculture and Fisheries of the Republic of Karelia is working on preparing proposals to improve the veterinary legislation aimed at expanding the possibilities of using fish farming and fish processing wastes with account of the present international practices.*

ulating interest on the part of private business.

Fish processing and manufacture of fish products are inextricably linked with the formation of a significant amount of fish processing waste, and the enterprise needs to solve an additional set of problems related to the organization of the process of their disposal. Noncompliance with the environmental legislation and production losses can result in a decrease in profitability and big fines for the enterprise.


The present world practices of manufacture of marketable products consider the environmental approach as a source of additional profit and competitive advantage in the market. Fish waste contains a large amount of protein, fat, valuable microelements, vitamins, minerals and can be involved in a waste-free production cycle for the manufacture of medical or veterinary drugs, components of animal feed, bio-fertilizers.

In this regard, there is an obvious need in the Republic of Karelia to use the potential of the waste from the fishing industry as raw materials for the production of an additional mass of commodities.

The pilot project was the trout degutting waste processing facility built in Berezovka settlement of Kondopoga district in 2018 based on IE Fedorenko N.V. fish-rearing farm with the capacity of up to 1 ton of raw materials per hour

which allows for the processing of waste from all neighboring fish farms. The facility is provided with modern German equipment that ensures the release of fish oil of veterinary and food quality. At the beginning of its activities in 1990, the volume of the grown commercial fish of IE Fedorenko N.V. amounted to only 25 tons, by 2019 the commercial fish volume was brought up to 2.3 thousand tons per year. In 2009, the entrepreneur commissioned a fish processing facility provided with modern equipment. The enterprise has a food safety system based on the principles of the HACCP.

A number of fish farms (Kala ya Mariyapoyat LLC, Pomor LLC, etc.) operate specialized equipment for the production of veterinary fat from fish degutting waste.

The Ministry of Agriculture and Fisheries of the Republic of Karelia is working on preparing proposals to improve the veterinary legislation aimed at expanding the possibilities of using fish farming and fish processing wastes with account of the present international practices. 





## Pskov Region: Economy and Ecology in Rapport

Agency of Investment Development of Pskov Region SAI PR

Pskov region has a unique ecological climate; therefore, the environment is the most attractive socio-economic resource of the region. In terms of compliance with the environmental standards, the region has a stable position in the Russian Federation and is most preferable for life in terms of the ecological safety and environment assets.

Currently, ways to improve resource-renewable production facilities and the development of closed-loop economy in order to rationalize the structure of production and consumption are one of the main tasks faced by Pskov region as well.

One of the main points of growth of the region is the imple-

mentation of major infrastructure and investment projects. The implementation of all projects involves consideration of sustainable nature management, preservation of the unique environmental situation in the region.

Examples of this approach are both the implemented projects on the territory of Pskov region and

the planned ones.

A successful example in the field of the closed cycle of agricultural production is the opening of the largest biological waste processing plant in the North-West in the early 2018 by Velikie Luki agro-industrial holding.

Raw materials for processing are received from meat processing

plants, livestock breeding complexes, farms and private subsidiary farms of the entire North-West of Russia.

It is dried, sterilized and crushed under high temperature. The final product is widely used in cosmetology, pharmacology, perfumery industry and in production of biofertilizers.

The enterprise was built in accordance with the most stringent Russian and environmental standards.

Another outstanding ecological project implemented on the territory of the region is Plyussa Processing Integrated Plant (PPIP).

The main objective of the enterprise is to increase the depth of processing of used plastic, reducing the level of environmental pollution with waste and natural resources saving. To this end, the enterprise has introduced modern low-waste and non-waste technologies which significantly reduce the volume of the waste buried at landfills, increase the level of their use, as well as the raw material and energy potential of secondary material resources. At the same time, waste recycling is environmentally friendly, which is important in the contemporary world.

PPIP is a leading enterprise in the North-West of Russia in terms of recycling of used plastic materials of a full cycle, its production capacities allowing recycling of plastic waste from the entire territory of Pskov region without harming the environment.

The full cycle is collection of plastic waste, its sorting and washing. Then the plastic waste goes through granulation and extrusion. The final products of the integrated plant are films, bags with printing, films for products packing and stretch films.







A separate product line has been also launched for the agricultural sector: seedling bags, garden films, flexible irrigation hoses and waterproofing films.

Construction is currently underway of the Titan-Polymer plant which will work for import substitution and export. The plant will be built in Moglino special economic zone of the industrial-production type. The major project for the construction of the Titan-Polymer plant is being implemented with the support of the Ministry of Industry and Trade of the Russian Federation and state financial institutions.

The plant plans to produce raw materials to provide more than 10 different sectors of the economy. The plant's production facilities will be based on technological units for production of polyesters (PET-granules) and products from

them (BOPET films).

In consideration of the possibility of launching production in Pskov region, special attention was paid to the absence of solid industrial waste: some of them will be recycled, and some are sold to partners for production of household propylene. This was, undoubtedly, the key feature for the implementation of such large-scale production in Pskov region.

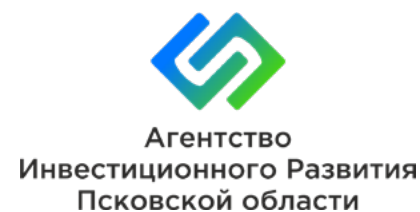
A successful example of the work of a closed-loop enterprise is the Finnish Nor-Maali paint-and-lacquer production enterprise operating in the territory of Moglino special economic zone of the industrial-production type.

The Finnish Nor-Maali plant is under an obligation to carry out its activities in accordance with the International Environmental Responsible Care Program.

The enterprise thoroughly

collects chemical waste in special tanks and then re-uses them in the production process. The plastic and cardboard used in packaging are delivered for recycling.

The use of forest reserves is strictly controlled in the region. A prerequisite for opening of any wood processing plant is reforestation. A successful example of the implementation of such a project is the Sudoma timber mill. The enterprise has a large nursery; in addition, it produces pellets, fuel granules, from production waste. ☺



## Millions to manure for fast-growing forests

By Carina Wellin, Paper Province - BIS project partner

Recent research made at the University of Karlstad shows that pine planted in soil with enriched biocarbon grows better. The result is a potential fertilizer for the forest.

**O**ur landowners are interested in a really strong plant. We want a fertilizer that is both economical and good for the environment, says Emil Mattsson at Swedish forest owner Mellanskog.

### Produced from sludge

The enriched biocarbon is produced from sludge from the pulp and paper mill's water purification. Mixed with ash from the biofuel boiler and nitrogen from a municipal treatment plant, the biocarbon becomes a fertilizer.

"Stora Enso wants to do good things both for the environment and the economy. Sustainability focus is a must for a modern group with environmentally conscious customers. It is a waste of resources not to take advantage of the residual currents. We want to close the cycle and at the same time reduce the cost of by-products", says Margareta Sandström, environmental manager at Stora Enso Skoghall's mill.

### Leaves large environmental footprint

"The fertilizers used in the forest today require a lot of energy in the production. We want pow-



erful fertilizers without producing so much carbon dioxide", says Emil Mattsson.

