7th December 2015

hardman&co

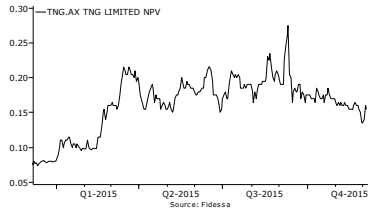
TNG Ltd

Mount Peake Feasibility Study Completed

The two-year process of delivering a Definitive Feasibility Study (DFS) for the Mount Peake project in the Northern Territory of Australia for TNG Ltd (TNG.A) is now complete and has provided very positive results. TNG has built a highly competant consortium of Tier One partners to deliver this significant new mine and processing plant, but is still working to arrange finance to build the project. When built, the refinery will commercialise the company's revolutionary TiVAN™ refining process, and have end sales of high grade vanadium pentoxide, pigment grade titanium dioxide and high purity pig iron.

- **Strategy:** Primary asset is the Mount Peake V-Ti-Fe Mine project around 230km north of Alice Springs with an associated refinery located in Darwin. The current feasibility study covers a 17-year mine life. Mine and refinery construction is expected to take two years, with production starting in 2018.
- **Point 2:** In addition to this mine development TNG has other base-metals exploration assets at various stages of development. The intention is for the majority of non-ferrous assets to be spun out as a new company, Todd River Resources, when market conditions permit. Holders of TNG stock will receive an in specie distribution of equity in Todd River Resources.
- **Valuation:** Using mining parameters from the company's feasibility study and Hardman & Co commodities price estimates, once financed and permitted, the project supports a Fair Market Value for 100% of the project, not including tax or interest, of A$4.63/sh on a fully diluted issue of 723m shares.
- **Risks:** There is low political risk but relatively high project development and global commodity price risks. The company has secured an off-take for a minimum of 60% of its vanadium product with a price floor 20% over production costs, but two other products (titanium dioxide and pig iron) remain to be sold. Negotiations for project finance are on-going.
- **Investment summary:** The main potential for rapid growth is the start of production of three high-value mineral products from a long-lived mine. On the current schedule this is due in 2018 with a production step up four year later. Project delivery has been significantly de-risked, but project finance has not been finalised and dilution of current holdings is expected.

Mining



Source: Fidessa

Market data

TKR	TNG.A
Price (A¢)	16.0
12m High (A¢)	29.0
12m Low (A¢)	7.1
Shares (m)	712.5
Mkt Cap (A$m)	106.9
EV (A$m)	100.1
Market	ASX

Description

Large vanadium-titanium-iron mine in advanced development with a patented hydrometallurgical process and base metals exploration programs in the Northern Territory of Australia

Company information

CEO/MD	Paul Burton
CFO	S Rauschenberger
Chairman	To be filled.
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Next event

End Jan 2016	Quarterly Reports
Mid March 2016	Half Yearly Reports
End April 2016	Quarterly Reports
End July 2016	Quarterly Reports
End October 2016	EOY Report

Analysts

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Financial summary

Year end July (A$000)	2011	2012	2013	2014	2015	2016E
Revenue	4	129	35	50	69	N/A
Operating Profit/(Loss)	-2,289	-3.623	-4,620	-3,668	-4,942	N/A
Net Interest	0	0	0	-13	-8	N/A
Profit Before Tax	-2,760	-4,114	-4,618	-3,670	-5,021	N/A
Profit After Tax	-2,148	-3,430	-4,618	-3,670	-5,021	N/A
Earning per share (Ac)	-0.81	-1.08	-1.10	-0.71	-0.83	N/A
Net (debt)/cash	3,210	10,230	2,595	4,002	5,157	N/A
Shares issued	8,207	33,518	14,350	71,020	50,019	N/A

Source: Hardman & Co Research

Background History and Timeline

TNG Ltd (previously Tennent Creek Gold) is a relatively long-lived Australian mining junior that has had its share of ups and downs over its 40-year history. Its history with the Mount Peake Project is significantly shorter, starting in 2008.

- **2004 - 2005** – New Management and group restructuring including the spin out of Thor Mining (THR.L) and the acquisition of the Manburrum Zinc-Lead project.
- **2005 – 2008** – Focus on developing the Manburrum Project as a new MVT district with a significant zinc-lead-silver resource of 44Mt Indicated and Inferred under JORC2004.
- **2006** – First drilling at Mount Peake by Discovery Nickel Ltd (pre-cursor to the recently liquidated Discovery Metals Ltd) under JV with TNG.
- **2007** - Mount Peake returned to TNG, without Discovery Nickel having sampled the core they drilled.
- **Mid-late 2008** – Sampling by TNG discovered the vanadium mineralization and led to the consolidation of land package around the identified area of geological and geophysical potential.
- **Early-Mid 2009** – Initial scoping study and proximal infrastructure encouraged onwards development of the project. Subsequent drilling and resource estimation at Mount Peake returns an inferred resource of 107Mt @ 0.32% V_2O_5, 5.9% TiO_2 & 25.2% Fe.
- **2010** – TNG switches focus to Mount Peake and, with its technology partners METS Ltd, starts to develop the processing technology that will become TiVAN™.
- **2011** – Interest from Chinese mainland entities, board changes towards current configuration, Mount Peake project continues to provide excellent results through metallurgy and exploration.
- **2012** – Second string exploration projects start to deliver strong copper results as Mount Peake is drilled and Chinese investments are confirmed. Preliminary Feasibility Study completed with positive results.
- **2013** – Mount Peake project advances positively, DFS starts and non-core projects start to be divested. SMS Siemag and CSIRO brought in to help optimise TiVAN™. Asian sales campaign starts in earnest.
- **2014** – Development, finance and sales partners found in Woojin, Hyundai Steel, POSCO, Gunvor Group, GPP Group. Successful capital raisings and continued technical progress at Mount Peake as the project is given Major Project Status by the NT government. First firm off-take – for magnetite concentrate.
- **2015** – Technical studies continue on site as development MoUs start to be signed. Local rail and port access, local engineering contractors, environmental and community liaison all progressed. DFS delivered August. Binding offtake for 60%+ of produced vanadium signed with Woojin. Central Land Council Sacred Site Clearance Certificate gained for mine site and infrastructure. Caterpillar confirmed as project partner.

Comment

Project development has been remarkably unremarkable

Hardman & Co has been watching TNG since before it discovered Mount Peake and we can truly say that for a project the size and scope of this 160Mt resource, there have been remarkably few setbacks. From the outset the geology has been remarkably unremarkable, with grades and geotechnical structure both seemingly playing ball. Not that they shouldn't have done so, this kind of deposit is well understood from elsewhere around the world, and is known to be relatively lacking in geological complexity. But as well as the compliance of the physical resource there has been a distinct lack of over promising, hype or hoo-ha by the company throughout the whole development process.

However, other similar projects and deposits didn't have the technological breakthrough that became TiVAN™, and it is the conjunction of innovation and a compliant geology that sets Mount Peake apart at the first order. At the second and third orders, timing and politics, the knee jerk reaction would be to suggest that these couldn't be worse for the development of a new long-life resource. Such a rush to judge would be to deny that Mount Peake has been developed almost entirely under the new commodities paradigm of constrained capital and the backdrop of declining revenue from Northern Territory minerals' extraction.

To the best of our knowledge it is the only world-class strategic metals project to get to the final hurdles of finance and permitting in the last five years. Note that we say world-class project rather than world-class resource. The story may have been very different without the innovative processing technology and with a different management ethos.

Mount Peake project managed from day one by Paul Burton, MD

From acquisition the same man, the MD Paul Burton, has managed the project. His inclusive management style is reflected in the diversity of the development partners that TNG has attracted; Chinese and Australian cornerstone investors, South Korean industrial giants, German/Austrian precision chemical engineers, Australian innovators and global commodity sales and distribution teams. For a junior miner to gather such a capable cohort is exceptional.

