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Analysis of the Usage of Principles of Circular Economy in the Industry of Thermal Insulation Materials (Using the Example of "Rockwool Group")

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Abstract. Motives of the study. The construction industry produces a third of global waste, most of which ends up in landfills. Over the period from 2000 to 2020, the volume of construction work has increased by more than 12 times. The reverse side of the process is the proportional growth of waste. An industry for recycling construction and demolition waste should be create. To speed up the work, it is important to rely on the experience of advanced companies, where the recycling industry has been operating for 20 years. The subject of the study. Lean manufacturing and closed-loop economics processes implemented in "Rockwool Group". The results of the study and its significance. The study analyzed the company's best practices, which in case of applying by other market players will help them to join the global trend of energy efficiency and environmental care, and can improve the situation in the construction industry. Eco–friendly production is part of a new model of world development, which is based on a cyclical economy, the preservation of natural capital and the release of products that have a positive impact on society.

Keywords: insulation materials, ecological report, lean production, eco-friendly production, Sustainable Development Goals

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Анализ использования принципов циркулярной экономики в индустрии теплоизоляционных материалов (на примере компании Rockwool)

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Аннотация. Предпосылки исследования. Строительная отрасль производит треть глобальных отходов, большая часть которых попадает на свалку. За период с 2000 по 2020 год объем строительных работ вырос более чем в 12 раз. Обратной стороной процесса является пропорциональный рост отходов. В отрасли следует создать индустрию рециклинга отходов строительства и сноса. Для ускорения работы важно опираться на опыт передовых компаний, где индустрия рециклинга действует уже 20 лет. Предмет исследования. Процессы бережливого производства и экономики замкнутого цикла, внедрённые в компании Rockwool. Результаты исследования и их значение. В ходе исследования были проанализированы лучшие практики компании, которые при их применении другими игроками рынка помогут им включиться в общемировой тренд энергоэффективности и заботы о природе, а также могут улучшить ситуацию в строительной отрасли. Экологичные производства – часть новой модели развития мира, которая основана на циклической экономике, сохранении природного капитала и выпуске положительно влияющей на общество продукции.

Ключевые слова: теплоизоляционные материалы, экологический отчёт, бережливое производство, экологичная продукция, цели устойчивого развития

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Introduction

Indicators of the development of the construction industry reliably show the state of affairs in the economy. Over the period from 2000 to 2020, the volume of construction work in Russia has increased by more than 12 times. Even during the crisis years, the volume of commissioning of new buildings has hardly decreased and is not going down, renovation and re-profiling projects of buildings are being implemented, public spaces are being improved, roads and railways are being built and repaired. All these processes which are necessary to create a comfortable human environment have a downside – the production of a large number of construction and demolition waste (CDW).

The issue of civilized treatment of CDW is particularly acute today. More recently, these wastes were sent for burial, but now, in the context of reducing the area of landfills and the associated acute social tension, it is time to solve the environmental problems of construction by methods adopted in developed countries of the world.

According to statistics, construction waste accounts for almost a third of all waste generated in developed economies. With the development of separate collection programs, construction debris occupies an increasing part of the total waste structure. In Germany and the Netherlands in 2020, the share of construction debris was 55 %, in France – 70 %, in Luxembourg it reached 90 %. Back in 2008, a framework directive was adopted in the EU, according to which the main way to combat the increase in the volume of CDW should be the processing of these wastes for further use. The share of CDW recycling that Europeans want to achieve by 2025 is at least 70%. And although this figure may not be achieved in a number of countries, up to 90 % of construction waste is already being processed in some European countries. The leaders in this are the members of the so–called Landfill ban – a ban on dumping waste into the ground, adopted in 1996 – Denmark, the Netherlands, Sweden and Germany [Pakhomova, 2017].

Experts say that a new industry is already functioning in Europe – the recycling industry. It took about 20 years to create it, and this work is complex. The ban on dumping waste into the ground does not exist in the form of a separate legislative norm – it is a whole system that includes strict control over attempts to create unauthorized landfills, a complete ban on the export of CDW to landfills, or prohibitively high prices for such disposal of construction debris. In parallel, the law prescribes, and the developed system of various benefits and preferences encourages the separation of construction waste into fractions and their maximum deep processing. In the USA and Canada, the cost of waste disposal also dramatically exceeds the cost of recycling, so a business that knows how to count money makes a choice in favor of environmentally friendly solutions [Kurilova-Palisaitiene, 2017].

According to environmentalists, in 2020, only 5–10 % of construction waste was recycled in Russia, and most of this volume is scrap reinforced concrete and bricks, the recycling of which does not require complex production processes.