The next step is to use enriched bio carbon at Stora Enso nursery. The plants will then be planted in the forest during October 2020 and 2021. There, the researchers will then have the opportunity to follow how the future trees grow. The research project has been ongoing since the end of 2018 and is a collaboration between among others Karlstad University, Stora Enso, Karlstad Municipality, Mellanskog, Econova and Paper Province.

### We bring the forest to the future

Paper Province is a world-leading business cluster within the

forest bio-economy. We are owned and operated by more than 100 member companies. The cluster is based in Karlstad, Sweden, and mainly operates in the province of Värmland and the surrounding area, but also nationally and globally. Together with our member companies we work towards sustainable development with focus on innovation, skilled work force, internationalization and regional mobilization. ☺







# Farm and biogas plant: cooperation experience in Finland

Tuija Ranta-Korhonen, Irina Uzhinova, Andrey Erk

## Introduction

Biogas production is one of the most popular areas of renewable energy development. According to the Annual report 2019 published by European Biogas Association, in the end of year 2018 the amount of Biogas plants in Europe was about 18 200 with annual growth of 2% (Annual report 2019, 10).



Biogas contains mainly methane  $CH_4$  (45-85%) and carbon dioxide  $CO_2$  (25-50%). During the cleaning process, carbon dioxide and minor impurities such as  $H_2S$  (hydrogen sulfide) and silicon oxides are removed. As a result, pure methane remains, equal in properties to natural gas.

In biogas plants, biogas is produced in fermentation tanks or reactors, where biogas is formed in aerobic process from different organic feedstock materials. Commonly used feedstock materials are organic fractions of municipal solid waste, agricultural manure and energy crops, food industry side-streams, sewage from wastewater treatment, slaughterhouse and fish processing waste. (Biovoima 2019.)

Thus, compared to other sources of renewable energy, biogas has a number of advantages that explains its growing popularity in agricultural areas.

Firstly, biogas plants are more compact and less dependent on natural conditions than wind and solar power plants, not to mention hydropower plants. Individual biogas units can occupy an area of several square meters and can be located on the territory of a small farm or garden plot.

Secondly, biogas offers a comprehensive solution to three important tasks: economic, environmental and social. In addition to the production of thermal and electrical energy, the biogas plant efficiently processes almost any agricultural waste into organic fertilizer. This is of great importance for farmers and foodstuff producers, who are disburden from both waste recycling and wood/coal heating. Besides that, biogas successfully replaces gasoline and solar oil as fuel for cars and agricultural machinery.

## Bioenergetics development in Finland

Finland is one of the leaders among the countries choosing a course toward environmental protection and climate conservation.

Opinion polls show that the country's population puts environmental issues above the economic problems and fight against terrorism.

As a part of the EU's long-term environmental programmes, Finland is committed to reduce greenhouse gas emissions by 80-95% by the year 2050. The share of transport biofuels will be increased to 30%, and the minimum aim is to have 250,000 electric and 50,000 gas-powered vehicles on the roads.

Equally ambitious goals are set for a closer perspective. Under a plan approved by the Finnish government, coal-fired heat/power plants all over the country must be closed or repurposed by 2029. The decision is connected with the fact that in the production of 1 MWh of electricity coal-powered CHP unit emits into the atmosphere about 0.8 tons of  $CO_2$  - twice as much as a natural gas (or biogas) CHP. In turn, the City Hall of Helsinki plans to reduce carbon dioxide emissions to zero by 2035 to counter global warming. It is implied that the «zero emission» will be achieved by switching to thermal energy from renewable sources.

As far as natural gas is not a renewable resource, and also requires considerable import costs, Finland is actively developing the production of biogas. There are two types of digestion methods, wet and dry. The difference between them is in the total solids (TS) content of the feedstock material. In wet process the TS is max 15% and in dry process 20-40% accordingly. The most common type of reactor for the wet fermentation process is completely/continuously stirred tank reactor.

As for the dry fermentation process, both batch and continuous type of reactors are used. Batch reactor means, that the reactor is fed with the organic material and then closed and feedstock is digested a certain period. After the digestion process is completed, the reactor is emptied. The continuous type of reactor means, that the feedstock is regularly added to the reactor and the digested material removed from the other end of the reactor. In continuous reactor, the biogas production rate and the methane content constantly remain approximately at the same level. (Kymäläinen & Pakarinen, 2016, 83.)

## Industrial cooperation: turning waste into resource

As mentioned, biogas plant in farm could bring several benefits; it could provide energy and help to manage the organic side flows, such as manure. The reasons for scarcity of the farm-scale biogas plants in Finland is high cost of investment and capricious support policy. Although farms get income from energy sales and also can reduce their own energy costs, it does not cover the annual investment and maintenance costs of the plant. Therefore, the profitability of the plant investment is highly dependable from various forms of financial support and gate fees



Photo 1, 2. Juvan Bioson OY Production Buildings. Photo: Hanne Soininen

from the organic waste materials. Refinement of biogas to transport fuel (biomethane) is also significant tool to increase the profitability of biogas plant.

In such conditions, the most profitable and successful way is industrial cooperation, based on the principle «Your waste is our resource.» An example is the Juvan Bioson OY plant located in Juva area, South Savo region.

Currently there are three centralised biogas plants in the South Savo region, and the fourth one will be completed in 2020. Juvan Bioson OY is one of them. It is a centralised

farm-scale biogas plant that started its operations at the end of 2011 in Juva, Finland. Biogas is produced by a continuous wet method based on the reactor, which operates in mesophilic conditions. Organic raw materials, including liquid manure, dry chicken droppings and plant waste, are constantly supplied by the plant's co-owners.

Juvan Bioson OY is jointly owned by 11 farms and a greenhouse-farm company Turakkalan puutarha OY. Accordingly, all waste of these farms is delivered to the plant and processed into biogas, and then - to electrical and



thermal energy. A special output of production is digestate, a neutralized and decontaminated organic substance that farmers get back to farms for use as fertilizer.

Transportation of raw materials and final product is handled by a private transport entrepreneur, whose services are paid by the co-owners of the company. As transport in Finland is expensive, the minimal distance between farms and the biogas plant is of great importance. The main advantage of the plant in Juva is its proximity to suppliers of raw materials and consumers of electricity, heat and digestate.

What are the main revenue items of this enterprise?

At the moment, all thermal energy and the bulk of electricity are used in the greenhouse farm Turakkalan Puutarha OY, which is located next to the plant. This significantly reduces the cost of the farm's production and makes its work more profitable. Some of the energy is used for the in-house load of the biogas plant, and all the extra energy is sold to the local energy company. Usually in Finland, so-called eco-electricity, or "green electricity", is a little bit more expensive, but the difference is not significant (at least for the private consumer). The biogas plant receives separate fees for the processing of organic waste by local food companies. Recycling waste from canteens and restaurants is also for a fee.

