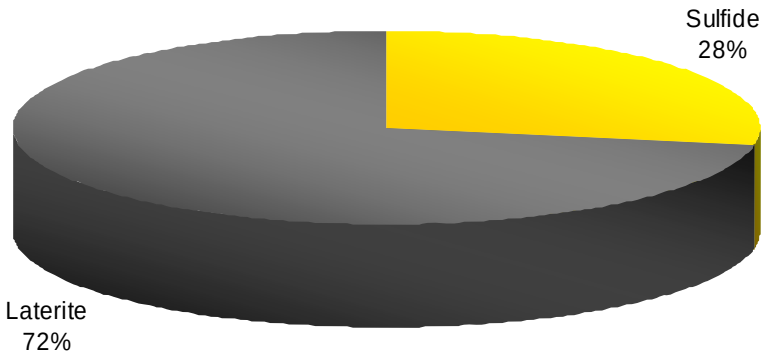
Ferro-nickel / NPI Production from Laterite Nickel Ore in China

Jiang Xinfang– Tsingshan Holding Group

1. Nickel Ore Importation in China

World Land Based Nickel Resource

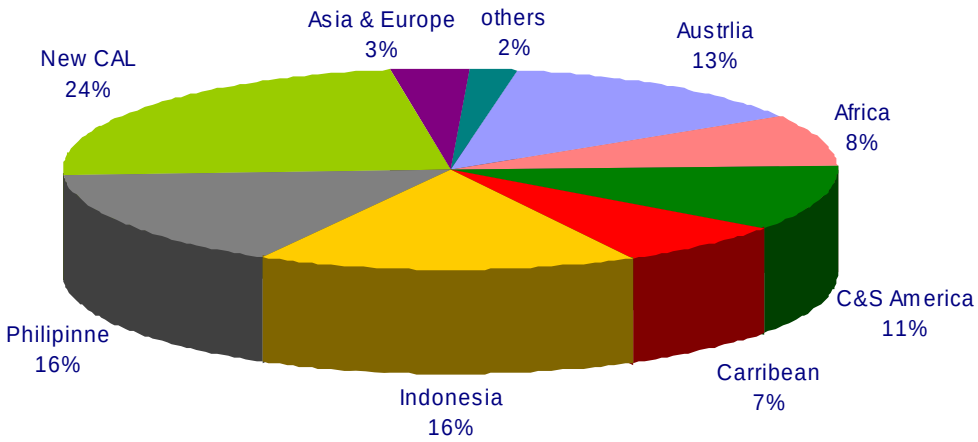


World Laterite Nickel Ore Resource

	Resource (M Ton)	Ni Content %	Ni MT	% of total
Sulfide	10,500	0.58	62	27.8
Laterite	12,600	1.28	161	72.2
Total	23,100	0.97%	223	100

With Vast deposit, Laterite nickel ore will be a promising and predominant resource of nickel in future;

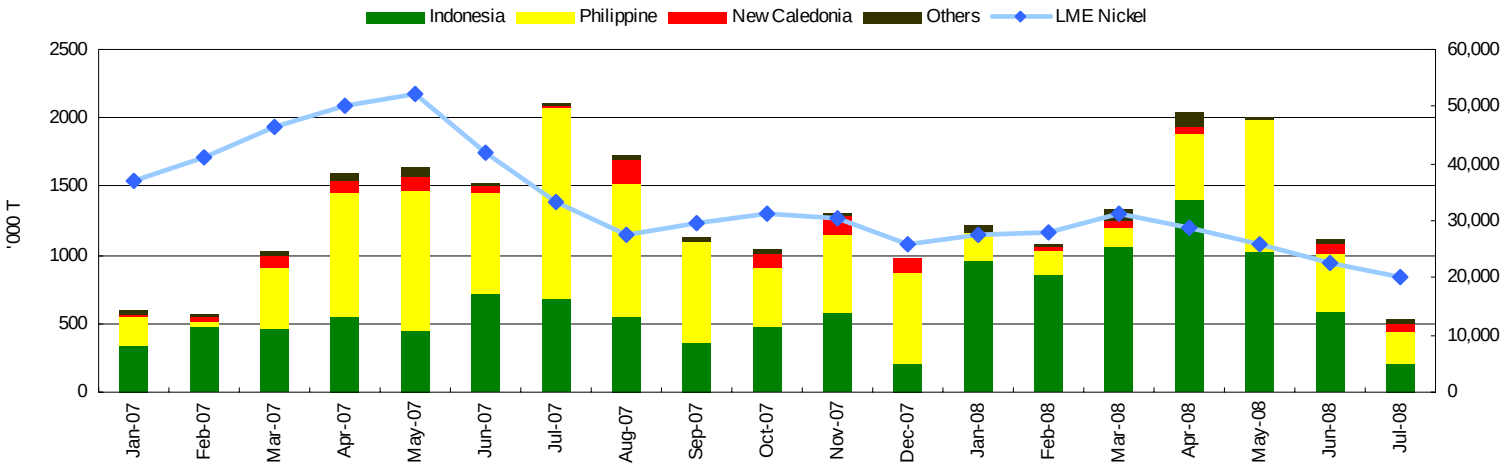
World Nickel Laterite Resource



Laterite Nickel Ore Distribution

Laterite nickel ore is mainly distributed in countries close to equator, as Philippine, Indonesia, New CAL, etc. which are also close to China.

