

Batteries and energy storage are increasingly in the spotlight

Recent trends are still in play

There hasn't been any real change in the dynamics or the themes over the past week. Gold is providing healthy volatility for the traders. The oil price is bouncing around and the leading equity indices have continued to struggle. The biggest news has been the slashing of BHP's dividend by 75% and the sombre near term outlook with this having a significant impact on the performance of the All Ords. The iron ore price improvement has eased the pain for producers.

Sentiment continues to be more positive in mining stocks generally and as predicted, there is an increasing number of companies out there looking to raise funds as investors have stopped panicking in the market place. Australian newspapers are preoccupied with the debate around negative gearing and this has been exacerbated by an article in the AFR asserting that the housing market is way overblown.

Imbalance between monetary and fiscal policy

Are you wondering why, after all the money that has been pumped into the economies that things seem to be grinding to a halt? We need to go back to traditional Keynesian style management to find a possible answer. There has been too much reliance on monetary policy without adequate involvement of fiscal policy. It has been left to central banks to throw money at the problem but this has merely caused inflation in non productive financial assets. It has lined the pockets of speculators and traders but has had little impact on the real economy and there has been no multiplier effect on real aggregate demand. So where has this gotten us? Not very far. We are now in a liquidity trap where negative interest rates are starting to take hold.

Central banks are just about ready to give up. They tried zero interest rates, then quantitative easing and now they are throwing their hands in the air with one final attempt - negative interest rates. They have been at the front line for too long without the support of fiscal policy. Monetary policy isn't working on its own, just like trying to clap with one hand. It doesn't work. Monetary policy becomes ineffective when interest rates are so low as the impact of changes is muted. Governments need to employ effective fiscal policy to stimulate demand but many of them have borrowed too heavily already and they don't want to go further into debt. So does this mean they do nothing, and nothing happens?

Batteries, graphite, carbon nanotubes and graphene

As mentioned previously, lithium producers and developers have been keenly sought after in the market and interest is increasing. They are at the beginning of the value chain but the vision should be extended to

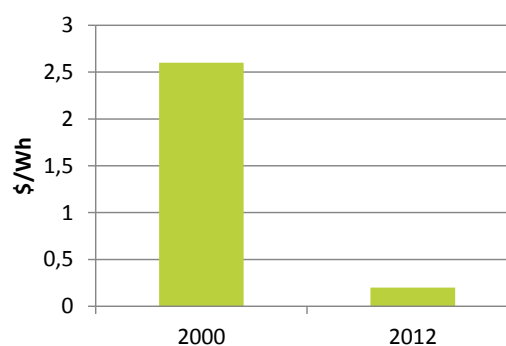
consider the role of graphite and advanced materials as we seek profitable investments in the sector.

We are having the future of graphite in batteries promoted to us by numerous companies but it is not always easy to tell who is being scientifically accurate and who is just pushing their barrows, with bias.

Some companies are telling us that you need large flakes in the lithium ion batteries. Others are telling us that you need spheroidal graphite on the anodes as that gives the best surface area to space ratio and the optimum size is 20 microns. The energy readily migrates into and out of the spaces in charging and discharging. When considering the relative merits of materials used there is a trade-off between speed of charging and total stored energy. A denser material charges faster but stores less energy.

A week ago Talga made the claim that it can use its unpurified natural graphite, which is less than 10 microns and 93% purity, directly onto the anodes without any micronising, spheroiding and coating steps as is used today. Is this good, given the comments above regarding the trade off between density and speed, and charging and total energy storage capacity? The grade of 93% purity means that the impurities are at 7%, which is a huge number on battery chemistry. Talga says it is the shape of the graphite crystals, as opposed to flakes, which may lead to its graphite being used instead of spheroidal graphite. There will be a trade off between cost and quality, and lab tests will need to be extended to large scales, but it is still early days.

