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China slowdown the end of the beginning, not the beginning of the end for EVs

Perhaps someone looking at commentary on Chinese electric vehicle sales over the past few years could be forgiven for thinking that the electric vehicle story would be a straight-line growth event given the Chinese Government’s focus on making Electric Vehicles a core industry.

Those of us who look closer at the market knew that that was unlikely to be the case and the Chinese government’s withdrawal of subsidies on some electric vehicles and its plan for a total withdrawal of subsidies by midway through next year has guaranteed it.

With Chinese PEV (Plug-in EV) sales now negative in y/y terms for the third consecutive month in September, and few signs of the seasonal surge in electric vehicle sales at the end of the year that many are hanging on for, many commentators are now suggesting that the situation in electric vehicles looks bleak.

Continued overleaf

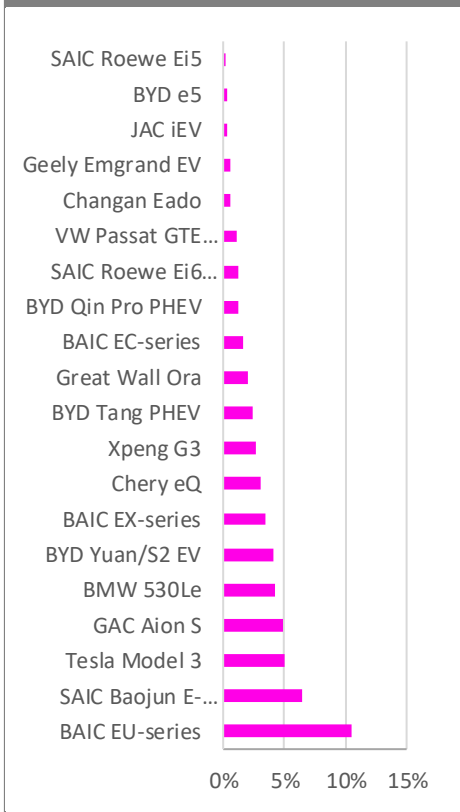
Focus...Moving to the next stage of EV market growth...

Why would the Chinese government cut back on subsidies in this way and endanger the nascent EV event? Well it's really down to the abuse of the subsidy regime by small auto manufacturers. The last five years have seen a plethora of small EV developers and manufacturers emerge. China famously has over 100 EV makers, but many are making only a handful of cars, which may not be selling but are still claiming subsidies.

Having said that, a lot of small EV makers *are* making cars. China's 10 brands with the highest market share only control 65% of the PEV market.

That leaves quite a lot for small makers. If we look at the top 20 models selling in September 2019, it's a really long tail. The bottom five models sold less than 500 units during the month, less than a 0.6% market share.

Market share of China 9M/19 PEV sales



Source: *EVVolumes.com*

That means that models selling less

than 185 units per month have a 44% market share.

That's the end of the market China wants to reign in. There's been free money for EVs for too long and it knows that only with a more consolidated market can Chinese companies compete with the Western World OEMs, which are now starting to move into the space with a vengeance.

Like in Rare Earths, China wants to have EV market leaders whose products are competitive all over the world. And it's not wary of banging a few heads together to make that happen.

But where does that leave investors in the battery story? We've talked before in Battery Materials Review about China's re-weighting from a carrot approach to subsidies to a stick approach. We said in the August 2019 issue that we believe that this re-weighting in the Chinese market could take years. But I don't believe that the Chinese government expected the magnitude of the decline in sales that it's seen. And if sales continue to decline at this rate it would bring China's whole Green agenda into doubt. So, don't be surprised to see a role back of some of the changes at some point. But it may take a good few months for that to happen.

But whether China acts to re-catalyse its EV market or not, it seems likely that the era of rapid Chinese growth in EV sales is at an end.

But I'm not panicking, because there's a new knight in shining armour that's likely to ride in to save the EV space. And that's Europe.

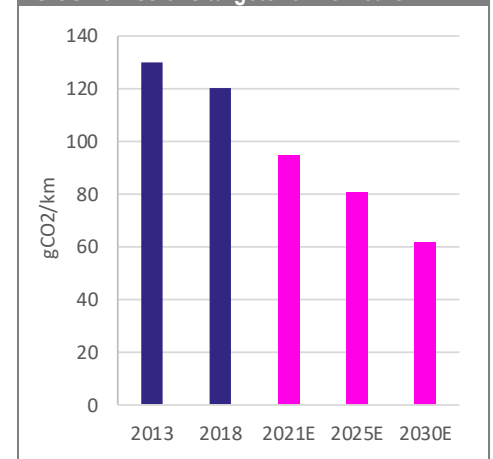
If you don't live in Europe it's difficult to describe the level of fervour that currently exists for the Green agenda

here. Every three or four adverts on the TV seems to be for electric vehicles of one sort or another, there is at least one climate change report on every TV or radio news bulletin and websites, newspapers and news magazines regularly feature reports on climate change or the measures being developed to combat it.

The EU is pushing the Green agenda strongly as well. And, what's more, it's pushing it strongly on the auto industry. A slew of tough new regulations on auto emissions are coming in next year, enforcing a 15% reduction on CO2 emissions between 2021 and 2025 and 37.5% between 2021 and 2030. This in addition to a 40% cut between 2007 and 2021.

Auto manufacturers will pay fines if they cannot meet these targets, although CO2 emission levels can be relaxed if companies hit certain market shares in zero or low-emission vehicles (ZLEVs; 15% from 2025 and 35% from 2030).

EU CO2 emissions targets for new cars



Source: *EU, BM Review*

In fact, Electric Vehicles are thought to be one of the reasons for the merger between Peugeot and Fiat. Fiat Chrysler does not have a single electric-only vehicle and plans only a handful. It is already struggling under a weight of

Focus... Moving to the next stage of EV market growth...

finances. Peugeot also has no current EVs but plans to launch the e-208 supermini in early-2020 and have a plug-in variant on all models by 2023.

Peugeot is not the only OEM planning EV launches in 2020. So far we're monitoring 28 EV launches for 2020, and at least 60 different models are expected. Even if there are not a significant number of orders for all of these models, if you consider the resources needed to lay down enough models for potential orders, to supply enough batteries, and raw materials for those batteries, we believe that that's a significant amount of material.

Europe had c.384,000 PEV sales in 2018 and is on course for just over 500,000 in

2019. Obviously, that's nowhere near China with its c.1.1 million sales in 2018 and 2019, but it could be significant. Particularly if EV makers move into the mass-market as we expect.

We discussed the distribution of European EV sales in our August issue and highlighted how far EVs are currently from the European mass-market (median EV sales price of £30-35,000 vs mass market at £15-20,000). But we're starting to see things changing.

- The Peugeot e-208 is a start. Peugeot expects it to retail at £25,050. It will have a 185-mile range, a 50kWh battery and take 30 minutes to recharge 80% using a fast-charger.
- The Honda e is also set to launch in Europe next year with a retail price of £26,160. It only boasts a 32kWh battery and range of 125 miles, so apart from being "cute" it doesn't really compete so well with the competition.
- Renault has announced plans to launch its K-ZE (first offered in China) in Europe, possibly under its Dacia brand. It's classified as a

"small car" in China and is certainly a city-focused product, but with a 26.8kWh battery, 150-mile range and a price tag of under £15,000 it should still find fans in the European car market. The car is being upgraded in terms of range and safety equipment for its European launch.

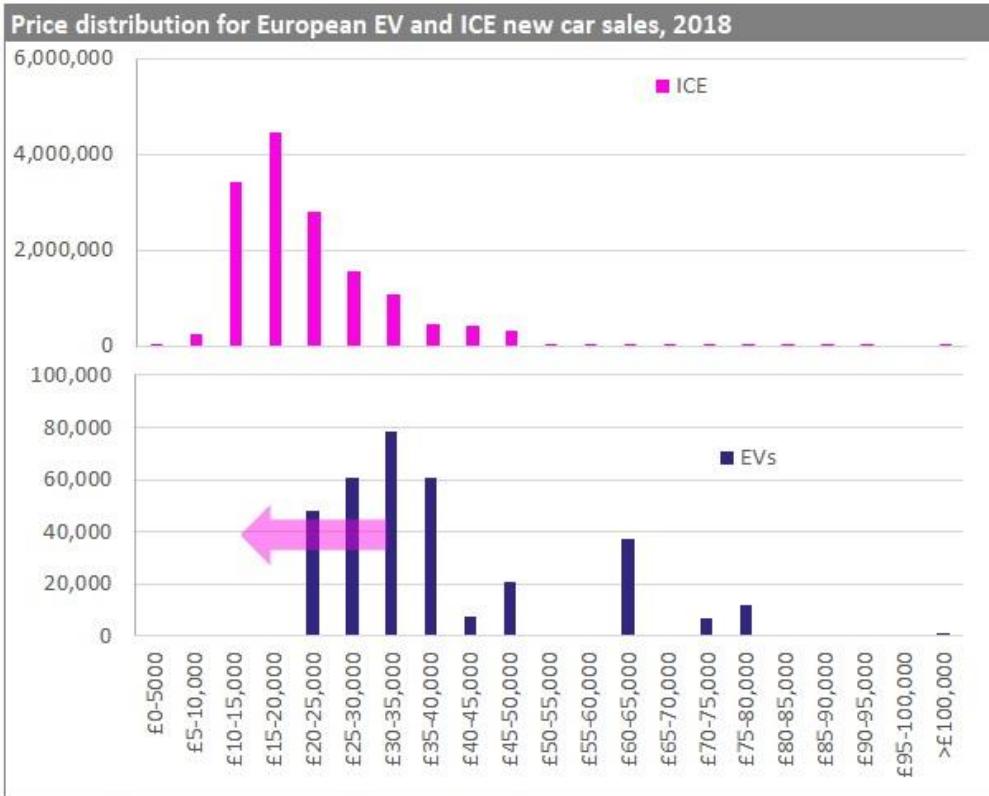
- And finally there's VW. Its new "Electric People's Car" is aimed to retail at sub-£18,000 and boast a range of c.124 miles. But it won't be available until 2023.

The European Federation of Transport & Environment forecasts that there will be over 330 EV models available by 2025. With 60-odd models to launch in 2020 and a further 30-40 over each of the next few years, it's not a stretch to suggest that Europe could become the biggest EV market in the world.

Particularly if it cracks the mass-market price level. Range is not such a concern in Europe as in other markets and if fast charging and charging infrastructure is in place then there's no reason that lower priced, lower ranged vehicles won't take off.

Given the very significant Government support and the need for auto producers to start toeing the line on carbon emissions, there is certainly a high likelihood that European EV sales will continue to grow strongly over the next 12-18 months. Hopefully that will be enough to fill in some of the slowdown in Chinese growth rates.

I don't think that the slowdown in Chinese activity is the beginning of the end for electric vehicles. But this reweighting of Chinese subsidies is certainly the end of the beginning of the first stage of the global EV growth event. Now the focus shifts to Europe.



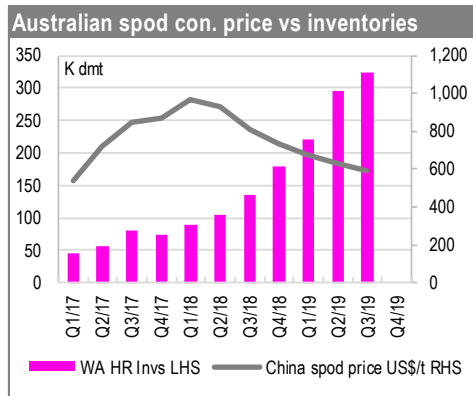
Source: AutoExpress, carsalesbase, BM Review estimates

Focus...Lithium – are we starting to approach the bottom?

