CREATION OF HIGHLY SCIENCE-INTENSIVE PRODUCTION FACILITIES, MATERIALS AND ELECTRONIC PRODUCTS - A WAY TO SOLVE THE MOST IMPORTANT PROBLEMS IN THE FORMATION OF INVESTMENT ATTRACTIVENESS OF REGIONS

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Abstract: The investment process plays an important role in the economy of any region and the country as a whole. Investing largely determines the economic growth of the state, level of employment and constitutes an essential element of the base the economic development of society rests on. Therefore, the problem associated with the effective implementation of investment deserves serious attention, especially at the present time - a time of consolidation of market entities and redistribution of property.

Kabardino-Balkaria and the city of Nalchik, as its capital, are part of the North Caucasus Federal District, and its economy is currently of a great interest for both domestic and foreign investors. Each region of the District has developed its own investment environment. Different regions and municipalities have different workforce and natural resources potentials, levels of development of manufacturing and construction industry, transport infrastructure, etc. In this regard, it is fundamentally important that investors will come to those regions and industries, where they will receive the greatest investment opportunities, level of security, and economic efficiency.

If we fail to attract investors to KBR, then the investments will flow to other regions. Formation of the investment attractiveness of the republic as an element of local economic policy, associated with the image of the republic and its business community, requires accurate identification of problems, selection and justification of a development system, and development of comprehensive measures aimed at attracting funds of domestic and foreign investors, effective use of local investment resources.

Keywords: The dynamics, money incomes, investments, capital, economic profitability, investment project.

Introduction

Due to the high importance of fundamental economic improvements of the industrial enterprises' investment policies system, and considering the peculiarities of investment projects, as well as the need to choose the most effective way to solve them a need to address issues of improving measures for its implementation has originated.

The main task of solving these problems is to develop effective ways to activate the investment process, developing elements of forecasting and investment analysis models.

Our research is devoted to the substantiation of the effectiveness of the creation of an industrial complex in order to attract investors to lend the necessary funds to acquire technological equipment [1].

The proposed long-term investment project is projected to evaluate the investment attractiveness of the project in terms of their position in the market of high-tech production.

And here we note the great importance of investments not only for the economy of the country as a whole, but also for the future position of a separate project [2].

We conducted market analysis of silicon and raw materials and came to the conclusion that to improve the investment climate and optimize the quality of the investments cluster in the region the construction of a plant for the production of single-crystal silicon is possible in Kabardino-Balkaria [3].

At the same time, mono-crystal silicon, used in electronic equipment, is a scarce semiconductor material and an exchange-traded commodity. Mono-silicon is the most advanced form of high-purity silicon and is the basic material for the production of first-generation solar cells and substrates in electronics production.

The equipment necessary for growing and processing of mono-silicon is produced in Russia, Germany, USA, China, Taiwan, etc.

Scientifically substantiated long-term investment project provides for the establishment of favorable investment climate in Kabardino-Balkaria, namely the organization of mono-silicon production by attracting necessary investment.

Financial forecast

This part of the long-term investment project describes important points and conditions of creating the project, as well as financial projections. The basic scenario of financial forecast is based on the principle of conservatism, and therefore, income and reserves of the Project, costs and liabilities are also based on this principle.

The startup process of crystal growth and wafer manufacturing, with a view to the rational allocation of financial and human resources, is divided into four stages.

Stage1. Familiarization with the crystals production process - 6 months

The stage of familiarization with the crystals production process starts after a period of three months of the site launch and mastering the technology of growing mono-crystalline silicon ingots.

At first two growth units produce mono-crystalline silicon ingots of solar quality intended mainly for the production of photovoltaic modules. Then, the silicon ingots of higher electronic quality are produced, the ones intended mainly for the production of discrete semiconductor devices and integrated circuits [4].

Stage 2. Familiarization with the wafers production process - 6 months

The stage of familiarization with wafer production begins after six months of familiarization with the crystals production process. Single melt load will remain at this stage at 240kg, and the yield of silicon will be 60%.

Stage 3. Industrial production of crystals and wafers - 1st year

After six months of familiarization with wafer production phase begins the industrial production of crystals and wafers. Single melt load and the yield of silicon at this stage will be 240kg and70%, respectively [5].

Stage 4. Start of production at full capacity (300 kg melt load)

After the period of one year industrial production of crystals and wafers production at full capacity will start. Single melt load at this stage reaches 300 kg, and the yield of silicon is 75%.

Costs and projected profits for the 1st and the next 4 years of work at the design capacity of the project are presented below.

