

# An overview of the future production and demand of ferronickel



## The 2nd Euro Nickel Conference



Robert Cartman – Hatch

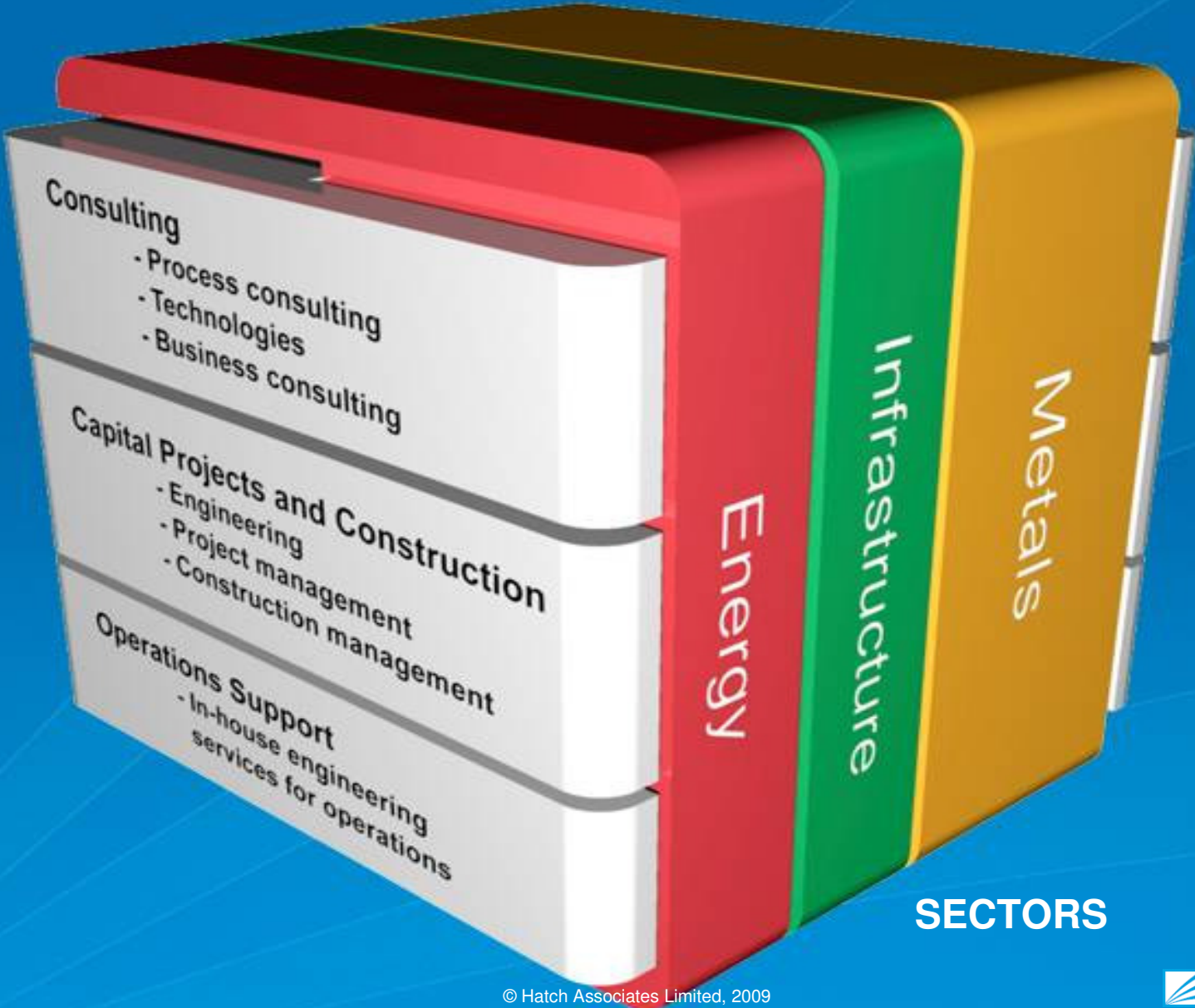
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- **Hatch**
- Overview of FeNi market
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- Conclusions

HATCH  
Hatch services and sectors

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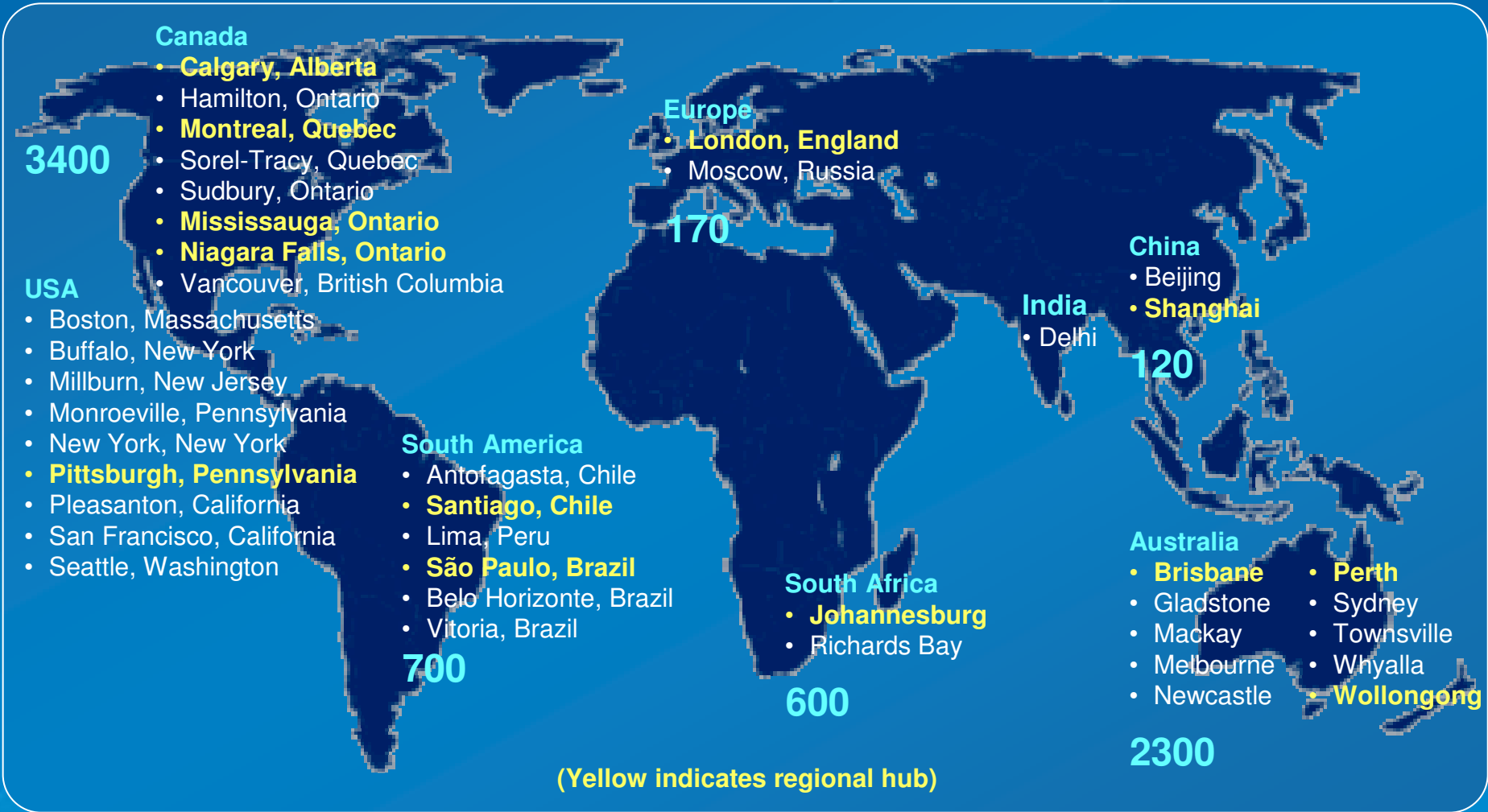


SECTORS

HATCH

# Global reach and resources

8000 people



## Hatch counts many of the world's major mining and steelmaking companies and financial institutions among its core client base

