ELGA COAL PROJECT
MASSIVE COAL HANDLING PROJECT
MINE TO PORT

By

Mukhamed Tsikanov, Mechel
David Morris, Taggart Global LLC

Introduction

The Elga coal project represents a major exercise in integrated coal handling. Elga, controlled by Mechel, is a 2.0 billion ton reserve of high quality thermal and coking coal located in the Sakha Republic in eastern Russia. Mining conditions are favorable with low stripping ratios (3:1) and seams located above drainage. It has been referred to as the "mother of all mountaintop stripping deposits."

The deposit is located approximately 450 km from nearest infrastructure at Neryungri where Mechel operates a large open pit mine producing low volatile coking coal. The site is located in permafrost with minus 35 ºC average winter temperatures. Relatively low coal prices and extensive infrastructure requirements delayed development of this project from the time it was first seriously considered in 1991. The expectation of sustained higher coal prices allows this world class project to move forward.

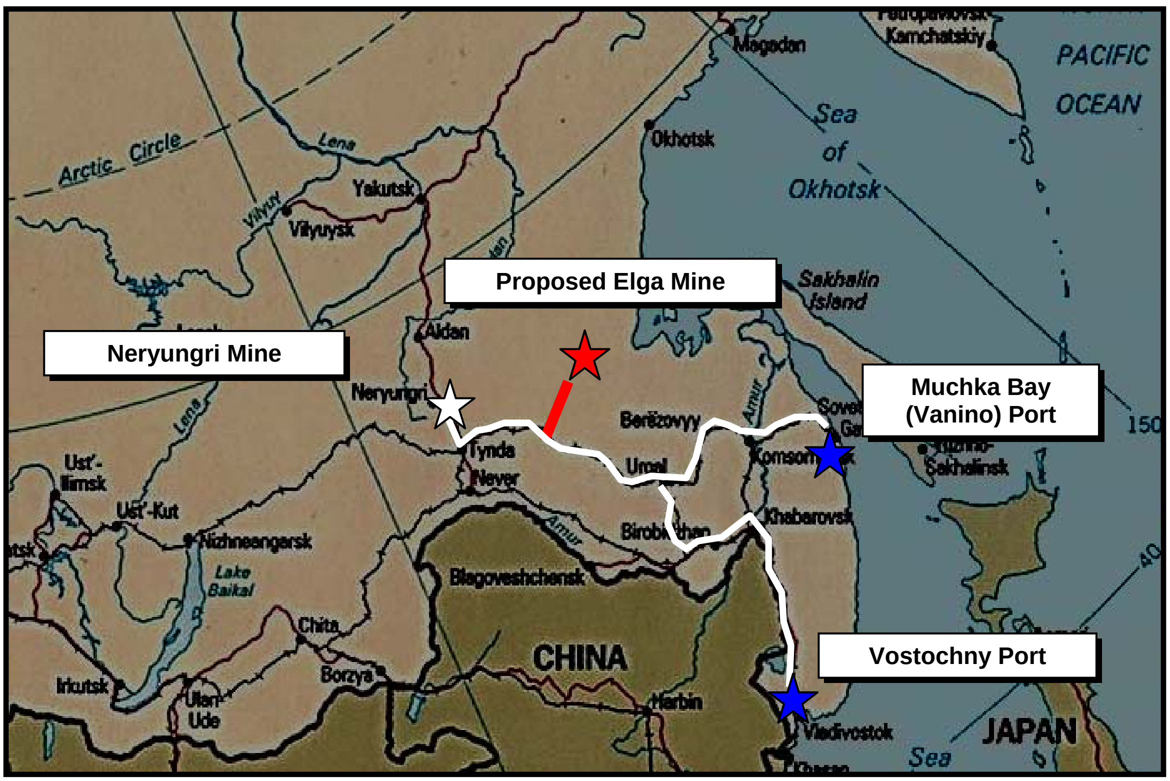

Figure 1. Russian Far East

At full production Elga produces 30 Mtpy ROM. Under current plans about half of the ROM production is directed to coking coal and half to thermal. Actual allocation will depend on differential coal prices in trade-off with differential plant yields. There is significant yield improvement going from 9 to 14 percent product ash.

