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PURE FONTE LTÉE
PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY
CUSTOMER N°: 1821



TENOVA
 TECHINT ENGINEERING & CONSTRUCTION

SECTION 1 - SUMMARY
CHAPTER 1.7
COMMERCIAL ANALYSIS

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Chapter's references:

- [1] AACE International, *AACE International Recommended Practice No. 18R-97*
] *COST ESTIMATE CLASSIFICATION SYSTEM – AS APPLIED IN ENGINEERING, PROCUREMENT, AND CONSTRUCTION FOR THE PROCESS INDUSTRIES, TCM Framework: 7.3 – Cost Estimating and Budgeting* , 2016.

1.7 Commercial Analysis

This chapter of Section 1 is a summary of the project economics, including the capital expenditure, the plant operating cost, an overview of the market analysis and the financial projections.

The Capital expenditure chapter has been studied by the company SNC Lavalin based on the engineering design performed by Techint Engineering and Construction, considering the equipment projected cost by Tenova. The accuracy of this capex is in line with what defined as a Class II Feasibility Study by AACE

ESTIMATE CLASS	Primary Characteristic	Secondary Characteristic		
	MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES Expressed as % of complete definition	END USAGE Typical purpose of estimate	METHODOLOGY Typical estimating method	EXPECTED ACCURACY RANGE Typical variation in low and high ranges
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

Figure 1.7-1.: Cost Estimate Classification Matrix for Process Industries [1]

The Opex has been developed by Tenova, while market analysis and financial projections have been developed by PURE FONTE LTÉE.

 SNC • LAVALIN	Capital Cost Estimate		Revision	
	635089-0000-33RA-0001		#	Date
			PB	2016/06/23

1.7.1 Capital budget

Discipline	Description	Direct Labour Hours	Avg. Crew Rate	Labour	Permanent Equipment	Permanent Material	Permanent Fabrication	Sub-Contract	TOTAL (CAD)	TOTAL (USD)
DIRECT COSTS										
41	Civil	33,765	\$160	\$5,402,439	\$0	\$2,744,452	\$0	\$0	\$8,146,891	\$6,261,106
	Dome technology	15,450	\$160	\$2,472,000	\$0	\$1,400,000	\$0	\$2,277,083	\$6,149,083	\$4,725,738
42	Concrete	121,484	\$109	\$13,241,757	\$0	\$7,140,844	\$0	\$0	\$20,382,601	\$15,064,585
43	Structural Steel	83,588	\$137	\$11,451,598	\$0	\$14,514,134	\$0	\$0	\$25,965,732	\$19,855,373
	Technological Steel (supplied by Tenova)	28,705	\$137	\$3,932,600	\$0	\$0	\$0	\$0	\$3,932,600	\$3,022,310
44	Architectural	60,093	\$120	\$7,188,007	\$0	\$5,675,819	\$0	\$0	\$12,863,826	\$9,886,201
45	Mechanical	218,798	\$124	\$27,163,072	\$2,868,520	\$564,126	\$0	\$0	\$30,595,718	\$23,513,644
45	Mechanical (Tenova Supply) - Allowance	0		\$0	\$184,768,980	\$0	\$0	\$0	\$184,768,980	\$142,000,000
46	Piping	168,514	\$121	\$20,198,976	\$0	\$6,971,620	\$3,232,405	\$2,382,855	\$32,785,856	\$25,196,824
47	Electrical	96,664	\$114	\$11,037,039	\$31,941,305	\$4,738,085	\$0	\$0	\$47,716,429	\$36,671,377
48	Automation	39,000	\$105	\$4,098,000	\$100,000	\$2,750,000	\$0	\$0	\$6,948,000	\$5,339,727
TOTAL DIRECT COSTS		664,062	\$123	\$106,185,487	\$219,678,805	\$46,499,080	\$3,232,405	\$4,659,938	\$380,255,714	\$292,236,686
INDIRECT COSTS										
	Construction Field Indirects		3.0%	% of direct costs					\$11,407,671	\$8,767,106
	warranty management- 1 person 1 year @ \$150/hour			included in EPCM					\$0	\$0
	Heavy Lift & Heavy Haul from Port								\$4,107,332	\$3,156,597
	Engineering, Procurement & Construction Management		8.0%	of direct costs					\$30,420,457	\$23,378,951
	Norda Stelo Engineering & Construction Management			included in Construction Field Directs					\$0	\$0
	Geotechnical Survey			included in Construction Field Directs					\$0	\$0
	Survey subcontract			included in Construction Field Directs					\$0	\$0
	External Laboratory Testing			included in Construction Field Directs					\$0	\$0
	Freight		7.0%	of SNC estimated equipment (freight for Tenova equipment included in \$142M USD)					\$1,047,927	\$805,360
	Freight's Insurance								\$0	\$0
	Vendor's Representative		2.0%	of SNC estimated equipment (vendor rep for Tenova equipment included in \$142M USD)					\$299,408	\$230,103
	Initial First Fills and Oils			included in Tenova \$142M USD					\$0	\$0
	Commissioning Spares		0.5%	of SNC estimated equipment (spares for Tenova equipment included in \$142M USD)					\$74,852	\$57,526
	Capital Spares		3.0%	of SNC estimated equipment (spares for Tenova equipment included in \$142M USD)					\$449,112	\$345,155
	Operating Spares (2 years)			Included in OPEX					\$0	\$0
	Pre-Commissioning Support (Trades assistance by sub-cont.)			of mechanical and electrical hours (15 men x 6 months x 4.3 weeks/month x 40 hrs/wk x \$115)					\$1,780,200	\$1,368,132
	Contingency		9.0%	of direct + indirects excluding escalation					\$38,685,841	\$29,731,124
TOTAL INDIRECT COSTS									\$88,272,800	\$67,640,054
TOTAL DIRECTS + INDIRECT COSTS									\$468,528,514	\$360,076,940

