



International Manganese Institute

Steel and Manganese Prospects to 2012

2007 International Manganese Institute
Annual Conference

Vienna, June 17-19, 2007



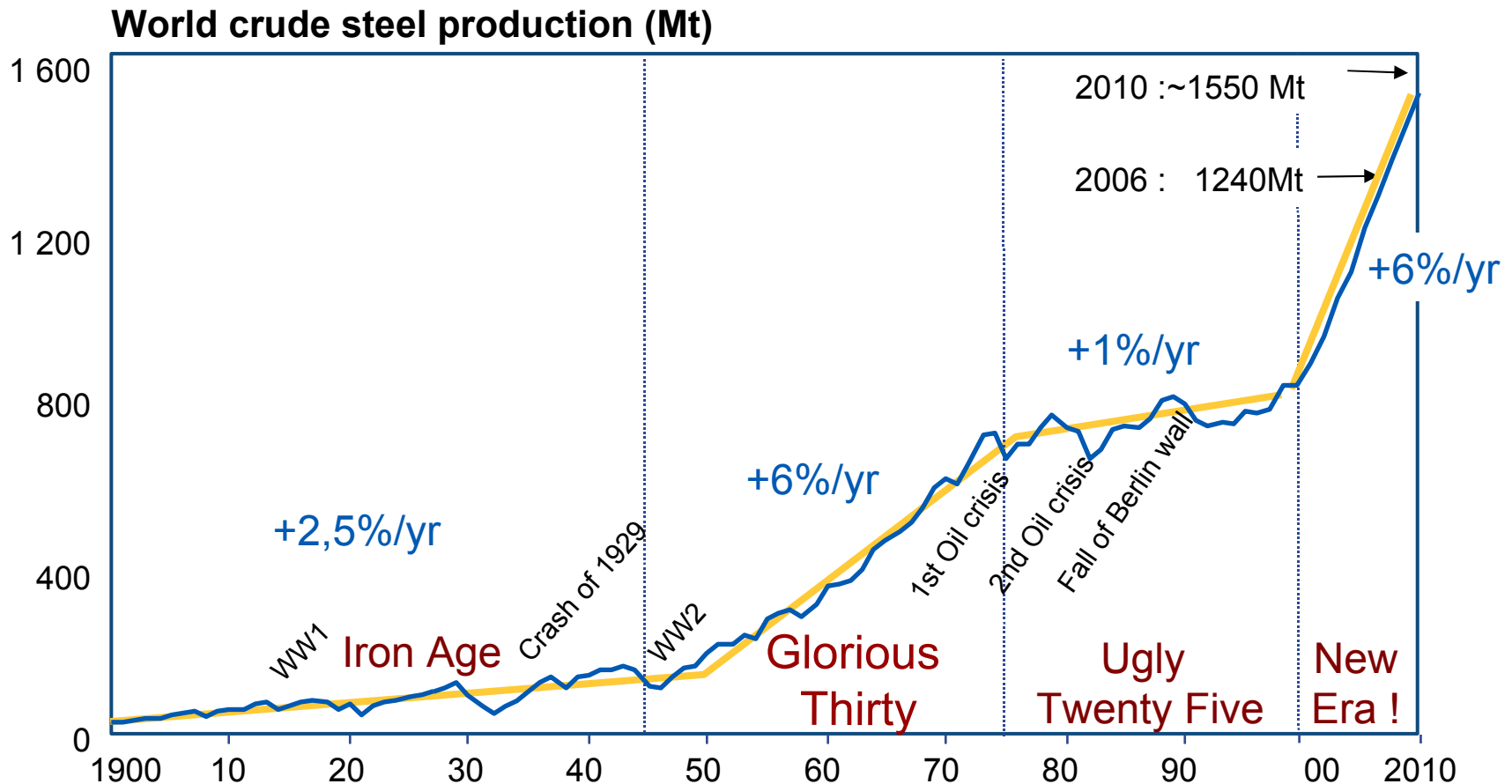
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Synthesis

- **Manganese demand prospects have never been so good**
 - Steel demand to exceed 6%/yr for many years to come
 - Specific Mn consumption growing again
 - Mn intensive steel grades to grow faster than average
 - Non steel applications also facing good prospects
 - Limited downside risks for next ten to fifteen years
- **Manganese supply can further leverage good prospects**
 - Recent price increases, but major energy and freight increases
 - Low barriers to entry prevent sustained price increases
 - Ample mineral resources to develop in line with demand
 - Marketing and communication to strengthen : Mn is sexy !



Since the beginning of this century, the steel industry has entered a era of sustained growth