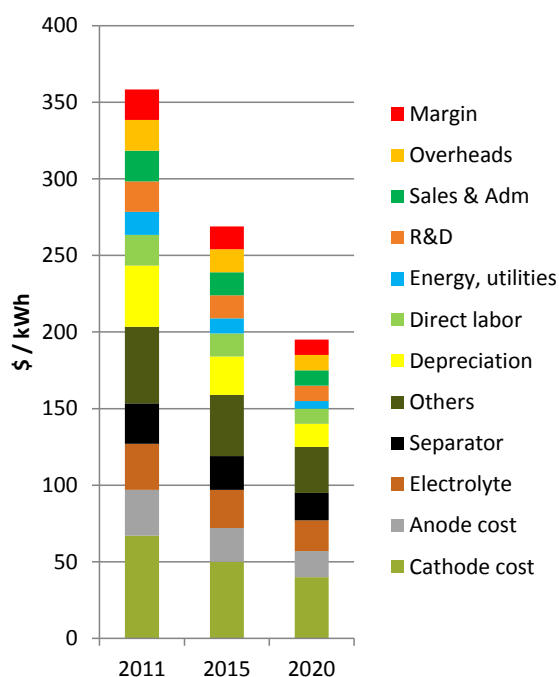
Li-ion 18650 cell price (\$/Wh)



Talga said that its graphite offers costs savings in the manufacturing of the lithium-ion batteries due to the elimination of a number of steps, stating also that lithium-ion batteries are restrained by limits to material performance and high production costs. These may be costs in getting the graphite to the factory floor, but it is relevant in the total cost of a battery? Let's look at that for a minute.

Lithium-ion batteries costs were very high to begin with, 20 years ago, but costs have fallen dramatically in recent years due to the *experience curve effect* that reduces value adding manufacturing costs by 10-30% with each doubling of cumulative production volume. When cylindrical lithium-ion batteries were launching in 1995, they were very expensive, but the cost fell to \$2.60/Wh by 2000 as volumes increased from 35 million cells p.a. to 0.5 bn cells p.a. Over the next five years the volumes increased to 1.6 bn cells p.a. and the cost fell to \$0.30/Wh. Experts expect that the cost will come down to \$0.20-\$0.25/Wh soon, for cylindrical, prismatic and laminate cells (the later two have been recent developments). Current production is about 6 bn cells p.a. The chart on the previous page shows how dramatic the fall has been .

Analysis of the cost structure of lithium-ion batteries, as presented by Avicenna Energy, is demonstrated in the chart below. You can see that the cost of the anode relative to the total cost is not large. Thus the motivation to reduce the cost of the anode would be secondary to the issue of performance enhancement.



Lithium-ion battery cost structure. Source: Avicenna Energy

The reason for going through this analysis is to point out that you have to be careful of ASX releases that seem to be saying good things, but where there is much more detailed required. There is no professional standard

imposed on companies to ensure that metallurgical or technical information release to the market is accurate. Geological statements are governed by the JORC Code, but there is nothing to govern statements about battery chemistry. We just have to assume that the company concerned is being truthful and that it knows what it is talking about. How trustful are you feeling?

There are many different teams around the world working on batteries. Each week we see new breakthroughs but it would be a mistake to assume they will lead to commercial production. Competition is intense and the time frame needed to prove a new product can be many years. Investors need to be circumspect and be prepared to have exposure to more than one company to improve their odds of backing a winner.

In a recent visit to a leading university in NSW I was fortunate enough to spend some time with scientists working on carbon nanotubes (CNT) and graphene. The CNT expert described how the cost of carbon nanotubes had fallen dramatically over the years. His specialty was the making of buckypaper out of CNTs. Interestingly, he thought that this material could replace graphite in batteries at some point. At that point the graphene expert piped up and said the future was in graphene. His pet project at the moment is the making of graphene from old plastic bottles and car tyres. You burn off the waste products in a furnace to create methane gas, which is then utilised to produce graphene via the CVD process (carbon vapour deposition). So, those of you who thought that manufacturing of graphene was a rare skill, think again. Any company that says it can make graphene needs to then be questioned on costs, yields and productivity.

