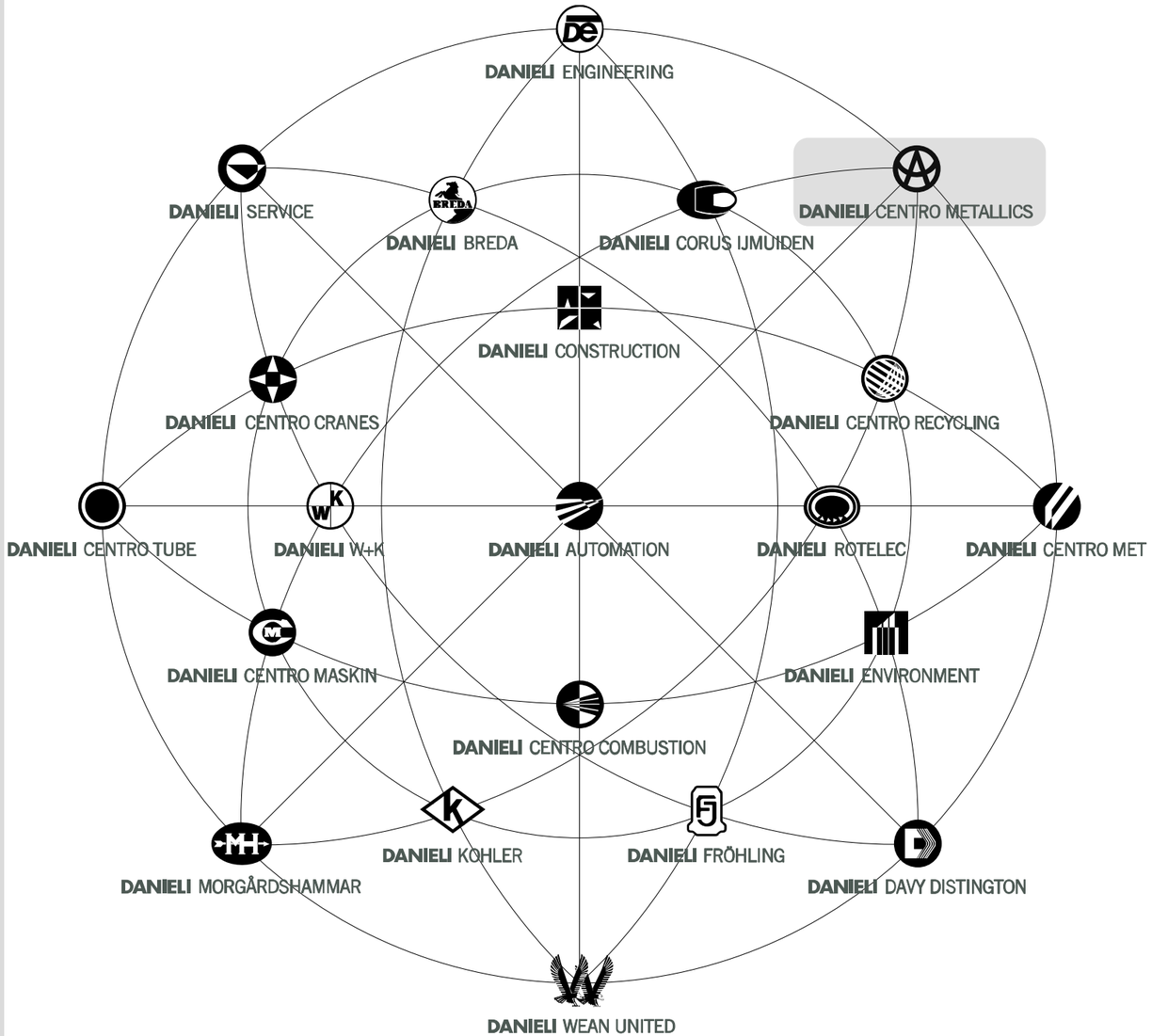
DANIELI CENTRO METALLICS

ENERGIRON HYL

ROCKEX MINING CORPORATION
CONCENTRATION, PELLETIZING & DR PLANT (HBI)



DANIELI CENTRO METALLICS

Ore Processing & Direct Reduction Plants

ENERGIRON HYL

THE INNOVATIVE DIRECT REDUCTION TECHNOLOGY

Is the innovative HYL Direct Reduction Technology developed jointly by Tenova and Danieli.

