

## **INCREASING THE COMPETITIVENESS AT TURCENI POWER PLANT BY STREAMLINING INVESTMENTS. CASE STUDY.**

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**Abstract:** On medium and long term, investments represent, in any field, the key element of keeping the business at the normal level and of developing it. This is why the reduction of investment costs should consider investment streamlining and it should not be regarded as a tool for reducing the total functioning cost of the business.

The investment streamlining may be accomplished by evaluating the projects as realistically as possible and by comparing them, in order to choose those projects bringing the highest profits reported to costs. If cost reduction is the priority, the purpose will become the choice of the projects with the lowest costs that keep the same level of the initially expected profits.

There are several methods of evaluating the investments, from the net present value (NUV) reported to the initial investment (II) to the complex models considering the risk. The choice of the optimal combination of indicators for evaluating the projects/ the most relevant model depends on the general economical environment where the activity will develop, on the sector mentioned by the project and on the project particularities.

**Keywords:** Financing, cost-benefit analysis, incremental method, optimal option, cash flow.

### **1. CONTENT OF THE WORK**

The economical-financial efficiency of the investment Denoxing Block 5 and Denoxing and electro-filters Block 4 at the Turceni Power Plant.

The current documentation analyses the economical-financial efficiency of the investment of Denoxing Block 5 and Denoxing and electro-filters Block 4 at the Turceni Power Plant.

Turceni Power Plant is the biggest electrical central in Romania with an installed capacity of 2,310 MW (7.330 MW installed power) and with an operational capacity of about 1,260 MW, containing:

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- 5 operational units (energetic blocks) of 330 MW;
- 1 unit in rehabilitation;
- 1 unit is out of the exploitation.

The net power delivered in the system by a unit of 330 MW is about 285 MW.

The blocks 4 et 5 in frame of Turceni Power Plant are considered as big burning installations (BBI), working mainly with the coal fuel.

From the burning process, it results gases with damaging content (NO<sub>x</sub>, CO, powders), gases that are to be released in the atmosphere, constituting a polluting factor.

The valid legislation regulating the limitation of the air emission of certain pollutants coming from big burning installations contains:

- GD no. 541/2003 [<sup>i</sup>] regarding the establishment of certain measures for limiting air emissions of certain pollutants from the big burning installations;
- GD no. 322/2005 [<sup>ii</sup>] for amending and completing GD no. 541/2003 regarding the establishment of certain measures for limiting air emissions of certain pollutants in the big burning installations;
- GD no. 1502/2006 [<sup>iii</sup>] - for amending GD no. 541/2003 regarding the establishment of certain measures for limiting the air emissions of certain pollutants in the big burning installations.

By these normative documents, we transpose the stipulations of Directive 96/61/EC (IPPC) regarding the prevention and the integrated control of pollution – as a consequence of the commitments assumed by Romania in the process of accessing the European Union, and also the stipulations of Directive no. 2001/80/CE.

Directive no. 2001/80/CE stipulates at article 4(3) the possibility of the states to choose, in order to significantly reduce the polluter emissions, between the following options:

- respecting the limit values of emission (LVE), for sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>) and powders stipulated in part A of annexes III – VII of the Directive, by every existent IMA;
- the elaboration of a National Plan for Reducing the Emissions of sulphur dioxides (SO<sub>2</sub>), nitrogen dioxides (NO<sub>x</sub>) and powders coming from the existent IMA.

Their confirmation with the limit values of emission (LVE) is not possible starting with January 1<sup>st</sup>, 2008, as the Directive stipulates, and this is why Romania has required transition lapses of time in order to be according to LVE: lapses of time contained between January 1<sup>st</sup>, 2008 – December 31<sup>st</sup>, 2013 and January 1<sup>st</sup>, 2016 – December 31<sup>st</sup>, 2017.

The granted transition lapses of time were materialized in the elaboration by every operator of existent IMA – type I and new one - type II of the programmes of progressive reduction of the emissions (PPRE), that should allow the staged conformation to the limit values of emission stipulated by GD no. 541/2003, amended and completed by GD no. 322/2005 and GD no. 1502/2006.

Turceni Power Plant should be framed in the reduction programme with January 2011 of the emissions (PPRE) as follows:

- the reduction of the powder emissions at block 4 (under 50 mg/Nmc air) starting with January 2011;
- the reduction of the NO<sub>x</sub> emissions at blocks 4 and 5 (under 200 mg/Nmc air) starting with January 2016.

