Prefeasibility Study of Naliakh Mine: Opportunities and Challenges

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Coal resources and coal deposits

- Mongolia contains vast coal resources within 15 large-scale coal bearing basins
- There are around 320 coal deposits and occurences (80 deposits and 240 occurences)
- Total geological coal resources are estimated at approx.150 billion tons, including about 20 billion tons explored.
- Major coal deposits:

  Tavantolgoi, Ulaan-Ovoo, Tugrug nuur, Tsaidam nuur,Baga nuur, Shivee-Ovoo,Nariin sukhait

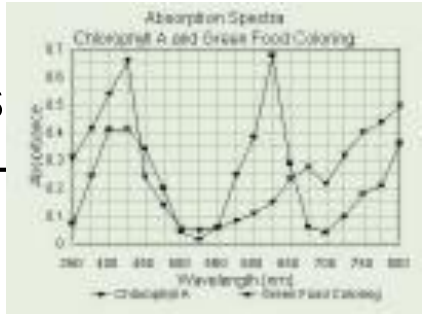
Coal and Green house gas including methane

- The energy sector of Mongolia is the country's largest contributor to GHG emissions

- The low energy content of Mongolian coal contribute to a high rate of carbon dioxide (CO_2) release per capita. Energy sector emitted 60 per cent of total GHG in Mongolia

- Current estimates of population growth and economic growth indicate that Mongolia may experience a three-fold increase in energy demand by the year 2020

- Throughout Mongolia, there are abundant coal resources, and associated CMM/CBM resources expected that coal methane resource is about 1 billion cubic meters



Main problem/barriers for recovery and use CMM/CBM in Mongolia

- No experienced companies in Mongolia to manage this type of work

- Lack of technology and technical knowledge (resources assessment, technology selection, formulating feasibility studies)
- Lack of financing or capacity to obtain financing

- Lack of clarify about legal and regulatory issues, especially coal and gas ownership in Mongolia

- Lack of pilot projects to demonstrate site – specific economic recovery & utilization
- Not yet developed the investment opportunities in coal Mine methane project in Nalaikh mine

How to remove the above problems/ barriers

- **Mobilize resources to Conduct Pre-feasibility and feasibility studies for CMM projects in Mongolia** (*identify promising sites for CMM project and conduct there conduct technical, economic and environmental feasibility assessments)*
- **Develop and implement Demonstration projects** (*drilling for assessment CMM resources, collect detailed site data, and selection of technology of use of CMM*)
- **Develop and improve existing oil and petroleum legislation** *(technical safety standards and degasification requirements, coal and gas ownership issues, possible tax and other incentives and clarify data sharing procedures between Government and companies which drilled for CMM resources)*
- **Create national human capacity building** *(seminars/ workshops on CMM issues)*
- **Make resources mobilization for CMM projects** *(get support from donors , use the fund allocated for reduction of UB air pollution and get loan from Private sector)*

The purpose of small project on Pre feasibility study project Methane recovery and utilization in Nalaikh mine area

- Conduct pre-feasibility on:

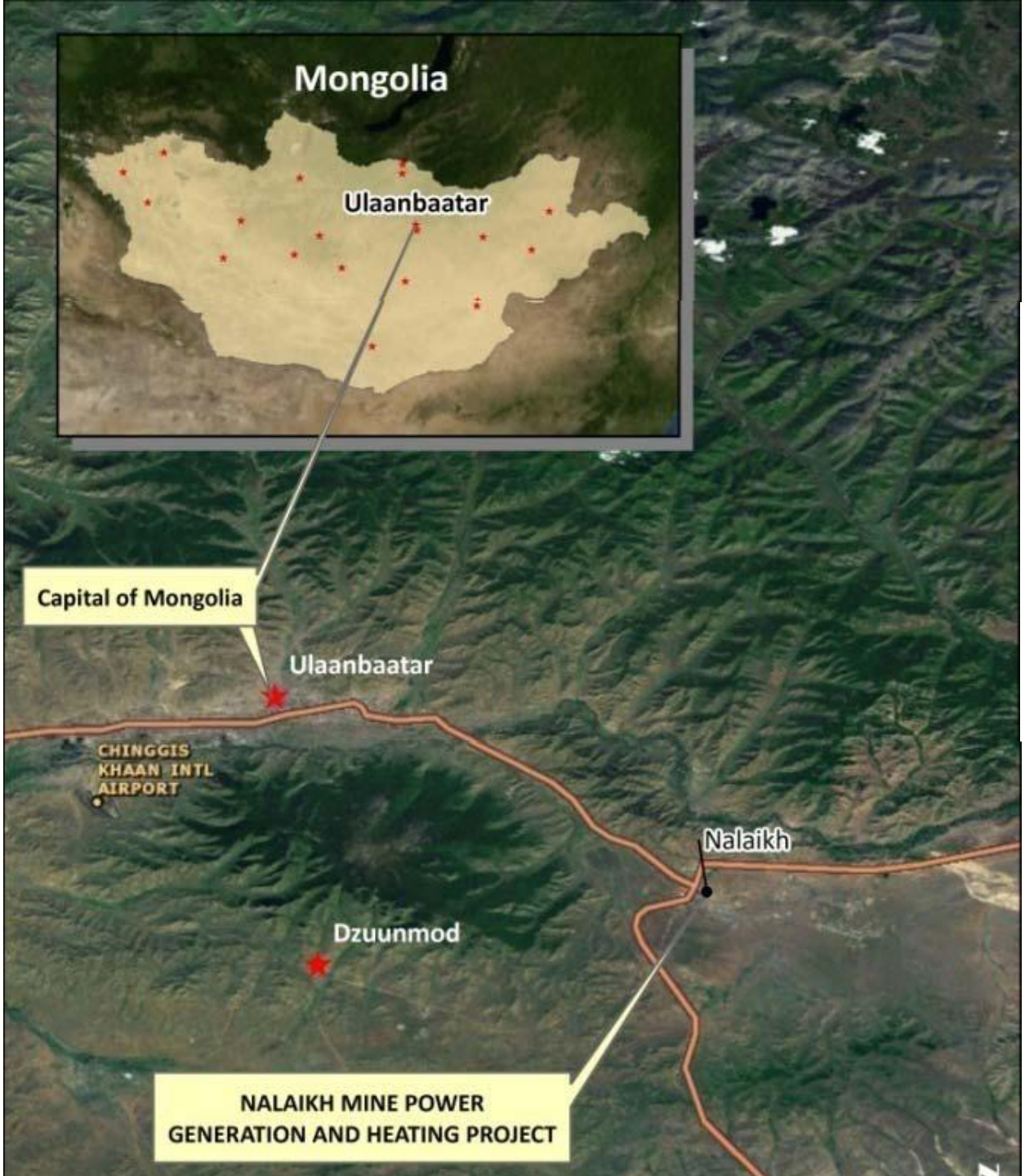
(identify geology and mine condition of Nalaikh mine, Conduct preliminary assessment of economic and environment benefits of use methane)

- Detailed study CMM resources of Nalaikh
  - Elaboration of existing energy and investment laws in order to develop CMM project
  - Develop the Methane recovery and utilization Project and submit it to Global Environment facility (GEF) for approval.