1.7.1.1 Exchange rate

The above table has been developed by SNC Lavalin considering cost in three different currencies: USD, CAD and EUR. The exchange rates used for the conversions are one published by oanda.com on May 28, 2016

- 1 USD = 1.30119 CAD
- 1 Euro = 1.45497 CAD

1.7.1.2 Basis of estimate

The basis of estimate for this Capex are described in the dedicated section of the FS and are defined in accordance with Quebec safety, environmental and Union Labor specifics as per SNC Lavalin files of recent projects

1.7.1.3 Explanation of direct costs

The cost of civil construction (code 41) is divided into three lines:

1. civil and excavation;
2. concrete; and
3. construction of the storage dome, which is a particular type of construction that has been quoted by a reputable supplier with experience in Quebec.

All three lines include materials and labor.

The cost for structural steel has been divided in two lines:

1. "technological structural steel" which is directly related and connected to the process equipment, estimated by Tenova; and
2. the balance of structural steel, estimated by SNC Lavalin

The cost for "mechanical" items has been divided in two lines:

1. the equipment supplied by the main OEM supplier and consolidator, price by Tenova; and
2. the balance estimated by SNC Lavalin

Piping, Electrical, Automation and Architecture have been estimated by SNC Lavalin based on material take offs ("MTOs") provided by Tenova and Techint. In certain cases,

where these MTOs have a large impact on the overall capex, for example piping, critical sections have been calculated based on isometric drawings. In Tenova and Techint’s experience, these types of drawings are generally only produced during the project execution phase, but have been realized for this Feasibility Study due to the nature of the job and the large impact that certain areas of construction have on the overall capex.

1.7.2 Operating Cost

1.7.2.1 Commodity prices

The operating cost has been developed assuming the following commodity prices:

Commodity Price Assumptions		
Iron Ore Pellets	(US\$/t)	88.72
Natural Gas	(US\$/mm btu)	3.5863
Electricity	(US\$/kwh)	0.0307
Lime	(US\$/t)	120

Table 1.7-1.: Commodity price assumptions

Electricity prices of US\$0.0307/kwh are based on the Quebec industrial power rates (April 1, 2018), as well as discussions with the Quebec province.

Delivered natural gas prices have been estimated at US\$3.5863/mmbtu based on discussion with Gaz Metro and updated prices from TransCanada Pipelines

The Lime cost is a 2018 market price for the lime quality required by PURE FONTE LTÉE in its operations.

Iron ore pellet prices from Eastern Canada, delivered to PFL site, are estimated US\$88.72 delivered to site.

1.7.2.2 Cash production costs

Specific consumption for each one of the cost items of the plant have been defined according to the performance values of each equipment.

