

The Traded Market for Ultrafine Iron Ore

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David Tucker, Managing Consultant, London

Hatch Beddows

Contents

- **Hatch**
- Supply
- Demand
- Issues
- Summary

Our organisation

- Hatch supplies business, process and technology consulting, design and engineering and construction, operations and project management to the mining and metals, energy and infrastructure industries worldwide
- Established 1955 and employee owned
- 8,000 highly skilled people serving clients worldwide
- US\$40BN of projects now under management in 80 countries

Our values

- Safety
- Quality
- Innovation
- Sustainable development
- Effective risk management

We deliver unprecedented and sustained results for our clients

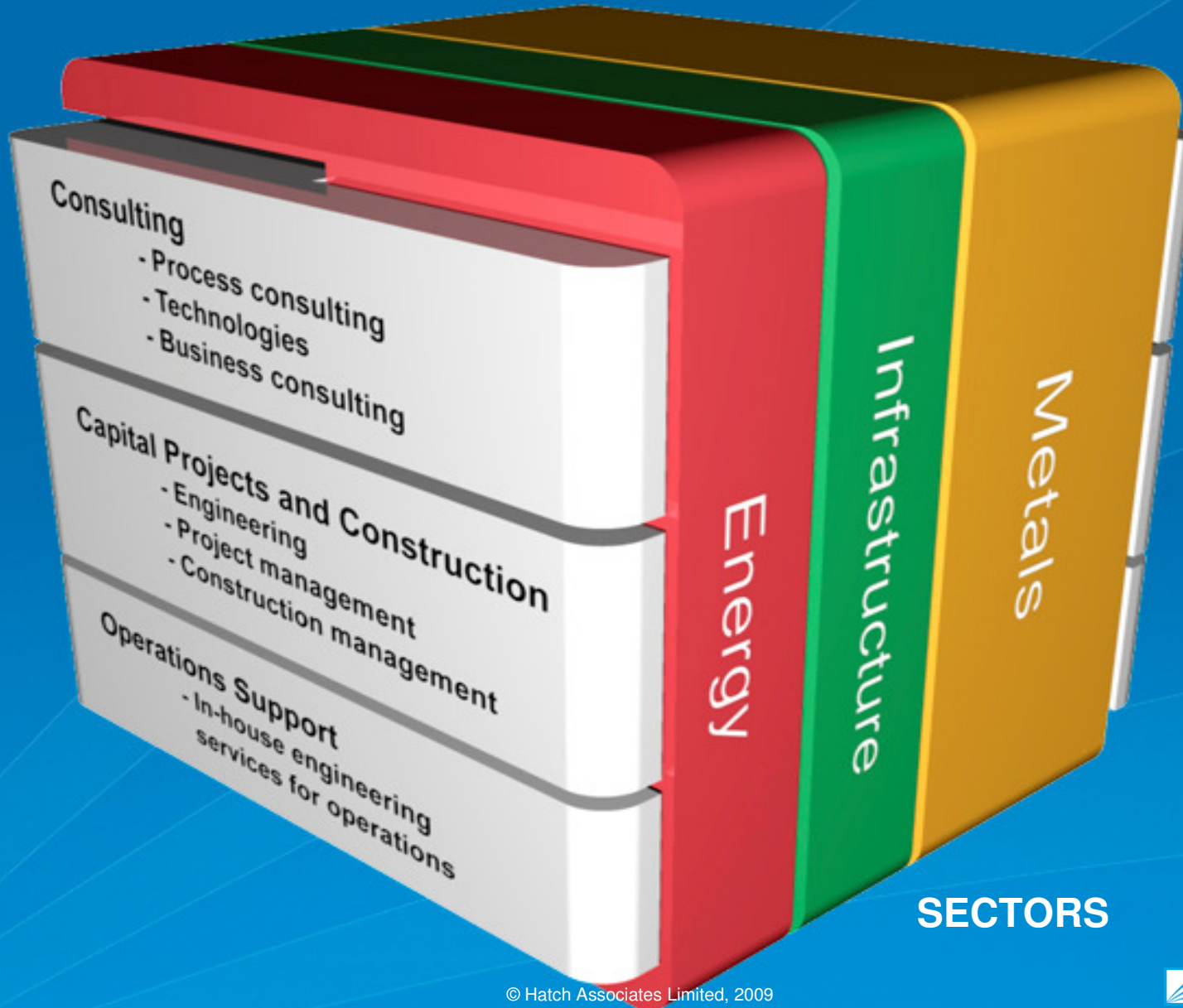
Global reach and resources



(Yellow indicates regional hub)

HATCH
Hatch services and sectors

S
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S



SECTORS

Hatch Beddows' strategy consulting experience spans the whole of the value chain from raw materials to finished steel to processed products for a comprehensive perspective

- **Raw materials and consumables**
 - Iron ore, pellet and sinter
 - Coking coal and coke
 - Metallics: scrap, pig iron, DRI / HBI
 - Ferroalloys: Cr, Mn, Ni, Si
 - Refractories
- **Semi-finished steel**
 - Slab
 - Billet and bloom
- **Long products**
 - Rebar
 - Merchant bars
 - Structural sections
 - Wire rod and wire products
 - Engineering bars
 - Rails
 - Grinding balls
- **Reversing mill / Steckel mill plate**
- **Strip mill products**
 - HR sheet / plate
 - CR sheet
 - Electrical steels
 - Galvanised sheet
 - Organic coated sheet
 - Tin mill products
 - Tailor-welded blanks
- **Pipe and tube**
 - OCTG and line pipe
 - Seamless and welded tubes
 - Hollow sections
- **Stainless steel**
- **Speciality steels and special metals**

