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EFFICIENCY OF INVEST IN A GAS GENERATOR IN MOLDOVA

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Abstract: For many years, the Republic of Moldova has been facing an energy crisis, both in terms of high energy supply prices and the stability of energy supply. There is a need to develop domestic energy sources, and in addition to renewable energy sources, it is necessary to explore investments in electricity generation from traditional energy sources. This article examines the possibility of investing in a gas generator from Rolls-Royce. The possibility of generating electricity and thermal energy has been examined, and the payback period of the generator has been calculated in terms of the sale of electricity and thermal energy. The article also calculates the payback period in terms of energy savings, assuming a reduction in consumption by the economic agent. An investment analysis has been conducted. A sensitivity analysis between electricity prices for sale to the grid and gas purchase prices has been performed. The possibilities of the state purchasing electricity during peak hours not from the Romanian Opcom exchange but from gas generator owners, under the condition of increasing the purchase price during peak hours as on the exchange, have been explored. We will also determine the minimum capacities of such generators capable of replacing electricity purchases on the exchange. Opportunities, forecasts, and risks for development in this sector will be identified. As a result, investments in gas generators under certain conditions may prove to be highly effective. This strategy will allow the country to reduce its dependence on imported electricity, decrease reliance on voltage fluctuations in the power system, spur the development of biogas production, enhance the country's energy security, create additional employment opportunities, and contribute to the growth of the gross domestic product.

Keywords: electricity, renewable energy, investments, energy prices, industry.

JEL Classification: Q42, Q43, Q47.

Introduction

Moldova does not have its own fossil resources; most of it imports. Moldova imports 96% of the required fuel, spending significant resources on this. (Быкова Е.В., 2013). In the production of thermal and electrical energy, neither the most advanced nor the most economical technologies are used. Energy today is like an artery for most sectors of the economy.

In recent years, the world and the region have experienced a crisis with rising energy prices, as well as the risk of their uninterrupted supply and possible shortages in the market. This is partly due to external factors, and partly due to insufficient funding from the state and economic agents. The development of energy technologies largely determines the rate of economic growth and its sectoral structure in the long term, affecting the value of relative and absolute production costs in the country. Investments in energy will lead to GDP growth directly through the formation of additional enterprises or production facilities, will lead to lower energy prices due to increased competition between suppliers, will lead to a reduction in consumption due to technology, and this will reduce the cost of products.

2.Research methodology

In recent years, due to the risk of insufficient supply of electricity and its possible termination by external and internal partners, as well as the risks of a possible increase in energy prices, there is a need for electricity production in Moldova. At the same time, we are seeing a significant increase in investments in renewable energy sources (RES), as well as an increase in production capacity from RES, but due to the fact that these energy sources for the most part do not have constant electricity generation, Moldova is forced to purchase the missing volumes of electricity on the exchange at higher prices than with long-term contracts. Therefore, in addition to investments in renewable energy sources, there is a need to invest in generators using traditional fuels such as natural gas. We will analyze the effectiveness of investment in a Rolls-Royse MTU 20V4000 GS generator.

