

Investment Analysis Krasnoarmeyskaya Zapadnaya № 1

The following calculations show the economic efficiency of the project with revenues obtained from emissions trading. The calculations show that without revenues from emissions trading a loss of about 25.3 Millions EUR is “earned” (NPV (10%)). Considering revenues from emissions trading, an internal rate of return of about 18.7 % is given, at which a price of 8.00 EUR per ERU has been presumed. The „return of investment“ adds up to 5 years

Furthermore a sensitivity analysis has been carried out, showing the influence of the three main factors of influence: Investment (capex), operating costs (opex) und operating hours (production) on the Internal Rate of Return IRR. The factors have been varied in a range of +/-20 %

The project is not viable without revenues from emissions trading because the expenses are higher than the income, and only costs are generated. The comparison of income and expenses is shown in table 2. The expenses consist of the payback of the investment and significantly involved the operation costs of the plants (opex). The costs are significantly accelerated by the high inflation rate in the Ukraine. The income consists of the revenues from selling ERU’s and the internal cost rates for power and heat generation.

In the table 1, an overview on the input parameters used for the investment analysis is given.

- The values for investment (capex), loan interest und operating costs (opex) have been determined by the project developer (Eco-Alliance) together with Donetsksteel.
- The interest has been excluded from the calculation
- The inflation rate of Ukraine has been taken from the CIA’s World fact book for the year 2005 [CIA]. The inflation rate is affecting opex, and the revenues for heat and power.
- The fiscal system is complicated in Ukraine. E.g. the taxes are different for work-related and production-related incomes; there are also corporation, property taxes etc. Resuming several taxes of Ukraine an average tax of 33 % has been put in calculation [DEMETA].
- The price of 8.00 EUR per ERU has been estimated by Eco-Alliance, based on the actual price development.
- The depreciation time is 10 years. Considering first investment in 2007, loan repayment starts in 2008 and the production ends in 2017.
- Revenues for ERU’s are calculated for the first crediting period only.
- The price of 8.00 EUR /MWh for heat is an internal cost rate of the coal mine including external costs and internal surcharges or reductions. The price is highly affected by the coal price, which was about 50.00 EUR/t (retail price Jan-July 2007 see annex: <coal bills.pdf>).
- The price for power purchased from the grid results from a mix of the day, afternoon and night tariffs, see annex: <power bills.pdf>).
Irrespective of the purchase price from the grid, the revenue for the feed-in of power into the grid is always lower (hold out of capacities, power reserves, transmission costs, etc.) and has to be negotiated between Donetsk steel and the local grid owner.
According to a statement from Donetsksteel a price of 30.00 EUR per MWh has been taken into account [KAZ].
- The efficiency of the upgraded coal fired steam boiler has been measured with 86%.
- The depreciation has been only taken into account for the calculation of the taxes and is not included in the cash flow. The interest rate of 15% is corresponding to the mean value given by the Bank of Ukraine <http://www.bank.gov.ua>.

The calculations are carried out assuming that:

- the investment on the flares will be done in 2007
- the investment on the cogeneration units will be done in 2008
- the additional investment on the upgraded boiler will be done in 2007
- the boiler started operation in 2003 and will produce the full heat amount in 2008
- the flares will start operation step by step, beginning with January 2008
- the cogeneration will start operation step by step, beginning with July 2008

Due to the step by step project installation follows:

- the power and heat production rate of the cogeneration units in 2008 will be 1/3 of the full possible amount
- the total heat production (CHP + boiler) in 2008 will be 1/2 of that in the following years
- the ERU production in 2008 will be 1/2 of that in the following years

The investment for the flares mainly consists of the price for a flare, import certification, transportation to Ukraine, import taxes, installation, piping, electric cables and initial operation. An estimated value of 300.000 EUR per flare has been taken into account.

The investment for the CMM burner systems mainly consists of an new measurement and monitoring system, including a gas analysis, the modification of the installed system, import certification, transportation to Ukraine, import taxes, installation, piping, electric cables and initial operation. An estimated value of 50.000 EUR has been taken into account.

For the installation of the new cogeneration units a value of 1 million EUR per 1.35 MW unit (containerised Deutz units) has been taken into account. This value is a first estimation value, which has been established by the experience made on similar projects in Germany. The value is lower than that in the previous Eco-Alliance projects, because of the large number of units, which allows a significant cost decrease.

39 units = 39,000,000 EUR.

Compared with the stationary Jenbacher units which require additionally new engine rooms, the containerised Deutz units are cheaper, so that the total investment is significantly lower when using containerised Deutz engines. This is conservative for the determination of additionality.

The opex for the flares / Gas pumps is mainly affected by the transportation costs for the mobile plants from one degassing well to another, the recurring deinstallation, re-installation and re-piping of the plants on new boreholes.

Further on wages for the maintenance personnel, operating resources, spare parts, insurances, regular acceptance inspections, emission measurements etc. are included.

