Social and Economic Analysis of Project Management for Foam Glass Production Company Establishment

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Abstract: Currently, much attention is paid to the development of new thermal insulation materials in the production of building materials suitable for use in industrial and residential premises. Foam glass is one of the most popular inorganic thermal insulation materials. Foam glass is considered as one of the most high-quality and durable heat-insulating materials. It has a number of strength characteristics, among which are resistance to deformation, compressive strength, and resistance to environmental influences. Foam glass products are resistant to heat and aggressive chemicals, they do not undergo a combustion process, do not form smoke and do not emit toxic combustion products, and are also resistant to low temperatures. The material is easy to process, which allows you to get products of any desired shape. In this regard, this article discusses the relevance of an enterprise establishment for the production of foam glass: they performed the review of the material properties, environmental friendliness, production methods, and technologies, and analyzed the presence of competitors in the Republic of Tatarstan. The main conclusions on scheduling and social and economic analysis of the planned production are also presented. The purpose of the work is the creation of an enterprise for the production of foam glass. To achieve this goal, it is necessary to analyze the Russian market of heat-insulating materials, research the sales market and draw up a marketing plan, develop a schedule for an enterprise establishment, calculate the economic justification for the proposed production effectiveness, analyze the risks of a project for an enterprise establishment using the sensitivity analysis method.

Keywords: Environmental friendliness, heat-insulating material, foam glass, inorganic material, economic analysis.

INTRODUCTION

The purpose of the work is to develop a project to establish an enterprise for the production of foam glass, as a heat-insulating material. To achieve this goal, the following tasks were solved:

1) The circle of main consumers and target markets for products has been determined, key competitors have been identified, the marketing strategy has been developed;

2) They selected the technological line for the production of foam glass as a heat-insulating material;

3) A schedule for the project implementation has been developed;

4) The break-even point of the project is calculated;

5) The basic economic indicators of the project are calculated and the economic efficiency of the project is evaluated;

6) The analysis of the project risk is performed.

Currently, in the production of building materials, much attention is paid to the development of new heat-insulating materials suitable for use in thermal insulation of industrial and residential premises. The market for insulation materials is provided with a huge variety of assortment and allows you to choose organic, inorganic, and mixed types of materials.

One of the most popular inorganic thermal insulation materials is foam glass. The main raw materials for its production are glass and a blowing agent, for which they use coal as the most affordable material (Minko *et al*., 2013).

Three methods are used for the production of foam glass:

1. Powder;

2. The formation of pre-foamed mass;

3. Foaming of glass powder with further mass sintering.

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The main and most cost-effective technology is the powder method of foam glass production. This method allows you to get foam glass with different structures and properties depending on the powder composition, the type and amount of blowing agent used, and heat treatment temperature and duration.

To produce the highest quality material, the smallest powder grains are used. This allows you to get a lighter and more durable material, with a uniform structure and low coefficient of thermal conductivity.

The bulk density of the foam glass also depends on heat treatment temperature and duration: at a higher temperature or a longer thermal process, the possibility of a lighter material obtaining increases.

The powder production method: silicate sodium-calcium glass is crushed to the size of 80 microns, mixed with a carbon-type foam-forming additive, placed in molds, and subjected to heat treatment. At the temperature of 750 - 850 °C, glass particles sinter, and at the same time gas is released in the system, which foams the composition. Then the foam-glass blocks are removed from the molds and placed in an annealing furnace, where they are cooled at the speed of 0.6-1.5 °C/min for 8-16 hours. Finished blocks are cut into the products of the required shape, polished, and sent for storage.

Currently, the studies are being conducted on the possibility of domestic and industrial cullet processing into highly efficient heat-insulating materials without the use of traditional carbonate and carbon-containing blowing agents. This will reduce the cost of finished products, as well as make the material more environmentally friendly. The environmental friendliness of the produced material will eliminate the negative impact on the environment and avoid the negative consequences of its operation (Semeynyh and Sopegin 2018).

METHODS

Foam glass is a highly effective thermal insulation material. It is made due to the ability of silicate glasses to soften and foam in the presence of a blowing agent. The main raw materials for its production are glass and a blowing agent, for which coal is used most often as the most affordable material. Glass can be used as a source of raw materials, which can be window, bottle, and other glass type cullet that is accumulated in solid household and industrial wastes (Artamonov *et al*.).

Thus, the production of foam glass is accompanied by the disposal of waste glass, which is not decomposed over time and accumulated in the environment in the form of human life waste. Currently, the problem of recycling production and waste consumption is extremely urgent, since they have a dangerous effect on the ecosystem.