The use of digestate is an important element of cost savings. This product widely reduces the need of co-owner farmers to buy fertilizers. Digestate is distributed to farmers free of charge, depending on the amount of raw materials supplied and the actual fertilizer needs of the farm. The transport company also cares about its delivery.

The annual sale of energy by South Savo plants is about 2,300 MWh (about 60% of all energy produced), in which the share of electricity is 1,190 MWh, thermal energy - about 1,120 MWh. The digestate is used as a fertilizer and soil amendment. The nutrient potential of the liquid manure increases because of the co-digestion of the manure with chicken litter and also because of the hydrolysis of the nutrients.

As long-term observation of Finnish experts shows, a well-organized cooperation in biogas production supports the local circulation of organic materials and also reduces the negative impact of farming on waterways, soil and air. The joint biogas plant intensifies the initiatives and aims of local farmers to take account the sustainable development in farming and in food production chain. This is a very important change in the traditional scheme "resources - energy - production - products - waste". Waste is converted into resources, the chain is transformed into closed circuit, a process of recycling nutrients is started.

#### BioCom Project: Spreading European Experience in Russia

Russia does not stay away from the world trends of bioenergy development. In 2018, the overall load capacity of renewable energy facilities in Russia was 54.7 GW. According to the International Renewable Energy Agency (IRENA), at the end of 2015, 20% of electricity capacity in Russia was produced by renewable energy facilities, mainly by large hydroelectric power plants. Between 2015 and 2020, more than 30 wind and solar power plants were commissioned in various regions of the country.

The main tools for promoting biotechnology in Russia are state targeted programs, business

investments, national and international projects. One such tool is the two-year BioCom project, developed under the Russia-Southeast Finland 2014-2020 Border Cooperation Programme and launched in May 2019.

Three organizations - two Russian and one Finnish - became partners of the project:

1) Institute of Engineering and Environmental Problems of Agricultural Production (IEEP) - a branch of Federal State Budgetary Scientific Institution FNAC VIM (St. Petersburg, Russia)

2) State Government Institution "Center for Energy Conservation and Energy Efficiency of the Leningrad Region" (Leningrad Region, Russia)

3) University of Applied Sciences of South-East Finland - XAMK (Finland)

South-East Finland and the Leningrad Region are intensively developing areas with a significant share of the agricultural sector. Promoting bioeconomic approach and developing cooperation in border rural areas will assist to covering the growing need for energy while reducing the anthropogenic load on the environment.

It should be noted that today in the Leningrad region only single farms have own biogas plants, and their use is not always stable and cost-effective. At the same time, the raw material base for biogas production is huge if to manage properly the waste of large livestock farms, wood processing and food production. The idea of industrial cooperation based on the principle "Your waste is our resources" with the proper support system could significantly accelerate the solution of the extremely urgent problem of waste management in the Leningrad Region.

The Bioeconomy Competence Centre, organised on the basis of



Photo 3. Russian project experts at the biogas plant in Haukivuori, Finland

the project Lead Partner (IEEP), performs a wide range of biotechnology promotion tasks that help on the sustainable development of pilot areas. First of all, it is informing and training of target groups (schoolchildren, students, farmers, rural specialists, researchers, entrepreneurs) on innovative educational programs developed by project experts. In addition, the Centre organises regular meetings of experts involved in the introduction of biotechnology in agribusiness.

Another important activity of the BioCom project is to help farms to reduce production energy costs. The project experts conduct an energy survey (energy audit) on pilot livestock farms: identify the potential for energy saving and make recommendations to improve the energy efficiency of enterprise.

Russian and Finnish experts plan to develop a model of the demonstration zone of energy efficiency for the agricultural sector. This task demands to create a common system of environmental and energy survey of agro-industrial enterprises on both sides of the

border. Particular attention will be paid to adapting successful Finnish experience to Russian conditions, taking into account objectively existing differences in the inclusive working environment of farms.

Successful implementation of project objectives leads to the formation of a new information / education space, which promotes the active cooperation in the field of energy efficiency and environmental security. Promising expectations from the project are to accelerate the process of innovation, increase the stability of pilot areas and reduce the environmental impact in the Baltic Sea Region.

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# Symbiosis of economy and ecology in woodworking

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## Abstract:

Through the example of a real case of a new woodworking enterprise in Leningrad region, the article describes the possibilities of organizing an effective model of industrial symbiosis for lengthening the value chain, increasing the depth of processing of raw materials and improving the economy of the project participants and partners.

The Russian economy is currently in an active phase of integration into global supply chains and international specialization of labor, consistently moving along the path of changing the structure of the export balance in favor of the goods with a high added value. This is facilitated both by the macroeconomic conditions in terms of the ruble devaluation of the ruble and by the serious government measures to create an infrastructure to support and stimulate the export of industrial processing products, including those stipulated by the National Project of "International Cooperation and Export" being implemented since 2018. According to the identification summary of this National Project, the export of competitive industrial goods from Russia to the world market alone is to almost double from 114 to 205 billion USD by 2024<sup>1</sup>.

Such ambitious challenges for national producers require a system approach to achieving the strategic goals, including applying new solutions to organizing the entire cycle of investment projects for creation of export-oriented production facilities from creation of business plans and financial models, engineering of enterprises, to building, commissioning and

formation of a value chain. At the same time, enterprises need to ensure not just a race for economic performance. The present social relations require that economic entities, especially those working in international markets, should strictly and often rigidly adhere to environmental standards and prevent the negative impact of industry on the environment.

As distinguished from a standard investment cycle which involves attraction of investments in the form of borrowed funds from banks or private investors against future cash flows secured by the project company (future solvent demand for the products), the cycle for new export enterprises of the present type has a more complicated structure, since it is necessary at the stage of the company's business engineering and manufacturing engineering both to confirm the demand for the company's products and to build a model of partnership with the concerned enterprises from related industries. This is necessary to extend the value chains and increase the depth of processing of raw materials and waste, which allows creating both new competitive advantages and profitability for the project participants, and a high tax effect for the society,

as well as mitigating the possible technology-related and environmental risks. The solution of the task of building such an industrial symbiosis and partnership implies proactive development of a system of horizontal network links with a wide range of participants outside of its industry market by the investment project initiator.

Practice is a criterion of truth, and the best confirmation of the theoretical economic models is the real cases with enterprises created using these models and successfully functioning. For the above-described model stipulating industrial symbiosis in an export-oriented industry, a relevant Russian example of a really operating successful enterprise is the integrated wood processing plant located in Volosovo, Leningrad region, an hour's drive from the border of St. Petersburg.

This integrated plant was built in several stages during the 2010s as a project for the development of the old Soviet industrial site (brownfield) for manufacture of an export-oriented product new for Russia: multilayer solid wood boards, as well as for manufacture of high-quality timber for the Russian and international markets. This structure of the enterprise's products was the result of a search

for a model ensuring the optimal economy of the enterprise with the efficient use of raw materials and sales of waste to partner enterprises.