The most competitive and environmentally clean solution for lowering the liquid steel production cost

Rockex Mining Project Conceptual Site

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The ROM (Run Of Mine ore) mined from Rockex properties will be processed in three steps:

1. **BENEFICIATION PLANT** in Lake St. Joseph
   - *for metallurgical upgrading of the ROM*
   - *product is iron ore concentrate*

2. **PELLETIZING PLANT** in Sioux Lookout
   - *for physical upgrading*
   - *product is iron ore pellet*

3. **DIRECT REDUCTION PLANTS** in Sioux Lookout
   - *for iron ore reduction to metallic Fe*
   - *product is HBI (Hot Briquetted Iron)*

Pelletizing and Direct Reduction Plants will be located in Sioux Lookout to take advantage of the geographically nearer point to the railway.

Concentrate will be transported from Lake St. Joseph to Sioux Lookout by means of a SLURRY PIPELINE.

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HBI (Hot Briquetted Iron)

- ✓ HBI is a form of Direct Reduced Iron (DRI) where iron oxide pellets and/or iron lump ores are reduced (oxygen is removed) in solid state by a reducing gas agent
- ✓ HBI is defined as a compacted form of DRI compressed at or above 650° C with a density greater than 5.0 g/cm^3
- ✓ Hot briquetting of DRI closes internal pores, lowers the accessible surface, increases the apparent density, and improves thermal conductivity, all of which reduce the DRI reactivity.
- ✓ Thanks to these characteristics, HBI is a stable product for long term storage and ocean shipping, therefore it's the preferred DRI form for merchant market applications.

HBI	%
METALLIZATION	94
CARBON	1,5

HBI	g/cm^3
BULK DENSITY	2,5 - 2,8
APPARENT DENSITY	4,8 – 5,3

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HBI IS USED AS A SOURCE OF VIRGIN IRON UNITS TO PRODUCE HIGH QUALITY STEEL

DRI IS USED IN ELECTRIC ARC FURNACES TO COMPLETELY OR PARTIALLY REPLACE SCRAP & PIG IRON

- ✓ Higher Volumetric Weight
- ✓ Uniformity of Chemical Analysis
- ✓ Freedom from Undesirable Elements

HBI CAN BE USED ALSO IN BLAST FURNACES AS PARTIAL FEEDING MATERIAL

- ✓ Lower BF CO_2 emissions
- ✓ Greater BF capacity
- ✓ Lower coke consumption

The Lake St. Joseph Mine Iron Ore

Simple Block Flow Diagram & Plants Capacity

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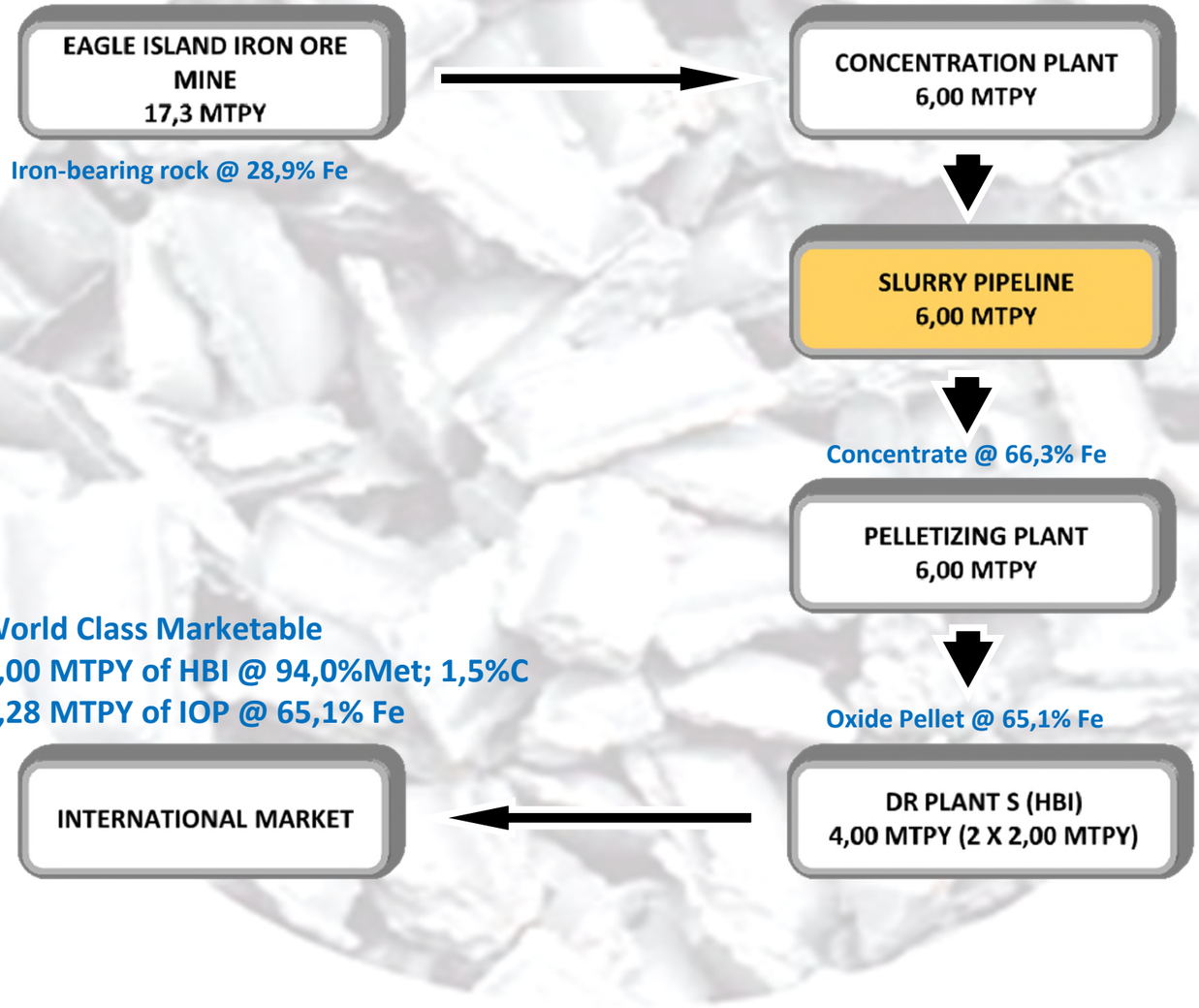
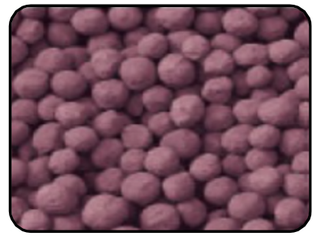
Operating Life: 30 years @ 52,752 t/d