### Mining

Alcan  
Alcoa  
Anglo American  
Assmang  
BHP Billiton  
De Beers  
ENRC  
Falconbridge  
Impala Platinum  
Lonmin  
Newmont Mining  
Norilsk  
Placer Dome  
QIT  
Rio Tinto  
SUAL  
Vale Inco  
Xstrata

### Steel

ArcelorMittal  
BlueScope Steel  
Celsa  
CMC  
Tata/Corus Group  
Evraz Group  
Gerdau Group  
Mechel  
Metalloinvest  
Metinvest  
Nucor  
POSCO  
Ruukki  
Severstal  
Shougang  
TMK  
U.S. Steel  
voestalpine

### Financial institutions

ADB  
Bank of America  
Bear Stearns  
CIBC  
Citibank  
Commonwealth Bank  
Credit Lyonnais  
CSFB  
Deutsche Bank  
EBRD  
HSBC  
IFC  
JP Morgan Chase  
Mellon Bank  
NM Rothschild & Sons  
RBS  
UBS Warburg  
World Bank

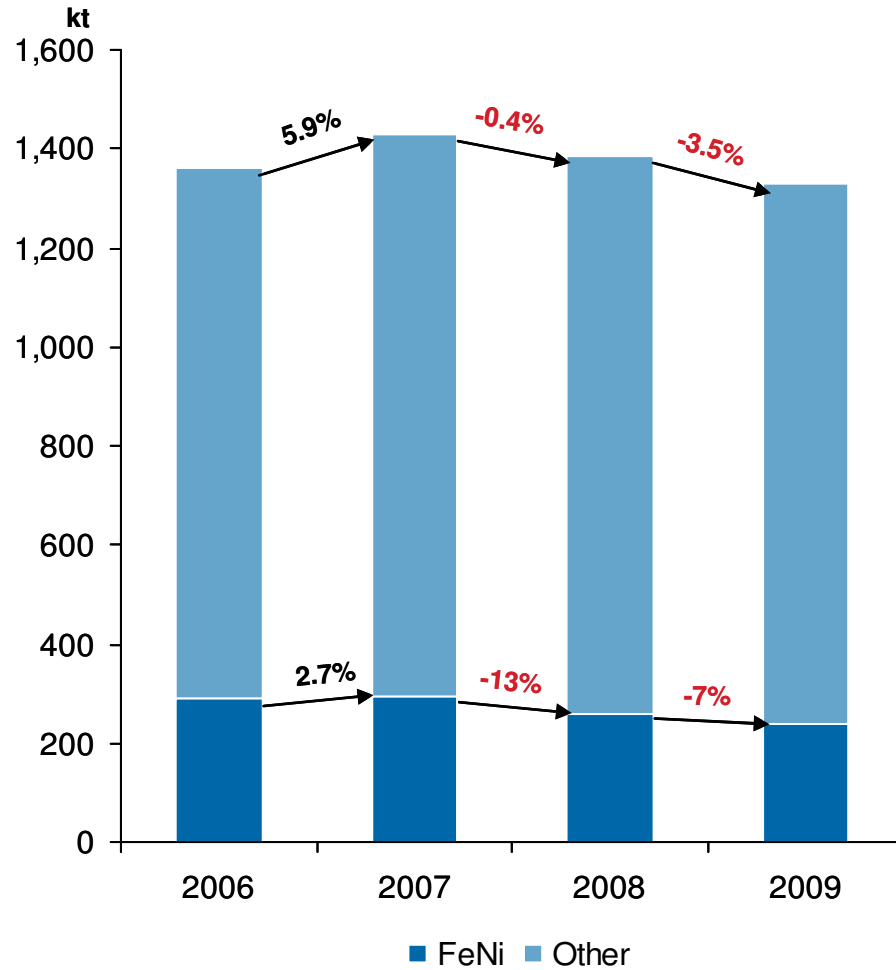
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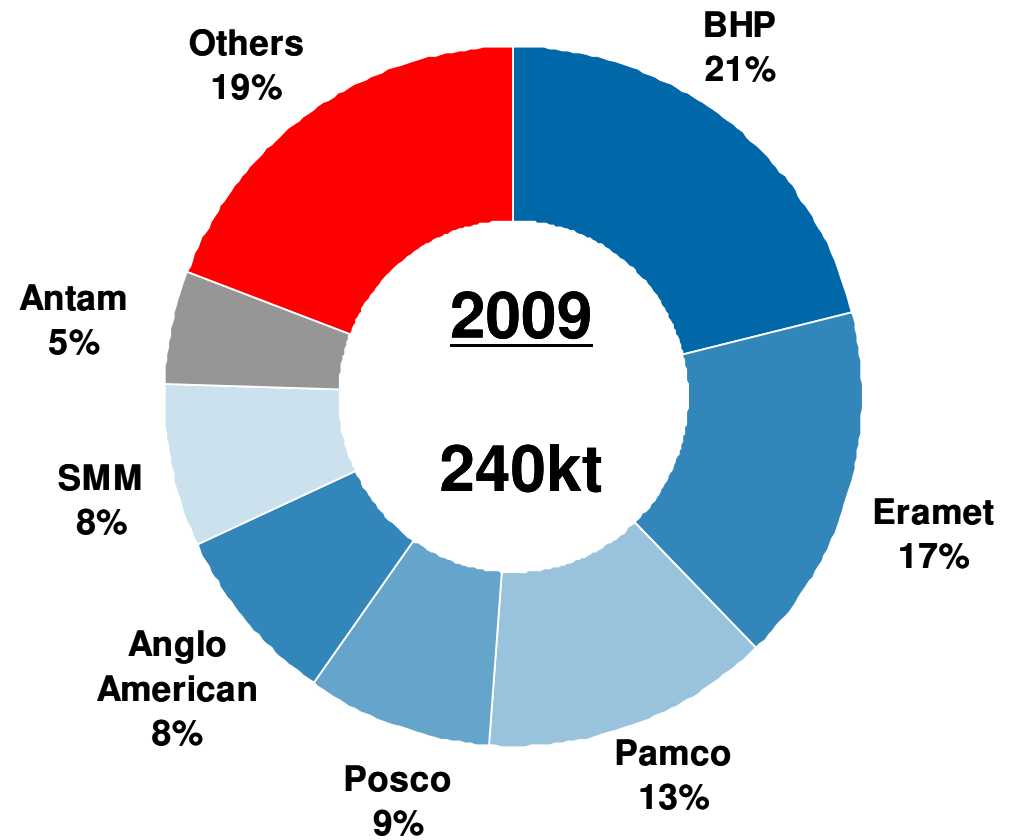
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# Annual FeNi production is typically ~250kt, with BHP and Eramet the largest producers in 2009

Global primary Ni production by type



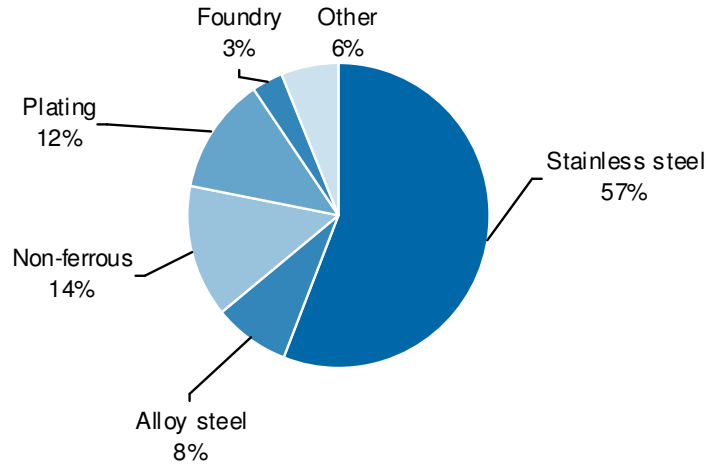
Global FeNi production by producer



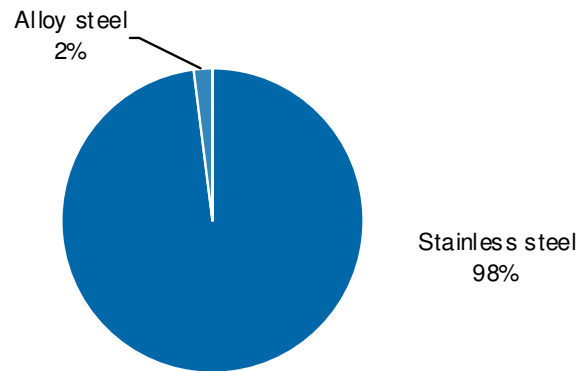
Source: ISSF, Hatch

# Ni demand is dominated by stainless steel production, particularly in the case of FeNi. Stainless steel production has fallen since 2006