Background

IMC conducted a pre-feasibility study of the deposit in 1998. John T. Boyd completed a feasibility study in 2001. During these efforts the extensive database was translated into English in anticipation that the project would involve international strategic investors. Exploration data was digitized and a computer model of the deposit created using Vulcan software. Boyd's study was updated in 2005. This update was funded by the Japanese Bank for International Cooperation and included capital and operating cost estimates associated with rail and port construction.

In spite of its remote location, the deposit was thoroughly explored by boreholes, trenches and adits. This work began in 1981 and continued through 2005 with bulk samples obtained for testing by Japanese steel mills. This body of work provided sufficient washability information to allow coal preparation plant design. Because the deposit is above drainage, oxidation plays a large role in determining suitability for coking coal production. Coking coal is produced from higher yield, un-oxidized zones. Expected coking coal quality is:

Parameter	Unit	Average	Range
Inherent Moisture	% air dry	1.05	0.20-1.90
Ash	% dry	9.0	8.5-9.5
Volatile Matter	% dry	32.7	31.2-34.2
Total Sulfur	% dry	0.21	0.15-0.27
Phosphorous	% dry	0.008	0.005-0.011
Carbon	% dry ash free	87.9	87.5-88.3
Hydrogen	% dry ash free	5.77	5.75-5.79
Oxygen	% dry ash free	5.22	5.18-5.26
Nitrogen	% dry ash free	0.84	0.83-0.85
Chlorine	%	0.07	0.01-0.19
Vitrinite	%	93.3	92.9-93.8
Reflectance	Rv (max)	0.93	0.91-0.95
Crucible Swelling Number	-	8	7 ½ - 8 ½
Gieseler Plastimetry	Ddpm	25,000	20,000-30,000+

Thermal coal is mostly produced from un-oxidized seams that have less attractive washing characteristics. Oxidized and partially oxidized reserves are also directed to the thermal coal markets. Expected typical thermal quality is:

Quality Parameter	**Average**
Moisture % (air dry)	1.2
Ash % (dry)	14
Volatile Matter % (dry)	32
Sulfur % (dry)	0.25
Total Moisture % (as received)	7
Heating Value Kcal/kg (air dry)	7,200
Nitrogen % (daf)	0.85
Chlorine % (dry)	0.07

HGI Index	65	
Ash Fusion Temperature:	Reducing	Oxidizing
Initial Deformation (°C)	1275	1300
H=1/2W (°C)	1320	1350
Fluid (°C)	1350	1380
Chemical Composition of Ash (%):		
SiO_2	56	
Al_2O_3	22	
Fe_2O_3	5	
CaO	8	
MgO	1.0	
MnO	0.15	
TiO_2	0	

In addition to primary products, Elga produces significant middlings (22.4 – 25.0% ash) that will either be used in a power plant on site or shipped to regional generators with boilers designed for high ash coal. Under current market conditions this high ash coal could be exported to northeast Asian cement manufacturers.

Mine

Selection of a large scale mining method is dictated by the geology. As noted in Figure 3 below multiple seam reserves are located above drainage.