The estimated operation costs for the upgraded boiler include wages for the maintenance personnel, operating resources, spare parts, insurances, regular acceptance inspections, emission measurements etc.

The estimated operation costs for the gas engines are mainly affected by the regular maintenance of the engines. E. g. oil change has to be done every 800-1200 hours depending on the gas quality, fresh motor oil, disposal of waste oil and regular exchange of sparks and valves etc. is needed.

In addition to the wages for the coal mines own maintenance personnel, a specialised gas engine service team has to be engaged.

Further on costs are generated by operating resources, spare parts, insurances, regular acceptance inspections, emission measurements etc.

The opex for the new pipelines connecting the mobile flares with the two shafts includes wages for the maintenance personnel, operating resources, spare parts, insurances, regular acceptance inspections etc. as mentioned above, and especially regular inspections of the pipes which, are installed in the steppe outside the coal mine boundaries.

All opex costs are estimated using the experience of the coal mine Krasnoarmeyskaya Zapadnaya No. 1, the experience of ECO-Alliance with other similar projects in the Ukraine and the experience of Emissions-Trader ET GmbH with about 50 similar projects in Germany, United Kingdom and Poland.

Table 1: Input parameters

Avoided CO2-emissions by using Coal Mine Methane				
firing capacity [MWh]	Efficiency [%]	Volume CH4 [m3]	Weight CH4 [t]	t CO2 eq
1,133,870	100	113,625,590	81,470	1,486,819
CO2-equivalent by power production (Avoided emissions in power plants)				
power produced [MWh]	spec. Emissions [t CO2 / MWh]			
353,808	0.896			317,012
CO2-equivalent by heat generation (Avoided emissions in heat plants)				
produced heat [MWh]	spec. emissions [tCO2 / MWh]	efficiency of coal boilers		
130,629	0.3406	73.5		60,534
CO2-equivalent by own consumption (power for CHP operation)				
own consumption	spec. emissions [tCO2 / MWh]	power		
12,383	0.807			9,993
gained environmental effect in t CO2				1,854,372

Revenues:

		Rev/year
Heat. EUR/kWh	8.00	1,045,032
Power EUR/MWh	30.00	10,614,240

Project

Project	Year
Investment	2007
Production Start	2008
Production End	2017

	Cost per Unit	Total cost	
Capex flaring	300,000	2,100,000 EUR	
Capex heat production	50,000	50,000 EUR	Sensitivity Capex
Capex power production	1,000,000	39,000,000 EUR	1
Capex pipelines		650,000 EUR	
Total Capex		41,800,000 EUR	

	Cost per Unit	Total cost per year	
Opex flaring	60,000	420,000 EUR	Sensitivity Opex
Opex heat production (EUR/kWh)	50,000	50,000 EUR	1
Opex power production (EUR/MWh)	25,000	8,845,200 EUR	
Opex pipelines	50,000	50,000 EUR	
Opex total		9,365,200	Sensitivity Production
			1

Depreciation Time	10
Interest	15%
Percentage of Debt Fin.	100%
Repayment Time Loan years	10
Tax Rate	33%
Inflation rate OPEX	11%

Economic Parameters - Krasnoarmeyskaya				
IRR	18.66	%	Revenues from ERUs	14,834,974
NPV (0 %)	33,829,232	EUR	ERU Volume	1,854,372
NPV (10 %)	9,946,736	EUR	ERU Price [EUR/t]	8.00

Table 2: Cash flow of the project including revenues from selling ERU's

Year	Investment EUR	Opex EUR	Interest EUR	Loan		Rev. Power EUR	Rev. Heat EUR	Rev. ERU EUR
				Repayment EUR	Income Tax EUR			
2007	2,150,000	420,000	0	0	0	0	0	0
2008	39,000,000	5,197,686	322,500	215,000	0	3,927,269	579,993	0
2009	0	11,538,863	6,140,250	4,115,000	0	11,781,806	1,287,584	7,417,487
2010	0	12,808,138	5,523,000	4,115,000	1,300,431	13,077,805	1,429,218	14,834,974
2011	0	14,217,033	4,905,750	4,115,000	2,540,996	14,516,364	1,586,432	14,834,974
2012	0	15,780,907	4,288,500	4,115,000	2,813,141	16,113,164	1,760,940	14,834,974
2013	0	17,516,806	3,671,250	4,115,000	3,092,817	17,885,612	1,954,643	14,834,974
2014	0	19,443,655	3,054,000	4,115,000	0	19,853,029	2,169,654	0
2015	0	21,582,457	2,436,750	4,115,000	0	22,036,862	2,408,316	0
2016	0	23,956,527	1,819,500	4,115,000	0	24,460,917	2,673,230	0
2018	0	29,516,837	1,202,250	4,115,000	0	27,151,618	3,293,687	0
2019	0	0	585,000	3,900,000	0	0	0	0

Table 3: Cumulated cash flow of the project including revenues from selling ERU's

