

Nickel: A Battery-Charged Future

PDAC 2018
Commodities and Market Outlook
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Cautionary Statement Regarding the Beta Hunt Mine

The decision by SLM to produce at the Beta Hunt Mine was not based on a feasibility study of mineral reserves, demonstrating economic and technical viability, and, as a result, there may be an increased uncertainty of achieving any particular level of recovery of minerals or the cost of such recovery, including increased risks associated with developing a commercially mineable deposit. Historically, such projects have a much higher risk of economic and technical failure. There is no guarantee that that anticipated production costs will be achieved. Failure to achieve the anticipated production costs would have a material adverse impact on SLM's cash flow and future profitability. It is further cautioned that the PEA is preliminary in nature and includes inferred resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. No mining feasibility study has been completed on Beta Hunt. Mineral resources are not mineral reserves and do not have demonstrated economic viability. There is no certainty that the PEA will be realized.

All currency references in U.S. dollars, unless otherwise stated.

Nickel market surprised many commentators with continued strong demand – recent market focus on demand from EVs in 2020s support an already robust medium and long-term picture

- Nickel demand – already robust – underpinned by stainless steel and a leader across all metals/materials with growth of 5% over last 10 years.
- Nickel demand growth in 2016 and 2017 in excess of 7% - large deficit in 2017 >150kt (or 7% of supply)
- EVs battery demand growth underpin an already robust long-term demand growth story and about to *drive annual demand growth to 2025 of 7+% requiring at least 1.5 Mt of new supply*
 - Driven by combination of significant growth in EVs and a shift in battery chemistry toward higher nickel content
- Supply structure of nickel has been transformed over last decade. Coming decade faces increasing dependence on higher political risk supply as few new low risk projects and declines in traditional supply
 - Nickel production increasingly concentrated in high political risk countries. Will car companies start paying a premium for low risk supply?
 - Few projects in pipeline, pressure acid leach (PAL) was not a solution to nickel supply last time
- Many misconceptions about nickel in batteries, particularly about types of feed – fundamental issue is *total* nickel units - No long-term shortage of nickel sulphate, no shortage of feed
- **Demand shift from EVs creating “once-in-a-generation investment opportunity” - big winners and losers**

Recent nickel price movements finally broke through a 7 year downtrend moving sharply higher at start of November

LME Cash Nickel Price (US\$/lb)

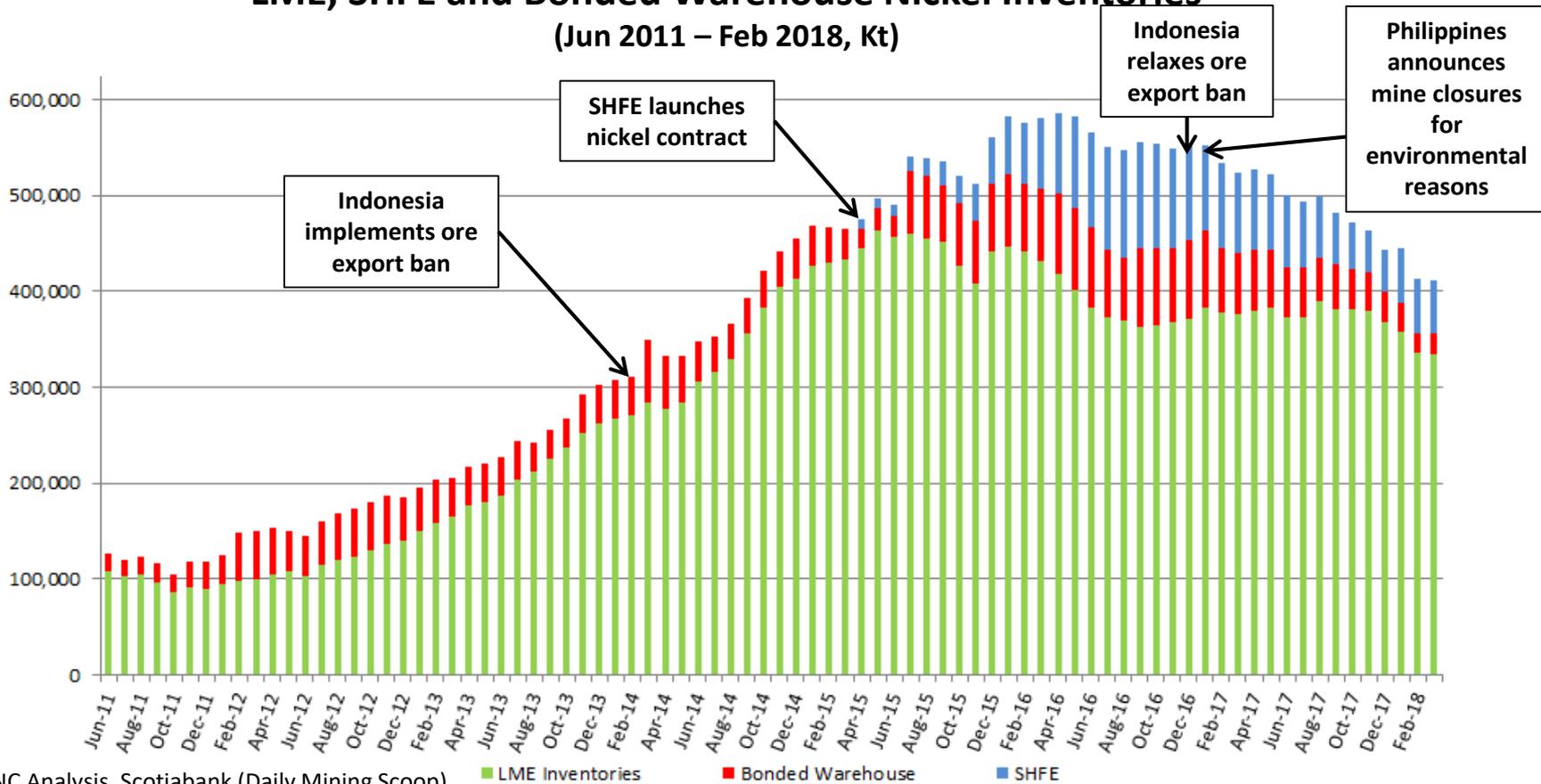


Source: Metalprices.com

Multi-year deficits now eroding 600 kt to recent level of just over 400 kt (2017 deficit of ~150kt or ~7% of demand). Since start of 2018, inventories declining at annualized rate of ~160 ktpa.