For accomplishing these objectives, we require financial assistance granted by the funds of the Sector Operational Programme “Increasing the Economic Competitiveness” – co-financed by the European Fund of Regional Development – code POS CCE / AP4 / DMI 1 Op. 4.1. c):

POS CCE – Sector Operational Programme “Increasing Economical Competitiveness”;

AP4 – Prior Axe 4 - “Increasing the energetic efficiency and the supplying security, in the context of combating climatic changes”;

DMI 1- The Major Intervention 1 – “Efficient and sustainable energy (improving the energetic efficiency and the sustainable development of the energetic system from the environmental viewpoint)”;

Operation 4.1 c) - “Investments in installations for de-sulphuring burning gases – burning with reduced NO<sub>x</sub> and filters for big burning installations in modernized/re-technological groups.

The legal frame regulating the co-financing requirement is GD 718/02.07.2008 regarding the approval of the scheme of horizontal state help for the sustainable regional development and the reduction of emissions.

The scheme of state help is addressed to the economical operators accomplishing initial investments in any of the 8 developing regions of Romania, activating in the industrial sectors and in the sector of producing the electrical and thermal energy.

The beneficiaries should accomplish certain eligibility criteria, mentioned in detail in GD 718/2008 [iv], art. 13.

The total estimated budget allocated to the scheme is 318,8 million Euro, of which 287,3 million Euro – equivalent in lei – represent non-refundable European funds provided by the European Fund of Regional Development (EFRD) and 31,5 million Euro – equivalent in lei – represents public co-financing funds provided by the state budget, by the Budget of the Ministry of Economy and Finances (HG 718/2008, ART.17).

The scheme of state help will develop during 2008-2013.

By rehabilitating the electro-filters at block 4 and the denoxing measures at block 4 and block 5– we forecast the reduction of powder emissions (from 60-90 mg/Nmc to maximum 50 mg/Nmc) and the NO<sub>x</sub> ones (from 340-500 mg/Nmc to the admitted limit values under 200 mg/Nmc in the gases evacuated by the chimney) – and from this viewpoint the objective is imposed as a necessary and compulsory investment for protecting the environment.

On the expiration date stipulated in PPRE (2010 for the powder emissions and 2015 for the NO<sub>x</sub> emissions), the installations that are not framed in the valid legislation regarding the environment, will permanently stop their activity, with all the major negative consequences resulting from here:

- endangering the safe functioning of the National Energetic System;
- the drastic reduction of the competitiveness of the energetic sector;
- the massive import of electric energy in the basic system;
- increasing the price and industrial and communal services;
- the massive staff dismissal having a negative social impact.

The closure of the blocks 4 and 5 in frame of the Turceni Power Plant would lead to significant negative effects:

- Reducing the electric energy production at local and national level – as Turceni Power Plant is the biggest electric central in Romania – with an operational capacity of about 1.260 MW, among which the Blocks 4 and 5 provide 57%;
- Massive staff dismissals (about 1.200 people) in a mono-industrial area with a high risk of unemployment;
- non-using some existent settled means with costly values.

As a consequence, the investment is extremely important for the future on an average and long term of the Turceni Power Plant, and also for providing the continuity of operating these installations.

The efficiency analysis of the investment was elaborated according to the requirements mentioned in The Applicant's Guide for the Sector Operational Programme "Increasing Economical Competitiveness" The Prior Axe (AP4) – Increasing the energetic efficiency and the supplying security, in the context of combating the climatic changes, the Major Field of Intervention (DMI1) – Efficient and sustainable Energy, Operation c) – "Investments in the installation of de-sulphuring the burning gases, burning with reduced NO<sub>x</sub> and filters for the big burning installations in the modernized/re-technological groups" [v]

The main objective of the financial analysis (the financial cost-benefit analysis) is to establish how much the project needs co-financing from the funds of POS CCE, by calculating the financial performance indicators of the project.

The method used in the financial analysis is the one of the present net cash flow (the cumulated flow). In this method, the non-monetary flows, such as the amortization and the provisions, are not considered. We will consider only the costs and the incomes directly connected to the investment object.

The analysis horizon recommended for the projects financed by POS CCE in case of this operation should be correlated to the life time of the groups for which the project is implemented (minimum 15 years of functioning since finishing the project for the modernized/re-technological groups).