Capacities are expressed in metric units

Basis of Design – ROCKEX Plant Capacity

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Plant Owner	**Rockex Mining Corporation**			
Country	Canada			
Location	Lake St. Joseph			
Operating Mode	Continuous			
Process	**Unit**	**Concentration**	**Pelletizing**	**Direct Reduction**
Technology		Grinding, Gravity and Magnetic Separation	Straight Grate	ENERGIRON ZR
Operating Mode		Continuous	Continuous	Continuous
Lines		1	1	2
Type of Product		**Concentrate**	**DR Grade Pellets**	**Hot Briquette Iron (HBI)**
Crude Ore Demand	Mt/a	17.3		
Nominal Production	**Mt/a**	**6.00**	**6.00**	**4,00**
Operating Time	h	7,884	7,884	7,800
Availability	%	90.0	90.0	89.0
Production Rate	t/h	761	761	512,8
Production Rate	t/d	18,264	18,264	12,308

Source: Danieli Heat &Mass Balances Simulations

Conceptual PFD – Concentration Process at Mine site

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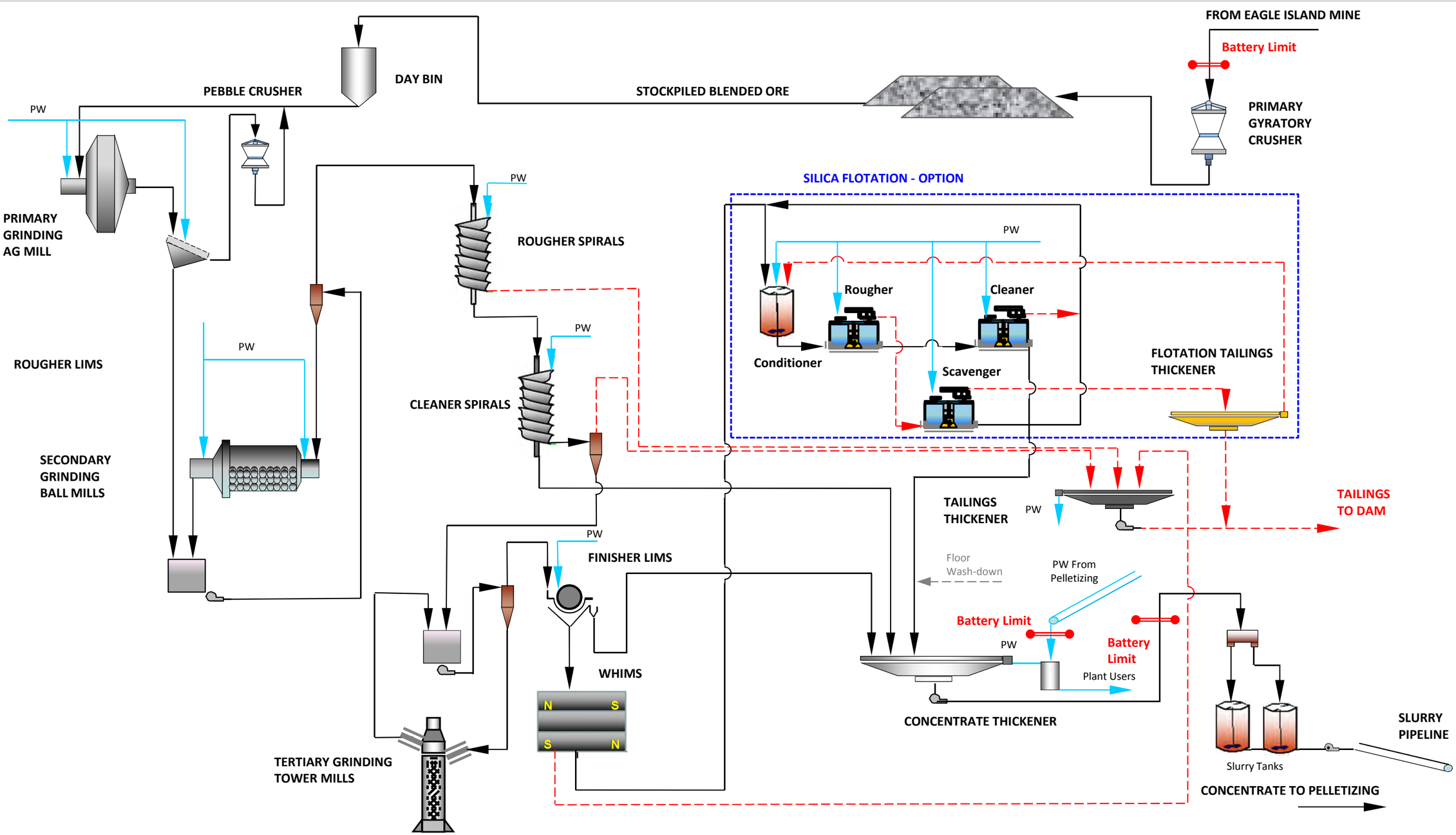

Source: Danieli Iron Ore Processing Group

Conceptual PFD – Pelletizing Process at Sioux Lookout

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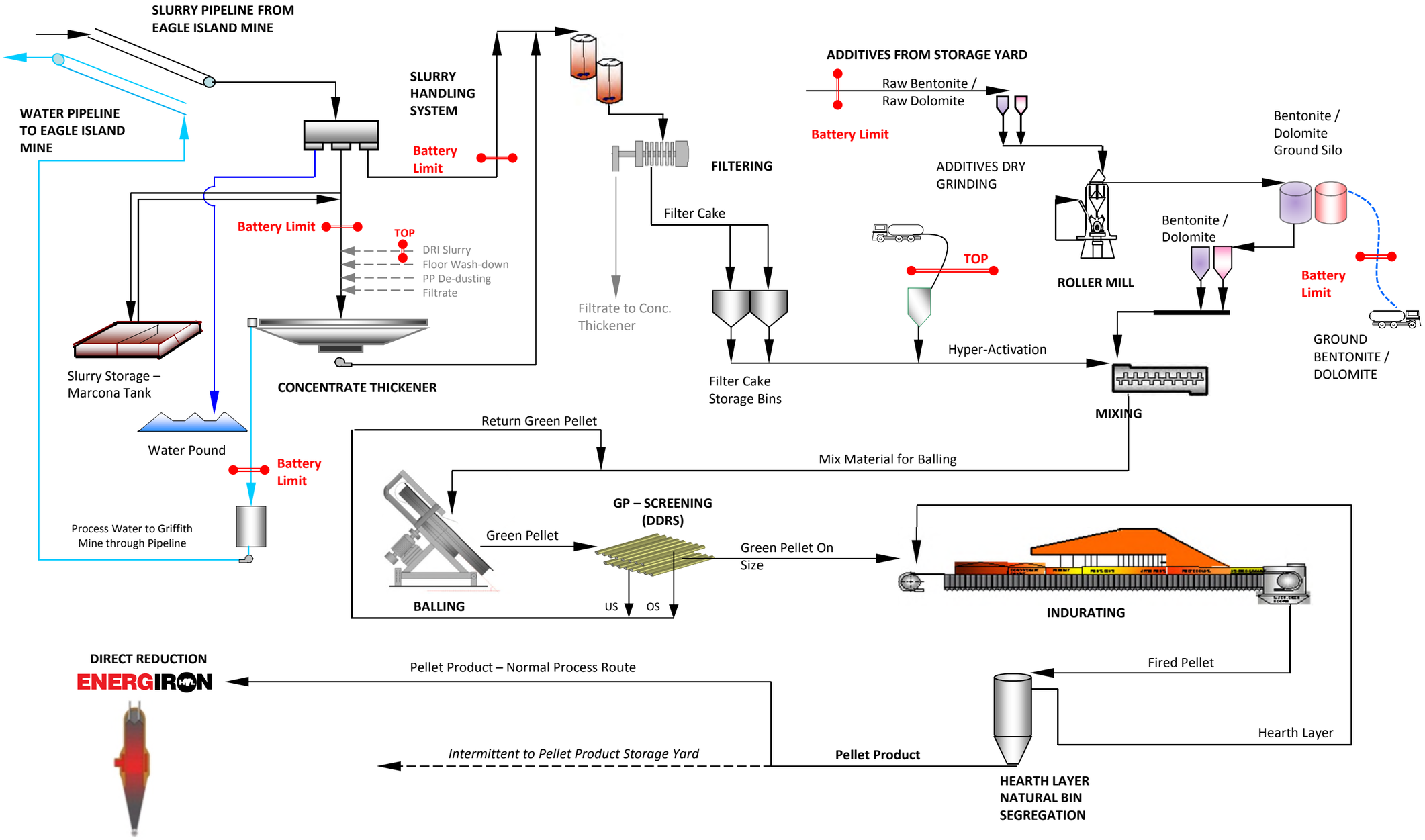