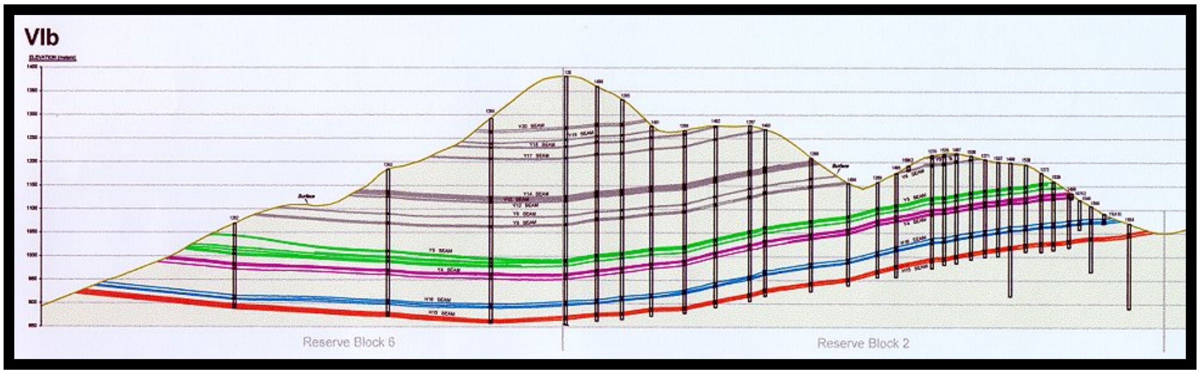

Figure 3. Typical Cross-section

Spoil is hauled to external spoil disposal areas where it's graded and eventually rehabilitated. Downhill hauls to these piles run 3-4 km. Average coal hauls to the ROM coal dump are in the 5-7 km range.

At nominal full production the mine requires the following major equipment:

	Loading		Hauling	
	Size (m^3)	No.	Size (tonne)	No.
Overburden	52	4	291	49
(Electric Rope)	31	2	187	25
Coal	26.4	2	291	5
(Diesel Hydraulic)	9.5	1	187	8

Dragline methods were examined and have potential application uncovering the lowest coal seam. Overburden requires drilling and blasting. Road conditions are generally good except during spring thaw conditions. Mechel's experience at the Neryungri mine support projections for normal productivity until conditions reach minus 35 ºC. Mining continues at reduced productivity until minus 45 at which time mobile equipment is moved into heated bays.

