

## PROJECT SUMMARY

### CONSTRUCTION OF TPP AT THE «OIKARAGAI» COAL DEPOSIT

*This Project has two development phases*

**The First phase** – expansion of coal mining for the coal-fired TPP under construction, as well as the coal sale in the region with the rise in the sales geography. Construction of a coal briquetting complex and a complex for the production of diesel fuel and semi-coke from coal.

The cost of this phase is **€ 96,04 mln.**

**The Second phase** – construction of the modern TPP «on board» of the coal open-pit mine, with the electric power of 250 MW, electricity generation and its sale in the Republic of Kazakhstan and the People's Republic of China.

The cost of this phase is **€ 300 mln.**

**The working capital** for the first year of the Project is **€ 3.96 mln.**

***In total, investment is needed for the Project – € 400 mln.***

The developed business plan for the construction of the TPP at the coal deposit and preliminary calculations on the actually existing financial and economic indicators of the entity that produces the coal show that the cost of construction will be about € 1 200 / 1 KW\*hour.

*Please, see the comparison of costs for different types of plants (provided the base load operation), which is calculated by various world expert organizations:*

Coal-fired Power Plants	EIA	MINIFI	Univ. Essen	ECN	Ours
Discount factor, %	8	8	10	9	<b>12,53</b>
Efficiency, %	36,7	43-44	38,6	45,4	<b>41</b>
Annual running time, hours	7446	8000	7500	7500	<b>8760</b>
Specific Capex, for kW of installed generating capacity, €	1300	1750	1025	1500	<b>1200</b>
Service life, years	40	35	35	30	<b>35</b>
Construction and installation works, months	48	36	36	-	<b>36</b>
Fuel price, \$ / MMBtu	1,2-1,5	1,4	2,1	1,4	-
Price for production of electric power, MW, €	36,52	38,15	36,95	38,04	<b>18,32</b>

## PROJECT EFFECTIVENESS

<i>Financial and economic efficiency</i>	<i>Unit of meas.</i>	<i>Value</i>
<b><i>Payback period (PBP)</i></b>	years	6,10
<b><i>Net present value (NPV)</i></b>	€	132 453 367
<b><i>Discounted pay-back period (DPBP)</i></b>	years	8,83
<b><i>Internal rate of return (IRR)</i></b>	%	19,64%
<b><i>Profitability index (PI)</i></b>	times	1,41
<b><i>Modified internal rate of return (MIRR)</i></b>	%	15,19%
<b><i>Total net income (NI)</i></b>	€	908 567 800
<b><i>Total cash flow (CF)</i></b>	€	676 213 293

The Project is paid off subject to discounting within the period of **8.83 years**. The project is aimed at a long-term perspective and, as usual, alternatives of such projects are paid off for 12-15 years. In general, the main financial indicators show the economic efficiency and feasibility.

As a result of all goods sales, the **€ 132 mln.** annual revenue is projected.

The first option is the sale of electricity in the Republic of Kazakhstan, power lines of 220 kV and above are trunk lines, being the property of the state, therefore, electricity is planned to be sold only on busbars of the TPP.

The second option is the construction of a 220 kV HV-line by the Chinese side with the export of electricity to the adjacent territory. The PRC will buy the products, on busbars of the TPP plant as well; the distance is 4 km to the border of the Republic of Kazakhstan – the People's Republic of China.

When operating the power plant, the sale rate inside the Republic of Kazakhstan will be € 0.03, and it will be € 0.05 for export to China.

The Letter of Intent to purchase electric energy on the part of the Republic of Kazakhstan was signed for the whole amount for a period of 10 years.

Negotiations with the People's Republic of China on participation in the construction of the TPP and a possibility of acquiring the entire amount of electric energy for a period of 35 years, or acquiring the TPP itself, are in progress.

## **INFORMATION ABOUT THE INITIATOR**

The Initiator of the Project and the General Director of «RAIMBEK ENERGY GROUP» is Kassayev Amangeldy Akhmetovitch (born in 1958).

As the president of CJSC «FEC «Berkut», later transformed into LLP «FEC Berkut», A. Kassayev developed and signed the Contract for subsurface use (№ 470 as of May 12, 2000) with the Government of the Republic of Kazakhstan. The project implementation started in 2000 on own funds of the Initiator.

## **INFORMATION ABOUT THE DEPOSIT**

The deposit of brown coal «Oikaragai» was explored in 1931 and was sealed off as «chemical production».

The Project will be implemented at the «Oikaragai» deposit in the Almaty region at coordinates 42°58'47" north latitude and 80°16'24" east longitude at an altitude of 2 017 meters above sea level, 48 km northeast of the village of Sarybastau, Raimbek district, with the district center in Kegen village.

[Reference to the deposit on the satellite map.](#)

Land allotments and mining allotments are approved; an enterprise's ecological passport is received, as well as the conclusions of the state environmental expertise and permits for special exploitation of the natural resources. The products and production were certified.

The explored coal reserves of the deposit are about 63 mln. tons.

## **ENVIRONMENTAL ASPECTS OF PRODUCTION**

The proposed impacts will be related to the operation of the TPP and coal mining, which will be limited by the Project's duration and the area of the entity's site.

The impact will be typical for coal mining entities and power plants: formation of ground and ash dumps, dust, noise, traffic. The project does not involve the use of hazardous and harmful materials and industries. There will be no significant increase in the environmental burden as part of the project.

The spectral analysis by the atom scanner showed the presence of harmful chemical elements in coal composition, below the EURO standards, by 150 %.

There is not a single settlement with people within a 48 km radius.