Year	Cash Out EUR	Cash In EUR	Cashflow incl. Financing EUR	Cashflow cumulated EUR	FreeCash aft. Amort. EUR
2007	2,570,000	0	-2,570,000	-2,570,000	
2008	44,197,686	4,507,262	-39,690,424	-42,260,424	-39,905,424
2009	11,538,863	20,486,878	8,948,015	-33,312,410	4,833,015
2010	14,108,569	29,341,998	15,233,429	-18,078,981	11,118,429
2011	16,758,029	30,937,770	14,179,741	-3,899,240	10,064,741
2012	18,594,048	32,709,078	14,115,030	10,215,790	10,000,030
2013	20,609,623	34,675,229	14,065,606	24,281,396	9,950,606
2014	19,443,655	22,022,683	2,579,028	26,860,423	-1,535,972
2015	21,582,457	24,445,178	2,862,721	29,723,144	-1,252,279
2016	23,956,527	27,134,147	3,177,620	32,900,764	-937,380
2018	29,516,837	30,445,305	928,468	33,829,232	-3,186,532
2019	0	0	0	33,829,232	-3,900,000

Table 4: Economic parameters of the project including ERU's

Economic Parameters – Krasnoarmeyskaya, including ERU's		
IRR	18.66	%
NPV (0 %)	33,829,232	EUR
NPV (10 %)	9,946,736	EUR

The cash flow and the economic parameters of the project including revenues from selling ERU's are listed in the tables 2, 3 and 4. Including the revenues from emissions trading the project gains an internal rate of return of about 18.7 %. Without revenues from emissions trading a loss of approx. 25.3 Millions EUR is "earned", as shown in table 5.

Table 5: Economic parameters of the project without ERU's

Economic Parameters – Krasnoarmeyskaya, without ERU's		
IRR	-13.09	%
NPV (0 %)	-23,180,768	EUR
NPV (10 %)	-25,315,595	EUR

The sensitivity of the project is shown in figure 6. The main three factors: production, investment (capex) and operating costs (opex) have been changed within a range of +/- 20 % in steps of 5 %, and the influence on the internal rate of return has been calculated.

As shown in figure 6, IRR vary in a range from 4.5 % to 25.4 % with revenues from selling ERU's.

In the case without ERU's, values for an increase of more than 5% for opex are not calculable. The IRR is mostly negative and becomes only slightly positive with opex decreased by 20% (IRR = 4.4%).

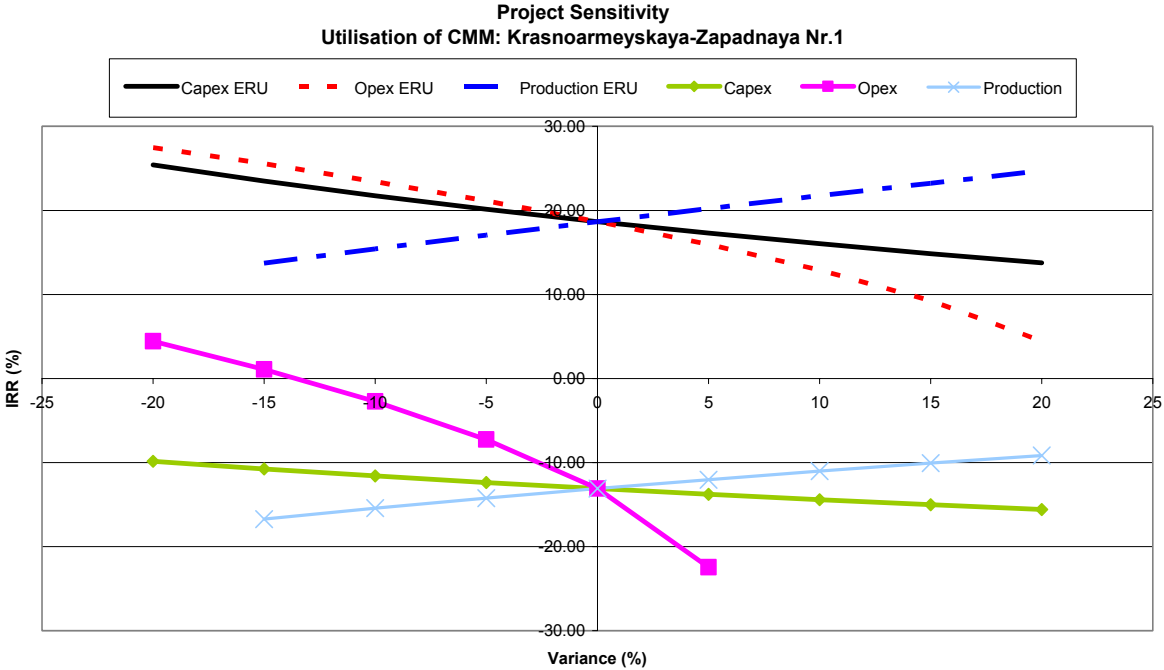


Figure 6: Influence of production, investment (capex) and operating costs (opex) on the internal rate of return. The three factors have been changed within a range of +/- 20 %