China Nickel Ore Import Quantity



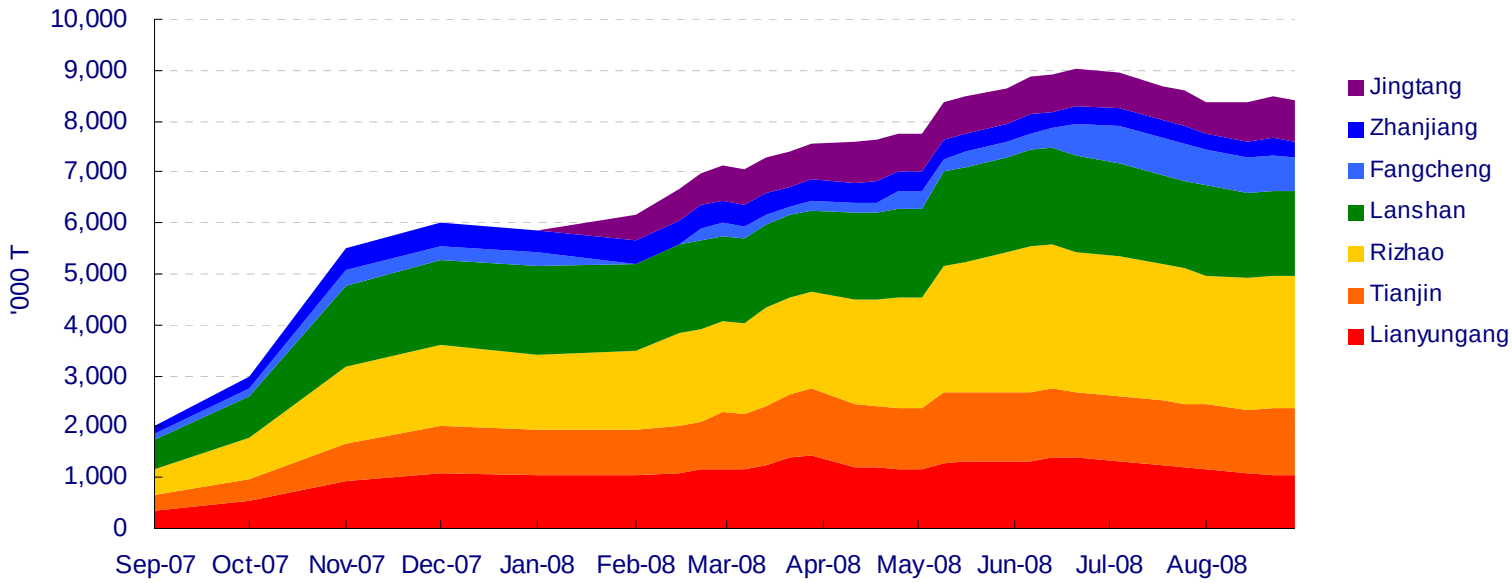
Laterite Nickel Ore Monthly Import Quantity & LME Nickel

Nickel ore imported in China is mainly from Indonesia and Philippine. Indonesia usually provide higher nickel grade, with nickel content over 1.6%, Philippine mostly supply lower grade , with nickel content less than 1.5%.

Nickel ore importation is mainly influenced by LME Nickel price. Stimulated by high nickel price and NPI production boom, nickel ore import dramatically increased in 2007 and reached historical peak in July over 2.2M ton/m, and then dropped untill end of 2007. In 2007, total annual importation around 15,610,000ton;

Slight recovery of nickel price in Q1 2008 created high expectation and excessive importation appeared again in Q2 2008; the total importation until July 2008 reached 9,150,000 ton.

Nickel ore stock



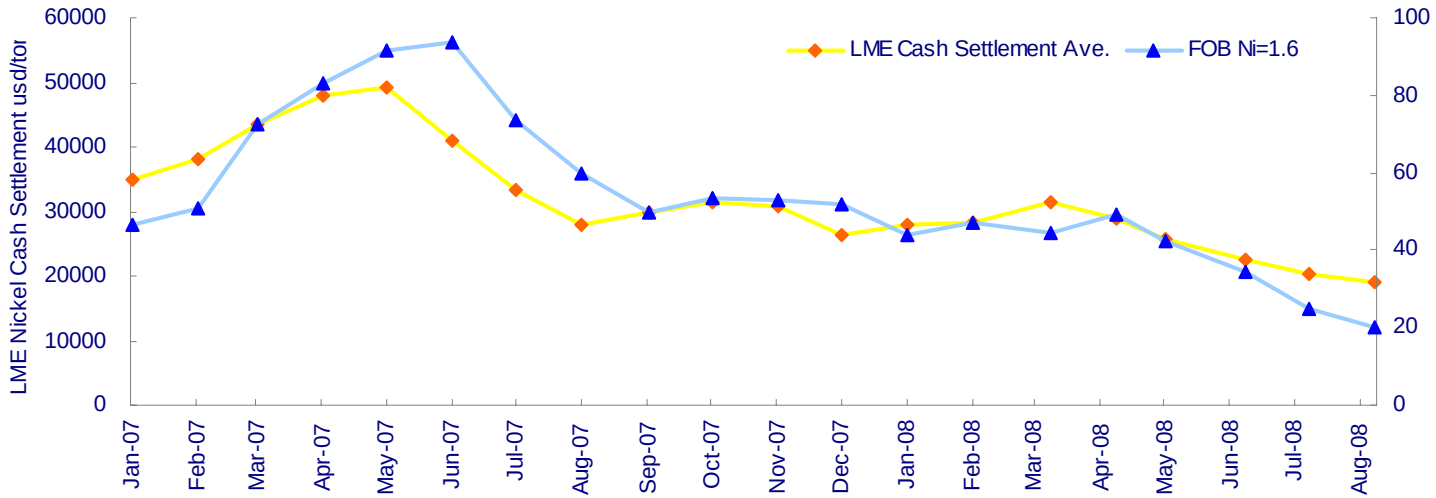
Laterite Nickel Ore Monthly Stock in China Main Ports

Laterite nickel ore are mainly unloaded in Rizhao, Lanshan, Tianjin and Lianyungang, which are close to the NPI production province like Shandong, Henan, Hebei, and Shanxi.

Stock keep increasing at the main ports from Q4 2007, indicating that domestic demand continuously weaken.

Congestion and demurrage during unloading continued from Q2 till now in main ports as Lian Yungang, Rizhao and Lanshan.