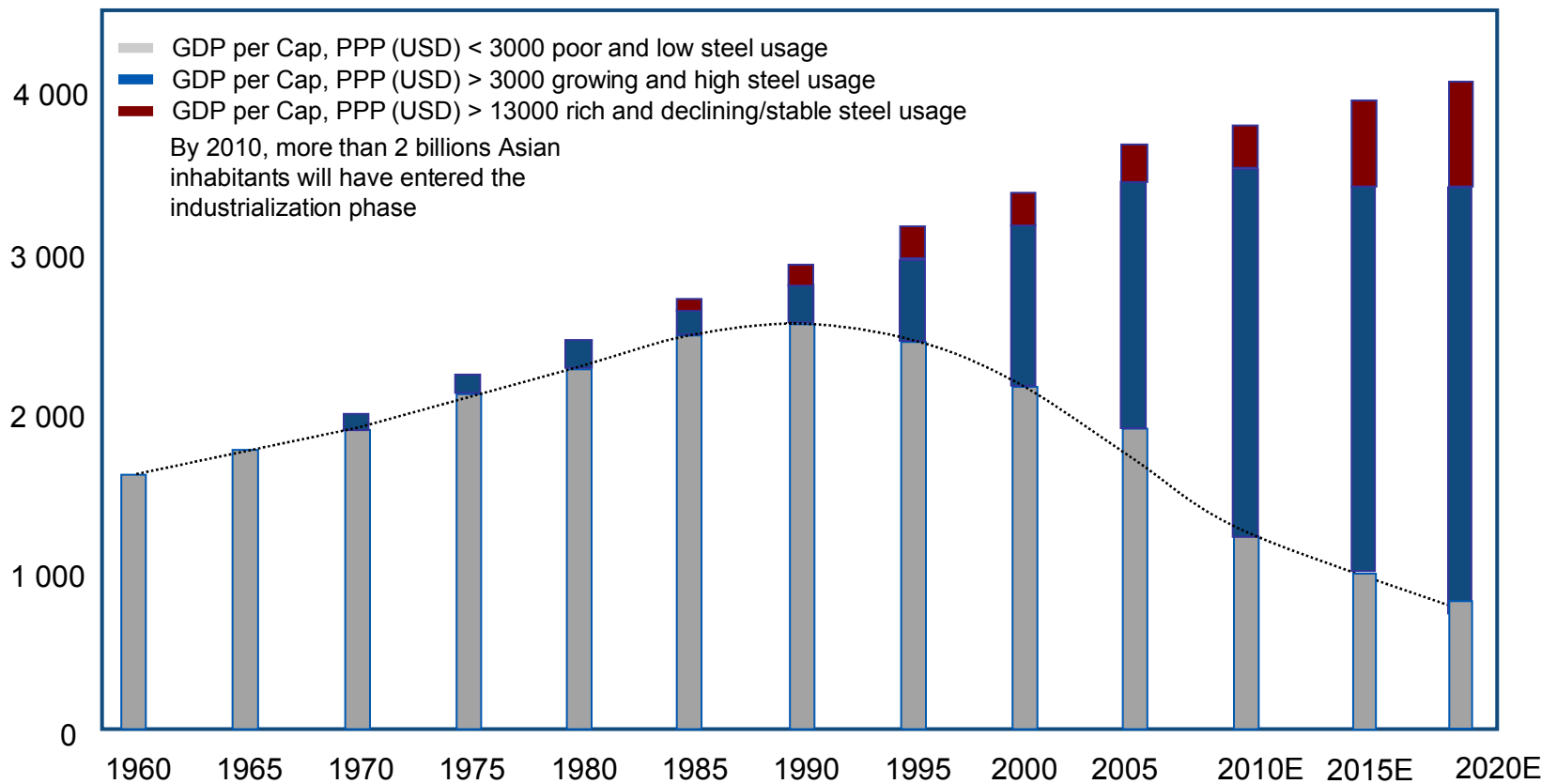


Source: Steel Statistical Yearbook, IISI, Laplace Conseil analysis



This is mostly due to the rapid industrialization of Asia, led by China

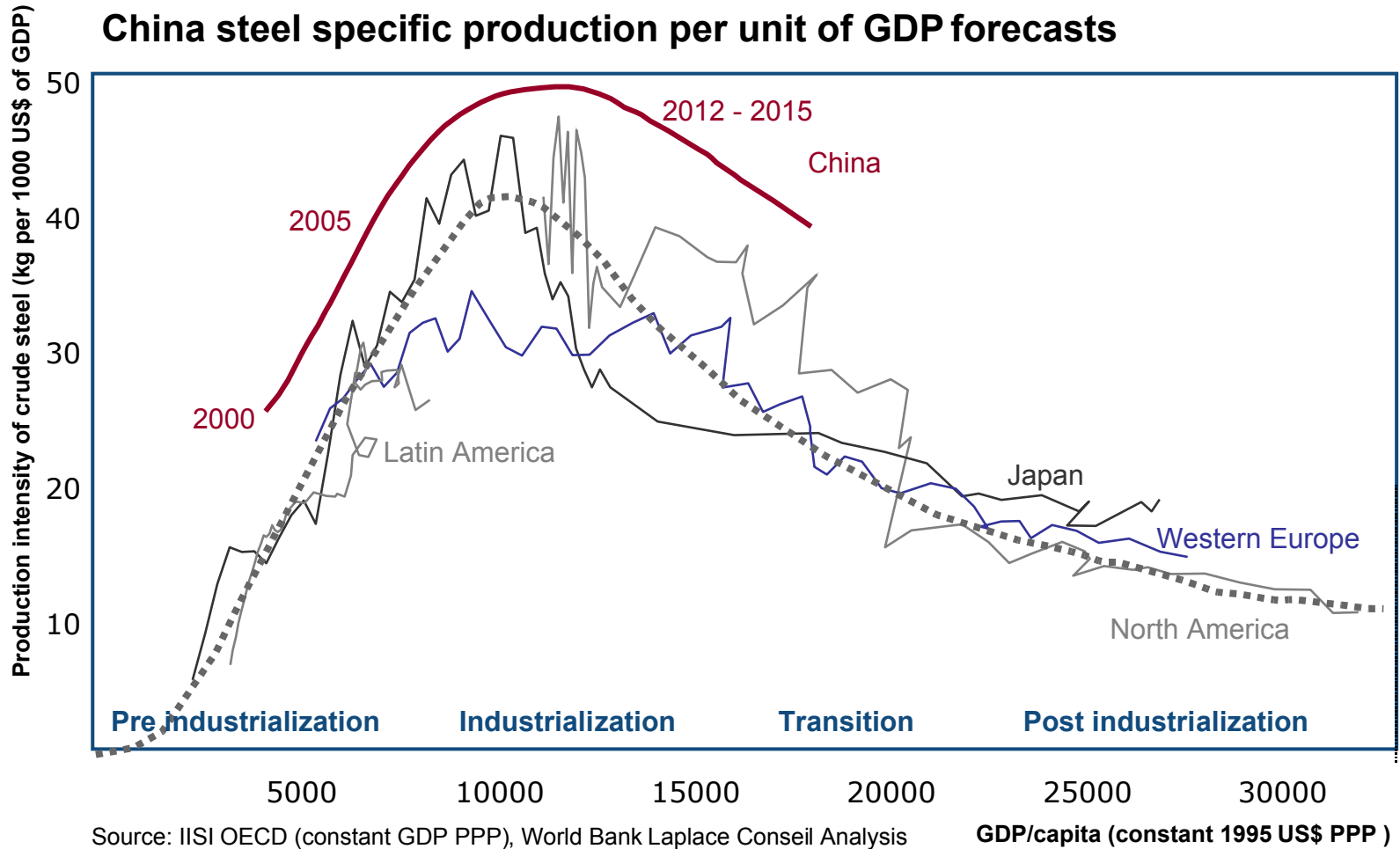
Economic Development of Asian populations (Million inhabitants)



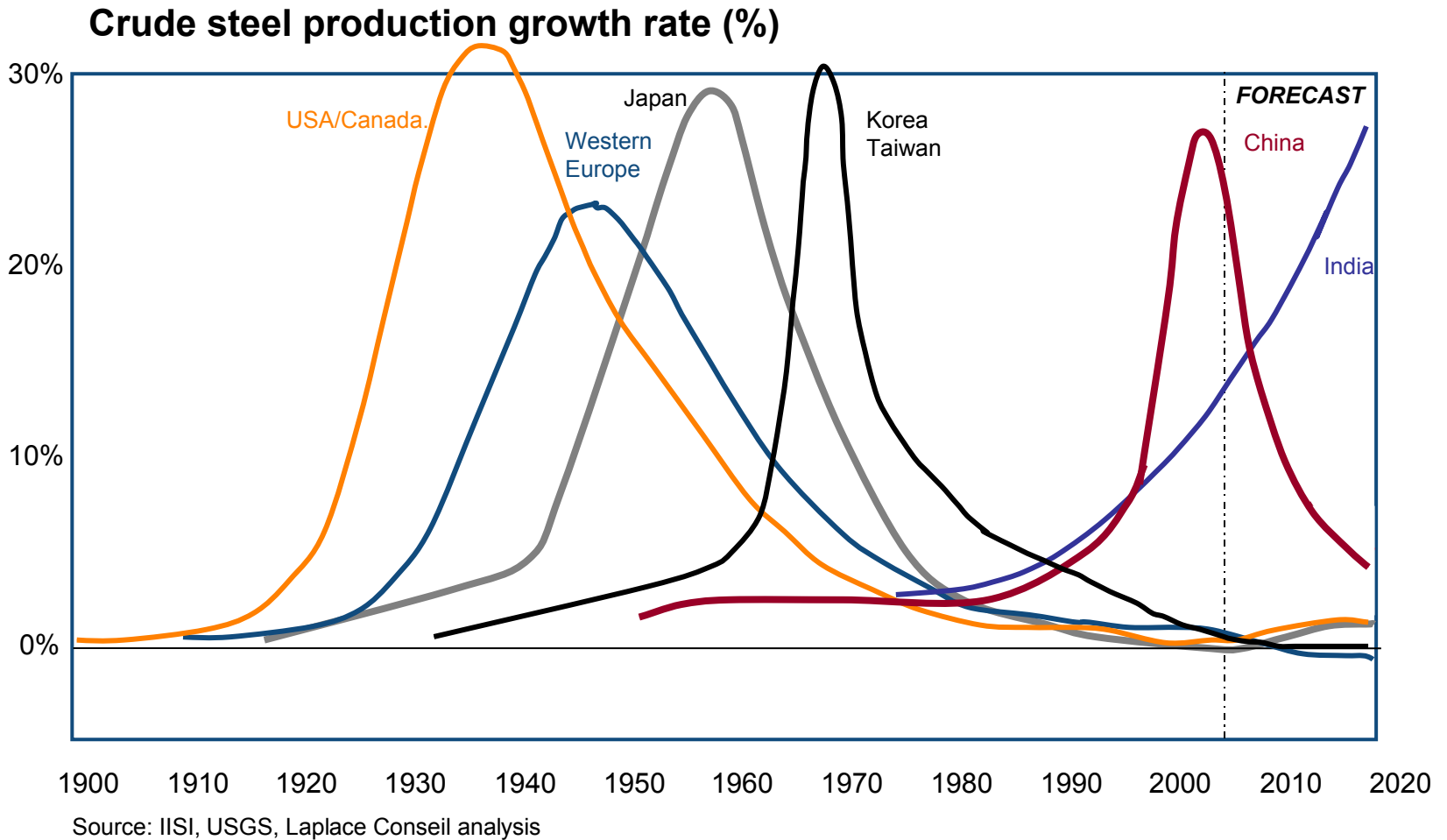
Source: World Bank, Laplace Conseil analysis



China's steel intensity curve is expected to peak in 2015 around 50 Kg per 1000 US\$ of GDP



China's current evolution is similar to the one experienced by developed economies in the past.



Summary of trends and drivers of steel demand

Probability by 2020

- The new consumers in Asia and transition economies pull global steel demand by **5 to 6 % per year for 20 to 30 years** 65 %
- The world economy “muddle through” with renewed shocks and cycles but the system remains resilient. Steel grow by **2 to 4% per year** with substantial fluctuations 20 %
- Major disruptions, in part caused by a growing gap between “have and have not” (energy shortage, environment catastrophe, major terrorist outbreak) trigger recession in developed economies and halt progress in developing world. Steel return to mid 2000’s level, then remains **more or less constant** with large cycles 15 %



Only global risks could derail the new era of continuous steel growth

“China Hard Landing”

Following Olympic euphoria and Shanghai world exhibition success, regional dissatisfaction could arise in China poorer provinces leading to major political, then economic instability. Uncertainty would lead to reduction in Chinese demand. Excess capacity would be dumped in global markets triggering world recession. Probability is viewed by most experts as fairly small.

“Environmental Catastrophy”

Numerous threats are regularly assessed from climate change to major pandemics. Competition for dwindling resources could also trigger conflicts leading to oil shocks, terrorism or transnational crime. Are you an optimist or a pessimist ?

“US or Western Recession”