The directions of the search for the structure and characteristics of the optimal model of manufacturing organization and symbiosis with partners were prompted by the needs of the market and the competition in it. The search for solutions was urged forward both by the constantly increasing requirements of the regulators to the environmental characteristics of the products in the key markets of the enterprise in Europe (requirements to emissions, the use of formaldehyde-free adhesive systems, FSC and EN certification of suppliers, etc.), and the high competition in terms of the price and quality with major European manufacturers from Germany, Austria and Switzerland in their domestic markets.

Today, the integrated wood processing plant in Volosovo has built a highly efficient production system with an open architecture of organization of industrial symbiosis. In general, this system can be described in the following structure and processes:

1. The pool of wood suppliers provides deliveries of high-quality lumber logs (round wood) to the enterprise with a minimum transport leg not exceeding 250-350 km, thereby forming a competitive price for raw materials at the enterprise and reducing the exhaust emissions through minimum distances of log haulage.

2. Using the state-of-the-art wood processing equipment of advanced European companies the integrated plant performs barking and sawing of round wood on a milling and chipping line with minimal waste compared to competitors: bark, sawdust, sawn



Manufacturing department of the integrated wood processing plant in Volosovo, Leningrad region



Multilayer solid wood boards – products of the integrated plant





Chippings



Fuel pellets – production of a partner enterprise

timber waste and wood chips. Thereby, the manufacturing process is organized in such a way that the waste generated during sawing and trimming of timber undergoes appropriate underworking and screening to obtain separate fractions of sawdust and chippings of class II1 (GOST 15815-83) and then goes to the buffer warehouse.

Despite the modern machine tool park, the waste yield after sawing up of round wood is up to 45-50% of the volume of raw wood (about 30-35% of wood chips and about 15% of sawdust, etc.). If the enterprise did not learn to manage these losses, the implementation of the investment project would become impossible already at the stage of consideration of the investment application by the bank.

3. Sawing of round wood with automatic sorting of the intermediate product (raw lumber) is carried out in such a way as to use the high-quality central part of wood for the production of

sawn timber (profiled log, boards). Whereas to use only the required minimum amount of high-quality raw materials for production of multilayer boards, while maintaining all the necessary technical characteristics and aesthetics of the facade surface, and to use lower-grade sawn timber, including from the side and slab parts of the log, for inner layers of the boards. Thus, the maximum effect is achieved from the point of view of forming high marginality of the company, depending on the fullest use of all parts of the raw material in the final product. With this approach to the production technology, inexpensive raw materials from round wood parts unsuitable for the production of merchantable sawn timber turn into multilayer boards - an environmentally friendly and expensive product for finishing of premises with a high profit rate and currency earnings, and high-grade sawn timber from high-quality raw materials is liquid

and high-demand goods for Russian and foreign buyers.

4. Manufacturing waste in the form of chippings, bark, sawdust, sawn timber waste is used by the integrated plant after collection, separation and underworking both directly for the enterprise's technological process and for sale to concerned enterprises.

Part of the waste after round wood sawing is used for the work of the boiler house operating on the industrial site. It provides both heating in the manufacturing departments of the integrated plant and the operation of the industrial drying chambers for preparation of wooden lamellas for assembly of multilayer boards at the next stage of the production cycle, as well as drying of future merchantable sawn timber (profiled log, board).

Another part of the chippings corresponding to the standardized category (II1 according to GOST 15815-83) is sold at market prices to consumers among the major pulp and paper mills in North-West Russia and in the border regions of Finland. The purchase of finished and inexpensive chippings as raw materials for pulp production allows these enterprises to replace deliveries of more expen-

sive round wood requiring additional processing. In this case the ecology of the main forest harvesting regions of these countries is also less affected, allowing saving additional forest areas from cutting down. In its turn, the sales of production wastes ensures additional marginality of activities within the production process (up to 5-8% of the total turnover) for the integrated wood processing plant in Volosovo.

In addition to incineration in the production boiler house for process needs, a considerable volume of sawdust is consumed by the tenant of the industrial site: a manufacturer of fuel pellets. The partner company installed the necessary equipment at the site with account of the volume of waste generated in the form of sawdust, and integrated its production into the overall technological cycle of the integrated wood processing plant. Thus, the plant secured its sales of waste to its partner, eliminating the problem of waste management and organization of a non-core business for pellet production and sale, as well as optimizing the use of the territory and engineering resources of the production site. Having entered into the symbiosis, the partner of the integrated plant has ensured a stable supply volume and quality of the sawdust feedstock, as well as minimized the cost of its production due to the low cost of the waste sold to it, the lack of the transport leg of raw materials deliveries, a favorable rental rate and efficient joint consumption of energy resources at the site.

In the aggregate, all the presented forms of optimizing the production cycle and organizing the ecosystem of industrial symbiosis have provided the result in the form of an advanced and profitable Russian enterprise in the field of

woodworking, ensuring both the profitability of its business and reducing losses due to the competent arrangement of sales, technological chain and product structure, and forming profitable input flows of raw materials and resources for concerned partners from the paper and fuel pellet industries in Russia and Finland.

The synergy from such a system of industrial symbiosis is manifested for the society in the formation of additional tax revenues that can be channeled for improving the quality of life, including the spread of environmentally sound manufacturing practices. In addition, the North-West of Russia, as well as the bordering countries of the Baltic region, will receive a significant environmental effect in the form of reducing additional volumes of deforestation down to 90-100 thousand cubic meters annually (when the plant in Volosovo reaches its design capacity in 2021) through the maximum use of wood raw materials for production of various in-demand products and joint management of the waste management chain together with partner companies.

Such economic and environmental effects can be achieved by managing the entire investment cycle from pre-design studies to the stage of direct operation of production. In the case of the integrated wood processing plant in Volosovo, Leningrad region, the success of the economic model of future cooperation and symbiosis was laid down in the several basic steps which can also be replicated in other sectors of the economy with account of the experience gained and the mistakes made in the search for an optimal model.

At the first stage, starting with the concept of a business plan, various options of organizing the production and use of raw mate-

rials and waste, including various composition of the manufacturing equipment, were worked out and calculated on the basis of a financial model. The simulation results were examined by dedicated industry experts in credit organizations, design and general contracting organizations and leading consulting companies.

At the second stage, when the basic structure of the production and technological chain and its parameters were formed, negotiations were held with the concerned parties (suppliers of raw materials and equipment, potential buyers of products and intermediate products and waste) formalized by agreements.

At the third stage, at the investment stage, the work model was tested on small volumes of production of multilayer boards and sawn timber as part of a test run of the first stage of the enterprise. After testing and necessary adjustments of the supply chain, adjustment of the system of contractual relationships, logistics and internal business processes, the model was put into operation, ensuring the achievement of target results of the profitability and environmental friendliness of the business of all its participants.

The basis for the success of the given case was primarily the actions of the project initiator on the system work both on optimizing the narrow tasks of organizing the production and sales, and on building long-term horizontal partnerships in related sectors of the economy and ensuring the mutual interest of all participants and partners of the project in its launch and sustainable functioning.