Nickel Ore FOB Price & LME

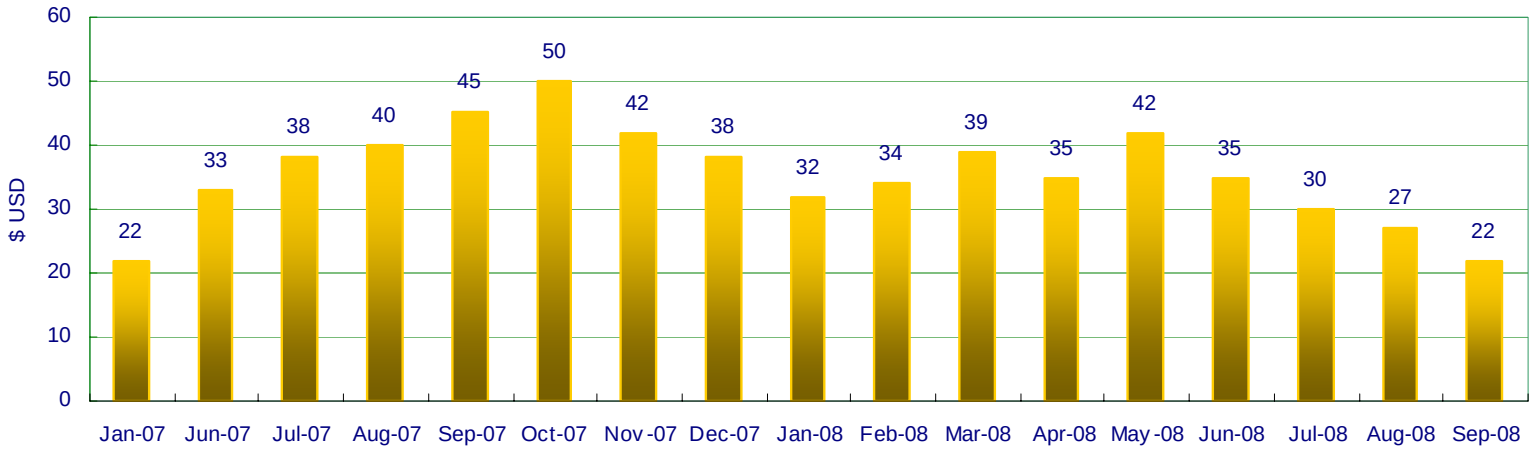


FOB price of Nickel ore: Ni = 1.6%, moisture = 30%

FOB price is normally defined through formula based on LME nickel price, nickel content, moisture and price discount ratio;

FOB price of nickel ore (Ni = 1.6%, Fe < 15%, Moisture < 30%) reached peak at 94 usd/wt in June 2007, and drop down to around 20 usd/ton in August 2008, mainly due to over supply and weak NPI production.

Sea Freight

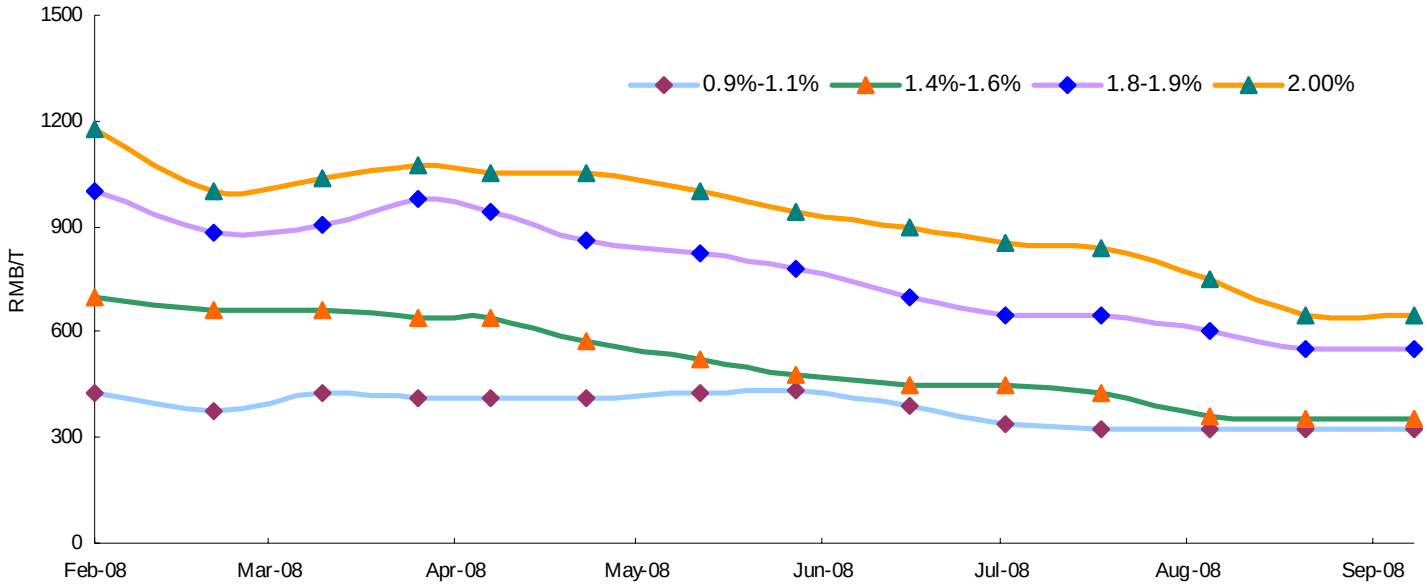


Sea Freight: vessel 50,000 ton, Indonesia to China Main Ports

Besides FOB price, sea freight was another major factor influencing nickel ore market price.

Sea freight of vessels with capacity over 50,000 ton from Indonesia to China main ports reached 50 usd/ton in Oct. 2007, down to 32 usd/ton in Jan. 2008, increased again to 42 usd/ton in May 2008, and back to 22usd/ton, same as the price level in beginning of 2007.