In the analysis frame, we will use the incremental method by determining the cumulated flow as a difference between the scenario business plus investment and the scenario of the operation with no investment (the existent infrastructure).

Thus, the financial efficiency indicators of the investment are afferent to the profit difference resulting from the two situations.

The characterization of the economical efficiency of the investment objectives is made by a system of dynamic indicators reflecting the investment efficiency, by using the upgrading method that also considers the time factor.

The upgrading rate recommended in frame of the financial analysis is 5%.

The most relevant dynamic indicators are:

- The report of the present incomes / Present Costs – R;
- The Net Present Value (NPV – Net Present Value);
- The Internal Rate of Return (IRR – Internal Rate of Return);
- The time for recovering the investment Dr.

The financial analysis will reflect:

a). If the project should be co-financed by funds of POS CCE, respectively if the FNPV indicator (financial net present value) is negative and IRFR (the internal rate of financial return) is under 5%, without the contribution of the non-refundable funds.

b). The financial reliability of the project in the conditions of the non-refundable intervention of POS CCE. In this sense, the cumulated net cash flow should be positive for the entire analysed lapse of time. The net cash flows that should be considered in this purpose should consider the investment costs, all the financial (national and community) resources and the net incomes. The residual value will not be considered.

By applying the incremental method, the projection of the result account is the difference between:

- The scenario with no investments – the existent situation;
- The scenario with investments – the situation after accomplishing the investigation.

In the following table - 1, The Incremental Method, it is presented the projection of the result account afferent to the investment. The projection of the result account developed during the entire analysed lapse of time (2007-2025), spotlights the following economical parameters, as additional values due to the accomplishment of the investment:

- The physical production expressed in MWh;
- The additional income;
- The additional expenses (by indicating the amortization of the new investment and the operation costs);
- The additional gross profit;
- The additional profit tax (16%);
- The additional net profit, by assigning it.

We find that it is obtained an additional net profit during the entire analysed lapse of time.

The projection purpose is to evaluate the net cash flows of the discrete lapses of time when the time horizon of the forecasting is divided, so that we could estimate the business ability of providing t least the balance between the cash sources estimated

as being achievable (cash from selling the products, infusions of the own capitals and attracted capitals, subventions, etc.) and the uses of cash (payments for investments, paying the suppliers for exploitation, the wages, the fiscal tasks, the shares and the interests, the dividends, etc.)

Like the projection of the result account, the cost/income flow was elaborated for the entire analysing time of the project.

In the table (2)- The cost-income flow – the incremental method– the way of calculation is presented in details.

The considered expenditures consist of:

- The own funds for investment (the own capital);
- The operating expenditures (the production costs diminishes by the amortizations);
- The profit tax;
- The dividends distributed from the additional net profit.

The incomes are afferent to the selling of the additional merchandise production.