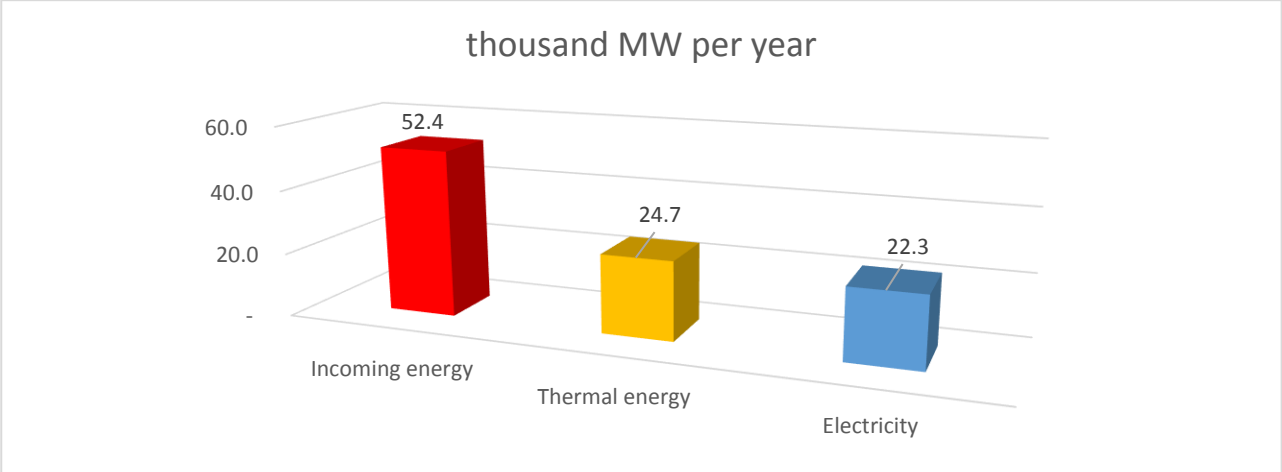

Figure 1. Incoming and outgoing energy from one generator throughout the year.
Source: prepared by authors based on data from the Technical Data Sheet

According to Figure 1, we see that almost half of the energy supplied to the generator in the form of gas combustion goes into thermal energy, and 42.5% goes into generating electricity.

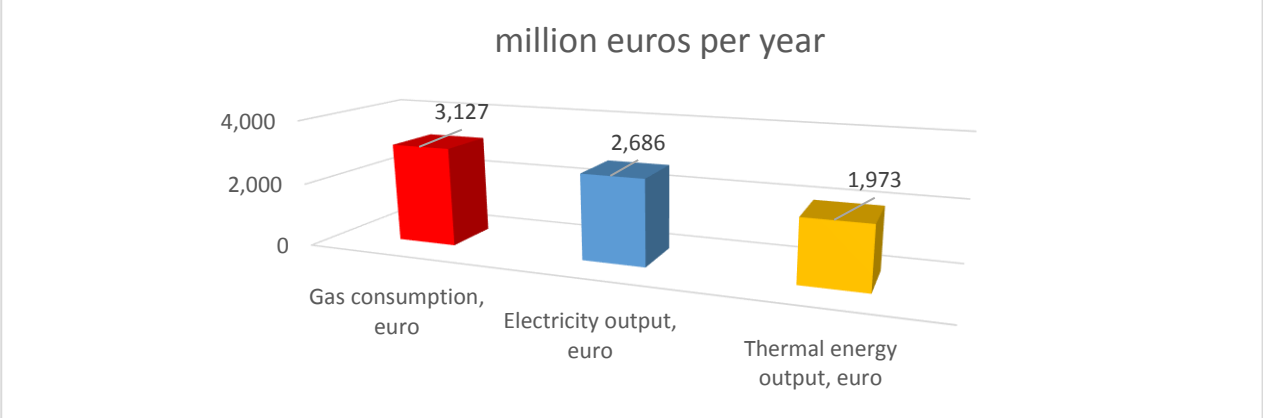

Figure 2. Purchase and sale of all received and produced energy in euros
Source: prepared by authors based on data from the National Energy Regulatory Agency./ Technical Data Sheet/Moldovagaz/Energocom

According to Figure 2, we see that by selling all generated electricity at the minimum selling price from electricity distributors at 2.34 lei per kWh, we will receive 2,686 million euros, as well as by selling all thermal energy with a 15% discount to the minimum selling price from suppliers' thermal

energy in the amount of 1824 lei per 1 Gcal we will receive 1973 million euros. In total, we cover the cost of gas consumption at the rate of 570 cubic meters of gas per hour at a selling price on the market of 12.15 lei per 1 cubic meter.

Table.1 Calculation of return on investment for the sale of all thermal and electrical energy.