<sup>1</sup> identification summary of the "International Cooperation and Export" national project of Russia <http://static.government.ru/media/files/FL01MAEp8YVvAkvbZotaYt-VKNEkaALYA.pdf>

*Despite the modern machine tool park, the waste yield after sawing up of round wood is up to 45-50% of the volume of raw wood (about 30-35% of wood chips and about 15% of sawdust, etc.).*





## New business opportunities in the field of biotechnology and circular economy within the framework of the cross-border cooperation program "South-East Finland – Russia 2014 - 2020»

Russia and Finland face similar challenges in implementing the principles of sustainable ecological and economic development. In addition to significant economic investments and modern technological applications, the solution of existing environmental problems requires new approaches to environmental protection measures.

In our countries, there is a trend nowadays to involve biotechnology in the environmental protection activities in various production fields and resource-efficient development models. Today, this trend is widely supported in our countries. It reflects a common effort to use natural

resources carefully and to minimize the environmental impact of human activities in border areas.

Russian-Finnish cooperation in the field of biotechnology and the circular economy has great prospects. This was emphasized during the business dialogue at the St. Petersburg Economic Forum in 2018 by Mika Lintila, Minister of Economic Development of the Republic of Finland, expressing the hope that "Finland and Russia can be pioneers in this field", as well as many Russian specialists.

The need for international cooperation generated launching of the BBC1 – "Business in Biotechnology and Circular Economy" project in the frames of the cross-border cooperation program "South-East Finland – Russia 2014 – 2020".

The project aims to improve sustainable economic growth in the border region by supporting entrepreneurship and establishing cooperation between science and business in the fields of biotechnology and circular economy. Key tasks to be solved within the project are the stimulation and starting new scientific research in the field, development work and startups. An important point is also to attract additional funds to universities for research.

### Principles of project implementation and organization of project activities

For assuring the successful completion of the project, was created a consortium including two strategic alliances, namely alliances of business development organizations: Mikkeli Development Miksei Ltd. (Mikkeli, Finland) – Association of the Environmental Partnership (NP "AsEP", St. Petersburg, Russia) and universities: ITMO University (St. Petersburg,



Russia) - South-Eastern Finland University of Applied Sciences, Xamk (Mikkeli, Finland).

The lead partner, "MikseiMikkeli", carries out the interaction between the partners and the project evaluation. The university partners will provide increased knowledge about sustainable entrepreneurship, train business skills and launch startups in the field of biotechnology and circular economy with verified methods for boosting innovation activities in universities and research institutes.

In the project will be developed skills and increased the competitiveness of Finnish and Russian companies in the field of biotechnology and circular economy through the organization of trainings and a specialized business orientated events.

In November 2019 was launched a cross-border business idea competition in the field of biotechnology and circular economy for students and anyone interested both in Russia and Finland. As a result of the competition, more than 80 proposals in the field of biotechnology and the circular economy have been received so far. From the Russian side were

gathered approximately 60 applications.

In Russia the selected project teams were given the opportunity to participate in the acceleration program, during which they will undergo training in order to develop their business ideas and commercialize scientific projects. Each team has experts and mentors who provide consulting assistance in developing business models, market analysis, attracting industrial partners, submitting applications for contests and grants. Of course, not all projects will be able to receive investments upon completion of the acceleration program, but however according to statistics, 1 of 10 startups survives.

And our task is not only to find investors for the best business projects, but also to help young scientists establish cooperation with industrial partners, which will allow universities, in cooperation with business, to jointly develop new projects in field of biotechnology and the circular economy.

Concerning St. Petersburg area within the framework of the BBC1 project, will be orientated to propose effective technological solutions for cleaning various components of the environment





from contamination by introducing biotechnologies. Particularly interesting is the use of modern biotechnological solutions for the treatment of wastewater and contaminated soils.

The implementation of the principles of a closed-loop economy based on waste recycling will save and reuse valuable reserves and natural resources, thereby helping to reduce the burden on the environment.

EcoSairila – a development and cooperation platform established by the City of Mikkeli – will offer a base to cooperate for both researchers and businesses. Experience in implementing Finnish biotechnology and circular economy solutions in practice in EcoSairila, representing the modern industri-

al zone of green economy in South Savo region, will be also useful for the Russian project area, St. Petersburg and the Leningrad region.

Unfortunately so far, it has not been possible to implement all the planned project measures according to the original schedule. The restrictions on interaction imposed due to the pandemic caused by the Covid-19 virus have significantly affected the progress of the project.

As the role of communication in the project is very important, it will be necessary to use more online resources to provide distance communication and training.

Project measures and current environmental news are constantly published in the media and on the following websites:

- Administration of the city of St. Petersburg – environmental portal (<http://www.infoeco.ru/>), division International cooperation
  - Project community - <https://biocircularbusiness.com/>
  - Environmental Information Center for Enterprises - <https://www.ecoprofi.info/>
  - St. Petersburg Chamber of Commerce - <http://spbtpp.ru/>
  - Cross-border cooperation program “Southeast Finland and Russia 2014 – 2020” - <https://www.sefrcbc.fi/>
- as well as on the Internet – Facebook (Business in Biotechnology and Circular Economy)

**We will be glad to cooperate with all interested organizations and citizens of our countries!**



# TIRES – Problem waste or energy source?

The global tire industry today produces 3,3 billion tires annually and its volume is \$200 billion. Each month 3,5 million tires for cars and trucks are being produced in Russia every month. Each tire consists of synthetic and natural rubber (55-60%), soot, metal (25%), fabric, zinc oxide and sulfur. **Every year more than 10 million tires in the world are out of use.**

Used tires are 4<sup>th</sup> substance hazard category. Most ways of processing this “low-hazardous substance” have a negative impact on the environment. Being buried tires resolves in 120-140 years leading also to uncontrolled fires on dump sites, subsoil waters get toxic and soil by itself starts to be unsuitable for agriculture. Italy, Germany and France stopped burying tires completely.

into the atmosphere.

Recycling technologies have not changed dramatically in the last 10 years, there are three ways and combinations of those – electromechanical, pyrolysis (processing into gas and liquid metals) and cryogenic (with the

use of liquid nitrogen). Sulfur becomes a volatile substance during pyrolysis and harms the environment, but it is too difficult and expensive to remove it from flue gas. **Being green at the most leads either to treading tires or to shred it.**

*Being buried tires resolves in 120-140 years leading also to uncontrolled fires on dump sites, subsoil waters get toxic and soil by itself starts to be unsuitable for agriculture. Italy, German and France stopped burying tires completely.*

Burning tires is also extremely dangerous - a lot of toxic substances and carbon dioxide are released

## Disposal and recycling volumes



Comparison study of tires processing in different countries

Country	Out of use tires per year (thousand tons)	Disposing (%)	Energy production (%)	Treading (%)	Crumbing (%)	Exporting (%)	Other (%)
Germany	582	0	36,4	12,9	34,5	14,4	1,7
UK	527	4,6	35,5	7,4	39,5	5,5	7,6
Italy	421	0	55,6	6,7	28,5	4	5,2
France	457	0	49,7	7,7	27,4	10,9	4,4
USA	4039	12,1	47,6	n/a	32,1	2,5	n/a
Japan	1000	7,8	64,3	5,6	10,5	11,5	0,3



Tires processed by the new recycling technologies allow to get a different **recyclable – product**. Crumb rubber is used as an asphalt component, synthetic rubber is also a cover for sports ground. Pyrolysis gas and liquids are sources of a fuel for households and commercial facilities. Fabric disposal is being used for mineral wools and gymnastic apparatus filler. Carbon is used as sorbent and pigment, scrapped metal – is a universal resource. Magnets get all the metal from rubber mix during a two-stages crumbling. Metal divides in different categories by crushing tires for two consequential times.