High-grade polycrystalline silicon of high purity and of the 5N - 9N grade is used as a raw material for manufacture of silicon single crystals. The product is freely sold at the stock exchange [6].

The main suppliers of polysilicon in the world are the USA, Russia and China.

The construction of a pilot plant for the production of cheap, in comparison with world prices of polysilicon in our country, in Irkutsk, at the production site and technology Institute of Geochemistry them. A.P. Vinogradov SO RAN is coming to the end [7].

An investment project OOO "NITOL COMPANY" is also putting into effect in the Irkutsk region, in Usolie-Sibirskoe, on the territory of "Usoliekhimprom".

Further, here is the construction of Russia's first large-scale production complex on manufacture of the basic raw material for solar energy and electronics industries - polysilicon capacity of 3800 tons per year. The cost of one kilogram of polysilicon, according to the purity varies from $2.3 to $40[8].

The Global polysilicon market. Silicon dioxide (silica) serves as a raw material for polycrystalline silicon. Silica is widely distributed in nature in the form of sand, quarz and clay. The production and consumption of silicon in the world is more than 125 thousand tons per year. Polycrystalline silicon (PCS polysilicon) and monocrystalline silicon (Monokini, monosilicon) belong to the category of high-purity (crystal, chemical) silicon. Polysilicon is a raw material for the production of more perfect silicon - monotreme, and can be also used in pure form along with monogrammiert in some applications (for example, in the production of solar modules)[9].

Polycrystalline silicon production for the needs of the solar industry is growing steadily. So, only for 2 years, its consumption has doubled (from 23 in 2011 up to 46

thousand tons in 2013). Annual growth is about 30 %, but there was a serious shortage of silicon for the needs of the solar industry.

In the end, by 2015, all manufacturers is planned to produce about 100 thousand tons of polycrystalline silicon[10].

The average production cost of 1 kg of polysilicon according to the traditional technology is $30.

The Russian market of solar energy**.** In Russia solar energy hardly developed till the last time, although solar cells are made for the space industry from 1950-ies.

On the territory of our country there are several manufactures of solar modules, including 3 large-scale, each with a capacity of not less than 10 MW per year in Moscow, Ryazan and Krasnodar. For example, in the Ryazan metal ceramics instrumentation plant (RZMKP) an american line on 15 MW per yearis mounted [11]. Most of the products of the plant till recently were exported. From all Russian manufacturers of solar batteries only OAO RZMKP has the certificates "Rostest" and ISO. Exactly, 2 lines of Ryazan plant in 2010 worked in normal mode, Krasnodar "solar wind" has brought its production in Spain recently.

The total production capacities of Russian producers of photovoltaic modules exceed 50 MW of finished products per year (evaluation of OAO NPP Kvant") [12]. Despite the fact that in Russia it is sold not more than 5 % of this amount, about 200 companies declare their main activities - sales and installation of solar power plants and photovoltaic systems on the territory of Russia.

At present, more than 13 companies in Russia produce photovoltaic cells for solar systems:

LLC "Firm "Solar wind" (Krasnodar);

ZAO "OKB of the plant "Krasnoe Znamya" (Ryazan);

OOO NPF "Quark" (Krasnodar);

OAO NPP "Kvant" (Moscow);

OOO NPF "Sunenergy" (Moscow);

OOO "Solar Energy" (Moscow);

AOZT "AMEX" (Zelenograd);

OAO "Podolsk chemical and metallurgical plant" (Podolsk);

ZAO "Telecom-STV (Zelenograd);

OAO "Saturn" (Krasnodar);

OAO "Ryazan metal ceramics instrumentation plant" (Ryazan);

OOO "Soltek" (Nizhny Novgorod) [13].

Currently we are building new plants of photovoltaic cells in the Stavropol region (by 2015), and in the Irkutsk region (since 2009, for7.5 billion rubles) and others.

The companies OAO Kvant, Nitol solar, the Continent's energy, Solar wind, Solar flux, Hevel, Podolsky chemical & metallurgical plant (PCMP) said about their projects on production of photo power engineering in Russia [14].

Opening of new manufactures of solar cells in Russia is connected with the creation of integrated structures with the beginning of the production chain, at least for polycrystalline silicon.

The organization of polysilicon production is the most expensive stage in the chain. Besides, this stage takes the longest time to organize the production.ROSNANO manifests itself most actively in the creation of solar cells in Russia, the company participates, at least in 3 applied projects.

ROSNANO is interested in solar panels, based on the polysilicon technology and thin-film technologies [15].