The plant is expected to reach the target production in 7,900 hours of production time per year, so using only 90% of the available time, while the rest of the time the plant will be considered down for planned annual maintenance. Other regular scheduled maintenance time is included in the production time

Summary per item	cost/year	cost/t
IO Pellets	52,360,068	120.74
Natural Gas	17,196,155	39.65
Electricity	9,616,344	22.17
Labor, excluding SGA	6,318,350	14.57
Refractories	4,338,435	10.00
Lime	3,465,918	7.99
Maintenance	2,438,599	5.62
DR supplies (O2, N2, DMDS, MDEA, etc.)	2,190,051	5.05
Electrodes	2,168,367	5.00
Slag processing	1,376,940	3.18
General services and supplies	758,929	1.75
Industrial Water and other gasses	271,545	0.63
Briquette binder	130,978	0.30
Total	102,630,680	236.65

Table 1.7-2.: Cash production costs

PURE FONTE LTÉE projects to have a 20-year average cash production cost of US\$236/t.

1.7.2.3 Comparative operating cost

PURE FONTE LTÉE will be one of the lowest cost producers of pig iron on a delivered basis to the U.S. Midwest and will be in an extremely competitive position to deliver to Western Europe.

PURE FONTE LTÉE will have US\$80 - \$90 per ton advantage over Russian and Brazilian suppliers.

Comparative Operating Costs per tonne MPI

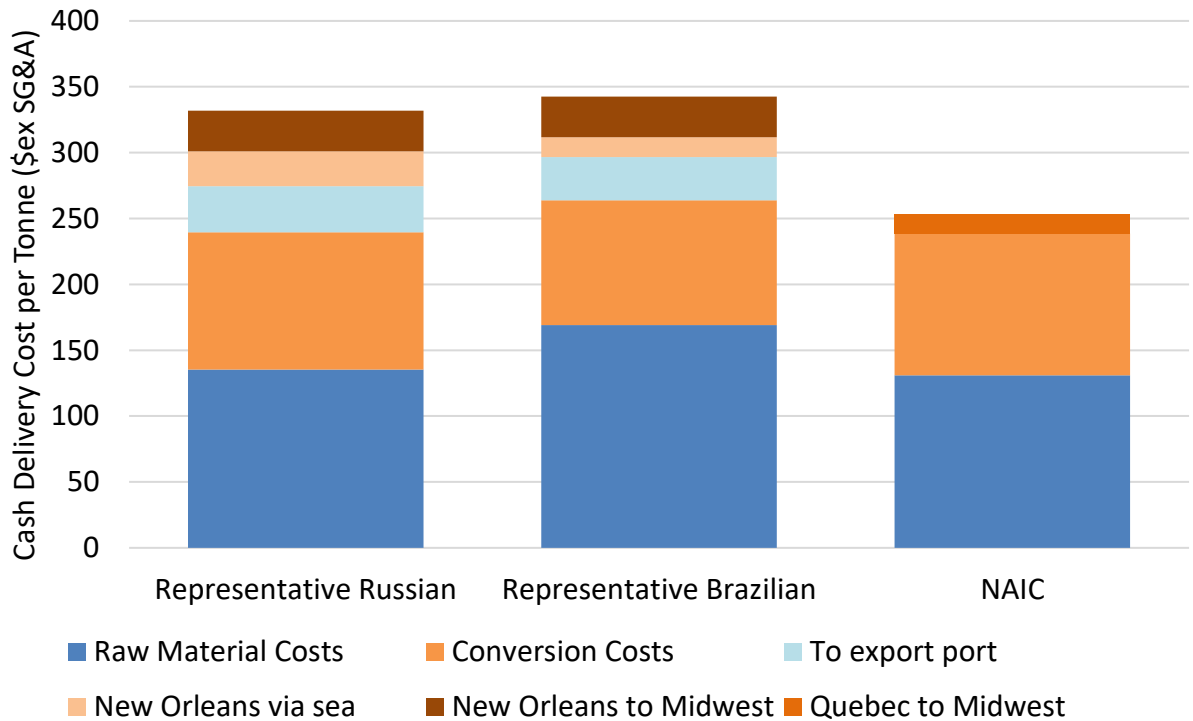


Figure 1.7-2: comparative operating costs (PURE FONTE LTÉE and CRU)

1.7.3 Market Studies and Offtake agreements

1.7.3.1 MPI supply

MPI is produced globally, with the majority of exports coming from Brazil, Russia and the Ukraine. China is a large producer and consumer of pig iron in EAF furnaces, however nearly all production is consumed internally. Like China, India is also a major producer of merchant grade pig iron for domestic consumption.