LME, SHFE and Bonded Warehouse Nickel Inventories

(Jun 2011 – Feb 2018, Kt)



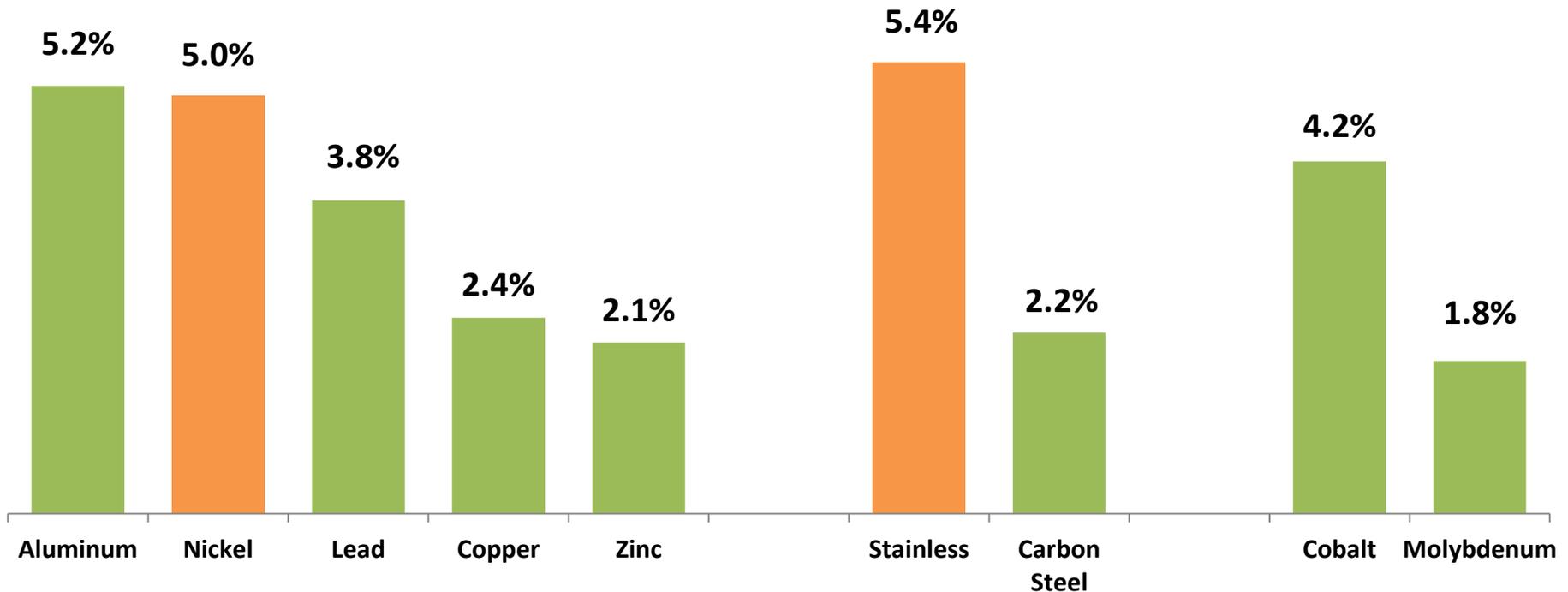
Source: RNC Analysis, Scotiabank (Daily Mining Scoop)

Nickel Demand

A Leader Among Metals

Nickel demand a leader among metals over the last decade (5%) driven by continued strong growth in stainless steel (5.4%). Both figures consistent/better than long-term trends

Base Metals & Other Metals
Demand CAGR% (2007 - 2017)



Source: Macquarie

Nickel Demand – A Battery Charged Future

Millions of EVs coming, Wide Range of Forecasts

IEA estimates EV cars on the road could range between 9 – 20 million by 2020 and 40 – 70 million by 2025 compared to just 2 million in 2017. *By 2025, multiple commentators suggest a minimum of 400ktpa of new nickel demand from EVs as nickel content increases to 35-50kg of nickel in typical battery*

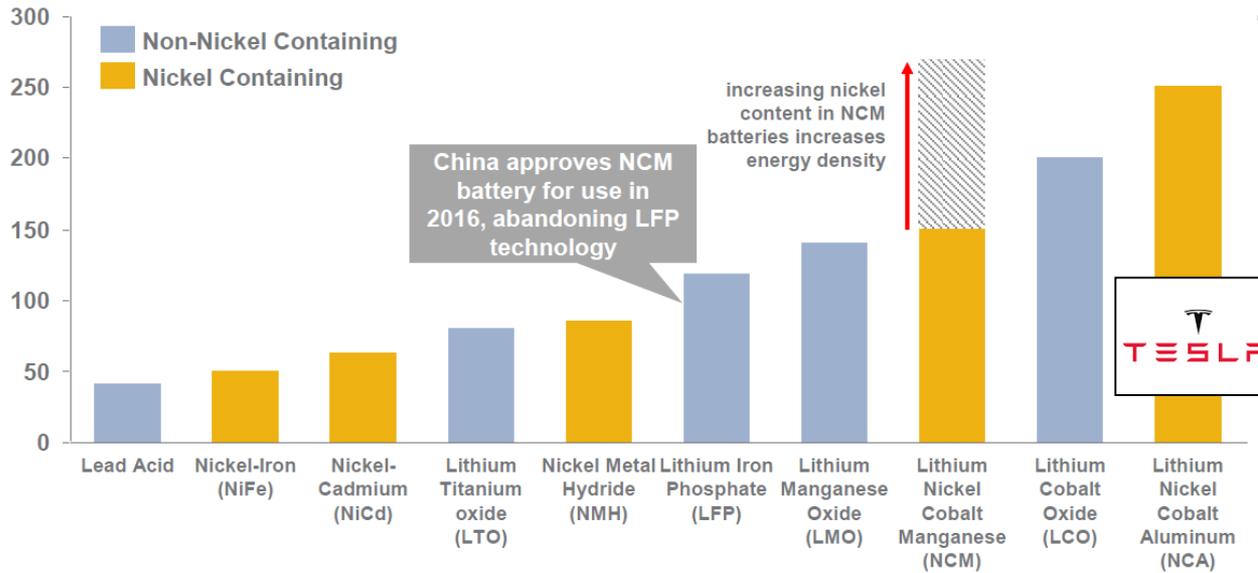


Nickel Demand – A Battery Charged Future

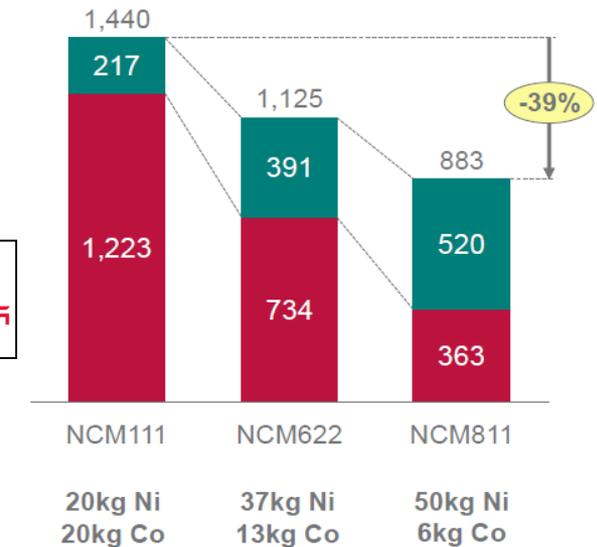
Demand Driven by Higher Energy Density, Lower Costs

Nickel will make up an increasing proportion of battery materials driven simply by need for higher energy density and lower costs (Tesla batteries already contain 80% nickel)

Comparing Energy Density for a range of Battery Technologies (Wh/kg)



Nickel and Cobalt costs for a 60kWh battery (USD at Q3 2017 average LME prices)



Given safety concerns for use in handheld devices and automobiles, development cycles for new batteries are very long – no other technologies on near-term horizon

Source: Vale presentation, October 2017

Nickel Supply - Little Momentum in Existing Supply & “Project Cupboard” Largely Empty

By 2025, trend demand of 5% growth requires 1.1 Mtpa of new supply and low end of EV forecasts suggests an additional 400ktpa is required, but “project cupboard” outside of Indonesian NPI is empty — few projects in pipeline and 35+ years of inertia to overcome

Trend: 1.1 Mt
EVs: 0.4 Mt

1.5 Mtpa
New Supply
Required

Where is new project supply going to come from?