**One burned tire equals 7,5 oil liters. It produces heavy metals, polycyclic aromatic hydrocarbons, butadiene, phenols, styrole, benzol.**

Russian made tires are different from imported ones – by the metal cord. This type of tires is quite easy for processing – magnets hold the cord in separators. The cord is different – high-carbon steel and light wire – that goes into sales by weight being pressed before. High-carbon steel goes for reinforced concrete and for fiber reinforced concrete.

**Tire recycling rate in Russia is low – not more than 10%.** All others 90% go to the dump site. There about 30 plants recycling tires in Russia and several tread them. Treading – is the greenest way to proceed a tire but most of consumers prefer to buy a new tire. Mostly the technology is applicable for an expensive truck tires and special tires – those are most expensive ones.

According to the research made by TYREMAN GROUP, an engineering company that takes care about smart use of tires, mainly truck tire is out of use when they still have about 25% of a lifetime and



Polytech (Saint-Petersburg Polytechnic University) masters study international recycling solutions

Research sessions on industrial symbiosis came through in Saint-Petersburg Polytechnic University. The event was arranged by "Setevyie issledovaniya" (Network researches) company on the initiative of Tyreman Group – member of Saint-Petersburg Cleantech Cluster for urban environment.

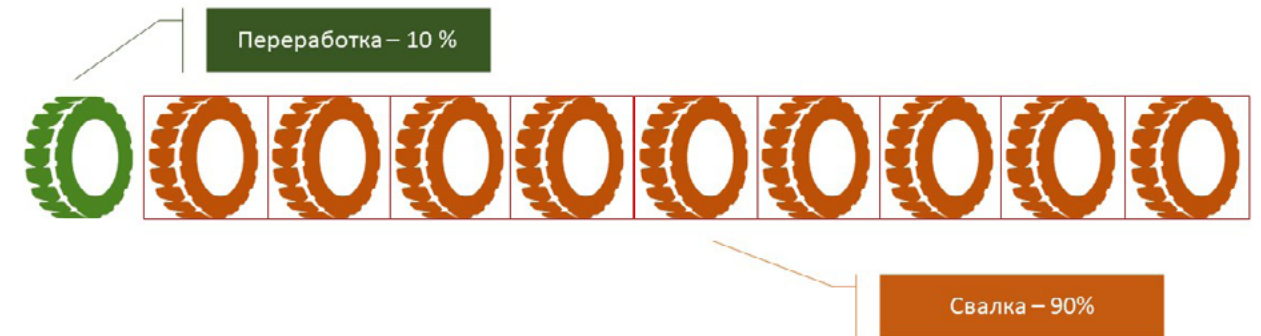
Members of three teams of master's programme "Digital economy and business analysis" studied cases of Russian partners of the "Baltic Industrial Symbiosis" project and proposed their ideas on recycling.

We would like to tell you about two cases and share the results of the study. One case is about recycling slaughtering wastes, the second one – issues of recycling and processing of cars and trucks tires.

that happens because of absence of a permanent pressure control valve. Extra fuel consumption can rise up to 5% due to low tire pressure. **Modern technologies allow to increase wear resistance of tires and to lower the impact on the environment.** There are cer-

tain smart technologies that helps to achieve this result: tire control systems, pressure and temperature control complexes. They allow using tires within "green corridor" (less than 5% departure from standard), increasing wear resistance and prolonging effective life. All

Статистика по переработке шин в РФ



this measures help to lower wastes and to decline an impact for the environment.

**Livestock breeding by-products** Polytech masters research shows that the most successful start-ups in livestock breeding are mostly oriented on processing of meat, but not wastes. Thus, large volumes of potentially valuable products are just disposed and there is a strong need in new technologies of processing.

Livestock breeding by-products include blood and hair coat. First has been used for production of albumen, blood flour – for animal feed, haematogen, hydrolysine, sausage products. Blood can be a raw material for production of technical specimens, plywood, cabinet making, drugs and it has been used in tobacco industry. Hair coat is a material for brooms and brushes.

Some large companies recycle blood and hair coat but actually they use **only 30% of those products**. Meanwhile, animal blood is a source of valuable proteins, micro- and macro-ele-

*The plant looks forward for new ways of using raw materials that they get to increase effectiveness of the production and make it more environmental friendly.*

ments. While disposing by-products instead of recycling large amounts of useful elements have been wasted that leads to material losses and increases production costs.

**How the recycling happens?**

Blood should be preserved for recycling. There are three different ways of preservation: cooking with the following drying of coagulate, chemical methods or non-waste technology based on the thermo-plastic extrusion (ingredients are being proportioned, mixed, cooled and packed).

Nowadays livestock blood recycling technologies rapidly develops. New equipment for complex recycling allows extracting maximum amount of valuable derivative products. By rising cost-effectiveness companies can

widen a range of food products, animal feeds, medical and technical products.

Still many meat products producers keep looking for new ways of recycling by-products and selling them.

Among these companies, one – "Tosnensliy" meat-processing plant, is a member of the "Baltic Industrial Symbiosis" project. It is one of the largest meat-processing facilities in North-West Russia; it produces high quality pork, beef, meat products and by-products. The plant looks forward for new ways of using raw materials that they get to increase effectiveness of the production and make it more environmental friendly.

*For more information about the Baltic industrial symbiosis project, see the link: [tyreman.ru/bis](http://tyreman.ru/bis)*





# «GREEN» logistics as a trend of development of industrial symbiosis in the transport complex of a large city (on the example of Saint-Peterburg)

Kol O.D., Saint-Petersburg State University of Economics

Today large cities, as the “locomotives” of economic growth (about 60% of global GDP), are the main sources of environmental pollution: 70% of global carbon emissions are caused by them and, more than that, 60% of the natural resources are used by the large cities.

There is an assumption that green logistics is a modern tool for overcoming a wide «spectrum» of negative trends of environmental pollution in large cities, although its role and importance, in our opinion, has not yet been sufficiently evaluated in the world and especially in Russia.

«Green logistics» has appeared recently as a separate scientific direction of the mix of logistics in general and urban logistics. The founder of a new scientific direction « is a German scientist E. Muller. In 1989 together with his colleagues, while they were studying transport logistics, he pointed out that there is a strong connection between logistics, environmental protection and natural resources.