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Iron ore products are distinguished by physical size, chemistry and metallurgical properties



Nominal sizing of iron ore products

Pellets: 8 – 20mm diameter

Direct Charge

Lump: 6.3 – 30mm

Sinter Fines
Pellet Feed

Fines: 0 – 6.3mm

Concentrate: <0.15mm

Pellet Feed: <0.05mm, Blaine >1,200cm²/g

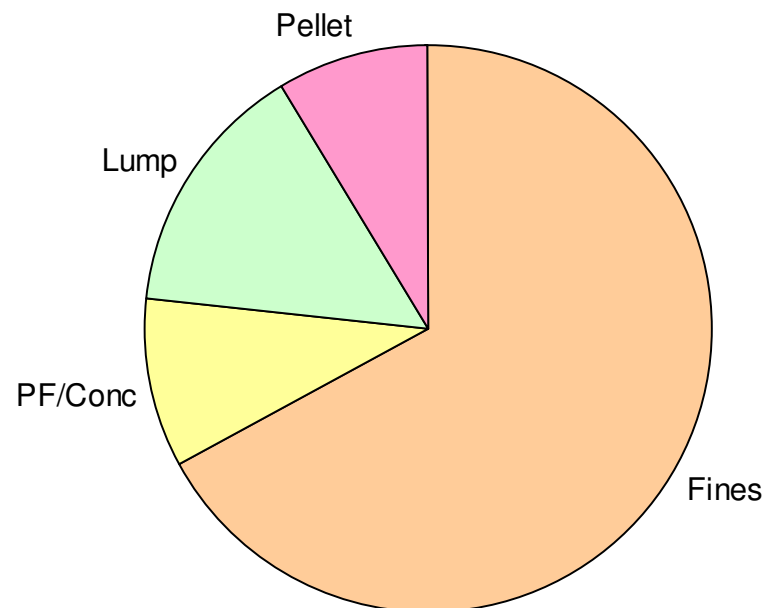
THE TRADED MARKET FOR ULTRAFINE IRON ORE - SUPPLY

Ultrafine material (pellet feed / concentrate) already accounted for 10% of seaborne trade in 2009

Seaborne traded iron ore, by Country / Company, (Mt)

Country	Company	2009
Australia	Rio Tinto	204
	BHP-B	122
	FMG	26
	Others	20
	Total	372
Brazil	Vale	222
	Samarco	17
	Anglo	2
	Others	25
	Total	266
India	various	115
Peru	Hierro Peru	7
Canada	IOC	13
	QCM	9
	Total	22
Chile	CMO	7
S. Africa	Kumba	34
	Assmang	9
	Total	43
Mauritania	SNIM	12
Sweden	LKAB	17
Venezuela	CVG	8
Others		26
Total		895

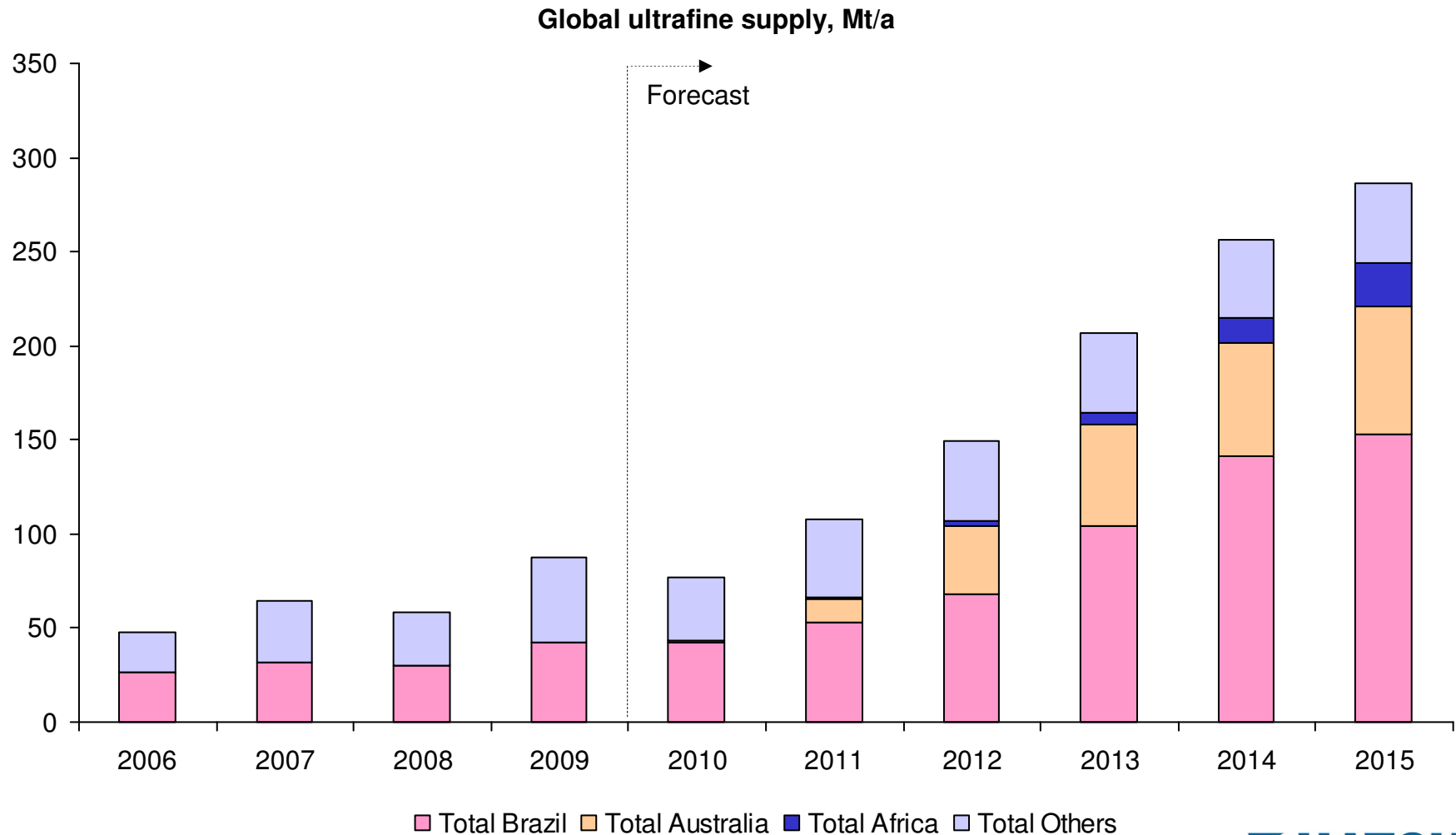
Seaborne iron ore trade by product 2009 total 895Mt