Costs of producing graphene will fall over time, just as have the costs for carbon nanotubes have fallen. The beneficiaries of the fall in costs will be the consumers of graphene. The businesses that are involved with developing applications and processes that take advantage of the amazing properties of graphene will be the really big winners. Australian investors haven't had access to ASX listed vehicles with this business model yet, but watch this space. There is one coming.

Correction: Last week I said the Lucapa options had a strike price of 40c. The correct figure is actually 30c.

Sentiment Indicator: Sentiment continued to improve during the week. There were 33% (32%) of the stocks in uptrend and 38% (44%) in downtrend.

Detailed Chart Comments







NB. Only the bold comments have been updated. Comments in grey type are from previous weeks and will be less relevant.

Indices	Code	Trend Comment	
All Ordinaries	XAO	broken important support line	
Metals and Mining	XMM	breakout on the upside	
Energy	XEJ	rally within a downtrend	
Stocks	Code	Trend Comment (updated comments in bold)	Main Interest
ABM Resources	ABU	steep uptrend	gold
Aeon Metals	AML	vertical rise	copper + cobalt
Alacer Gold	AQG	breached downtrend	gold – production
Alkane Resources	ALK	continuing down	gold, zirconia
Acacia Resources	AJC	Sideways at the bottom	coal
African Energy	AFR	still in downtrend	coal
Agua Resources	AGR	downtrend	phosphate
Altech Chemicals	ATC	breached downtrend	industrial minerals
Anova Metals	AWV	uptrend, but heavy pullback	gold
Antipa Minerals	AZY	breached downtrend	gold
Archer Exploration	AXE	sideways	graphite
Argent Minerals	ARD	testing downtrend	polymetallic
Atlas Iron	AGO	new low	iron ore
Atrum Coal	ATU	breached downtrend	coal
Australian Bauxite	ABX	New low	bauxite
Avanco Resources	AVB	testing downtrend	copper
AWE	AWE	New low	oil and gas
BHP	BHP	breached short term uptrend	diversified
Base Resources	BSE	steep rise from lows	mineral sands
Beach Energy	BPT	testing downtrend	oil and gas
Beadell Resources	BDR	strong rise	gold
Berkeley Resources	BKY	correcting downwards	uranium
Blackham Resources	BLK	steeply higher	gold
Broken Hill Prospect.	BPL	breached downtrend	minerals sands
Buru Energy	BRU	sideways at lows	oil
Canyon Resources	CAY	breaching downtrend	bauxite
Carnegie Wave	CWE	down	wave energy
Cassini Resources	CZI	new low	nickel/Cu expl.
Chalice Gold	CHN	sideways to higher	gold
Consolidated Tin	CSD	heavy slump	tin
Consolidated Zinc	CZL	breached downtrend	zinc
Coventary Resources	CYY	breached downtrend	copper
Cudeco	CDU	Collapse on relisting	copper
Dacian Gold	DCN	new high	gold exploration
Danakiali	DNK	testing downtrend	potash
Doray Minerals	DRM	new high	gold
Duketon Mining	DKM	short term uptrend	nickel
Eden Energy	EDE	testing resistance	carbon nanotubes
Energia Minerals	EMX	strong breach of downtrend	zinc
Energy Resources	ERA	breached downtrend	uranium
Evolution Mining	EVN	new high	gold
Excelsior Gold	EXG	sideways through uptrend line	gold
First Australian	FAR	recovered but hitting longer term resistance	oil/gas
First Graphite	FGR	sideways to down	graphite
Fortescue Metals	FMG	short term uptrend	iron ore
Galaxy Resources	GXY	testing steep uptrend	lithium
Galilee Energy	GXY	down	oil and gas, CBM
Gascoyne Resources	GCY	uptrend	gold
General Mining	GMM	testing steep uptrend	lithium
Geopacific Res. Resources	GPR	Rise halted by long term downtrend	copper/gold exp.
Gold Road	GOR	uptrend	gold exploration
Goldphyre	GPH	holding flatter uptrend now	potash
Gryphon Minerals	GRY	higher	gold
Herron Resources	HRR	down	zinc