Today, in general terms, «green logistics» in a large city is the practice of the supply chain management at all levels of urban management based on a strategy that focus on reducing the ecological burden on the urban environment. According to large cities «green» logistics can be considered in the following interrelated directions:

- reduction of environmental

damage from freight transport;

- rationalization of passenger transport;
- return or reverse logistics;
- strategies of the corporate logistics system (for example, industrial enterprises);
- efficiency of utilization, storage and processing of household and industrial waste;
- green supply chain management.

It seems that one of the most relevant ways to apply some methods and tools of «green» logistics in practice is «industrial symbiosis» which include the project with the same name Baltic Industrial Symbiosis (BIS), that is coming to life at the moment. One of the goals of this project is to develop the transport potential of the Baltic sea countries.

As everyone knows, transport (cargo and passenger) has always been the main source of air, water and soil pollution in large cities for many years. At the same time today freight transport plays the role of the “connecting” link in the supply chain and in bringing finished products from industrial enterprises to consumers. Therefore it is very important to implement

effective interaction of all types of transport on the territory of a large city in order to ensure both the delivery of goods on time and in good condition and its environmental sustainability.

The achievement of this task is possible due to the interaction of transport complex enterprises which are located in the large city. This transport complex combines both international giants (e.g., Maersk) and small enterprises with 4-5 employees, more than it includes not only transport-automobile, sea and river carriers, aviation and railway, but also forwarding companies, warehouses, container terminals, companies for reprocessing spent fuel, various types of waste (e.g., car tires), manufacturers of automobile and aviation fuel, etc.

What opportunities does «green» logistics offer in order to reduce the harmful effects of transport activities on the ecology of a large city, and as a result – on the health of its inhabitants? Consider this problem using the example of Saint-Petersburg.

St. Petersburg is the largest transport hub through which all

types of the international freight and passenger transportation is carried out. In 2019 49% of cargo was transported by rail from St. Petersburg to other regions of the country, 33% was delivered by road, 14% by river. So, four districts of the Large port of St. Petersburg are located directly within the Northern capital with a cargo turnover of almost 60 million tons per year. (Fig. 1) For example, high rates of motorization growth and large cargo flows going through the city in transit, as well as forming in the city itself and heading to the city create a huge load on road infrastructure.

At the moment several methods and tools of «green» logistics are started to implement. For example, transferring of cargo and passenger traffic from automobile to rail, as well as starting the modernization of Saint-Petersburg and Leningrad region transport framework.

Therefore, the Concept for the development of the St. Petersburg railway hub (hereinafter referred to as the Concept) was created in order to develop intra-city and suburban railway services and to modernize the railway infrastructure.

At the first stage of its implementation it is planned to withdraw transit freight traffic from the city by building the North-East (Pavlovo-on-Neva - Orekhovo) and South-West railway bypasses (Mga - Vladimirskaya - Bronka) (Fig. 2).

The scheme of the main activities of the Concept in order to change the transport frame is shown in Fig. 3.

JSC “Russian Railways” has been using the technology of “green” logistics for a long time. For example, the ecological strategy of JSC “Russian Railways” appeared in 2009; today the “Environmental strategy of JSC “Russian Railways”

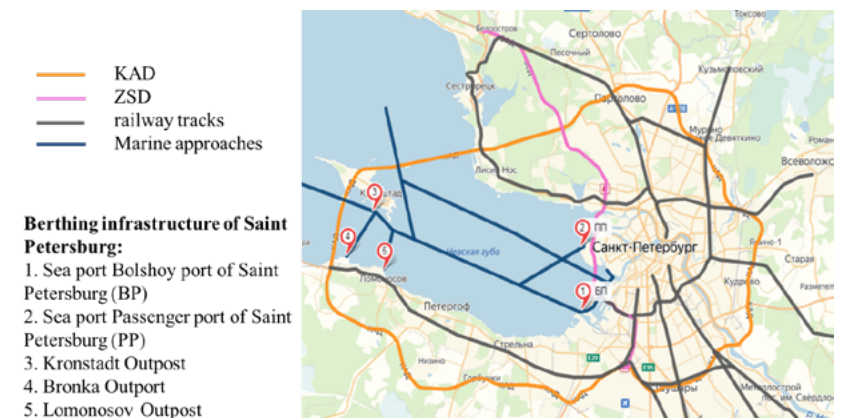


Figure 1. Scheme of railway and automobile infrastructure on the approaches to the seaports of St. Petersburg<sup>1</sup>



Fig. 2. North-Eastern and South-Western railway bypasses<sup>2</sup>

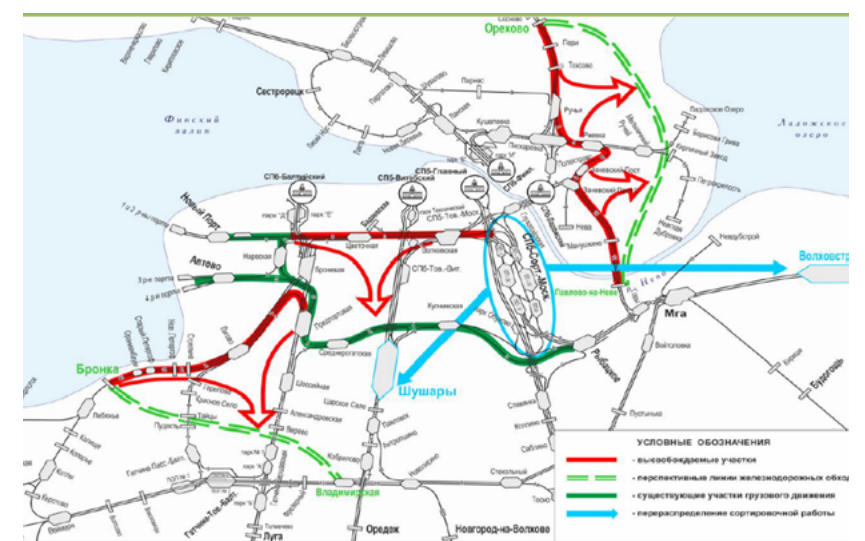


Fig. 3. Removal of transit cargo traffic from the central part of the St. Petersburg transport hub<sup>3</sup>

has been developed and is being implemented for the period until 2020 and the perspective until 2030. The main goal of the strategy is to reduce the environmental impact of all company’s activities



by 2 times by 2030, with the priority given to “green technologies”.

To our opinion, it is also remarkable that PJSC “TransContainer” has created the plan of organizational and technical measures in order to meet the target parameters of saving the main fuel and energy resources. This plan was created taking into account some aspects of the Program of energy saving and energy efficiency improvement of JSC “Russian Railways” for 2013-2015.

The most promising tool of “green” logistics should be the widespread introduction of technologies for con trailer transport (Fig.4). This type of transportation includes a range of services for the delivery of goods by road and by rail.

Most of the way trucks are located on the railway platform, and only a small segment of the route is covered «on wheels», so, it allows companies to provide targeted delivery of goods «from door to door». According to «green» logistics, this will reduce car fuel consumption, environmental pollution and ensure the safety of the roads.