Laterites – HPAL?

Laterites – FeNi?

NPI?

Sulphides?

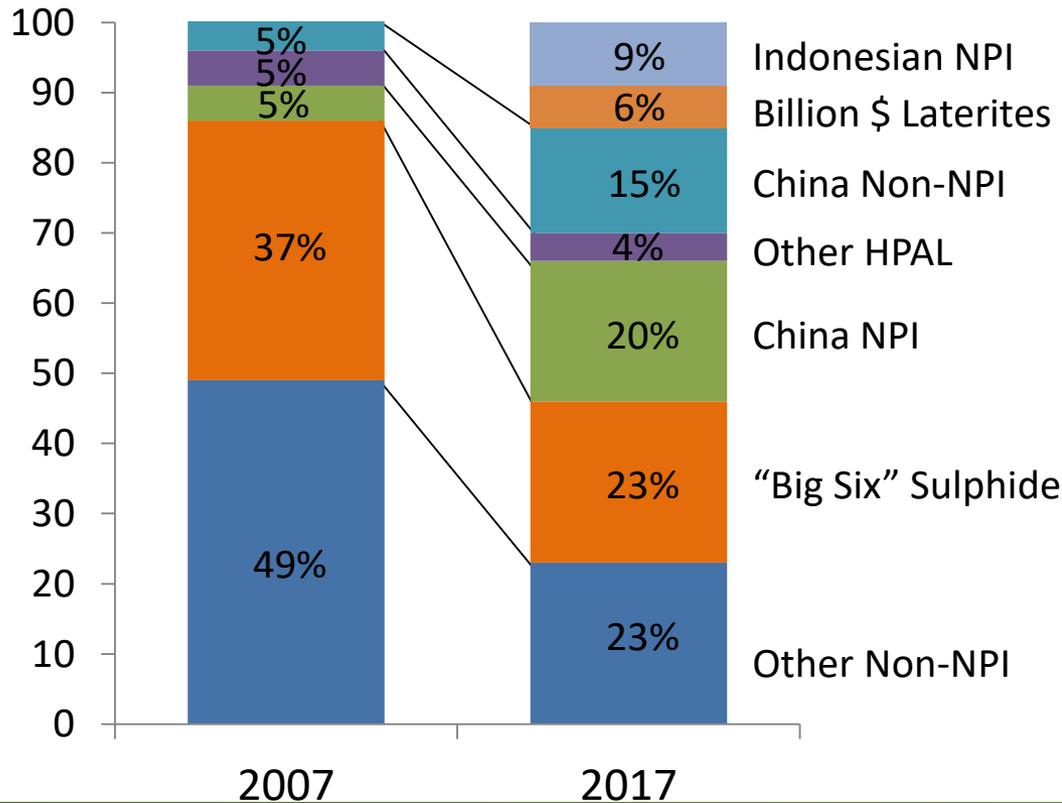
This is equivalent to *4X growth in Chinese NPI production* or *total 2010 nickel production !!*

Nickel Supply

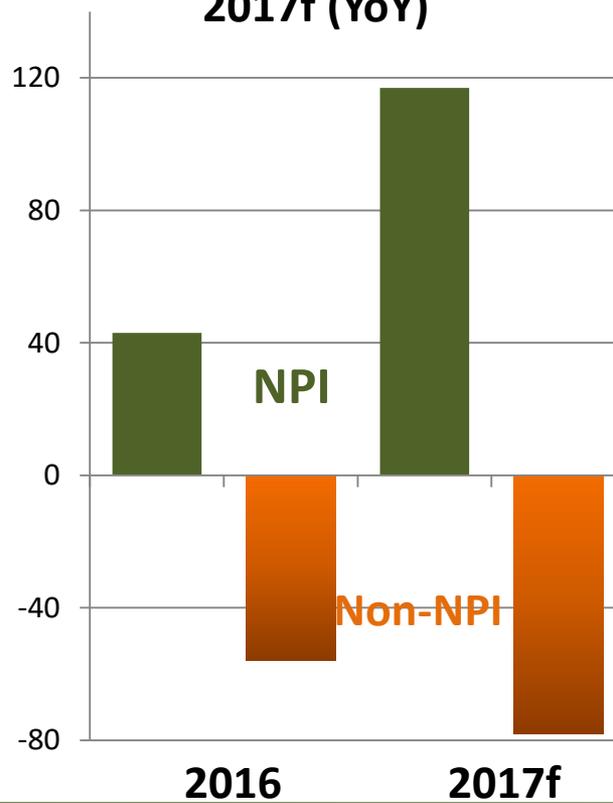
Dominated by NPI – Increasingly Risky, Historical Supply in Reverse

Traditional sulphide and FeNi producers provided 85% of supply in 2007. By 2017, they had declined to <50% of supply as NPI growth in China and Indonesia provided more than 100% growth in nickel supply (including 2016 and 2017)

**NPI vs Non-NPI Nickel Production
(% of Total Supply)**



**Nickel Supply
Increase/Decrease
2017f (YoY)**

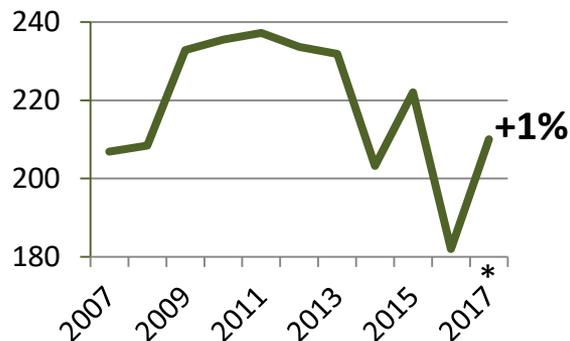


Nickel Supply

Decline of the “Big Six”

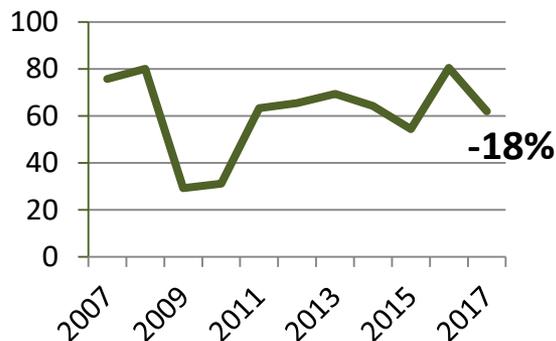
Nickel production from most of the largest sulphide operations has declined over the last decade as low nickel prices deterred investment