It's been another difficult reporting period for the world's lithium producers and developers and for the Australian hard rock producers and developers in particular.

After profit warnings earlier in the month, both **Ganfeng Lithium** (HKG:1772) and **Tianqi Lithium** (SHE:002466) reported very weak results with Tianqi experiencing its first loss in 5½ years and suggesting that it will also report a Q4 loss, and Ganfeng reporting an 86.5% y/y drop in net income.

Albemarle (NYSE:ALB) warned on Q3 and downgraded its 2019 guidance due to weak sales, use of tollers to meet customer commitments, low prices and LC inventory valuations, and **Orocobre** (ASX:ORE) reported a 21% q/q drop in revenue and 13% fall in realised prices.



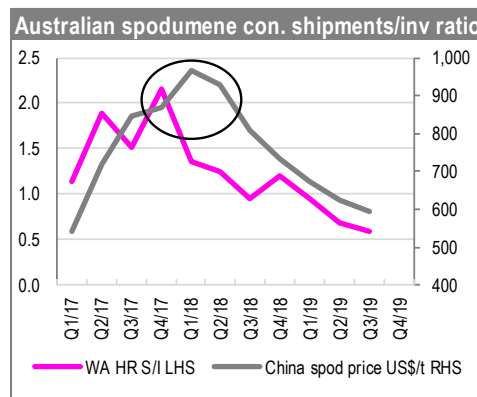
Source: Company data, BM Review estimates

In Hard Rock land the situation was, if anything worse. **Pilbara Minerals** (ASX:PLS) cut its production back to 21.3Kdmt in CQ3/19 from 63.8Kdmt the previous quarter and cut its shipments more than 50%; **Galaxy Resources** (ASX:GXY) reported a reasonable quarter but guided to a significant production cut in CQ4/19; **Altura Mining** (ASX:AJM) reported robust production but lower shipments; and **Mineral Resources** (ASX:MIN) put its newly-opened

Wodgina mine on Care and Maintenance due to prevailing market conditions.

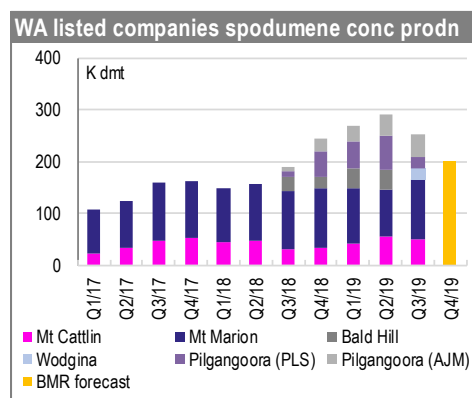
Having said that, the fact that we are seeing production cuts in hard rock now must be interpreted as a positive.

Our calculated shipment/inventory ratio for the Western Australian hard rock producers has fallen to 0.6x in CQ3/19 from 0.7x in CQ2/19.



Source: Company data, BM Review estimates

With **Alita Resources** now out of the market, Wodgina moving to Care and Maintenance over the course of the quarter, and lowered production at Pilbara and at Galaxy, it looks likely that inventories could peak around now, but the question is how long will it take them to be worked off?



Source: Company data

Ex-Greenbushes, WA inventories are currently c.325Kt. With production of c.200Kt forecast (by us) for this quarter and shipments standing at c.192Kt in CQ3/19, it's likely to take some time to

clear this inventory build-up. In fact, inventories may peak only in CQ4/19.

Prices normally bottom out about one quarter after a trough in shipments/inventory ratio, so realistically we're looking for prices to bottom out in H1/20 but spodumene concentrate prices may not recover materially until late in 2020.

Once we start to see a trough in spodumene concentrate prices then we can finally put in a floor price in lithium hydroxide and, to some extent, lithium carbonate.

It's hard to see 6% spodumene concentrate prices going materially below US\$450-500/t for any length of time given current production costs. It's just not viable for hard rock producers to sell at below that price in the long-run, so it seems that we're much closer to the trough than the peak, but whether prices recover strongly off the trough or simply bounce along the bottom is really the question.

And that all comes down to the demand environment. Actually, lithium demand growth has been extremely robust in 2019. Major producers have talked about double digit demand growth even despite the slowdown in Chinese EV sales.

So I'm not too worried about demand, particularly given my view about the potential for the European EV sector to take market leadership.

That suggests to me that the end of 2020 is likely to be a better environment for lithium producers and developers than the end of 2019. In the view of most market participants that can't come quickly enough!

Lithium-ion inventors receive Nobel prize

The Royal Swedish Academy of Science awarded this year's Nobel Prize for Chemistry to the three scientists that played a pioneering role in the invention and development of lithium-ion batteries. The prize was jointly awarded to John Goodenough from the University of Texas, Akira Yoshino from chemical company Asahi Kasei and Mejo University and to Stanley Whittingham, who is currently an executive director of lithium-ion battery producer **Magnis Energy Technologies** (ASX: MNS). Mr Goodenough is the oldest Nobel laureate, at 97. Congratulations to all.

Western Australia introduces new lithium chemicals royalty rate

Western Australia has introduced a 5% royalty rate on lithium hydroxide and carbonate produced from spodumene concentrate mined in the state. This gives clarification for the industry, according to the Government.

Bacanora lauds Ganfeng deal

Management of **Bacanora Lithium** (AIM:BCN) seems to think that all of its Christmases have come at once after it banked £21.96m from **Ganfeng Lithium** (HKG:1772) in exchange for a 29.99% equity interest in Bacanora and a 22.5% JV investment directly into the Sonora project.

Reuters reports that the company is now planning a US\$300m raise "in the early part of next year". It previously tried to raise US\$100m in summer 2018 before being forced to cancel the raise due to market conditions. It hooked Ganfeng as an investor and is

now keen to go ahead with raising funds to build Sonora.

But the issue is – has anything actually changed? Yes, they've got Ganfeng as an investor, but Ganfeng has holdings in lots of projects and producers, so that doesn't really differentiate it and, in addition, Ganfeng has its own problems, as we report elsewhere in this edition.

Elsewhere nothing's different. In fact, the situation has deteriorated since 2018 with regards to lithium prices, and there are no signs that lithium pricing will recover before the second half of 2020. The risks in Sonora still remain – it's an unproven technology on this scale and, given the lithium industry's recent track record, even with proven technologies, you wouldn't bet on this one being that successful in the near-term. As a financial investor, why would I invest in a project like that? A question that Bacanora's management might wish to consider...

Rio Tinto studying Li extraction from Borates

Rio Tinto (LSE:RIO) is reportedly studying extraction of lithium from tailings from its US-based Borates division. It has produced borates in California's Mojave Desert for nearly a century, leaving behind a significant amount of tailings.

Now the company is to spend US\$10m to build a pilot plant which will use a heat and leaching process at 950°C to produce c.10tpa of lithium. If it's successful, RIO will consider spending a further US\$50m to upscale it to produce 5Ktpa of BG lithium carbonate.

Why the LME is barking up the wrong tree on Li

The LME has announced that it will bring in industry members to form a

committee to discuss the launch of its lithium futures contract. Readers will remember that on 10 June it selected Fastmarkets as its partner to develop a globally-accepted lithium price to underpin a futures contract, upsetting Benchmark Minerals, which most industry followers had expected to be the front runner.

However, we increasingly wonder whether it's possible to establish an underlying futures contract for lithium. The reason? As we are all beginning to understand (except the LME!) lithium is a specialty material, not a commodity. Increasingly it looks like lithium carbonate or hydroxide production will be specialised towards one particular cathode or battery maker and different lithium production from different producers will not be fungible.

It's not viable to expect there to be a trade in battery-grade lithium chemicals because the purity and chemical makeup of those products will be specifically targeted. And each consumer of those products is likely to be after a slightly different product. There is no representative product like there is in iron ore or copper and hence establishment of a lithium contract is likely to prove impossible, no matter how attractive it may look from the financing perspective.

This is yet one more hurdle that companies that want to develop lithium projects must jump. But the solution for them is surely to encourage financiers to look at their projects as chemicals projects, not mining projects. Because that is effectively what they are now. And that trend is only set to continue.

Talison expansion opens

Talison Lithium has officially opened its Chemical Grade Processing Plant 2 (CPG2) at the Greenbushes mine in

Western Australia which could take capacity at the mine to 1.3Mtpa of spodumene concentrate. But Talison recently announced that it will stall construction of CPG3 and CPG4 due to market conditions, even though it expects to start production at CPG4 within 3-4 years. Total production capacity could reach 2.4Mtpa.

Indonesia bans nickel ore shipments immediately

Indonesia banned nickel ore shipments with immediate effect at the end of October after a planned ban on shipments from the beginning of 2020 led to a rush to beat the deadline. Ore will now have to be processed through smelters before export. The plan to halt ore exports is part of Indonesia's plan to extract more value-add from its minerals industry. Announced in August, the Jan 2020 ban was, itself, brought forward by two years.

Since the August announcement there has been a material increase in the nickel price and panic buying of refined nickel inventories on the LME. Since 29 October when the ban was brought forward, prices have held roughly flat, not moving anything like as much as after the initial announcement.

There is much debate over the near-term outlook for nickel prices, with some commentators suggesting that a large amount of inventories remain available off-exchange, and a majority of short interest in the Chinese market. Elsewhere more bullish investors cite the significant uptick in nickel demand for batteries this year and suggest that nickel markets could remain in deficit.

Options for Ni in WA

There were a number of updates on the potential for nickel projects in

Western Australia at the recent Paydirt Nickel conference.

ASX-listed **Panoramic Resources** (ASX: PAN) confirmed that its Savannah North operation is expected to start production in November 2019, just 16 months after the decision was taken to reopen the mine. The first ore will come from development drives being run towards the North orebody from the existing Savannah mine. At full production it will produce 10.8Ktpa of nickel, 6.1Ktpa of copper and 0.8Ktpa of cobalt, all in concentrate.

BHP (ASX: BHP) is also close to being out of the blocks with first ore from its Yakabindie project due by December 2019, and the mine should be the primary source of mill feed for the Mt Keith concentrator from 2021 onwards. Nickel West is also making progress at the Venus underground and B11 block cave project near the Leinster smelter. It expects first production of nickel sulphate from Kwinana in H1/20.

Western Areas (ASX: WSA) confirmed that its Odysseus project is on track for first production in 2022. Speaking on our Recharge podcast, CEO Dan Lougher also highlighted the Company's significant exploration pipeline beyond that.

Diversified miner **Independence Group** (ASX: IGO) is expected to take a decision on the long-term future of its Nova mine in the next few weeks. After agreeing a renewal of its concentrate offtake agreements in the early days of November IGO made a hostile offer for PAN.

Tsingshan behind drop in nickel inventories

Mining.com reported that Chinese stainless steel producer Tsingshan

Holding Group Co. was one of the main drivers behind a substantial fall in LME nickel inventories in October, according to "people familiar with the matter".

Reportedly the company bought material to secure supplies ahead of the Indonesian nickel ore export ban but a 25Kt drawdown on inventories is one of the biggest declines in the 40-year history of the contract. Estimates for the total amount of material that they've accumulated recently are in the 30-80Kt range.