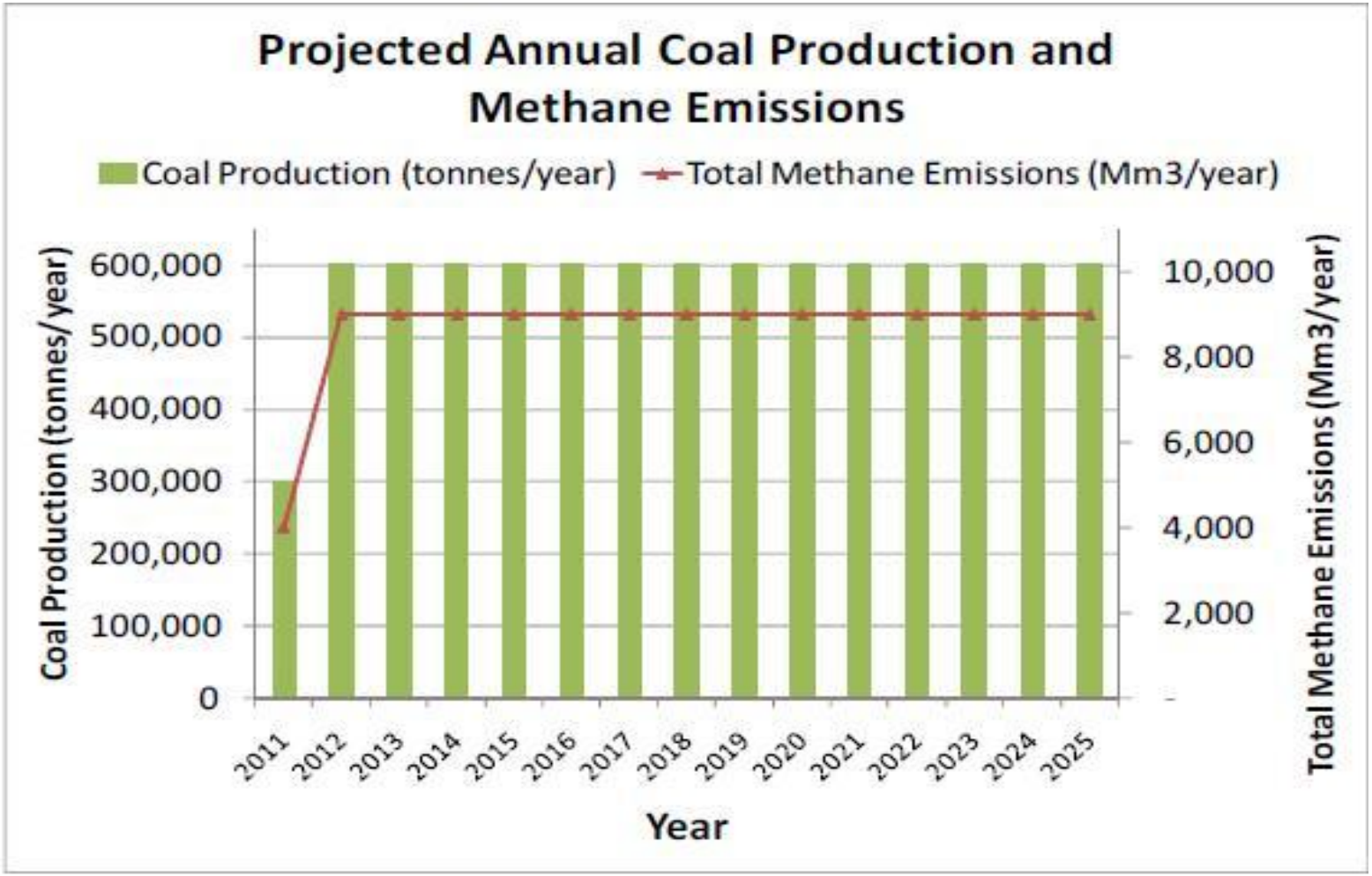
Why Nalaikh selected for implementing for Pre-feasibility study?

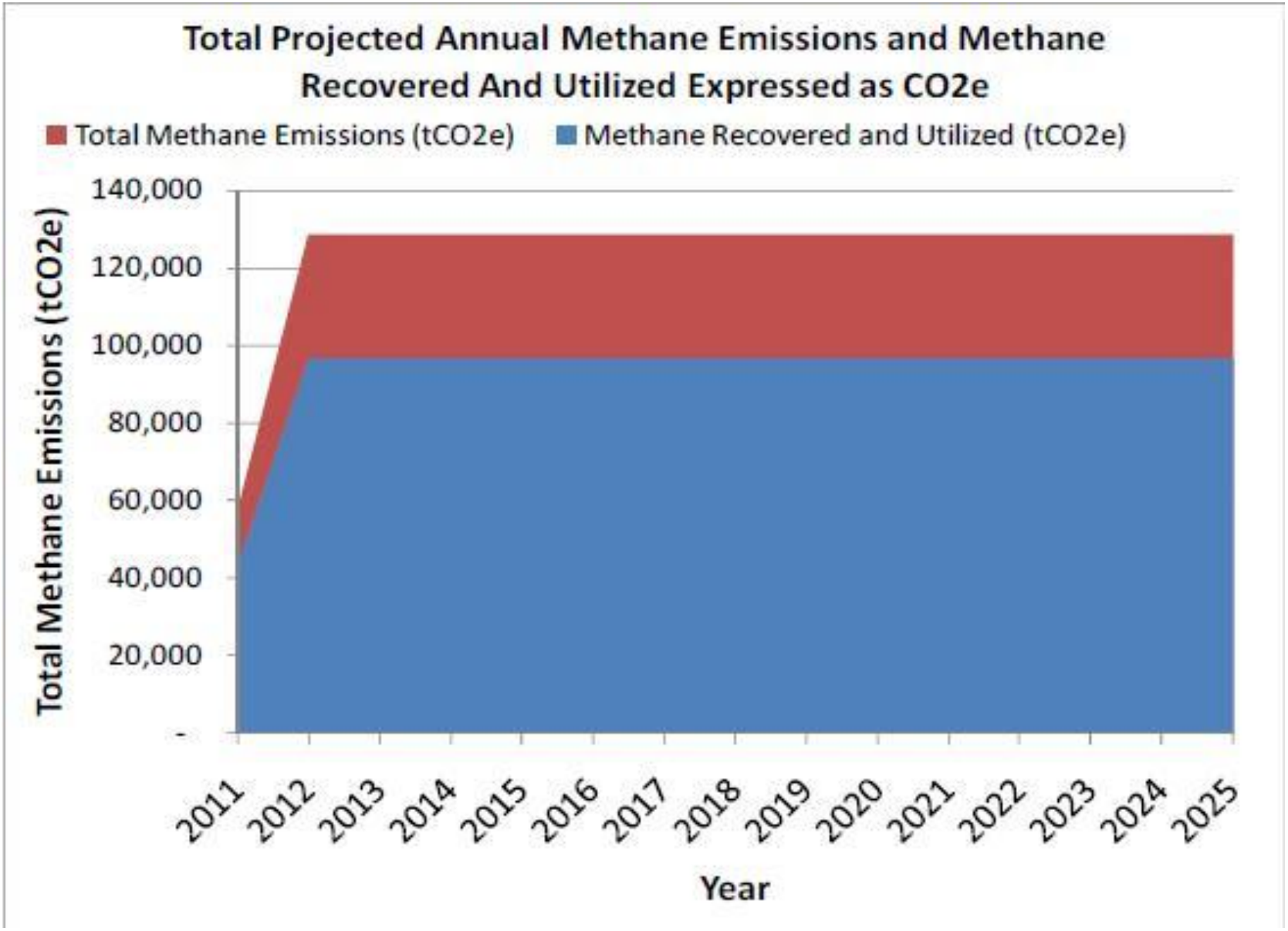
- Well developed mining site with a long history of use. Also, need to improve coal mine safety measures
- CBM resources is estimated about 200 million m3
- Located 37 km from UB where 1/3 of Mongolia's population lives, as well as other provincial capitals
- A good infrastructure exists including roads, bridges, and the railroad.
- Concentrations of air pollution in Ulaanbaatar and Nalaikh area exceeds the permission levels for October to March due to increased emission from local heating resources and electric generation.
- Health risks: One of the three people in Ulaanbaatar are infected respiratory diseases.

