PRIVATE & CONFIDENTIAL

AFGHANISTAN RESOURCE CORRIDOR DEVELOPMENT

regarding

ASSESSMENT OF DOWNSTREAM MINERALS MARKET

made for

THE WORLD BANK
Working for a World Free of Poverty

Report 3: Mill and further downstream potential

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1. Introduction

The World Bank is helping the Government of the Islamic Republic of Afghanistan to prepare a Resource Growth Corridor Strategy anchored to upcoming large mining investments.

The latest large scale mining tender in Afghanistan concerned the Hajigak iron ore deposit. In this tender three out of four blocks, containing some 1.5 – 1.8 billion tons of iron ore (grade 62 – 63%), were awarded to the AFISCO consortium. The proposal of the consortium included the commitment to build a 7 million ton per annum steel mill in Afghanistan. Within this commitment it is assumed that proximate coking coal deposits will be developed for utilization in the steel plant.

In order to further the assistance for the Resource Growth Corridor strategy development, and in particular to assess the viability and potential of these AFISCO consortium plans and to consider possible alternative scenario's against the objectives of the strategy, an assessment of downstream mineral markets is to be made.

This report is preceded by the "Inception report, dd 14 04 2012" with focus on a quantitative assessment of the steel market in the wider region, and the "first overview of mill potential, dd 20 04 2012", evaluating the merits of a 7 million ton steel plant. These reports have been discussed with the WB team. Taking the reported findings and the feedback with findings from other sector studies (specifically transport) into account, this report will focus on a viable phased downstream development.

Where the report "first overview of mill potential, dd 20 04 2012" assumed a market price connect of raw materials with the international markets, and took current market prices into account, this report will base the analyses on a more fundamental approach of "long term structural / sustainable" price levels based on a raw materials market analyses.

This report, "Mill and further downstream potential" presents:

- Considerations with regard to cost of raw materials
- Mill phasing strategy
- Phase one, outline and assessment of feasibility
- Further downstream potential
- Scenario alternatives

The report is the third out of four reports. The fourth report will be the draft final report and will summarize the foregoing content reports and will draw overall conclusions and recommendations (synthesizing the analyses made).

2. Objective, Starting points, and methodology

Objective:

The main objective of this report is to draft a realistic scenario for an optimal first phase downstream development;

Starting points:

Next to the Inception report and the 'first overview of mill potential' report, that both serve as starting point considerations are made with regard to the possibility and timing of a Heavy Haul railway connecting the mines to a sea port.
In this report the materialization of a direct Heavy Haul railway to connect the mines to a sea port is assumed highly uncertain, and possible investments thereto to will take place behind the horizon of initial, first phase, downstream investments.

Prices refer to US $ value Q1 2012. Constant $ accounting (excluding inflation).

Methodology / approach per subject:

a. Considerations with regard to cost of raw materials.

   The mining of ore and coal is outside the scope of this study. Nevertheless, since the cost price of the raw materials determine to a large extent the viability of a downstream iron and steel operation, a general assessment of the situation will be made. Conclusions indicate risk and subjects that might need further research.

b. Mill phasing strategy

   Based on market analyses, growth assumptions and analyses of infrastructure/transport developments a contingency planning (what if) phasing of investments will be drafted. It is the objective to define a first phase with optimal economic viability of the downstream development (the iron and steel mill). Next phases will cover expansion plans subject to market and national infrastructure developments.

c. Phase one, outline and assessment of viability

   Market assessment, determination of scope and a cost price analyses will be the basis of a feasibility analyses. This will be amended with a risk and sensitivity analyses.

d. Further downstream potential

   Against the background of the above analyses, considerations will be made with regard to further downstream potential next to the first phase iron and steel mill.

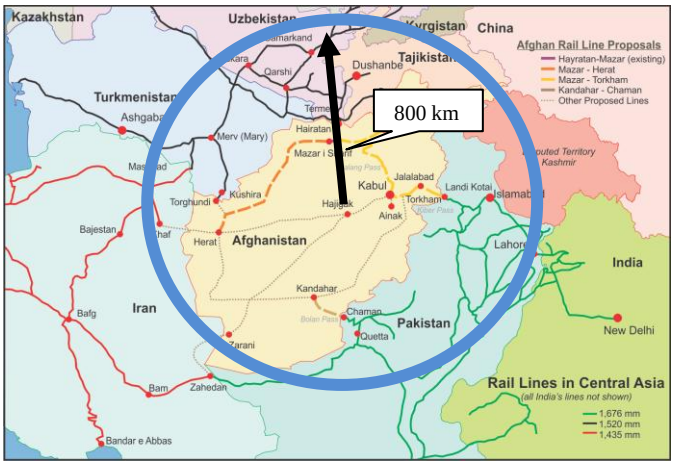
e. Scenario alternatives

   Based on brainstorm methods, with the (limited) knowledge available and the analyses made so far, alternatives will be drafted on headlines.

3. Executive summary and conclusions

One of the key determining factors in assessing strategic options for the downstream minerals market in Afghanistan is the lack of low cost transportation of bulk material to international markets outside the region. Neighboring rail systems are either not suitable (Pakistan), lead to no-markets (CIS) or are expensive with limited capacity(Iran).

Both, the iron ore / coking coal mining operation and the downstream iron- and steelmaking project will therefore primarily depend on the regional market (Afghanistan, Uzbekistan, Turkmenistan, Tajikistan, Kirghizstan, and the North of Pakistan).



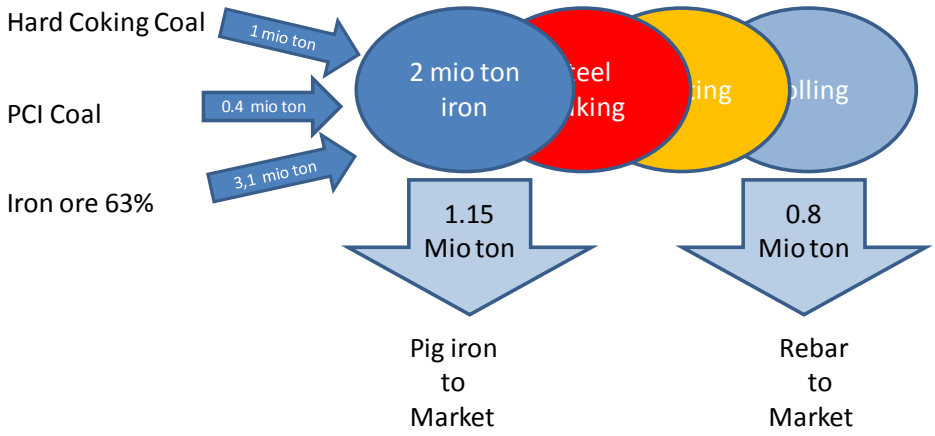
This means the capacity requirement of raw materials mining will depend mainly on the demand from the downstream project, the iron and steel mill.
There is no other integrated steel mill in the area.

The scope of the iron and steel mill project is determined by the following criteria:

- Maximization of the raw materials demand
- Market size and growth perspective (mill products)
- Competition
- Sales prices and factor cost
- Investment cost and ROI
- Timing the commissioning in 2018
- Risk

Analyses of these criteria leads to the conclusion that a phased investment in iron and steelmaking capacity is optimal from an investors perspective.

The resulting scope leads to a 2 million ton hot iron and a 0,8 million ton rolled steel operation. In schedule:



The total investment for this first phase is estimated at $ 2.3 billion.