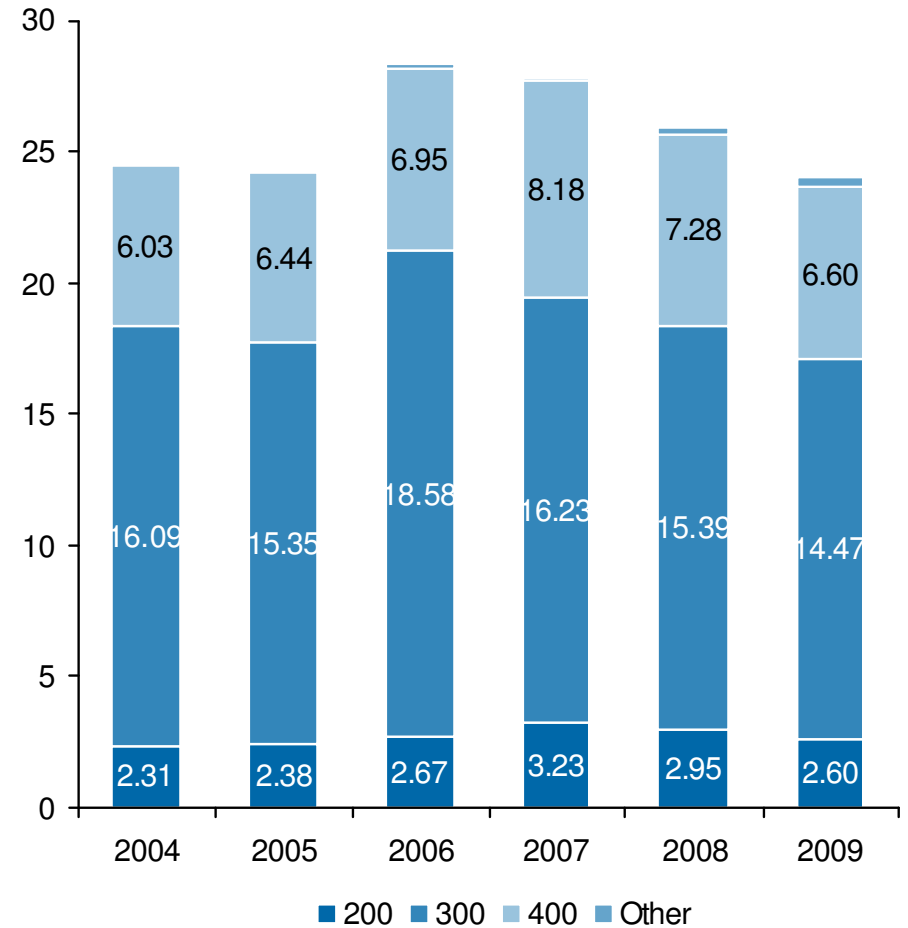
**Ni demand by end-use**



**FeNi demand by end-use**



**Global stainless steel production by series (2004-09)**



Source: ISSF, Hatch

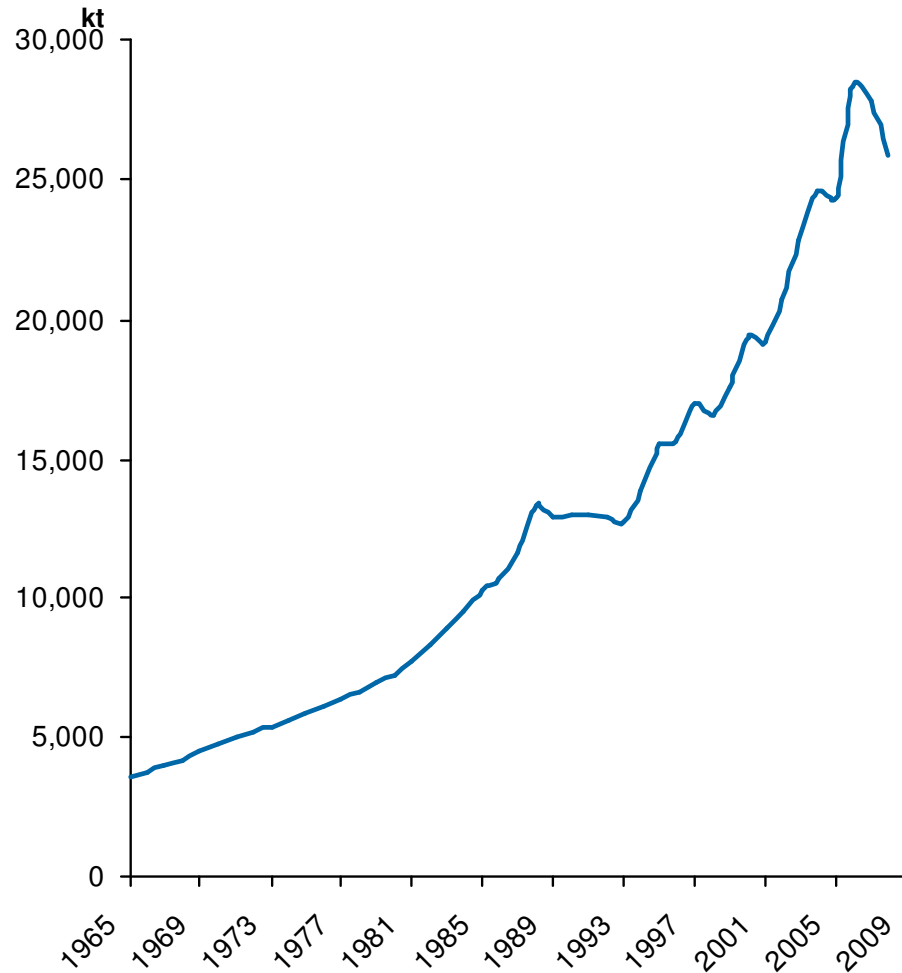
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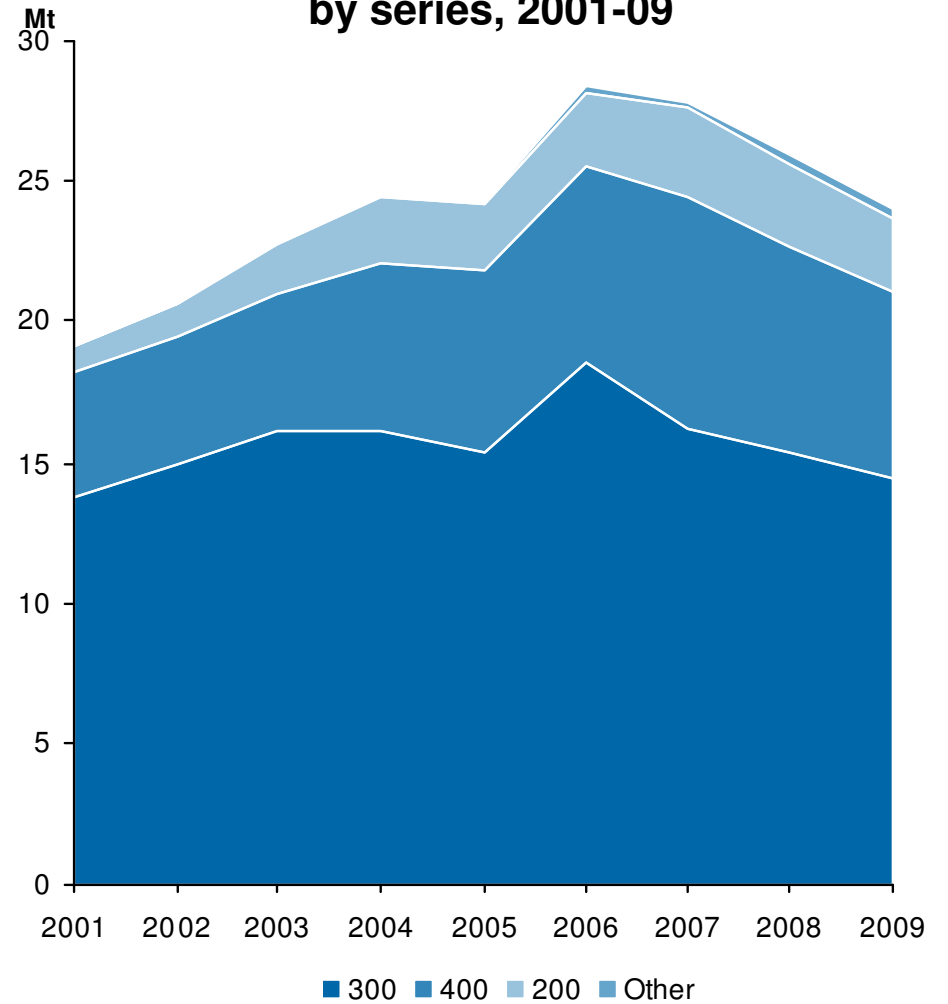
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# Long-term stainless steel production has risen at a CAGR of 4.5% since 1965