## SOME COAL CHARACTERISTICS

Fossil coal of low coalification degree is a transition form from peat to coal. The density of the organic mass is 1.2-1.5 g / cm<sup>3</sup>. The calorific value of the combustible matter is 22.6-31 MJ / kg.

Average 5 % or 50 grams of hydrogen or 0.555 m<sup>3</sup> can be obtained from one kg of coal, with the combustion of which it is possible to get 1,443 kcal of heat. 2 m<sup>3</sup> of air are required for combustion of 1 m<sup>3</sup> of hydrogen, it reduces emissions of nitrogen compounds and carbon dioxide by 7.5 times less than combustion of 1 m<sup>3</sup> of natural gas. If the content in the coal is 15.4-16.1 % of oxygen, which for 1 kg of coal is 153.7 grams or 0,119 m<sup>3</sup>, it will also reduce the amount of combustion air in the boiler units by almost 2 times and reduce the electric power consumption for fans and smoke exhausters of the boiler units by 4 times. The water of the mountain rivers is low mineralized and has a low average annual temperature, which will positively affect the operation of the TPP. Moreover, it will allow draining the concentrate into the river below the water intake after reverse osmosis plants. The temperature of the cooling water on turbine condensers should be not higher than 20 °C, and the temperature after the condenser will be 45 °C; therefore, streaming water at a temperature of 10 °C at the condenser outlet, the water temperature will be 25 °C, which will reduce the water entrainment into the atmosphere by 2 times.

The TPP should be located as close as possible to the open-pit coal mine to reduce the distance between the conveyor lines of coal supply to the plant, because hydrogen begins to volatilize actively during the coal transportation, and it affects the final caloric value of coal when it is burnt in boiler aggregates. An ash dump must be located below the power plant, so that the ash of the slurry is dumped into the ash dump by gravity.

The thickness of overburden increases uniformly in the direction from the southeast to the northwest from 8 to 55 m. The overburden ratio within the boundaries of the open-pit mine area varies from 0.7 m<sup>3</sup> / t to 7.0 m<sup>3</sup> / t in the northeast of the open-pit mine area. The bulk of the reserves (80 %) has 2.7 m<sup>3</sup> / t stripping ratio.

The rocks covering the coal seam are represented by boulder-pebbly sediments, sandstones, clays and loosening of overburden with drilling and blasting methods is partly required. The rock-hardness ratio on the scale of Professor M.N. Protodyakonov is from 3-5 to 7, coal 1-2.

According to the exploitation data, the calorific value of coal is from 5 500 kcal / kg to 7 200 kcal / kg, an average of 5 560 kcal / kg in the lower part with an ash content from 3 to 9 %.

Brown coal of «Oikaragai» deposit is intended for combustion both in stationary boiler units and for household needs of the population and meets all GOSTs.

- Coal brand	B - 3
- GOST / coal type	25543 - 88 / 30
- Weight, t / m <sup>3</sup>	1,2

**Coal test record. «Centrgeolanalit», The Republic of Kazakhstan,  
Karaganda city, dated 18.06.2016**

Parameter and measurement unit	Actual results
Mass fraction of moisture as received, $W^r_t$ , %	29.4
Mass fraction of moisture of analysis sample, $W^a$ , %	14.8
Ash content, $A^d$ , %	9.2
Maximum moisture content, $W_{max}$ , %	35.2
Volatile content (dry and ash-free basis), $V^{daf}$ , %	32.2
Net calorific value (as received), $Q^r_i$ , kkal/kg	4150
Gross calorific value (dry and ash-free basis), $Q_s^{daf}$ , kkal/kg	6970
Total carbon weight percentage (dry and ash-free basis), $C^{daf}$ , %	78.48
Total carbon weight percentage (dry basis), $C^d$ , %	71.21
Total hydrogen weight percentage (dry and ash-free basis), $H^{daf}$ , %	4.23
Total hydrogen weight percentage (dry basis), $H^d$ , %	3.85
Total nitrogen weight percentage (dry and ash-free basis), $N^{daf}$ , %	0.90
Total nitrogen weight percentage (dry basis), $N^d$ , %	0.82
Total oxygen weight percentage (dry and ash-free basis), $O^{daf}$ , %	16.06
Total sulfur weight percentage, $S^d_t$ , %	0.31
Mass fraction of humic acids, $HA_t^{daf}$ , %	3.9
<b>Oxide content in coal ash, %:</b>	
SiO <sub>2</sub>	50.14
Al <sub>2</sub> O <sub>3</sub>	10.68
FeO <sub>3</sub>	2.38
CaO	30.82
MgO	3.57
K <sub>2</sub> O	0.46
Na <sub>2</sub> O	0.54
TiO <sub>2</sub>	0.90
P <sub>2</sub> O <sub>5</sub>	0.14
Mn <sub>3</sub> O <sub>4</sub>	<0.04
SO <sub>3</sub>	0.05

Therefore, the brown coal of the «Oikaragai» deposit is unique within the borders of the former USSR, not counting the huge value of the ash residue, which contains 52 elements of the Mendeleev's Periodic Table.

The total area of the TPP should be 40.4 hectares, including the area of all buildings and structures of 30.36 hectares, of which the main building is 12 227 hectares. The ash dump bowl should be located south-west of the TPP at the level below the plant site. The construction of ash dump will require 8 250 thousand m<sup>3</sup>. For geological surveys of the site, land allocation area of 800 x 1 000 meters will be required for the ash dump of 10 meters depth, and for 30 meters depth – an area of 275 x 1 000 meters. Ash will be a secondary income source in the future.