Subsequent phases will lead to a 6 – 7 million ton steel plant. Next phases will benefit from threshold investment in the first phase. Decisions to build a next phase will be subject to:

- Market development
- Competition
- Country infrastructure development

The first phase, excluding any next phase, is evaluated at an IRR of 12%.

Sensitivities are:

Event	IRR	Difference
Basis	**12%**	**-**
Gas price reduced to $ 7 (-23%)	10%	-2%
(other) Conversion cost + 20%	9%	-3%
Iron ore price + 20%	9%	-3%
Coal price (HCC & PCI) + 20%	10%	-2%
Overhead + 20%	11%	-1%
Sales prices - 10%	6%	-6%
Volume - 10%	10%	-2%
Investment overrun + 20%	10%	-2%

Further downstream potential can be found in:

- Projects that relate to the iron and steel mill, either by consuming by-products or by supplying products / services.
  These projects are realistic and relatively low risk.
- Projects that are based on the raw material availability. With a limited local market, only high value products, can be considered to overcome the logistical to-market cost. Exception might be the forging of grinding balls for the mining industry, which will have a local market.

Alternative scenario's are not likely viable since the same problem of no or a limited local market and high logistical cost to out of the region export markets is at stake.

4. Considerations with regard to cost of raw materials

Hard Coking Coal (HCC) and Iron Ore are the major direct cost factors in the cost price of pig iron, and subsequently slightly more moderate in integrated steelmaking. In Pig Iron these cost are > 65% of the total direct cost. (85% when excluding the value of by-products)[1].

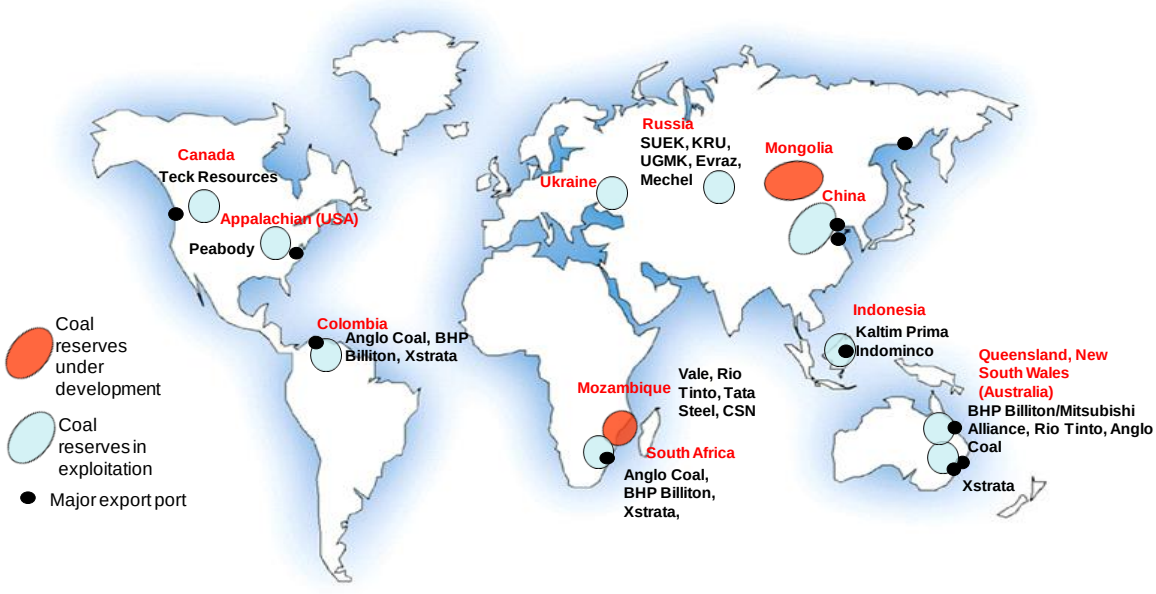
As long as there is no viable solution for the (competitive) transportation of these raw material to international markets, the business case for the development of these mineral reserves depend fully on the local demand from the downs stream market. Within the scope of this study, the transportation will depend on rail connections with Pakistan (technically not feasible), Turkmenistan / Uzbekistan ➔ CIS (not leading to any market with net demand) or Turkmenistan-Iran / Iran ➔ to a sea port (limited capacity, high cost, in need for technical investments – locomotive capacity – rolling stock). The route through Iran to a sea port, at guesstimate cost of $ 35 / ton has limited capacity[2] and a tradeoff should be made with regard to either shipping (semi)end product, or shipping raw material.

This means that the local demand for the downstream developments is determining the capacity requirements of the mining in this first phase[3]. At this stage, there is no knowledge on the threshold investments for the development of the coal and iron ore mine.

Lack of specific knowledge on the deposits excludes in this stage to make a judgment on the business case for the mine developments. We will elaborate on the market supply of HCC and iron ore, in order to have a basis for a rough price estimate (price determination).

4.1 Market price HCC

In contrast to the situation with iron ore, there are not many high quality coking coal reserves known in the world. The most significant developments are in Mongolia and Mozambique.

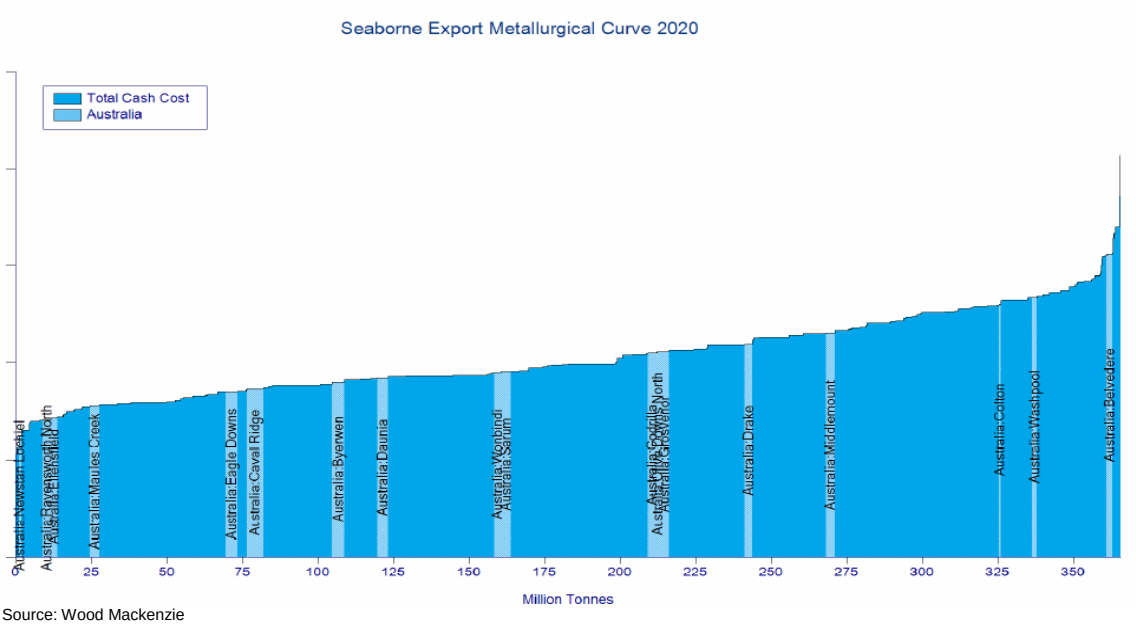


Source: SteelConsult analysis

[1] Using price assumptions as made in report "first overview of steel mill potential",
[2] See report on Railway development plan, draft April 13, HWKTS, + subsequent response on questions (attached)
[3] In a next phase the capacity limitations are assumed to be removed with either a new Heavy Haul track or capacity adjustments along existing lines.