### Stainless steel production



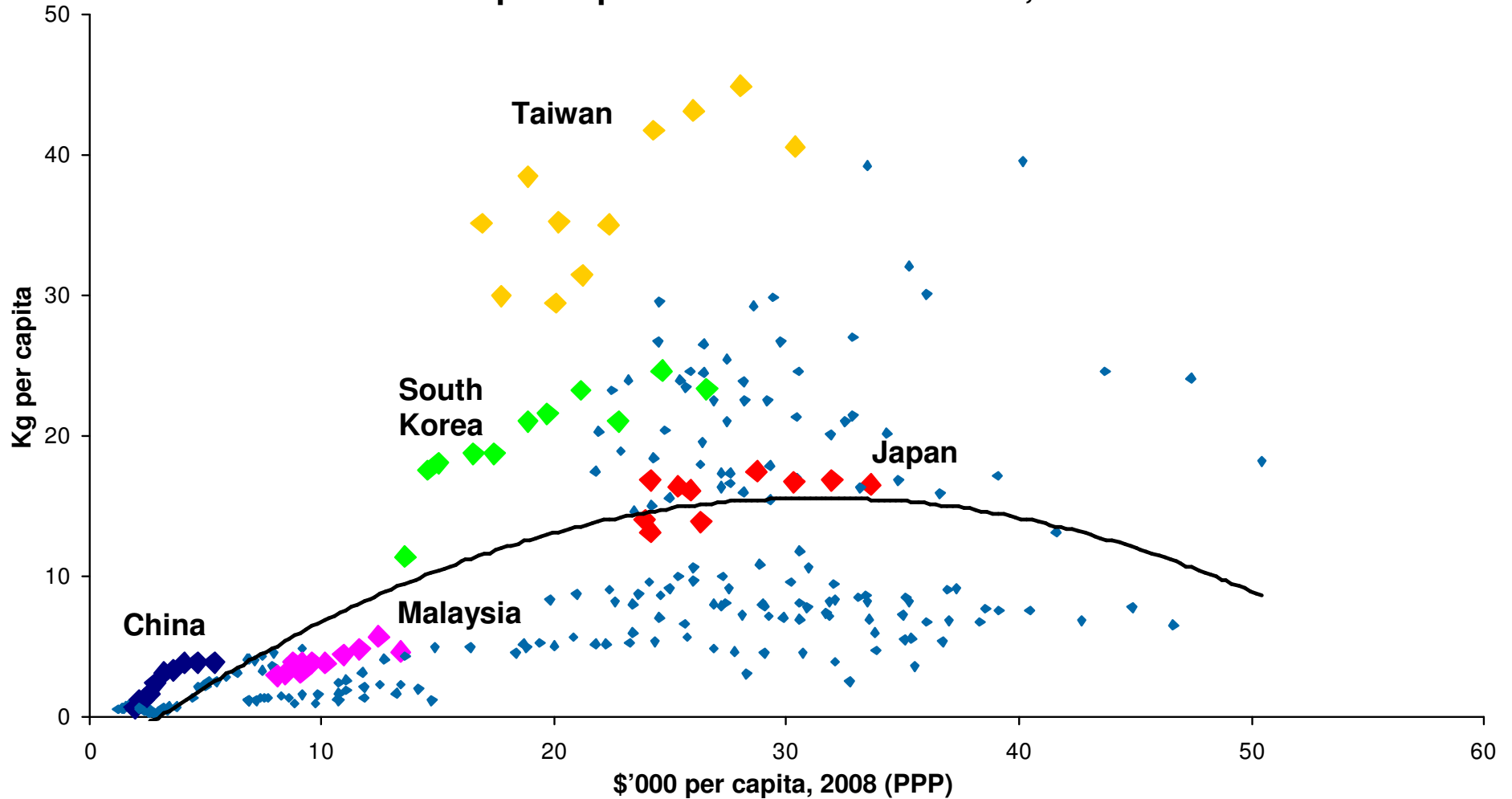
### Stainless steel production by series, 2001-09



Source: Vale, ISSF, Hatch

# Stainless steel production is forecast to continue rising in order to meet the expected growth in consumption by the developing world

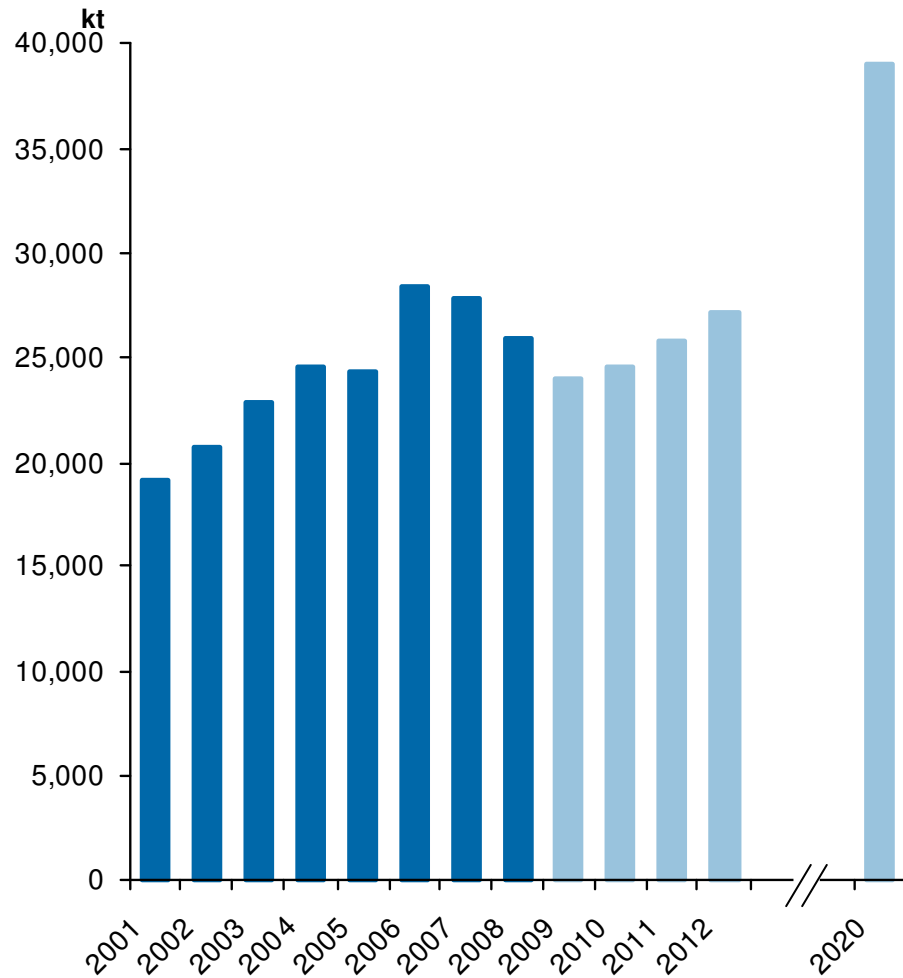
### Per capita consumption of stainless steel vs income per capita for selected countries, 1997-2008