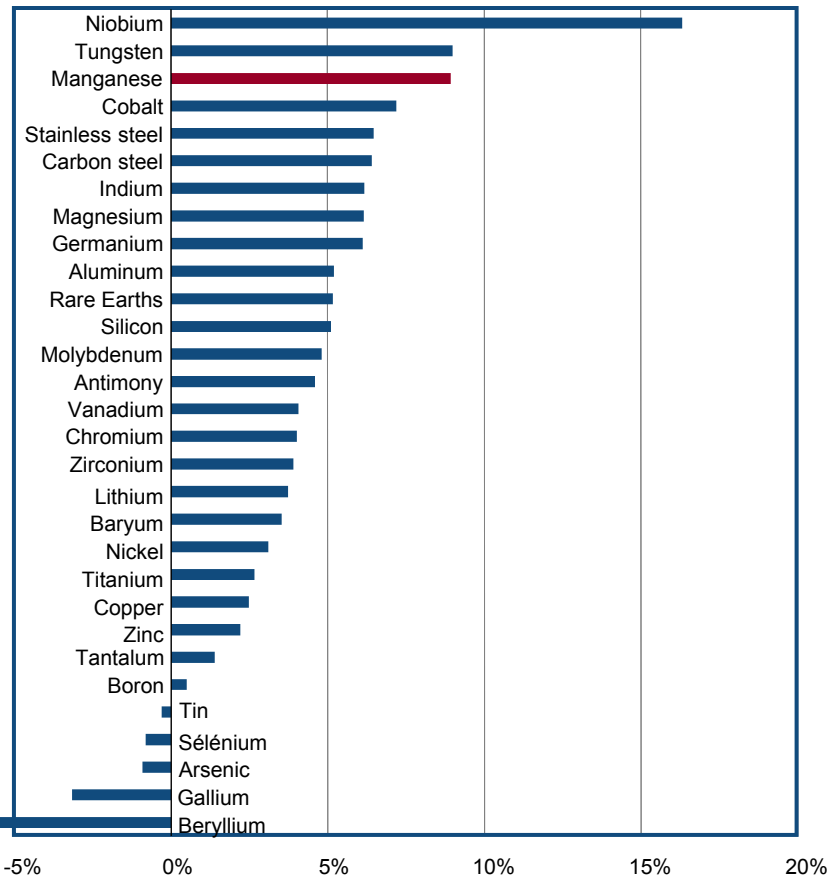
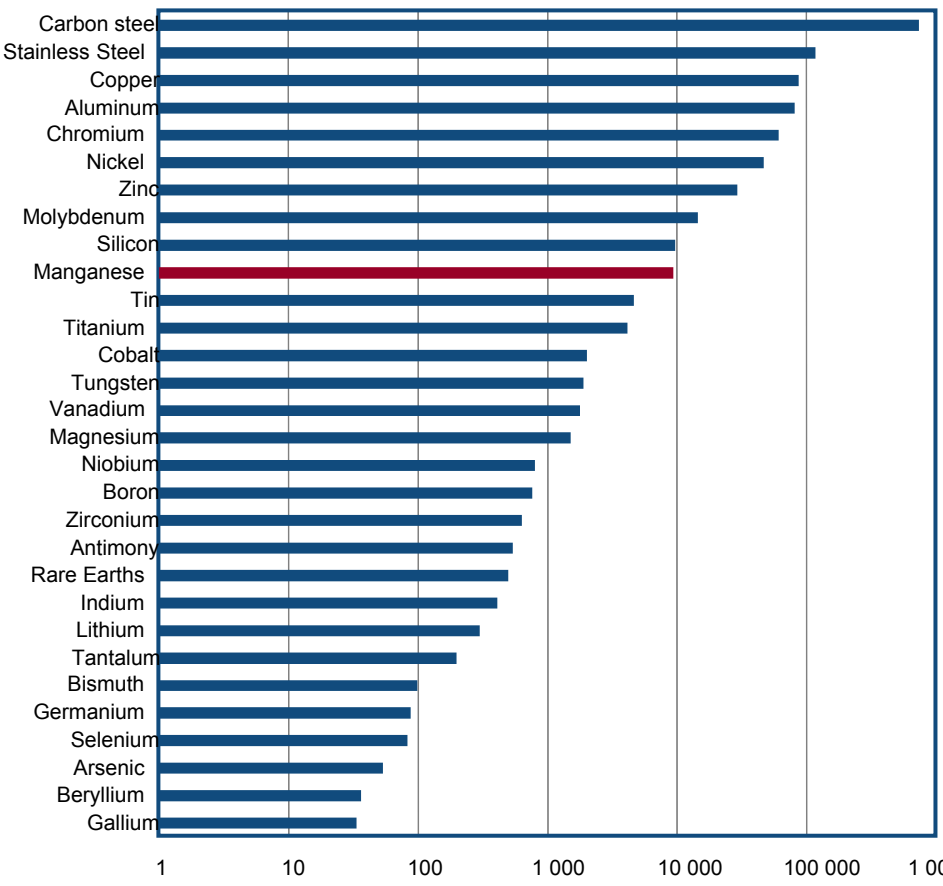
In the past, steel demand and prices were heavily influenced by Western economies. Today, a major US recession would reduce steel demand by 30 Mt at the most, that is the equivalent of three weeks of China consumption or four months of Chinese growth. Steel dynamics are no longer governed by Western trends. Of course, these events can and will trigger pricing volatility and at times instability.



Manganese is among the 10 most valuable metals and records one of the highest CAGR

Metals and Minerals value ranking (M\$)

Compounded Average Growth Rate 2000-2006 (%)



log scales

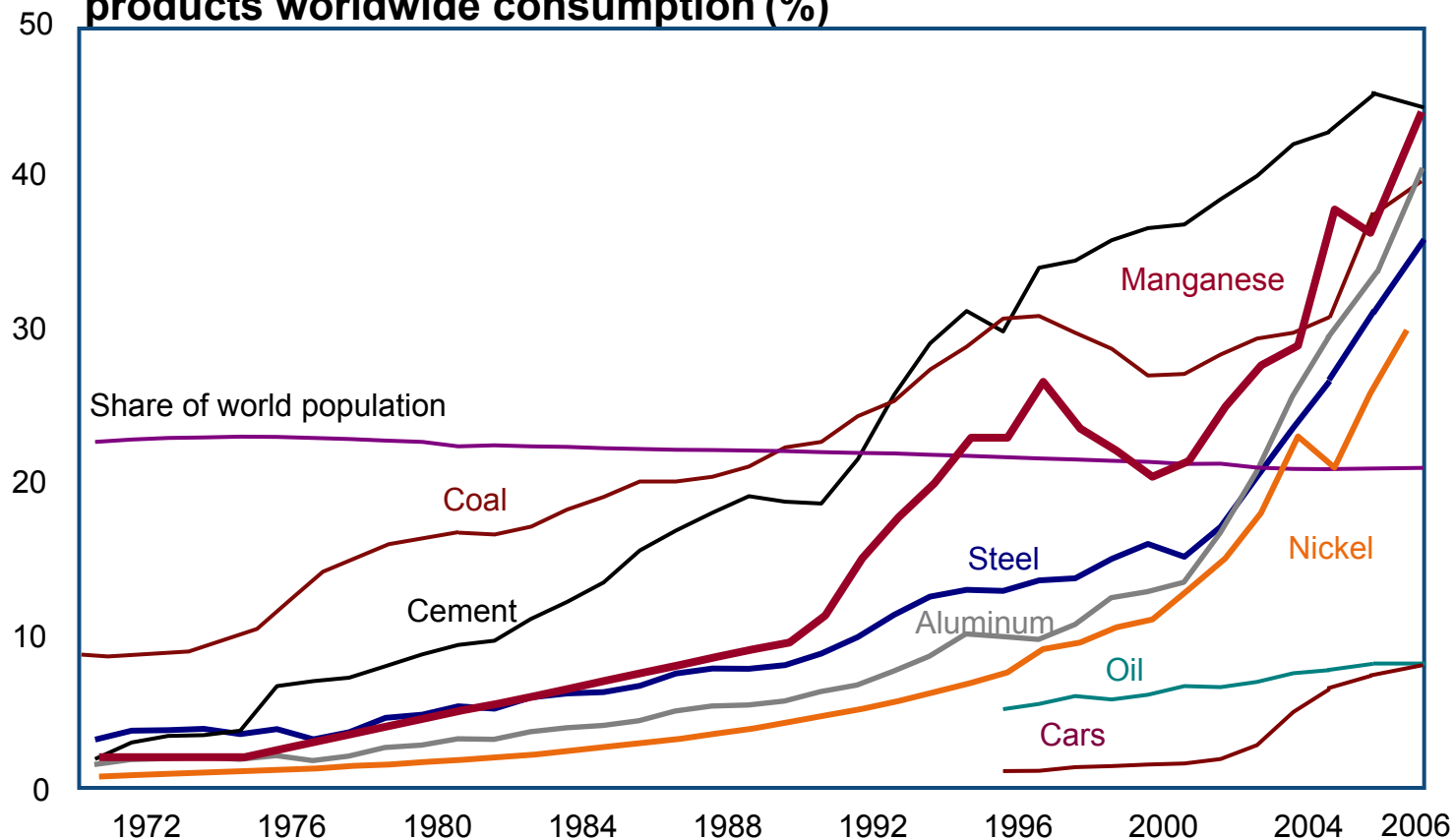


Source : USGS, Wikipédia, Laplace Conseil analysis
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China accounts for about 45% of world Mn demand

Chinese market share in metals, minerals, and intermediaries products worldwide consumption (%)

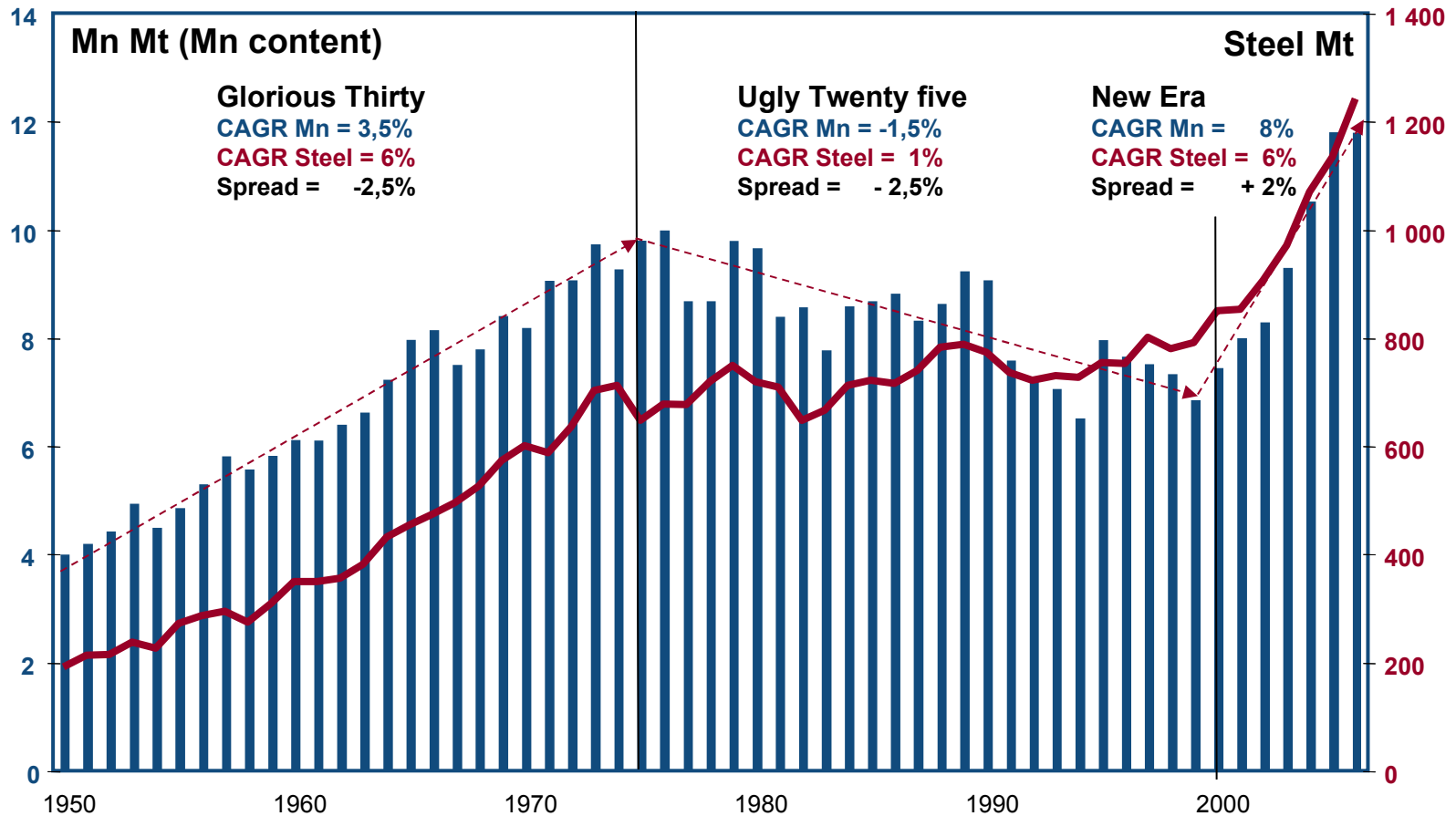


Source: IISI, Organisation Internationale des Constructeurs Automobiles, International Aluminum Institute, Coal Institute, Wikipedia, China Metals, BP, Eramet, China Geological Survey, International Mn Institute, Laplace Conseil analysis