Ramu closed by PNG

Papua New Guinea has officially closed **MCC's** (SHA:601618) Ramu nickel mine for environmental violations after an expert said that water test results following a spill in August were "alarming".

Alex Mojon, an environmental remediation expert, told PNG's EMTV Online that "there is evidence that Ramu Nickel is not managing their waste...I am shocked". 28 samples tested were found to have toxic levels of heavy metals concentrates according to EMTV.

The operation was shut down for "not adhering to remedial measures issued 6 weeks ago" according to the PNG Mineral Resources Authority. At this stage the closure is expected to be temporary but how temporary it is remains to be seen, given the mine's long-term history of disposing of tailings offshore.

Hexagon looks to refocus

It's been an interesting month for **Hexagon Resources** (ASX: HXG). No sooner had it announced a surprising move into Rare Earth Element processing via a binding investment agreement with Innovation Metals

Corp (IMC), than its JV partner **Mineral Resources** (ASX:MIN) publicly announced its decision to pull out of the McIntosh graphite JV in Australia.

The two companies had previously signed an agreement for MIN to earn a 51% stake in the project by funding it to commercial production, but it looks like the project has become another victim of the downturn in graphite pricing. Hexagon has stated that it intends to keep the project running but for the near-term focus on downstream graphite processing and its new REE business.

HXG has an option to acquire a 49% stake in a new company, American Innovation Metals (AIM) for US\$2.0m, plus US\$4.0m in deferred consideration. AIM will focus on commercialising IMC's RapidSX technology for the separation of REEs. The US\$2.0m will be utilised to build a commercial development plant for the technology in North America, with commissioning planned for Q3/20. The plant will produce 60-80 tonnes per annum of REO.

The RapidSX tech combines solvent extraction with a new column-based platform which reduces time to completion and plant footprint.

Now coal could be a source of REE

Canadian-based REE developer **Avalon Advance Materials** (TSX:AVL) has signed a binding LOI to earn a 50% interest in the Will Scarlett REE project in Illinois, US.

Will Scarlett is a closed coal mine where geochemical testing has indicated elevated levels of REEs and other metallic elements such as cobalt, nickel and manganese.

The company plans to proceed immediately with analytical and process testwork to evaluate extraction of REE and see if it can be done economically.

BMW to purchase own battery RMs

BMW has decided to restructure its supply chains to allow it to purchase lithium and cobalt for EV applications directly from 2020 onwards, according to Chief Purchasing Officer Andreas Wendt.

According to BMW, this will help it to achieve better transparency about the origin of the raw materials it uses.

According to the automaker, its contracts guarantee security of supply until 2025 and beyond.

POSCO Chemicals anode plant to start production

POSCO Chemicals (KRX:003670) has announced that its new 20Ktpa graphite-based anode plant is to start in November 2019. The new plant, based in Sejong, South Korea, will be the company's second with the first stage of the plant taking the company's capacity to 44Ktpa. Capacity for the second stage could take PoscoChem's total capacity to 74Ktpa by 2022.

In a fragmented market PoscoChem only accounted for c.5% of global lithium-ion battery anode material production in 2018, but it's been looking to increase its market share vs Chinese and Japanese players. The market was traditionally led by Japan-based **Hitachi Chemical** (TYO:4217) but low labour costs and heightened availability of raw materials in China have led that country to dominate in recent years. China now accounts for more than 75% of global anode materials production.

Umicore signs cathode supply agreement with Samsung SDI

Umicore (EBR:UMI) signed an agreement to supply **Samsung SDI** (KRX:006400) with 80Kt of NMC cathode material over a five year term from 2020. The majority of the cathode will be for EVs with a smaller portion for ESS.

Just last month UMI signed a similar agreement with **LG Chem** (KRX:051910) for 125Kt of NMC material over a similar timeline. A large part of that contract is believed to be for LG's Polish battery plant.

Recycling market could reach US\$6bn by 2030

A report by Circular Energy Storage (CES) has predicted that the lithium-ion battery recycling market could be worth as much as US\$6bn by 2030.

CES is the same commentator that suggested that global recycling rates were being massively under-estimated earlier this year. It predicts that China could generate c.500Ktpa of battery waste by 2020 and 1.2Mtpa by 2030.

The consultancy suggests that recycling could generate up to 125Ktpa of LCE, 50% of current lithium market production, and 35Ktpa of cobalt, 30% of current cobalt output, as well as 86Ktpa of nickel. This could have a significant impact on raw materials supply given the current shortage of investment in the space.

It also highlights the importance of second life applications, noting that by 2030, batteries with a capacity of close to 1,000GWh will have become available for second life usage, possibly in applications such as stationary energy storage and backup power.

Galan continues strong Hombre Muerto results

Following up its maiden resource last month, **Galan Lithium** was back to drilling in October, releasing further high grade intercepts from the Hombre Muerto project in Argentina.

Drilling from the Pata Pila licence returned numerous intercepts of brine above 900mg/l Li and with low levels of Mg/Li below 2.0. Management believes that there's good potential to expand the maiden resource of 685Kt @ 672mg/l Li.

St George continues good Ni results

Drilling continues at **St George Mining's** Mt Alexander project in Western Australia which featured in this section in June.

These results were from the Radar prospect, located 1.2km east of the known Cathedrals prospect and it extends the known strike length of mineralisation to 5.5km. Drilling continues and the company has initiated a PEA.

Development News

Cobalt

Fortune Minerals (TSX:FT) has cut back its plans for the Nico Co-Au-Sb-Cu project in Northwest Territories, Canada. The 2014 FS targeted a 4.65Ktpd project which was later updated to 6Ktpa. But its plan has now been cut back down again due to market conditions.

Last month resource roundup

Date	Company	Ticker	Main commodity	Project	Location	Country	Status	P&P Reserve		MII Resource		By-product
								Mt	Grade %	Mt	Grade %	
01-Oct-19	Search Minerals	TSX:SMY	REE	Deep Fox	Labrador	Canada	Maiden	-	-	6.20	0.21% Nd/Pr	Dy
03-Oct-19	Altura Mining	ASX:AJM	Lithium	Altura	W. Australia	Australia	Upgrade	37.6	1.08% Li2O	45.70	1.06% Li2O	-
10-Oct-19	Aura Energy	ASX:AEE	Vanadium	Haggan	-	Sweden	Upgrade	-	-	2000.0	0.3% V2O5	Mo, Ni, Zn
15-Oct-19	Sagon Resources	ASX:SG1	REE	Cummins Range	W. Australia	Australia	Maiden	-	-	13.0	1.13% TREO	-
15-Oct-19	Talga Resources	ASX:TLG	Graphite	Niska (Vittangi)	-	Sweden	Maiden	-	-	4.6	25.8% TGC	-
21-Oct-19	Toro Energy	ASX:TOE	Vanadium	Wiluna	W. Australia	Australia	Maiden	-	-	53.6	0.038% V2O5	U
30-Oct-19	Beowulf Mining	AIM:BEM	Graphite	Aitolampi	-	Finland	Upgrade	-	-	26.7	4.8% TGC	-

Source: Company data, BM Review

October 2019 drilling news

Date	Operator	Project	Location	Status	Depth	Key intercept	Hot or not?
Lithium							
08-Oct-19	Liontown Resources (ASX:LTR)	Kathleen Valley	Australia	PFS	256m	29m @ 1.3% Li2O	
09-Oct-19	Galan Lithium (ASX:GLN)	Hombre Muerto	Argentina	R	582m	65m @ 948mg/L Li; Mg/Li: 1.63	🔥
14-Oct-19	Core Lithium (ASX:CXO)	Finniss (BP33)	Australia	R	77m	52m @ 1.28% Li2O	
21-Oct-19	Jindalee Resources (ASX:JRL)	McDermitt	US (Nevada)	R	36m	54m @ 1773ppm Li	
29-Oct-19	Jindalee Resources (ASX:JRL)	McDermitt	US (Nevada)	R	28m	30m @ 1967ppm Li	
Nickel							
09-Oct-19	St George Mining (ASX:SGQ)	Mt Alexander	Western Australia	R	46m	6m @ 2.14% Ni, 0.74% Cu	🔥
16-Oct-19	Blackstone Minerals (ASX:BSX)	Ta Khoa	Vietnam	R	140.6m	29.4m @ 1.00% Ni	
Vanadium							
02-Oct-19	Strategic Resources (TSXV:SR)	Akanvaara	Finland	R	136m	25.1m @ 0.48% V2O5	

Source: Company data, BM Review. Status: PR: pre-resource; R: resource evaluation; RS: Re-start

Glencore (LSE:GLEN) signed a five-year offtake agreement with Chinese battery producer **GEM Co.** for at least 61.2Kt of cobalt hydroxide between 2020-24. The agreement comes after GEM was previously reported to have defaulted on a three-year supply contract as prices declined at the end of 2018.

Neometals (ASX:NMT) signed a binding MOU with Germany's SMS Group for the next stage of evaluation and commercialisation of its lithium-ion battery recycling technology.

Graphite

Armadale Capital (AIM:ACP) has signed a MOU with China's Datong Resources for 25Ktpa of graphite concentrate over five years from its Mahenge Liandu project in Tanzania. This is the third agreement the company has signed, taking total volume under offtake contracts to 60Ktpa vs its targeted production of 49Ktpa.

Lithium

Advantage Lithium (TSXV:AAL) published a PFS on its Cauchari JV with **Orocobre** (ASX:ORE) in Argentina,

which supports a 30-year mine life producing 25Ktpa of BG lithium carbonate for a pre-production capex of US\$446m and average opex of US\$3560/tonne LoM.

Mali Lithium (ASX:MLL) has initiated a scoping study into downstream processing of concentrate to be produced from its Goulamina project in Mali. The study into production of lithium sulphate and lithium oxide will be undertaken alongside the DFS for the Goulamina concentrate project. The study is expected to take six months.

Millennial Lithium (TSXV:MLL) reported that the Argentinean government has granted it a tax break for the Pastos Grandes project, lowering the corporation tax rate to 25% from 1 January 2020.

Piedmont Lithium (ASX:PLL) signed a LOI with Ion Carbon & Minerals LLC, a division of AMCI Group, to market quartz, feldspar and mica produced from its planned lithium project. The industrial minerals would provide important by-product credits for the project.

Raw & Intermediate Materials: Development News...

Posco (KRX:005490) has decided to fast-track its Hombre Muerto project in Argentina without even waiting for the final results from the project's demonstration plant. The company confirmed that a 25Ktpa project will start production in H1/20. It has increased its reserve estimate for the project to 5.67Mt LCE from 2.25Mt which will give the project a 50 year rather than a 20 year life

Sigma Lithium (TSXV:SGMA) published a positive FS for the Xuxa deposit at its Grota do Cirilo HR project in Minas Gerais, Brazil. It supports a 9-year project with 220Ktpa output of 6% concentrate with cash costs CIF China of US\$342/t for upfront capex of US\$98.4m.

Others

Defense Metals (TSXV:DEFN) published results from metallurgical testwork on a 30 tonne bulk sample from its Wicheeda project in BC, Canada, which indicates a 48.7% TREO concentrate can be produced with a 85.7% TREO metallurgical recovery and 8.2% mass yield.

Geomega Resources (TSXV:GMA) has scaled up the planned daily throughput at its proposed REE recycling plant and increased the capex plan. The new plan will run at 1.5tpd (previously 1.0tpd) and cost C\$2.6m (C\$2.0m). The ISR process recycles REEs, focusing on Nd, Pr, Tb and Dy. Initial production at the plant is targeted for 2020.