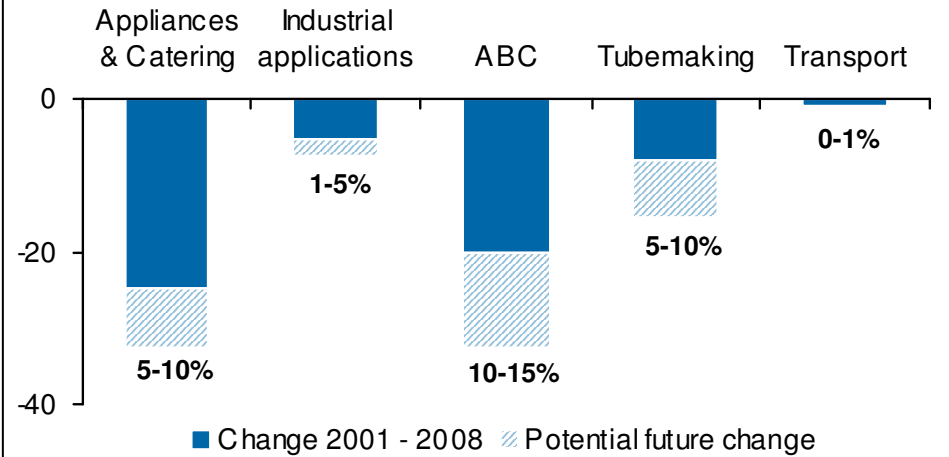
Source: Vale, IMF, Hatch

# Long-term stainless steel production will move toward 40Mt by 2020. Further substitution is possible but most of this has already taken place