Indicators		**1 year**	**2 year**	**3 year**	**4 year**	**5 year**	**6 year**	**7 year**	**8 year**	**9 year**	**10 year**
Investment in generator, euro	1 450 000										
Additional investments in installation, pipes, cells, piping, design, etc., euro	350 000										
Electricity production MW/year		22 271	22 271	22 271	22 271	22 271	22 271	22 271	22 271	22 271	22 271
Thermal energy production, Gcal/year		21 240	21 240	21 240	21 240	21 240	21 240	21 240	21 240	21 240	21 240
Gas consumption, m3 year		4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200
Sales income, euro		**4 659 069**	**4 659 069**	**4 659 069**	**4 659 069**	**4 659 069**	**4 659 069**	**4 659 069**	**4 659 069**	**4 659 069**	**4 659 069**
Sales of electricity, euro		2 686 250	2 686 250	2 686 250	2 686 250	2 686 250	2 686 250	2 686 250	2 686 250	2 686 250	2 686 250
Sales of thermal energy, euro		1 972 818	1 972 818	1 972 818	1 972 818	1 972 818	1 972 818	1 972 818	1 972 818	1 972 818	1 972 818
Costs, euro		**3 513 556**	**3 513 556**	**3 513 556**	**3 513 556**	**3 513 556**	**3 513 556**	**3 513 556**	**3 513 556**	**3 513 556**	**3 513 556**
Gas consumption costs, euros		3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708
Operating expenses (salaries, repairs, oils, maintenance), euro		255 188	255 188	255 188	255 188	255 188	255 188	255 188	255 188	255 188	255 188
Taxes		131 661	131 661	131 661	131 661	131 661	131 661	131 661	131 661	131 661	131 661
Cumulative Income and Expenses, euro		**1 145 512**	**2 291 024**	**3 436 537**	**4 582 049**	**5 727 561**	**6 873 073**	**8 018 586**	**9 164 098**	**10 309 610**	**11 455 122**
Payback, years											**1,58**

Source: prepared by authors based on data from the National Energy Regulatory Agency./ Technical Data Sheet/Moldovagaz/GEE/Energocom

According to table 1, we see that 1.8 million euros are needed for the purchase and installation of a generator. By selling all generated electricity at 2.34 lei per kWh, as well as all thermal energy at 1,550.4 lei per 1 Gcal, operating 365 days a year and 24 hours a day, we will receive an income of 4.7 million euros per year, with in this case, the cost of gas consumption during energy production, as well as operating expenses and taxes will amount to 3.5 million euros.

The return on investment in this case will be 1.58 years.

Table.2 Calculation of return on investment for the sale of all electrical energy and heat during the heating season.

Indicators		**1 year**	**2 year**	**3 year**	**4 year**	**5 year**	**6 year**	**7 year**	**8 year**	**9 year**	**10 year**
Investment in generator, euro	1 450 000										
Additional investments in installation, pipes, cells, piping, design, etc., euro	350 000										
Electricity production MW/year		22 271	22 271	22 271	22 271	22 271	22 271	22 271	22 271	22 271	22 271
Thermal energy production, Gcal/year		10 475	10 475	10 475	10 475	10 475	10 475	10 475	10 475	10 475	10 475
Gas consumption, m3 year		4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200
Number of days of sale of thermal energy		180	180	180	180	180	180	180	180	180	180
Sales income, euro		**3 659 147**	**3 659 147**	**3 659 147**	**3 659 147**	**3 659 147**	**3 659 147**	**3 659 147**	**3 659 147**	**3 659 147**	**3 659 147**
Sales of electricity, euro		2 686 250	2 686 250	2 686 250	2 686 250	2 686 250	2 686 250	2 686 250	2 686 250	2 686 250	2 686 250
Sales of thermal energy, euro		972 897	972 897	972 897	972 897	972 897	972 897	972 897	972 897	972 897	972 897
Costs, euro		**3 393 566**	**3 393 566**	**3 393 566**	**3 393 566**	**3 393 566**	**3 393 566**	**3 393 566**	**3 393 566**	**3 393 566**	**3 393 566**
Gas consumption costs, euros		3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708
Operating expenses (salaries, repairs, oils, maintenance), euro		255 188	255 188	255 188	255 188	255 188	255 188	255 188	255 188	255 188	255 188
Taxes		11 670	11 670	11 670	11 670	11 670	11 670	11 670	11 670	11 670	11 670
Cumulative Income and Expenses, euro		**265 581**	**531 162**	**796 743**	**1 062 325**	**1 327 906**	**1 593 487**	**1 859 068**	**2 124 649**	**2 390 230**	**2 655 812**
Payback, years											**6,53**