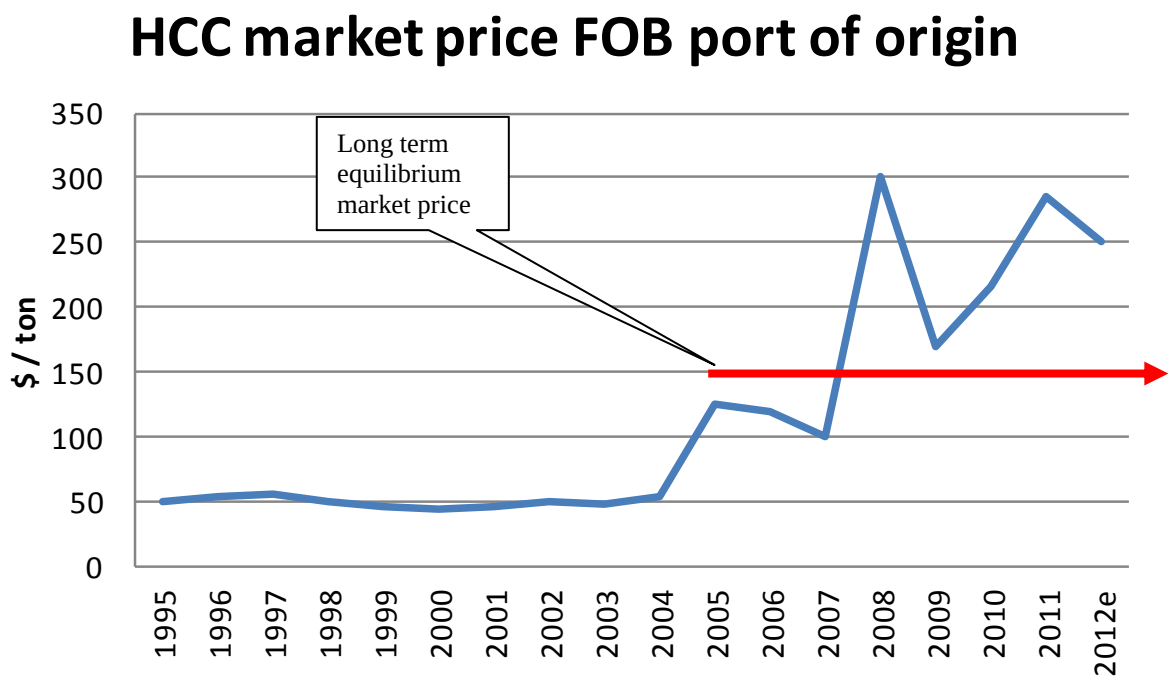
Potential developments which are in early stage of assessment and consideration are in Australia.

Seaborne traded HCC determines the worldmarket price level. Taking all the known developments into account, the supply curve for the seaborne traded HCC is estimated to look as follows:



Source: Wood Mackenzie

Market prices have long been stable around $ 50 / ton (nominal !), but have increased sharply related to the strong demand growth in the Chinese steel industry.

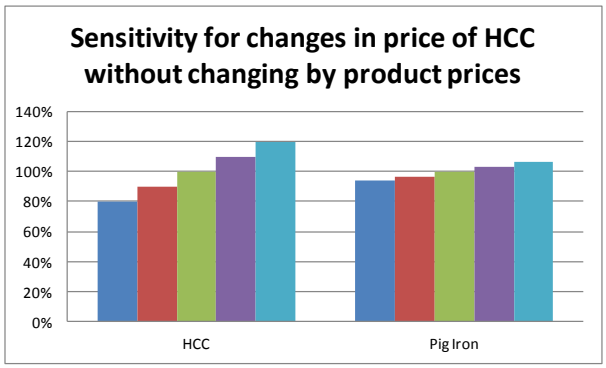


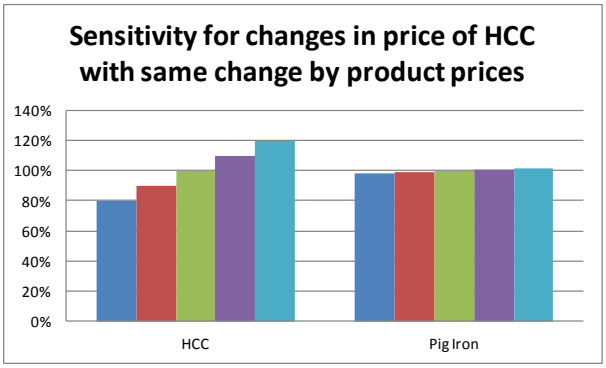
Source: Cordellt analyses

Long term demand analyses in combination with the supply curve brings most analysts to the conclusion the long term market price price ($ 2012) will be around, or just below, $ 150 / ton.

4.2 HCC in the cost price of Afghan Iron and Steel company

The role of HCC in the cost price is complicated by the fact that the most valuable by-products stem from the HCC input and these reduce the cost price with the income they generate.
Price changes in HCC do not necessarily translate in changes in the market price (or value) for the off gas from Coke Plant and Blast Furnace. We show the differences.



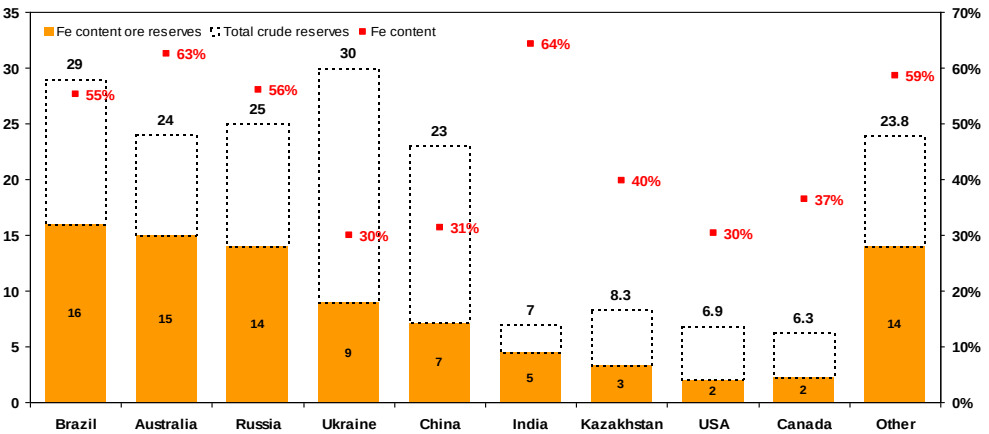


So, where a 10% change in the price for HCC results in a consequential cost price change of pig iron with 4%, it is in the case the sales price of by-products remains unchanged, that this sensitivity is reduced to a consequential change of 2 % when the by-product prices (in fact most of the energy of the coal) move the same.

For purposes of the analyses in this report of phase one of the downstream strategy (see section 6), we will take a (long term structural) price for HCC into account of **$ 150 / ton**. Since in the first phase there is a (logistical) disconnect with international markets for raw materials, we assume that changes to this cost price are driven by the cost of mining[4] only, and therefore have no impact on the market driven prices for by-products.

4.3 market price Iron Ore

Of the currently explorable iron ore, Ukraine has the largest reserves, though Fe content is low. Brazil, Australia and Russia have the largest reserves, respectively, in terms of pure iron contents. Total current charted reserves amount to 183bn tonnes worldwide, or well over 100 years of requirements. Moreover, 7% of the earth's crust consists of iron ...