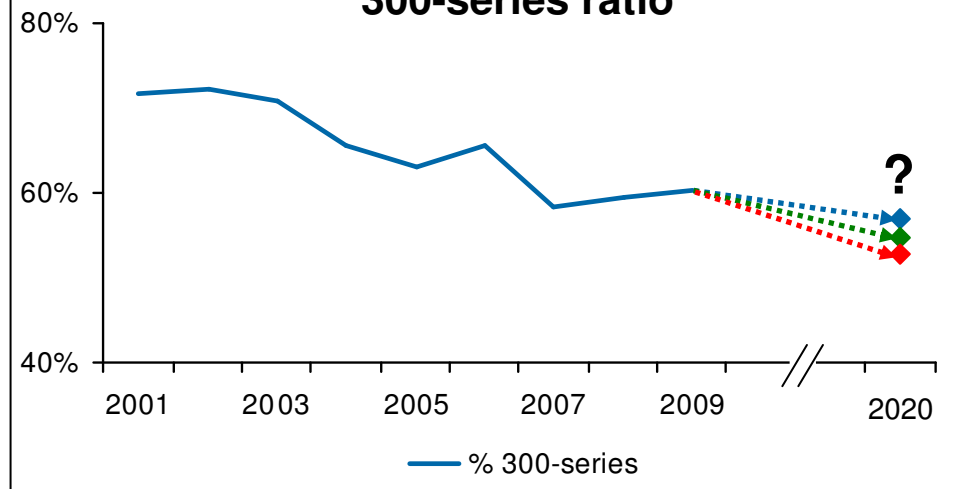
**Stainless steel production**



**Percentage point shift from 300-series**



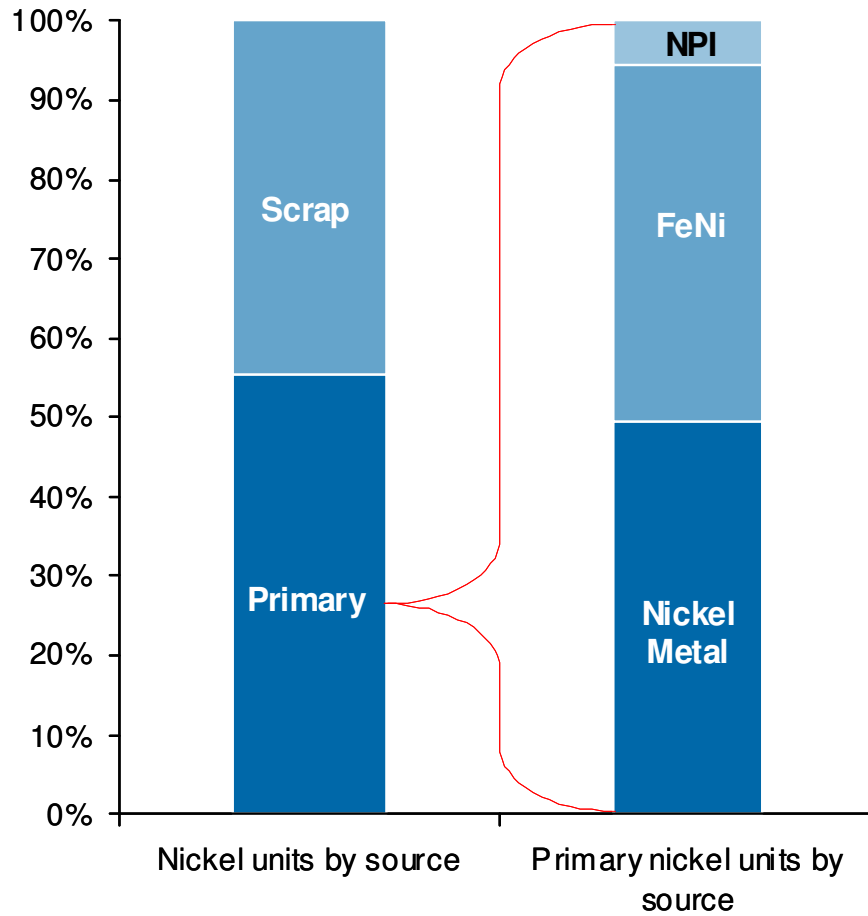
**300-series ratio**



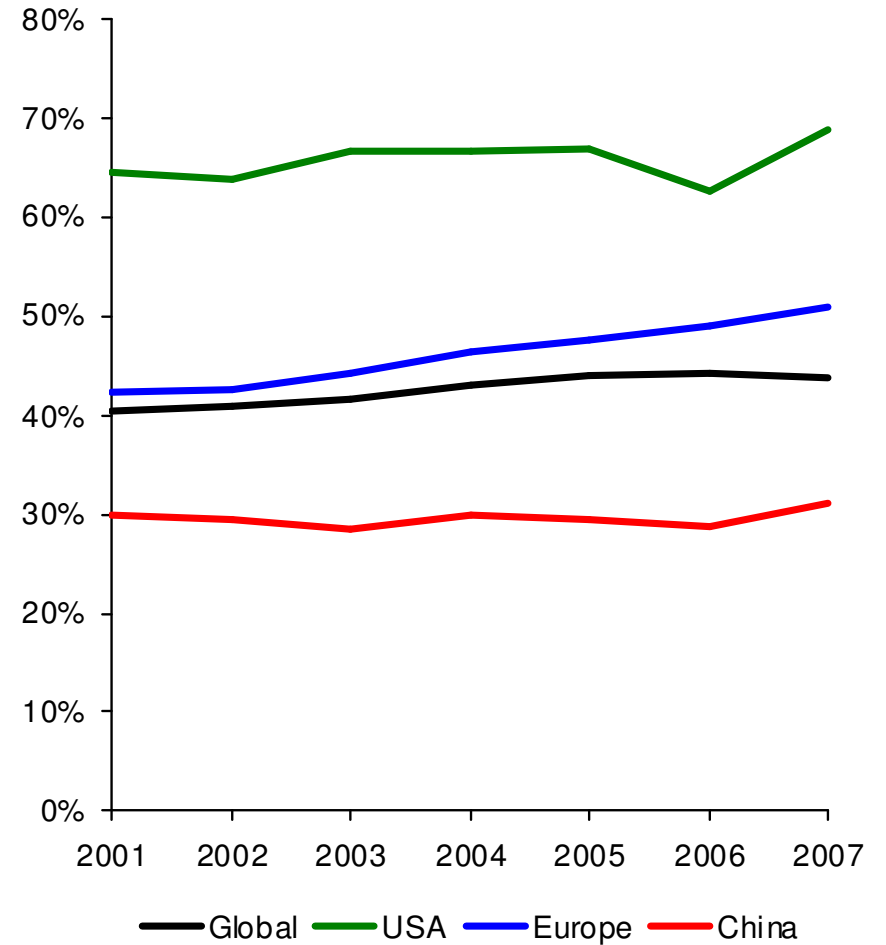
Source: ISSF, Hatch

# FeNi faces substitution threats from other refined nickel products and secondary sources of nickel i.e. scrap

**Breakdown of nickel consumption by stainless steel mills**



**Breakdown of scrap ratios by regions**



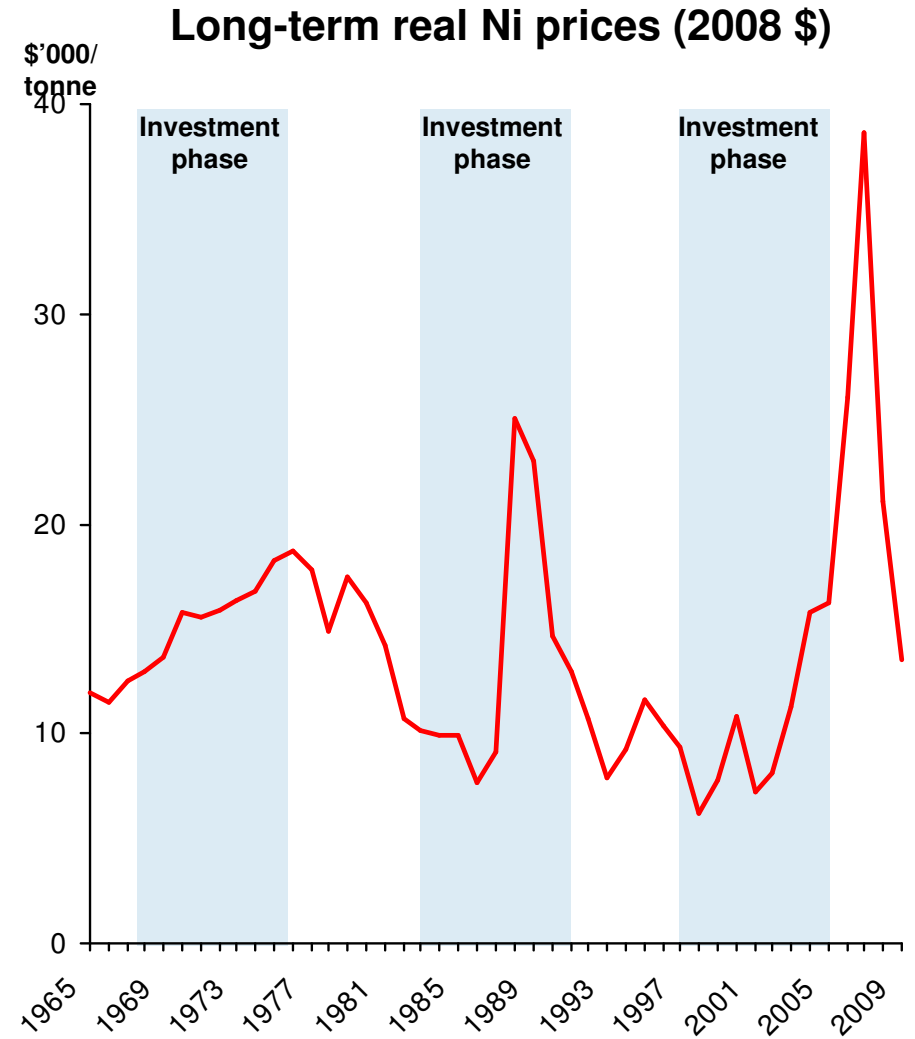
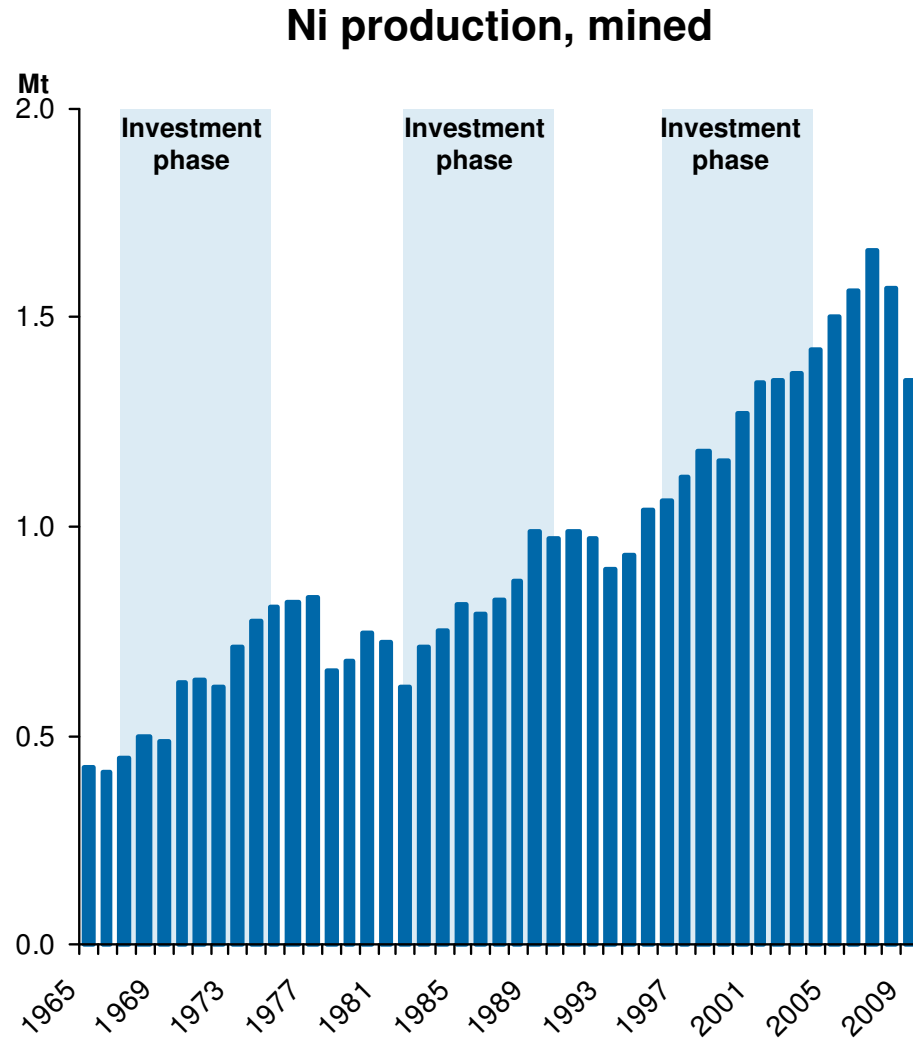
Source: ISSF, Hatch

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# Long-term Ni supply fluctuates between waves of investment, followed by exploitation