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Highfield Resources	HFR		less steep uptrend	potash
Highlands Pacific	HIG		New low	copper, nickel
Hillgrove Resources	HGO		new low	copper
Hot Chili	HCH		new low	copper
Iluka Resources	ILU		surged higher, but at resistance line	mineral sands
Independence	IGO		steep rise	gold, nickel
Intrepid Mines	IAU		sideways	copper
IMX Resources	IXR		down	graphite
Karoo Gas	KAR		at lows	gas
Kasbah Resources	KAS		breaching downtrend	tin
KBL Mining	KBL		strongly higher	copper/gold/zinc
Kibaran Resources	KNL		breaching support	graphite
Kin Mining	KIN		at lows	gold
King Island Scheel.	KIS		New low	tungsten
Kingsgate Consol.	KCN		surge though downtrend	gold
Kingsrose Mining	KRM		kicked up through downtrend line	gold
Legend Mining	LEG		testing downtrend	exploration
Lithium Australia	LIT		correcting lower	lithium
Lucapa Diamond	LOM		steeply higher on 404 carat diamond	diamonds
Macphersons Res.	MRP		testing downtrend	silver
Medusa Mining	MML		breached downtrend	gold
Metals of Africa	MTA		surged higher, but at resistance line	zinc expl/graph.
MetalsX	MLX		breached downtrend	tin, gold
Mincor Resources	MCR		new low	nickel
MMJ PhytoTech	MMJ		uptrend in play	medical cannabis
Mount Gibson	MGX		sideways	iron ore
Mustang Resources	MUS		heavy fall	diamonds, rubies
MZI Resources	MZI		new low	mineral sands
Newfield Resources	NWF		down	diamonds
Northern Minerals	NTU		new low	REE
Northern Star Res.	NST		new high	gold
Oceana Gold	OGC		new high	gold
Oklo Resources	OKU		breached downtrend	gold expl.
OM Holdings	OMH		New low	manganese
OreCorp	ORR		back to high	gold development
Orinoco Gold	OGX		softer during rights issue	gold development
Orocobre	ORE		correcting downwards	lithium
Oz Minerals	OZL		steeply higher	copper
Paladin Energy	PDN		still in LT downtrend	uranium
Pacific American Coal	PAK		strong rise	coal
Pantorro	PNR		rising	gold
Panoramic Res	PAN		bounced off low	nickel
Panterra Gold	PGI		downtrend	gold production
Paringa Resources	PNL		breaching downtrend	coal
Peel Mining	PEX		down	copper
Peninsula Energy	PEN		down	uranium
Perseus Mining	PRU		rising again	gold
Pilbara Minerals	PLS		ST downtrend, being tested	lithium/tantalum
Platina Resources	PGM		new low	PGMs, gold
Potash West	PWN		steeply higher	potash
Red River Resources	RVR		rising	zinc
Regal Resources	RER		new low	copper
Regis Resources	RRL		new high	gold
Renaissance Min.	RNS		testing downtrend	gold
Resolute Mining	RSG		steeply higher	gold
Reward Minerals	RWD		down	potash
Rex Minerals	RXM		secondary downtrend	copper
RIO	RIO		short term uptrend breached	diversified
RTG Mining	RTG		breached downtrend	copper/gold
Rum Jungle	RUM		breached downtrend	quartz
Salt Lake Potash	SO4		uptrend	potash
Saracen Minerals	SAR		new high	gold
St Barbara	SBM		new high	gold