TNG's Wider Property Portfolio

The bulk of TNG's portfolio of exploration stage projects, excluding some iron ore properties and the immediate land surrounding Mount Peake, are scheduled to be spun-off as an in specie dividend in a new Northern Territory-focussed explorer, Todd River Resources, when market conditions permit and will not be considered in this note in detail.

Manburrum Zinc-Lead-Silver Project

This project comprises a number of identified, JORC (2004) compliant, Mississippi Valley Style (MVT) mineral resources along the margin of a known sedimentary basin, totalling 44Mt including 24Mt @ 2.26% Zn+Pb and a significant haematite resource. These resources have been vended out under Joint Venture agreements in the past but have since returned to the TNG portfolio.

Mount Hardy Copper Project

This is an advanced exploration stage project focussed on the area around the Mount Hardy copper mine. It has been drilled and has demonstrated good copper and gold grades. Further drilling is required before a JORC compliant resource estimate can be published.

MacArthur River Base Metals Project

Located in the same geological terrain as the MacArthur River Zinc-Lead Mine, TNG's MacArthur River Project has geology that is prospective for several styles of syn-sedimetary base metals deposits. Recent surface mapping has demonstrated sedimentary copper occurrences with a similar nature to Keuperschiefer-style deposits, but on the basis of good structural and mineralogical evidence SEDEX and even MVT style deposits have been hypothesised in this area. Limited drilling has provided good stratigraphic evidence for the next stage of exploration.

Other Projects

TNG holds one of the Northern Territory's largest exploration portfolios and has interests in a number of projects, either under Joint venture or as a non-contributory minority owner.

TNG property holdings under JV or minority ownership		
Project Name	**Status**	**Minerals Sought**
Cawse Extended	20% free carried to production with Norilsk	Nickel laterite
Melville Island	Exploration stage JV with Rio Tinto (RT.L)	Bauxite (aluminium)
Petermans	JV with Western Desert Resources	Copper, gold
Goddards	JV with Western Desert Resources	Copper, gold
Rover	JV with Western Desert Resources	Copper, gold

Source: Company

Top five shareholders on current issue		
Shareholder	**Number of Shares**	**% of Issue**
WWB INVESTMENTS	79,385,000	11.14
AOSU INVESTMENT AND DEVELOPMENT CO PTY LTD	56,308,643	7.9
AO-ZHONG INTERNATIONAL MINERAL RESOURCES PTY LTD	44,978,812	6.31
THE ONSLOW SUPER FUND	12,050,000	1.69
MR PAUL BURTON	12,000,000	1.68

Source: Company

Two Chinese companies injected significant capital at the start of the Mount Peake project

Top Five Shareholders

- WBB Investments is a vehicle of the Queensland-based Brown family, long-term holders of TNG who have bought on-market as well as during new issues.
- AOSU Investment is a privately-held Chinese entity with strong links into downstream technology and commodities-based businesses.
- Ao-Zhong International is a subsidiary of the Chinese parastatal commodities business, ECE.
- Both Chinese entities bought into TNG at the start of the Mount Peake project with 15% holdings each and have recently allowed themselves to be diluted, and in Ao-Zhong's case have also sold a proportion of its stake at a recent peak of 29A¢.
- The Onslow Superfund belongs to The Martens family of Australia.
- Paul Burton, as mentioned, is the MD.
- Recent equity sales to HK and London-based institutions have been successful with A$9.5m raised in FY ending June 2015.

Native Title, Local Suppliers and Community Relations

Outside the technicalities of geology and processing technology, permission to explore and mine is always a concern for the extractive industries in Australia. However, TNG has been working with the same Northern Territory Land Councils for well over a decade, including a period when one of its directors (now a consultant), Eddie Fry, was a tribal elder and the company has always seen its goals as shared with the local communities, wherever they originated.

TNG has a long–term and continuous relationship with tribal elders and land councils representing indigenous communities

Although the Land Councils and elders have effectively signed off on the development of Mount Peake infrastructure by issuing the Sacred Site Clearance Certificate, TNG continues to have discussions with them to make sure that the development is carried out according to their full understanding and consent alongside all its exploration works elsewhere in the Northern Territory. The final Native Title Mining Agreement remains to be signed as part of the final permitting process.

Where possible TNG has picked local or indigenous contractors to provide local services, up to and including the McMahon Services group, identified as interim project manager, responsible for delivery of most aspects of the project outside the actual mine and refinery build. This phase, known as 'pre-development', includes management of the both permitting and community relations.

There will be a substantial element of FIFO (Fly-In, Fly-Out) for the construction operation, that is inevitable, but with the refinery and operations base to be built in Darwin, and Alice Springs only 235km away by road, the probability is that travel will be limited to within the Territory for most workers after the initial construction period. At a time when FIFO is coming under increasing scrutiny from Health & Safety experts, from both physical and psychological perspectives, it can be no bad thing to try and embed the mine in the community more effectively than the previous generation of mines has achieved.

Northern Territory Major Project Status – Quid pro quo

These actions, to localise the supply chain and skills base, should also maximise the overall tax returns to government coffers, through local income taxes and supply chain development and utilisation, returning some of the faith that local policy-makers had in the project when they named it under the Northern Territories Major Project framework.

In order to be accorded Major Project Status the development had to;

- Exceed A$50m capital expenditure
- The majority of which would be expended within the NT
- Using NT workforce and supply chain
- Have a strategic impact by unlocking downstream opportunities
- Be complex and wide-reaching, such that the given status and its benefits have value to the project originator

The primary benefit of being awarded Major Project Status is embodied in the Project Facilitation Agreement as follows;

"The Proponent and the Territory have agreed to work in the spirit of co-operation to achieve the timely, efficient and effective development of the Project and to maximise the economic and community benefit for the Northern Territory"

Major Project Status award provides dedicated support channel through all aspects of government relations during mine development and permitting

In effect this means that TNG agreed, up front, to a set of measurable community benefits, whether they be infrastructure, educational, ecological or economic and the government agreed that these actions were proportionate to the benefits that TNG will gain and that they are achievable within a given development timescale.

In return the NT government set up a development taskforce including representatives from;

- Department of the Chief Minister;
- Department of Land Resource Management;
- Department of Primary Industry and Fisheries;
- Department of Lands, Planning and the Environment;
- Department of Business;
- Department of Transport;
- Northern Territory Environment Protection Authority; and
- Department of Attorney-General and Justice.

This taskforce will provide assistance and guidance to the TNG development team over and above that which is legally provided to similar developments, not accorded MP Status.

To date we have seen this status be highly effective in providing diplomatic support to overseas sales efforts across Asia and now, as TNG enters permitting, the third phase of assistance may become apparent with TNG provided a single dedicated access point to discuss permitting progress.

Project Partners

The list of current and announced potential partners in the Mount Peake project is impressive.

POSCO E&C – Engineering and potential finance

Hyundai Steel – Engineering and potential off-take

Woojin Ltd – Off-take and technology partner

SMS Siemag – Engineering and technology partner

CSIRO – Government science and technology validation partner

Caterpillar – Project and plant finance partner

Gunvor Group – Sales and distribution partner

GPP Group – Sales and distribution partner

McMahon Group – Infrastructure delivery partner

METS Ltd – Technology partner

Several export and development banks and funds have also expressed an interest in the project finance.