Source: Sinferbase, Tex Report, Company Reports and Hatch Beddows

THE TRADED MARKET FOR ULTRAFINE IRON ORE - SUPPLY

The growth in ultrafine supply is forecast principally from new projects in Brazil, Australia and to a lesser extent West Africa

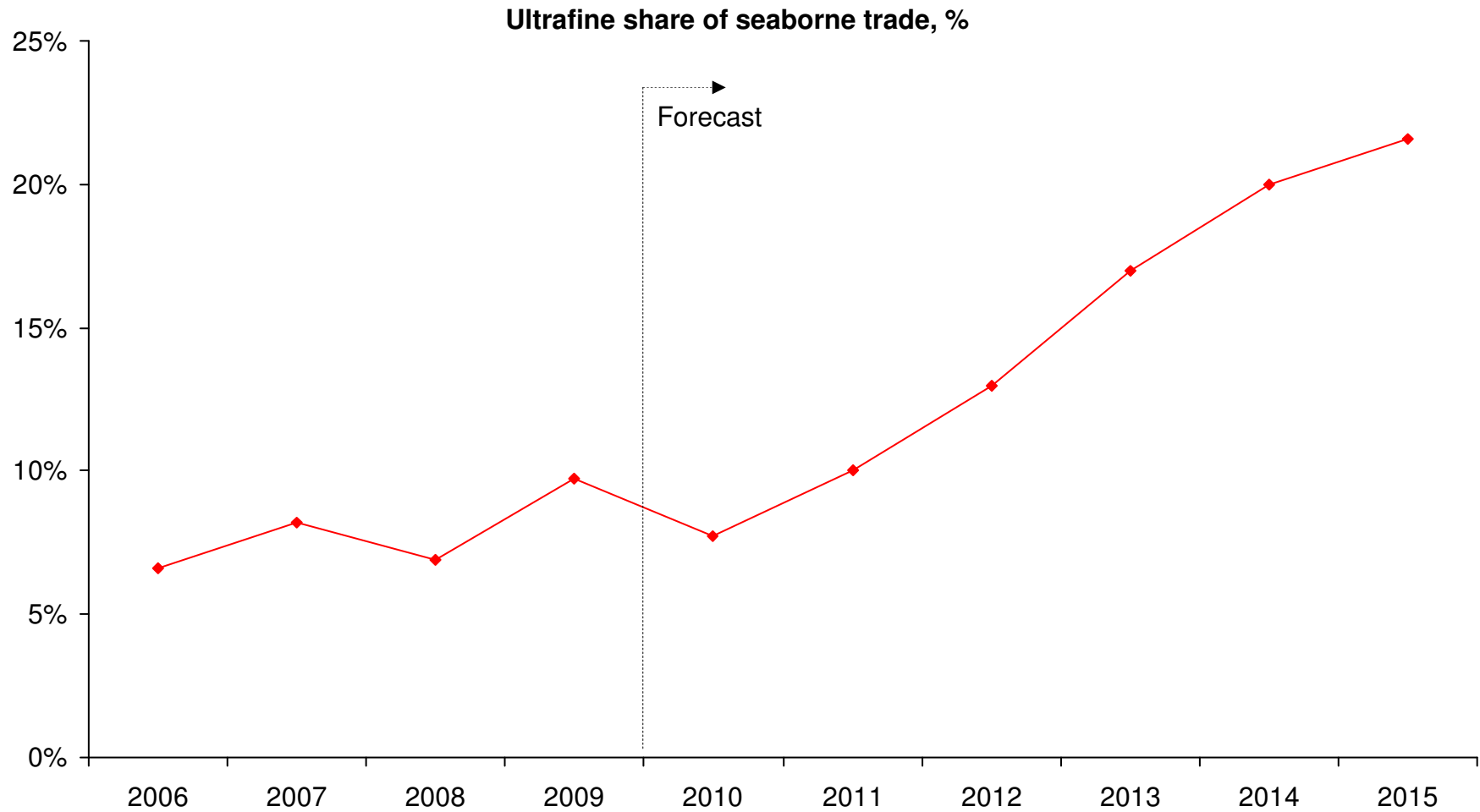


Source: Company Reports & Hatch Beddows

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THE TRADED MARKET FOR ULTRAFINE IRON ORE - SUPPLY