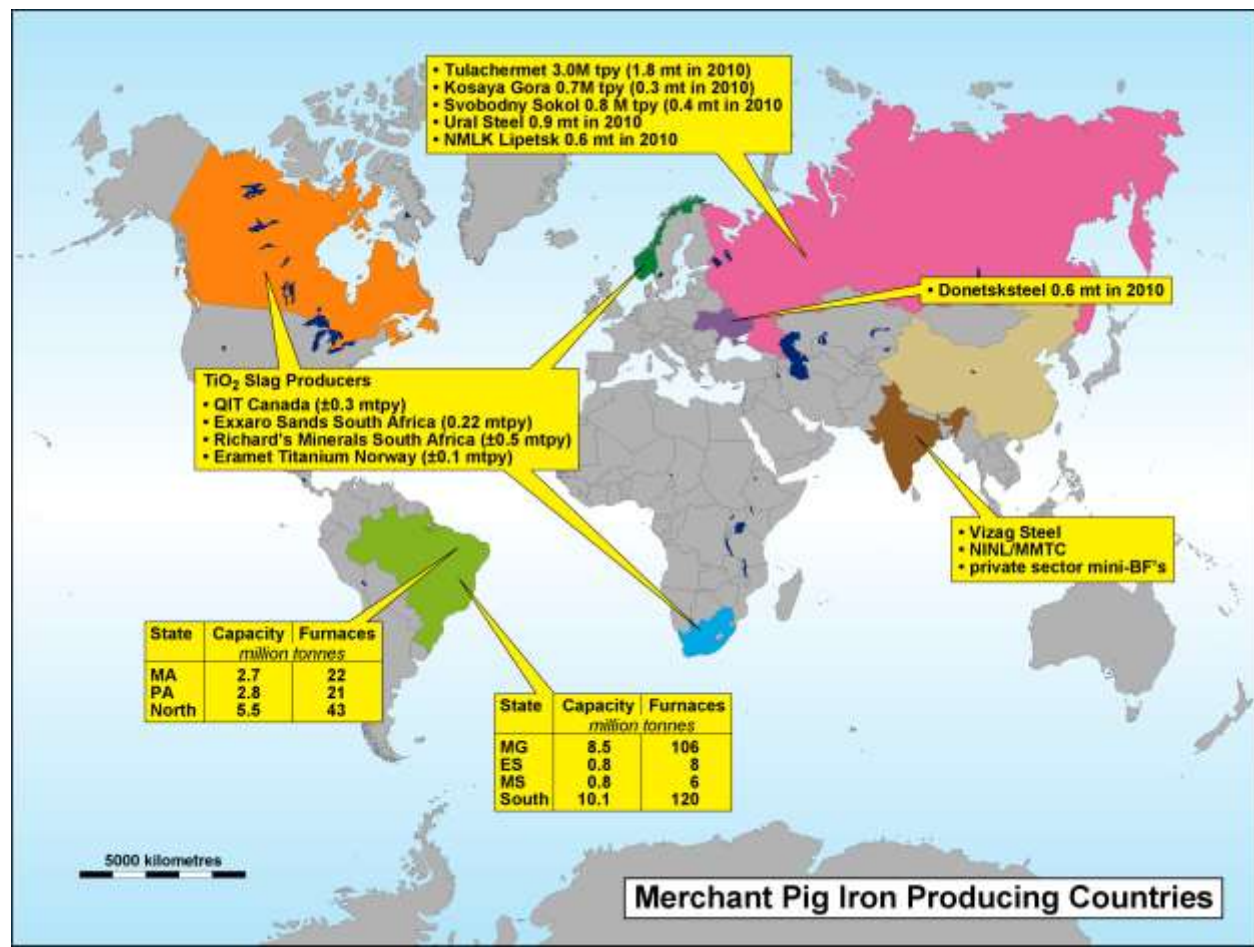


Figure 1.7-3.: MPI Production Capacity

Brazilian production relies to a large extent on the availability of low cost iron ore and the use of charcoal. A significant portion of the charcoal supply has traditionally been sourced from newly deforested areas being converted to agricultural land.