Norilsk Ni Production
(Polar + Kola, kt)



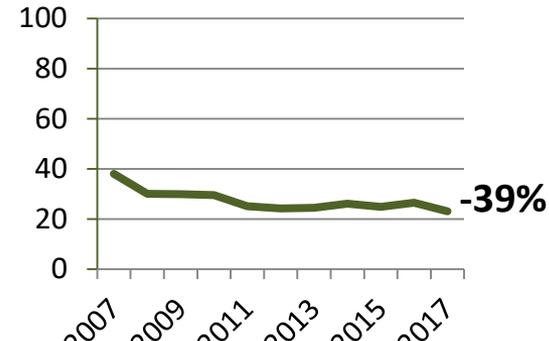
* 2017 guidance is 206-211 kt

Vale Sudbury Ni Production
(kt)



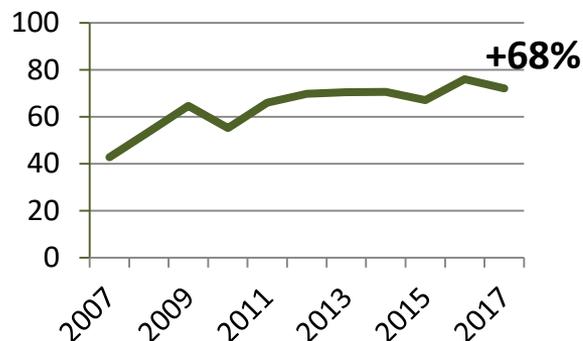
* 2017 forecast based on 9M2017 production

Vale Manitoba Ni Production
(kt)



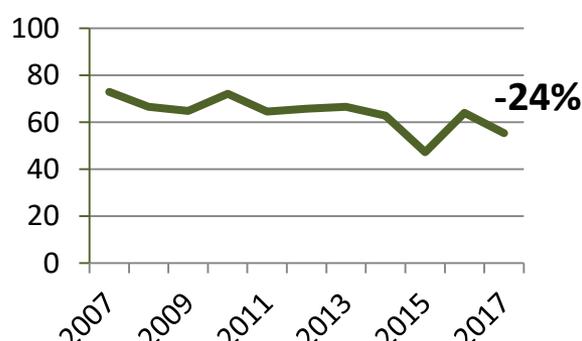
* 2017 forecast based on 9M2017 production

Jinchuan Ni Production
(kt)



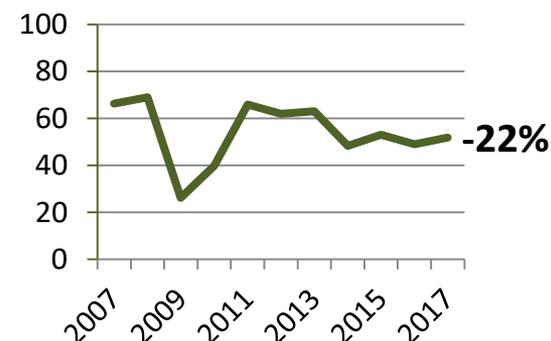
* 2017 forecast based on CRU

Mount Keith + Leinster Ni Production
(kt)



* 2017 forecast based on CRU

Voisey's Bay Ni Production
(kt)

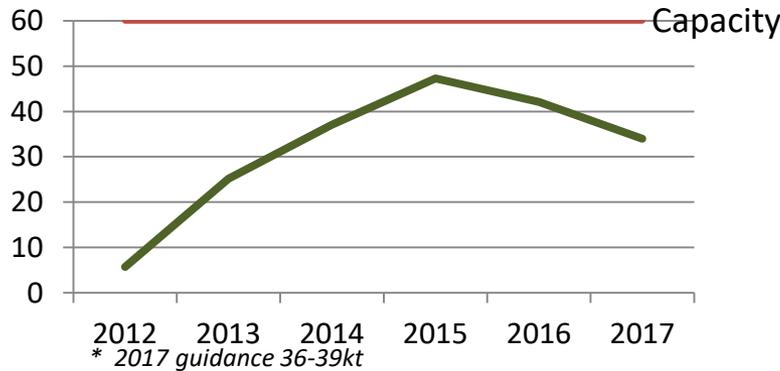


* 2017 forecast based on 9M2017 production

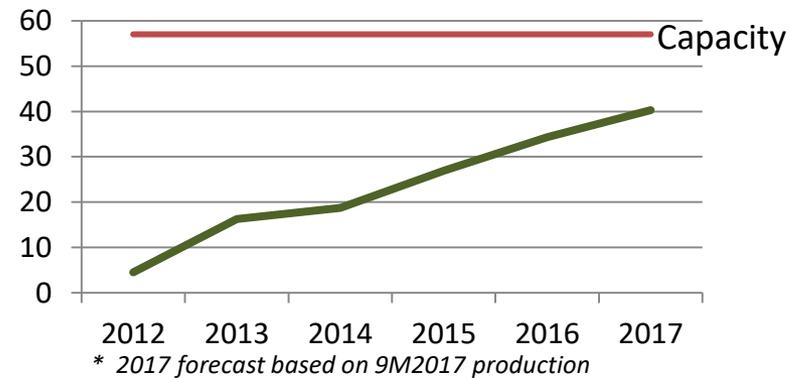
Nickel Supply – HPAL/FeNi Billion Dollar Ramp-ups

The amount of additional nickel supply from the billion dollar laterite projects of the last decade (> \$20 Billion) remains underwhelming...

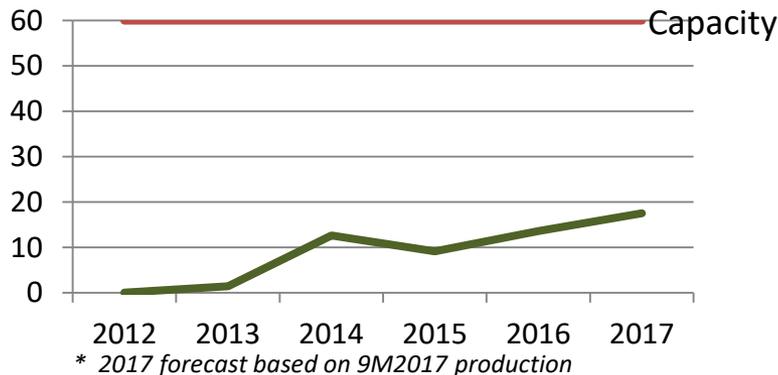
Ambatovy



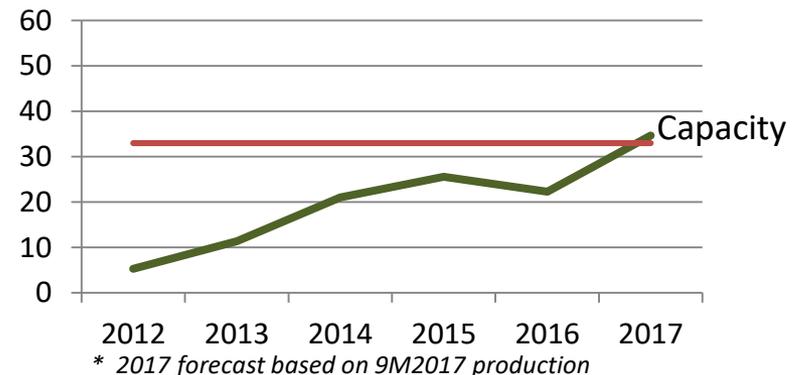
Vale New Caledonia (Goro)