Geology and Infrastructure

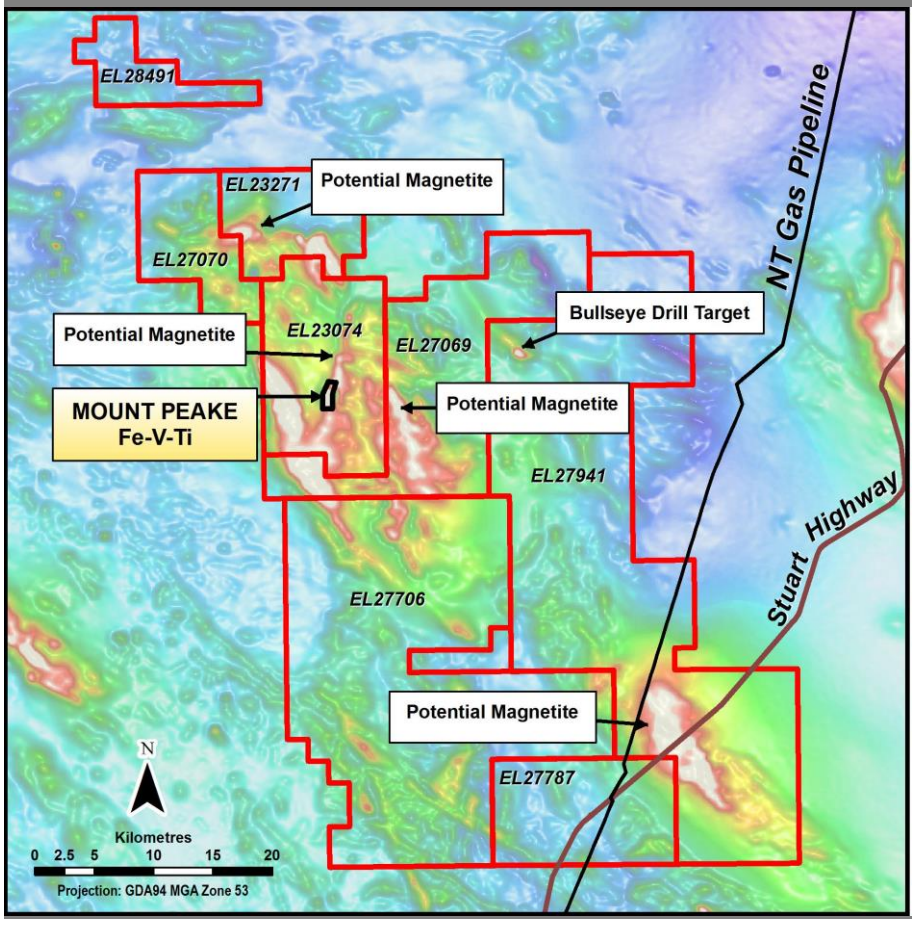
Geology

The geology of Mount Peake is relatively well understood for a newly discovered resource. Of course there are scientific details that aren't known, but in general terms the Mount Peake ore body is hosted within the vanadiferous magnetite-rich portion of a larger gabbro body. Technically the geology has been identified as a gabbro-norite, but more broadly the ore body fits well into the class known as layered igneous intrusions.

The currently defined Mount Peake ore body is around 2,000m long x 350m wide x 100m thick and it has common structural features with other well-known layered igneous intrusions and a mineralogy that is consistent with those deposits.

It is clear from geophysics, surface lag sampling and shallow scout drilling that the same vanadium-titanium rich layer can be found outside the currently defined resource.

Figure 1: Geophysical trace of the geology underlying the Mount Peake Project area with infrastructure and license boundaries overlain.



Source: Company

Hardman & Co has long and consistently estimated that this mine, when we include the potential resources, both adjacent and outlying, could last 50 years or more at the current production rate. We repeat this estimate in the face of the DFS results whose limiting factor is not geology (and which, we will show later, has less to do with the technical viability of this mine than one might initially think).

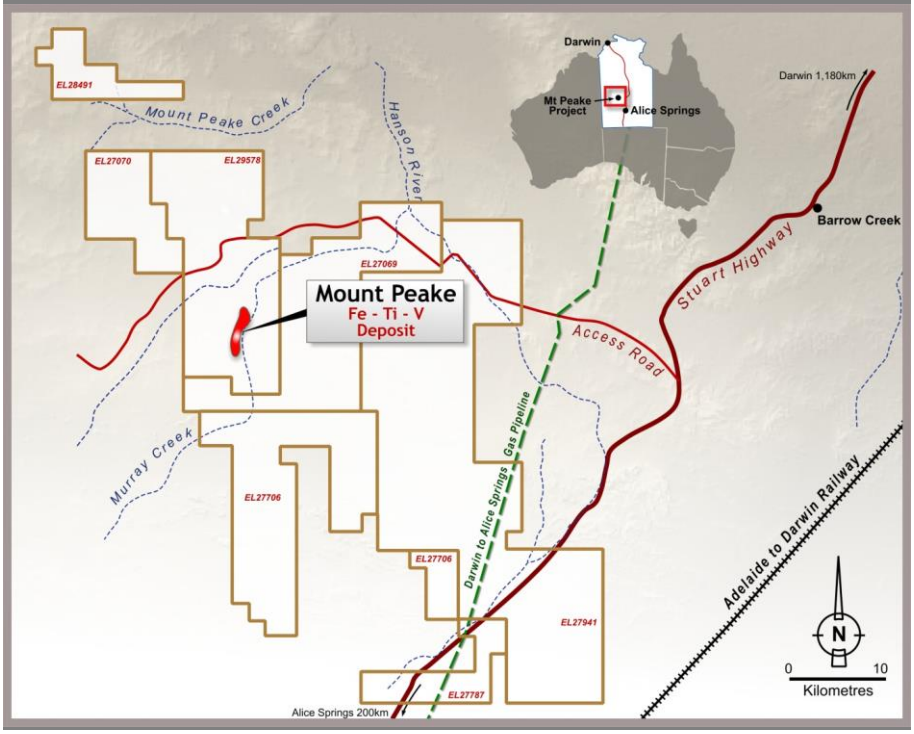
The Mount Peake ore body is geologically and structurally simple with decent grades

Geologically the only feature of the deposit really worth highlighting is the lack of deformation of the ore body which, if located in other areas of the world such as South China or the Urals of Russia, might reasonably be expected to be curved or twisted into a more difficult geometry, but in the middle of Outback Australia, there have been few geological influences on the Mount Peake ore body post-emplacement.

There are exposures, on the exploration license close to the Mount Peake resource, where the magnetite host rock has been eroded away leaving an enriched residue at surface. These exposures have been evaluated, only to a small degree as they were discovered well into the development of the current resource, but apart from that the body and its surrounding exposures have remained untouched through time, waiting to be discovered. Lag sampling of these exposures shows metal grades broadly similar to those of the mine-gate magnetite concentrate that is expected to be shipped, by rail, to Darwin.

Infrastructure

Figure 2: Communications and energy infrastructure connecting Mount Peake to the world. Exploration license boundaries are now a little out of date, with additional land under license completing the block to the south west.



Source: Company

Rail, Road, Air and Energy infrastructure all present within 110km

The Mount Peake deposit lies some 235km by road NNW of the regional capital of Alice Springs and 1200km south of the Panamax-capable port of Darwin in the Northern Territory of Australia. Both the main N-S Stuart Highway and the Darwin to Alice Springs gas pipeline run across exploration licenses held by TNG, about 20km to the south and east of the ore body. A further 10km or so to the east lies the Adelaide to Darwin rail link and the Ti-Tree air strip lies around 70km to the south, adjacent to the Stuart Highway.

So within an hour's drive of the ore body there are; a main highway, a major rail corridor with bulk-capable ports at either end, a gas main and a paved air strip suitable for regional jets.

New Infrastructure

For its outback location Mount Peake is remarkably well endowed with existing infrastructure. However, work will need to be carried out to re-enforce that infrastructure to be able to cope with a new long-life mine and some risks will need to be mitigated.

New infrastructure developments that are stated in the DFS will include;

- Upgrading the existing 1.6km long Ti-Tree airstrip and developing the terminal to cope with substantial jet aircraft (up to about 100 passengers or several tonnes of cargo).
- Installing a gas-fired power plant fed, probably, from a spur line off the main gas pipeline.
- Building a dedicated concentrate haul road from the mine to new rail sidings, approx. 103km from the proposed site of the concentrator.
- Building a worker village to accommodate 350 during the build phase, then 170 through production.
- Sinking a well-field to supply drinking and process water for the plant and worker village.