Horizonte Minerals (AIM/TSX:HZM) has published the PFS for the Vermelho Ni-Co project in Brazil's Para state. It supports a 38-year mine life producing 25Ktpa of Ni and 1.25Ktpa of Co utilising HPAL for a US\$652m initial capital cost and for US\$3.64/lb Ni C1 cash cost (net of bpcs). The project will

produce nickel sulphate and battery grade cobalt sulphate.

Xuxa FS recoveries more realistic

Sigma Lithium's FS for the Xuxa orebody at its Grota do Cirilo hard rock project in Brazil certainly stacks up well against the opposition.

The orebody is spodumene-rich and yields a 6% Li₂O concentrate on a coarse grind utilizing only DMS and realizing a 60.4% lithium recovery.

While lithium recovery seems to be quite low compared to the levels targeted by the Western Australian hard rock developers, given the issues that these companies have had reaching their targeted recovery rates, this looks to us like a welcome case of conservatism.

The project benefits from low-cost Brazilian hydro power which helps to keep minesite costs low, as well as highly developed transportation infrastructure for bulk materials in Minas Gerais state. FOB cash costs of US\$238/t are very competitive and delivered China cash costs of US\$342/t are certainly in the lower portion of the cost curve.

Capex of US\$98.4m highlights that this is probably one of the most attractive development projects in the hard rock space currently. It's worth noting the 9-year mine life for the project but highlighting that there is exploration upside at the Xuxa orebody itself as well as other pegmatites located in the Grota do Cirilo project area.

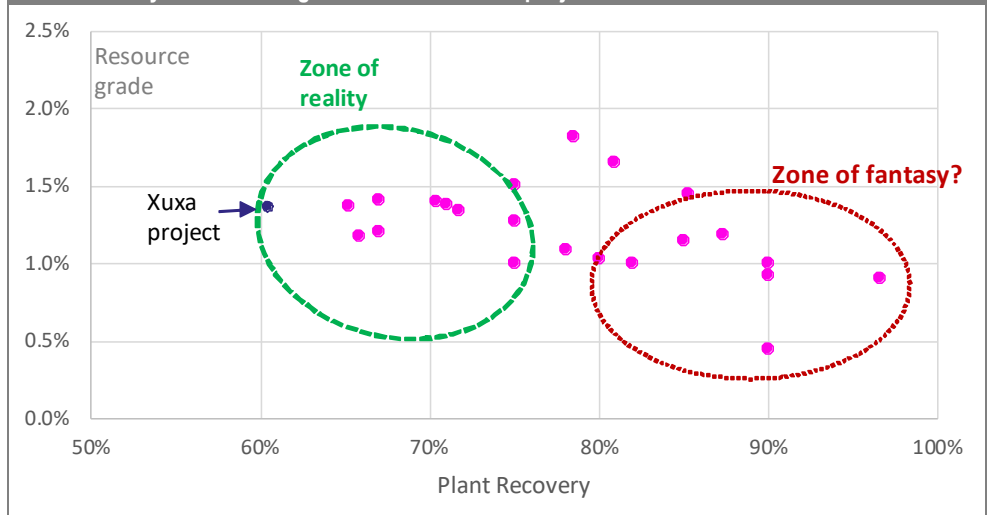
Product grade will be key for Cauchari

Contrast the technically simple, low capital intensity of the Xuxa project with AAL's and ORE's Cauchari JV which has an upfront capex of US\$446m.

The question, as always with Argentinean brine projects, is whether the project can produce enough battery grade material to command premium prices? Based on Orocobre's recent production history and test results from other companies (eg Neo Lithium; TSXV:NLC), you'd have to say that there's a big question mark there.

Opex looks attractive and, if they get it right, the numbers all stack up but the resource grade is lower than ORE's Olaroz operation and, as we know, that one has also struggled to produce battery-grade product.

Plant recovery vs resource grades for HR lithium projects



Source: Company data, BM Review estimates

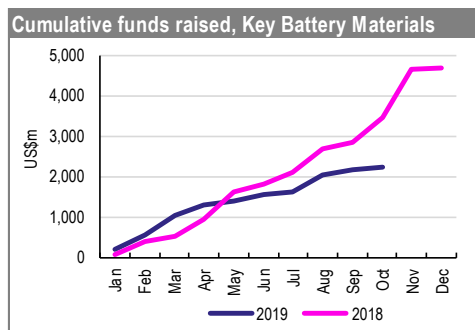
Raw & Intermediate Materials: Financing/M&A News

The feasibility study utilizes average selling prices of US\$12,166/t LCE which look pretty racy on today's levels, although possibly not by the mid-2020s, but it also suggests that the project will produce 100% battery grade product by year four, which most brine operations struggle to do.

It is becoming increasingly important in brine for companies to build pilot and demonstration plants to demonstrate that they can upscale their laboratory procedures in order to produce promised levels of battery grade products.

Funds raised now down 35% in 2019

October was another tough month for raising finance in the battery materials sector with total funds raised down 60% m/m and now down 35% y/y YTD.



Source: Company data, BM Review

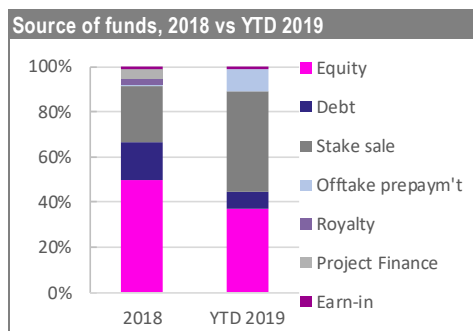
The only sub-sector showing substantial positive momentum is graphite, where we saw just over US\$30m of funds raised, which comprised 50% of total funds raised in battery materials for the month, a rather tragic datapoint.

October 2019 financing round-up (over US\$1m)

Date	Company	Ticker	Commodity	Amt raised local CCY	Unit	Placing price local CCY	Use of funds
09-Oct-19	Walkabout Resources	ASX:WKT	Graphite	A\$5m	Bridging loan	NA	Development of Lindi Jumbo
16-Oct-19	Sagon Resources	ASX:SG1	REE	A\$1.25	Placement	A¢6	Exploration at Cummins Range
17-Oct-19	Altura Mining	ASX:AJM	Lithium	A\$21.5m	Rights issue	2 for 13 @ A¢6	Working capital
23-Oct-19	St George Mining	ASX:SGQ	Nickel	A\$5.8m	Placement	A¢15	Exploration at Mt Alexander
25-Oct-19	Ucore Rare Metals	TSXV:UCU	REE	C\$8.1m	Rights issue	C\$0.10	Bokan-Dotson project
25-Oct-19	Walkabout Resources	ASX:WKT	Graphite	A\$40m	Loan note	NA	Development of Lindi Jumbo
30-Oct-19	Standard Lithium	TSXV:SLL	Lithium	C\$5m	Convertible loan	C\$0.80	South Arkansas demonstration plant

Source: Company data, BM Review

There has been a very significant change in funding behavior as raw material and stock prices have fallen, with sales of stakes now a substantially larger proportion of funding, and equity and debt smaller components.



Source: Company data, BM Review

Cobalt

Jervois Mining (ASX:JRV) has banked A\$3.1m via the sale of its Bullabulling gold royalty and plans to allocate the proceeds to exploration at its Idaho cobalt project.

Pala sweetened its offer for **Cobalt 27 (TSXV:KBLT)** to C\$4 in cash and one share in the newly minted **Conic Metals (TSXV:NKL)**, with an implied value of C\$1.92, vs its previous offer of C\$3.57 in cash and C\$2.18 in shares of Conic. The changes follow the lukewarm reception of the offer by shareholders. The new structure also reduces the cash change of control payments for management by C\$7.1m or 46%.

Lithium

Nemaska Lithium (TSX:NMX) now expects to close a C\$600m deal with Pallinghurst Resources by the end of the year after DD took longer than

expected. The parties have agreed to extend the exclusivity period to 31 Dec. Separately Nemaska announced plans to cease operations at the Phase 1 plant and downsize operations due to the delay in finalising its financing.

Uranium One (UUU), a subsidiary of Rosatom, signed a MOU to buy a 51% stake in **Wealth Minerals' (TSXV:WML)** Atacama brine project in Chile. The commercial terms of the acquisition are still to be agreed on. We have previously reported about UUU's direct lithium extraction technology and we would suggest that this project may serve as a testbed for the development of that technology.

Others

Bushveld Minerals (AIM:BMN) has negotiated a lower price for the acquisition of the Vanchem business of US\$53.5m rather than US\$68m to reflect the current state of the vanadium market. BMN will pay US\$30m in cash with the balance in convertible loans.

Hochschild Mining (LSE:HOC) announced that it acquired a 93.8% stake in the BioLantanidos ionic clay project for US\$56.3m, taking its holding to 100%. Hochschild previously invested \$2.5-million in the project during 2018 and early 2019 in exchange for a 6.2% equity stake, with an option to increase ownership. Mineralisation at the project occurs from surface to 20-30m depth and is unconsolidated sediments. The clay

undergoes a simple washing process in which rare earths will be desorbed into a solution, concentrated and calcined to obtain a rare-earth oxide. Waste clay can be returned to the open pit. There is a FS on the project which HOC intends to revise over the next 18 months.

Lithium Australia (ASX:LIT) and Envirostream Australia are to combine their battery recycling operations into a new entity which is intended to be listed on the ASX in mid-2019. This would be the only pure-play listed recycling option listed anywhere in the world currently.

Polymetal (LSE:POLY) is reportedly considering investing in the Tomtor REE project in Russia, which is being developed by its largest shareholder, the Nesis family.

VanadiumCorp Resources (TSXV:VRB) signed a Definitive Agreement with a private Canadian corporation (PrivateCo) whereby PrivateCo can earn up to a 100% interest in its Iron-T VTM project by funding the project through to production in exchange for a right of first refusal on 200Ktpa pf VTM concentrate for LoM at a discounted price.

Vital Metals (ASX:VML) has completed the acquisition of privately-held Cheetah Resources in exchange for 400m shares, valuing it at A\$4.8m. It will now focus on the Nechalanko/Thor Lake project which has a resource of 149.3Mt @ 1.42% REO.

Cobalt

Katanga Mining (TSX:KAT) produced 4.76Kt of cobalt in hydroxide in Q3/19, up 83% q/q, with 97% having low enough uranium levels to be shipped. A detailed operational review has indicated the potential to cut costs by US\$200-250m per annum which should

be attainable by 2022. Cobalt production guidance for 2019 is 16Kt, for 2020 is 29Kt and for 2021 is 32Kt.

Graphite

Bass Metals (ASX:BSM) reported CQ3/19 graphite production of 1.1Kt vs 1.0Kt in CQ2/19 with large flake share of 42% vs 32% in CQ2/19.

Syrah Resources (ASX:SYR) has announced that up to 30% of its staff at the Balama mine in Mozambique are to be made redundant as it struggles to cope with the material drop in graphite prices. It had already announced plans to cut graphite production by c.5Kt/month and announced that it expects to produce 120-150Ktpa in 2020. It expects the restructuring to result in a c.A\$22m annualised cost reduction.

Lithium

Lithium reporting is discussed in our Focus section and will not be repeated here.