So the project management in this field can be useful for the employment and also environmental ethics as the main concern of the modern society. So in this paper in addition to the productivity, the reduction of the unemployment's and its harmful effects on society have been considered.

Scientists have studied the possibility of glass waste recycling through the production of building materials since the 1970-ies, but no practical studies have been conducted in this area. This issue was raised by the experts from the faculty of Engineering and Applied Sciences of Columbia University (USA), and by the experts from Mordovia State University (Russia).

The production of high-quality block foam glass is a complex technology conditioned by physical-chemical processes during foaming, as well as by the fact that strict requirements are imposed on the processes of fixation and annealing.

The fixation of foam glass is complicated by the fact that glass does not exhibit sharp hardening upon cooling, and the process can also be accompanied by exothermic reactions and glass melt crystallization.

The production of granular foam glass is less complicated. Its mass production is less demanding on the composition of glass and the perfection of heat engineering units (Pshinko *et al*. 2015).

RESULTS AND DISCUSSION

Social and economic analysis for project management from the aspect of the sociology shows its efficiency in employment rate and environmental issue, whilst it can be used for better performance in the production and GDP. Polymeric heat-insulating materials on the market are mainly represented by polystyrene foam, polyurethane foam, and Penoflex.

It is important to note that, nevertheless, the properties of heat-insulating materials of different groups are quite close, since the main characteristic - thermal conductivity - has close indicators for all types of materials (Scherbak 2013).

There are 49 enterprises in Russia producing thermal insulation materials of mineral wool, 25 factories for the production of extruded polystyrene foam, and more than 150 factories for the production of expanded polystyrene foam. The largest manufacturers of heat-insulating materials in Russia are the companies "TekhnoNikol" LLC, "Rokvul" LLC and "URSA-Eurasia" LLC.

The market of heat-insulating materials in Russia demonstrates a constant increase in total consumption, as well as a fairly small amount of imported products, the range is mostly represented by domestic materials. Besides, domestic manufacturers also send part of their products for export to other countries.

The Russian market has a significant amount of innovative thermal insulation materials. A fairly wide range of liquid ceramic thermal insulation is presented, which is available in the form of heat-insulating paint. However, equating this product with thermal insulation materials will not be entirely correct (Skorokhodova 2014).

At present, foam glass is highly demanded among consumers, since this heat-insulating material has good technical characteristics and at the same time has a low cost as compared to other materials. Competition in the foam glass production market is quite low.

The main reasons for heat-insulating material production and sale increase in Russia are the increase of sports facilities, the renovation of housing and communal services, the increased requirements for energy efficiency of buildings, and the development of exports.

The analysis of competitors in the Tatarstan market for the production of foam glass showed that it is not widely developed and the competition is quite low (https://infelko.ru; Website of the company LLC “Globus”; https://prcs.ru; Website of the company TepIzProm LLC; http://izostek.ru; http://www.icmglass.ru).

This project will solve the social and environmental problems of the region. The marketing plan will be needed to provide for the following set of measures:

1) Creation, promotion and maintenance of the site, which will host all the basic information about the company, the proposed range, as well as the online sale of foam glass, feedback will be organized with consumers;
2) Participation in exhibitions of heat-insulating materials;
3) Business meetings and contracting with construction companies;
4) Contextual advertising, for example, in "Yandex.Direct";
5) Maintaining an account on Instagram, advertising on social networks.

The planned premises for the foam glass manufacturing enterprise must meet all the requirements for the placement of the necessary production equipment:

1) The availability of space for finished products and raw material storage;
2) The premise must be heated and guarded;
3) The corresponding ceiling and gate height;
4) The presence of a ramp, a crane beam.

Geographical characteristics of an enterprise:

1) The production room should be located in some industrial zone within the city, with a convenient passage from anywhere in the city;
2) The availability of office space in close proximity to production;
3) The presence of railway tracks and stations in the immediate vicinity of the production site to facilitate the supply.

The technology for foam glass production includes the following steps:

1) Cleaning cullet from debris and drying;
2) Grinding of raw materials to a powder state (80 microns);
3) Mixing glass with a carbon-type foaming additive;
4) Foaming the resulting glass mixture with the addition of a blowing agent when it is heated to 750 - 850 °C. At this stage, the mass acquires a porous structure due to the evolution of gas, which foams the composition.

In the process of pore formation, the mass is a plastic viscous mixture in which the blowing agent is distributed evenly, and the evolved gas creates a

stable and uniform glass foam. The resulting highly porous structure is fixed by rapid hardening of the glass during product cooling. Hardened foam glass is annealed to relieve temperature stresses in the bulk material.