Energy Risks and Opportunities

There are some residual risks associated with the long-term use of gas-fired power, both regulatory and price-centric. As a result TNG is in advanced discussions to build a solar (PV) power plant backed by a Vanadium Flow Battery energy storage device.

Long-term uncertainty over gas price and availability provides impetus for solar PV farm at mine site

While it looks likely that the 17-year mine life discussed in the DFS will be largely covered by 'local' gas production transported along the pipeline, over the longer term gas prices can't be guaranteed and nor can industrial-scale supplies. The Northern Territory is working to incentivise new gas production from onshore basins that can utilise this pipeline, but there are no new fields currently awaiting connection to it. The economic viability of reversing the gas flow, so that gas imports from the world-scale offshore Ichthys LNG project can be sent from its refinery at Darwin to the red centre is currently unknown.

For TNG the installation of solar PV plus storage should provide a hedge against long-term energy costs, as well as raising the company's environmental credentials and demonstrating the utility-scale viability of a key vanadium-consuming technology.

Solar PV with VFB provides additional differentiator and environmental credentials for eco-conscious manufacturers

Though environmental awareness is currently unfashionable in some sections of Australian mining, the products that TNG will provide are closely linked to 'green' or 'blue' (energy efficient) products whose marketing is likely to include cradle to grave assessments of CO_2 emissions and overall environmental impact.

EU, Japanese and Chinese product makers are all being encouraged by policy-makers to provide a 360° view of their environmental impacts including the upstream supply chain. This provides TNG the potential for a marginal advantage compared with competitors and means to demonstrate that marginal advantage through close energy monitoring and independent verification.

Indeed since TiVAN™ itself is likely to be substantially less energy-intense and have lower environmental emissions, the means to lower those costs and impacts should take Mount Peake's whole product line into a new paradigm as far as energy usage in mined products is concerned. The new vanadium supply chain enabled by TiVAN™ is then substantially differentiated from old vanadium supply chains based on iron slag or oil refining residues, both of which are energy hungry and emissions-heavy.

Three Products, Multiple Markets

The Mount Peake/TiVAN™ combination will be supplemented with two downstream plants that will output refined products to the market place.

The three products are;

V_2O_5 - Vanadium Pentoxide at 99%+ purity, as flake
TiO_2 – Titanium Dioxide at 95%+ purity, as powder
Pig Iron – A high purity cast iron product, as 'pigs' or ingots

Product lines, estimated sales prices and resultant revenues

Product	Predicted Annual Production (Yr 5+) (t)	Estimated Cost of Production (US$/t)	Break-even Annual Revenue (US$m)	40-year Median price (Inc US CPI) (2015US$/t)	Estimated Annual Sales Revenue (US$m)
Vanadium Pentoxide	17,560	5,578	97.94	14,700	258
Titanium Dioxide	236,000	1,380	325.68	3,090	729
Pig Iron	637,000	137	87.27	360	229
Basket of All Three Products	-	-	510.89	-	1,216

Source: Company, US Bureau of Labor, USGS, Hardman & Co.

Some Price Commentary

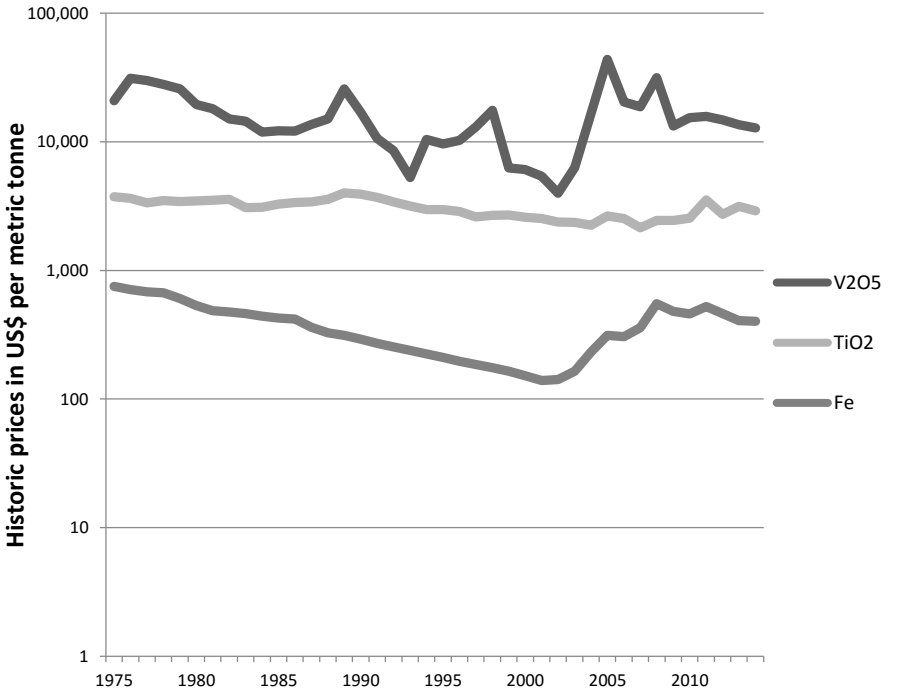
Figure 3 (below) shows the 40-year median prices for all three of Mount Peake's proposed products, corrected to 2015US$ using CPI.

We use the median rather than mean here because of the high degree of volatility in the V_2O_5 price, where exceptionally high price spikes of very short durations skew the underlying trends by over 10%. While neither the mean nor the median prices can be seen as predictive, the median is more reliably diagnostic for identifying macro-trends.

We use the 40-year history here because the data originates in the US, and there is a large price break in all US$ denominated commodities in 1973 as the dollar was floated free of the gold standard.

In the following sections we will address the market dynamics of each separate commodity, but it is well worth remembering that TiVAN™, as a process, will always produce at least three primary products. As such Mount Peake could be considered as producer of a 'basket' of commodities, along the same lines as a platinum miner or rare earth miner, and the metals pricing risk adjusted appropriately. This feature of the product markets working as an ensemble, rather than individually, allows for much greater flexibility in sales and diversification of risk, a property that comes under the term 'optionality' within mining. In simple terms it means that this vanadium-producing mine should have a far greater degree of earnings stability than a vanadium-only mine.

Figure 3: 40-year price histories for each product, adjusted to 2015US$ using US CPI



Source: USGS, US Bureau of Labor

Vanadium Pentoxide

At present TNG has secured a binding offtake agreement for 60%+ of the vanadium pentoxide from its Korean partner Woojin Industries Ltd. This deal also includes technology transfer, which we understand is primarily so that Woojin may co-site a FerroVanadium production facility alongside the TiVAN™ plant in Darwin, but could also include the development of additional product lines.

Take-or-pay offtake for 60%+ vanadium production with price floor at 20% premium to production cost

The deal with Woojin is take-or-pay and sets a floor price at 20% over cost of production, so that on present estimates the minimum sales price would be US$3.04/lb or US$6,693/t. On this basis, at full production and for the life of the mine, TNG has secured a minimum annual revenue stream of US$70.5m.

TNG has signed an MoU with an, as yet, unnamed Vanadium Flow Battery (VFB) producer with the intent to test this utility-scale energy storage technology at its mine site as a means to reduce long term energy costs alongside a potential solar farm.

Given that the largest potential for demand growth in high purity vanadium products is currently the VFB technology there could be potential for strategic agreements that go beyond a simple sales contract. If the vanadium product is provided to the open market, without a long-term contract, its purity means that a premium to the current open market price is expected.