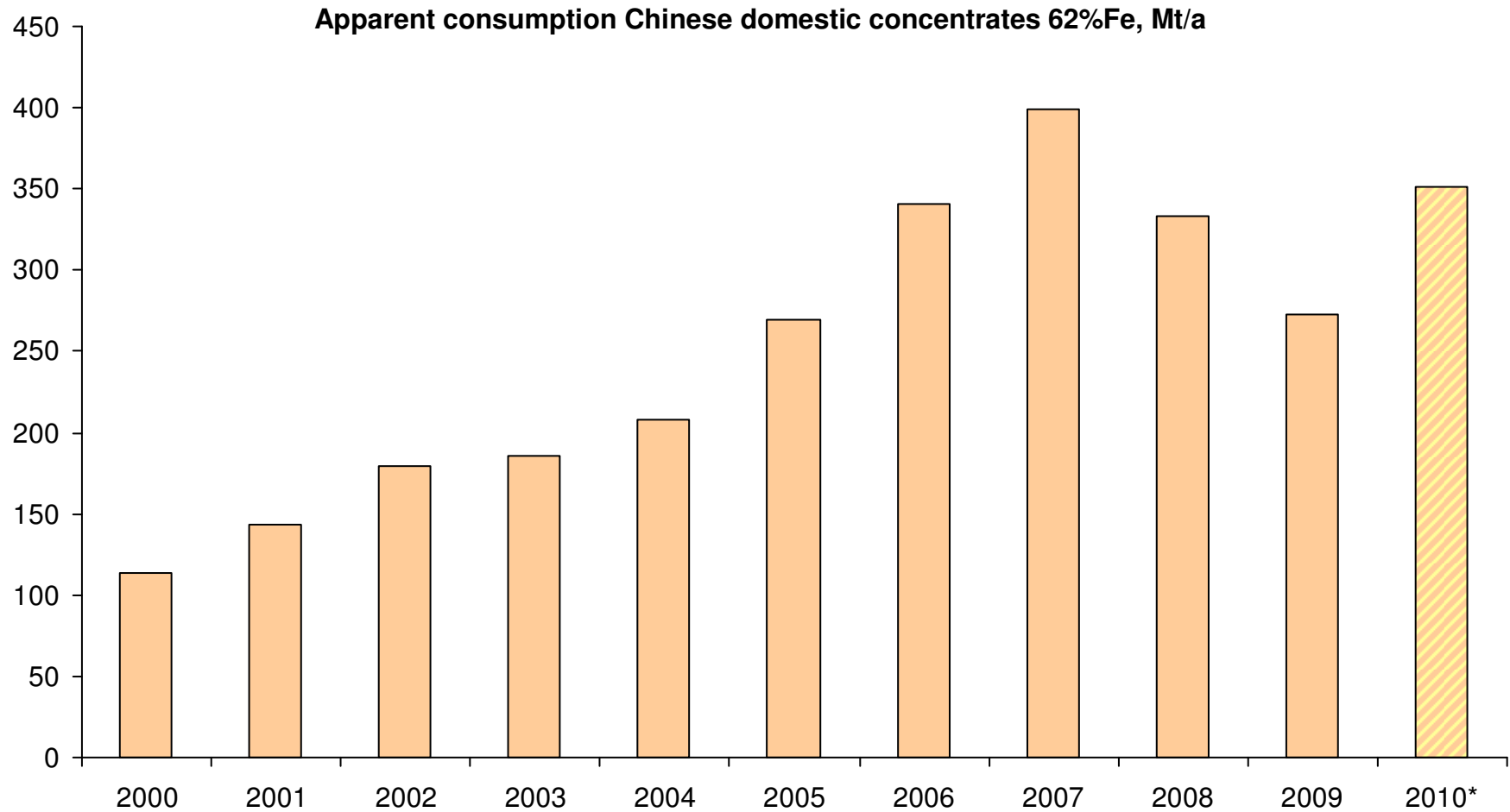
Assuming direct charge material maintain share, then 1 in every 3 tonnes of seaborne trade will be ultrafine by 2015



Source: Compared with Hatch Beddows high-side demand model

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The apparent consumption of Chinese domestic concentrate peaked in 2007 but appears to be recovering strongly year to date 2010