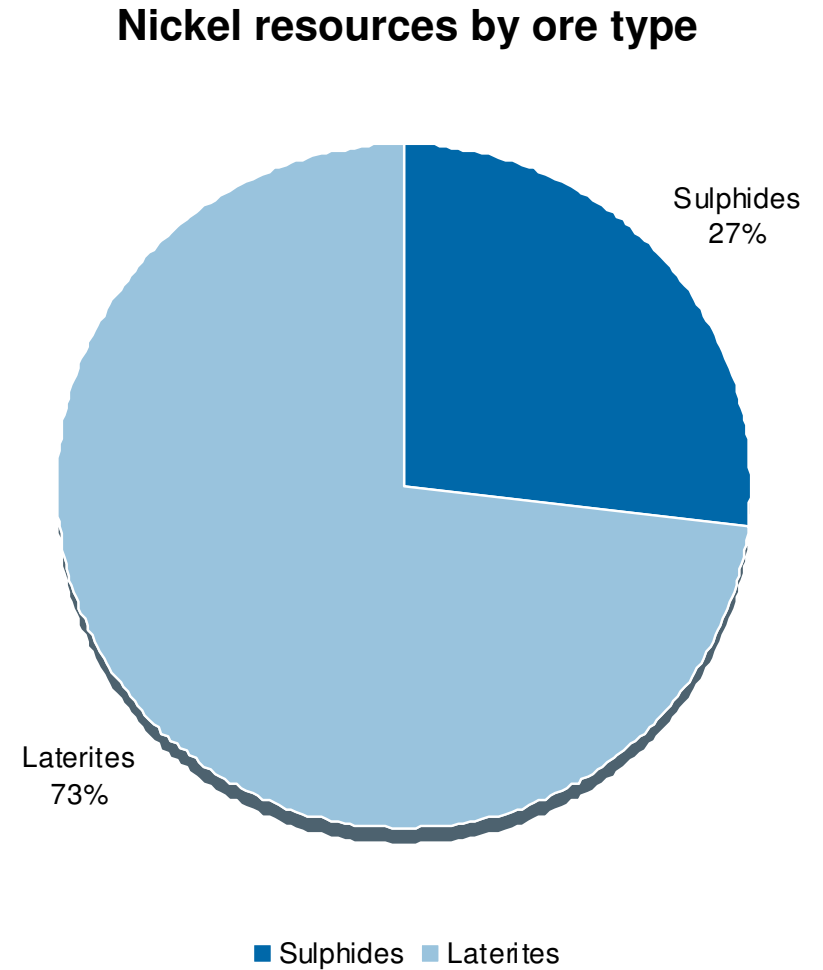
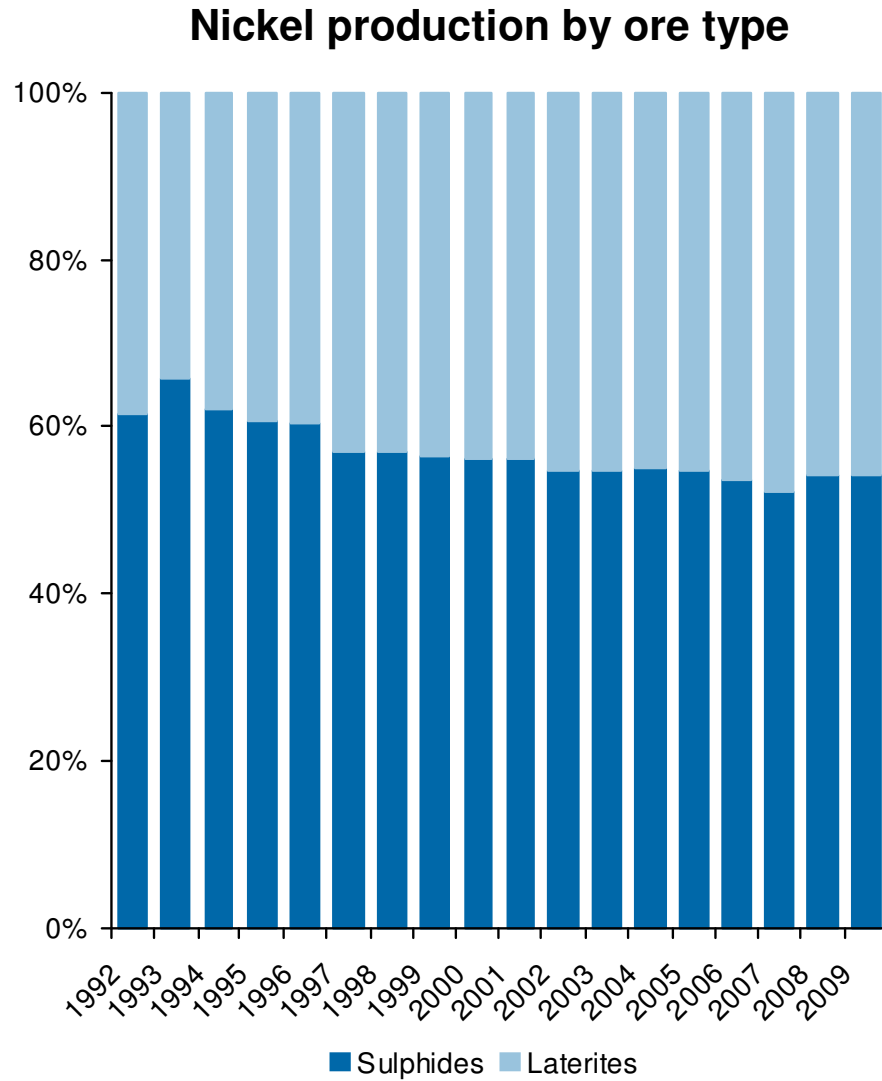
Source: INSG, USGS, LME, Hatch

## The next wave of investment could add another ~500kt of capacity

	Ore type and process	Capacity	2010	2011	2012	2013+
<b>Ambatovy</b>	Laterite – HPAL	60kt		→	→	→
<b>Barro Alto</b>	Laterite – RKEF	36kt		→	→	→
<b>Eagle (?)</b>	Sulphide	10kt (?)			→	→
<b>Fenix (?)</b>	Laterite – RKEF	23kt				→
<b>Gladstone (?)</b>	Laterite – HPAL	63kt				→
<b>Goro</b>	Laterite – HPAL	60kt	→	→	→	→
<b>Koniambo</b>	Laterite – RKEF	60kt			→	→
<b>Nonoc (?)</b>	Laterite - HPAL	40kt (?)			→	→
<b>Nunavik</b>	Sulphide	12kt		→	→	→
<b>Onca Puma</b>	Laterite – RKEF	52kt		→	→	→
<b>Ramu</b>	Laterite – HPAL	31kt	→	→	→	→
<b>Shevchenko</b>	Laterite – Heap	22kt			→	→
<b>Tagaung Taung</b>	Laterite – RKEF	23kt		→	→	→
<b>Vermelho (?)</b>	Laterite – HPAL	46kt				→
<b>Weda Bay (?)</b>	Laterite – HPAL	60kt				→