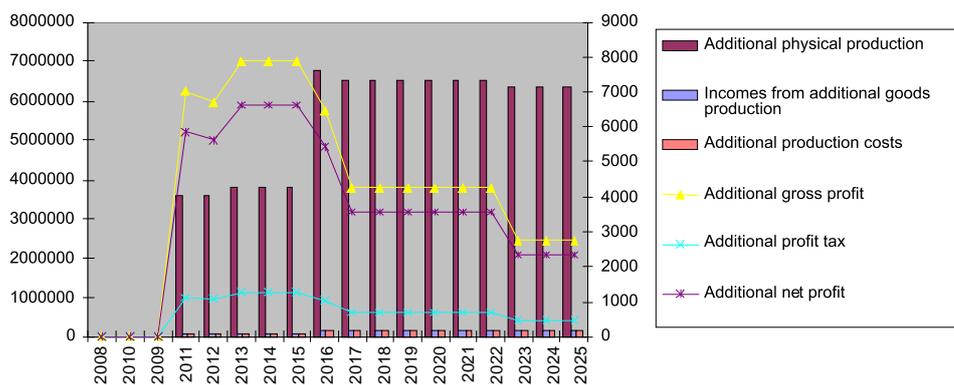


Fig.1. Result account

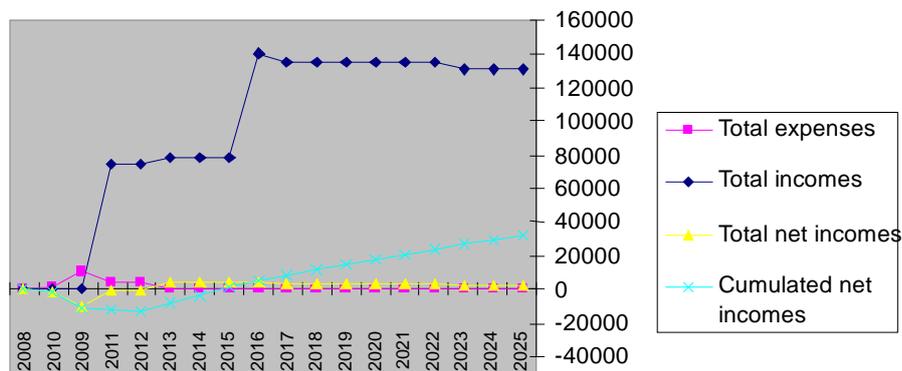


Fig.2. Result account

Table 1 RESULT ACCOUNT – INCREMENTAL METHOD

No	Name	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2026	Cumulated	
		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		22
	Additional physical production, MWh/year																					
1	Produced power:	0	0	0	0	1.900.000	1.900.000	2.000.000	2.000.000	2.900.000	3.600.000	3.450.000	3.450.000	3.450.000	3.450.000	3.450.000	3.450.000	3.450.000	3.350.000	3.350.000	3.350.000	44.150.000
	Sold power	0	0	0	0	1.681.980	1.681.980	1.770.505	1.770.505	1.770.505	3.186.909	3.054.122	3.054.122	3.054.122	3.054.122	3.054.122	3.054.122	3.054.122	2.965.596	2.965.596	2.965.596	39.083.903
	Incomes from additional goods																					
2	production	0	0	0	0	74.362	74.362	78.276	78.276	78.276	140.897	135.026	135.026	135.026	135.026	135.026	135.026	131.112	131.112	131.112	1.727.942	
	Costs from production - additional	0	0	0	0	67.369	67.676	70.405	70.405	70.405	134.407	130.772	130.772	130.772	130.772	130.772	130.772	128.351	128.351	128.351	1.650.351	
	Additional operating costs	0	0	0	0	66.596	66.596	69.017	69.017	69.017	133.019	129.384	129.384	129.384	129.384	129.384	129.384	126.963	126.963	126.963	1.630.456	
	Additional write-offs	0	0	0	0	773	1.080	1.388	1.388	1.388	1.388	1.388	1.388	1.388	1.388	1.388	1.388	1.388	1.388	1.388	19.896	
	Gross profit from operation - additional	0	0	0	0	6.994	6.686	7.871	7.871	7.871	6.490	4.254	4.254	4.254	4.254	4.254	4.254	2.761	2.761	2.761	77.591	
	Credit interests - additional																				0	
	Taxable profit - additional	0	0	0	0	6.994	6.686	7.871	7.871	7.871	6.490	4.254	4.254	4.254	4.254	4.254	4.254	2.761	2.761	2.761	77.591	
	Additional profit tax	0	0	0	0	1.119	1.070	1.259	1.259	1.259	1.038	681	681	681	681	681	681	442	442	442	12.415	
8	Additional net profit	0	0	0	0	5.875	5.616	6.612	6.612	6.612	5.452	3.573	3.573	3.573	3.573	3.573	3.573	2.320	2.320	2.320	65.177	
	Development fund	0	0	0	0	2.937	2.808	3.306	3.306	3.306	2.726	1.787	1.787	1.787	1.787	1.787	1.787	1.160	1.160	1.160	32.588	
	Dividends	0	0	0	0	2.937	2.808	3.306	3.306	3.306	2.726	1.787	1.787	1.787	1.787	1.787	1.787	1.160	1.160	1.160	32.588	
	Dividend/net profit weight					50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %	50 %