Koniambo

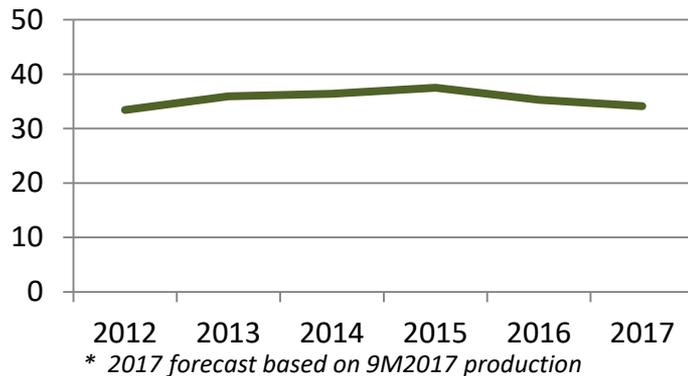


Ramu

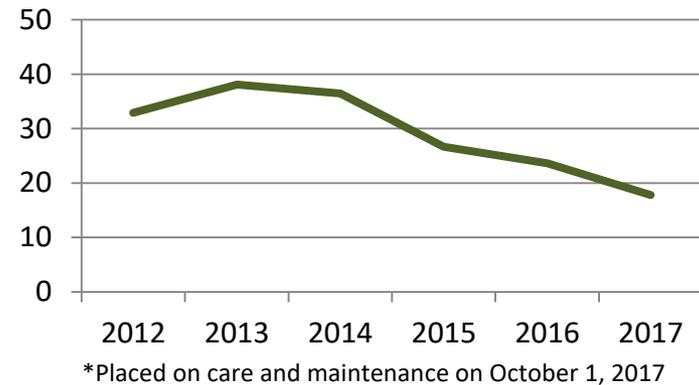


...While established HPAL producers are facing challenges to maintain existing production levels

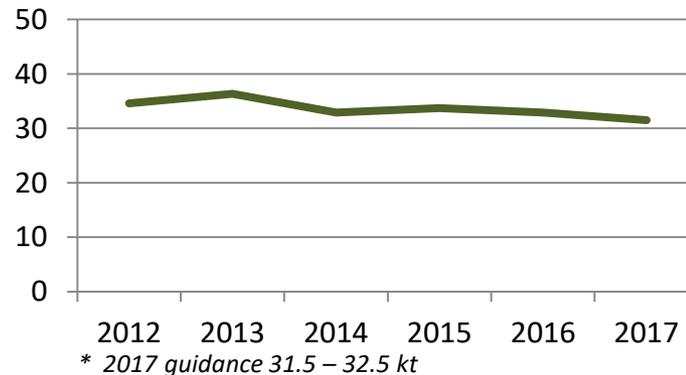
Murrin Murrin



Ravensthorpe*



Moa Bay

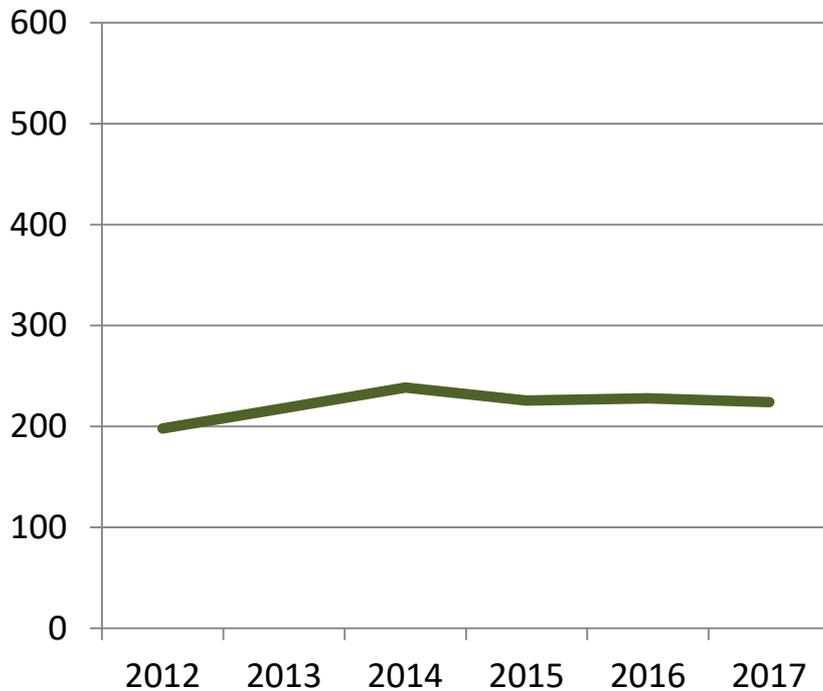


Source: Company reports

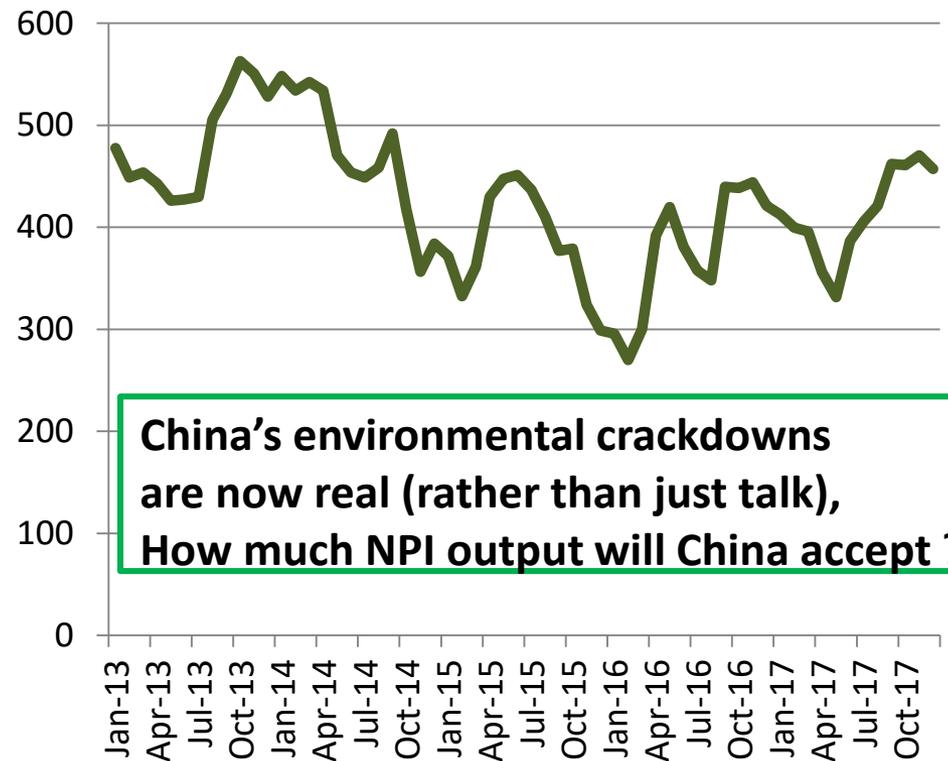
Nickel Supply – China Production Leveling Out