Others

Independence Group (ASX:IGO) reported CQ3/19 nickel production of 7.7Kt, down 2% q/q at cash costs of A\$2.59/lb (up 17% q/q).

It has decided not to proceed to a FS on its Downstream Nickel Sulphate Processing project after successfully securing significantly better terms from offtakers **BHP** (ASX:BHP) Nickel West and Trafigura for nickel sulphide concentrate from its Nova mine. Even though the PFS demonstrated the technical feasibility of the patent-pending IGO Process, it was decided not to go ahead with the project which had an indicative capital cost of A\$530m with operating costs of A\$1.50/lb of payable nickel metal with average nickel payability of 70%.

IGO seems instead to have opted for a lower risk offer for **Panoramic Resources** (ASX:PAN) for which it made an A\$312m hostile offer at the beginning of November.

Largo Resources (TSX:LGO) reported Q3/19 V2O5 production of 2.95Kt, up 15% y/y, and lowered its cost guidance for the year to US\$3.30-3.40/lb for cash costs excluding royalties.

Lynas Corp (ASX:LYC) reported CQ3/19 NdPr production of 1.242Kt, down 17% q/q, with REE production down 16% q/q. It has yet to receive approval to increase lanthanide concentrate processing. Sales revenue for the quarter was A\$99.1m vs A\$87.5m in the previous quarter due to higher selling prices.

Western Areas (ASX:WSA) reported a 7% q/q increase in nickel production to 5.8Kt in CQ3/19 with nickel in concentrate production down slightly on lower mining grades. Sales were also down slightly at 5.05Kt (5.89Kt last quarter). Unit cash costs were A\$3.06/lb with FY20 guidance of A\$2.90-3.30/lb.

People Moves

Bearing Lithium (TSXV:BRZ) announced the resignation of CEO Jeremy Poirier.

Mark Selby, former CEO of **RNC Minerals** (TSX:RNX) has been appointed as Chairman and CEO of Canada Nickel, a subsidiary of **Noble Mineral Exploration** (TSXV:NOB), which is developing the Crawford Ni/Co project in Ontario, Canada.

Panoramic Resources (ASX:PAN) appointed Victor Rajasooriar as the new MD and CEO, starting 11 November. He replaces Peter Harold who resigned in August. Rajasooriar is a mining engineer and was previously MD of Echo Resources.

KORE to build 10GWh battery plant in the US

KORE Power has announced plans to build a 10GWh lithium-ion battery plant in the US to support global growth efforts for its Mark 1 Energy Storage System.

The company is currently reviewing sites for the proposed one million square foot facility, which is expected to create over 2,000 new jobs. The plant will augment the 6GWh of battery capacity that KORE will have available from partner Do Fluoride Chemicals' plant in Jiaozuo, China, which is expected to come into production in Q1/20.

US-based KORE's utility-scale Mark 1 ESS product utilises proprietary NMC cells.

Valmet introduces new battery management system

Valmet Automotive (HEL:VALMT) has developed a new battery management system for electric vehicles which it believes could lower costs by around 25%, having a significant knock-on effect on the profitability of EVs.

The company has utilised a wireless data connection to eliminate end-to-end low voltage wiring in the individual cell modules, cables between modules, slave electronics on the module and corresponding connector systems. This will revolutionise management of the vehicle while significantly lowering the amount of copper required.

Dyson out of EV business

Dyson (LSE:DYS), the British tech company, has announced that it will ditch its plans to develop electric vehicles. Apparently, it will "rechannel" the US\$2.5bn already invested into other technology.

The issue seems to be the commercial viability of the design rather than engineering viability. Given the move of OEMs into the EV space, it seems that Dyson worried that it could not compete. Likely a good decision.

Tesla misses Q3 delivery target

Tesla (NASDAQ:TSLA) managed to deliver 97,000 electric cars in Q3/19, narrowly missing its target of 100,000. It managed 79,600 Model 3, as well as 17,400 Model S and Model X.

Despite failing to meet the target, this is still a record quarter for Tesla, which managed 95,356 deliveries in Q2. Given the material slowdown in sales activity in the US and China, this looks like a reasonable return. Tesla is still targeting deliveries of between 360,000 and 400,000 units for 2019.

The company reported that it had record new orders in Q3 and increased its order backlog into Q4, without giving details.

Elsewhere its results were a bit mixed. It produced a Q3 net profit but analysts were concerned that EV revenues were down 12% y/y on lower selling prices but gross margins were up, with the company giving no indication of how this was achieved. There were non-recurring items as well as a US\$30m boost from its Autopilot software upgrades. There is no indication whether these improvements are one-off or can be repeated in the future. Doubts remain about whether it can come anywhere close to its 2019 volume targets.

BYD suffers from subsidy loss and competition

BYD (HKG:1211) warned that it expects its 2019 profit to fall 43% as it unveiled an 89% drop in Q3/19 profit, which it

attributed to the Chinese EV subsidy rollbacks and greater competition.

It sold 107,723 vehicles in the quarter, down 15% y/y with NEV sales down 34% y/y in September alone. However it's not just the subsidy cuts impacting sales. Electrive also reports that the Tesla Model 3 is also generating competition for BYD in some of its key models.

Soul the latest model delayed by battery shortages

Kia's (KRX:000270) Soul has become the latest model to suffer from a lack of battery supplies. The Soul EV was supposed to launch in the US in 2020 but Kia has now announced that that has been delayed until 2021. The reason? Difficulties with supplying the batteries and shortages of electric motors.

The Soul becomes just the most recent model which has been delayed due to battery shortages. This in an environment where many battery plants are running at sub-50% utilisation rates. It suggests that the difference between tier one and tier two battery producers is significant in terms of pipeline.

Toyota introduces e-TNGA platform

Toyota (TYO:7203) has released further details about its e-TNGA platform which is being developed for all of its future electric vehicle models. The new platform will support rear, front and four-wheel drive and will be suitable for all sizes of car with battery sizes between 50 and 100kWh. Initially it will be designed for lithium-ion batteries but other batteries could potentially be hosted as well at a later date. The platform is a likely competitor to

Volkswagen's (ETR:VOW3) MEB platform.

In separate news, Toyota has announced that it will offer its first high volume BEVs in China in 2020 due to its unused quotas in that market, delaying their European launch for a further two to three years. We have to say that, given our lead article this month, we can't help but feel that Toyota's strategy is flawed, but then Toyota has been quite behind the times in PEVs all along, preferring to focus its business on self-recharging HEVs, in which it has established a strong position.

Honda speeds up plans for electrification in Europe

Honda (TYO:7267) has announced that it is to electrify all of its core models in Europe three years earlier than it initially planned. In contrast to Toyota it has decided that its business in Europe will be at "the forefront" of the Group's electrification plans.

Demand from customers is one of the key drivers of this. It launched its first hybrid SUV, the CR-V, in Europe last year and it already accounts for 60% of sales in the model. The Honda e, which only launched earlier this year, has already received 45,000 expressions of interest and deliveries are due to start in summer 2020.

In addition to the Honda e, the company plans to launch a Jazz hybrid in 2020, with four more models to follow by 2022.

Brussels to ban petrol and diesel vehicles by 2035

The Brussels regional government has announced that it is banning diesel vehicles from 2030 and petrol vehicles

from 2035. Motorised two wheelers will also be subject to bans and most polluting motorcycles will be banned from 2022.

The Belgian city is to make significant infrastructure investments over the next ten years to help solve the issue of inadequate public transport solutions. One hopes that this will include charging infrastructure, of which the city is currently noticeably deficient.

According to Bloomberg data, 24 European cities with 62 million inhabitants have now announced plans to phase out diesel cars in the long-term, with 13 of these cities planning to eliminate petrol vehicles as well.

Charging Round-up

Ionity, which is developing a network of 400 high voltage charging stations across Europe, has reached 151, with 64 more currently under construction.

Lidl announced that it is to install fast chargers at over 300 stores in the UK over the next three years. New stores will only be built with stations and existing stores will be retrofitted.

ITT Cannon has launched a liquid-cooled DC charging solution that is designed to charge vehicles up to 500kW and which allows charging to a 100 mile range in three to five minutes.

ABB (SWX:ABBN) has acquired a 67% stake in Chinese company Chargedot, which supplies charging station software to EV manufacturers, charging network operators and real estate developers. ABB has sold more than 11,000 fast-charging stations in 76 countries worldwide.

Ford (NYSE:F) has announced that its forthcoming EVs will be able to access the largest charging network in the US,

the FordPass Charging Network, which will allow access to over 12,000 stations operated by various companies. Ford customers will be able to pay through a centralised app without having to subscribe separately to individual networks. Surely the shape of things to come?

Second life gets new incarnation in Japan

Three companies are planning to develop a business to re-use end-of-life lithium-ion batteries from electric vehicles for energy storage systems.

Japanese trading house **Itochu** (TYO:8001), battery and electric vehicle producer **BYD** (HKG:1211) and vehicle battery recycler **Shenzhen Pandpower** plan to set up a business that utilises old auto batteries to make container-type storage batteries, perhaps as soon as 2020.

Lithium-ion batteries used in cars usually last for 8-10 years and it has now been nearly 10 years since the first EVs began to appear. The hope is to re-use these batteries since storage applications are less high-spec than EV applications and there is still significant value left in the battery.

Numerous car batteries will be placed inside a 40-foot container and turned into a one megawatt-hour battery. One of these containers would be enough to fuel the daily energy consumption for 100 households, although the batteries are expected to be sold mainly to industrial users. Itochu will own the batteries and customers will pay according to the volume of electricity they use.

The JV initially plans to target Australia and South East Asia with operations expanded to the US and Japan over

time. Itochu hopes that revenues could reach ¥10bn (US\$92m) within five years.

Better monitoring could prevent battery fires

A study by testing and certification company DNV GL Energy, requested by the South Korean government, has concluded that better monitoring and prevention can avoid dangerous battery fires in South Korean ESS plants.

The report identified a minor manufacturing glitch which initiated battery failures, but suggested that inadequate monitoring and protection systems allowed the failures to escalate into major fires. It highlighted the differences between South Korean and international safety standards as a key differentiating factor.

The report looks positive for Korean battery manufacturers, which had been impacted by safety fears in recent months.

New York approves 316MW Battery Project

New York's utility regulator has approved the Ravenswood project which, if built, will be the largest battery plant in the state.

The 316MW/2528MWh battery project would allow the demolition and replacement of 16 50-year old combustion turbines which run at peak power demand. The new plant would have capacity to discharge for up to eight hours.

The regulatory approval does not guarantee that the project will happen but it does make it more likely, and also easier to secure financing.

Battery & Tech News

New DLE technology?

Energy Exploration Technologies

(EnergyX) is the latest to announce development of direct lithium extraction (DLE) technology that could "revolutionise" lithium production from brines.

Its process uses a metal organic framework (MOF) membrane technology catchily known as Lithium Ion Transport and Separation (LiTAS) which was developed by University of Texas, Monash University and CSIRO.

The technology which, so far, works at lab scale can process lithium in just one to two days compared to the 18-24 months it takes to produce via evaporation, without using any freshwater (vs the c.2300L/t of lithium carbonate used in evaporation) and can even separate lithium salts from other metal salts. In addition it has a recovery rate of 90% vs 30-50% for the conventional process.

EnergyX isn't the first, and won't be the last, to believe they have a viable process based on lab-scale testing. But we need to see commercial scale testing before investors are likely to believe the hype.