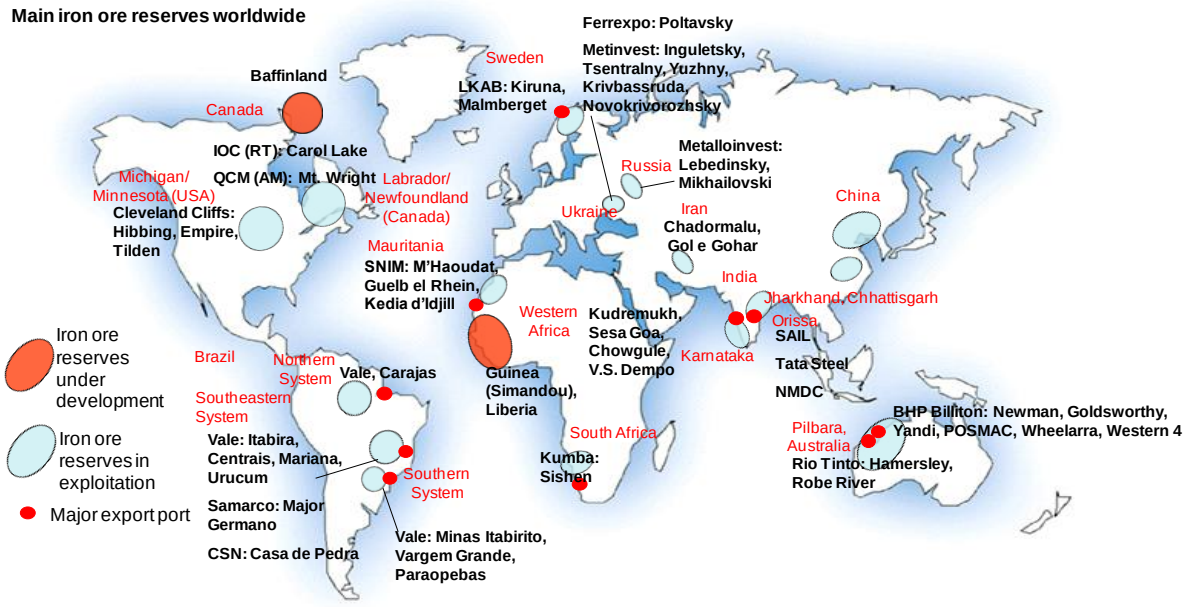


Source: USGS, SteelConsult

[4] A feasibility analyses will have to determine the minimum price for HCC in order to decide for exploration.

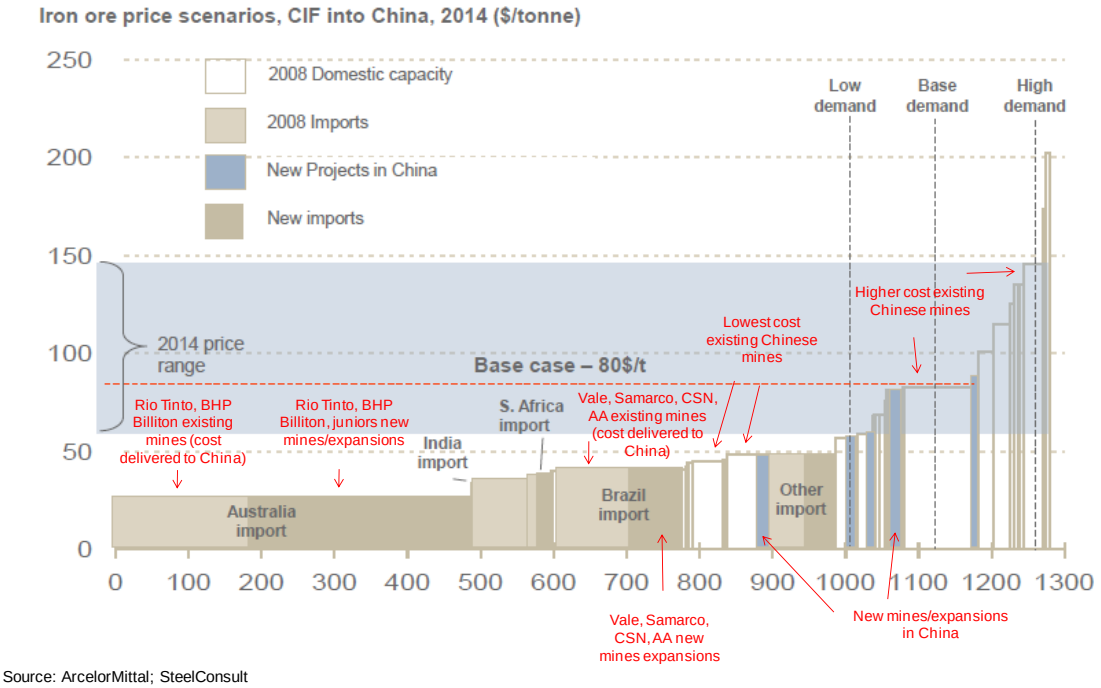
Therewith, iron ore is abundantly available. And with Ukraine and Russia having major, partly developed, reserves this underlines that the CIS market is not a sound outlet for Afghanistan ore given the transportation cost attached.

But ore quality will decrease and the cost of mining will increase over time as the best pockets of existing mines are depleted, whilst new projects require more beneficiation, and are developed in more difficult, more remote, less developed and less politically stable areas



Source: SteelConsult analysis

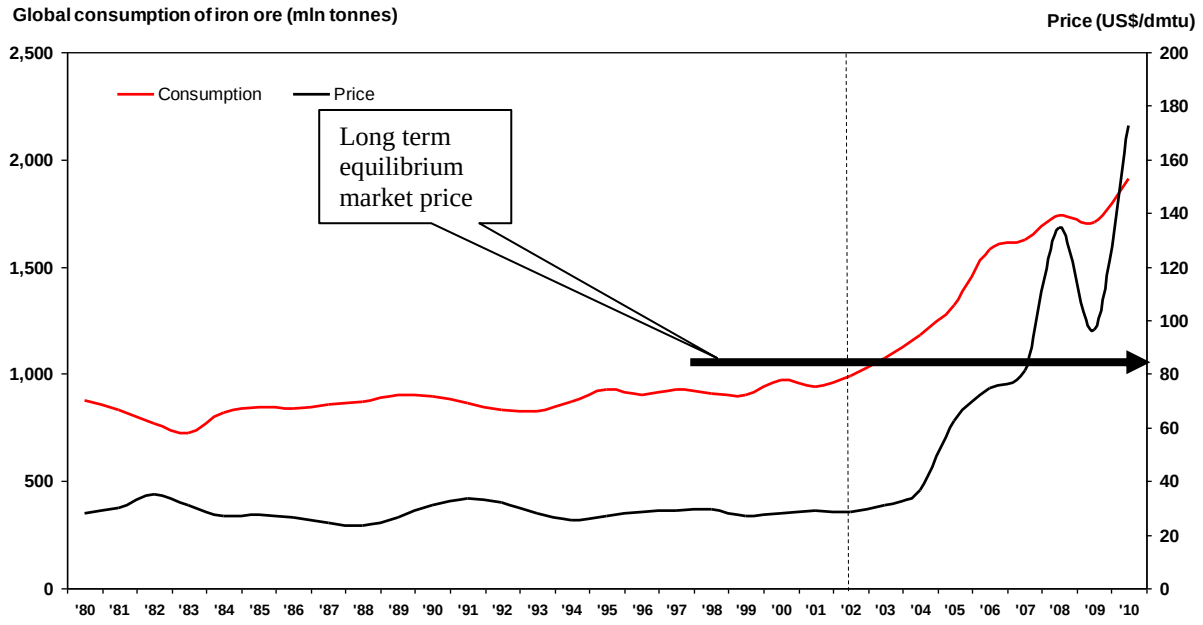
The current supply curve for iron ore explains the current price level, as determined by the inefficient and costly mines in China that the "short term" shortfall of low cost capacity.