Chinese nickel supply of both NPI and non-NPI metal has leveled out in recent years - cost pressures, environmental constraints, and lower ore grades will constrain future growth

**Chinese Nickel Production (ex-NPI)
(Kt)**



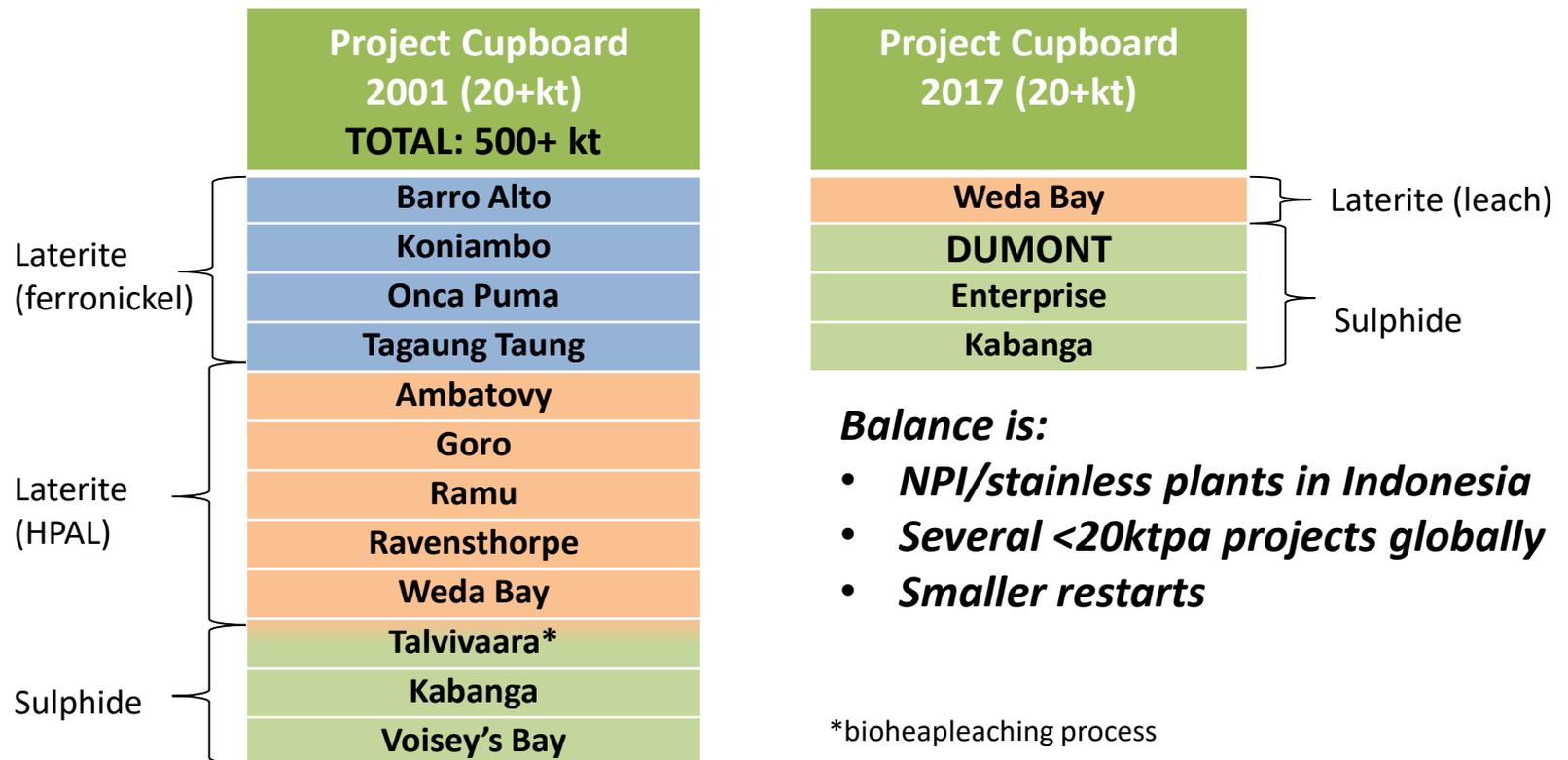
**Chinese Nickel Pig Iron Production
(Annualized Monthly Production, Kt)**



**China's environmental crackdowns are now real (rather than just talk),
How much NPI output will China accept ?**

The fundamental issue facing the nickel industry in 2017 is an empty “project cupboard” of large projects outside Indonesia

- At the beginning of the last decade prior to the significant run-up in nickel prices, the “project cupboard” was very full with *many large (>20ktpa) projects known for decades*
- Today’s picture is very, very different, setting the stage for an exciting nickel cycle