Source: prepared by authors based on data from the National Energy Regulatory Agency./ Technical Data Sheet/Moldovagaz/GEE/Energocom

According to the table, we see that if the company implementing the investment can sell thermal energy only during the heating season (October-April) and all the electricity produced, then the annual income will be 3.7 million euros, while the costs will be 3.4 million Euro.The return on investment with this scheme of work will be 6.5 years.

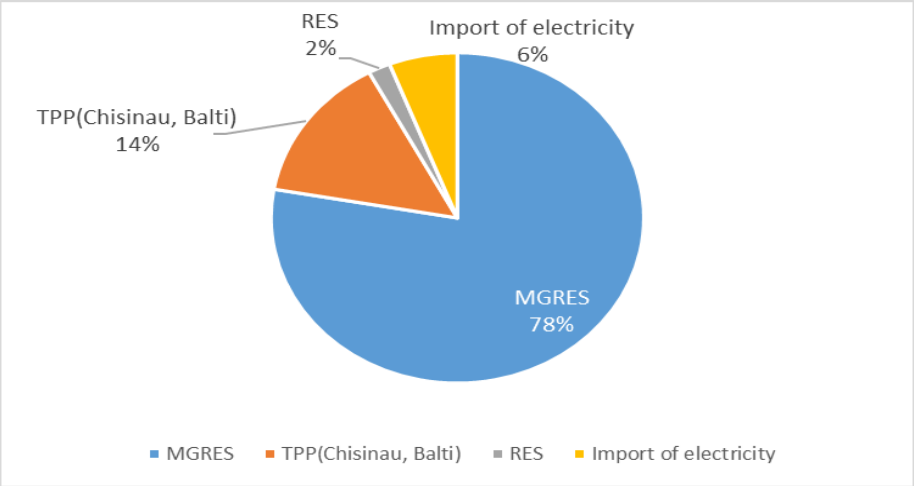

Figure 3. Structure of electricity purchases by the state company Energocom in 2023.
Source: prepared by authors based on data from Energocom

According to Figure 3, we see that the Energocom company (the main supplier of electricity for distribution networks) purchased 78% of electricity from the Moldavian State District Power Plant, it is also worth highlighting the import of electricity in the structure of 6% or 250,000 MGWh. The share of imports was dominated by electricity purchased on the Romanian exchange Opcom.

Table. 3 Purchase of electricity from Energocom and the need for generators

Sources,MWh	**2023 year**
MGRES	3 278 475
Thermal Power Plant (Chisinau, Balti)	605 216
RES	81 000
Import of electricity	250 000
Total	**4 214 691**
Gas generator production	22 271
Gas generator production during peak hours	5 568
Number of generators to cover imports	45

Source: prepared by authors based on data from the Technical Data Sheet /Energocom

From the table we see that to cover the import of electricity, which mainly occurs during peak hours (6 hours a day), 45 units of such generators are needed.

Table. 4 Calculation of return on investment for the sale of all electrical energy and heat during the heating season, during peak hours, electrical energy at import prices.