The Brazilian government has recently placed significant restrictions on charcoal production from native forests. This has had the result of significantly increasing Brazilian pig iron production costs as producers have been forced to convert to the use of higher priced coal.

According to CRU, road freight costs have increased greatly affecting the logistics of inland MPI producers.

Recent weakening of the Brazilian currency has worked to offset some of the challenges facing Brazilian producers.

Russian and Ukrainian pig iron production is based on relatively low priced coal and iron raw materials sourced from mines in the Urals and the Donetsk basin. Production costs are relatively low, offsetting the relatively higher freight costs from Black Sea ports to major markets in Europe and the United States.

Ukrainian and Russian MPI exports are set to decrease as the producers turn towards producing steel for local markets, thus utilizing the pig iron they produce internally.

Pig iron production from Canada, South Africa and Norway is based on ilmenite smelting to produce titanium slag. This type of pig iron has a ductile iron chemistry and is priced at a premium to standard pig iron. It is primarily used in high performance automotive and machinery castings.

Essentially all Canadian pig iron production is exported to the United States, as is a significant portion of South African production. Norwegian production is primarily sold to consumers in Europe.

1.7.3.2 MPI Global Demand

According to the International Iron & Metallics Association (“IIMA”), MPI consumption by the foundry industry will grow from 44 mtpa in 2014 to 55 mtpa in 2205. PURE FONTE LTÉE will be selling into a growing market. Of the foundry market consumption, 1.5 million tonnes is of nodular grade.

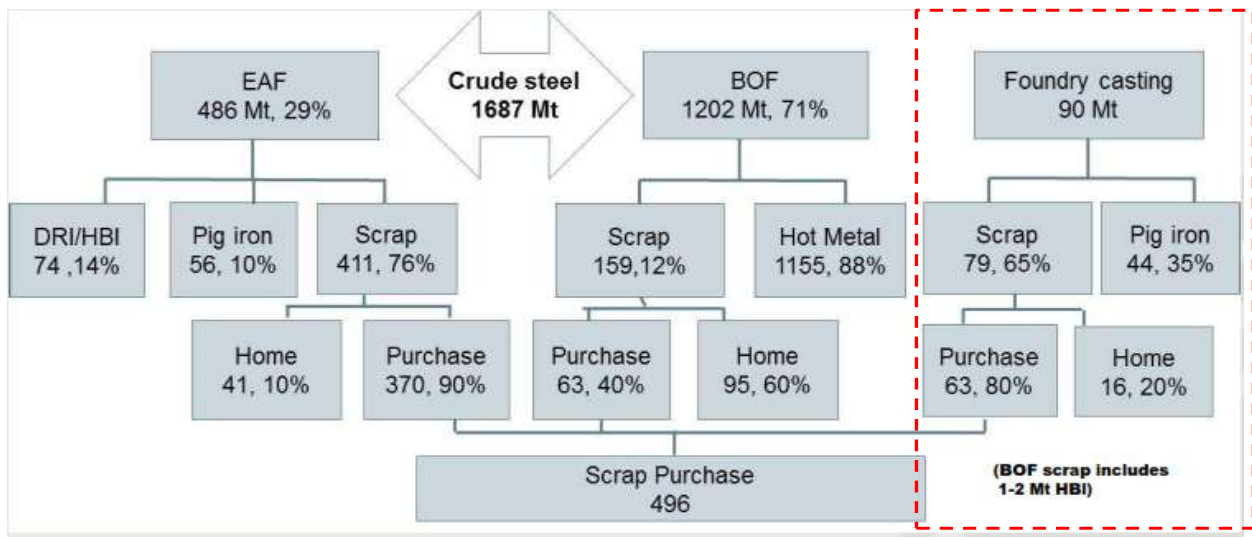


Figure 1.7-4.: Foundry market, Global MPI Market Opportunity – 2014 according to IIMA