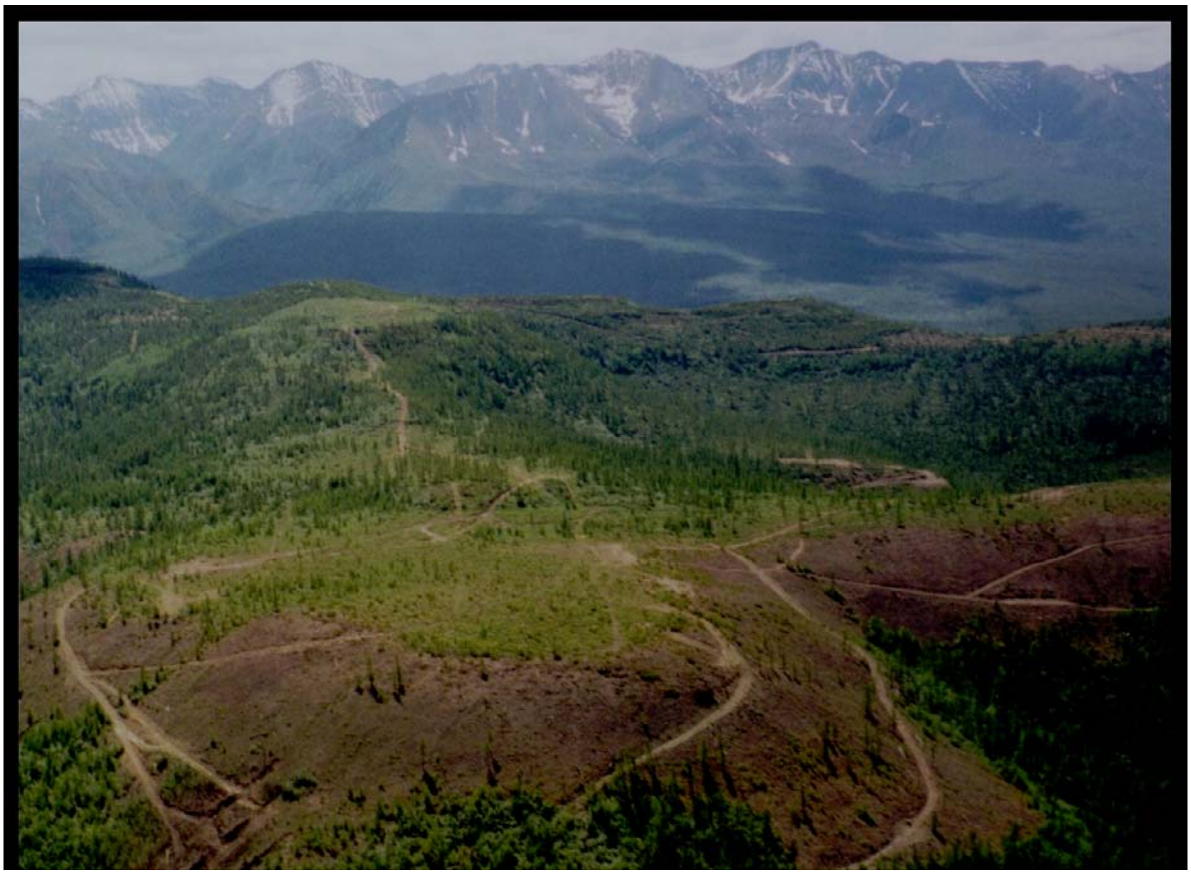

Figure 2. Elga Site Looking South toward Stanavoy Mountains

Coal extraction can begin early from exposed outcrops. Build up to full production is expected to take four years after the first major equipment arrives on site.

Temporary living quarters are provided on site. Miners are flown or railed in on a rotation basis and will likely live in Neryungri or near Ulak in Amur. A large air strip is included in Mechel's infrastructure budget to allow for air transport from Neryungri.

Coal Handling and Preparation Plant

Coal handling and preparation facilities at the mine will be designed to process 30 MTPY ROM. This includes both high fluidity metallurgical grade product as well as several brands of high quality extremely low sulfur thermal grade. Middlings will be sold to regional power plants and/or will be consumed on site for a combined heating and power plant.

Six 1000 tph modules are considered for coal washing. Coking coal and thermal coal circuits are similar with small design changes to accommodate additional middlings circuitry for the coking coal units. Large diameter heavy media cyclones separate 50 x 1.0 mm. Spirals process 1.0 x 0.15 mm and froth flotation recovers the 0.15 x 0 mm fraction.

HMC product is dewatered in centrifuges, spiral product in screen bowls and floatation product is initially dewatered through a pressure filter. Russian Railways requires 7% moisture to minimize rail car freezing from October to April. This specification may be met with mechanical drying but thermal dryers may be required and are incorporated in the design. Large thermal dryers are operated by Mechel at the Neryungri mine.

Mechel expects that detail CHPP design and engineering will commence by the end of 2008. Plant construction is phased consistent with mine, rail, port and infrastructure construction schedules.

Railroad

In February 2008 Mechel announced it contracted with Transstroy to construct the 317 km rail line connecting to the project with existing underutilized Baikal-Amur rail line (BAM). This is one of the largest new rail lines to be constructed in Russia in recent times and is routed through the rugged Stanavoy mountain range. Elevations range from 390 to 1100 m. Terrain is similar to the transcontinental lines running through the Cascade Mountains in Washington State. The Stanavoy range is also the continental divide with water flow south into the Amur River and the Pacific Ocean. North water flows are into the Lena River and on to the Arctic Ocean.

A parallel access road running from Ulak to Elga is scheduled for completion for the first quarter of 2009. Access road completion allows commencement of rail line construction at multiple locations. It also allows preliminary construction of mine site infrastructure and test mining.

Figure 4. End of Rail Construction as of September 2005

Key features of the rail transportation chain from mine to port are summarized:

- Construction on the Ulak to Elga rail line commenced initially in 2001 and was halted later that same year.

- 60 km has been cleared and grubbed, grade established through cut and fill, bridges and culverts have been constructed, embankment work completed, and track has been laid.

- From 60 to 120 km, much of the land has been cleared and grubbed and access road constructed, some grade has been established through cut or fill, bridges are under construction, and. some culverts constructed. This is the focus of recent rail construction efforts.