Source: UNCTAD, Tex Report & Hatch Beddows
2010* year to date August annualised

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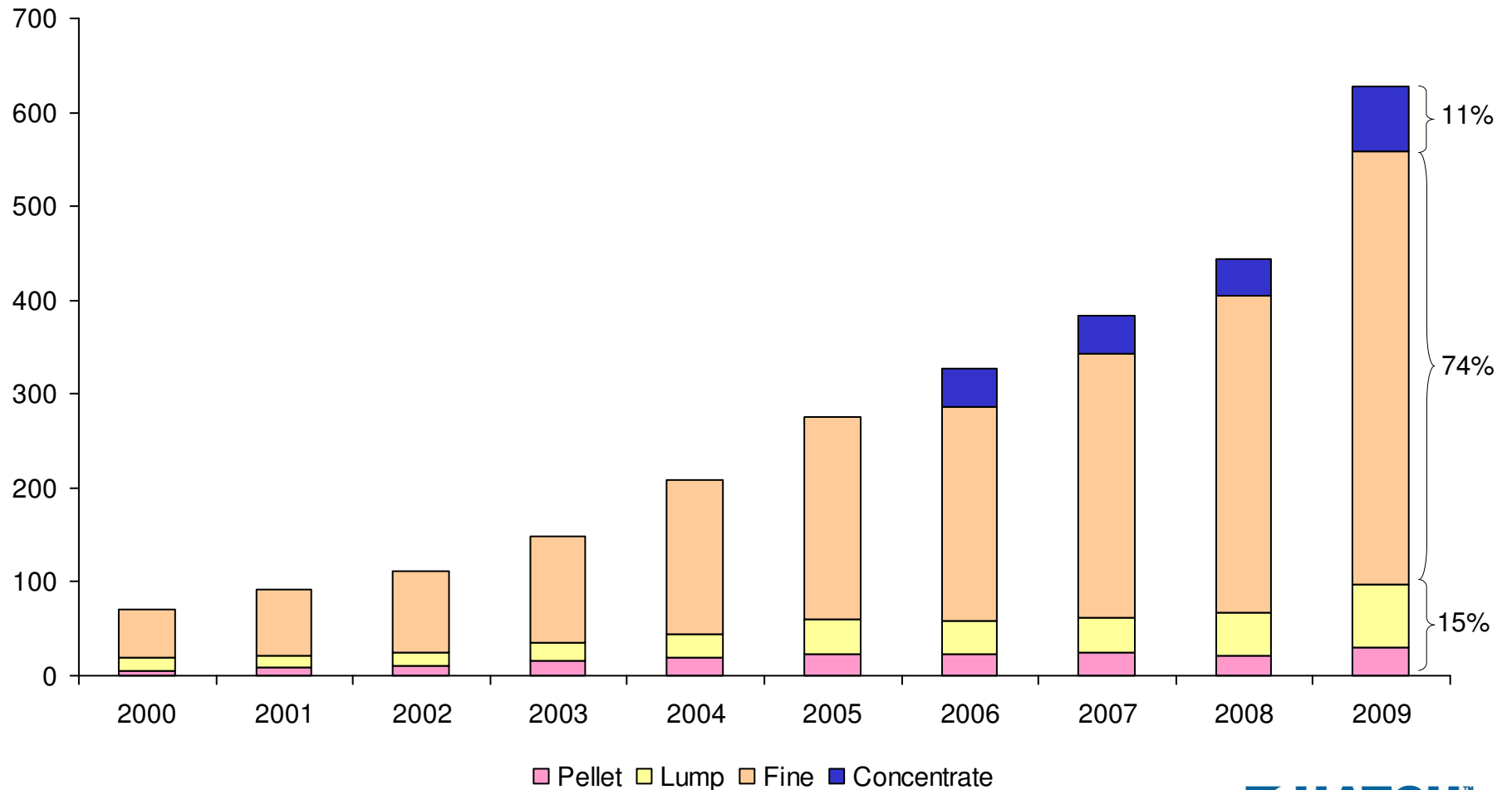
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THE TRADED MARKET FOR ULTRAFINE IRON ORE - DEMAND