- The Nalaikh coal deposit is located approximately 40 km
- The Nalaikh colliery was established in 1922 and stopped its operation in 1992-1994 with a mining history of 70 years.
- There are still many small scale, artisanal mines operating at shallow depth to supply rather high quality coal to Ulaanbaatar and Nalaikh customers.
- Tsagaan Shonkhor Holding Company holds mining licenses in the western part of Nalaikh deposit area. The license area has five mineable coal seams and coal reserves are estimated to approximately 24 million tonnes


Mongolia
Ulaanbaatar
Capital of Mongolia
Ulaanbaatar
CHINGGIS KHAAN INTL AIRPORT
Nalaikh
Dzuunmod
NALAIKH MINE POWER GENERATION AND HEATING PROJECT

COAL PRODUCTION AND METHANE EMISSION CHARTS




Total Projected Annual Methane Emissions and Methane Recovered And Utilized Expressed as CO2e
Total Methane Emissions (tCO2e)
Methane Recovered and Utilized (tCO2e)
Total Methane Emissions (tCO2e)
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
Year

GREENHOUSE GAS EMISSION REDUCTIONS

TOTAL VOLUME OF METHANE EXPECTED TO BE RECOVERED/UTILIZED

YEAR	2011	2012	2013	2014	2015	2016	2017	2018
Total CH4 recovered and utilized (m3/year)	3,000,000	6,750,000	6,750,000	6,750,000	6,750,000	6,750,000	6,750,000	6,750,000
Total CH4 recovered and utilized (tCO2e)	42,840	96,390	96,390	96,390	96,390	96,390	96,390	96,390
YEAR	2019	2020	2021	2022	2023	2024	2025	Total Reductions
Total CH4 recovered and utilized (m3/year)	6,750,000	6,750,000	6,750,000	6,750,000	6,750,000	6,750,000	6,750,000	97,500,000
Total CH4 recovered and utilized (tCO2e)	96,390	96,390	96,390	96,390	96,390	96,390	96,390	1,392,300

PROPOSED TECHNOLOGIES

Proposed technologies for the Nalaikh project include a methane distribution system that will carry high, medium and low quality gas to internal combustion engines. Given the preliminary resource assessment, it is estimated that two 1.8 MW engines will be deployed for a 3.6 MW power project.