Improved silicon electrode

GS Yuasa (TYO:6674) has developed a silicon metal-based electrode which can triple energy density compared to conventional lithium-ion batteries.

The company believes that the technology could be ready to be used in EV batteries as early as 2025.

Yuasa, previously most well-known for its lead-acid batteries has been moving towards lithium-ion technologies.

Exciting Li-CO2 battery developments

The number of column inches on lithium-CO2 batteries is substantial this month. A team at the University of Illinois at Chicago have published a paper in the journal *Advanced Materials* which showed results from what they say was the world's first usable Li-CO2 battery.

LiCO2 batteries could theoretically reach an energy density of 1876Wh/kg compared to state of the art lithium-ion batteries at 256Wh/kg.

Their battery has been tested over 500 cycles. So far it avoids the build up of carbon within the battery that has previously led to failures. The team managed to do this by adding molybdenum disulphide as a cathode catalyst, which helps get the carbon back into action in the battery.

It's early days for this formulation but if further testing can replicate the success it looks like being one for the future.



Tune into

RECHARGE

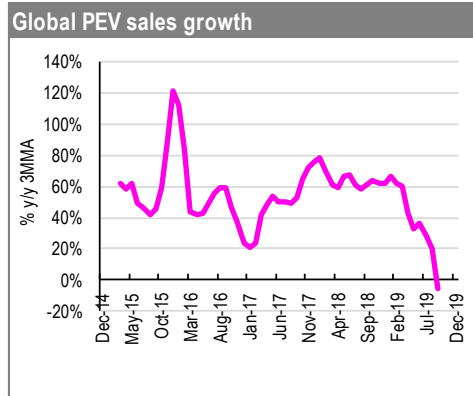
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Trade & Demand: Batteries & End-use markets

Global EV sales down again

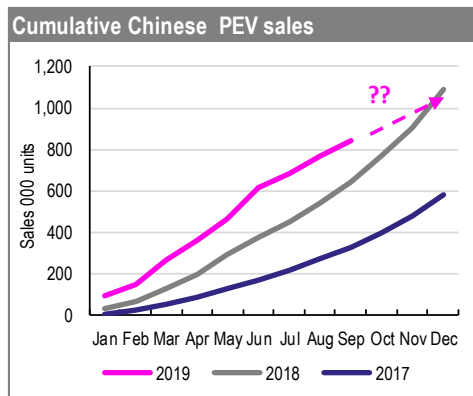
Although bouncing 16% m/m in September, Global EV sales were still down 9% y/y, following up August's 8% y/y decline.



Source: BM Review, EVvolumes.com

Once again the weakness came in both China and the US, with a further monthly decline in China. We are not so worried about the US where the bulk of the problem is difficult y/y comparisons due to the Model 3 launch in H2/18.

Chinese sales, however, were down 5% m/m and 27% y/y and there must now be significant concerns for Q4/19 given that Q4 is normally a seasonally strong quarter.



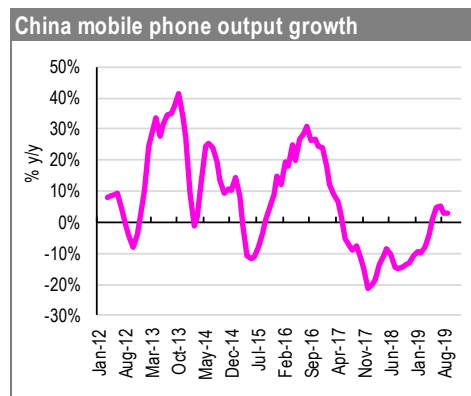
Source: BM Review, EVvolumes.com

If sales continue at current levels in Q4/19 then Chinese EV sales will fall y/y for the full year 2019. One has to assume that that would be an unacceptable metric for the Chinese government, and so we might hope to

see a pull back of the subsidy changes which could give a boost to the industry ahead of expected European demand coming through in 2020.

China phone output up

China's mobile phone output growth has now been positive for five out of the past six months, a positive indicator for small lithium-ion battery demand in the midst of a maturing market for smartphones.

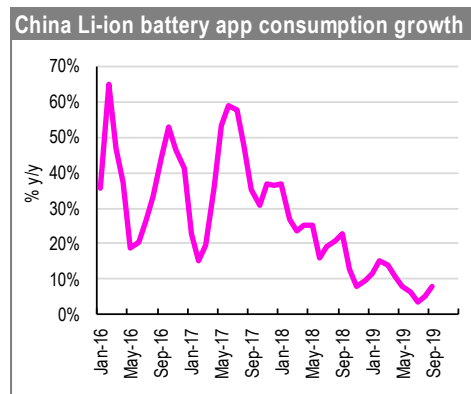


Source: BM Review, China NBS

China and Japan battery apparent consumption growth recovering

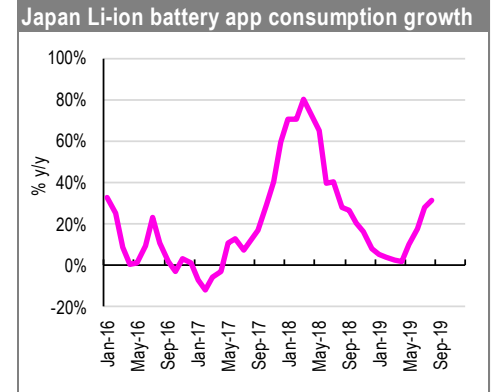
Apparent consumption growth for lithium-ion batteries in both China and Japan is showing signs of re-accelerating in recent months, a positive for raw material makers.

China's LIB consumption growth hit a multi-year low over the summer but has showed signs of re-accelerating in the past few months.



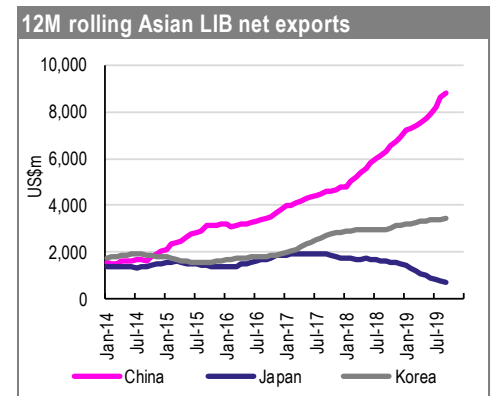
Source: BMR, China NBS, GlobalTradeTracker

Whereas Japan's consumption of lithium-ion batteries hit a 2% growth rate in April, before recovering strongly off that level (latest data is for August).



Source: BMR, BAJ, GlobalTradeTracker

This acceleration in domestic demand has left Japanese net exports of lithium-ion batteries at multi-year lows.



Source: BM Review, Global Trade Tracker

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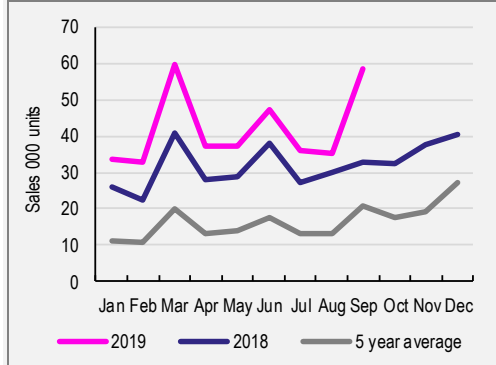
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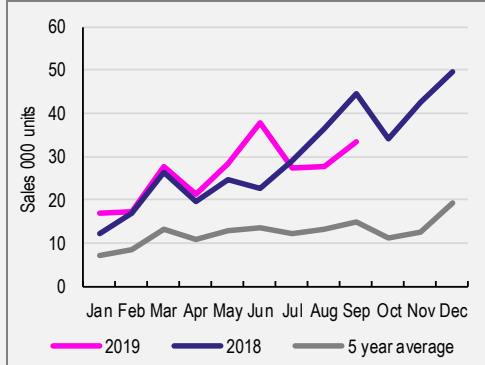
Trade & Demand: Data Summary

Seasonality of European PEV sales



Source: EVvolumes.com, BM Review

Seasonality of US PEV sales



Source: EVvolumes.com, BM Review

Monthly sales & trade summary

		Sep-19	m/m	y/y	YTD y/y
PEV sales					
Europe	K units	58.7	66%	80%	38%
US	K units	33.4	21%	-25%	2%
China	K units	76.7	-5%	-27%	30%
Global	K units	183.4	16%	-9%	25%

Trade data

China

Net imports

Cobalt ores & conc.	Kt	15.0	7%	2%	-41%
Lithium carbonate	Kt	1.1	-67%	-372%	-19%
Nickel metal & alloys	Kt	25.6	-53%	-41%	-5%
Flake graphite	Kt	10.9	629%	233%	306%

Net exports

Spherical graphite	Kt	4.7	-5%	-19%	15%
Lithium hydroxide	Kt	4.6	25%	94%	105%
Lithium ion batteries	M units	83.7	14%	242%	146%

Exports

Rare Earth & products	Kt	7.1	-11%	-20%	-5%
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Japan

Net imports

Lithium carbonate	Kt	1.0	-50%	-49%	7%
Lithium hydroxide	Kt	1.2	96%	25%	485%
Lithium ion batteries	US\$m	84.3	117%	-26%	-63%

Korea

Net imports

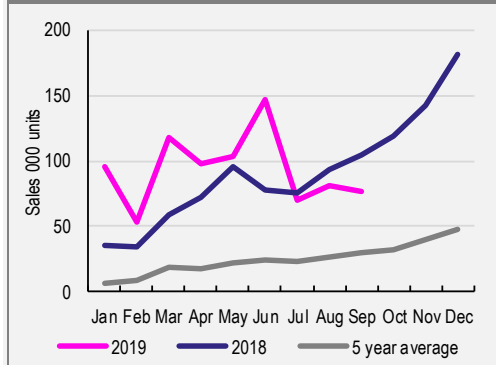
Lithium carbonate	Kt	2.4	-22%	-7%	29%
Lithium hydroxide	Kt	1.5	-29%	29%	97%

Net exports

Lithium ion batteries	US\$m	269.6	-12%	10%	12%
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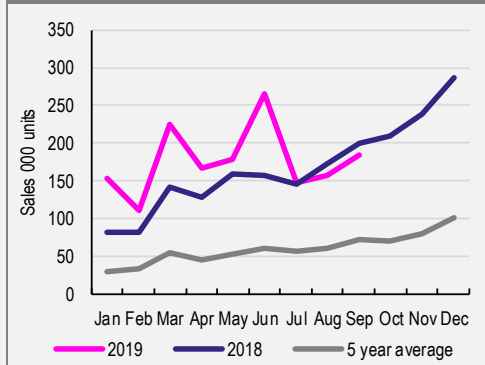
Source: EVvolumes.com, GlobalTradeTracker, BM Review