- Preliminary engineering for the line was completed by Mosgiprotrans, a large transportation design institute, in 1998. Mosgiprotrans used the following key design parameters:

    - 1.8% maximum grade
    - 316-km total length

- 400-m minimum radius (4º degree curve)
- 2,083-m rise in elevation (sum of ascending grades) from Ulak
- 1,564-m rise in elevation (sum of ascending grades) from Elga
- 1,080-m passing tracks
- Diesel locomotives 3TЭ10m (4,500-tonne rating)
- 46 cars per train with nominal capacity of 3,200 tonnes per train
- Maximum speed 60 kph
- P65 rail (65 kg/m)
- Seismic grade 7 on the Russian system (0-12 with 12 being the most seismically active)

➢ Mosgiprotrans completed detailed engineering for a portion of the route in 2000. This work increased the number of bridges required and allowed construction to commence. Environmental reviews were completed and approvals granted by the Amur provincial government.

➢ Transtroy completed additional engineering for the line in 2004 in preparing a bid to construct. Transstroy's design decreased the curve radius to 300 m, increased the train capacity to 6,000 t and assumed larger locomotives. Under the Transstroy design 10,590 linear meters of large bridges are required.

➢ Elga line connects to the BAM at Ulak. The BAM uses diesel locomotives for train power and will be the primary railroad servicing Elga. BAM uses primarily 3TЭ10m (4,500-tonne rating)[1] units with some 2TЭ10m (3,600-tonne rating) units on the lines from Urgal to Izvestkovaya and Komsomolsk to Toki and TЭ3 (1,000-tonne rating) units from Toki to Vanino. The BAM is generally a single-track railroad with passing sidings.

➢ From Ulak coal can be shipped west to domestic customers are east for export.

➢ Russian Railways is upgrading the existing BAM rail line to efficiently handle new tonnage. The main BAM route is underutilized but the route from Komsolmolsk to Toki station near Vanino is limited and requires substantial construction to meet demands from SUEK and Mechel.

➢ Rail distance from Elga to Vanino (Muchka Bay) is 2018 km. Distance to Vostochny is 2494 km.

➢ RZD currently has a shortage of rolling stock so it must be assumed that new locomotives and cars are purchased to meet Elga's 20 Mtpy product shipments. The exact number of units will vary depending on ultimate cycle times but are expected to range as follows:

- Locomotives (6,000 t class) 180 – 220
- Cars (71 t capacity) 9,000 -12,000

➢ Mechel recently announced it commenced wagon manufacturing for its own account.

Port

Given Elga's relative proximity to the Pacific Rim markets and lack of existing port capacity on the Russian east coast, the project requires a new dedicated port. Mechel examined several alternatives for this car thawing, coal storage and ship loading facility. Most Russian coal exported to Pacific Rim customers is shipped through Port Vostochny. Vostochny is an established all weather port with a nominal capacity of 14 Mtpy. Vostochny has expansion plans that could accommodate some if not all of Elga's production.

After careful consideration, Muchka Bay Terminal 2, located near the Port of Vanino was selected as the optimal solution. Mechel acquired rights to construct a new port and engineering is ongoing. The fact that it is 476 km closer to Elga than Vostochny reduces rail transportation costs. This new port is located near SUEK's new 12 Mtpy capacity Terminal 1 scheduled to become operational in late 2008. Mechel recently announced details on the new port:

➢ Capacity 25 Mtpy with 15 Mtpy in the first phase
➢ Construction commences in 2009 and is completed in 2012 (first phase)
➢ Total cost $500 million