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Sandfire Resources	SFR		breached downtrend	copper
Santos	STO		new uptrend	oil/gas
Sheffield Resources	SFX		down	mineral sands
Silver City Minerals	SCI		heavy fall	base metals
Silver Lake Resources	SLR		new uptrend commenced	gold
Sino Gas & Energy	SEH		new uptrend	gas
Southern Gold	SAU		uptrend	gold
Sthn Hemisphere	SUH		down	copper
Stavelly Minerals	SVY		downtrend	copper exploration
Sunbird Energy	SNY		New low	gas/CBM
Sundance Energy	SEA		short term uptrend, approaching resistance	oil/gas
Syrah Resources	SYR		uptrend	graphite
Talga Resources	TLG		sideways through downtrend	graphene
Tanami Gold	TAM		down	gold
Tiger Resources	TGS		testing downtrend	copper
TNG Resources	TGS		breaching downtrend	titanium, vanadium
Torian Resources	TNR		breaching downtrend	gold expl'n
Toro Energy	TOE		downtrend	uranium
Triton Minerals	TON		Turned down	graphite
Unity Mining	UML		breached downtrend	gold
UraniumSA	USA		Secondary downtrend	uranium
URI	URI		downtrend	uranium
Valence Industries	VXL		down - suspended	graphite
Vimy Resources	VMY		back to downtrend	uranium
West African Resources	WAF		new uptrend	gold
Westwits	WWI		breached uptrend	gold exploration/development
Western Areas	WSA		New low	nickel
Wolf Minerals	WLF		down	tungsten
Totals	33%	47	Uptrend	
	38%	54	Downtrend	
		144	Total	

Guides to Chart Interpretations

- Charts usually go pass from one trend (up or down) into the other via a period of indecision and uncertainty during which the trend can either recover or change. This period is signified by the orange colour. The orange represent both the greatest risk and greatest reward possibilities.
- Once a chart is in confirmed up or downtrends it is not uncommon for 10-20% of that trend to have already transpired.
- There are trends within trends. The focus of this chart review is the immediate trend that affects the sentiment i.e. it can be a downtrend within a long-term uptrend.
- Not every chart warrants a new comment every week. The new comments are in bold type. Grey type comments may be dated.
- Individual charts provide a single view. It is valuable to look at charts of other companies in similar commodities, and the overall sentiment is also very valuable. Not many stocks can swim against the tide.
- We periodically add or delete charts, some times for obscure reasons. If a chart consistent gives poor signals or is very erratic, we may delete it. Sometimes we add a chart because we want to see what all the fuss is about. We do have a preference for charting stocks that we cover in our research as well.
- Errors and omissions may occur from time to time, especially in fast moving markets.

Amber Lights in Tables: Just a reminder if when the amber light is used in the table – it is when the charts are ambiguous or when there is a change of trend taking place. If a chart is breaching a downtrend it can either be a positive sign or a trap. Only once it has done more work can it be confirmed as a new uptrend. Maybe it is a new uptrend (or conversely a new downtrend); the risk takers can decide to jump on board early (or sell). They will maximise their profits (or minimise their losses if indeed it is the start of the new uptrend (downtrend). More risk-averse investors should wait a little longer, being prepared to give up some of the gains in return for greater certainty.

Weightings of Sectors Represented in the Company Charts			
Sector	No. of Companies	Weighting	
Gold	33	22.9%	
Copper	19	13.2%	
Oil/Gas	10	6.9%	

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Weightings of Sectors Represented in the Company Charts			
Gold Exploration	8	5.6%	
Uranium	8	5.6%	
Graphite	8	5.6%	
Potash/Phosphate	7	4.9%	
Zinc	6	4.2%	
Nickel	5	3.5%	
Coal	5	3.5%	
Mineral Sands	5	3.5%	
Iron Ore	3	2.1%	
Tin	3	2.1%	
Lithium	4	2.8%	
Silver	2	1.4%	
Diamonds	3	2.1%	
Bauxite	2	1.4%	
Other	13		
Total	144		

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