Seasonality of Chinese PEV sales



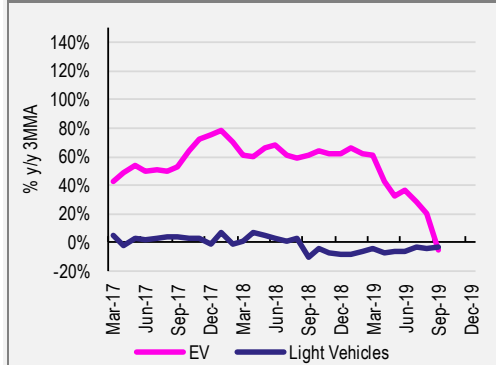
Source: EVvolumes.com, BM Review

Seasonality of Global PEV sales



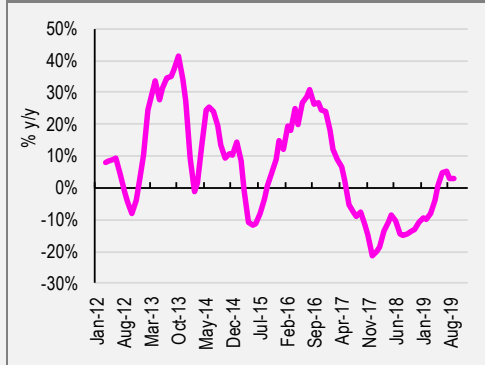
Source: EVvolumes.com, BM Review

Global PEV vs Light Vehicle sales growth



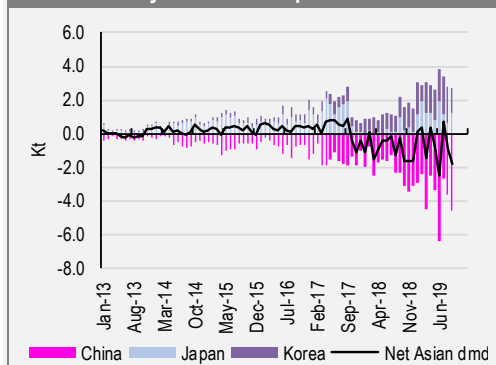
Source: EVvolumes.com, carsalesbase, BM Review

Chinese mobile phone output growth



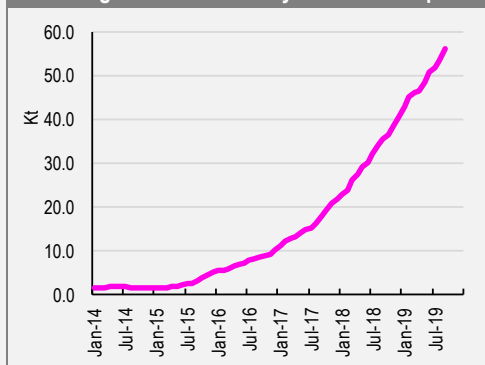
Source: National Bureau of Statistics, BM Review

Asian lithium hydroxide net imports



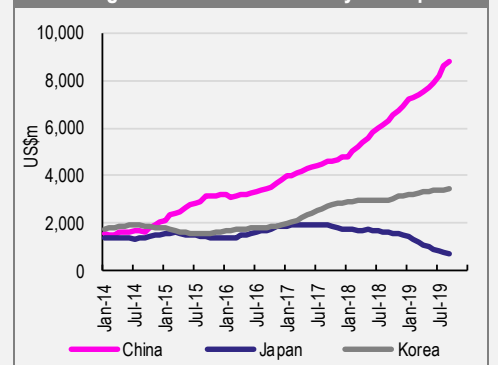
Source: GlobalTradeTracker, BM Review

12M rolling China Ni-Mn-Co hydroxide net exports



Source: GlobalTradeTracker, BM Review

12M rolling Asian lithium-ion battery net exports



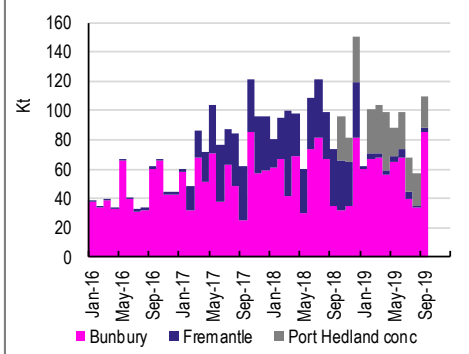
Source: GlobalTradeTracker, BM Review

Trade & Demand: Commodities

W. Australian spodumene exports bounce strongly

Our Australian three ports spodumene export series bounced strongly in September, aided by bumper exports from Bunbury (mostly Talison Lithium), which hit their second-highest level ever. Port Hedland and Fremantle exports remained weak.

Australian 3 ports spodumene con exports

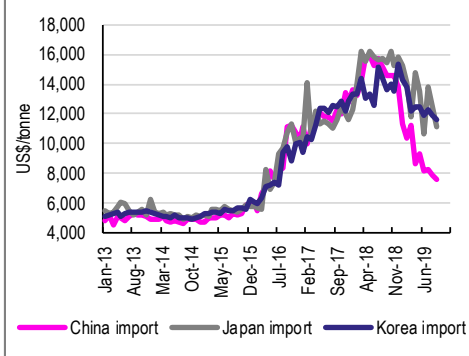


Source: Pilbara Port Authority, Southern Ports

No signs of life in lithium

Chinese lithium carbonate prices held up relatively well in October while hydroxide prices continued to fall; probably no great surprise given the increase in Australian spodumene exports in September and the fall in spodumene prices that month.

Lithium carbonate realised prices



Source: Chilean Central Bank, GlobalTradeTracker

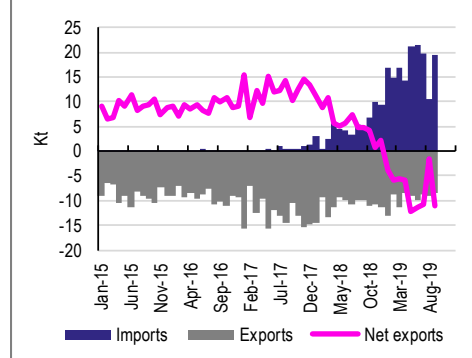
There's an interesting differential between Chinese import prices of lithium carbonate and Japanese/Korean import prices, illustrated in the chart above.

It tends to suggest that a high proportion of the material imported to China is not battery grade, while most of that imported to Korea and Japan is.

Chinese flake graphite imports bounce back

China's flake graphite imports recovered strongly in September, confounding our previous assumption that **Syrah Resources'** (ASX:SYR) production cuts would push China back to a net export position.

China flake graphite net exports



Source: BM Review, GlobalTradeTracker

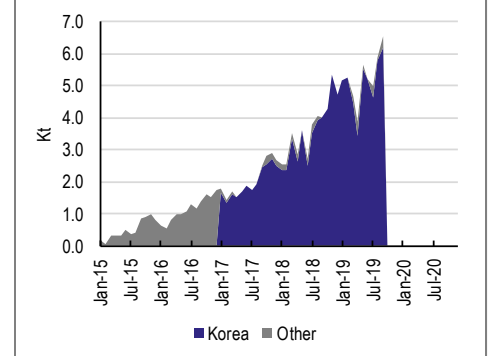
We still believe that a balanced or small net import position is likely over the next 12 months given Syrah's need to match supply with demand.

Korea's battery production evolution in charts

As we were looking at our data this month, we were struck by the significant evolution of Korea as a battery producer in the past few years. Korea's key battery producers, **Samsung SDI** (KRX:006400), **LG Chem** (KRX:051910) and **SK Innovation** (KRX:096770) have leapfrogged their more conservative Japanese counterparts and nowhere is that better illustrated than in raw material demand.

Korea's battery manufacturers have quickly adopted the NCM battery chemistry while Japanese manufacturers stick with NCA and other chemistries.

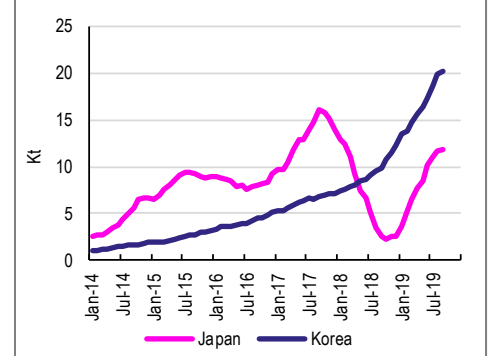
China Ni-Mn-Co hydroxide exports by region



Source: BM Review, GlobalTradeTracker

Korea's imports of lithium carbonate and lithium hydroxide have fast-outpaced Japan with Korea now importing roughly double the lithium raw materials that Japan is.

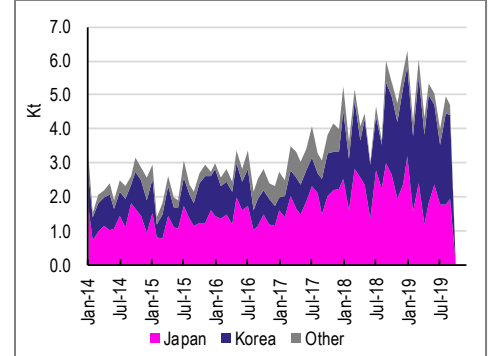
12M rolling Japan, Korea Li-OH net imports



Source: BM Review, Global Trade Tracker

And even in graphite, historically a strength of Japan's, Korea is also starting to become a key player.

China spherical graphite exports by country



Source: BM Review, GlobalTradeTracker

It's no surprise that Korean producers dominate the top tier of global battery manufacturers.

Materials round-up

Cobalt slips on end of re-stocking

Cobalt prices slipped in October as the re-stocking caused by the **Glencore** (LSE:GLEN) production cut back announcements appeared to peter out.

As a result cobalt slipped two places in our material ranking. While it looks more positive with this material out of the market, absent a major restocking cycle in raw materials, it's hard to see material catalysts in the near- to medium-term.

Vanadium down on Ferro-V weakness

Chinese vanadium prices collapsed towards the end of the month as Chinese domestic and export players dropped their offers amid lacklustre demand from both domestic and overseas markets.

Vanadium falls two spots in our ranking but with limited downside to the marginal cost of production we rank it above cobalt which suffers from being a by-product.

Nickel still top-ranked

Indonesia continued to dominate sentiment in nickel markets in October, with its brought-forward ban on ore exports causing ructions throughout the supply chain.

Monthly performance of key battery materials, October 2019

US\$		Current	1M	3M	12M	YTD
Spodumene concentrate (CIF China)	US\$/t	540	0%	-13%	-28%	-25%
Lithium carbonate China (99% del)	US\$/kg	7.3	1%	-14%	-28%	-25%
Lithium hydroxide China (96% del)	US\$/kg	9.8	-5%	-22%	-45%	-42%
Cobalt LME	US\$/t	35,510	-3%	39%	-41%	-35%
Cobalt sulphate China (20% Del)	US\$/kg	8.6	-5%	58%	-29%	-2%
Graphite, China flake 190	US\$/t	310	0%	-6%	-31%	-31%
Vanadium pentoxide, China 98% FOB	US\$/lb	6.7	-22%	-19%	-80%	-67%
NdPr oxide, Shanghai	US\$/kg	41.8	-6%	-1%	-9%	-8%
Aluminium, LME	US\$/t	1790.8	4%	1%	-8%	-4%
Copper, LME	US\$/t	5,827	2%	-2%	-4%	-2%
Lead, LME	US\$/t	2170.3	6%	9%	16%	8%
Nickel, LME	US\$/t	16,799	-3%	17%	45%	59%
Zinc, LME	US\$/t	2581.0	10%	6%	0%	3%

Source: BM Review

There were some big drops in LME nickel inventories with much buying blamed on Chinese stainless producer Tsingshan, but also some big chunks of material added, which worried the market, due to concerns (which we support) of large amounts of off-exchange material.

Having noted that, combined LME and Shanghai nickel inventories ended the month at 91.6Kt, the lowest level since December 2011 and it is notable that in 2011 the average nickel price was US\$22,800/t, significantly higher than it is today...