Market Prices of Different Grades

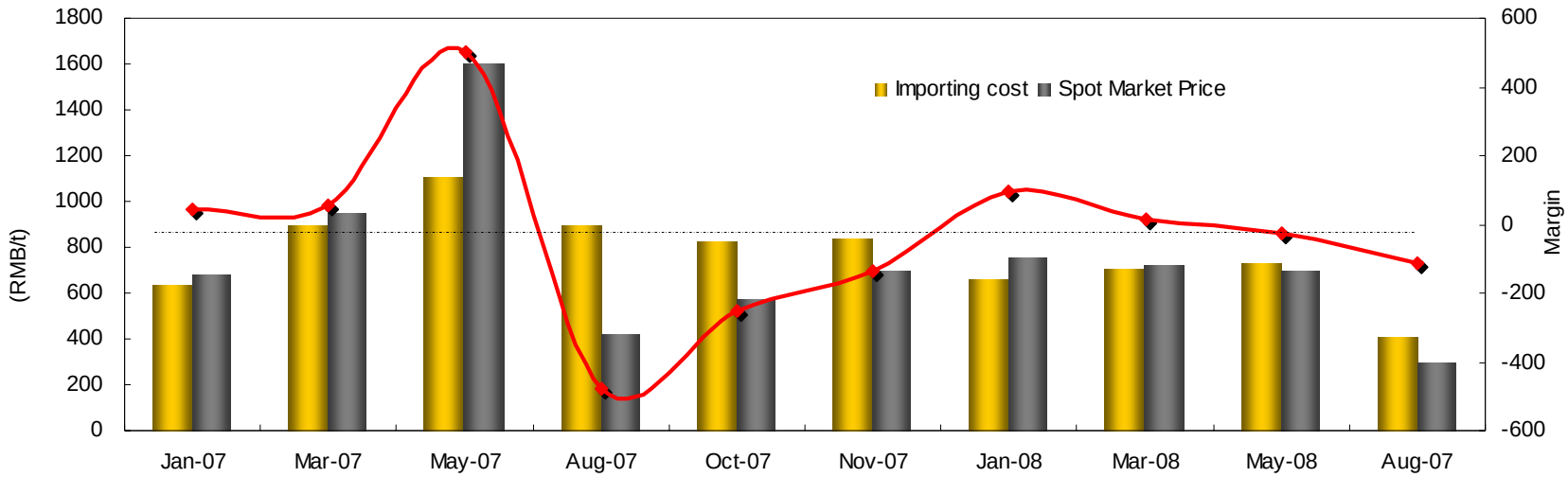


Market Price of Nickel Ore with Different Ni Content

With increasing stockpile, decreasing FOB price and sea freight and weak demand, the market prices of various grades have been decreasing from beginning of 2008.

For low grade with Ni less than 1.1%, market price dropped around 25%; while for other high grades with Ni over 1.4%, market price dropped around 50%.

Importation Cost & Market Price



Import Cost & Market Price of Nickel Ore: Ni = 1.6%, moisture = 30

Importation cost at unloading port = FOB + sea freight + VAT + port charges;

When nickel price skyrocketed in May 2007, spot market price of nickel ore reached historically zenith and unit margin around 500 RMB/Ton; Starting from August until end of 2007, market price stayed lower than importation cost;

Slightly increase of nickel price in Q1 2008 encouraged the production of NPI and stimulated the demand of nickel ore, which warm the nickel ore market and end the loss of nickel ore trader; Following nickel price drop in Q2 and Q3 bellow break-even point of NPI, NPI producers mostly stopped production, nickel ore demand shrink, and market price significantly dropped to level lower than importation cost again.

Outlook of Nickel Ore Price in 2008

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- **Over supply of nickel ore:**
  - Nickel mines in medium & small scales started production in 2008;
  - Fierce competitions from various nickel ore miners queeze the mining margin and result in lower FOB;
  - Higher stock level to be maintained in China main ports, over 7,000,000 ton till end of 2008;

- **Restrained Demand of nickel ore:**

  Even major local stainless steel producers overcome technical problems of NPI application and started to accept NPI in 2008, but the production of NPI is limited due to
  - stainless steel production cut esp. 300 series from major stainless steel producers will continue from Q2 till end of 2008;
  - most of blast furnaces were shut down due to high production cost and low nickel price;
  - electric furnaces mostly turned to the production of other Ferro-alloys esp. Fe-Cr, Fe-Mn etc.;

- **In conclusion,**
  nickel ore will be in oversupply in 2008, and market price will be kept in low level close to importation cost.

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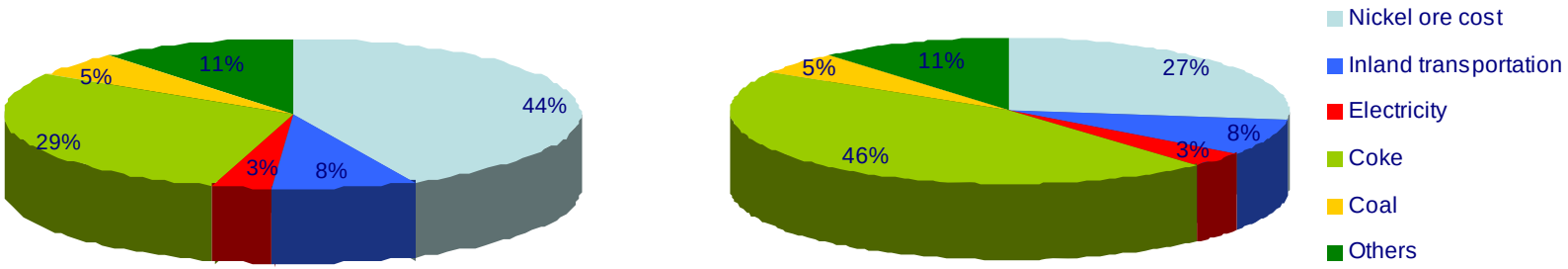
2. NPI Production in China

NPI Cost Structure - BF

Preconditions:

1) Ni % in ore = 1.6%; Ni % in NPI = 5%; Inland Transportation = 150 RMB/WT;
2) January 2008: Ni ore market price = 650 RMB/WT, Coke market price = 2050 RMB/KWH
4) August 2008: Ni ore market price = 400 RMB/WT, Coke market price = 2300 RMB/KWH