World Mn production increased by 8% since 2000, while spread with steel improved by 4,5%

World manganese ore & carbon steel production



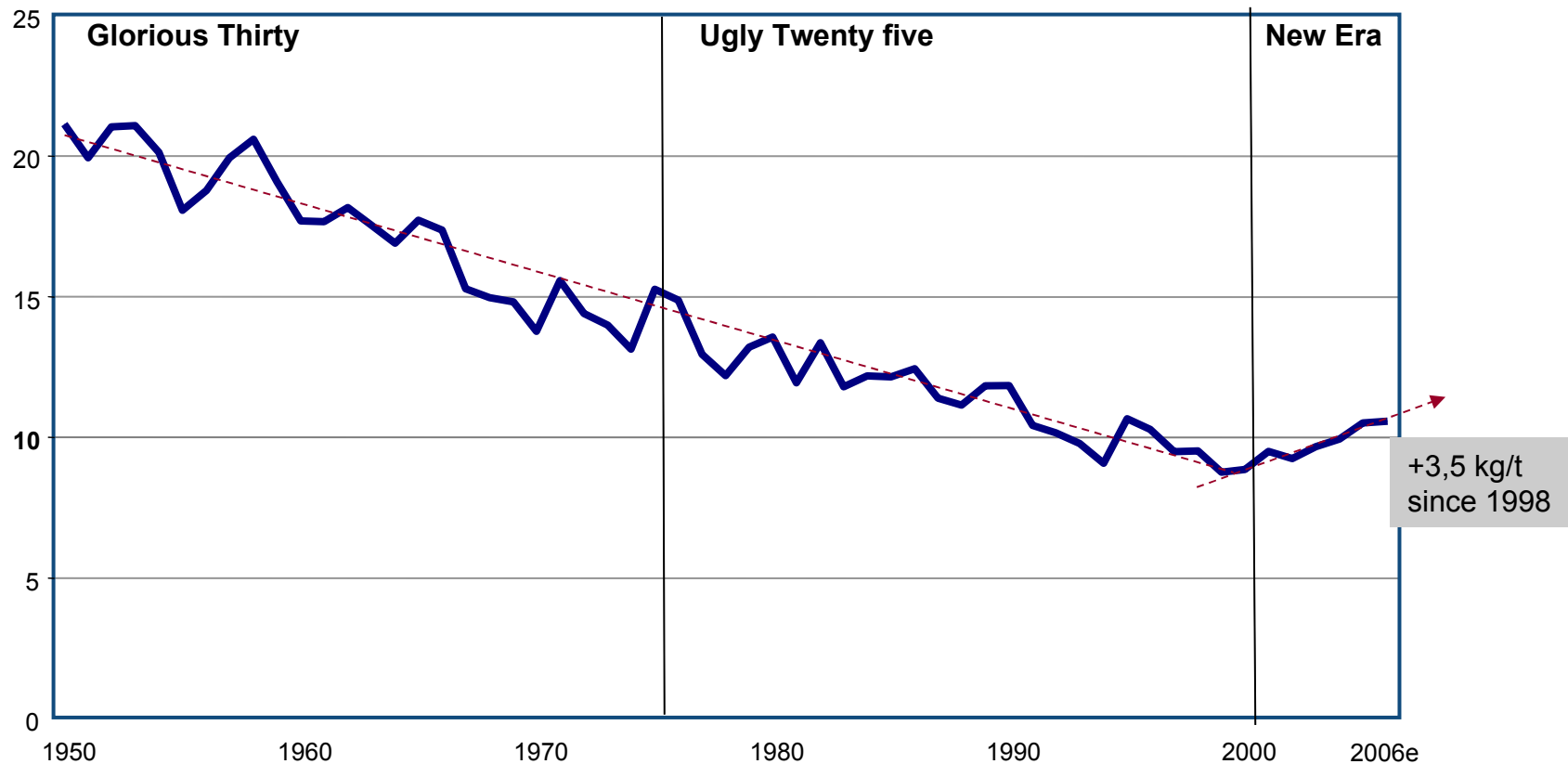
Source : USGS, IISI, IMnI, Laplace Conseil analysis

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Manganese specific consumption has been increasing since the beginning of the New Era

Specific consumption of Manganese in steel production (kg/ton of steel)



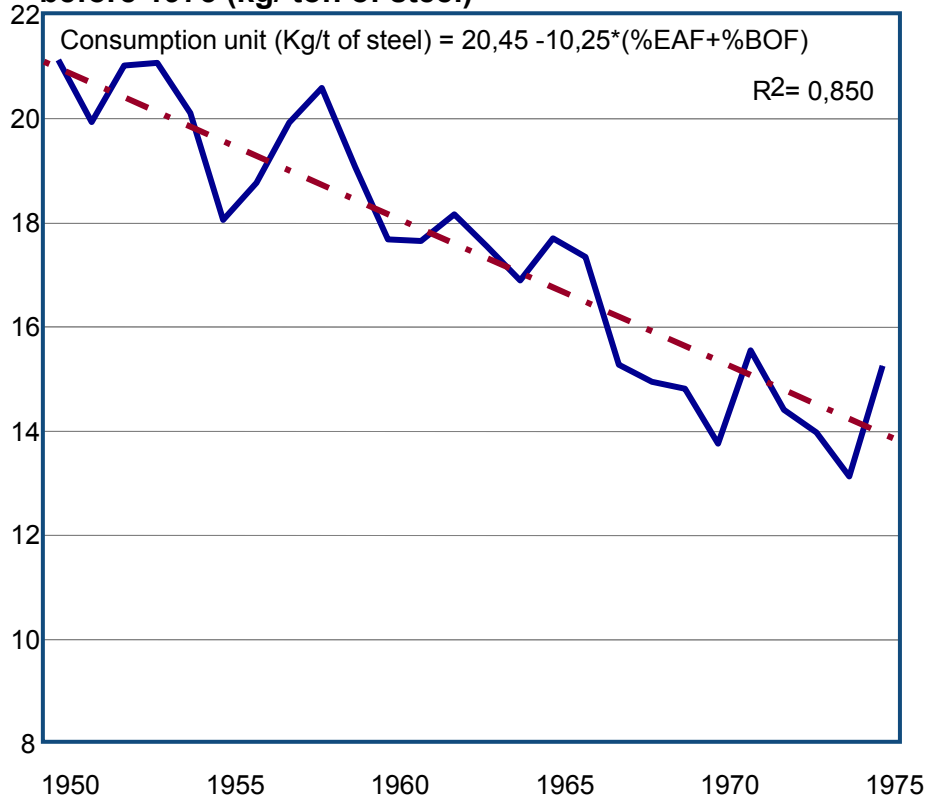
Source : USGS, IISI, International Manganese Institute, Laplace Conseil Analysis

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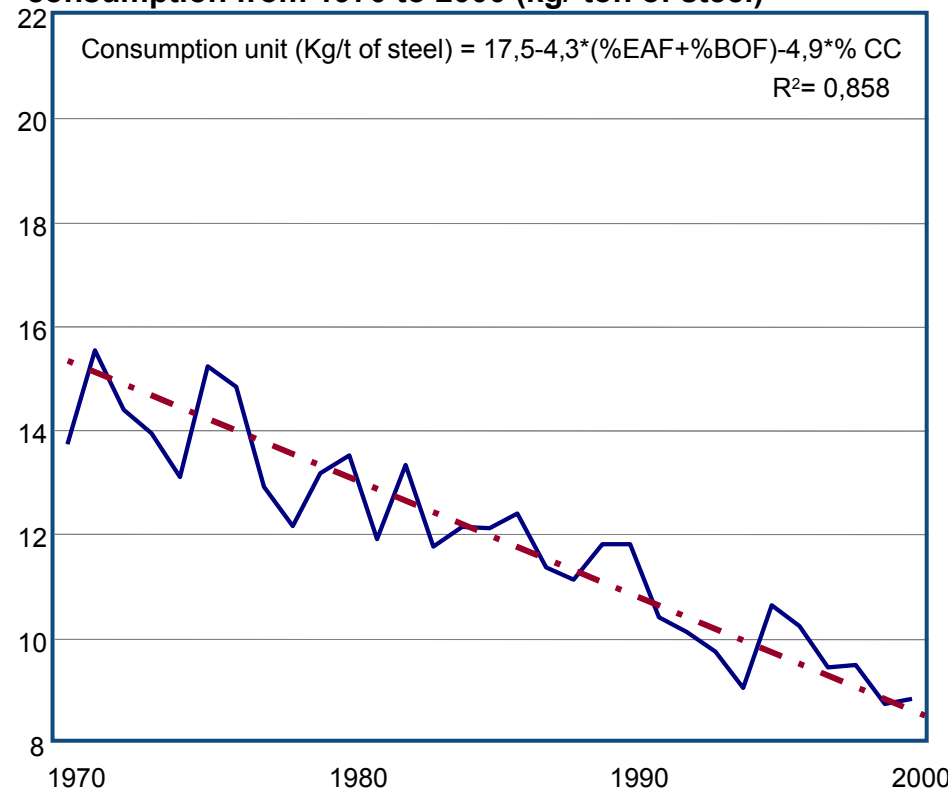