MARKET ANALYSIS/DEMAND ANALYSIS

- The primary end use for the methane would be for electricity generation to support the mine's power supply. A 3.6 MW power plant is anticipated. If enough methane is available for a second stage of the project, coal mine methane could also be supplied to the district heating plant, which is located nearby and currently uses coal. For this second stage of the project, the boiler would need to be converted from coal to gas and construction of a gas supply pipeline of 3 to 4 kilometers would be required.

- Costs for implementation of the power project are estimated to be US$5 million. Costs for the second stage district heating plant have not yet been estimated. The project would require capital investment.

ASSESSMENT OF SOCIO-ENVIROPMENT BENEFITS OF CMM IN MONGOLIA

Require for CMM consumption

To reduce Coal consumption in Ulaanbaatar city and its Nalaikh district

- Reduce expense of households and commercial facilities
- Reduce air pollution in Ulaanbaatar city
- Reduction GHG (CH4 gas) emission in Mines

Overview of fuel consumption in Ulaanbaatar city and it's district Nalaikh

Nalaikh:

- ✓ Private houses or stoves – 9000
  annual coal consumption -37800 tn
- ✓ Heat only Boilers - 24GCal/h
  annual coal consumption -33800 tn

Total-71600 tn

Ulaanbaatar city:

- ➢ 130000 households –
  Annual coal consumption -540000 tn
- ➢ 100,000 vehicles-
  Annual coal consumption 2200*100000=220000tn
- ➢ Heat only Boilers-
  Annual coal consumption 2200*100000=32350 tn

Total- 792350 tn

Coal price and it's volume in the expences

- Price of Nalaikh's coal- 35…45 U$/tn
- Price of Baganuur's coal- 32…40 U$/tn
- Heating cost

  - In heat-only boilers… 24 u$/GCal

  Coal price is 60% of heating cost.

- A household spends annually:

  ~ 4.5t (coal)* 45000₮ = 250000...300000₮ (260 US)

- Heat expenses rate is 30% in total expenses Schools, Health Facilities (Municipal Organizations).

Air Pollution Ulaanbaatar city and it's Nalaikh district

Air pollution is increasing because of coal burning in inefficient stoves

Smog concentration esimating experiment

	Chemical name		Stove-2	Average
1	CO	mg/m3	1998.656	**1918.98**
2	SO_2	mg/m3	2.3	**19.37**
3	NO_X	mg/m3	2.8815	**12.44**
4	Ash in gas	mg/m3	1531.8	**1222.88**
5	GHG, CO_2	mg/m3	59028.75	**53030.2**

CMM Parameters

- Methane rate:
  Kuzbass coal mine 25-30m.cub/tonne
  Nalaikh coal mine 5 m.cub/tonne
- Net Heating Value- 10000 kcal/kg
- Density 0,72 kg/m3
- Possibility of high pressure compression
- Price is three times low than coal’s
- 4 times less Hazardous Gas Emission than Coal

Methane Annual Demand

In Nalaikh district

- Householders -1400m3*9000=130,000m3
- Heat-only boilers 11,000,000 m3

TOTAL- 11,1 million m3(8136.0 tn)

coal-2,2 mln tn

In Ulaanbaatar city

- Householders - 182,000,000 m3
- Auto transport -3,500,000,000 m3
- Heat Plants- 45,000,000

TOTAL-185 million m3

Environmental benefits

Reduction of GHG emission

- Per household: CO_2 - 2.2 tn/year
  NH_4 – 1.1 tn/year
- Per GCal heat: CO_2 – 0,33 tn/year
  NH_4 – 0.1 tn/year

<u>in Nalaikh district</u>

1. Households: CO_2 – 19800 tn/year; NH_4 – 9900 tn/year
2. HOB's: CO_2-66000*0,33=21780 tn;NH_4-66000*0,1=6600tn

<u>in Ulaanbaatar</u>

1. Households: CO_2–130000*2,2=286000 tn; NH_4 –143000 tn
2. HOB's: CO_2-275000*0,33=90000 tn;NH_4-275000*0,1=27500tn

Economical benefits of CMM Consumption

a) heat-only boilers will reduce their heating cost by 16000₮ or 14$/Gcal

b) Householder will economy 100000₮ or 86 u$ in fuel expenses

c) Vehicle fuel expenses-500000₮ or 460$/year

in Nalaikh district

1. heat-only boilers-66000*14=924000 $
2. Household's -9000*86=774000$

total-1,9 million

In Ulaanbaatar

1. heat-only boilers-275000*14=3,8 mln $
2. Household's -130000*86=11,2 mln $
3. Vehicles-80000*460=36,8 mln $

total- 51,2 mln $

THANK YOU FOR YOUR ATTENTION