

## NEW CLEANER FUEL COMPREHENSIVE UTILIZATION PROJECT

<b>Investment highlights</b>	
Air pollution of Ulaanbaatar	<ul style="list-style-type: none"> <li>➤ air pollution has become increasingly serious in Ulaanbaatar, and the whole city is surrounded in smoke all through the winter</li> <li>➤ Creation of a comprehensive clean fuel plant could reduce toxic air pollution from the 600,000 households of the ger districts by more than 80-90%.</li> <li>➤ Requirement of clean fuel for Ulaanbaatar city residents</li> </ul>
Supply and technology	<ul style="list-style-type: none"> <li>➤ Erdenes Mongol LLC is stakeholder of Baganuur mine. Guarantee of raw material.</li> <li>➤ The project implementation team is highly experienced internationally in China and other countries. The project team has successfully implemented similar projects in many other countries and this will be an advantage for the company.</li> <li>➤ This project can increase the economic importance of brown coal and could also increase the export of Mongolian coal tar.</li> </ul>
Product reliance	<ul style="list-style-type: none"> <li>➤ Semi-coke, coal tar and gas are products that are used commonly by the market due to their high value and cost.</li> <li>➤ Semi-coke will make a significant contribution to the reduction of air pollution in Ulaanbaatar City</li> <li>➤ Coal tar is the main raw material used to fuel heavy factories as well as to produce petrol and diesel fuel. It will be exported to China.</li> <li>➤ The purpose of gas fuel is to heat the process of pyrolysis and the excess gas fuel has the capacity to generate <math>1.42 \times 10^8</math> KBT/hour of electricity and it will mainly be supplied to the power plant that will be built for the semi-coke plant.</li> </ul>
Strongly experienced team for plant constructing and guarantee of raw material supply	<ul style="list-style-type: none"> <li>➤ Project implementer ZZM Company received patent № ZL201120227177.7 from the PRC Intellectual Property Office in February 2011. This patent protects an indirect heating technology that uses semi-coke and its production by-products.</li> <li>➤ There are built several semi-coke plants in China and Australia and Indonesia via ZZM patent.</li> </ul>
<b>Company overview</b>	
Operation scope	<p>Erdenes Mongol LLC /Mongolia/</p> <ul style="list-style-type: none"> <li>➤ The State Owned Company. Also, state owned stakeholder of strategic deposits in Mongolia including Baganuur, Tavantolgoi etc.</li> <li>➤ Bring strategic deposits in economic circulation</li> <li>➤ Support to subsidiaries operation</li> <li>➤ Implement the projects for processing natural resources.</li> </ul> <p>ZZM Co.,Ltd /China/</p> <ul style="list-style-type: none"> <li>➤ Engineering design, engineering prospecting, project supervision, EPC project contracting, technical consultation, technical service, technical transfer, joint development, feasibility study, environment assessment, labor safety assessment, investment and technical economy assessment.</li> </ul>
Experience in operation scope	<ul style="list-style-type: none"> <li>➤ In 2009, at the start of this technology's usage, over 30,000 tons of lignite were converted to coke experimentally in the Shanxi Province of China. Furthermore many international projects were implemented by using the ZZM company's patent. These include, in 2012 in Kheinan province, converting 500 000 tons of brown coal to coke per year, from January 8, 2012 in Xinjiang converting 1.6 million tons of coal to semi-coke and SNG plant project, from winter of 2012 with Australian company CEA, converting 2 million tons of brown coal to semi-coke, Indonesia Jat Energy company, converting 2 million tons of thermal coal to semi-coke.</li> </ul>
Agreement or MOU etc.	<p>ZZM LLC and Erdenes Mongol LLC has agreed sign on the MOU according to the pre terms of conditions of project implementation.</p>



Semi-coke plant in Shaanxi province, China



Crude gas power plant

**Sector and industry overview**

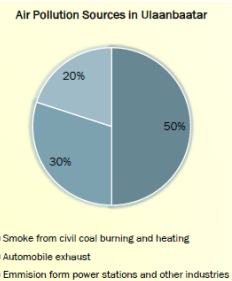
**Semi-coke**

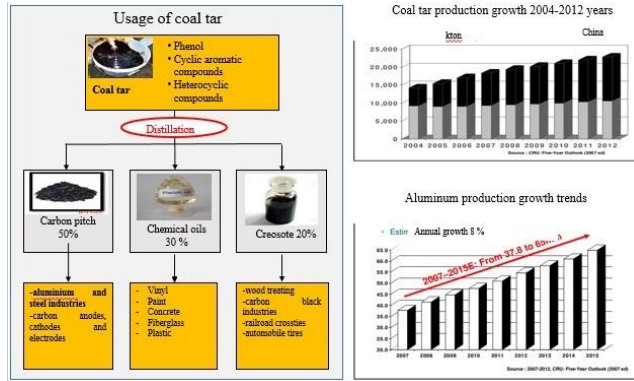
According to the preliminary estimate, the requirement for carbocoal will be 600kt/a, if the about 1.32 million residents in Ulaanbaatar all use carbocoal for heating. The quantity of carbocoal needed to provide is 250kt/a, after the completion of this project. Thus, the prospect of market is good, because of the undersupply of carbocoal in late 5 to 10 years.