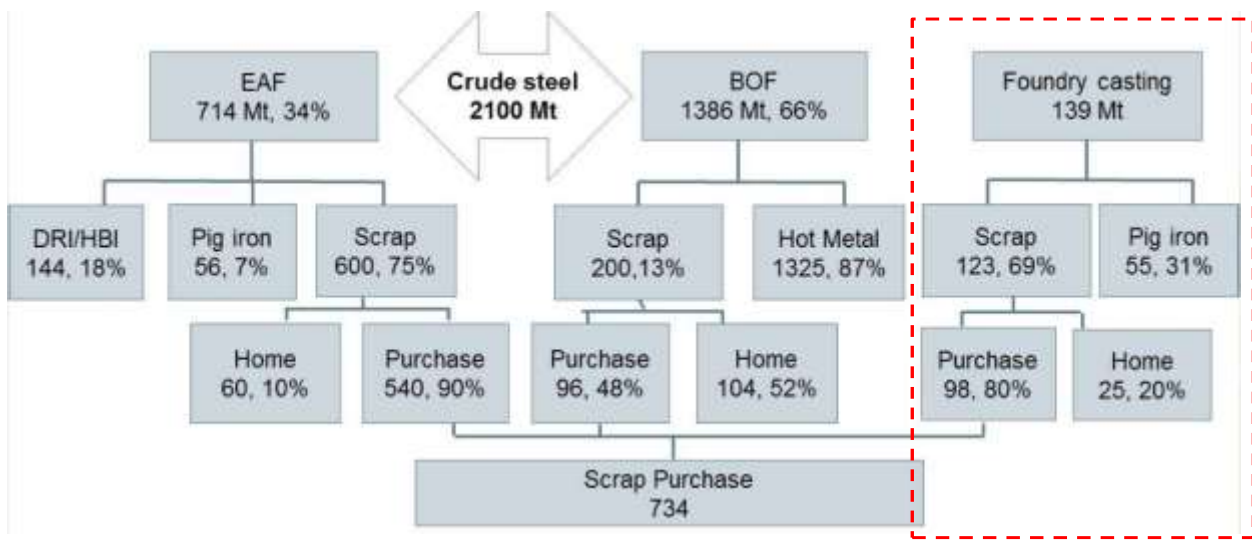


Figure 1.7-5.: Foundry market, Global MPI Market Opportunity – 2025 according to IIMA

Thanks to its chosen location in Port Saguenay, PURE FONTE LTÉE will have easy access to 4 of the top 10 iron foundry industries.

Country	Gray Iron	Ductile Iron	Total Iron
China	20,550,000	11,600,000	32,150,000
U.S.	4,083,000	4,251,500	8,334,500
India	6,700,000	1,000,000	7,700,000
Germany	2,381,462	1,541,737	3,923,199
Japan	2,135,794	1,683,250	3,819,044
Russia	1,811,765	988,235	2,800,000
Brazil	1,825,000	746,300	2,571,300
Korea	1,086,400	705,100	1,791,500
France	635,414	703,141	1,338,555
Italy	689,000	387,600	1,076,600
Total	41,897,835	23,606,863	65,504,698
Total ex- China	21,347,835	12,006,863	33,354,698

Table 1.7-3.: Top 10 Iron Casting Producing Countries (2013 t) according to IIMA



Figure 1.7-6.: Location of Top 20 US Foundry Customers for Nodular Pig Iron

In the United States, the foundry industry is nearly 500ktpa and the Top 20 Consumers are clustered in the Great Lakes region. These customers are ideally suited to be served from Port Saguenay.

Customer	City	State
CWC	Muskegon	MI
Dura-Bar	Woodstock	IL
Dexter Foundry	Fairfield	IA
Dotson Foundry	Mankato	MN
Elyia/Hodge Foundry	Elyria	OH
Elyia/Hodge Foundry	Greenville	PA
Grede Foundries	New Castle	IN
Grede Foundries	Reedsburg	WI
Grede Foundries	St Cloud	MN
John Deere	Moline	IL
Kent Foundry	Greenville	MI
Metal Technologies	Three Rivers	MI
Quality Castings	Orrville	OH
RH Sheppard	Hanover	PA
Aarrowcast	Shawano	WI
Anvil Int'l	Columbia	PA
Benton Foundry	Benton	PA
Urick Foundry	Erie	PA
Ward Mfg	Blossberg	PA
Whemco	Canton	OH
Whemco	Lima	OH
Decatur Foundry	Decatur	IL
Waupaca	Marinette	WI
Waupaca	Waupaca	WI
Neenah Castings	Neenah	WI

Table 1.7-4.: Top 20 US Foundry Customers for Nodular Pig Iron

The European foundry market for nodular pig iron is the same size as the U.S. It is also easily accessible across the Atlantic from Port Saguenay.

