

Transport costs from Mine to Market

Executive Summary

From a transport cost perspective, the total transport cost, from mine to market, is quite similar for sites at Boden, Luleå and Piteå (see table 1 below). Inbound graphite can be brought into the site by truck at a cost of SEK190 – 205 per tonne (about 7,000 tonnes of graphite anodes and about 8,000 tonnes of crushed graphite in big bags) and finished product can be shipped to Hamburg and/or Hull at a cost of SEK 600 per tonne and SEK 550 per tonne respectively (about 7'000 tonnes annually). Total cost for finished products would be approximately SEK 1'100 for Hamburg and SEK 1'050 for Hull.

Trucking is by far the most competitive mode of transportation for all transports from mine to processing plant where the difference between trucking and rail transports would be about SEK 150 to SEK 180 for the various sites (See table 3 below).

For transports from the processing plant(-s), shipping by sea is the only cost-efficient solution for anything to be shipped outside of the Baltic Sea region, e.g. Germany and the UK. For transports to potential markets within Scandinavia further investigations need to be done.

Table 1 – total cost per tonne of finished product from mine to market

<u>Site</u>	<u>Trucking</u>	<u>Loading operations</u>	<u>Total inbound cost</u>	<u>Site to port</u>	<u>Sea freight Hamburg</u>	<u>Sea freight Hull</u>	<u>Total cost (*) Hamburg</u>	<u>Total cost (*) Hull</u>
Boden	150	40	190	100	600	550	1'104	1'054
Luleå	150	40	190	80	600	550	1'084	1'034
Piteå	165	40	205	60	600	550	1,096	1'046
Skellefteå	210	40	250	100	600	550	1'231	1'181

(*) Costs for inbound transport to be borne by quantity of finished goods, i.e. 7'000 tonnes instead of the inbound quantity of 15'000 tonnes (division by 0.47 to convert to costs for finished goods).

Table 2 – costs per tonne of graphite anodes and crushed graphite from mine to processing plant when using rail transports from Kiruna

<u>Site</u>	<u>Nunasvaara – Kiruna</u>	<u>Loading op's</u>	<u>Rail freight</u>	<u>Handling at site(*)</u>	<u>Total costs</u>
Boden	110	70	107	80	347
Luleå	110	70	117	80	377
Piteå	110	70	133	40	353
Skellefteå	110	70	183	40	403

(*) Includes costs for transloading onto and off-loading a truck for short distance transport.

Table 3 – trucking vs rail transport costs from mine to processing plant.

<u>Site</u>	<u>Total inbound cost By truck</u>	<u>Total inbound cost By train</u>	<u>Cost difference</u>
Boden	190	347	157
Luleå	190	377	187
Piteå	205	353	148
Skellefteå	250	403	153

Objective

The objective with this report is to demonstrate what location would be best from a logistics cost perspective and what mode of transportation is the most cost competitive.

Methodology

Budget offers have been collected from potential transport service providers after they've been given brief information about what kind of goods are to be transported and in what quantities. There have been in-depth discussions with people directly involved in and with valuable experience from, actual handling and transports of similar goods for best possible reliability. Discussions and meetings have been held with potential partners for short-distance (Nunasvaara – Kiruna/Gällivare) as well as long-distance (Nunasvaara/Kiruna – Boden/Luleå/Piteå/Skellefteå) trucking and rail, terminal operations (Kiruna) and sea freight. In these discussions matters like suitable pallet weight, size of big bags, methods for loading/unloading, potential payloads, advantages/disadvantages with different types of load carriers (e.g. containers, flatbeds etc.) and much more have been discussed.

Findings

Trucking:

Trucking costs have been gathered from DB Schenker (international), BDX (regional) and OreFields & LTH (local) and resulted in the following best costs (basis 36 tonnes per truck):

<u>Site</u>	<u>Mine to rail terminal (LTH)</u>	<u>Mine to site (DB Schenker)</u>	<u>Mine to site (BDX)</u>	<u>Site to port (basis DB Schenker)</u>	<u>Site to port (basis DB Schenker)</u>
Boden	110	150	318	100	100
Luleå	110	150	324	80	80
Piteå	110	165	342	60	60
Skellefteå	110	210	364	100	100

The advantage with trucking is its flexibility, the large number of competitors, the limited number of loading/unloading operations and no need for any specific investments.

Loading/unloading op's:

Loading and unloading has been calculated based on information received primarily in discussions with LTH, BDX and ShoreLink. The hourly rate for a loader, either a forklift truck or a small front loader, ranges from SEK 650 to SEK 800 and the estimated time for loading/unloading a 36 tonnes truck, which is estimated to take about 1 hour. The average cost is expected to be SEK 20 per tonne.

When transloading from truck to train and vice versa it is expected that it can be direct transfer only 50% of the time, i.e. implying an average cost of SEK 30 per tonne.

Rail transports:

Rail transports can currently be done only from a cargo terminal in Kiruna operated by Kiruna Cargo. Svappavaara and Pitkäjärvi terminals are not equipped for handling of Talga goods and there are no common freight trains operating on that line. The only trains trafficking that line are iron ore trains and block trains for fuel and additives to the pelletizing made by LKAB at Svappavaara. Gällivare is currently not used for loading/unloading of freight trains. In order to utilize the Kiruna cargo terminal, trucking would have to be made from Nunasvaara to the terminal, product put on storage and then loaded onto trains, either in big bags or on pallets, both on flatbed railcars as part of a train set. At the destination the goods would be unloaded either directly at the site (Skellefteå and possibly Piteå) or reloaded onto truck (Boden and Luleå) for final transport.

Kiruna Cargo will handle our goods at the terminal once we're in operation and its sister company, LTH, has quoted on the trucking operations from Nunasvaara to Kiruna (about SEK 110 per tonne).

The freight costs for rail have been obtained from Green Cargo, the only operator currently on the rail lines in question.

Costs for a rail alternative would be as follows:

<u>Site</u>	<u>Nunasvaara – Kiruna</u>	<u>Loading op's</u>	<u>Rail freight</u>	<u>Handling at site</u>	<u>Total costs</u>
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Sea freight:

Transport by sea can be arranged from the container terminal at Haraholmen, the municipal port in Piteå. There are regular shipments of container vessels to Germany, the Netherlands, Belgium and UK with weekly or bi-weekly departures. The vessels calling at Piteå carry 5 – 10,000 tonnes of cargo, most commonly wood and paper products but also other products stuffed in containers or loaded in big bags. There are currently no shipments from any of the ports in the Bay of Bothnia calling on the Port of Gothenburg and no plans for opening such line in the foreseeable future.

The ShoreLink Group is the dominant Logistics company when it comes to seaborne logistics in the Bay of Bothnia (the ports of Kalix, Luleå, Piteå and Skellefteå). They are the only ones offering stevedoring services and they also offer complete logistics solutions including freight offers, shipping agency, freight forwarding, storage rental etc. We have obtained the following freight offers for shipments to Hamburg (DE) and Hull (UK), including all costs from unloading of incoming trucks into the port until loaded onto trucks in the port of discharge:

Piteå – Hamburg: SEK 600 per tonne (on pallets or in big bag)

Piteå – Hull: SEK 550 per tonne (on pallets or in big bag)