Source: Danieli Iron Ore Processing Group

Conceptual PFD – Direct Reduction HBI Process at Sioux Lookout

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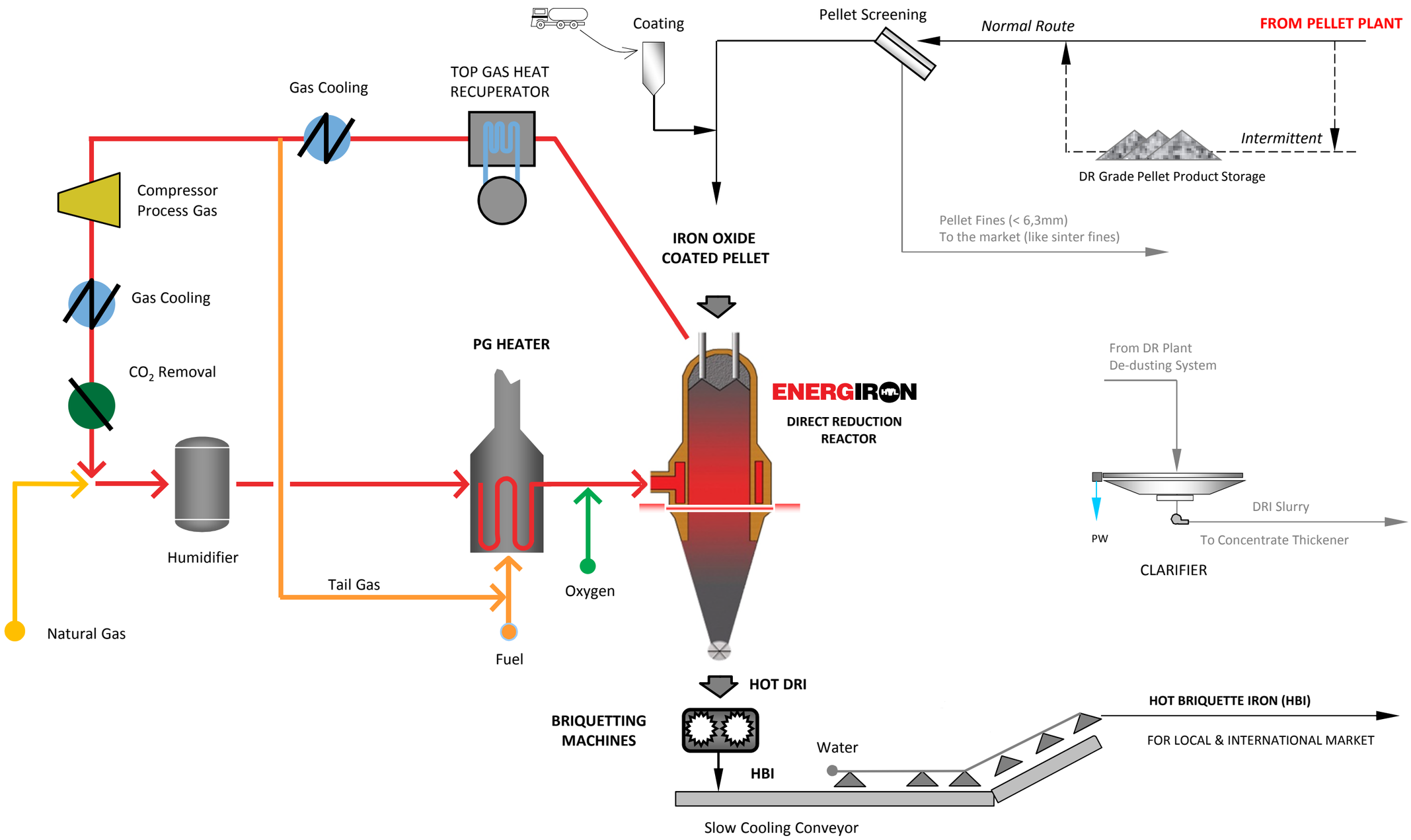