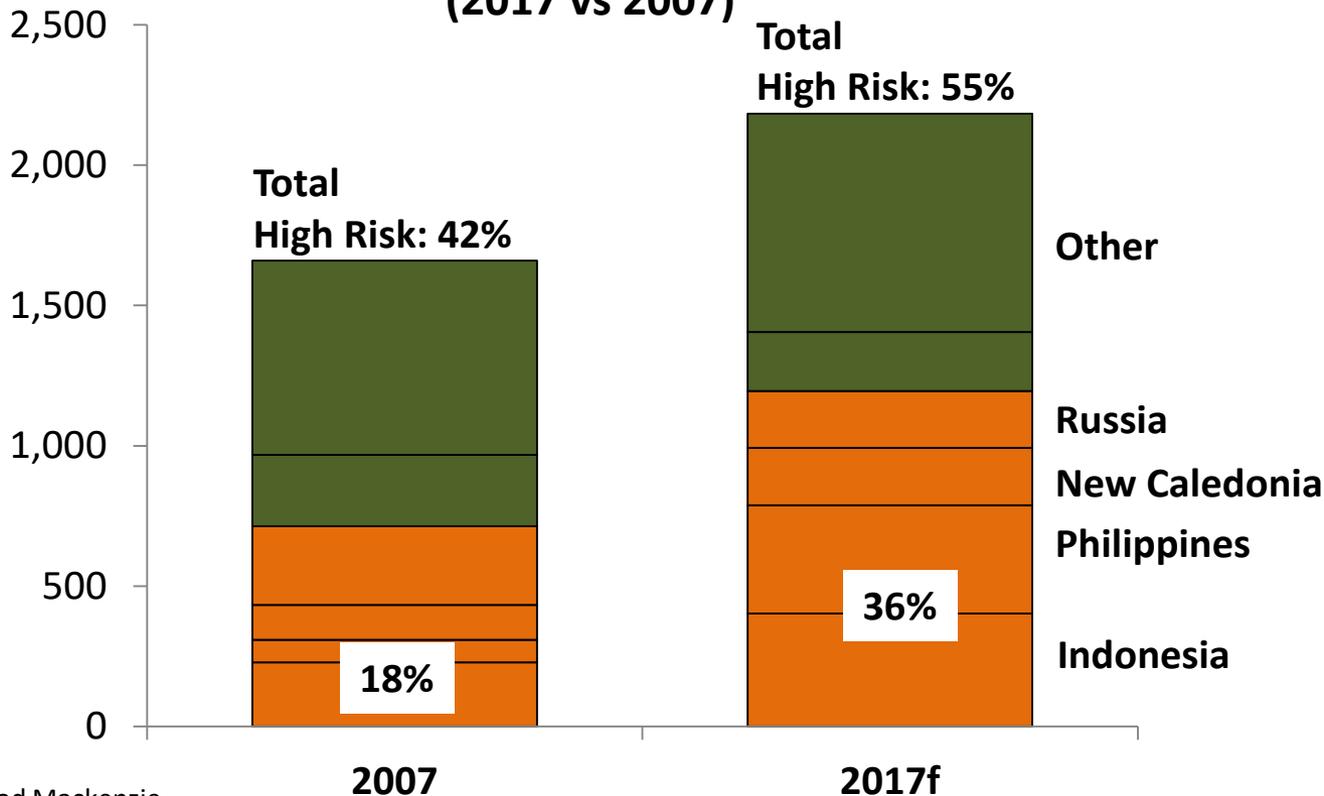


Nickel Supply

Higher Political Risk

Nickel increasingly dependent on higher political risk supply over last decade, particularly Indonesia and Philippines (doubling from 18% to 36%) who have implemented policies in recent years causing substantial supply disruption *and who will be the primary source of supply growth over coming decade*

**Nickel Mine Production by Country
(2017 vs 2007)**



Source: USGS, Wood Mackenzie

Nickel Supply – Market *Needs* Indonesia NPI Output, Will Consumers be Willing to Rely On It ?

NPI from Indonesia is one of few potential sources of new nickel that the market requires, but it comes with significant political risk

- Indonesian NPI ~10% of global supply in 2017 and first significant production of stainless steel, largely by Tsingshan
- Tsingshan will bring on 3 Mt of stainless steel production capacity by 1st half 2018
- Dangerous to extrapolate Tsingshan performance to other companies
 - Tsingshan result is successful execution of long-term plan executed over a decade
 - Poor track record of Chinese mining projects outside China
 - Political risk in Indonesia has *increased substantially* over last few years – which will slow pace of investment
- Indonesia is in position to become *the world's largest nickel producer and one of the largest stainless producers* but will take until the early to mid-2020s at the earliest

RNC's strategic alliance with Tsingshan led to the development of the first integrated nickel pig iron ("NPI") plant to directly utilize nickel sulphide concentrate as part of the stainless steel production process through concentrate roasting

- Significant potential benefits to producers of suitable nickel sulphide concentrate feed such as RNC's Dumont Project:
 - ✓ **Lower costs** due to simpler processing compared to traditional smelting and refining
 - ✓ **Higher payabilities** than traditional smelting and refining
 - ✓ **Greater flexibility** for more potential partners and customers
- Roasted nickel concentrate is effectively a very high grade laterite ore feed – creates new source of demand for nickel sulphide concentrate, notably at a time when many NPI and ferronickel producers face feed shortages as a result of Indonesia's nickel ore export ban

*Ferronickel puck
produced from
Dumont concentrate*



Any new supply/demand source develops a number of stories – two myths have emerged which are TOTAL FICTION

- **There will be a shortage of nickel sulphate for batteries**
 - Supply is tight now, but China will build 2-3X what market needs (like they have for every semi-processed material) and bid premiums down to zero profit (feed suppliers win !)

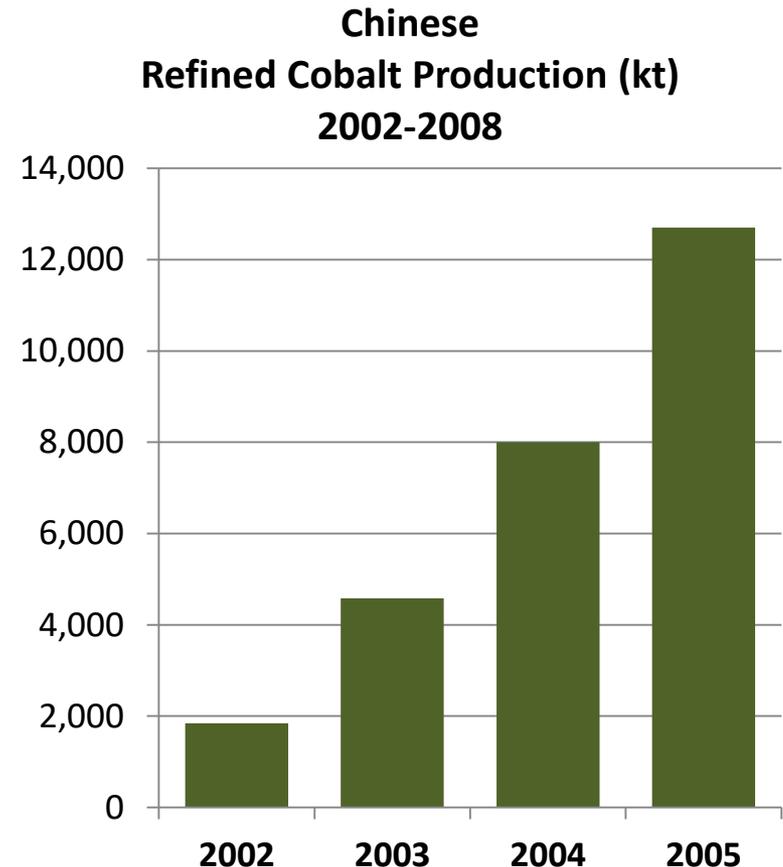
- **There will be a shortage of Class I nickel for batteries**
 - Over 400kt (~20%) of nickel supply (or almost 40% of Class I supply) ends up in stainless steel where it is not necessary
 - NPI plants can simply add a converter, add sulphur and produce a 70% nickel matte (PT Inco has done for 30 years) to be refined (and also get cobalt !)

The assertion that there will be future shortages of nickel sulphate is *ludicrous*. Chinese refined production of cobalt (mostly cobalt salts) increased by 6X in just 3 years to more than 20% of global refined production.

In many, many commodities, China has very quickly added 2-3X the capacity the market requires for many semi processed materials

- Steel
- Alumina
- Aluminum
- NPI
- Cobalt products

NICKEL SULPHATE WILL BE NO EXCEPTION !