Concentrate, material less than 0.8mm, imports to China doubled in 2009

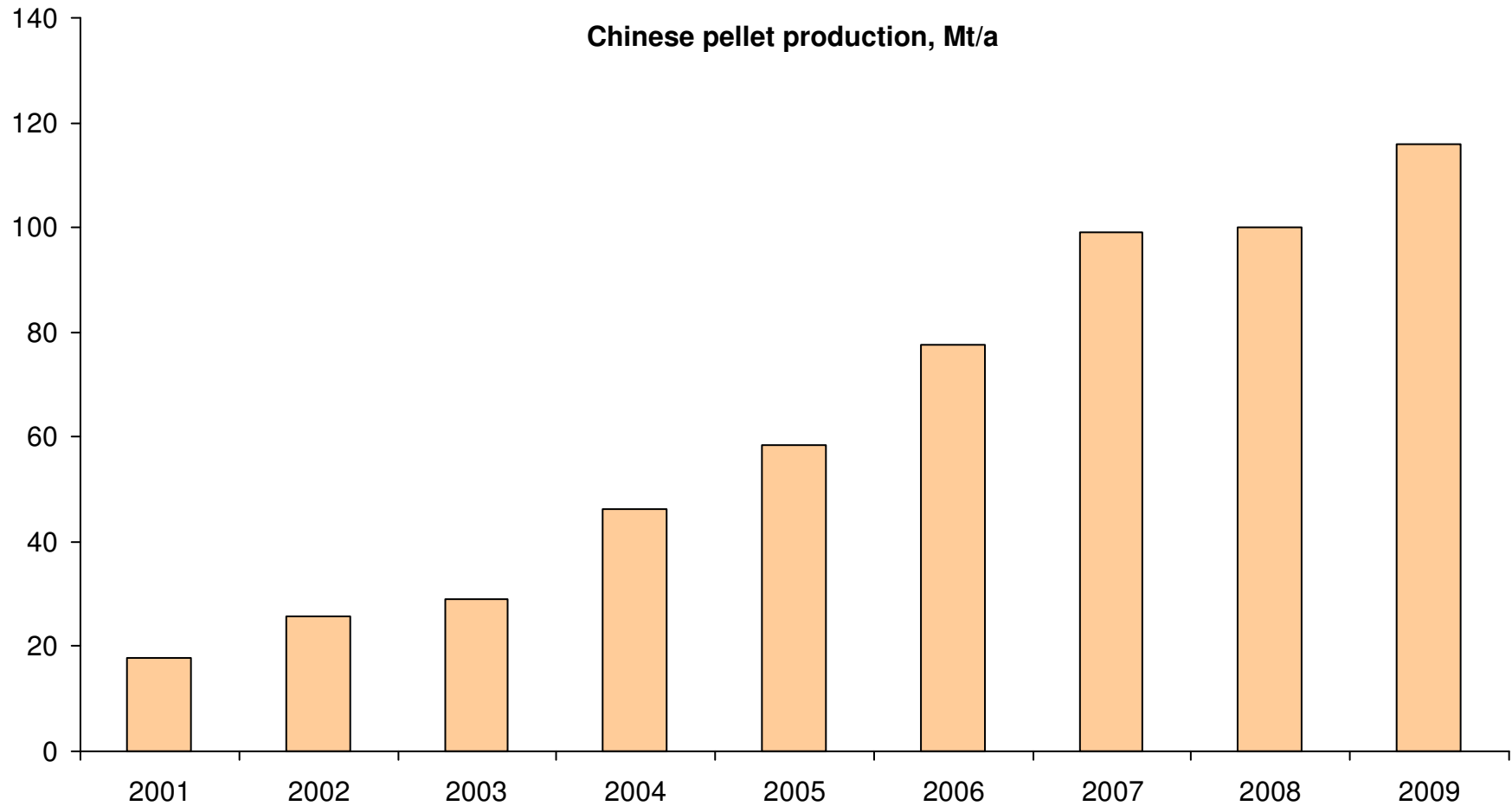
Chinese iron ore imports by type, Mt/a



Source: Company Reports & Hatch Beddows

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The rate of growth of Chinese pellet capacity has slowed during the Global Financial Crisis



Chinese capital investment has a short lead time with an additional 19Mt of new capacity forecast in the next 2 years

Chinese pellet plant planned expansion, Mt/a

Location	Company	Capacity	Status
Hebei	Shougang	4.0Mt/a	Op. June 2010
Tianjin	Rongcheng Steel	1.5Mt/a	Op. May 2010
Hebei	Hebei Qianjin	0.8Mt/a	Op. July 2010
Hebei	Qinhuangdao Tanggang	2.0Mt/a	Op. July 2010
Miyi	Gangcheng Grp	1.4Mt/a	Op. end 2010
Heilongjiang	Xilin Steel	0.8Mt/a	Op. end 2010
Tianjin	Tianjin I&S	2.0Mt/a	Op. Sep 2011
Inner Mongolia	Baotou Steel	1.2Mt/a	Op. Sep 2011
Xinjiang	Shandong-Kashi JV	0.6Mt/a	Op. end 2011
Shaanxi	Chongqing	1.2Mt/a	2011
Henan	Vale-Anyang JV	1.2Mt/a	Apr-10 in construction
Hebei	Shanxi Haixin Steel	2.5Mt/a	Planning
Total		19.2Mt/a	

Source: Mysteel, Metal Bulletin, SBB, Company Reports & Hatch Beddows

Boundary limits make capital cost comparisons difficult. The cost of building pellet capacity in China is half that in the Western World

Representative pellet plant investments in China

Producer	Project Capacity (million tonnes)	Investment (RMB million)	US\$/t Cap	Technology
China VTM	1.0	104	13	Grate Kiln
Baosteel	5.0	3,200	80	Grate Kiln
Jiuquan Steel	2.0	440	28	Shaft Furnace
Shuangli Mining	1.2	220	23	Grate Kiln
Yichun Xilin	0.8	140	22	-
Baotou Steel	1.2	250	26	Grate Kiln
Jinling Mining	0.6	120	25	Grate Kiln
Vale-Anyang Steel	1.2	625	65	Grate Kiln
Shangdong-Kashi	1.2	350	36	Grate Kiln
Tonghua Steel	2.0	440	28	Grate Kiln

Source: Mysteel, Metal Bulletin, SBB, Company Reports & Hatch Beddows

Demand growth could limit the ultrafine supply overhang to 200Mt in 2015

- Chinese pellet capacity growth continuing at trend 2000-2009 will require 50Mt/a ultrafine by 2015
- The maximum pellet capacity growth in the Middle East is forecast to require an additional 25Mt/a by 2015
- Chinese pellet burden is low by global standards
 - China 17%
 - Non-China 25%
 - World 20%
- The low capital cost of Chinese pellet plants can offset; the movement of high moisture ultrafines and the logistics costs to the end user
- China is capable of surprising on the upside