Thousand Euro

Table 2 COST – INCOME FLOW

Thousand Euro

No.	Name	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Cumulated
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
I	TOTAL EXPENSES	22	1.348	10.225	75.264	75.085	73.582	73.582	73.582	136.783	131.852	131.852	131.852	131.852	131.852	131.852	128.565	128.566	128.565	1.696.276
1	Own investment capital	22	1.348	10.225	4.612	4.612														20.818
2	Working capital increase	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	Operating costs	0	0	0	66.596	66.596	69.017	69.017	69.017	133.019	129.384	129.384	129.384	129.384	129.384	129.384	126.963	126.963	126.963	1.630.456
4	Credit interests	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Profit tax	0	0	0	1.119	1.070	1.259	1.259	1.259	1.038	681	681	681	681	681	681	442	442	442	12.415
6	Credit instalments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Dividends	0	0	0	2.937	2.808	3.306	3.306	3.306	2.726	1.787	1.787	1.787	1.787	1.787	1.787	1.160	1.160	1.160	32.588
II	TOTAL INCOMES	0	0	0	74.362	74.362	78.276	78.276	78.276	140.897	135.026	135.026	135.026	135.026	135.026	135.026	131.112	131.112	131.112	1.777.942
III	TOTAL NET INCOME	-22	-1.348	-10.225	-901	-723	4.694	4.694	4.694	4.114	3.175	3.175	3.175	3.175	3.175	3.175	2.548	2.548	2.548	31.666
IV	CUMULATED NET INCOME	-22	-1.370	-11.594	-12.496	-13.219	-8.525	-3.831	862	4.976	8.150	11.325	14.499	17.674	20.849	24.023	26.571	29.118	31.666	31.666

The difference between the total incomes and the total expenditures represents the net income that is spotlighted yearly and in a cumulated manner.

We find that the net flows of every year and cumulated at the end of the time are positive, by proving the self-financing ability of the investment project.

The cumulated value of the net income developed by the investment objective, at the end of the analysed lapse of time, is 31.666 thousands Euros.

## 2. EFFICIENCY INDICATORS OF THE INVESTMENT

By using the cost/income flows, we determined the most relevant dynamic efficiency indicators of the investment:

- a) The ratio of the present incomes / present costs – R;
- b) The Net Present Value VNA (NPV – Net Present Value);
- c) The Internal Rate of Return RIR (IRR - Internal Rate of Return);
- d) The time of recovering the investment Dr.

According to The Applicant's Guide, the upgrading rate recommended in frame of the financial analysis is 5%.

### a) The report of the present incomes / present costs – “R”

The incomes-costs analysis is based on the evaluation of the report between the total present incomes ( $V_{ta}$ ) and the total present costs ( $C_{ta}$ ), calculated according to the relations 1 and 2

$$V_{ta} = \sum_{n=1}^n V_n \times \frac{1}{(1+a)^n} \quad (1)$$

$$C_{ta} = \sum_{n=1}^n C_n \times \frac{1}{(1+a)^n} \quad (2)$$

where:  $V_n$ =yearly total incomes;  $C_n$ =yearly total costs;  $n$ =the time of the analysing time (execution + exploitation);  $a$ =the upgrading rate  $a=5\%$ .

The indicator of the report of the present incomes / present costs is calculated thus:  $R=V_{ta}/C_{ta}$

The ratio of the present incomes / present costs is a favourable indicator if it has a super-unit, by indicating higher values of the present incomes than the ones of the present expenditures.

The resulted values of The report of the present incomes / present costs is:  $R=1,015$ , a super-unit value, by indicating higher values of the present incomes than the ones of the present expenditures, constituting thus a favourable indicator.

### b). The net present value “VNA”

VNA represents the positive or negative value difference between the present available cash flows, generated by the exploitation of an investment during its economical life and the present value of the investment.

A positive net present value may be interpreted as a capital benefit (or as a value benefit of the firm) in addition to the expectations of the capital suppliers, while a negative net present value may be interpreted as a loss in report to their expectations.

The calculation relation of the net present value is given by the formula 3:

$$\text{VNA} = V_{\text{ta}} - C_{\text{ta}} \text{ or}$$

$$\text{VNA} = \sum_{n=1}^n [V_n - (I_n + C_n)] \times \frac{1}{(1+a)^n} \quad (3)$$

where:  $I_n$ =yearly investment;  $C_n$ =yearly expenditures of exploitation;  $n$ =the time of the analysing lapse of time (execution + exploitation);  $a$ =upgrading rate  $a=5\%$ .

**c). The internal rate of return “RIR”**

The internal rate of return RIR, is the most important indicator expressing the ability of the investment object of generating profit during the entire efficient time of functioning.