So, according to analytical studies it is revealed that of all the projects of organization of production of solar batteries in Russia, five of them are realized, another three also have very high chances. The main obstacle for the remaining projects is the global financial and economic crisis, which reduced the investment activity of the participants.

Profits

In this part of the investment project an earnings forecast for the first five years of operation of the project is provided. The first year of the project is displayed by months, while the estimates for 2nd to the 5th year of operation are summarized by year.

Project revenues are calculated separately for the two different products – the silicon mono-crystal ingots of grades 5N - 9N and the silicon wafers. The main products of the operation are the silicon mono-crystals for electronics and solar energy industry.

According to the project the calculations of the turnover were based on the premise that in the first month of operation 1 ton of mono-crystalline ingots will be made.

During the first year of operation the production will increase gradually to 9 tons per month. During the launch period the silicon wafers will not be made, therefore, in this period there will be no turnover of silicon wafers [16].

When calculating the turnover of ingots it was assumed that the selling price during first year of operation of electronic quality silicon mono-crystal ingots would be $200/kg, while the growth of the price of grade 5N silicon was not considered.

Production of ingots of electronic and solar quality will be in equal volumes. Price of solar grade of ingots will be $ 180/kg [17].

Based on the above statement, the turnover of silicon mono-crystal ingots in the first months of the plant operation is scheduled to increase in the amount of $ 0.19 - $ 3.344 million per month, in the last month of the first year of operation, this figure will rise to $ 3.44 million per month. Entire turnover of mono-crystalline silicon in the first year of operation is planned to be in the amount of $ 4.93 million.

Turnover by product is shown in Table I.

According to the calculations of the project, additional revenue from the resale of transport costs is also included in income (recorded as markup on goods). According to the forecasts of the project there is an opportunity to sell to customers the costs associated with the export of goods, such as transport and forwarding costs. Thus, the additional revenue from the resale of transport costs in the first year will be $ 7,000 - $ 122,700 per month and approximately $ 548,000 per year [18].

Table II shows the sales forecast for 300 mm diameter silicon ingots in the first five years of operation. Forecast of turnover is calculated by product type. When calculating earnings forecasts it was assumed that production of silicon mono-crystal ingot will remain at 200 tons per year and the market price of electronic and solar grade will remain at $ 200,000and $ 180,000 per ton respectively.

Volume of mono-crystal silicon production for 2-5 year of operation will remain at 200 tons and the market price at $ 200/kg.

In this regard, the sales revenue of only silicon ingots of electronic (50%) and solar (50%) quality in the period from the 3rdto the 5th year is planned in the amount of $ 60,192thousand a year.

Additional revenue from the resale of transport costs from 2nd to 5th year of operation is planned in the amount of $ 942,800 (see Table. II).

From the second half-year begins the stage of wafer manufacturing of electronic and solar grade in equal volumes. Price of one 300mm electronic quality plate is $ 110, solar quality - $ 100.

Income from these products during development increases from $ 1.2 to $ 5.544 million per month [19]. Entire turnover in the first year of the production of silicon wafers is planned in the amount of $19,614,000. Turnover by product type is shown in Table III.

Table IV reflects the earnings forecast for the first five years of operation in the case when only the silicon wafers of 300 mm in diameter were to be produced.

It should be emphasized that if the volume of production of silicon mono-crystals for the 2nd- 5thyears of operation will remain at 200 tons and only silicon wafers of electronic and solar grade will be made then the market price of the product will increase to an average of $ 500/kg.

Therefore, the revenues from silicon wafers of electronic (50%) and solar (50%) quality in the period of from the 2ndto the 5th year are planned in the amount of $ 66.528 million per year [20]. Additional revenue from the resale of transport costs from the

2nd to the 5th year of operation are planned in the amount of $ 2440. Other calculations in the first five years are calculated on the basis of these revenues.

Depending on the ratio of sales of ingots and wafers annual income may vary.