Mn past specific consumption decline was mostly due to the change in steel making processes

Correlation (%EAF+%BOF) to Mn specific consumption before 1975 (kg/ ton of steel)



Correlation (%EAF+%BOF) and %Concast to Mn specific consumption from 1970 to 2000 (kg/ ton of steel)



Source : IISI, Laplace Conseil analysis

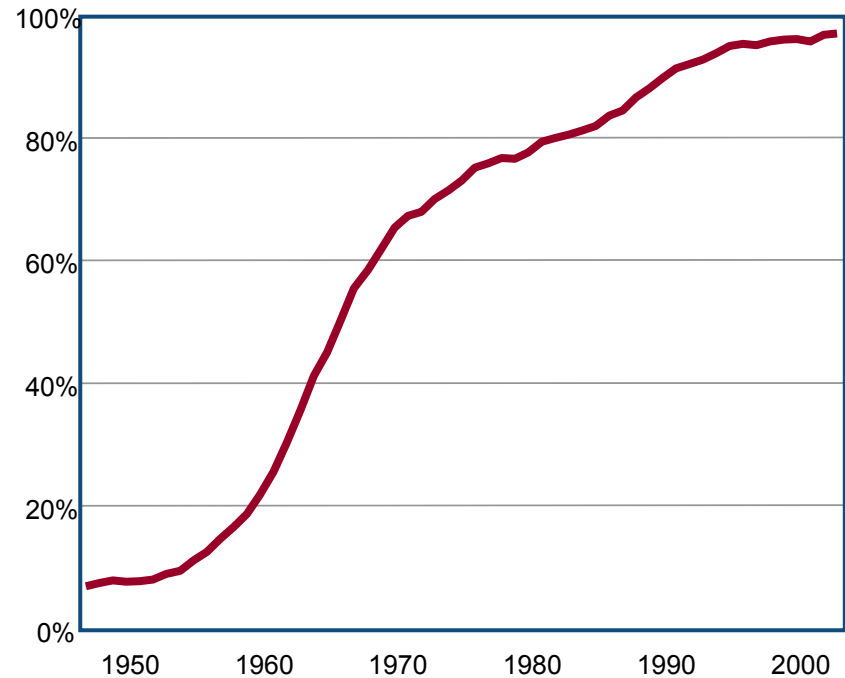


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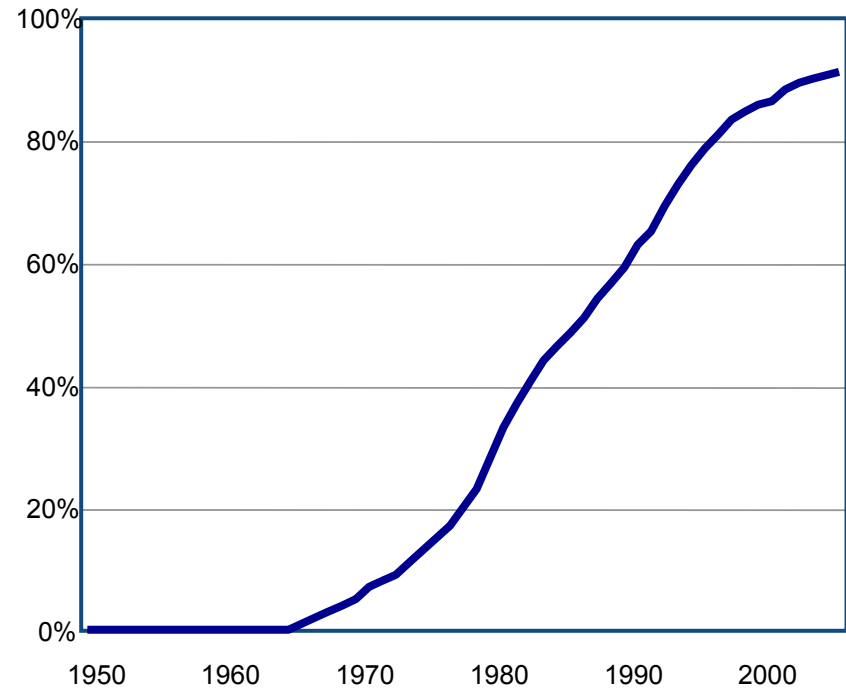


Crude steel production is now almost exclusively produced via EAF or BOF and continuously cast

**BOF + EAF crude steel production
(% world total production)**



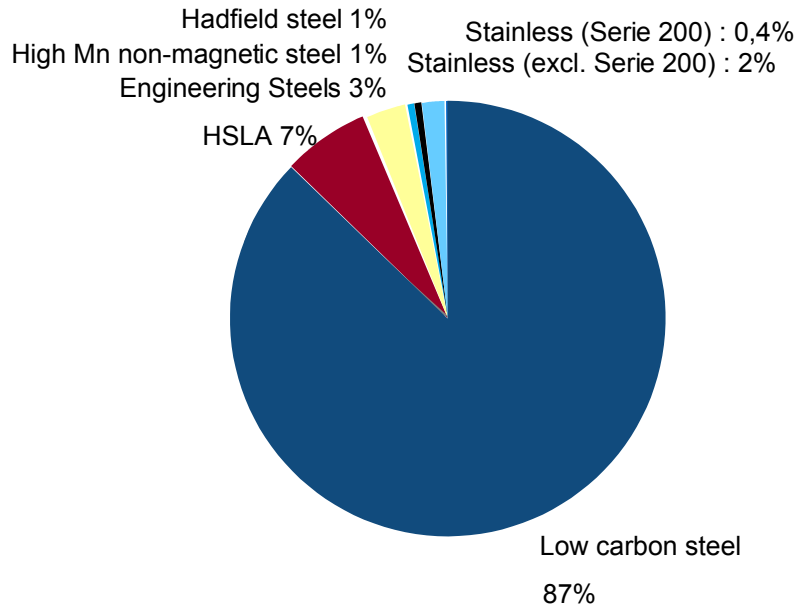
**Continuous casting evolution rate
(% world crude steel production)**



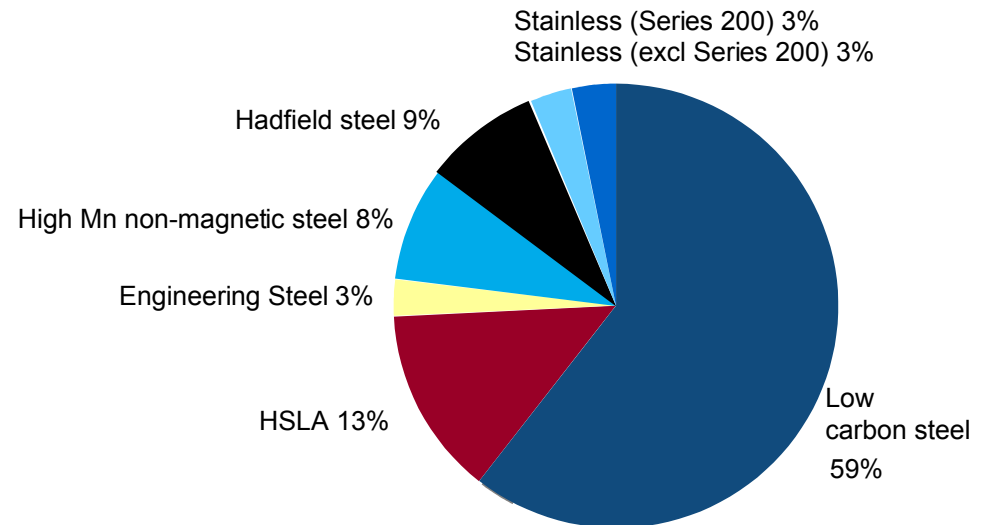
Mn intensive steel represents 13% of total steel production but consumes 41 % of Mn used