Comment - Some Notes on the Vanadium Trade

Vanadium, in common with many other minor metals, doesn't have an open cry or a futures market and is non-codified, so price setting is dominated by confidential bilateral agreements. However, even though details are always private, there are some well-established conventions that underlie the majority of the trade.

Around 80% of all vanadium (in ferrovanadium, pentoxide or other forms) is sold on the basis of annual contracts at prices agreed under a formula, which is set in advance. It is normal for these contract formulae to be related to spot pricing, as published by the Metal Bulletin, with a relatively small adjustment of maybe +/- 5% from the spot price that applies at the time of a specific shipment.

Every year, at meetings around the autumn vanadium market participant's conference, interested parties get together and decide what the percentage adjustments will be for individual contracts covering the coming year, so arranging a discount or a premium to spot for all shipments during the upcoming year.

We haven't seen the confidential contract details between TNG and Woojin, but we understand that it follows the current conventions in the rest of the market. In effect this means is that Mount Peake will be selling at or very close to spot prices.

The only explicit price detail that TNG has released is that Woojin will guarantee that it will always, whatever happens in the spot market, cover TNG's production costs +20%. This will provide a price floor of around US$3/lb (US$6,700/t) and ensure that TNG will never sell its vanadium to Woojin at a loss.

Market Trends

Roskill, the commodities analysts, estimate global vanadium production to be 97kt of vanadium in 2014 (equivalent to a potential of 181kt V_2O_5, though actual production of the metal in the pentoxide form is much lower).

Vanadium use has grown steadily with global economic growth

Around 91% of all vanadium is used in steel production, with two main trends in consumption. The first trend is the increased use of higher specification alloys, the so-called high-speed steels, and the second trend is the increased specification of high volume construction steels such as reinforcing bars (rebar). China's uptake of Grade 3 rebar is expected to have the largest single impact on vanadium consumption in the near future.

Note; Woojin's vanadium conversion technology is both efficient and effective, providing industry-leading productivity at a high grade of ferrovanadium. The FeV80 (80% vanadium by weight) product is suitable not only for steel production, but for the production of some high value titanium alloys, such as that used in aircraft undercarriages and golf clubs (e.g. SP-700). The ability to produce a premium grade FeV straightaway, rather than undertaking a long-lived and risky learning process, provides a diversity of market and strong underpinnings for the vanadium revenue stream.

Competition

Existing producers in China, Russia and South Africa all have problems. Chinese producers have energy-hungry and emissions-heavy facilities in a national industrial paradigm that is heading the opposite direction. Russia is low on developed reserves and has aging production capacity and South Africa is struggling to provide energy to any of its industry, to the point where Evraz Highveld has filed for voluntary bankruptcy, due in a large part to energy prices. Australia's Windimurra Mine is in difficulties because of a large fire in the ferrovanadium production facility that occurred soon after the mine opened.

Many existing producers have issues with dwindling reserves, energy costs or productivity

There is a new start mine in Brazil, Largo Resources (LGO.TV) Maracás Mine, but its production (11,400 tpa V_2O_5) is 100% off-taken by Glencore (GLEN.L) and is only covered by a 6 year contract, so for 2 years after Mount Peake is expected to come into initial production.

Despite some commentary to the contrary there appears plenty of room for high purity, energy and emissions 'lite' production of premium product over the longer term, displacing old production capacity in China and Russia and picking up the slack from South Africa's mothballed mines.

Titanium Dioxide

Mount Peake's titanium dioxide is to be produced at greater than 95% purity and using the chloride production method. This is well-understood refining technique providing an industry standard product that should be welcomed by the open market. At present TNG has an LOI with Global Pacific Partners (GPP), a division of leading chemicals distributor, Soda Ash Holding BV, based in The Netherlands, that covers sales and distribution of the titanium product.

Market Trends

LOI covering distribution in place with GPP for titanium products

The majority of refined TiO_2, sometimes referred to as pigment grade, is sold, as one might expect, to the pigments sector. This includes industrial colourants, surface paints and plastic body colours. Other uses for TiO_2 are in glass coatings and solar-reactive cements, where it acts as a catalytic surface to help precipitate pollution out of the air, and next generation solar cells.

With pigments being the dominant market for TiO_2, by far the largest influence on demand is the intensity of its use, but not necessarily in capital building projects.

In common with a few other key bellwether commodities, TiO_2 pigment strongly tracks per capita GDP, so that, irrespective of local preferences and fashions for different colours, the richer people get the more TiO_2 they use. This is mainly because most of the high volume industrial uses rely on product function rather than the aesthetic whiteness of the pigment itself. In many products, including non-white paints, TiO_2 pigment acts as an opacifier to allow other pigments to shine through and in yet others (notably some plastics and rubbers) it provides physical bulk and stiffness, as well as colour functions.

As a result of the multiple combinations of desirable qualities that an individual customer may require, TiO_2 is a quality-driven market where reliable sources can demand a premium.

One of the more visible market trends for titanium is its increasing use in its metallic form. Whether it is in high performance in aerospace applications or in lightweight vehicle chassis, titanium, used alongside composite materials, is the metal to watch in performance marques, as aluminium replaces steel in mass-market vehicles.

Global trend towards increased titanium metal use in transport

Russian and Japanese titanium producers have announced production increases over the next couple of years, but a large portion of any extra metal production from them is expected to be taken up by increased military use, and their moves are mainly seen as pre-emptive against any future trade barriers that might be raised on a product with close military ties.

The newest metallic titanium refining technologies use high purity TiO_2 as a feedstock, where previously ferro-titanium slags were used. This means that as the market for metallic titanium grows, TNG will be future-proofed whether it sells directly to metallic titanium producers or not.

Pig Iron

Pig iron is one of the world's oldest metallic commodities, first produced and traded at the start of the Industrial Revolution as the world switched from wrought (beaten) iron to pig (poured) iron. Pig iron remains the trading form of choice for raw metallic iron but, as steel has taken end-use market share, its relative importance has shrunk.

Today pig iron is used as a means to dilute out impurities in steel, as a means to reduce the energy demand in primary steel production, and is still used simply because it is the most convenient tradable form of metallic iron.

At around 600kt of pig iron per year, TNG will be a minor player in the steel supply chain, but its high purity and relatively low energy profile means that its iron could be sold at a premium and there shouldn't be any difficulty selling into a well-developed open market. Look especially for strategic agreements with recycling centres in the Middle East and India, where pig iron is used to dilute down impurities from scrap steel (mostly from shredded cars) so that it can be reused as structural steel.

Some commentators have predicted that steel scrap could replace a much greater proportion of raw iron ore, as vehicles switch to aluminium, composites and titanium, and more countries recycle a greater proportion of their existing metal inventories. In the longer run this would mean that refined metallic iron could become the supply chain of preference, over virgin iron ore production, and by virtue of its lower energy consumption profile and localised emissions.

This could imply that the long-term downward price trend in pig iron prices may well have ended, and the next industry shift will follow system-wide energy efficiency much more closely than did the move to a sea bore iron trade (whose price has followed supply-demand dynamics closely. Moreover it might be that we are witnessing the emergence of this kind of commercially-driven systemic thinking as Tata-JLR develops is product range for a high degree of recyclability, as well as individual performance. Granted there is a degree of policy-push at play, but the majority of JLR vehicles are not recycled in the EU, so their scrap competes directly with iron ore.

The Big Decisions and Market Choices That TNG Made

The Definitive Feasibility Study (DFS), whose 2-year delivery was managed by Snowden Mining Industry Consultants, shows some structural difference from the range of designs being considered. Most notable of the variations are the final decision on refinery location (Darwin instead of Malaysia), the final titanium product (refined, pigment grade TiO_2 vs. a high grade concentrate) and the final iron product (pig iron vs. High Purity Fe_2O_3).

This DFS shows how TNG will make the jump from developer to producer, what markets it will enter and to what profit

The underlying message coming from the decisions on the final product range is that TNG is going to use current low interest rates to build a more capable processing plant, and in doing so, to become a producer of industry standard products, excepting vanadium where a premium product line can be expected.