Although there is potential for further volatility in nickel, we do believe that as a commodity it is likely to outperform the other battery

commodities absent a raw material re-stocking cycle.

Lithium still lagging

Lithium products are still hugging the bottom of our ranking. While the negative pricing momentum is definitely slowing in lithium, it's difficult to see a recovery any time in the next few months.

As we noted in our Focus, production cuts should help to top out spodumene inventories in Q4/19 but it could be later in 2020 before prices bottom out.

After that we are waiting for a re-stocking cycle to catalyse prices and absent a Chinese announcement on rolling back EV subsidy cuts, we don't see anything over the next few months.

Battery Materials Ranking, November 2019

Rank	m/m	Product	Short-Term S/D	Long-Term S/D	Inventory levels	Downside to marginal prod'n cost	Price momentum	Industry structure	Cyclical positioning	Risk factor	Total	Comments
		1	Oversupply	Oversupply	High	Lots	Negative	Fragmented	Negative	High	8	
		5	Deficit	Deficit	Low	Little	Positive	Consolidated	Positive	Low	40	
1	-	Nickel	3	5	3	3	4	3	4	2	27	Price momentum stalled for now but still attractive
2	➔+2	HP Manganese	3	4	4	3	3	3	3	3	26	Continuing growth in use of high-nickel batteries
3	➔+2	REE	3	5	3	2	3	4	3	3	26	Stable but unexciting on fundamentals
4	➔-2	Vanadium	3	4	3	4	3	3	3	3	26	Prices slightly weaker but demand still present
5	➔-2	Cobalt	2	4	3	3	3	4	2	3	24	Re-stocking cycle over for now
6	➔+1	Flake graphite	2	4	2	4	3	2	2	3	22	Prices stabilising but still oversupply
7	➔-1	Spodumene	1	4	1	4	2	3	2	3	20	High invs but approaching marginal cost support levels
8	-	Lithium carbonate	1	4	2	2	2	2	2	3	18	Oversupply and no marginal cost support
9	-	Lithium hydroxide	1	3	1	3	2	2	2	3	17	High inventories and LT oversupply concerns

Source: BM Review

Equity round-up

Wider equity markets robust in October

The S&P Global 1200 index was up 3% in October as equity markets generally recorded robust performance.

Basic Materials also performed, as did the ETF and Solactive Battery Value-Chain index, up 2% and 6% respectively.

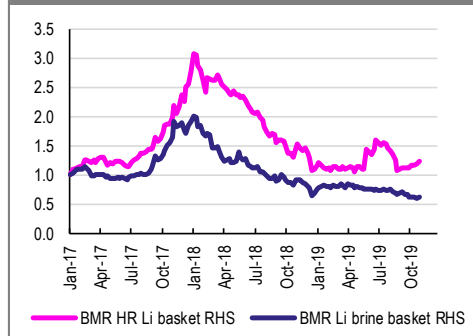
It wasn't a great month for battery materials equities, with profit-taking in nickel and cobalt. Our Downstream equity basket was the real winner, up 15%.

Hard Rock lithium up again

Our Hard Rock Lithium basket managed 8% for the month, our best performer among battery material baskets. Performance was due to a short-squeeze in the Australian names after a news story suggesting that Tesla might be a buyer of lithium developers.

Brine producers and developers were underperformers as concerns regarding protests in Latin America impacted.

Chinese Li carbonate vs BMR Li baskets



Source: BM Review

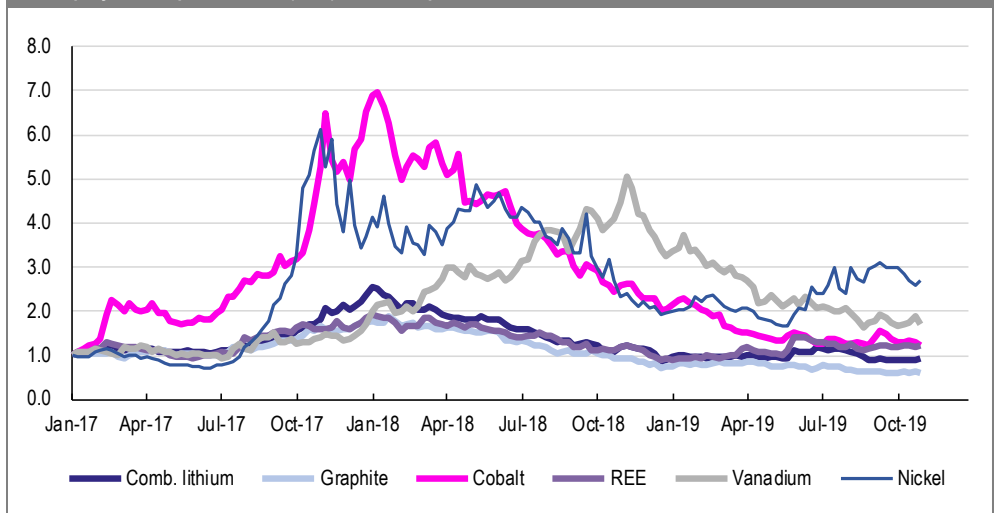
Nickel and Cobalt baskets down on profit taking

Our BMR Nickel basket was our worst performer, down 10% for the month, as most producers and developers succumbed to profit taking.

October performance of key equities

US\$	Current	1M	3M	12M	YTD
BM Review equity baskets					
Cobalt	1.24	-6%	-2%	-52%	-42%
Copper	1.30	2%	-11%	6%	15%
Graphite	0.61	1%	-11%	-34%	-18%
HR Lithium	1.23	8%	-16%	-16%	6%
Brine Lithium	0.62	-2%	-17%	-34%	-19%
Manganese	0.87	0%	-9%	3%	12%
Nickel	2.69	-10%	13%	15%	36%
REE	1.22	4%	3%	4%	38%
Vanadium	1.69	2%	-18%	-62%	-50%
Downstream	1.80	15%	19%	31%	43%
Other indices, stocks and funds					
S&P Global 1200 index	2487	3%	2%	11%	18%
S&P Global 1200 Materials index	2629	2%	0%	6%	12%
Global X Lithium & Battery Tech ETF	24.9	2%	-4%	-18%	-8%
Solactive Battery Value-Chain index	219.1	6%	2%	1%	9%

BMR Equity basket performance (US\$), Jan 2017-present

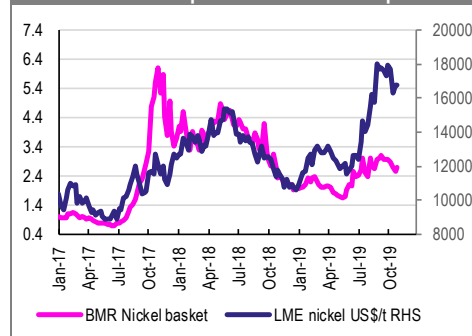


Source: BM Review

Developers **Garibaldi Resources** (ASX:GGI) and **Poseidon Nickel** (ASX:POS) were the worst-affected.

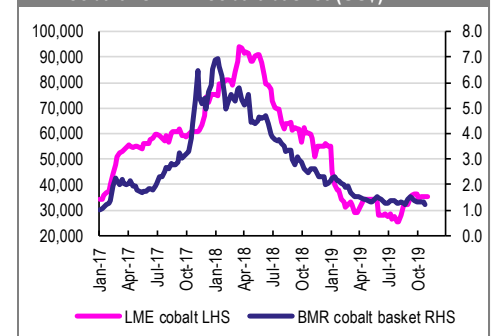
It was the same story in cobalt, where **Artemis Resources** (ASX:ARV) and **Celsius Resources** (ASX:CLA) suffered most.

BMR nickel basket performance vs LME price



Source: BM Review

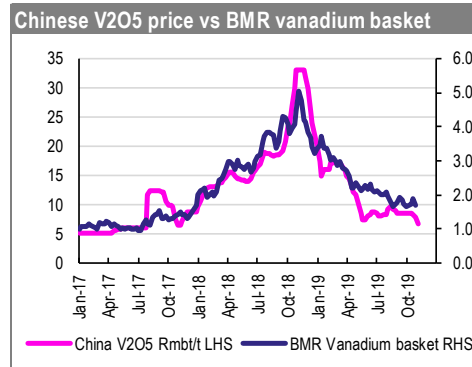
LME cobalt vs BMR cobalt basket (US\$)



Source: BM Review

Vanadium holds up despite commodity weakness

Our BMR Vanadium basket was in the black for the month despite the significant fall in V2O5 prices. Strength in **Bushveld Minerals** (AIM:BMN) was enough to offset weaker performances elsewhere.

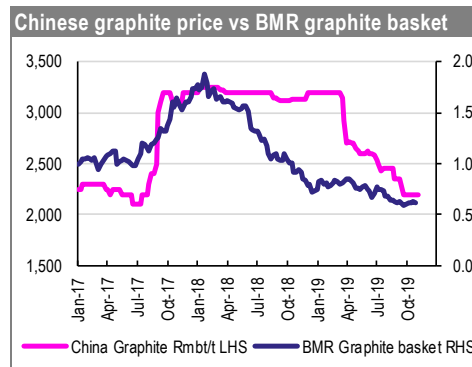


Source: BM Review

Talga supports graphite

Graphite equities were up 1% after a tough three months and now look relatively fairly valued vs the commodity.

Magnis Energy Technologies (ASX:MNS) was the worst performer in our basket, down 28%, on not a lot of news and **Syrah Resources** (ASX:SYR) was also weak on its production cuts announcement.



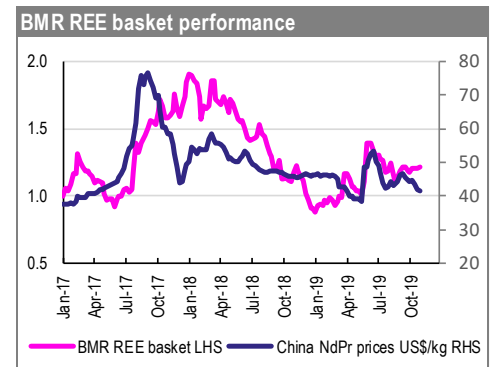
Source: BM Review

Talga Resources (ASX:TLG) was the best performer in our basket after a slew of MOU announcements and its maiden resource on the Niska deposit.

REE holds up despite NdPr weakness

Our REE basket managed 4% for October despite the 6% fall in NdPr prices in China.

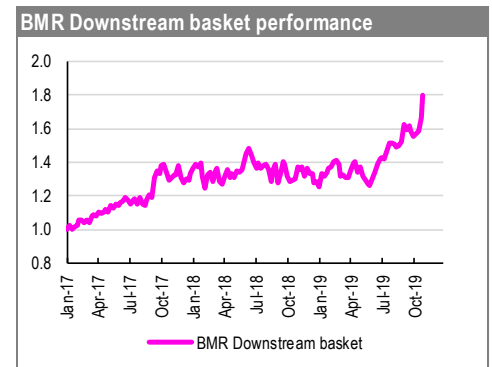
The equity market continues to focus on issues of resource scarcity despite weak market fundamentals and suggestions that Trade War fears are receding.



Source: BM Review

Downstream the real winner

Our Downstream basket continued its outperformance vs raw materials in October, up 15% for the month.



Source: BM Review

Tesla (NASDAQ:TSLA) dominated, up 29% on a short-squeeze resulting from its strong revenue numbers, and battery maker **Varta** (ETR:VAR1) was also up 21% for the month as battery manufacturers continued to outperform.

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