Results and discussion

Circular economy is a system built on three principles: minimization of waste and absence of negative impact on the environment, maximum use of manufactured products, reproduction of natural resources. This is especially true for the construction industry, which consumes almost half

of all resources extracted every year and produces a third of global waste, most of which ends up in landfill.

It is necessary to create an CDW recycling processes in the industry as soon as possible. It is advisable to draw on the experience of leading companies in this area.

An example is the Rockwool Group – an international group of companies, a manufacturer of solutions based on stone wool. The products are used for insulation, sound insulation and fire protection and are intended for all types of buildings and structures, as well as for shipbuilding and industrial equipment.

The Danish company "Rockwool" has 4 plants in Russia: LLC "Rockwool" (Moscow region), LLC "Rockwool-Sever" (Leningrad region), LLC "Rockwool-Ural" (Chelyabinsk region), LLC "Rockwool –Volga" (Republic of Tatarstan).

The construction industry accounts for up to a third of global waste. Most of them end up in landfill, harming the environment. Rockwool company, as one of the largest manufacturers of stone wool insulation in Russia, contributes to solving the problem of recycling construction waste.

The company began to introduce lean technologies at its plants located in the territory of the Russian Federation. Her experience, scalable to other enterprises in the construction industry, can have a positive effect on the issue of waste recycling [Narusawa, 2019].

Rockwool's environmental standards are uniform at more than 50 production sites worldwide. In 2019, the 20th anniversary of the production of natural stone in Russia was celebrated. The most important thing is that in addition to the development of the enterprise, great attention is paid to social projects. And the company's approaches to the ecology of our planet, including our country, are the most advanced, and today this is especially valuable.

In 2016, the company committed itself to fulfilling 10 of the 17 UN Sustainable Development Goals. Stone wool initially allows you to save the resources of the planet: due to high-quality insulation, buildings consume less energy for heating and air conditioning. The less energy humanity consumes, the smaller the carbon footprint left and the negative impact on nature.

Rockwool believes that a modern company, no matter how energy-intensive it may be, should strive for decarbonization and negative carbon emissions. Therefore, in 2020, Rockwool joined the SBTi Science Goals initiative and approved an ambitious plan to reduce greenhouse gas emissions during the product lifecycle.

Rockwool has the status of a company with negative carbon emissions, since the products sold annually during their operation will prevent 100 times more carbon emissions than were generated during its production.

All Rockwool products are classified by global climate risk analysis data provider Trucost as having a positive impact on achieving the SDGs. Out of 15,000 assessed businesses, Rockwool is among the top ten leaders in reducing carbon emissions and preserving the environment [Korhonen, 2018].

The principles of the closed-loop economy are similar to Rockwool and fully echo the set goals of sustainable development. At the end of 2020, Rockwool announced ambitious, science-based global decarbonization goals, which were tested and approved as part of the Science Based Targets (SBTi) initiative. This is a joint initiative of the Carbon Disclosure Project, WWF, the UN Global Compact and the World Resources Institute (WRI). Key elements of the decarbonization plan include:

– reduction of absolute greenhouse gas emissions at enterprises by 38 % by 2034 (compared to the base year 2019);

– reduction of non-production greenhouse gas emissions in absolute terms over the entire product life cycle by 20 % by 2034 (compared to the base year 2019).

In total, Rockwool plans to reduce CO2 emissions by a third by 2034 at all stages of the life cycle of rock wool: from extraction of raw materials and production to processing and disposal. The company is going to continue to reduce the carbon intensity of production (carbon emissions per ton of output).

Another evidence that circular economy and lean manufacturing are a priority for Rockwool is joining the Ellen MacArthur Foundation in 2019.

The Ellen MacArthur Foundation (EMF) is an international leader in the field of analytics, whose activities are aimed at actively supporting the transition to a closed–loop economy. UPM Raflatac participates in the initiative program of the New Economy of Plastics, led by the Foundation [Jones, 2020].

The Ellen MacArthur Foundation is an international non–profit organization founded in 2010 to accelerate the transition to a closed-loop economy. Since its inception, the organization has grown into a global opinion leader, putting the closed-loop economy on the agenda for decision makers in business, government and academia.

In order to make the transition to a closed-loop economy, it is necessary to involve all parts of the system. Therefore, the Foundation works with enterprises, international organizations, governments, cities, universities, non-governmental organizations, innovators and many other categories of stakeholders. The Foundation creates resources and tools to help stakeholders establish effective policies, find new ways of doing business and develop better products [Geissdoerfer, 2017].