Steel absorbs 93% of all Mn production

**Steel production breakdown
2006 : 100% = 1 239 Mt**



**Mn consumption by steel industry
2006 : 100% = 10,4 Mt (Mn content)**



Source : IISI, ISSF, IMnI, Laplace Conseil Analysis



“Mn intensive steel” should grow faster than ordinary low carbon steel

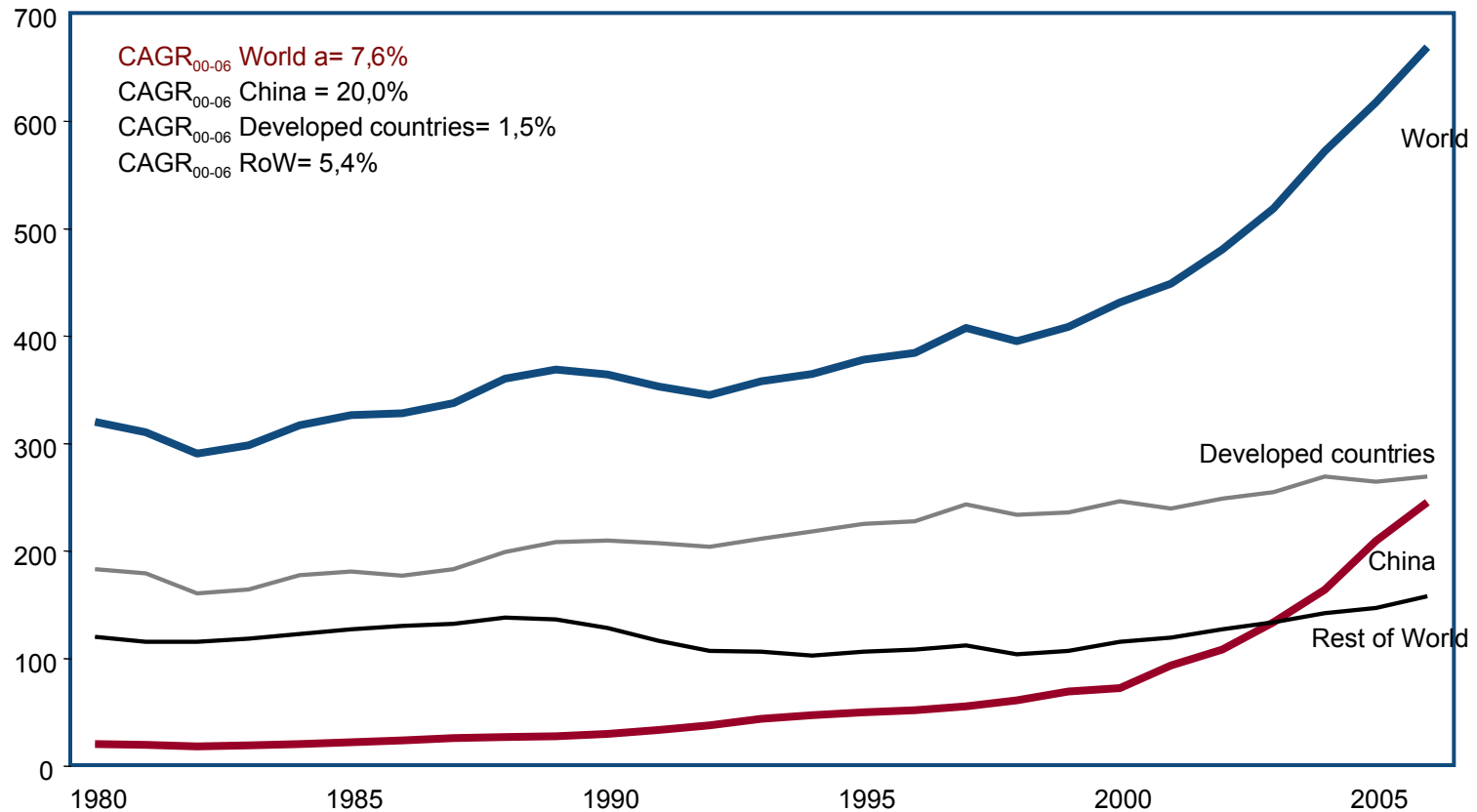
Material	Growth per year	Mn content
• Carbon steel	6,0%	0,5%
• Construction steel	7,6%	1,0%
• Stainless steel (other series)	8,0%	1,0%
• HSLA	12,0%	1,5%
• High Mn non magnetic steel	6,5%	11%
• Hadfield steel	8,0%	13%
• Stainless steel (series 200)	12,0%	12%

Doubling Mn conso by 2015



In volume, steel for construction has increased by 7,6%/year since 2000

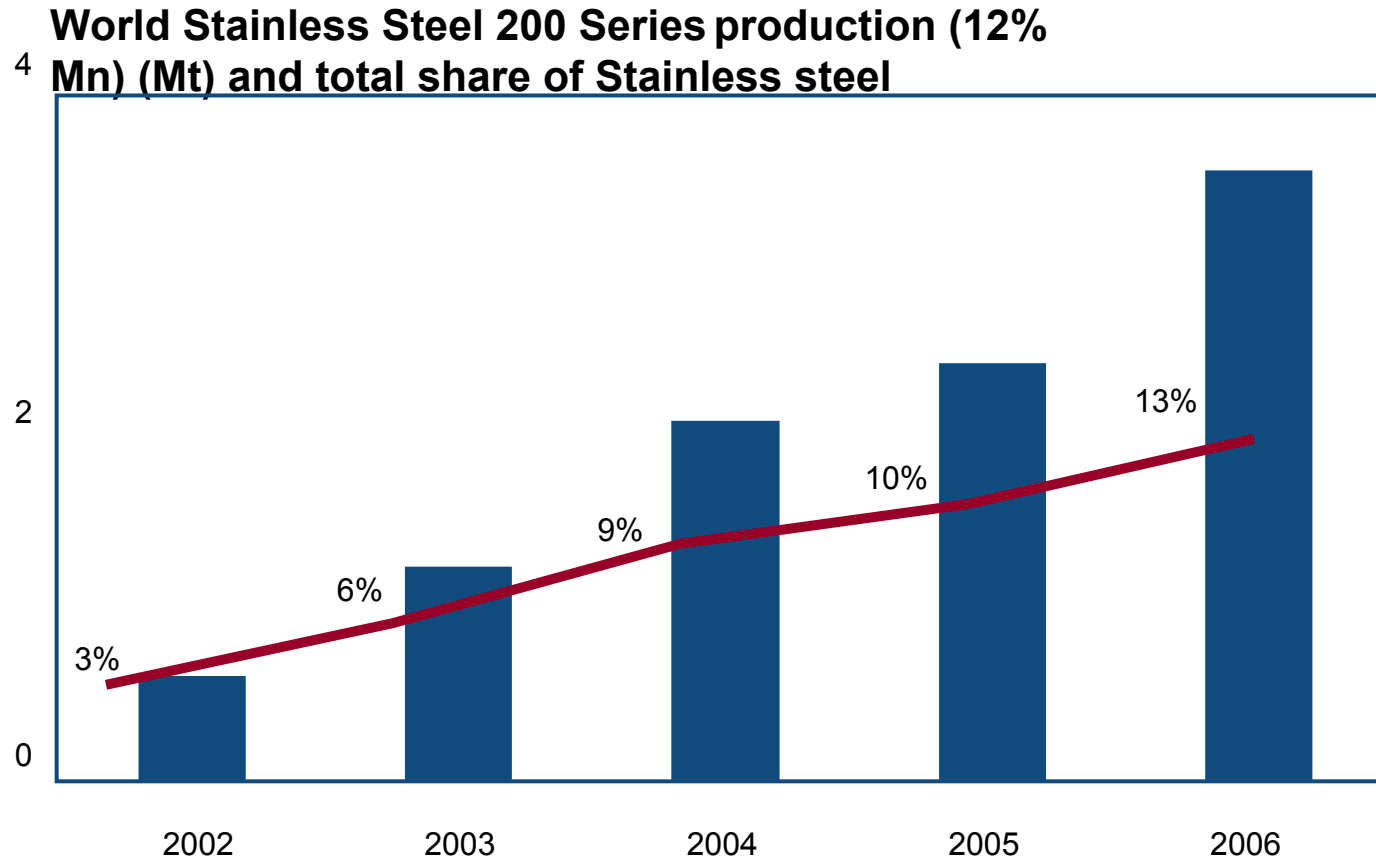
Evolution construction steel consumption (Mt)



Source : JF King, Laplace Conseil analysis



The market reacted to the high Ni price by promoting Stainless Steel 200 Series

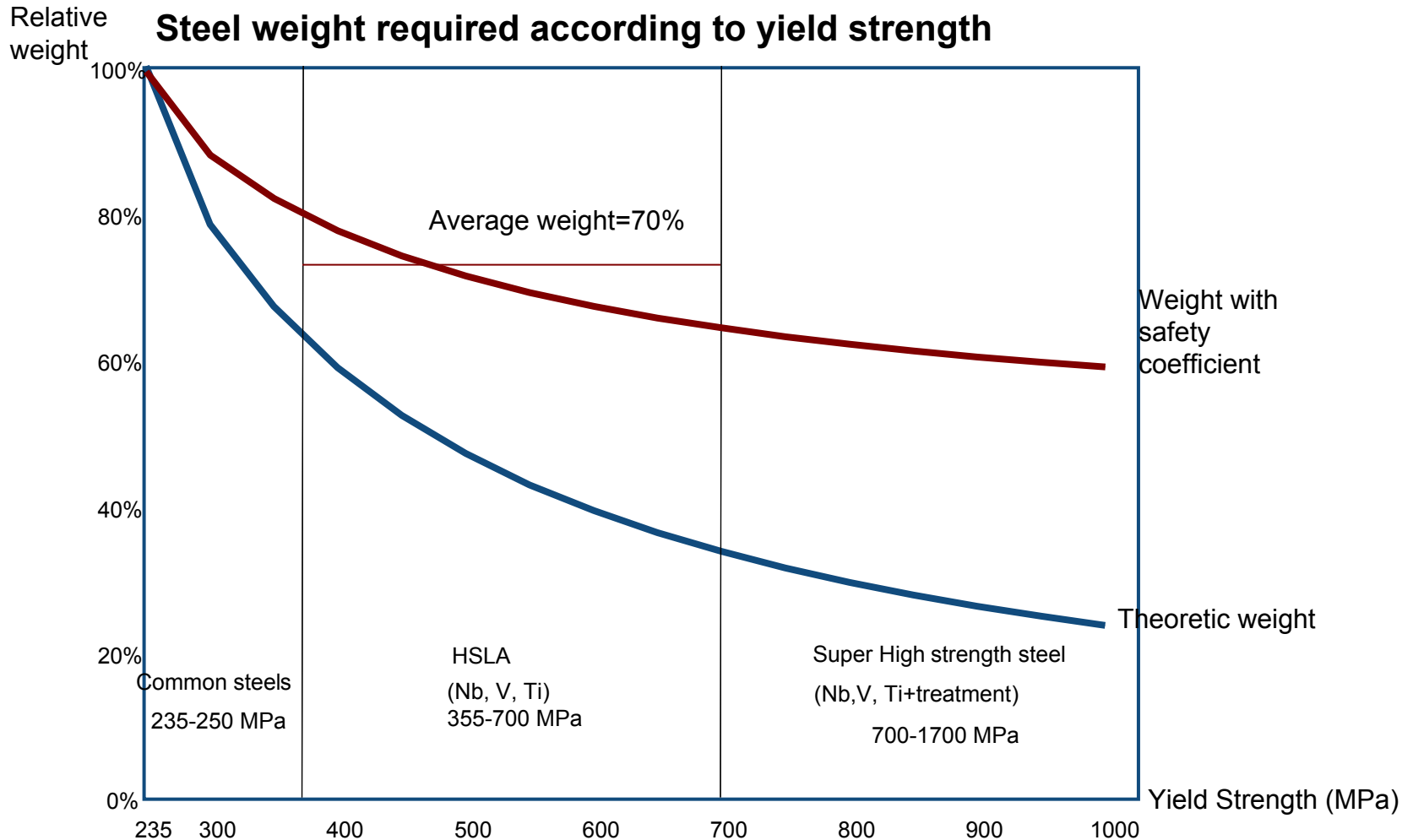


Source : ISSF, Eramet, Manganese Metal Company, Laplace Conseil analysis

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HSLA provides 25 to 35 % weight gain and represents real benefits for consumer