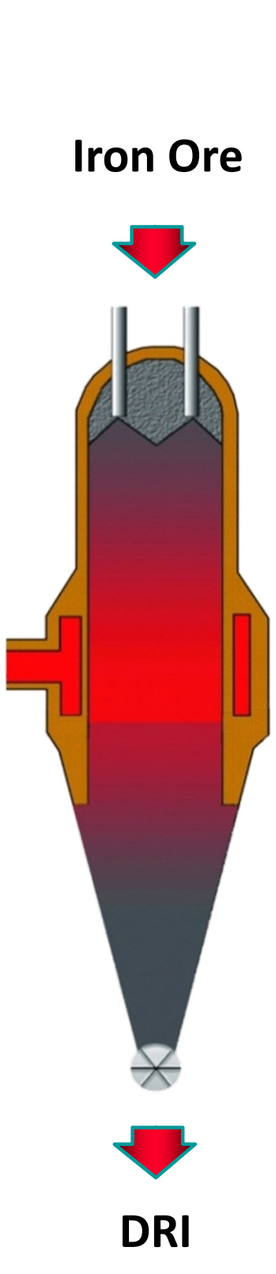
Source: Danieli Direct Reduction Group

IN-SITU Reforming:

- *Conditions for Hydrocarbons reforming:*
  - ✓ presence of Oxidants and hydrocarbons ($H_2O+CO_2+C_nH_{2n+2}$)
  - ✓ high temperature
  - ✓ presence of catalyst

Iron Oxides Reduction:

- *The conditions for the reduction of iron oxides are:*
  - ✓ presence of reductants $(H_2+CO)/(H_2O+CO_2)>>1$
  - ✓ high temperature
  - ✓ presence of iron oxides