Cost structure of NPI Production in China

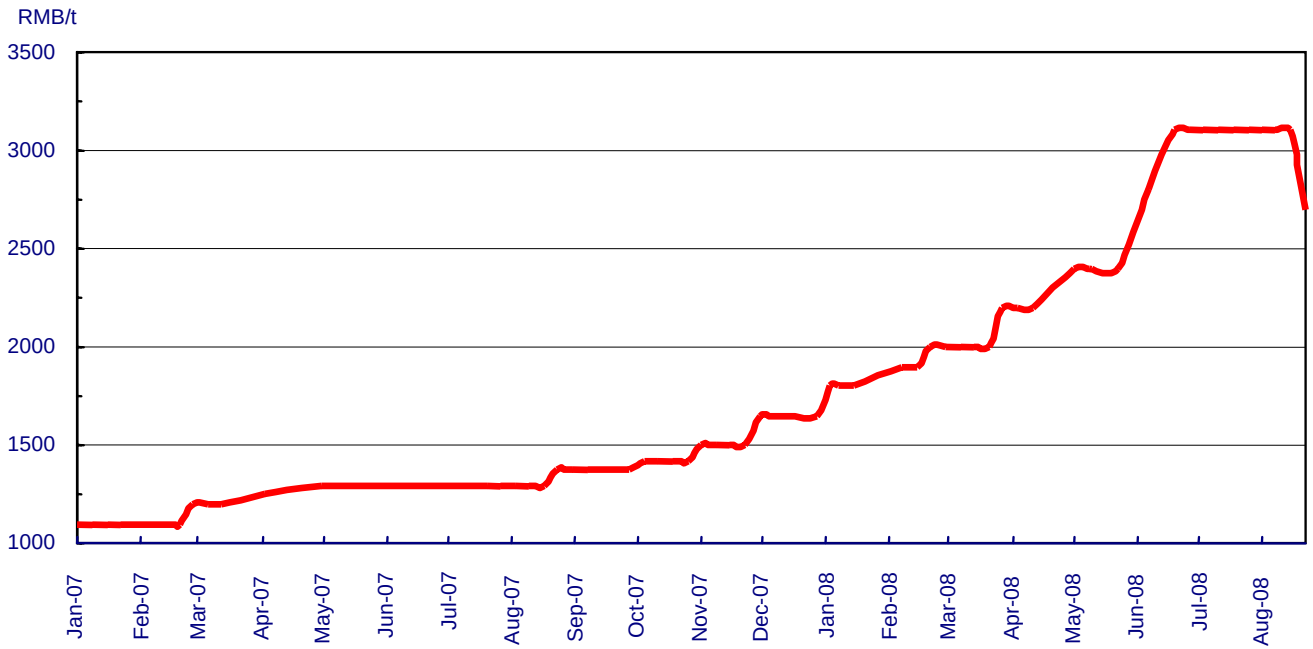
Nickel ore, coke and electricity are main factors influencing NPI production cost.

In January, nickel ore account for 44% of total production cost of NPI, while coke for 29%;

In August, with surging price of coke and decreasing price of nickel ore, coke account for 46% of total cost of NPI, and ore account for 27%;

In general, even nickel ore price dropped greatly, but due to coke price dramatically increase, NPI total production cost stay in relatively same level from January to August 2008.

Market Price of Coke



Market Price of Coke in Shandong Province: Ash < 12.5%, S <0.8%

From beginning of 2007, average coke prices have been tripled until July 2008, which contributes a dramatic increase in nickel pig iron production costs.

Due to production cut of NPI and pig iron, coke price started to decrease in August 2008.

NPI Cost Structure – Existing EF

Preconditions:

1) Ni % in ore = 1.8%; moisture = 30%, Ni % in NPI = 10%;
2) Nickel ore price (Ni % = 1.8%) = 550 RMB/WT; Inland transportation cost = 250 RMB/WT
3) Electricity price = 0.5 RMB/KWH

Cost structure of NPI Production by electric furnace in China

Compared with major electric furnaces for Fe-Ni production in the world, the existing electric furnaces in China are in small capacity and have

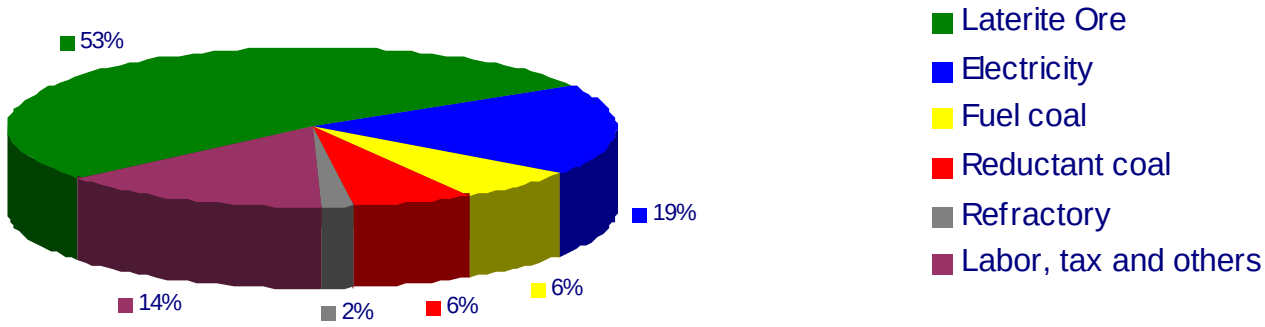
- no rotary kiln - higher electricity consumption;
- mostly designed for other Ferro-alloy – lower production, lower nickel recovery;
- short life time of refractory lining – higher maintenance cost, lower production time;

Compared with blast furnace, the production cost of NPI from existing electric furnaces in China is slightly cheaper than blast furnace.

Cost Structure – New Project EF

Preconditions:

1) Ni % in ore = 1.8%; moisture = 30%, Ni % in NPI = 10%;
2) Nickel ore price (Ni % = 1.5%) = 550 RMB/WT
3) Electricity price = 0.50 RMB/KWH



Cost structure of NPI New Projects in China

Compared to blast furnaces and existing electric furnaces, electric furnaces of newly established projects are cost saving and environmental-friendly, with

- rotary kiln – lower electricity consumption;
- dedicatedly designed and big capacity - higher production & nickel recovery, lower maintenance;
- close to sea ports – no inland transportation cost;

Except sea freight as additional cost, newly built electric furnaces in China have no disadvantages comparing with other Fe-Ni production furnaces in other countries.