Indicators		1 year	2 year	3 year	4 year	5 year	6 year	7 year	8 year	9 year	10 year
Investment in generator, euro	1 450 000										
Additional investments in installation, pipes, cells, piping, design, etc., euro	350 000										
Off-peak electricity production MW/year		16 703	16 703	16 703	16 703	16 703	16 703	16 703	16 703	16 703	16 703
Electricity production during peak hours MW/year		5 568	5 568	5 568	5 568	5 568	5 568	5 568	5 568	5 568	5 568
Thermal energy production, Gcal/year		4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200	4 993 200
Gas consumption, m3 year		1 450 000	1 450 000	1 450 000	1 450 000	1 450 000	1 450 000	1 450 000	1 450 000	1 450 000	1 450 000
Number of days of sale of thermal energy		180	180	180	180	180	180	180	180	180	180
Peak hours per year for electricity consumption		2 190	2 190	2 190	2 190	2 190	2 190	2 190	2 190	2 190	2 190
Sales income, euro		**4 010 752**	**4 010 752**	**4 010 752**	**4 010 752**	**4 010 752**	**4 010 752**	**4 010 752**	**4 010 752**	**4 010 752**	**4 010 752**
Sale of electricity outside peak hours, euro		2 014 688	2 014 688	2 014 688	2 014 688	2 014 688	2 014 688	2 014 688	2 014 688	2 014 688	2 014 688
Sale of electricity during peak hours, euro		1 023 168	1 023 168	1 023 168	1 023 168	1 023 168	1 023 168	1 023 168	1 023 168	1 023 168	1 023 168
Sales of thermal energy, euro		972 897	972 897	972 897	972 897	972 897	972 897	972 897	972 897	972 897	972 897
Costs, euro		**3 435 758**	**3 435 758**	**3 435 758**	**3 435 758**	**3 435 758**	**3 435 758**	**3 435 758**	**3 435 758**	**3 435 758**	**3 435 758**
Gas consumption costs, euros		3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708	3 126 708
Operating expenses (salaries, repairs, oils, maintenance), euro		255 188	255 188	255 188	255 188	255 188	255 188	255 188	255 188	255 188	255 188
Taxes		53 863	53 863	53 863	53 863	53 863	53 863	53 863	53 863	53 863	53 863
Cumulative Income and Expenses, euro		**574 994**	**1 149 988**	**1 724 982**	**2 299 975**	**2 874 969**	**3 449 963**	**4 024 957**	**4 599 951**	**5 174 945**	**5 749 939**
Payback, years											**3,53**

Source: prepared by authors based on data from the National Energy Regulatory Agency./ Technical Data Sheet/Moldovagaz/GEE/Energocom

The table shows that to calculate the payback, we used the sale of thermal energy during the heating season at a price of 1,550.4 lei per Gcal, also if Energocom during peak hours purchased electricity not on the exchange, but from an investor in gas generators at the minimum price as on the exchange in 2024, which is 200 euros per 1 MW, assuming that daily consumption during peak hours is 6 hours, the rest of the electricity we calculate at a price of 2.34 lei per 1 KW.
As a result, sales income will be 4 010 thousand euros per year, costs will be 3 436 thousand euros. The payback period for this type of work will be 3.5 years.