In-situ Reforming

$CH_4 + H_2O \longrightarrow CO + 3H_2$

$CH_4 + CO_2 \longrightarrow 2CO + 2H_2$

Reduction

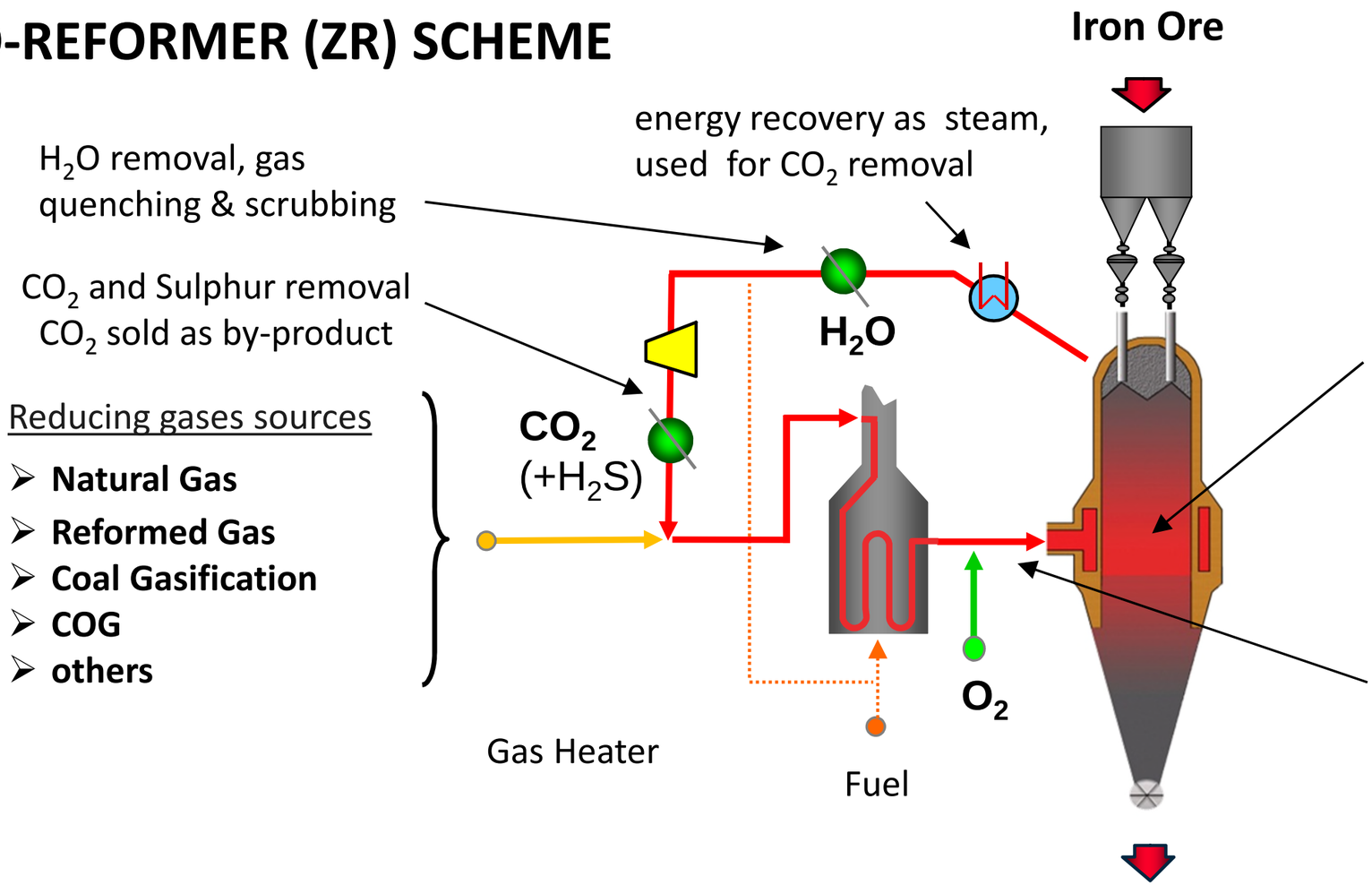
$Fe_2O_3 + 3CO \longrightarrow 2Fe° + 3CO_2$

$Fe_2O_3 + 3H_2 \longrightarrow 2Fe° + 3H_2O$

Carburization

$3Fe° + CH_4 \longrightarrow Fe_3C + 2H_2$

THE INNOVATIVE ZERO-REFORMER (ZR) SCHEME



Reducing gases sources

- **Natural Gas**
- **Reformed Gas**
- **Coal Gasification**
- **COG**
- **others**

Simultaneous:

- ***in-situ*** **CH_4 reforming**
- **Reduction of iron ore**
- **Carburisation**

- **High Temp: >1050°C**
- **High Pressure: 6-8 bar**

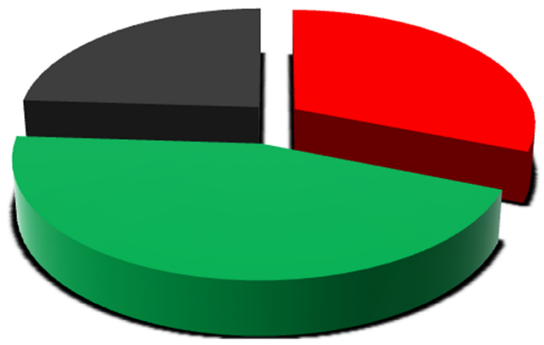
DRI with Metallisation ≥94% and 1.5%-4% Carbon, mostly as Fe_3C (>90%)

- **High-Carbon DRI**
- **Hot DRI**
- **HBI**

Direct Reduction Process – Environmental Impact

GREEN TECHNOLOGY (Low CO_2 and NO_x emissions)

- CO_2 and NO_X emissions are in compliance with the most strictly environmental regulation worldwide
- Approx. the 60% of total C input can be **SELECTIVELY** removed as pure CO_2:
  - ✓ Reduction in CO_2 emissions
  - ✓ Possibility to sell as by-product the removed CO_2



	Carbon Balance %	Carbon Balance kg/t $_{DRI}$	Kg CO_2/t DRI
Carbon in Non Selective Emission	31%	44,4	163
Carbon in Selective Emission	45%	64,2	240
Carbon in Product (C=3.5%)	24%	35,2	-

Facilities Emission Levels

Particulate & Gaseous Emissions

Compound	
Dust	
SOx	In compliance with environmental regulations worldwide
NOx	

Noise Emissions	dBA	< 85

Solid Effluents

The plant produces no solid effluents.