Table I. Project revenue forecasts for the 1st year of operation. Production of 300 mm diameter ingots

Parameter	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Total 1 year
Mono-crystalline ingots Sales													
Max production capacity, kg	17600	17600	17600	17600	17600	17600	17600	17600	17600	17600	17600	17600	211200
Actual production of "electronics" quality ingots, kg	500	1000	1500	1500	2000	3000	3500	4000	4000	4500	5000	8800	39300
Price, $/kg	200	200	200	200	200	200	200	200	200	200	200	200	200
"Electronics" quality ingots sales	100 000	200 000	300 000	300 000	400 000	600 000	700 000	800 000	800 000	900 000	1000000	1 760 000	7 860 000
Actual production of "solar" quality ingots, kg	500	1000	1500	1500	2000	3000	3500	4000	4000	4500	5000	8800	39300
Price, $/kg	180	180	180	180	180	180	180	180	180	180	180	180	180
"Solar" quality ingots sales	90 000	180 000	270 000	270 000	360 000	540 000	630 000	720 000	720 000	810 000	900 000	1 584 000	7 074 000
Subtotal	190 000	380 000	570 000	570 000	760 000	1140000	1330000	1520000	1520000	1710000	1900000	3344000	14934000
Sales change, %		100%	50%	0%	33%	50%	17%	14%	0%	13%	11%	76%	
Additional income from transport operations sale	6975	13949	20924	20924	27899	41848	48823	55797	55797	62772	69747	122754	548208
TOTAL income	196975	393949	590924	590924	787899	1181848	1378823	1575797	1575797	1772772	1969747	3466754	15482208

Table II. Project revenue forecasts for the first 5 years of operation. Sales of 300 mm diameter silicon ingots

Parameter	1st year	2nd year	3rd year	4th year	5th year
Mono-crystalline ingots Sales					
Max production capacity, kg	211200	211200	211200	211200	211200
Actual production of "electronics" quality ingots, kg	126720	147840	158400	158400	158400
Price, $/kg	200	200	200	200	200

"Electronics" quality ingots sales	25 344 000	29 568 000	31 680 000	31 680 000	31 680 000
Actual production of "solar" quality ingots, kg	126720	147840	158400	158400	158400
Price, $/kg	180	180	180	180	180
"Solar" quality ingots sales	22 809 600	26 611 200	28 512 000	28 512 000	28 512 000
Subtotal	48 153 600	56 179 200	60 192 000	60 192 000	60 192 000
Sales change, %		16,67%	0,00%	0,00%	0,00%
Additional income from transport operations sale	172 108	942 766	942 766	942 766	942 766
TOTAL income	48 325 708	57 121 966	61 134 766	61 134 766	61 134 766

Table III. Project revenue projections for the 1st year of operation. Production of wafers of 300 mm diameter

Parameter	1st year of operation												1st year TOTAL
	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	
Sales													
Max production capacity, tons							17.6	17.6	17.6	17.6	17.6	17.6	105,6
Actual production of "electronics" quality wafers, tons							1,2	1,6	2,4	3,6	4,6	5,28	18,68
Price, $/t							550000	550000	550000	550000	550000	550000	550000
"Electronics" quality wafers sales, $							660000	880000	1320000	1980000	2530000	2904000	10274000
Actual production of "solar" quality wafers, tons							1.2	1,6	2,4	3,6	4,6	5,28	18,68
Price, $/t							500000	500000	500000	500000	500000	500000	500000
"Solar" quality wafers sales, $							600000	800000	1200000	1800000	2300000	2640000	9340000
Subtotal, $							1260000	1680000	2520000	3780000	4830000	5544000	19614000
Sales change, %								33.3	50	50	27,8	14,8	
Additional income from transport operations sale, $							46242	61656	92484	138726	177261	203465	719834
TOTAL Income, $							1306242	1741656	2612484	3918726	5007261	5747465	20333834
TOTAL Income, $ mil							1,31	1,74	2,61	3,92	5,01	5,75	20,33

Table IV. Project revenue projections for the first five years of operation. Sale of silicon wafers with a diameter of 300 mm.

Parameter	Implementation period				First 5 years of operation				
	1st quarter	2nd quarter	3rd quarter	Total	1st year	2nd year	3rd year	4th year	5th year
Sales									
Max production capacity, tons					106	211	211	211	211
Actual production of "electronics" quality wafers, tons					19	63	63	63	63
Price, $/t					550000	550000	550000	550000	550000
"Electronics" quality wafers sales, $					10274000	34848000	34848000	34848000	34848000
Actual production of "solar" quality wafers, tons					19	63	63	63	63
Price, $/t					500000	500000	500000	500000	500000
"Solar" quality wafers sales, $					9340000	31680000	31680000	31680000	31680000
Subtotal, $					19614000	66528000	66528000	66528000	66528000
Sales change, %						239,2	0	0	0
Additional income from transport operations sale, $					719834	2441578	2441578	2441578	2441578
TOTAL Income, $					20333834	68969578	68969578	68969578	68969578
TOTAL Income, $ mil					20,33	68,97	68,97	68,97	68,97

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