Source: ArcelorMittal; SteelConsult

The shortfall is caused by the fast growth of Chinese demand, and the lead time to develop more efficient new capacity.

Looking at the long term price development, it can be observed that, when between 1970 and 2002, the world had plenty of iron ore mining capacity, the mining margins were low and falling...iron ore prices hovered around US$28/dmtu for over two decades in nominal terms, in real terms ore prices were in long term decline

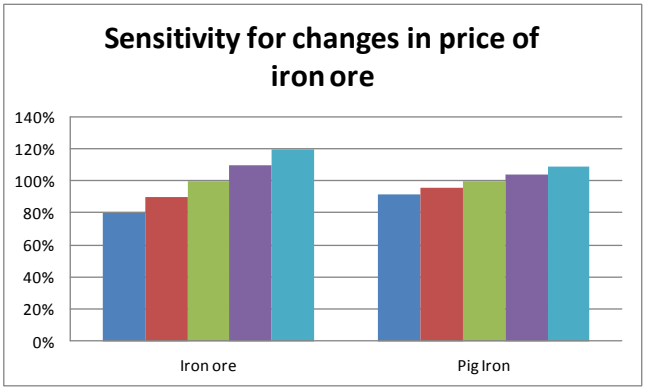


Source: Tex report, SBB, SteelConsult analysis

Please mind the above graphs are in $ / dmtu (dry metric ton unit), which applies on a virtual 100% Fe content.
Long term demand analyses in combination with the supply curve and the cost price of reserves that can and will be brought in production brings analysts to the conclusion the long term market price price ($ 2012) will be around, $ 80 / dmtu CIF China, or $ 63 / dmtu FOB port of origin. For 63% ore this translates to $ 100 / ton.

4.4 Iron Ore in the cost price of “Afghan Iron and Steel company”

The price of by-product of the ore (a fraction of the slag) is unrelated to the ore price. The total amount is not significant either. Therefore the sensitivity of the cost price of pig iron is directly related to the proportion of iron ore in the cost price.



10% change in the price of iron ore results therefore in a consequential cost price change of pig iron with a little over 4%.
For purposes of the analyses in this report of phase one of the downstream strategy (see section 6), we will take a (long term structural) price for iron ore into account of $ 100 / ton.

4.5 Conclusion

With a market disconnect for the key raw materials in this phase of the development of a downstream processing industry the “price adjustments” for local market conditions is an open issue.

In order to respect the required feasibility conditions for the investments in the mining development, and at the same base the feasibility analyses of the downstream investments on a realistic sustainable basis, we determine the raw materials at the long term structural international market supply – demand equilibrium. This concludes to:

- HCC $ 150 / ton CIF downstream plant
- Iron ore fines 63%: $ 100 / ton CIF downstream plant

Note: These assumptions must be checked for consistency with the feasibility analyses of the mining developments.

5. Mill phasing strategy

Criteria for sound investment include amongst others:

- Market development
- Factor cost
- Investment volume
- Risk
- ROI

Initiating driver for the investment in an iron and steel mill in Afghanistan is the iron ore and coking coal reserve of the country. Basic raw materials for iron- and steelmaking.

Another key driver is the availability of market for ferrous products and their growth perspective.

Constraining factor is the current logistical disconnect / limitations, in economical terms, to export markets out of the region for both, the raw materials and the ferrous products.

Considerations for an investment strategy are to cover:

- that the (upstream) mining investments benefit from scale of operations, and in a first phase will fully depend on demand from the mill
- the earliest availability of raw materials for processing is 2017
- that the mill is bound to meet the regional demand for iron and steel products, and that the limited export capacity into Iran is better used for metal trade than raw materials
- the status of industrialization in the region, posing a risk to protect the investment
- that there is no experience in Afghanistan with integrated iron and steel making

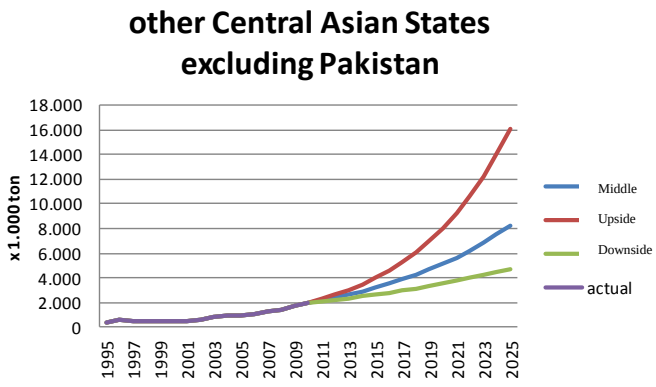
Many other considerations can be made, but taking the above into account an outline of a logical investment / development strategy can be drafted:

5.1 Scope of first phase

With start-up in the second half of 2017, a first phase plant, with a simple product mix, could prudently be scheduled to reach 80% of rated capacity end 2018 and full capacity 2019.

5.1.1 Market

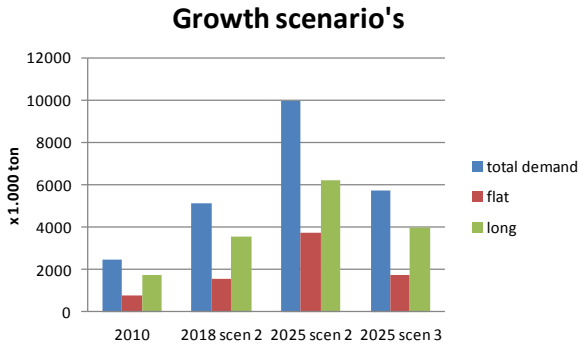
Given the mentioned constraining factors, the size of the mill is limited to what the regional market can bare. The analyses of the quantitative market evolution outlined the market potential in the region, covering the “Stan” countries (see Inception report 14 04 2012) and distinguishes Pakistan and the other countries.



The potential growth of Pakistan outweighs the others, but:

- the growth is much more speculative
- due to geography and transportation logistics only the northern sectors can be assumed to be part of the market basin of an Afghanistan steel industry. The import position of the south of the country is oriented on seaborne imports setting there the price level.
- There are no statistics to estimate the northern market segment of Pakistan.

The home market is defined as Afghanistan, Uzbekistan, Turkmenistan, Tajikistan, Kirghizstan, and the North of Pakistan[5]. Taking the middle scenario as a starting point, and the conservative scenario as the downside, than Market snapshots for the different scenarios indicate for the **long products** home market volume:



2010: 1,742 kton
2018: 2,570 kton
2025: 6,200 kton for middle scenario
2025: 4,000 kton for downside scenario

Regional (home market) production capacity exists of scrap based mini mills. One of the major problems in the area to meet demand with local production is the scars scrap availability and problematic power supply. Assuming these problems get solved, we estimate[6] the following, excluding a long products production of the Afghan steel mill project:

Long products X 1.000 ton	2010	2018	2025 middle	2025 downside
demand	1,742	2,570	6,200	4,000
capacity	950	1,200	3,000	2,500
production	800	1,100	2,700	2,300
Market gap	942	1,370	3,500	1,700

5.1.2 product mix; market share; capacity first phase

The first phase has to consider

- the objective to maximize capacity in order to allow the mining operations economies of scale
- risk with regard to market, because of the locked in character of the home market in this stage
- risk with regard to plant construction and operations
  - critical learning curve in first phase
- potential to expand in next phases (rather than to design for initial overcapacity)

To reduce market risk, the 2018 market estimate will be taken as a basis and the 2025 downside will be taken as the market reference for determining capacity. The finished

[5] Please mind the estimate is including North of Pakistan, which we estimate in 2010 at 250 kton and to grow proportionally with the scenarios

[6] Total production and demand in the region it up to a maximum of 200 kt higher (margin of error, due to un reported, undetected production)

product market position will respect the current import positions (so filling in growth rather than substituting imports) respecting market conditions (price).