In the market economy, the internal rate of return is considered as the basic criterion for accepting the investigation projects.

The internal rate of return represents the yearly average profit generated by the exploitation of an investment, in report to its value, during the economical life time of the project or the maximum share of the interest where we could finance an investment project during its entire economical life time.

The internal rate of return is calculated by upgrading the available cash flows, by using increasing upgrading rates, until obtaining two values of VNA of opposite signs (a positive one and a negative one), considering that the absolute difference between the upgrading rates used for obtaining the two values should be maximum 5%.

The calculation relation of the internal rate of return is given by the formula:

$$\text{RIR} = a_{\text{min}} + (a_{\text{max}} - a_{\text{min}}) \times \frac{\text{VNA}(+)}{\text{VNA}(+) + \text{VNA}(-)} \quad (4)$$

where:  $a_{\text{min}}$  and  $a_{\text{max}}$  are the smaller rate, respectively the bigger upgrading one used for calculating VNA.

The resulted value **RIR=19,1%**, is bigger than the considered upgrading rate (5%), constituting a favourable indicator.

**d). The time of recovering the investment “Dr”**

The recovering time of the investment represents the lapse of time, measured in years, after which the participants to the financing of an investment project recover both their investment and the expected profits.

By considering the year 2013 as the year 1 since applying it, the net flows are:

	thousand Euros								
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Yearly net income	4.694	4.694	4.694	4.114	3.175	3.175	3.175	3.175	3.175
Cumulated net income	-8.525	-3.831	862	4.976	8.150	11.325	14.499	17.674	20.849

The investment that is to be financed by its own funds is of 20.218 thousands Euros.

The time of recovering the own capital invested from the cumulated cash flow is calculated by extrapolation, as the value of this indicator is of **9 years** since its application.

The indicator is favourable, as it is placed under the economical life time of the project (15 years).

Conclusion:

By analysing the dynamic efficiency indicators, we find out that:

- R has super-unit value;
- The resulted VNA is positive;
- RIR is higher than the upgrading rate;
- Dr is shorter than the economical life time of the project.

The interpretation reflecting a favourable situation regarding the project feasibility.

### 3. CONCLUSIONS

Considering that the non-refundable financing provided by the scheme of state help regulated by GD 718/2008 is made by discounting the works in the category of the eligible costs, for initiating the execution it is necessary for the investor to have funds for the entire project value.

The economical analysis is elaborated in the case of financing the entire investment by funds provided by the investor.

The investor will suffer an investment effort constituted of ineligible costs, where we add the non-financed value of the eligible costs.

The yearly positive cash flows indicate the ability of self-financing the suggested investment project.

The present project constitutes an absolutely necessary environmental investment.

a). Accomplishing the investment will lead to a positive impact on the environment, respectively on the society and on the quality of the inhabitants in the area.

b). Respecting the programme of progressive reduction of the emissions in the energetic field will further allow the functioning of the energetic blocks 4 and 5, having a positive impact on the national and regional economy:

- the safe functioning of the National Energetic System;
- increasing the competitiveness of the energetic sector;
- avoiding the massive import of electric energy in the basic system;
- avoiding the increase of the price and of the industrial and communal services;
- avoiding the massive dismissals having a negative social impact in a mono-industrial area with high risk of unemployment;
- efficiently using certain existent settled means with costly values.

The investment project presents a good stability when increasing the investment value with maximum 20% over the reference value in the project.

In conclusion, the investment Denoxing Block 5 and Denoxing and electro-filters Block 4 at the Turceni Power Plant, is an important object for respecting the environmental protection norms and for providing the continuity of the society activity, by presenting favourable indicators of economical-financial efficiency, arguments recommending the accomplishment of this investment as being necessary and opportune.

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<sup>i</sup> The Official Gazette no. 365/May 29<sup>th</sup>, 2003

<sup>ii</sup> The Official Gazette no. 359/April 27<sup>th</sup>, 2005

<sup>iii</sup> The Official Gazette no. 899 on November 6<sup>th</sup>, 2006

<sup>iv</sup> The Official Gazette, Part I no. 529 on 14/07/2008

<sup>v</sup> The Applicant's Guide "*Financial support granted for the investment projects in capitalizing the renewable energy resources for producing the green energy in frame of Axe 4 of the Sector Operational Programme Increasing the Economic Competitiveness*"