As part of the CE100 project, Rockwool has much more opportunities for close cooperation with other companies seeking a closed production cycle in their fields. Rockwool's stone wool products are durable and recyclable, so they already have cyclic properties. It will be very valuable to work closely with other companies, partners and regulatory authorities to improve, for example, waste management methods and optimize recycling and reuse schemes of materials.

The closed-loop economy program assumes expanded responsibility of the manufacturer for packaging.

Today, the construction industry needs to organize a closed production cycle, within which packaging is never sent to waste and does not harm the environment. Packaging that cannot be discarded and cannot be reused should remain within the closed-loop economy and should not be released into the environment. Rockwool, together with more than 150 leading companies and organizations, joined the initiative of the Ellen MacArthur Foundation to introduce Extended Manufacturer Responsibility (EPR) for packaging [Doroshenko, 2017].

Stone wool can withstand an unlimited number of recycling cycles

Rockwool is the first thermal insulation to receive the EcoMaterial Green mark. He confirms that the material is safe for use in all types of buildings and for interior decoration, including bedrooms and children's rooms.

In 2016, all four plants in Russia were awarded one of the highest environmental safety marks – EcoMaterial Absolute.

In 2017, the Russian division of the Rockwool Group received an Environmental Product Declaration (EPD). The use of such products in construction makes it possible to increase the rating of environmental friendliness of buildings according to the international assessment systems LEED and BREEAM. The presence of a declaration is necessary if the materials are used in houses that are built according to «green» standards.

Thermal insulation plays a huge role in solving the issue of energy conservation and conservation of natural resources. After all, well-insulated houses require less energy consumption for heating and air conditioning, which means they reduce human influence on nature.

The company is constantly improving the technological process of manufacturing stone wool to minimize the impact of enterprises on the environment. All plants have a closed cycle: cotton wool trimmings are returned back to production to make it as lean as possible. In addition, Rockwool insulation is one of the few industrial products with a positive energy balance. This means that the amount of energy that their solutions save is many times higher than that used for their production [Gallaud, 2016].

Recycling of thermal insulation from construction sites is a new step in the development of the brand's environmental initiatives. Even now, including at Russian factories, technological waste and by-products are being returned back to production.

In general, Rockwool processes its products in 10 countries around the world, including Russia. In 2019, the company processed 160,000 tons of rock wool, and this figure will only grow, as the brand plans to introduce recycling services in 30 countries by 2030.

Since July 2020, the company's plant in Vyborg has been accepting for processing scraps of facade and roof insulation boards formed during installation, as well as materials that have already served. The project was called "Second life", and it really fully reveals the cyclic properties of stone wool: the material can be recycled without loss of quality an infinite number of times.

Now manufacturers of installation and repair work do not need to dispose of construction residues, you can bring materials to the manufacturer's factory – it is convenient and cost-effective. For the company, the processing of thermal insulation from stone wool is a serious contribution to improving the environmental situation. Waste intended for landfill disposal is turning into a promising source of raw materials. The service life of stone wool is at least 50 years, but with the introduction of processing technology tends to infinity.

The list of the company's achievements in the field of sustainable development for 2018 includes the following facts:

200 million tons of CO2 emissions during its operation will be avoided by thermal insulation produced and installed in 2018 (Sustainable Development Goal (SDG) 13 – combating climate change).

The company's work on this aspect began in 2017. The results are shown in figure 1 [Kopnina, 2021].

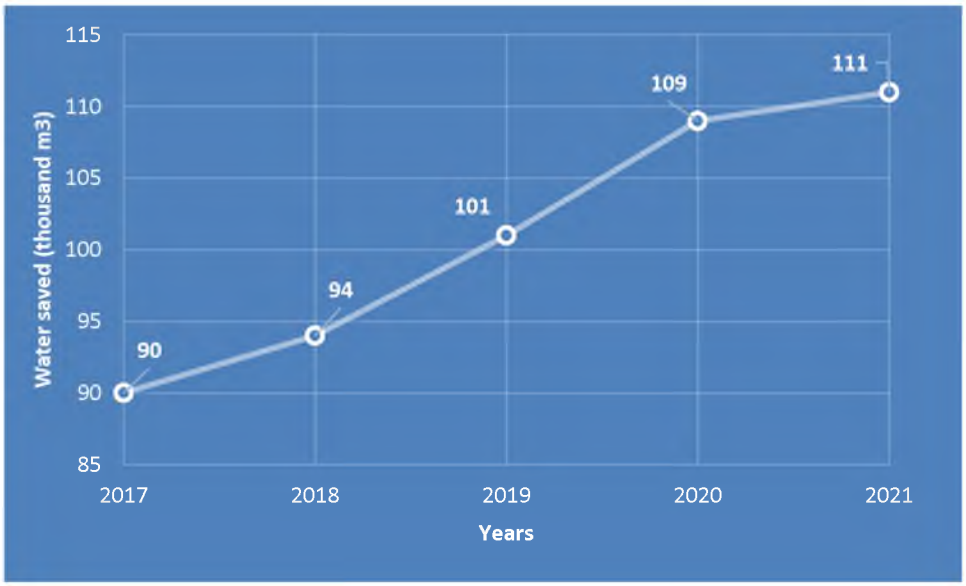

Fig. 1. Enabling more carbon-efficient buildings and industry. Carbon emissions avoided (Mt CO2) in the lifetime of building insulation sold