By moving downstream in the product lines, especially the iron by-product, Mount Peake becomes less dependent on niche markets and opens its arms to a wider range of consumers, whilst still being forward-looking by providing world-leading product purity and energy efficiency through its innovative production process.

Pig Iron vs. High Purity Fe_2O_3

Pig iron is preferentially used in recycled steel over virgin steel production, as a means to dilute out the variability inherent in recycled steels and reduce the energy costs associated with melting alloys. With increased steel recycling will come increased demand for pig iron, with current demand centres in the Middle East, India and the USA.

Global market for high purity pig iron is more stable than for iron oxide

There were always concerns over the ability of the market to absorb the enormous amount of super-high purity iron oxide that the Mount Peake acid regeneration plant will produce. Prices across the world of refined iron oxide products could still be high when compared with raw iron ore, but the cost of sales would be commensurate with those potentials and on a global scale Mount Peake had the potential to destroy value rather than build it.

Competing in seaborne iron ore market would be risky and negative in terms of value creation

The sale of the refined iron oxide as raw iron ore fines (albeit a premium grade product) would have drawn TNG, backwards, away from the end-customer and forced it to take part in the current glut of Australian seaborne ore.

Committing to step away from flooding the current market structure of refined iron oxide products and towards participation in the global steel recycling industry builds on the base price (the iron content) and adds value through the use of energy to convert the oxide into the metallic state. It makes more sense to us to use that energy cost in metal production, rather than in transporting raw iron ore, especially with the giant Ichthys LNG plant under construction adjacent to Darwin providing local energy security for the surrounding area.

So in summary the equation of risk for the iron product is this;

Iron oxide powder – low additional CAPEX, high risk markets, highest sales cost but high to very high value.
Iron oxide powder as iron ore fines – lowest additional CAPEX, lower risk markets and lowest sales cost, but lowest value product.
Pig iron – higher additional CAPEX, lowest risk markets and low sales cost, high value market.

There is one downside to the choice of pig iron and that is because the capital required to equip a pig iron smelter is relatively low (in global iron industry terms). As such it will be the first port of call for iron producers who want to valorise their product and ensure their investment in upstream production capacity. We can see this already with Brazil's pig iron exports jumping over 40% y-o-y for June 2014-15 as Brazilian iron producers take on the Australian seaborne ore duopoly, but on total trade of under 300kt, the whole of Brazil is currently producing under half the pig iron that TNG will at full tilt.

Additional CAPEX for pig iron plant more than offset by market stability and ease of doing business

Additionally with a fully equipped futures market in iron, should it ever need to, TNG would be able to manage its risk through a trading function of its own, rather than operating as a 'simple' vendor.

Pigment Grade TiO_2 vs. TiO_2 Concentrate

TNG has chosen to process its titanium to a pigment grade TiO_2 which carries values of over US$3000/t vs 55% concentrate with value around US$300/t

The Preliminary Feasibility Study (back in 2012) suggested a 55% TiO_2 concentrate as a product line. This is perfectly reasonable, and would find buyers in most constituencies, at an Australian export benchmark based on Iluka's ilmenite pricing of around the US$300-400/t mark. However, the price differential between export grade ilmenite at 55% purity and pigment-grade TiO_2 at 95%+ purity is broadly a 10-fold up-step from US$300/t to >$3000/t, with premiums available for ready-to-use products carrying ISO specification.

TNG chose the high spec chloride route TiO_2 pigment production process to maximise value-add potential

There are two chemical routes to approach this pigment grade from a concentrate, both require large amounts of acid. One requires sulphuric acid and the other hydrochloric acid.

The process that uses sulphuric acid (known in the trade as the sulphate route) is slightly easier to operate, is more forgiving of the incoming concentrate and is therefore suitable for a more variable concentrate feed grade. However it produces slightly inferior product in terms of end-user functionality (the white is not quite as white as the alternate route), and so demands a marginally lower market price, when both products are sold side-by-side on technical merit alone.

TNG has chosen to go with the higher specification, chloride route, using hydrochloric acid and producing the marginally higher quality end product. By integrating this downstream processing TNG is effectively eliminating a transport cost (for some 250kt per annum) and a waste treatment or storage cost (the acid regen circuit used for TiVAN™ will be tailored for use in both processes and the by-product iron oxide fed into the pig iron production circuit).

Co-location of three refineries removes systemic costs in transport, technical and admin support

Systematically then TNG is starting to take lumps out of external inefficiencies, such as transporting mineralogically-bound water or oxygen around the world for no profit. There is of course a balance between locating refinery capacity close to mines and closer to demand centres, but with the issues of secure energy pricing and reliable energy quality high on the long-term agenda, TNG's refinery is to be built at the port of Darwin, on-grid (both energy and transport) with easy access to workers and the wider supply chain. Again we can see the project delivering on aspects of 'quality' over quantity in order to become a preferred development partner and commodity supplier.

Pigment Grade TiO_2 Market Close to Full Swing

Pigment grade titanium production now concentrated in China

Globally, around 55% of pigment grade TiO_2 is produced via the chloride route, out of the roughly 6.5Mt market for the product class. This gives TNG a market share of about 7% of the chloride route pigment grade TiO_2 or 4% of all pigment grade TiO_2 (on Iluka's global market data).

This is a significant market share, but not a dominant one. In the western market TiO_2 has undergone a full cycle of consolidation and pigment manufacturers have found that their old plant can no longer compete on cost with, primarily, Chinese sulphate route capacity, and are instead looking towards quality-driven markets.

We believe that the recent sale by Huntsman, of its pigments division, represents a low water mark for western industry and the titanium market is now approaching a wholesale reworking on the back of technologies such as TiVAN™ and others.

New generation of titanium production technology close to or at market

As a result the production of pigment grade TiO_2, at the higher end of the quality spectrum, represents a significant downstep in risk, so long as the price of the finance to buy the plant is reasonable. Over the next decade or two as these new titanium processing technologies from CSIRO, ARGEX, Metalysis, TNG and others, start to take over we may also see a new generation of downstream technologies benefiting from them as titanium starts to reach mass markets such as the automotive sector. Pigment grade TiO_2 is very much a stepping stone in this process and TNG's choices here are forward-looking but risk averse.

TiVAN™: Productivity Through Processing Innovation

Low energy, low emissions, low waste, three refined products

The standard way of processing vanadium-titanium ore similar to that found at Mount Peake is energy and emissions intense salt-roasting, followed by leaching to extract the vanadium leaving a titanium-rich slag which then undergoes a second set of energy intense processes to end up with TiO_2 that can be refined to a pigment grade and iron with a range of grades and purities.

TiVAN™, TNG's patented hydrometallurgical process, provides similar end products but removes two energy intense processing stages, and all the emissions associated with them. Instead a cascade of solvent extraction and acid leaches results in around 40% less energy being used with consequent impacts on the processing plant's need for energy infrastructure.

TiVAN™ itself is not a widget or gadget, but an extractive process that radically changes the economics of vanadium production and could substantially impact the titanium supply chain too.

Whether TNG could find enough allies to leverage some kind of 'green' or 'blue' accreditation of vanadium and titanium products derived from ore processed through TiVAN™ is not yet known. However, as a means of adding value, raising informal barriers to materials produced using old higher energy, higher emissions technologies is a well-worn path, the most recent sector to invoke it are the western, mainly hydro-powered, aluminium producers. Their competition is a fleet of modern, but coal-powered, Chinese aluminium smelters.

Discussion

Three refined metal products buck trend for Australia as a quarry for China

The DFS for Mount Peake carries some substantial differences from the project 'as trailed' in our previous notes, the majority of which should be seen as strong positives. The increased focus on downstream, value-added products, all of which of which have long-established benchmark pricing schemes and global trading networks is the most positive move as it cuts the risks and costs associated with sales while maximising the available revenue.