Source: Arcelor Mittal, USGS, SSAB, Engineering Fundamentals, US Vanadium Corporation, Laplace Conseil analysis



Hadfield steels containing 13% Mn should grow strongly in coming years

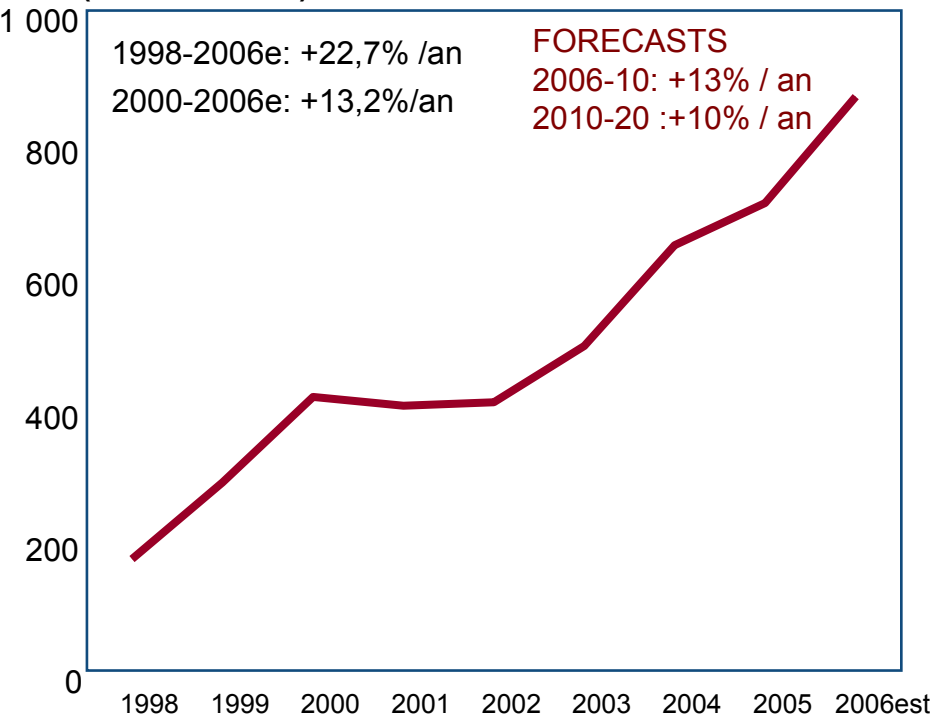
- Austenitic manganese steel, contains between 12% and 14% manganese.
- High toughness and ductility with high work-hardening capacity and good resistance to wear. Extend by 3 to 5 fold service life for components exposed to slow abrasive wear.
- Earthmoving, mining, quarrying, oil well drilling, steelmaking, railroading, dredging, lumbering, and in the manufacture of cement and clay products.
- Sectors experience strong growth to sustain Asia and in particular China economic development.

Source : Key to Steel, Wikipedia, Laplace Conseil analysis



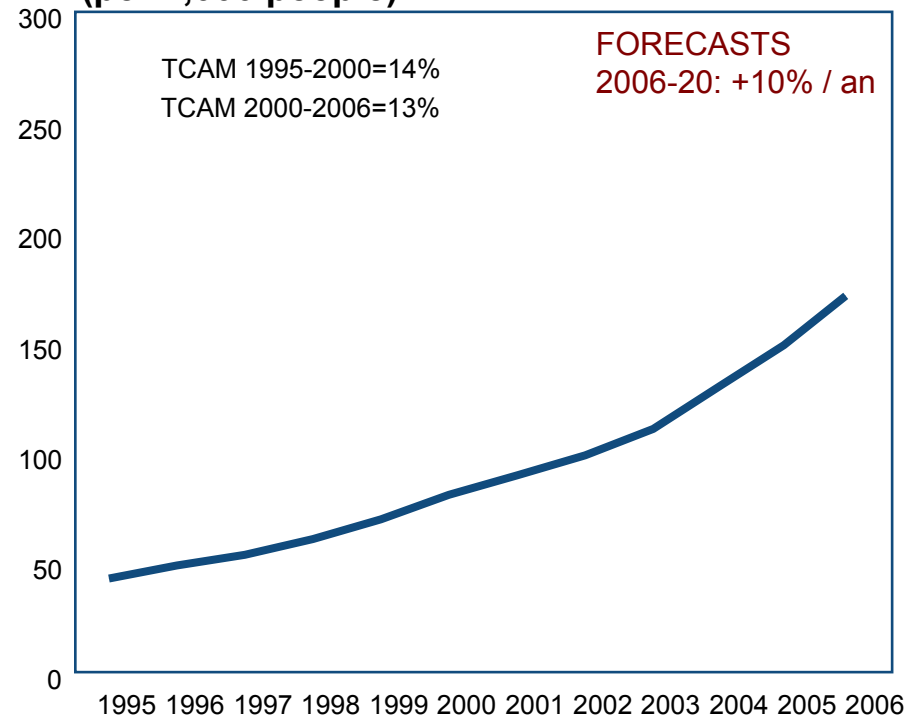
Cell phones and PC growth should exceed 10%, hence high Alkaline and Li-ion batteries and EMD

**World cellular phones sales
(Millions Units)**



Source : Gartner, Nokia, analyse Laplace Conseil

**World personal computers
(per 1,000 people)**



Source: World Bank, Laplace Conseil analysis

New application could add potential development for Manganese dioxide

- A group of researchers from Kyoto University, led by Professor Hideki Koyanaka, has developed a new process designed to reproduce photosynthesis process, i.e. able to absorb large quantity of CO₂ emissions, using manganese dioxide.
- Researchers have developed a combustion technique enabling to produce pure dioxide manganese particles with a size of few nanometers. Small particles size enable to make this material more reactive and efficient to copy natural photosynthesis phenomenon.
- In theory, this technique could be 300 times more efficient than natural photosynthesis.
- If this process could be developed , it would represent huge potential development for manganese dioxide.



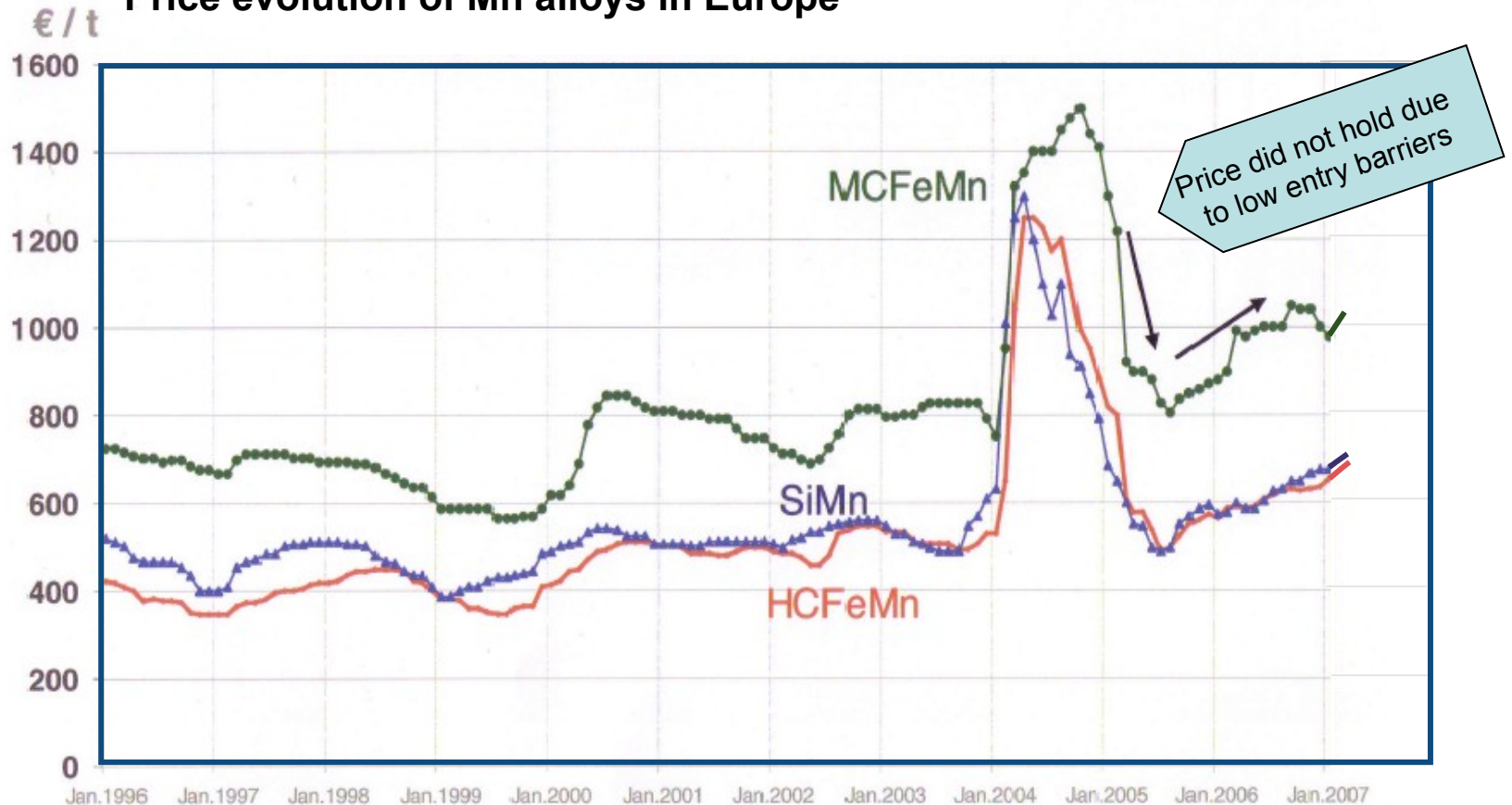
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Rising demand and cost pressures have led to increases in manganese alloy prices