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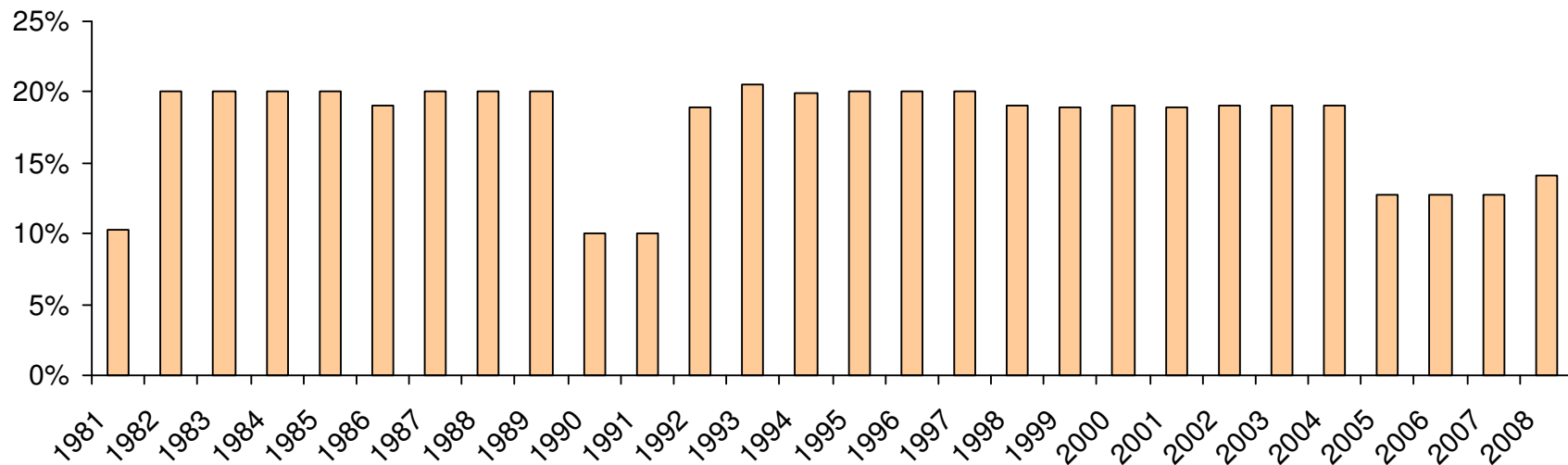
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Without the ultrafine iron ore projects in development the seaborne traded market will be supply constrained

- Pricing
 - Traditional VIU discounting of ultrafine material
 - Chinese Fe driven purchasing
- Costs
 - Ultrafine projects are significantly more expensive from a Capital & Operating perspective than Direct Shipping Ore (DSO) mines
- Supply
 - Market and or price outlook delays ultrafine projects
 - DSO projects are unable to provide an additional 200Mt by 2015
- Demand
 - Merchant pellet capacity
 - Sinter capacity to process ultrafine ores
 - Chemical – addition of burnt lime
 - Physical – changes to granulation circuit
 - Alternative iron making technologies

Pellet Feed differentials into Europe have been remarkably consistent at 20% excluding periods of market tightness

Pellet feed – Sinter fines differential to Europe 1981-2008, (%)



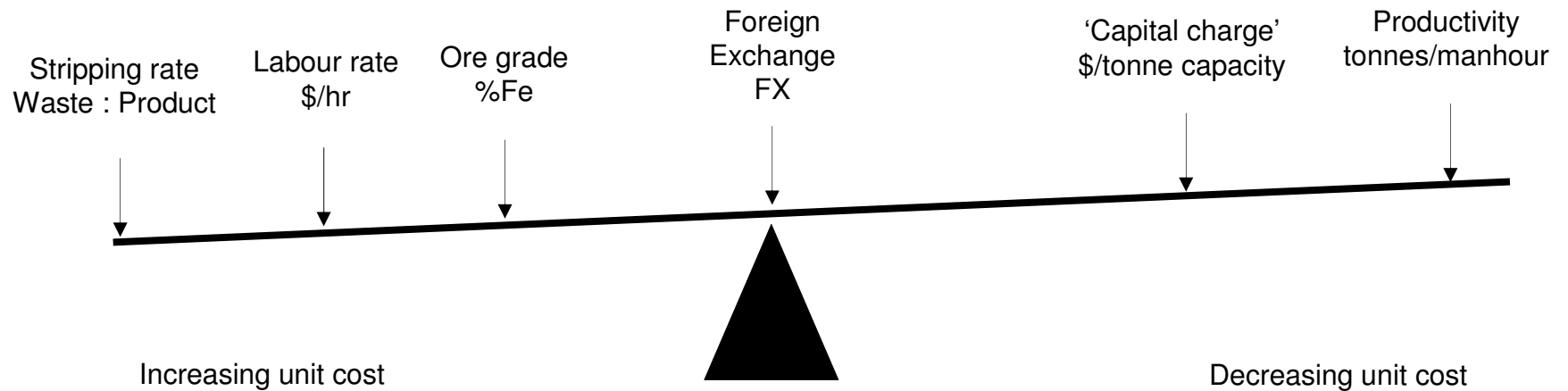
- MBR and Samarco Pellet Feed has been compared with Vale's Standard Sinter Fines (SSF)
- In the European Market Pellet Feed has been discounted by 19-20%. The actual average discount 1981 – 2008 was 18%
- The only exception is during periods of supply tightness when the discount has narrowed, the 2008 discount was 14%

China buys iron ores predominantly on iron content, in part because 40% of Chinese demand is still met domestically