As discussed in section 4, the priority for export capacity to Iran, or to Iranian port will be given to metal products. In view of the fast growing steel industry in Iran, pig iron seems a sensible product with hardly any market risk up to a volume of 500kton as long as the scrap needs in Iran continue to grow due to growing steel demand (pig iron can substitute the scars scrap). Longer term, the sustainability of a market position with pig iron in Iran is questionable.

Strategy to obtain a solid market position with finished products will increase added value, as well as it mitigates market risk.

Based on these considerations the initial feasible sales mix, **with low market risk**, is:

X 1.000 ton / a	**2018**	Market share	**2019**	Market share	**2025**	Market share1	Market share2
Pig iron export Iran	600	<15%	850	<20%	200	<3%	
Pig Iron home market[7]	300	20%	500	33%	950	30%	35%
Rolled products home market	400	16%	600	22%	800	13%	20%

Market share 1 refers to middle growth scenario, Market share 2, to down side scenario.

The initial capacity on this basis is:

Iron making: 2.0 million ton / a
Steel making: 0,9 million ton / a (130 ton converter)
Rolling: 0,8 million ton / a

According raw material requirement is:

- HCC 1,0 million ton / a
- PCI Coal 0,4 million ton / a
- Iron ore fines 3,1 million ton / a

Subject to a growth strategy, risk appetite and according more aggressive optimization of plant design, a higher penetration of rolled products could be considered (pushing imports out of the market). Such can result in a Blast Furnace of 3.0 million ton and BOF steelmaking with a 250 ton converter and 1,6 million ton capacity.

Subject to specific market requirement the rolled, finished, products could be a mix of rebar, wire rod and light sections. Specifically in growth scenario's it makes sense to diversify the mix. For this analyses it is assumed that the mill produces rebar only.

[7] Pig iron market share is calculated as the share in the total of purchased scrap and/or iron

5.2 Growth strategy

Considerations with regard to growth can be made with regard to:

- Aggressive market penetration
- Market growth
- Export markets

5.2.1 Aggressive market penetration

Within the context of the same market scenario and subject to the moderation/reduction of risk due to a successful first phase, an expansion plan can be decided at the earliest end 2019. Such expansion plan could double capacity based on:
- pushing back imports by doubling the rolled products output
- maintaining or developing a sustainable position with pig iron exports to Iran

Subject to actual market growth, a second expansion can be considered in 2024.

5.2.2 Market growth

Market growth is uncertain and therewith a risk factor. When market growth materializes along the middle or the most aggressive growth path (see 5.1.1), expansion can take place, while maintaining prudent sales scenarios.

5.2.3 Export markets

Unlocking Afghanistan with low cost rail connection to international markets (sea port), will create a complete new market environment. A tradeoff between the export of raw materials against the export of downstream products will not necessarily turn out in favor of downstream products if the Return on Investments from the steel mill is the criteria. Unsuccessful investments in Brazil in downstream processing for export (Thyssen) illustrate this point.

5.3 Summarizing scenario's and conclusion on Phase one strategy

Rough estimation of the above discussed scenarios can be Summarized in next table:

	earliest commisioning	Blast Furnace	BOF steelmaking	rolling mill(s)	Investment estimate $ x million
first phase	2018	1 x 2 million ton	1 x 130 ton converter	0,8 million ton	2.300
expansion 1	2021	1 x 2 million ton	1 x 130 ton converter	0,8 million ton	1.700
expansion 3	2023	1 x 2 million ton	1 x 130 ton converter	0,8 million ton	1.700
final capacity		6 million ton	2,8 million ton	2,4 million ton	5.640
first phase optimizing for growth	2018	1 x 2 million ton	1 x 250 ton converter	0,8 million ton	2.410
expansion 1	2021	1 x 2 million ton		0,8 million ton	1.565
expansion 2	2023	1 x 2 million ton	1 x 250 ton converter	1,6 million ton	2.145
final capacity		6 million ton	4 million ton	3,2 million ton	6.060
first phase with risk appetite	2018	1 x 3 million ton	1 x 250 ton converter	0,8 million ton	2.940
expansion 1	2021			0,8 million ton	410
expansion 2	2023	1 x 3 million ton	1 x 250 ton converter	1,6 million ton	2.740
final capacity		6 million ton	4 million ton	3,2 million ton	6.030

It must be noted that:

- Site circumstances are not known today
- The location of the site is not known
- International environmental standards are assumed
- Connection to national infrastructure (road; rail) is not included.
- Each phase is decided after the previous phase runs at capacity

Conclusion:

The Afghan steel mill will, at least initially, have to work in a confined market. This market has growth perspective, but around the year 2018 the market size is not such that it can absorb an additional 6 – 7 million ton of iron and steel.

A new steel mill will have to fit in, and care should be taken to allow the market (supply and demand) to develop in a healthy way. For the market entry strategy there are two choices:

- Tap in on the growth on top of current import levels and the autonomous growth of the regional steel industry, or
- Push regional imports (Kazakhstan, Russia, China, Turkey) back with a more aggressive sales approach.

The first strategy motivates an initial plant size of 2 million ton hot metal (liquid iron) capacity and small BOF steel mill converters (130 ton). The second strategy allows a first step of 3 million ton hot metal and middle size converters.

Taking into account that there are many uncertainties going forward, to be translated in (costly) risks, the most flexible (kind of modular) approach will have preference. Risk appetite has to be balanced against economies of scale.

Without insight in the aspect of risk appetite of the investor, we conclude the small scale approach is best to be motivated economically.[8]

[8] A model is outside the scope of this report.

6. Phase one, outline and assessment of feasibility

6.1 Scope and investment

Scope of the initial investment:

Plant	Capacity (net) X 1,000 ton a	Investment $ x 1,000,000
Coke making	940	340
Sinter plant	3,200	160
Blast Furnace	2,000	450
Desulphurization	1,980	10
Pig iron granulator	1,135	10
BOF steel plant	875	80
Continuous billet caster	840	90
Rebar rolling mill	800	200
subtotal		
Auxiliaries, infra, site prep and project cost		960
Total		**2,300**

Auxiliaries include, oxygen plant, water treatment, central workshop etc. Internal infrastructure includes, road, rail, gas transport, communication lines etc. Central administration offices etc.

Power plant is assumed to be off site, third parties. (priced in at 10 ct / kwh). Substation is in scope.

Site access to country infrastructure is assumed outside the scope. (so, specific rail connect to the Coal mine, as suggested, is not in this scope except for the part that is on tite).