Price evolution of Mn alloys in Europe



Source : CRU

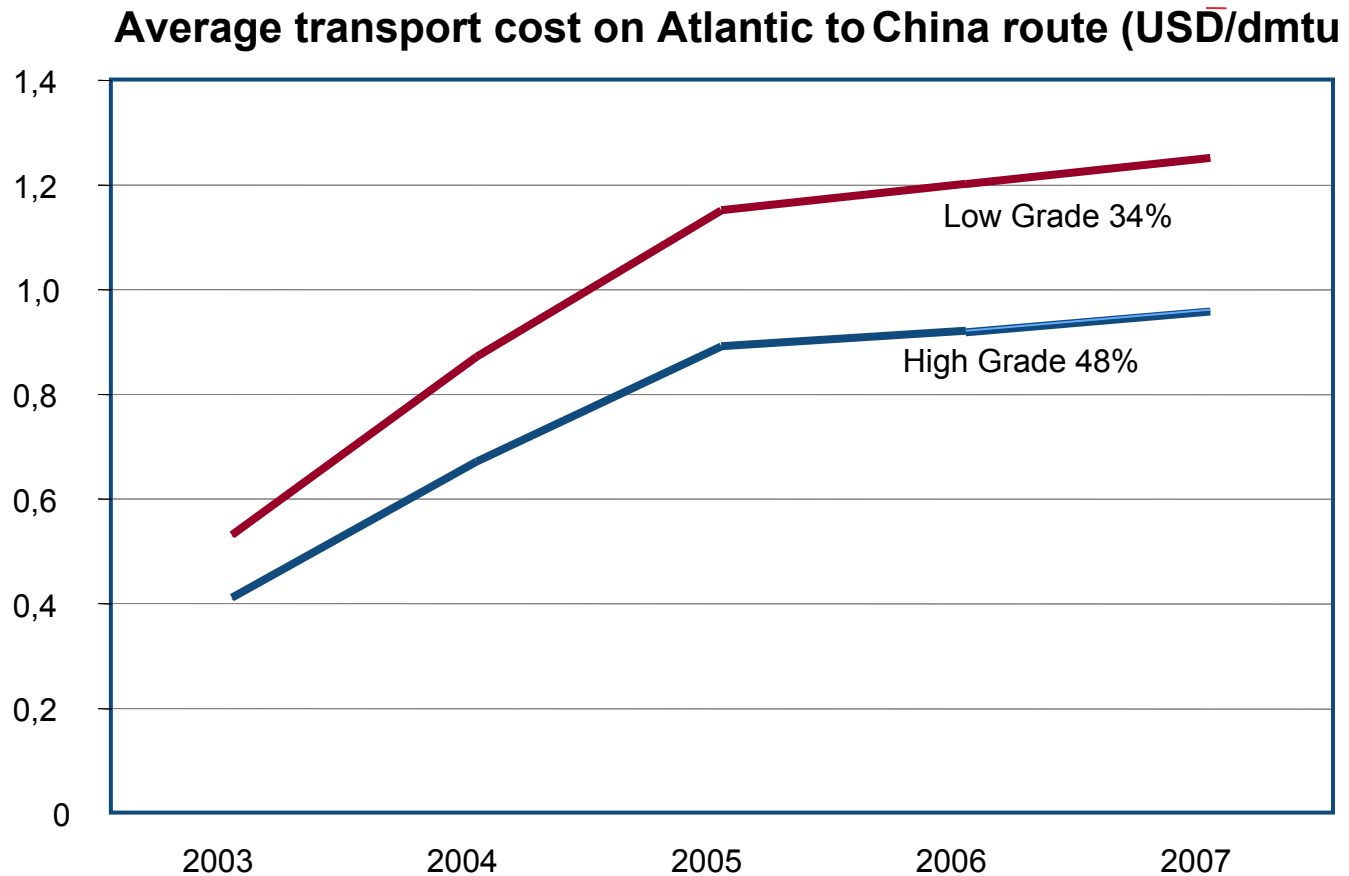
EUROPE



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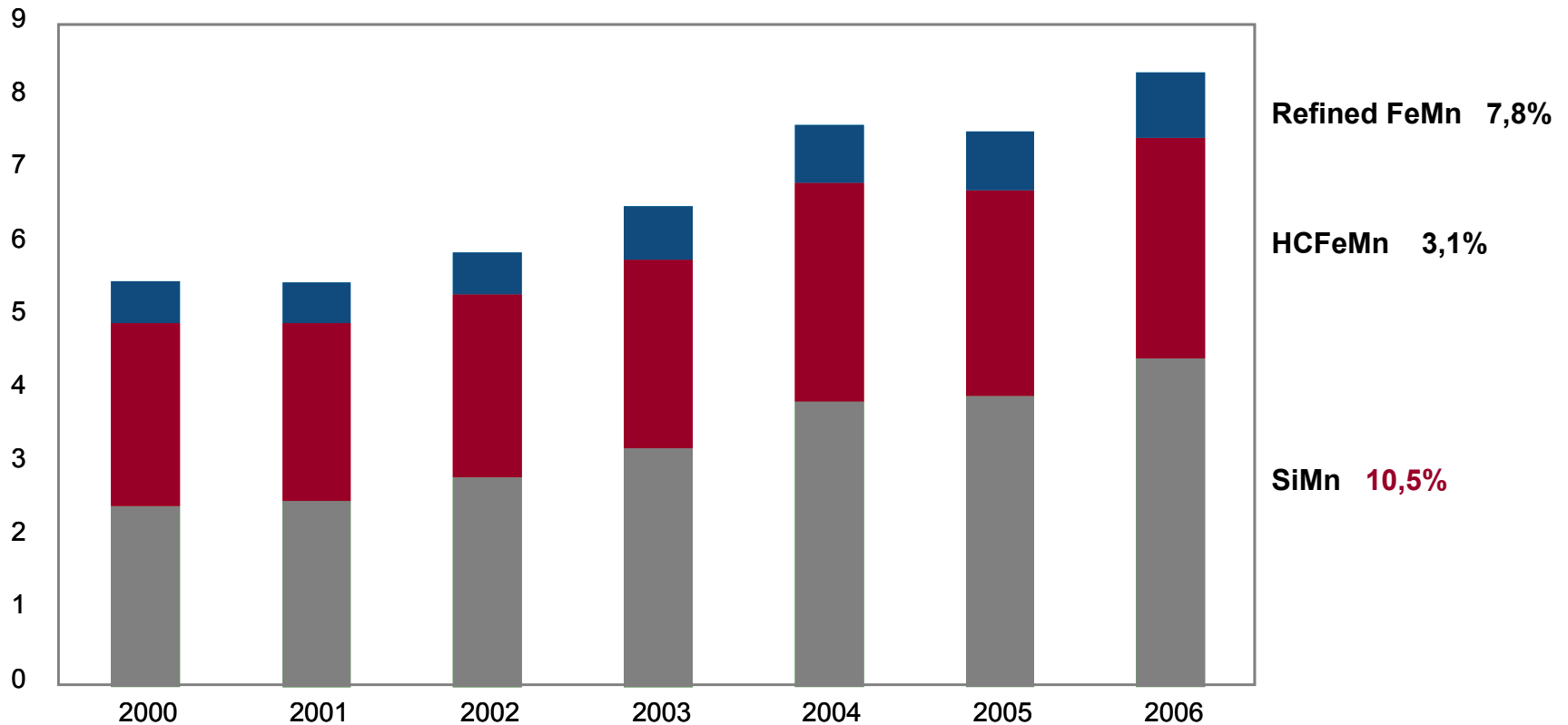


Logistics cost increases and competition from other bulk commodities is major factor for industry



Low barriers to entry for SiMn requires careful capacity management for price/volume trade-off

Mn alloys production evolution (Mt Mn content)

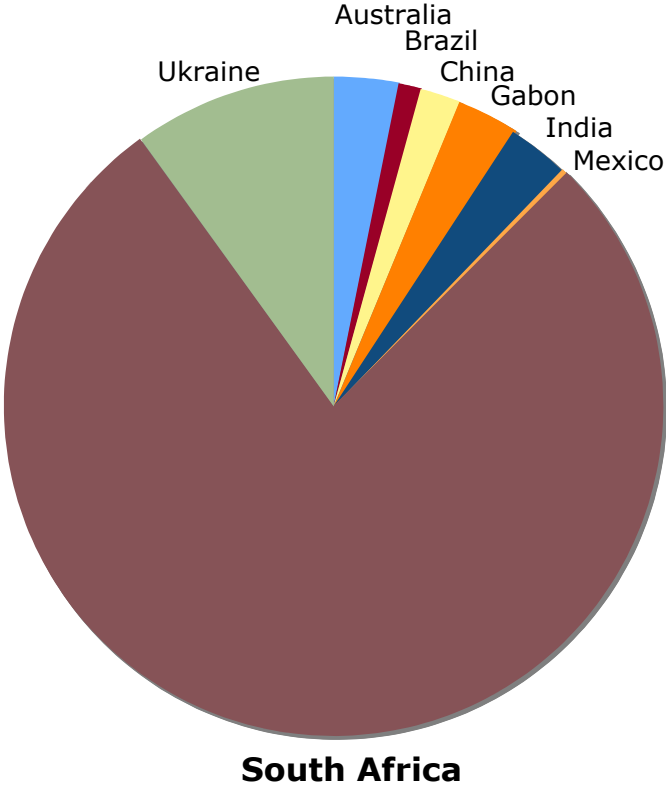


Source : International Manganese Institute , Laplace Conseil analysis



Vast Mn reserves, unequally spread, will need careful planning to accommodate future demand

Known Manganese reserve base (Mn content)
100% = 5 200 Mt



Measurement of reserves as stated by individual country; methodology not fully comparable

Source USGS mineral survey

Strengthening Marketing and communication could help capture value potential

- Manganese value is mostly captured by steelmaker and end user, not enough by manganese producer.
- Substitution mostly favor Manganese, but awareness could be increased.
- Manganese producers have room to increase value without triggering negative substitution
- Focus on specific segments : HSLA, Hadfield, SS200 Series,...



Thank you for your attention

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