Then the foam-glass blocks are removed from the molds and placed in an annealing furnace, where they are cooled at the speed of 0.6-1.5 °C/min for 8-16 hours.

The foam glass production line consists of a shredder or a crusher, a mixer, a conveyor belt, furnaces, washing machines and packaging machines (Semeynyh and Sopegin 2018; Pshinko *et al*. 2015).

The project duration makes 7 years, based on the useful life of the equipment for foam glass production. According to OKOF, this equipment belongs to group 5 with a useful life of more than 7 years up to 10 years inclusive.

Working hours in the project: work week - 5 days, shift time - 8 hours, number of shifts - 1, lunch break - 1 hour. To implement this project, it is necessary to employ 8 people.

SUMMARY

The building materials market has a wide range of products to offer. One of the most important materials is heat insulation, which is currently in great demand among consumers. This is due to the fact that traditional building materials are not able to retain effectively the heat that the walls of the rooms emit. Special heat-insulating materials are used for this.

These materials are necessary to ensure a comfortable microclimate inside the premises, reduce heat loss from the inside of the building and limit the flow of excess heat from the environment. Also, the use of thermal insulation can significantly reduce the cost of building materials, reduce the mass of structures and reduce the cost of heating buildings and structures, which in turn reduces the amount of carbon dioxide and other combustion products into the atmosphere. Thanks to this, the overall environmental situation improves and the level of the greenhouse effect decreases.

Also, the social impact of the project management through the environmental ethics and employment rate can be evident. Currently, a fairly wide range of heaters is presented on the building materials market, which provides consumers with the opportunity to select materials that satisfy their needs.

One of the most popular materials is foam glass, since it has quite good characteristics in "price-quality" ratio. Market competition for the production of foam glass is currently minimal, which means that the creation of a project for foam glass production from cullet can become a fairly profitable enterprise.

Glass recycling is an important waste management industry that helps protect the environment, conserve natural resources, and significantly reduces production costs.

There are a number of reasons why it is necessary to send glass for recycling:

- Firstly, glass is not biodegradable;
- Secondly, glass fragments pose a danger to the life of animals and people;
- Thirdly, the glass clogged soil becomes unsuitable for plant growth;
- Fourthly, re-processing allows you to save natural resources: sand, soda, limestone.

All mentioned above determines the relevance of this work. Thermal insulation materials made of foam glass are currently quite popular among consumers. Within the ratio “price-quality”, they allow you to create the most comfortable conditions in residential premises, and to create conditions for maximum energy saving.

CONCLUSIONS

The aim of the project was the creation and commissioning of a company for foam glass production. To achieve the main goal in economy, sociology and environment, the following tasks were completed:

- They analyzed the Russian market of thermal insulation materials;
- The sales market has been studied;
- A marketing plan has been drawn up (Iskhakova *et al*. 2017) - it is planned to spend about 120,000 rubles a year on marketing activities;
- The premise for production was selected - the newly created enterprise will be located in the Aircraft Building District of Kazan according to the following address: Tetsevskaya str., bld. 19;

- The suppliers of equipment and raw materials were found;

- They calculated the cost of electricity, water (Iskhakova *et al*. 2017) for the production of 1 m3 - 14.25 rubles., and 3.93 rubles, respectively;

- They determined the key phases of the project; project participants (their duties, responsibilities); they compiled a project work schedule (Iskhakova *et al*. 2017) - the duration of the project was determined by the critical path and PERT methods, which amounted to 378 and 405 days, respectively;

- Breakeven point was found (Sultanova *et al*. 2018) - in order to compensate for expenses with revenues, it is necessary to produce 434.47 tons of foam glass per year;

- They calculated net discounted income for 7 years (Sultanova *et al*., 2018) - with each year the value of income increases, which means that the project can be considered as profitable;

- The payback period (Sultanova *et al*. 2018) of the project is determined, which will be about three years;

- They calculated yield index (Sultanova *et al*. 2018), equal to 7.48 rubles. - the value of the profitability index indicates that our project is profitable, for one ruble of invested funds, the discounted profit will be 7.48 rubles;

- they calculated the internal rate of return (Sultanova *et al*. 2018), amounting to 52.80% - at this value, the present value of all the cash flows of the project is zero;

- The risks of the project were analyzed by the sensitivity analysis method (Sultanova *et al*. 2018)- the greatest danger is represented by the risk of 10% revenue decrease and by 10% inflation increase, it will be necessary to pay close attention to them. The lowest risk is the cost of equipment increase by 10%.

Based on the sources studied, the following conclusion can be made: the domestic market has great potential for business development to produce such heat-insulating material as foam glass.

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