Total investment: $ 2,300 million. There are many unknowns with regard to this specific investment, a.o. the site location and the general infrastructure in 2016-2017. Therefore there is no basis for country specific contingency. (sensitivity for budget overrun, see 6.5)

6.2 Operational cost, product cost

6.2.1 Raw material cost

Iron ore sinter fines, 63% Fe: $ 100 / ton (see section 4)

Hard Coking Coal: $ 150 / ton (see section 4)

PCI Coal	$ 115 / ton	(consistent with HCC)
Scrap	$ 350 / ton	(consistent with structural)
Fluxes	$ 20 / ton	
Alloys		

And, amongst others:

Electricity	$ 0,1 / kwh
Man hours	$ 20 / hr

(other include, gasses, refractory, etc.)

6.3.2 By-products prices (credits)

In the steel industry the common way of cost price calculation deducts the value of by-products from the cost incurred in that specific production phase. Such includes scrap that, thereafter against market prices is input with the steelmaking.

Gas:	$ 9 / Gj
Slag:	$ 5 / ton
Tar:	$ 200 / ton

These prices are based on separate market mechanisms (Energy and Construction) and are independent from raw material prices. For the analyses we keep them stable on the current level.

6.3.3 Product costing

The saleable product mix consists of

- Granulated pig iron
- Rebar

With the (“structural”) input prices as defined in 6.3.1 and the cost credits for by-products based on the transfer prices identified in 6.3.2 , the direct cost of these products are:

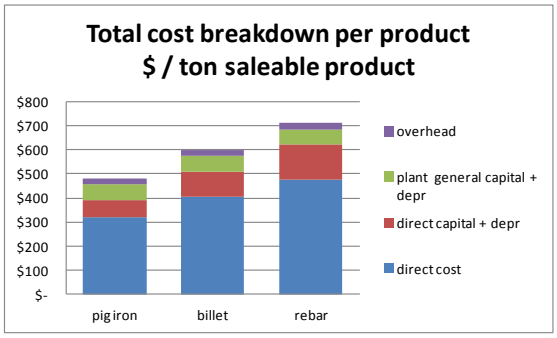
$ / ton, at site	Granulated pig iron	Rebar
Direct cost	295	450

To arrive at the integrated cost price, or full cost, overhead and capital cost have to be added.

Overhead cost, including administration, sales, all kind of indirect cost including local duties and levies etc. is in this stage hard to define. In international feasibility studies a ball park number of $ 25 / ton is used, assuming a full finished product mix. Although this estimate seems high in view of the simple first phase, this will be applied equally on a per ton bases for both products.

Capital cost for investments in auxiliaries and general infrastructure applies equally on a per ton basis to all products sold. The capital cost for specific investments in steelmaking, casting and rolling is assigned to the rolled products only.
Calculating a WACC of 9% and depreciation in 20 years for main plant and 30 years average for auxiliaries, site and infrastructure, the following integral cost can be calculated.

	Cost price $ / ton		
	pig iron	billet	rebar
direct cost	$ 319	$ 405	$ 477
direct capital + depr	$ 73	$ 104	$ 144
plant general capital + depr	$ 64	$ 64	$ 64
overhead	$ 25	$ 25	$ 25
	$ 481	$ 598	$ 710



We include a cost price for billets, but there is no regional market for billets taken into account.

In comparison with the preliminary mill evaluation with a size of 6.5 million ton of products sold, there is a disadvantage of scale specifically in the capital cost and depreciation. The disadvantage of scale is approximate $ 30 / ton, mainly due to threshold investments in auxiliaries, site infrastructure and site preparation. When the plant expands in next phases, these economies will be obtained (diseconomies fading out) at that time.

Of course these cost prices have to be confronted with market prices in the same “structural” market circumstances (so, aligned with the raw material assumptions). See section 6.4

6.3.4 By-products volume, Gas

The carbon products used in the process of steelmaking are primarily used for the chemical reduction process of the iron-oxide. Most of the energy content is recoverable in the form of low caloric off gas at the Coking process and at the Blast Furnace.

These gases are usually used for the generation of electric power.

Gas used in the process of the plant (sintering, heating of the ladles and tundish for steelmaking and casting, firing the reheating furnace for rolling) is Natural gas, for its higher caloric value which is required in the high velocity burners for heating.

The Coke-oven gas and the Blast Furnace gas have a different caloric value and need to be mixed, with some natural gas added to suite the power generation the best.

In the first phase, at full production:

• the Coke plant produces:	4.6 million GJ /a
• The Blast furnace produces:	12.6 million GJ /a

Total	17.2 million GJ /a

6.4 Market prices

Market prices in the home market region are indirectly related to world market prices, adjusted for the additional logistical cost. At this stage good market research is failing, but it is known that some of the local, scrap based, production is of questionable (bad) quality.

We use as a reference Turkey export to the region:

Prices, consistent with the raw materials structural prices are:

- Scrap: $ 350 / ton (FOB port Turkey)
- Rebar $ 630 / ton

Seaborne transportation Turkey (Iskendrun) – Iran (Bandar):	$ 25 / ton
Inland transportation by Truck:	$ 90 / ton

Total price difference CIF customer basis	$ 115 / ton

Since the region is and for the foreseeable future will be scars in scrap, the good quality (imported) scrap will locally sell to the mini mills for $ 465 / ton (CIF).

6.4.1 Market price for rebar:

There are now two ways to estimate the market price for rebar.

- The imported rebar will cost minimal $ 745 CIF (delivered)
- The locally produced rebar, in mini mill (e.g. Uzmetkombinat):
  Conversion cost is $ 220 - $ 250 /ton
  Yield of scrap is 85% - 88%
  Interest and overheads are $ 25 - $ 35 / ton

⇨ The lowest estimate adds up to $ 775 FOB mill, meaning $ 800 – 825 CIF customer.

Possibly the transportation cost are underestimated with port charges (could be $ 5 – 10 / ton at each end), perhaps some import duties, and on the other hand the production cost by local mini mills might be overestimated because they might mix low cost local scrap with imported scrap. Taking that into account, a reasonable estimate of local rebar price is $ 760 / ton CIF.

Conclusion: structural market price for rebar in the home market (consistent with the structural raw material prices) is $ 760 / ton CIF customer.

Transportation cost from the mill to the customers are estimated between $ 10 / ton (nearby) - $ 50 / ton (export neighboring country), with an estimated average at $ 35 / ton.

Rebar market price **FOB mill: $ 725.-**

6.4.2 Market price for pig iron

The reference market price for pig iron is (imported) scrap. This reference price is: $ 465 / ton CIF customer mill home market region.

In Iran the scrap might sell more competitively due to infrastructure and location of the steel works. We estimate an advantage of $ 25 / ton, Meaning a CIF customer mill price of $ 440 / ton.

For scrap based mini mills, the input of pig iron has two major advantages:

- The re-melting cost is lower than of scrap (less energy required, less yield loss), and
- The pure metal helps to control the quality better

This rates the market price of pig iron at > 15% over scrap. (15% - 20% subject to processing parameters and the quality of products). Prudently the calculations are made with 15%.