Major NPI Projects in China

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Investor	*Location*	*Nickel Capacity (tpa)*	*Process*	*Production Time*
Sinosteel & Baosteel	Hebei	16,000	2*33000 kva	2009 Q2
Fujian Desheng Nickel Products Co. Ltd	Fu Jian	50,000	2*450 M^3 4*25000 kva	2009 Q3
Qinzhou Heng Xin Nickel Products Co. Ltd	Guangxi	10,000	4*12500kva	2009 Q1
Tsingshan Holding Group	Fu Jian	20,000	2*33000 kva	2009 Q2
Qin Hai Aokai Coal Development Group Co.ltd	Qing Hai	20,000	4*125000 kva 6*25000 kva	2009 Q2

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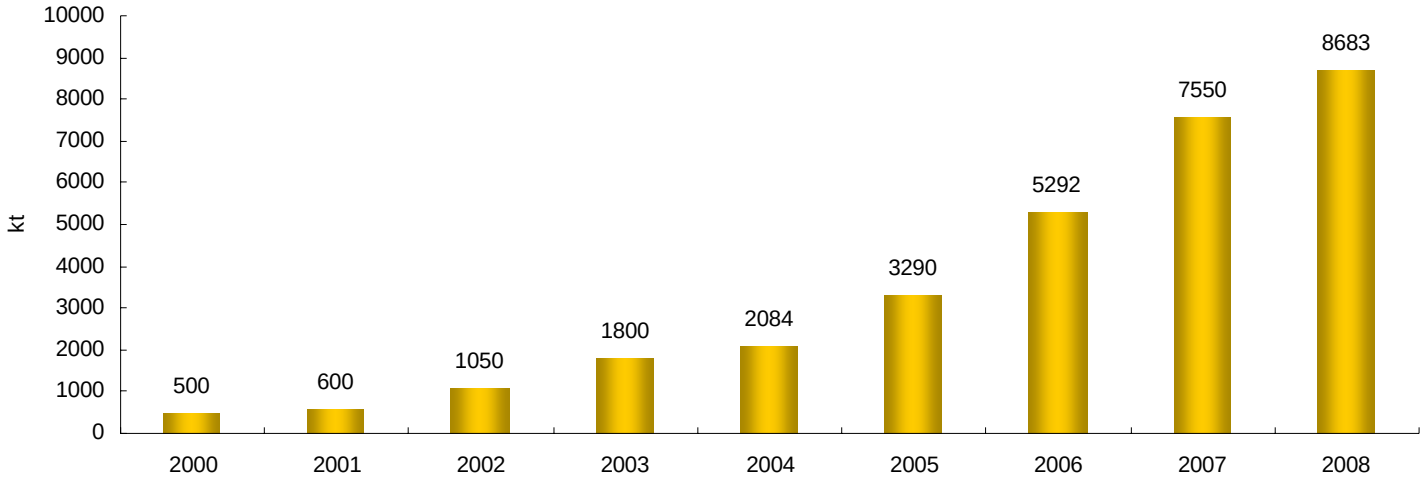
3. NPI Demand Analysis

Stainless Steel Production In China



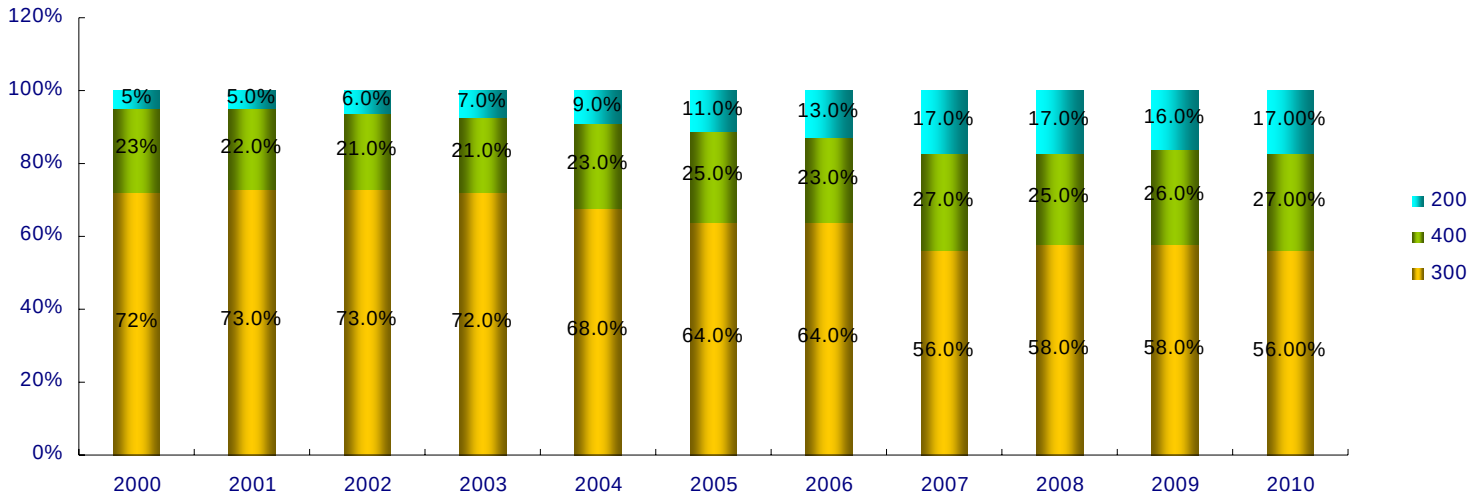
Stainless Steel Production in China

In 2007, the total stainless steel production reached over 7,550,000 ton, which was 15 times the production of 2000.

In 2008, even stainless steel market stays weak, but the production will continue the growth rate as 1.5 x GDP as around 15% to reach 8,600,000 ton;

Continuous growth of stainless steel production in China will create lasting growth of Ni consumption.