As the high quality steam coal, the carbocoal has very strong market competitiveness with high heat value, relative low price. This project can make sure that parts of the residents in Ulaanbaatar adopt carbocoal for heating, which can reduce the discharge of poisonous and harmful organics and then the air quality of that areas can be improved.

**Coal tar**

The tar produced in this project is transferred to China by railway. Evaluating the industry scale, according to the low-rank coal pyrolyzation, the supply amount will be 8,000kt, at the end of 2014, and the process ability of medium and low temperature tar is 12,500kt. So, analyzing the relationship of industry supply and demand, the demand will exceed the supply. If we look the tar as the supplement and substitution of petroleum, the quantity of tar is only 120 million tons, even the whole pyrolyzation of more than 2 billion tons high volatile matter coal produced in China every year.





**Electric power**

The project, gas-steam combined cycle power plant pyrolyzes the left gas 6.12×107 Nm<sup>3</sup>/a by the pyrolysis plant to supply power. This can not only meet the own requirement of pyrolysis plant and the power plant, but also can output 1.08×108kWh/a electricity.

**Project introduction**

Project overview

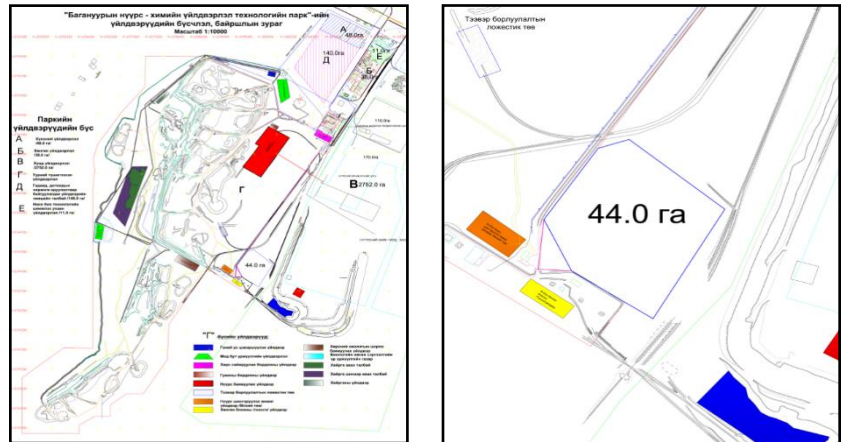
Through this project, we can produce 250 kt of semi-coke and 25 kt of coal tar from 600 kt of brown coal. We can also build a high technology 18 MW power plant in order to provide industrial electricity and thermal use for the manufacturers, as well as providing surplus energy to the central transmission line of the country.

Technology

The semi-coke plant technology is based on pyrolysis of external heating of coal. This technology is one of the latest developments of advanced coal processing. The technology process flow chart is presented below.

Project location

Baganuur district, Ulaanbaatar city



## Financial snapshot

Project investment					
Project	Estimation (million USD)				
	Construction	Installation	Equipment cost	Other	Total
Pyrolysis plant	4.584	1.484	14.274	-	20.342
Power plant	3.029	1.545	11.429		16.003
Others /communications, interest, office etc/	-	-	-	11.744	11.744
<b>Subtotal</b>	<b>7.613</b>	<b>3.029</b>	<b>25.703</b>	<b>11.744</b>	<b>48.089</b>
Working capital	-	-	-	2.034	2.034
Initial working capital	-	-	-	0.610	0.610
<b>Total</b>	<b>7.613</b>	<b>3.029</b>	<b>25.703</b>	<b>13.778</b>	<b>50.123</b>

## Project economic indicators

Total investment of project	Ten thousand USD	4,869.94
Construction investment (including the interest incurred during construction)	Ten thousand USD	4,808.91
Working capital	Ten thousand USD	203.41
Sales revenue	Ten thousand USD/year	2,636.39
Sales tax & annexation (not including added-value tax)	Ten thousand USD/year	22.51
Raw material cost	Ten thousand USD/year	967
Power cost	Ten thousand USD/year	18.89
Total cost	Ten thousand USD/year	1,848.2
Total profit	Ten thousand USD/year	765.69
Income tax	Ten thousand USD/year	191.42
After-tax profits	Ten thousand USD/year	574.27
Total investment internal rate of return (pre-tax)	%	18.47
Total investment internal rate of return (after tax)	%	15.46
Internal rate of return for owned fund (after tax)	%	27.09
Payback period of total investment (pre-tax)	year	6.47
Payback period of total investment (after tax)	year	7.08
Payback period of owned fund (after tax)	year	8.39

Net present value of total investment (pre-tax)	Ten thousand USD/year	1,508.92
Net present value of total investment (after tax)	Ten thousand USD/year	761.85
Net present value of owned fund	Ten thousand USD/year	1,285.95
ROI	%	15.28
Profit & tax investment ratio	%	21.34
Net profit rate of capital	%	56.19
Repayment period of loan	year	7.86

**Project team**



**Tselmeg Sosorbaram**

Deputy director

**Nandinjargal B**

Head of Infrastructure and Project Department

**Oyub Batdorj**

Officer of Infrastructure and Project Department

**Bold-Erdene Ryenchinbyamba**

Officer of Infrastructure and Project Department

**Tsolmon Tovuusuren**

Officer of Infrastructure and Project Department



**Li Lai Guang**

Engineer

**Project management**

To implement this project, we will cooperate foreign and domestic entities, government organizations including Mining Ministry and Industry Ministry.

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**2 June 2015**