Conclusions:

Price “home region”: $ 465 x 1,15 = $ 535 / ton CIF customer (delivered) or deducting $ 50 transportation cost **$ 485 / ton FOB mill**

Price Iran: $ 440 x 1,15 = $ 510 / ton CIF customer (delivered), or deducting $ 50 transportation cost **$ 460 / ton FOB mill**

In summary:

$ / ton FOB	Market price	Integral cost price
Rebar	725	710
Pig iron home market	485	481
Pig Iron Iran	460	481

Sales to Iran do provide a contribution margin of course

6.5 Return on Investment and sensitivity analyses

The foregoing can be analyzed in a simple model with regard to its financial repercussions. With reference to section 2:

- $ are US dollar, value Q1 2012
- Constant $ projections (no inflation)

Year		2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2038
Sales												
volume:												
Rebar home market	x 1,000 ton			200	600	640	680	720	740	780	800	800
Pig iron home market	x 1,000 ton			150	500	590	680	770	840	900	950	950
Pig iron export Iran	x 1,000 ton			300	850	720	590	460	370	270	200	200
Prices												
Rebar home market	$ / ton fob			725	725	725	725	725	725	725	725	725
Pig iron home market	$ / ton fob			485	485	485	485	485	485	485	485	485
Pig iron export Iran	$ / ton fob			460	460	460	460	460	460	460	460	460
REVENU	**$ x million**			***356***	***1069***	***1081***	***1094***	***1107***	***1114***	***1126***	***1133***	***1133***
Operational cost												
Rebar	$ / ton			477	477	477	477	477	477	477	477	477
Pig iron	$ / ton			319	319	319	319	319	319	319	319	319
Production cost	$ million			239	717	723	729	736	739	745	748	748
Overhead	$ million			49	49	49	49	49	49	49	49	49
OPERATIONAL COST	**$ x million**			***288***	***766***	***772***	***778***	***785***	***788***	***794***	***797***	***797***
Investment												
Investments	$ x million	600	800	900								
INVESTMENTS	**$ x million**	***600***	***800***	***900***								
PRE-FINANCING CASHFLOW	$ x million	-600	-800	-832	303	309	316	322	326	332	336	336
IRR	**12%**											

The IRR, internal rate of return (period 2016 – 2038), of 12% is healthy for the industry.

Event	IRR	Difference
Basis	**12%**	**-**
Gas price reduced to $ 7 (-23%)	10%	-2%
(other) Conversion cost + 20%	9%	-3%
(other) Conversion cost - 20%	14%	+2%
Iron ore price + 20%	9%	-3%
Iron ore price - 20%	14%	+2%
Coal price (HCC & PCI) + 20%	10%	-2%
Coal price (HCC & PCI) - 20%	13%	+1%
Overhead + 20%	11%	-1%
Sales prices - 10%	6%	-6%
Volume - 10%	10%	-2%
Investment overrun + 20%	10%	-2%

The sensitivity is calculated keeping all other factors constant (CP). In practice there will be correlation between factors, such as ore and scrap price, scrap and sales price etc. A lower price and lower volume might also relate in certain scenarios.

7. Further downstream potential

In the Inception report dd. 14 04 2012, it was stated that, with reference to the industrial development of Kazakhstan, the downstream development is not to be limited to the initial iron and steel mill project.

One of the lessons learned in the steel industry is that focus on a coherent set op product-market combinations pays out.

The drafted mill in section 6, is to characterize as focus on prime material and the construction/building industry.

A further downstream strategy may be considered along the following two main lines:

a) Industries, processing by-products of and/or supplying specific inputs of the steel mill
b) industries that find a basis in the availability of raw materials and connect to a market.

Ad a) directly related to the steel mill

The following matrix provides guidance to opportunities that can be considered. All of these have precedents in the steel industry. With regard to potential investors it is recommended to look for investors that are specialized in the subject matter, preferably not the same as the investors in the steel mill.

Basis	Potential application	Local Market	remark	Potential investors
By-product gas	Power generation	yes / likely	Mix with natural gas	Power industry
By-product gas	Fertilizer	yes		Chemical industries
By-product tar	Chemical products	likely	Combine with fertilizer plant	Chemical industries
By product slag	Road foundation	likely	Competes with grinded rock	Construction industry
By-product slag	Cement	yes	High quality	Cement industry
Oxygen and Inert gas needs	Steel plant / steel processing industries / hospitals	yes	Look for IOMA members http://www.iomaweb.org/	Industrial gas industries
Power	Steel plant / others	yes		Power industry
Mechanical services	Preparing of spares / consumables	Yes/likely	In house steel plant if no alternatives	Local
Logistical services	Distribution of products	yes	In house steel plant if no alternatives	Traders in surrounding countries

For these there is not much question with regard to market and opportunity. Traditionally steel plant investors incorporate most of these investments in their project. Although this makes sense from an investment risk point of view (it all is dependent on the functioning of the steel plant), it has proven to be sub optimal. There are specialized markets at stake, and these are better served with specialization. At the same it helps to finance the investments and to reduce the risk of the entire project (all the projects together).

Ad b) related to the availability of raw materials

In fact unrelated from the steel mill project, although the Coal and Iron ore mines will depend on the of take of the steel mill to be viable.
Also here it is tempting to argue that these downstream investments could be merged, in whole or in part, into the steel mill project. But specialization is the same answer not to do so. An iron and steel mill is a process industry and therewith very sensitive to disruptions of the production. The mix of structural steel production with any kind of more specialized steels has proven to increase overall cost and reduce the control.
Also from a market perspective there is no real synergy. Only risk to sub optimize because joint cost will take away the required transparency.

Product	Potential application	Local Market	remark	Potential investors
Seamless tubes	Oil & gas industry	Yes, region	Unlike to compete with current projects in U/K	Tube makers
Heavy sections	Constructions	yes	To small market in this stage	Steel industry
Stainless steel	Export	Small (too small)	Based on raw materials (chromium), Compete with scrap	Stainless steel makers (Aperam etc.)
Engineering steel	Export engineering industries	hardly	High value. Based on alloy minerals in Afghanistan	Specialty steel makers
Grinding balls (forging)	Mining industry	yes	See also report of Altai	Grinding media industries

Out of these possibilities, the production of grinding balls for mining operations has the best logic. Although there is a competitive international market, there is the logistical advantage to this land-locked market. This advantage counts less for these higher value products, but is still a competitive factor. Another aspect is the proximity of alloying elements (same argument as for engineering steels).

A set up of a mini blast furnace (obtaining coke from the steel mill of section 6), small steel making unit, a billet caster and a forging line con be considered on a scale of < 250.000 t / a. By sharing some infrastructure with the steel plant a competitive cost basis is imaginable.

8. Alternative scenario's

In section 5 the strategic options for the initial size and phasing of the steel mill project are reviewed. The mill design in section 6 is the base strategy.

The feasibility of the mining operations is to be regarded the basis for any (alternative) scenario. Assuming the mining operation is feasible with the size and cost price level of the first phase (see section 6), alternative scenarios to consider are:

Alternative	remark	Feasibility
Pelletizing for export	Could be combination with lump ore.	Not likely prior Heavy haul rail
Export DRI quality	Middle East and India markets pay a premium of > 10%	Not likely prior Heavy haul rail
Pig iron + by-products only	Only regional (home) market is accessible,	Feasible, but inferior to base strategy
Steelmaking, only semis	No regional re-rollers market.	Export overseas infeasible
Rolling operations first	Idea is to build up market share first and than integrate backwards	Billet imports are just as uncompetitive as billet exports
Coating operations	Flat products, importing to galvanize and paint	Market must be assessed first.
Transformation	Start with downstream processing operation. In view of market likely small	Steel service centre chain, to develop the market, perhaps in joint venture with others

The land locked situation, without low cost transport options to international markets remains a handicap for the development of a bulk materials industry. The further downstream, the smaller the operations, fitting in the market environment. Investments in the organisation of the steel processing construction industry are likely viable as long as there is a fairly good supply of materials (bar, wire, sections, sheet). That requires investments in the steel industry, and therewith such is not an alternative scenario, but an additional strategy.

Conclusion:
There are no alternative, obviously viable, downstream minerals market scenario's. In case the basis scenario cannot be funded, a, more risky, pig iron only strategy might be a marginally viable alternative.