Stainless Steel Product structure

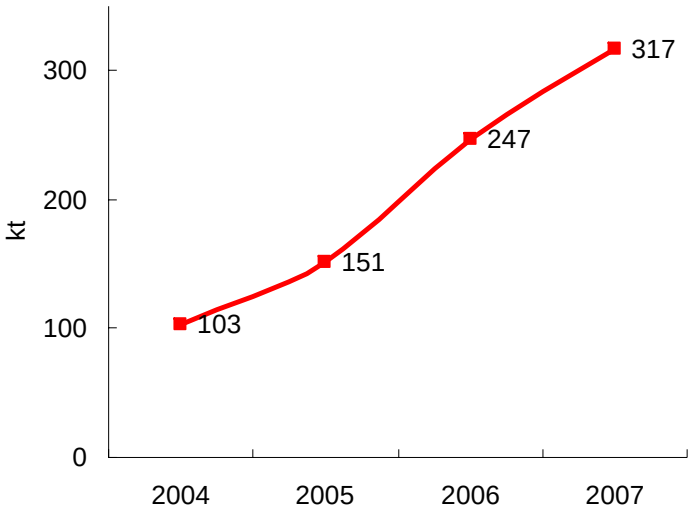


Percentage of 300 and 200 & 400 series stainless steel production in China

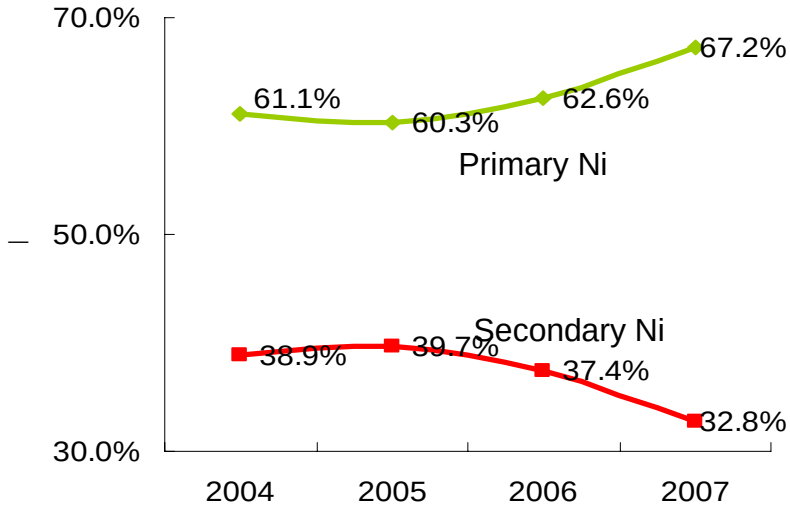
From 2000 to 2006, 200 and 400 series percentage increased due to high growth rate and substitution of 200 & 400 in applications as automobile, household appliance, and architectures, etc.

In 2007, due to high and unstable nickel price, 300 series dramatically decreased by 8%; in the coming years, due to technical reasons, the percentage of 300 will maintain over 55%;

Nickel Demand of Stainless Steel Production



Nickel consumption of Stainless Steel in China



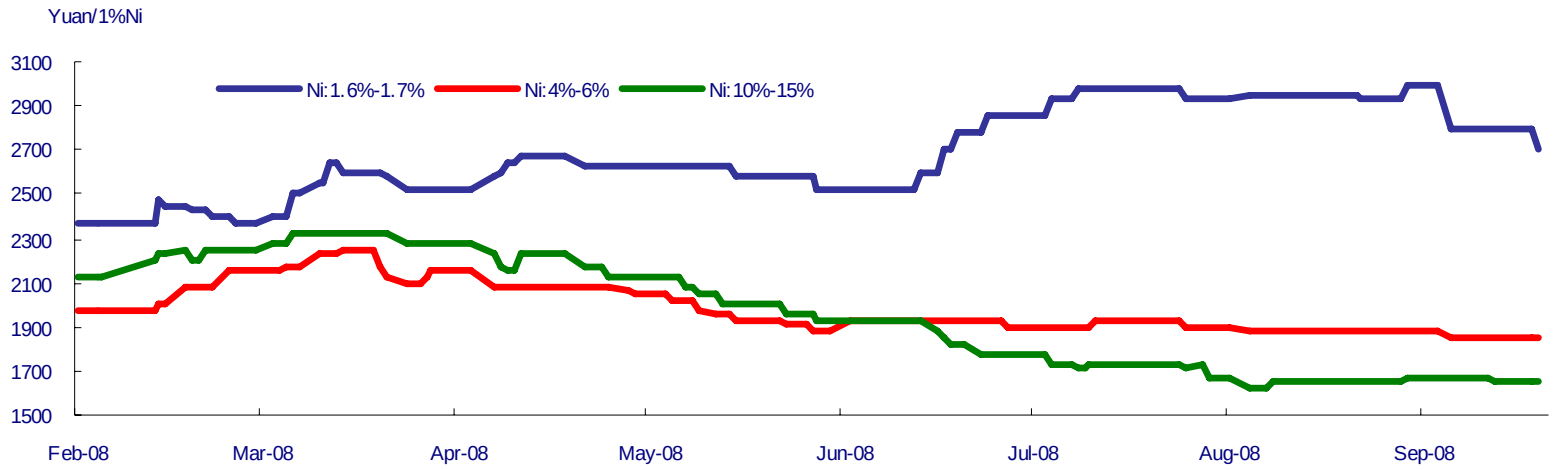
Percentage between primary and secondary Ni for stainless steel production in China

Figures proved the continuously increase of Nickel consumption from stainless steel production; but the increase rate is mild in 2007, due to stainless steel production cut and 400 & 200 percentage increase;

Percentage between primary and secondary nickel shown that primary nickel was more and more preferable to stainless steel producers;

In 2007, NPI contribute around 90,000 nickel for stainless steel production in China, as major driver of primary nickel percentage increase.