Floor Wash-down

Concrete floors around the process equipment will be designed to be cleaned by high-pressure process water.
The slurry will be collected in sumps and returned to the process through the Concentrate Thickener

Liquid Effluents

Industrial Waste water:	Max 43 t/h blow-down will be generated from DRP WTP
Tailings:	From concentration plant 1050 m3/h will be disposed at the tailings pound
Cooling Water:	Cooling water blow-down is absorbed into the process water system
Steam Condensate:	Steam condensate, if any, is absorbed into the process water system
Sanitary Waste:	Approximately 50m^3/day

NOTE: Definition of the applicable document for Industrial Emissions
Assumed: Ontario Ministry of the Environment
Ontario Regulation 194/05: Industry Emissions -- Nitrogen Oxides and Sulphur Dioxide
Intensity Rate for Iron and Steel

Raw Materials, Intermediate Products and HBI Qualities

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The final HBI quality predicted for ROCKEX is a marketable product

RAW MATERIALS /PRODUCT	UNIT	ROCKEX MINE		BINDER	FIRED PELLET	DRI/HBI
Chemical		Crude Ore	Concentrate	Bentonite	Iron Oxide Pellet	Hot Briquette Iron
Fe tot	**%**	**29**	**66,3**	**1,97**	**65,1**	**87,62**
FeO	%		16		0,5	6,76
Fe2O3	%		-	2,86	91,42	
SiO2	%		5,23	65	5,48	7,37
Al2O3	%		0,2	18	0,29	0,39
CaO	%		0,1	1	0,56	0,75
MgO	%		0,1	2	0,36	0,48
S	%		0,05	0	0,002	0,0027
P	%		0,02	0	0,02	0,027
K2O	%		0,02		0,02	0,027
Na2O	%		0,02		0,02	0,027
MnO	%		0,08		0,08	0,11
TiO2	%		0,15		0,15	0,18
B2	CaO/SiO2				0,1	0,1
Gangue	%		5,97	-	6,97	9,37
LOI	%		1,06	11	0	
Plate Water Absorption	%			500 to 600		
Size	%		85% < 44 µ	75% < 74µ	-16+8mm 93%	110x50x30 mm
Tumbler	%				93	
CCS	Kg/P				250	
Carbon	**%**					**1,5**
Metallization	**%**					**94**

Metallurgical Experimentation must be implemented to confirm the final process configuration and quality of the concentrate – pellet product and finally the HBI

Source: Danieli Heat &Mass Balances Simulations

Conclusions

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SUSTAINABILITY

Environmental impact for steel production DRP-EAF is lower than traditional BF route

- ✓ ENERGIRON is the DR technology with lowest CO_2 and NO_x emissions

STEEL QUALITY

Steel market trends towards higher quality steel grades

- ✓ Use of HBI provides higher final product quality and protects steel producers from volatility of scrap price

AVAILABILITY

Despite the market request, there's a lack of HBI merchant suppliers, especially in North America

- ✓ The past-leading Venezuela's HBI industry is progressively collapsing
- ✓ voestAlpine plans to start production in Texas in 2016, anyhow most of the HBI production won't be for merchant market
- ✓ Nucor operates in LA the largest DRP in the world, ENERGIRON ZR technology, anyhow the production of 2.5Mtpy of High-C CDRI is entirely shipped to the Nucor's EAF mills in NA

THE ROCKEX HBI PROJECT IS A MARKET OPPORTUNITY TO FILL THE LACK OF DRI OFFER.

POLITICAL STABILITY, COMMIDITIES AVAILABILITY AND GOOD LOGISTICS MAKE CANADA A PERFECT LOCATION TO SERVE NORTH AMERICA AND POTENTIALLY THE ENTIRE GLOBAL MARKET.

THANKS TO THE INNOVATIVE DANIELI TECHNOLOGY, ROCKEX WILL BE ABLE TO SATISFY THE STEEL MARKET'S REQUESTS PROVIDING MERCHANT HBI IN A SUSTAINABLE AND ECONOMICAL WAY.