Project now strongly localised and should maximise local industrial growth multipliers

The shift to a Darwin-based refinery is a political win for the Territory, driving directly attributable revenues through its biggest port and adding significantly to the prestige of the project as a whole. Australia's reputation as Asia's quarry gets a dent with the building of a major metals refining complex, with all the high-skilled jobs and innovation potential that travel with the development. A recent AusIMMM study showed that Australian refined metal production has dropped by over 56% from 545kg per capita in 2007-8 to 349kg per capita in 2012-13 (the latest data), so TNG's willingness to push downstream into value-added products should be appreciated at all levels, domestically at least.

Acid plant outsourced to processing plant specialist, SMS Siemag

In the long run a small Australian miner would have had less political influence in the proposed development in Malaysia, and as we have seen with other operators, the physical gap between extraction and processing can be exploited by anti-mining NGOs.

The acid production and reforming plant, is to be built and funded by SMS Siemag, the German-Austrian processing plant specialist that took part in the TiVAN™ optimisation process. This is a major expense that will reside off TNG's books, but

still be dedicated to providing services to the TNG refinery. Earlier in the relationship, immediately after their own extensive due diligence process, SMS Siemag were reported to be prepared to part-finance the refinery but, in the end, a simpler solution was found and instead it will build a commercially separate but interlinked acid production and reforming facility.

Of course this will take a slice off the total project CAPEX required by TNG, but crucially from a production standpoint, it will also shift responsibility for skills, training and maintenance in this essential part of the refinery support system to a German-Austrian market leader in the field.

Price Prediction Predicaments and a Little Legal Paranoia

Shorter than expected mine life is due to conservatism in how far forward metal price predictions can be projected

There is one administrative issue arising from the study; the start-up mine life is substantially shorter than we had expected, based on the 160Mt of reportable resources.

We have had the opportunity to have an extended conversation with the decision-makers and managers of the Mount Peake DFS (and once again we thank them for their time and openness), and as providers of external independent comment we now fully understand the limitations imposed on them by the reporting regulations (JORC2012 in this case) and that have resulted in a smaller reportable *reserve*, and hence a shorter mine life, than the reportable mineral *resources* might be seen as implying.

The problem is that, contrary to the ideal of a technical mineral reporting mechanism, JORC2012 has, in its application, become a potential legal battlefield such that technical experts are having to address professional risk directly as they produce forward metals pricing estimates. So while, again ideally, the professional competent persons concerned were previously able to tally a technically derived mine life with an economically derived reserve, against a geologically constrained resource. Now they must also include a macro-economic measure of risk in the metals pricing, an area where lawyers and economists tend to be more at home than geologists or mining engineers.

We class this as an administrative issue because it doesn't really impact how the mine will operate over the long term, or the sizing of the refinery, both of which fit the current scale of the downstream market through a staged growth path. The start-up costs are the same whether this mine is planned as a 20-year or a 30-year project and any investor conducting due diligence on a life-of-mine opportunity is not going to look only at the DFS. The constellation of Tier One partners already involved in the project clearly demonstrates that fact.

Profit Pointers and Discount Rates for Buy-side and Sell-side Analysis

As London-based analysts we're not constricted by the same guidelines as a company publishing JORC compliant reserve estimates so we can approach the issue of mine economics in a slightly different manner.

Broadly speaking there will be two viewpoints for the readership of this note; buy-side scepticism and sell-side optimism. In this next section we hope to provide evidence that will help both sides reach an opinion.

For the buy-siders we have developed a break-even model that we believe shows that the economic returns estimated in the DFS are conservative, and for the sell-

siders we have constructed a conventional Discounted Cash Flow model using our own commodities price predictions to help quantify the scale of the opportunity.

Discount Rates vs Mine Life

17-year mine life in the DFS implies an overall 20% discount rate on the project

We can show (in Fig 4, overleaf) that the intersection between break-even operating costs and Net Present Value implies an effective discount rate of around 20% if we use the 17-year mine life published in the feasibility study.

As always the discount rates used in long-term financial planning and valuation are contentious. The current sell-side standard 8%-10% may be seen by buy-siders as optimistic over a multi-decadal span, but if we look at Australian Large Business Lending Rates (from the Reserve Bank of Australia, the RBA) we see a simple average of 12.25% over the period since December 1978 (the maximum period of available data).

Using break-even prices and a 12% discount rate implies a 26-year mine life is possible

If we use that long term average in our model of discounted cash flow from Mount Peake and plot it (again Fig 4, below), we see that the NPV12 curve cuts the break-even operating cost curve at 26 years mine life, 9 years longer than that published in the DFS. What this suggests is that the length of the metals price projections fall well short of the potential profitable mine life, even if long term average interest rates are accounted for.

Looking at a Basket of Prices

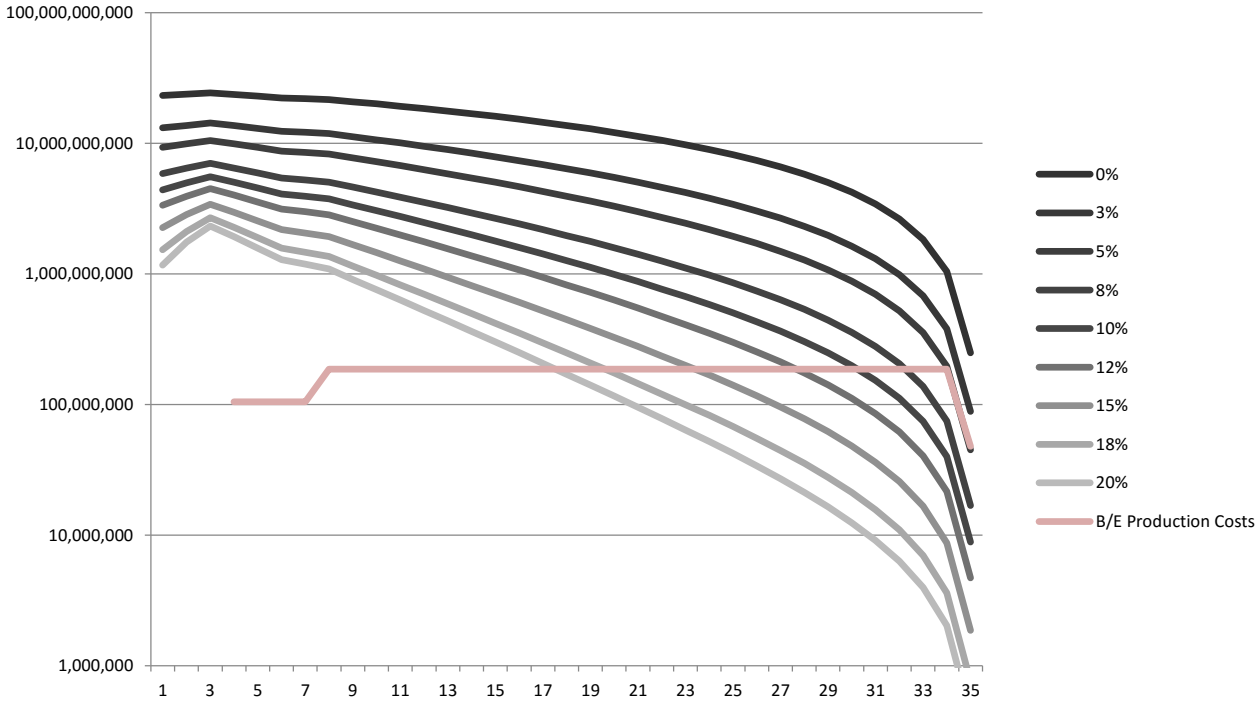
56-year price history shows that the combined basket of three products have never had prices lower than break-even production cost

If we then look back at prices over past six decades we can see some confirmation of the performance of the combined 'basket' of Mount Peake's products, seen in Fig 5, overleaf (though, of course the past is a wholly imperfect guide to the future).