Table. 5 Sensitivity analysis for gas and electricity. Profit per year in euros

		Gas price, lei									
		6	8	11	12	13	14	15	16	17	18
Electricity price, lei	2,4	1 832 982	1 379 991	700 504	474 008	247 513	21 017 -	233 498 -	490 880 -	748 261 -	1 005 643
	2,3	1 757 216	1 304 225	624 738	398 242	171 747 -	62 215 -	319 596 -	576 978 -	834 359 -	1 091 741
	2,2	1 681 450	1 228 459	548 972	322 476	95 981 -	148 313 -	405 694 -	663 075 -	920 457 -	1 177 838
	2,1	1 605 684	1 152 693	473 206	246 710	20 215 -	234 410 -	491 792 -	749 173 -	1 006 555 -	1 263 936
	2	1 529 918	1 076 927	397 440	170 944 -	63 127 -	320 508 -	577 889 -	835 271 -	1 092 652 -	1 350 034
	1,9	1 454 152	1 001 161	321 674	95 178 -	149 224 -	406 606 -	663 987 -	921 369 -	1 178 750 -	1 436 132
	1,8	1 378 386	925 395	245 908	19 412 -	235 322 -	492 704 -	750 085 -	1 007 466 -	1 264 848 -	1 522 229
	1,7	1 302 620	849 629	170 142 -	64 038 -	321 420 -	578 801 -	836 183 -	1 093 564 -	1 350 946 -	1 608 327
	1,6	1 226 854	773 863	94 376 -	150 136 -	407 518 -	664 899 -	922 281 -	1 179 662 -	1 437 043 -	1 694 425
	1,5	1 151 088	698 097	18 610 -	236 234 -	493 615 -	750 997 -	1 008 378 -	1 265 760 -	1 523 141 -	1 780 523
	1,4	1 075 322	622 331 -	64 950 -	322 332 -	579 713 -	837 095 -	1 094 476 -	1 351 857 -	1 609 239 -	1 866 620
	1,3	999 556	546 565 -	151 048 -	408 429 -	665 811 -	923 192 -	1 180 574 -	1 437 955 -	1 695 337 -	1 952 718
	1,2	923 790	470 799 -	237 146 -	494 527 -	751 909 -	1 009 290 -	1 266 672 -	1 524 053 -	1 781 434 -	2 038 816
	1,1	848 024	395 033 -	323 244 -	580 625 -	838 006 -	1 095 388 -	1 352 769 -	1 610 151 -	1 867 532 -	2 124 914
	1	772 258	319 267 -	409 341 -	666 723 -	924 104 -	1 181 486 -	1 438 867 -	1 696 249 -	1 953 630 -	2 211 011
	0,9	696 492	243 501 -	495 439 -	752 821 -	1 010 202 -	1 267 583 -	1 524 965 -	1 782 346 -	2 039 728 -	2 297 109
	0,8	620 726	167 735 -	581 537 -	838 918 -	1 096 300 -	1 353 681 -	1 611 063 -	1 868 444 -	2 125 825 -	2 383 207

Source: prepared by authors based on data from the National Energy Regulatory Agency./ Technical Data Sheet/Moldovagaz

The table presents a sensitivity analysis of changes in electricity prices and gas prices, according to the work scheme from Table 4. In this table we see how a decrease in purchase prices for gas can lead to an increase in profits from the production of a gas generator, as well as how an increase in sales prices for electricity also promotes profit growth

Conclusions

Investments are an important element of the country's economic development. In this context, the economic policy of the Republic of Moldova for the medium and long term should be focused on increasing investment and maintaining it at a high level. Investments by enterprises in small gas generators make it possible to ensure an uninterrupted flow of electricity, especially during peak hours, as well as at times when electricity generation from renewable energy sources is unstable. From the state's point of view, the country's energy security is improving. At the same time, companies implementing this type of investment run the risk of being unable to sell the generated energy, primarily thermal energy. At the same time, the state should legally allow the purchase of electricity during peak hours from such enterprises at the price of imports on the exchange; this will allow companies to be more willing to invest in this kind of generators, which provides additional income to companies, creates jobs, and increases GDP. Even if electricity is purchased during peak hours at import prices, there is a risk with the sale of thermal energy, for example, they cannot connect to heating plants and not everyone will be able to buy this energy from heat suppliers for consumers. Therefore, enterprises where there is a high own consumption of thermal energy have the greatest opportunity to invest in such generators. In Moldova these are distilleries, glass factories, brick factories. At the same time, the payback may be insufficient and to stimulate this kind of investment, the state should guarantee the purchase of electricity during peak hours at the price of imports from the exchange, the purchase of the rest of the electricity at a standard price, provide grants and subsidies, and facilitate the conditions for the purchase of thermal energy from state heating plants.

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