Market Prices of NPI



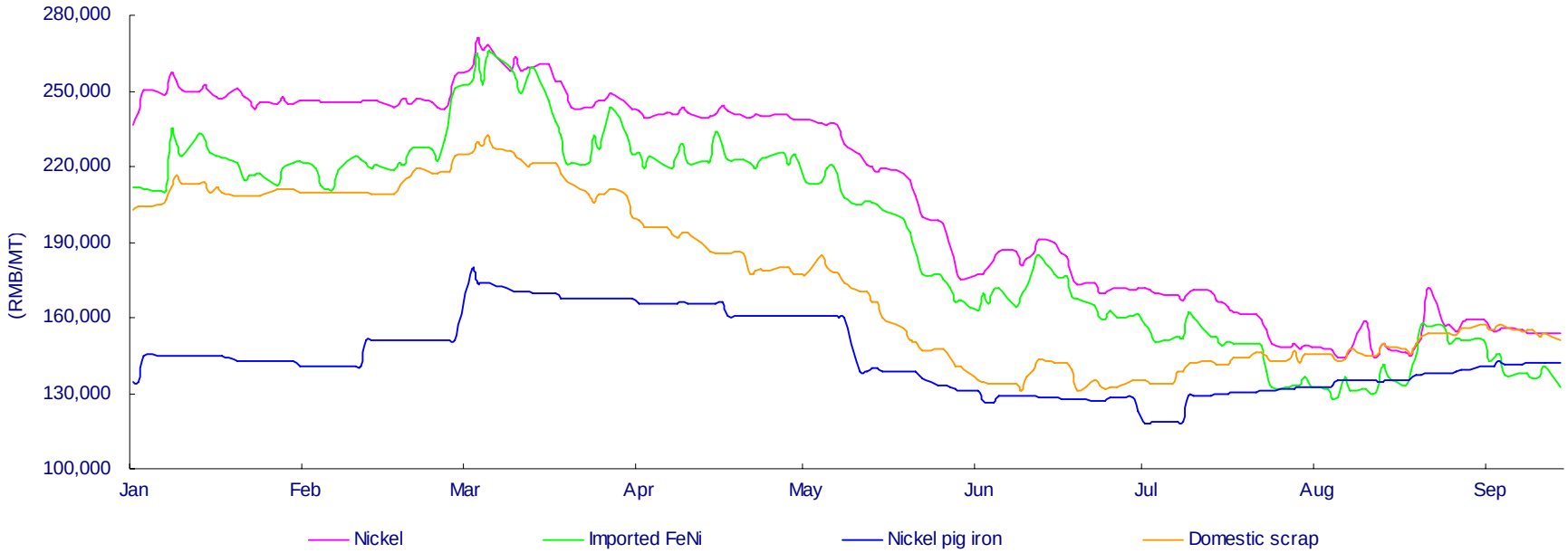
NPI Market Price in China

NPI with Ni content 10% was slightly increased by 9% in March 2008, then dramatically dropped by 40% and close to production cost from March to Sept. 2008.

NPI with Ni content 5% was also increased by 14% in March, then dropped by 20% till Sept. 2008 with no margin for producers.

For NPI with Ni content less than 2%, it was mainly used as major resource of Iron for stainless steel, esp. 200 series. Due to increasing iron price, NPI with nickel less than 2% increased greatly in August, and some blast furnace turned to produce low grade NPI for better margin. But in Sept. when iron price start to drop, low grade NPI price also started to drop.

Comparison of Primary and Secondary Nickel Price



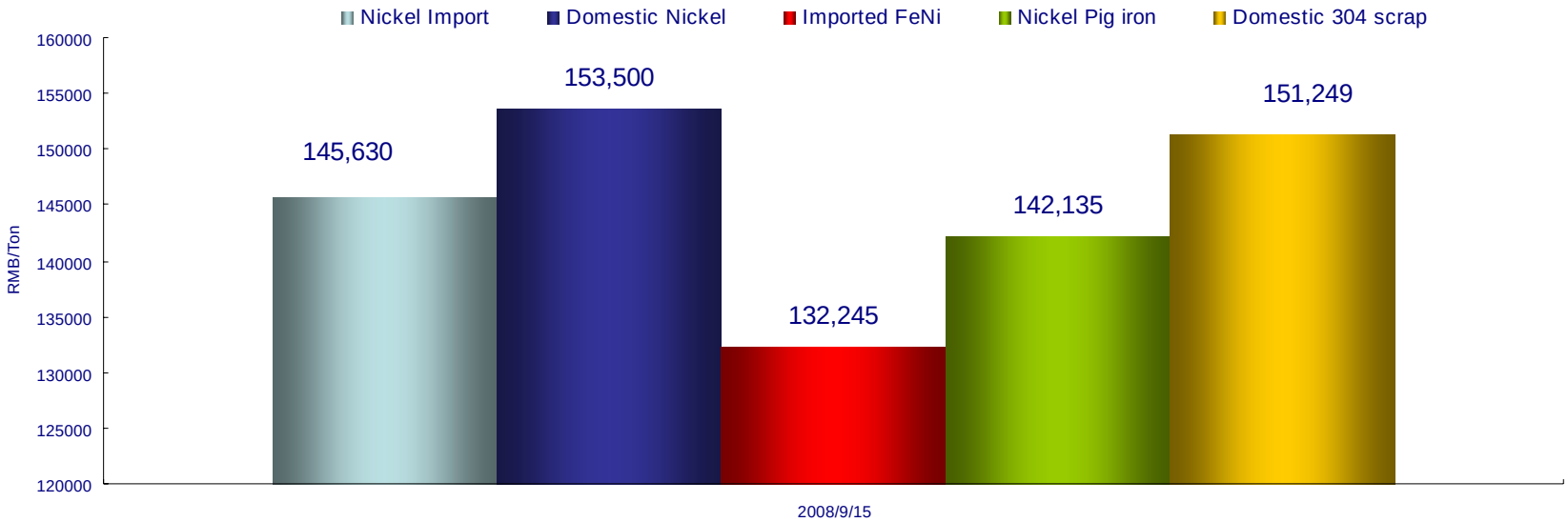
Nickel cost comparison

The curves explained nickel cost difference from various resources as nickel, imported Fe-Ni, local NPI, and SS scrap;

Deduct the cost of iron and chrome from Fe-Ni, NPI and SS scrap, NPI was shown a big cost advantage comparing with other nickel resources in 2007 and first half of 2008;

With nickel price further down in Q3 and increasing production cost of NPI, market price of NPI has no room to decrease further, and gradually lost cost advantages comparing with Fe-Ni import and Nickel.

Comparison of Primary and Secondary Nickel Price



Nickel cost comparison on Sept. 15, 2008

The curves explained nickel cost difference from various resources as imported nickel, local nickel, imported Fe-Ni, local NPI, and local SS scrap based on data on Sept. 15, 2008.

As a resource of nickel, NPI has lost cost advantage comparing with Fe-Ni imported, and slightly cheaper than nickel.

NPI Consumption

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- NPI application will be temporarily threatened by low LME nickel price below 18,000. Diminishing cost advantage will limit the consumption to certain degree, but NPI will not disappear.

- Production cost cut from ore, coke, sea freight and technical improvement to reduce consumption have supported producers left in the market;

- **NPI Consumption Estimated in 2008:**

  - 180,000 – 250,000 ton/m
  - Mostly with nickel content 5 – 8%, 1-2% mainly for 200 series
  - 120,000 – 150,000 ton

Challenges and Opportunities

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Challenges

- Nickel price below break even point;
- Production facilities and process to be upgraded;
- Sea freight increase and instability;
- Export policy changes of nickel ore;
- More and more strict requirements of environmental protection and energy saving;

Opportunities

- Consistent growth of Chinese stainless steel industry create promising demand of NPI;
- New projects with advanced equipment and process will insure the competitiveness of production cost, product quality, and environmental protection in the long run;
- Sufficient nickel ore supply secured through active oversea investment;

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Thanks for your attention!