1.7.3.3 BPI prices

Generic BPI is correlated to the price of iron ore. Basic MPI is currently trading towards the bottom of current pricing cycles, similar to iron ore.

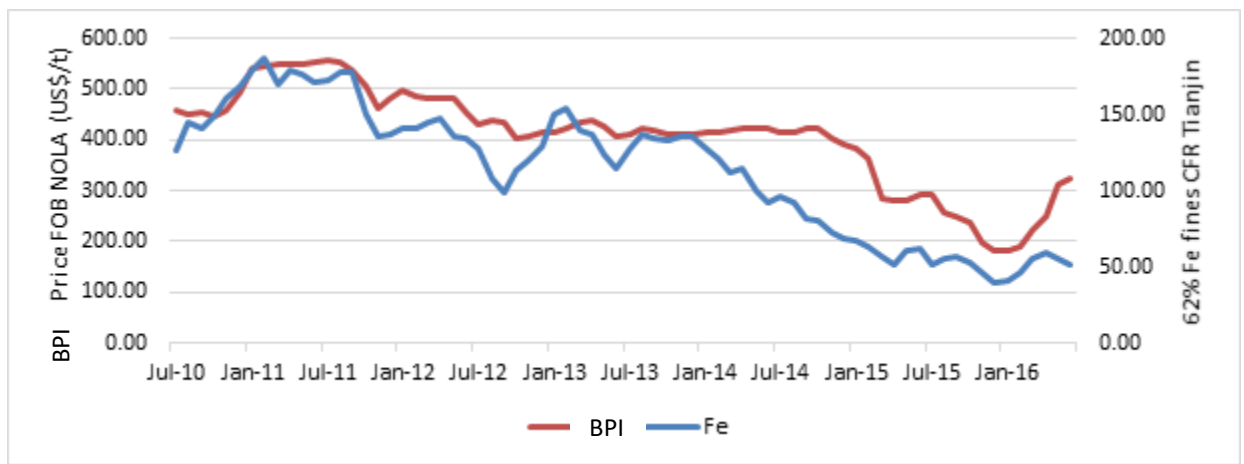


Figure 1.7-7.: BPI Prices (US\$/t), source CRU

NPI trades at a premium to BPI (the price shown in figure 1.7-7). This premium generally expands as the price of BPI falls due to a larger inelasticity of demand for the product. There is no replacement for NPI for foundry customers. Currently the premium is roughly US\$100/t.

PURE FONTE LTÉE determines the current price of NPI by directly speaking to buyers and traders as there is no published price like there is with BPI (published bi-weekly by CRU).

1.7.3.4 NPI price model

To calculate the estimated NPI sales price FOB Port Saguenay, PURE FONTE LTÉE first begins with the current pricing for Brazilian material. NPI is offered by Brazilian producers FOB ship. From there the various logistics and financing costs need to be added to arrive at the delivered cost warehouse in Chicago. Currently Brazilian NPI is being offered at US\$380/t, a full US\$30/t higher than PURE FONTE LTÉE is using in its model.

To calculate the FOB Saguenay price, PURE FONTE LTÉE uses current transportation assumptions to a Great Lakes port and uses an FOB cost such that the final delivered price is equivalent to the Brazilian one. The output from this model is in the table below.

Currently NPI is trading at a significant premium on a per ton basis to BPI.