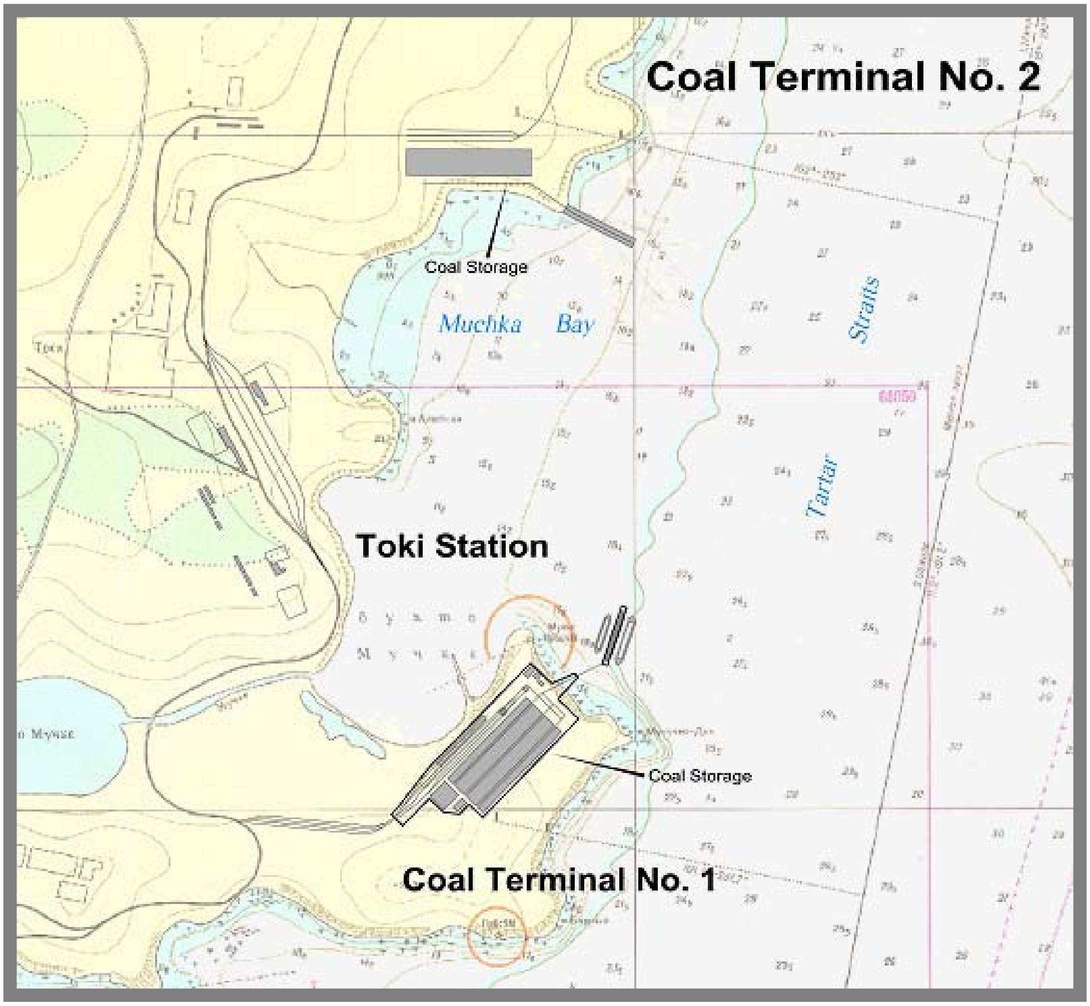

Figure 6. Muchka Bay General Layout

Rail car thawing at the port is required from the middle of October through middle of April. Sheds are heated to 100ºC by steam provided by a district heating plant. It takes approximately 45-50 minutes under these conditions to thaw a set of cars. Thawing capability is a limiting factor in determining a port's coal loading capacity during the winter.

Muchka Bay generally operates under all weather conditions but does have moderate ice in the winter. Adverse wind conditions can build up sufficient ice to require an ice breaker to be stationed at nearby Port Vanino. This is not a significant port operating cost item and has been thoroughly examined by international shipping companies.

Conclusion

As can now be appreciated, Elga truly is a major exercise in material handling from the mine to the port. It is a world class, low cost, coal deposit that has been under consideration for 17 years. Uncertain coal prices and large capital requirements have delayed development. With improved product pricing the project is moving forward but faces infrastructure challenges similar to those encountered at other large coal projects including those in Mozambique and Australia. Mechel is meeting these challenges aggressively on all fronts as demonstrated by the commitment of capital to resume rail construction and construct the new port.