- China dominates iron ore trade
 - In 2009 China accounted for:
 - 70% of seaborne traded iron ore
 - 60% of blast furnace iron production
- Chinese Mills buy predominantly on iron content
 - The iron ore pricing mechanism is in transition.
 - Unlike other markets we don't yet have transparency around marker grades
- Substitution of domestic concentrate with imported ultrafine ores
 - Unlikely that 66% Fe concentrates will trade at a discount to 62% Indian fines
 - Significant volume of ultrafines will be destined for China by 2015
 - Can envisage a commodity grade with price parity for low grade DSO fines and ultrafines
 - Similarly could expect a premium to emerge for high quality DSO ores

Generally mining costs increase over time as grades decline, haul rates increase and stripping ratios deteriorate. These are offset by any gains in productivity

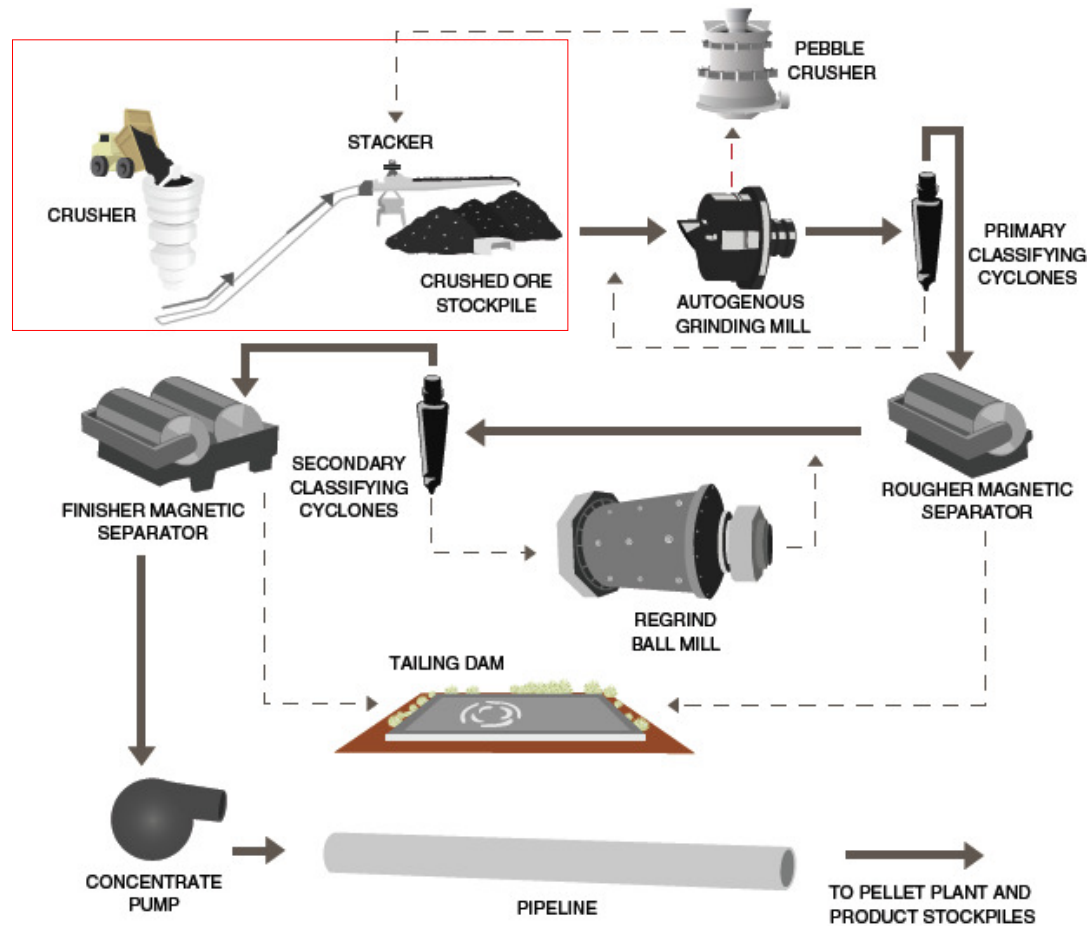
Schematic mine cost drivers



Magnetite concentration entails additional cost through material movement of low grade ore, energy to finely grind the ore for liberation, yield losses and high capital cost

Direct Shipping Ore (DSO) operation plus secondary & tertiary crushing & screening

Magnetite concentration process



New steel making technologies require an economic impetus, be it lower raw material costs or decreased carbon footprint, to challenge the hegemony of the Blast Furnace

Classification of new iron making technologies

Ferrous feedstock	Reductant		
	Gas	Coal	
Pellet / Lump	MIDREX HYL III GHAEM	Corex SL/RN DRC	
Fines	Cirored Iron Carbide Finmet Fior	Circofer Fastmet Inmetco ITmk3	Fastmelt Hi-Qip Hismelt Dios Finex Ausmelt Romelt

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The iron ore market will be in oversupply of ultrafine material by 2015

- The iron ore market will be in oversupply of ultrafine material by 2015
- This will have implications for pricing iron ores
 - Traditional discount model
 - China model
- If pricing evolves rationally then the market will move to correct this supply imbalance
 - More substitution for domestic Chinese concentrates
 - More merchant pellet capacity
 - More sinter strand demand
 - More impetus to commercially develop alternative iron making technologies

THE TRADED MARKET FOR ULTRAFINE IRON ORE
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