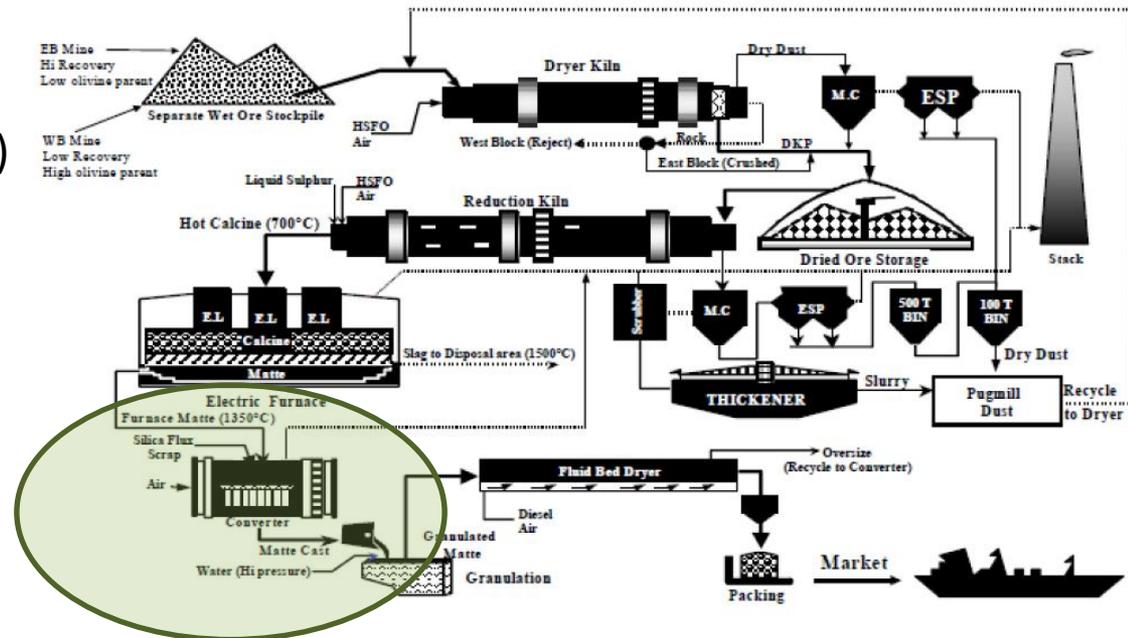


Nickel & EVs

NO SHORTAGE OF CLASS I NICKEL

- Over 20% of total nickel supply and almost 40% of existing Tier 1 nickel ends up in stainless steel – only a tiny fraction of this purity is actually required by the stainless product
- Very easy to take saprolite feed to a Tier 1 nickel feed (PT Inco has produced nickel matte for nearly 40 years)
 - Add a converter to existing NPI flowsheet
 - Add sulphur
 - Slag iron off
 - Produce high grade matte (high grade feed for nickel sulphate producer)

PT Inco Process Flow Sheet (source: 2010 External Audit of Mineral Reserves)



- 1) China is going to build significant nickel – cobalt processing capacity to produce battery products – creating massive overcapacity and leading to breakdown of multi-decade nickel smelting “oligopoly”**

WINNERS:

- *Miners: Terms for Ni-Co sulphide concentrates, HPAL intermediates will improve dramatically as Chinese processors bid feed down to marginal cost*

LOSERS:

- *Existing nickel smelters (without captive feed) will face massive competition for first time*
- *Existing nickel sulphate suppliers will see premiums erode to marginal costs*

- 2) Significant and increasing political risk in both nickel and cobalt supply**

WINNERS:

- *Nickel-cobalt projects in low political risk jurisdictions will see increasing scarcity premium as automakers and supply chain partners want access to long-term, low risk feed*

- 3) Meaningful HPAL intermediate capacity from imported limonite ore will emerge in China (and a few other structurally advantaged locations) to address market shortfalls and act as swing higher cost nickel-cobalt capacity**

WINNERS:

- *Nickel & cobalt markets will get swing capacity which will reduce price volatility and improve market stability*

LOSERS:

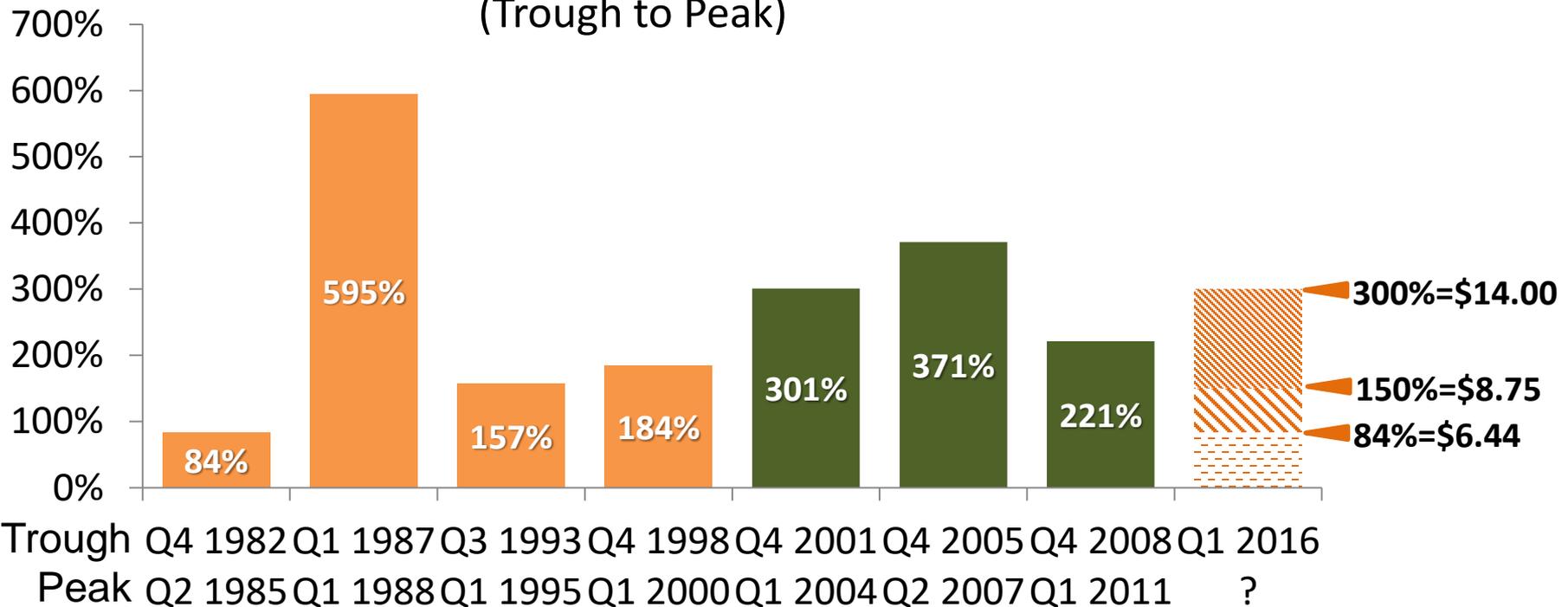
- *HPAL capacity without ore grade and structural cost advantages will get squeezed out of the market*

Nickel Price Cycle Analysis — Explosive Price Moves

Nickel price moves have always been explosive even without China. Again, why would it be different this cycle, particularly when major new source of demand from EVs is emerging (with few substitutes)

Remember that a 150-300% price increase from a \$3.50 trough is \$9-\$14 per pound!

Nickel Price Increase
(Trough to Peak)



Source: MetalPrices.com, RNC analysis