94 million liters of water are saved by greenhouse products sold in 2018 (SDG 6 – clean water and sanitation);

It is important to note that Rockwool started working in this direction in 2017 and continues today. We present the results in figure 2 [Ghosh, 2021].

In 2019, the GREEN BOOK catalog for the fifth time confirmed the chemical and radiological safety for human health of Rockwool materials made of non-combustible natural stone. The purpose of the project is to inform the public about the environmental aspects of building materials presented on the Russian market. The company is the first and permanent participant of the «green» catalog.

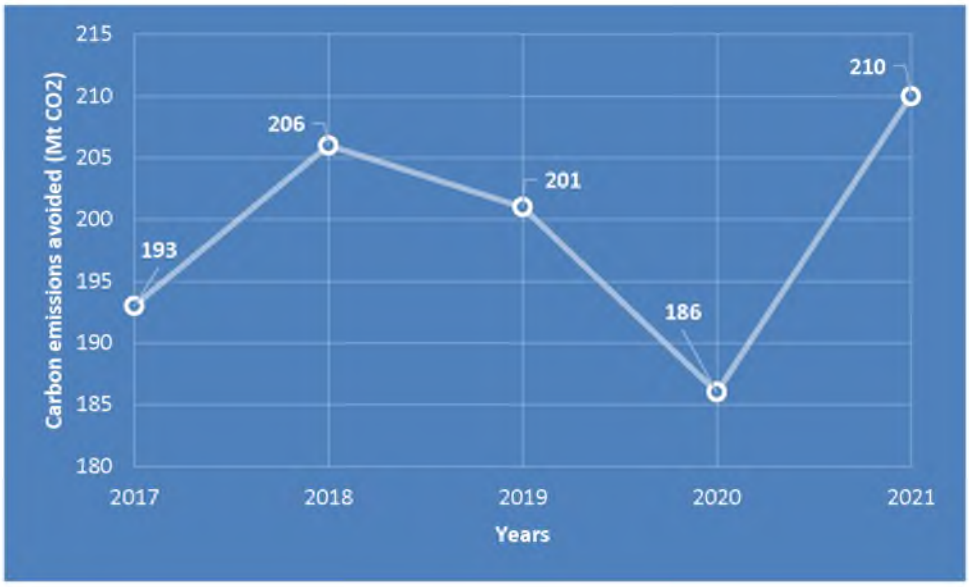

Fig. 2. Enhancing water efficiency in horticulture. Water saved (thousand m3) by precision growing products sold compared to soil-based solutions

Rockwool products comply with the Eco Material Absolute environmental safety standard and have an EPD environmental declaration, increases the rating of buildings certified according to LEED and BREEAM standards [Tukker, 2015].

In 2020, for the second time, all Rockwool products were classified by Trucost, a global data provider for climate risk analysis, as having a positive impact on achieving the SDGs.

Rockwool has achieved two of its six interim sustainability goals two years ahead of schedule. This is a 50 % reduction in industrial waste sent to landfill, and an increase in the efficiency of water use at the brand's plants by 10 %.

In 2021, Rockwool switched three production lines to low-carbon melting technologies and fuel sources, and also announced plans to create additional low-carbon capacities. The effect of these and other emissions reduction investments will manifest itself in the coming years, helping the company achieve decarbonization goals.

Conclusion

All companies are in need of being actively involved in the global trend of energy efficiency and caring for nature. At its own level, almost every company can do this.

A responsible and efficient business today is unthinkable without a sustainable development program covering all stages of the product life cycle, its production conditions, the comfort of employees and care for the environment [Kumar, 2016].

The construction of a healthy, dynamically developing economy should be associated with high social and environmental responsibility of all professionals involved in this process. And in order for plans and intentions to be filled with real meaning, they must be based on sound calculation and clear procedures.

Eco-friendly production is part of a new model of world development, which is based on a cyclical economy, the preservation of natural capital and the release of products that have a positive impact on society. Rockwool believes that by joining forces with other market participants, it will be possible to build a sustainable future for the next generations.

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