BRAZILIAN BASE LINE PRICE		SAGUENAY PRICE	
General information		General information	
Date	18-Jul-16	Date	18-Jul-16
Supplier	Brazil-Rio	Supplier	NAIC
Customer	Chicago foundries	Customer	Chicago foundries
Product	Nodular Pig Iron	Product	Nodular Pig Iron
H.S. Code	7202.19.50	H.S. Code	7202.19.50
Production month	July	Production month	July
Shipment	August	Shipment	August
Quantity	10000	Quantity	10000
Port of Arrival	New Orleans	Port of Arrival	New Orleans
	Current		Current
Size	Pig Iron	Size	Pig Iron
Qty (mt)	10,000	Qty (mt)	10,000
Final destination	Chicago	Final destination	Chicago
Via	New Orleans	Via	New Orleans
Ex works price	\$ 350.00	Ex works price	\$ 395.00
costs to FOB Stowed	\$ -	costs to FOB Stowed	\$ -
FOB Stowed	\$ 350.00	FOB Stowed	\$ 395.00
L/C costs	\$ 0.88	L/C costs	\$ 0.99
Ocean freight to (CFR)	\$ 20.00	Ocean freight to (CFR)	\$ 8.00
Stevedore (discharge vessel)	\$ 3.00	Stevedore (discharge vessel)	\$ 3.00
CFR liner out value	\$ 373.88	CFR liner out value	\$ 406.99
Import Duty	\$ -	Import Duty	\$ -
Harbor Maintenance	\$ 0.44	Harbor Maintenance	\$ 0.49
Merchandise Processing	\$ 0.05	Merchandise Processing	\$ 0.05
Marine Insurance	\$ 0.41	Marine Insurance	\$ 0.45
Barge Freight	\$ 19.00	Barge Freight	\$ -
Stevedore	\$ 8.00	Stevedore	\$ -
Shrinkage	\$ 1.87	Shrinkage	\$ 2.03
Sundry Costs	\$ 2.00	Sundry Costs	\$ 2.00
Interest Loss:	\$ 8.04	Interest Loss:	\$ 2.04
Credit Ins:	\$ -	Credit Ins:	\$ -
Total Cost per MT	\$ 413.68	Total Cost per MT	\$ 414.05
Total Cost per GT	\$ 420.32	Total Cost per GT	\$ 420.70
Total Cost per CWT	\$ 18.76	Total Cost per CWT	\$ 18.78
Total Cost per NT	\$ 375.28	Total Cost per NT	\$ 375.63
Sales Price per MT	\$ 434.36	Sales Price per MT	\$ 434.75
Sales Price per GT	\$ 441.34	Sales Price per GT	\$ 441.74
Sales Price per CWT	\$ 19.70	Sales Price per CWT	\$ 19.72
Sales Price per NT	\$ 394.05	Sales Price per NT	\$ 394.41
Profit per MT	\$ 20.68	Profit per MT	\$ 20.70
Margin	5.00%	Margin	5.00%

Table 1.7-5: PURE FONTE LTÉE NPI price model

1.7.4 Financial Analysis

The financial model is based on the estimates from the recently completed financial model by PURE FONTE LTÉE. The estimated pig iron sales price is FOB port Saguenay and is based on the current sales price in a Chicago Warehouse minus the cost of delivery from Saguenay. The discount rate for the NPV calculation and the exit multiple for the IRR calculation is based on a comparable company analysis, details of which are in later parts of this section.

A detailed Financial model is presented in a dedicated section of the FS.

Summary Economics		
NPV @ 8% post-tax	US\$m	153.2
Unlevered		
IRR (assuming 6.0x EBITDA exit multiple in year 5)	%	13.6%
IRR no exit (based on 20 years of cash flows)	%	13.5%
Payback	yrs	6.4
Levered		
IRR (assuming 6.0x EBITDA exit multiple in year 5)	%	20.5%
IRR no exit (based on 20 years of cash flows)	%	17.5%
Payback	yrs	6.1
EBITDA - average p.a.	US\$m	62.3
Debt Capacity - 11 yr tenor	US\$m	253.4
FX rate	CAD:USD	0.77
Avg. Commodity Prices - FOB Plant		
NPI - FOB Port Saguenay	US\$/t	395.0
BPI - FOB Port Saguenay	US\$/t	335.0
Iron ore	US\$/t	76.5
Lime	US\$/t	120.0
Electricity	US\$/kwh	0.031
Natural gas	US\$/mm btu	3.5
Operating cost - 20 yr avg		
Plant production cost (ex SG&A)	US\$/t	237.0
Plant operating cost (inc. SG&A)	US\$/t	247.1
Plant operating cost (inc. SG&A, D&A & Int)	US\$/t	301.6
Capex		
Upfront	US\$m	364.4

Table 1.7-6.: Financial Analysis