There are other ways to implement «green» logistics, for example, by introducing various digital tools. A striking example of this is the creation of a territorial automated system for monitoring the state of atmospheric air (AFM) in Saint Petersburg over the past 15 years. It pursues a number of objectives: the first one is to improve the quality of the air and the second one is to find the measures to prevent and to reduce the negative impact on the air.

In the future, the development of «green» logistics in the transport complex of St. Petersburg should go through the following areas:

- building of new logistics and multimodal centers in order to

improve the efficiency of logistics enterprises and freight transportation;

- introduction of specialized technologies in the warehouse for the purpose of rational organization of the warehouse space and, as a result, reduction of warehouse space and energy consumption;
- development of transport interchanges, construction of new roads;
- reduction of the share of road transport, their replacement by rail and sea (including the development of container traffic);
- monitoring and wide awareness of the city residents and its guests about the environmental situation and measures to improve it;
- providing consumers with the information about the environmental orientation of companies by marking packaging with special signs;
- development and stimulation of waste processing, reduction of recycling tariffs (many entrepreneurs do not bring waste to the recycling zones and leave them at the gates of the recycling enter-

prises because of the high rates of waste disposal).

It seems that in the future the development of industrial symbiosis tools and the successful implementation of the self-titled project in the Baltic sea countries will allow to solve the problems above and to output green logistics to another level of its practical use.

<sup>1</sup>Batrakov E.V. *Transport and transit potential of St. Petersburg / Report at the XII International Forum “Transport Potential”. St. Petersburg, 2019*

<sup>2</sup>According to the Directorate for the development of the transport system of St. Petersburg and the Leningrad Region

<sup>3</sup>According to the Directorate for the development of the transport system of St. Petersburg and the Leningrad Region

## ТЕХНОЛОГИИ КОНТРЕЙЛЕРНЫХ ПЕРЕВОЗОК

### На платформах RoLa



### В вагонах с карманами

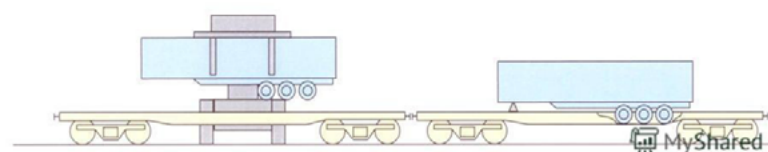


Fig. 4. Cargo piggyback scheme

# Innovative Technologies for the Organic Waste Management

GAIA Corporation has been established in 1992, and since then GAIA Corp. has been manufacturing and trading Organic Waste Recycling Machines/Plants all over the world. GAIA Corp. is the longest and biggest company in this field, and the technologies are mostly applied to treat/recycle food waste, dead livestock. GAIA Corp. has wide range of product, which the smallest is 20kg/day up to 100ton/day. GAIA Corp. suggests the most eco-friendly and the most economical solution of recycling organic wastes.

**Drying:** Drying means dehydration, which means taking out the moisture part of the organic waste.

In other words, it means the whole other parts remains as original, which is the beauty of the drying technology. During drying process the moisture part is being taken out only, while the other solid part is remaining as it is.

Therefore, if there is 100kg of food waste that has 80% of moisture contents, and drying this food waste with GAIA's product until 4.8% of moisture contents, then you will have 21kg of dried food waste.

In other application, if you have big facility and drying 50 metric ton of food waste daily that has 80% of moisture contents, and drying this until around 5% of moisture contents, then you will have 10.5 metric ton of dried food waste every day.

**De-odorizing:** Food itself has good and different nutrition, but when we do not eat and keep it well the food and any type of organic waste will spoil and eventually have very bad smell—odor.

If organic waste treating or recycling machine cannot resolve this odor problem, then actually the manufacturer should never think of launching the product, because this odor is not just one simple odor that can be handled by microorganism or fresh air and so on. When such different organic are mixed, especially when different foods are mixed in waste bin, then the odor is very much mixed and this is called complex odor.

In addition, there are VOC (Volatile Organic Compound), which means such organic that even melts within liquid and gives bad smell to people, which is exactly what sewage sludge and spoiled food waste does.

GAIA has patents that are implemented for the products so the odor is completely blocked and there is no odor around the machineries.

**Crushing:** Without having crushing machines, GAIA technology already has crushing system embedded, so that all dried material comes out in powder form.



**Sterilizing:** GAIA dries organic waste in high temperature, so that all pathogen, germs, bacteria, virus are going to be killed during the drying process.

The bacteria and virus usually are killed higher than 70°C and longer than 1 hour, or 80°C and longer minutes, and GAIA products are in operation with higher temperature, so all harmful virus are killed.

**Recycling:** Because of the functions above, the dried material is ready to recycle, and there are 3 (three) options for recycling. The dried material is also called as ‘Biomass’, you can recycle biomass as Animal feed, Fertilizer/Compost and Fuel.





# ROADSHOW and Peer to Peer exchange of the Baltic Industrial Symbiosis in Russia

**Roadshow** will be organized to present the results of the international project R#082 "Baltic Industrial Symbiosis" of the Interreg Baltic Sea Region Program (BIS project) to a wide audience and all stakeholders within the framework of the XXI International Environmental Forum "Baltic Sea Day" on March 23-24, 2021. The BIS Project promotes the idea of industrial symbiosis as part of the concept of sustainable development in the Baltic Sea region.



The goal of the Roadshow to be successively held in Poland, Russia, Estonia, Latvia and Lithuania, is to inspire municipalities and regions to develop and replicate industrial symbiosis. The event will feature business cases, the results of trainings, examples of policies and decisions.

Simultaneously with the Roadshow, St. Petersburg will host an event for practical experience sharing for managers of industrial symbiosis (Peer-to-peer). It is part of a series of practical experience sharing that took place in Denmark

and Norway, and is also scheduled to be held in Finland, Sweden and Poland. The main goal of these events is to build the potential among practitioners of industrial symbiosis and give managers of industrial symbiosis a unique opportunity to study the real experience of colleagues from neighboring countries and to promote the development of industrial symbiosis from a practical point of view.


The participants of both events will visit the LIVING LAB and learn about the experience of building symbiotic chains in St. Petersburg,

get acquainted with the residents of the laboratory and their pilot projects, as well as share ideas and experience for its development.

*In 1996, the Baltic Marine Environment Protection Commission (HELCOM) declared March 22 the Baltic Sea Day. This decision was first implemented in March 1999, and since then the Baltic Sea Day Forum has been on the annual agenda of HELCOM events*

*The event is held under the auspices of HELCOM, with the support of the Ministry of Natural Resources and Ecology of the Russian Federation, the Government of St. Petersburg, is included in the Work Plan of the Maritime Board under the Government of the Russian Federation.*

*Information on the preparation for the XXI International Environmental Forum "Baltic Sea Day" and registration is available at: [www.helcom.ru](http://www.helcom.ru).*

*Please send your proposals, as well as all questions about the organization, participation and holding of the Baltic Sea Day Forum to the Organizing Committee at [bsd@helcom.ru](mailto:bsd@helcom.ru). Natalia Bobyleva mobile 89112342820. *