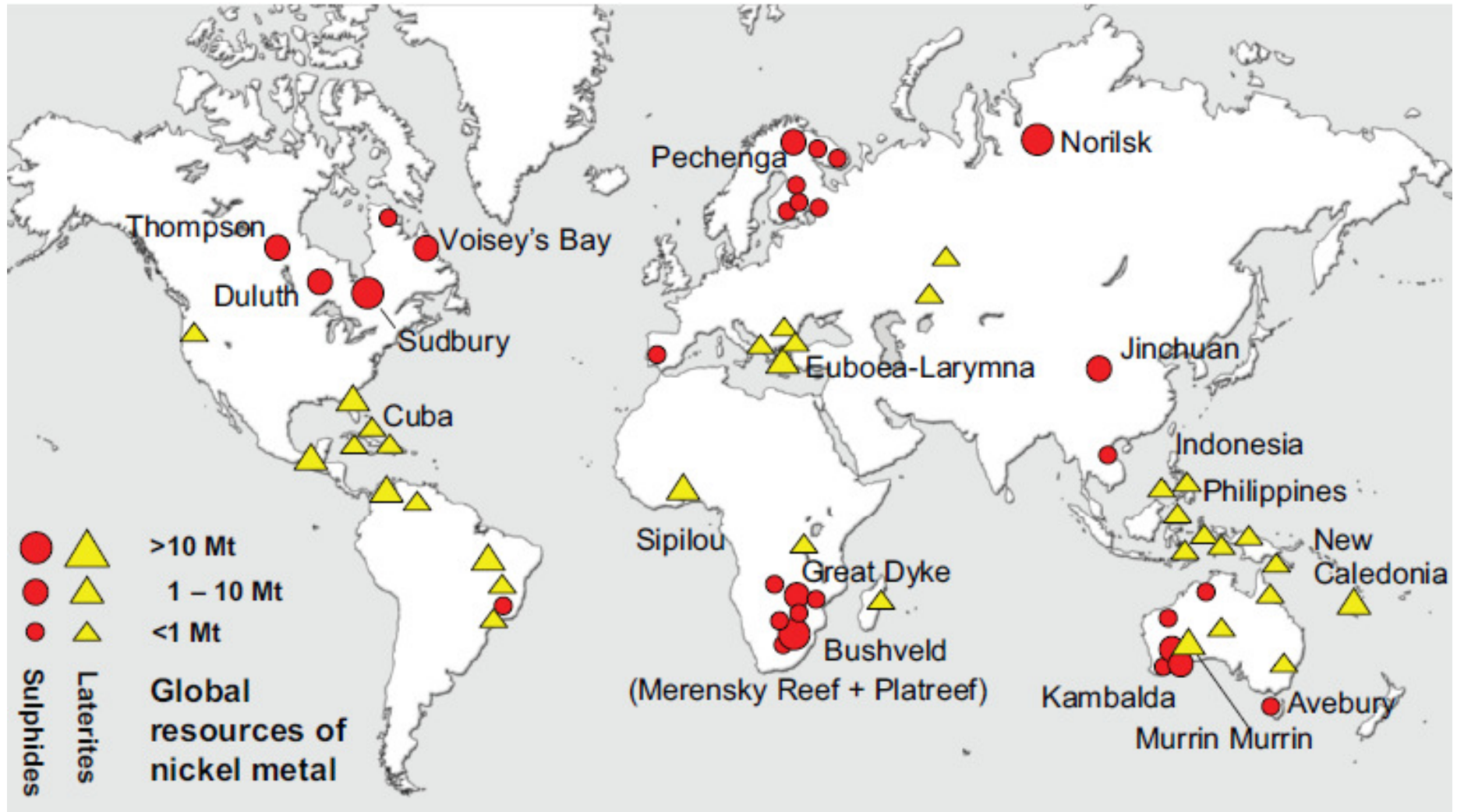
Source: Company reports, Hatch

# Nickel is increasingly being extracted from lateritic ores



Source: Hatch

# Laterite resources are mainly found in countries that require large spending on infrastructure



# Lateritic ores need to be subdivided into limonites or saprolites in order to understand the respective mining and processing costs

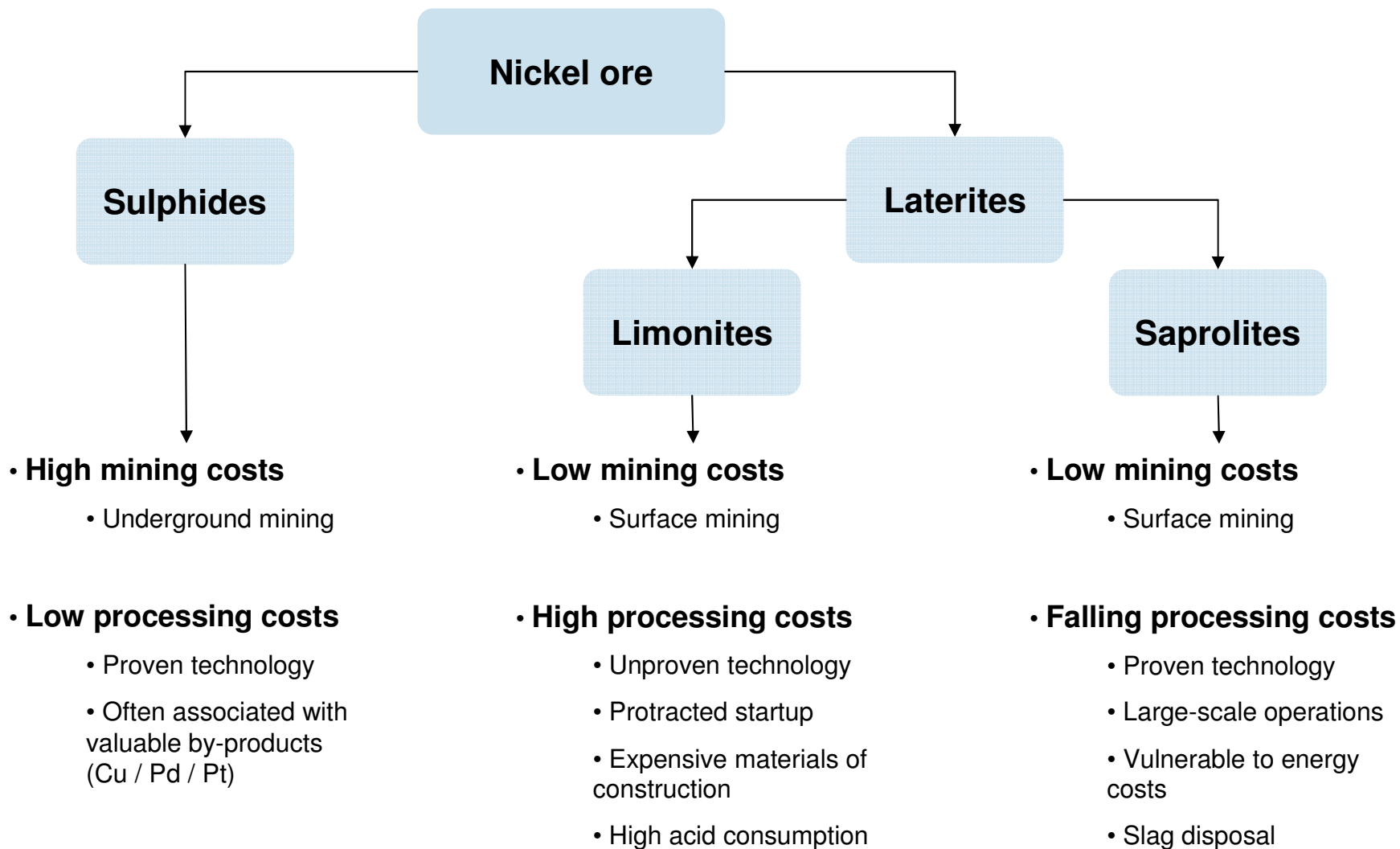
Depth		% content			
		Ni	Co	Fe	MgO
5.5m	Limonite	0.8 – 1.5	0.1 – 0.2	40 – 50	0.5 – 5
	Transition zone	1.5 – 4	0.02 – 0.1	25 – 40	5 – 15
10m	Saprolite	1.8 – 3	0.02 – 0.1	10 – 25	15 – 35
	Bedrock	0.3	0.01	5	35 – 45

**Oxides**  
 High Fe, low MgO, low SiO<sub>2</sub>  
 Processing – Dependent on presence of clay minerals. Typically hydrometallurgy (HPAL, Heap, Caron)

**Silicates**  
 Low Fe, high MgO, high SiO<sub>2</sub>  
 Processing – Pyrometallurgy. End product (FeNi, matte) dependent on mineralogy

Source: Mick Elias, Hatch

# Summary of nickel ores and their pros and cons



# Mining and processing costs will depend on a variety of factors. It is too simplistic to categorise as laterites vs. sulphides

## Resource

Higher grade = better

>1.5% ≈ saprolite

Saprolite = proven processing technology

Larger size = better  
Lower capex per tonne

## Inputs

Merchant vs. captive

Hydroelectricity vs. fossil fuels

Hydrocarbons

Labour availability / skills

## Project management

Project phasing

Project team continuity

New technologies

## Ore mineralogy

Content of clay minerals  
Lower = better

Magnesium content  
Lower = less acid consumption  
in hydrometallurgy

SiO<sub>2</sub> / MgO ratio  
Impacts on choice of end-product

## Infrastructure

Power / Acid / Lime plants

Transportation  
Road / Sea / Air

Conveyors / Pipelines

Difficulty of terrain / climate

Accommodation

Permits / Compensation

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# Conclusions

## Demand

- Stainless steel production to increase
  - Approaching 40Mt by 2020
  - Production increase will offset effects of substitution
- China/India + other EMs to drive consumption growth
  - Beneficial for local laterite-based suppliers
  - FeNi likely to supersede NPI
- Increase in scrap ratio a key threat
  - Development of collection networks in EMs

## Supply

- New supplies to arrive from lateritic ores
  - Not just FeNi though
  - FeNi to account for 20-25% of refined Ni production
    - Compared with 15-20% at present
- Other things being equal, production costs will rise
  - Increased spend on infrastructure
  - Unproven technologies
- Technological advance likely to minimise LT real price rises

## Your contacts for further information

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