Had this mine been operating between 1959 and the present day (the maximum period for which continuous price series are available, re-based to 2015 using US CPI), its products would never have dropped below production costs. At its lowest point, in pre-China 2002, when there was a simultaneous low point for V_2O_5 and Pig Iron, the basket would still have provided 28% margin over production costs. At their peak, in 1974, sales prices would have provided 187% over costs and over the whole period the basket provides an average of 93.24% margin over break-even production costs.

This strongly suggests that, if it ever needed to, Mount Peake would be able to compete on prices, because of, not despite, its three-product basket.

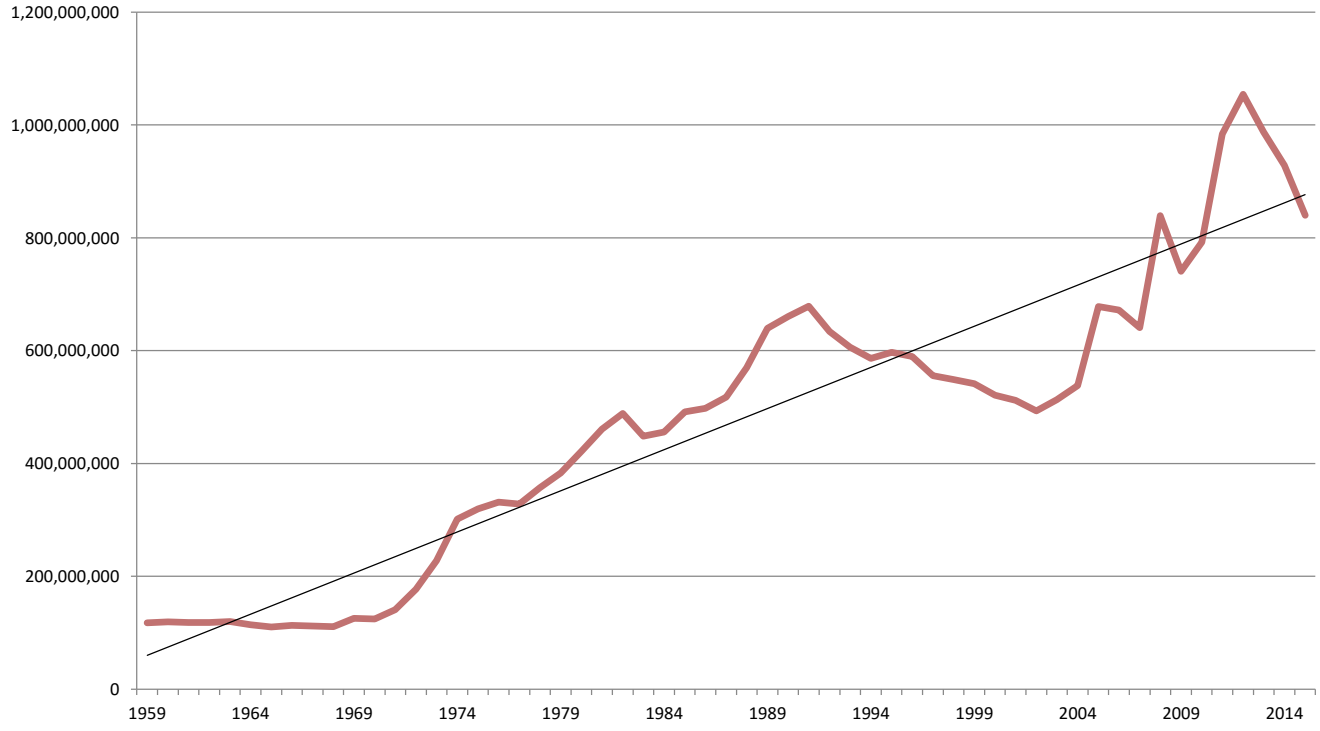
Figure 4: Break-even Net Present Value (in A$) plotted against mine life in years for various discount rates.



Source: Hardman & Co

Total operating cost curve is plotted without tax, depreciation or interest. X Axis is mine lifetime in years. Y-axis is plotted as logarithmic.

Figure 5: Historic basket revenue (in US$) weighted to Mount Peake production tonnages with trend line in black.



Source: USGS, Company

Valuation of 100% of Mount Peake on a 17-year DCF suggests Fair Market Value of A$4.63/sh on Day One of construction

A Conventional DCF Valuation

Using the mining parameters provided by TNG (shown in the Appendix), excepting product price (which has not been published by the company) and discount rate (where we will use the Australian LBLR long term average of 12%), we find a Fair Market Value for 100% of the Mount Peake project, on Day One of construction (so the project has been financed and permitted), of A$4.63/share on a fully diluted distribution of 723m. IRR is 46%.

The commodity pricing that we use is a simple 40-year median rounded to the third significant figure; US$14,700/t V_2O_5, US$3,090/t TiO2, US$360/t Pig Iron held constant over the life of mine.

No debt interest or dilution has been included, though both may be expected. The reason for this is the complexity of the consortium involved. Each partner and prospective financier has different expectations and we are not going to pre-judge the outcome of the on-going financing discussions. We have included no arbitrary evaluations of the various risk factors, outside of interest rates where there is good empirical data.

Investment conclusion

With a strong coalition of project partners with internal capacity ranging from mine building, through finance and to end-user sales and distribution, this is a technically strong project. Add into the mix a revolutionary new processing flowsheet that allows three high-value products to be sold and the vast majority of the mined resource to be utilised at relatively low cost, and Mount Peake becomes an efficient mining operation in the making.

There is economic strength arising from the production of multiple products that is not apparent in the raw financial figures provided by the DFS. This 'optionality' is a key feature of successful mines, but a feasibility study constructed under the Australian reporting code, JORC, has no requirement to discuss this flexibility in terms of a risk management opportunity.

Finally, there is the high degree of likelihood that additional resources, known to exist on the current tenements, can be used to extend the mine life (subject to all the relevant permissions). In past notes we have assessed the geophysical footprint and suggested a potential 50-year resource base. We stick by that estimate, but obviously the presence of additional in-ground mineral resource does not make that resource economic to extract. Commodity prices will have an impact.

China's headline growth may be back down to more normal global rates but Mount Peake's product lines have been designed to meet future needs rather than past ones, with new challenges and technologies pointing towards continued demand growth for each of its three products. The current price environment is tough but lack of new mines is building-in future supply issues.

This a significant project for Australia and the strategic minerals supply chain globally, but in simple terms it is also a mine start-up with a new processing technology, so the underlying risk/reward ratio is high. The DFS shows that TNG has done its best to de-risk that core challenge through the use of the best available engineering partners and trusted external validation.

Appendix – Mount Peake Study Key Parameters

Mineable reserves and mineral resources	Tonnage (millions)	V_2O_5 (%)	TiO_2 (%)	Fe (%)
Probable Ore Reserve	41.1	0.42	7.99	28.0
Mineable Inventory	77.8			15% cut-off
Mineral Resources				
Measured	120	0.29	5.5	24
Indicated	20	0.28	5.3	22

Source: Company

Stage One – Years 1-4

CAPEX – A$970m inc infrastructure, mine site & concentrator (A$208m) and refinery (A$647m)

Mining rate	3 Mtpa
Concentrate production rate	900 ktpa
Approx. Refined Production	10,700 t V_2O_5, 150 kt TiO_2, 360kt Fe

Stage Two – Years 5+

CAPEX – A$792m inc infrastructure, mine site & concentrator (A$67m) and refinery (A$631m). Paid from revenue

Mining Rate	6 Mtpa
Concentrate production rate	1,800 ktpa
Approx. Refined Production	20,000 t V_2O_5, 268 kt TiO_2, 740 kt Fe
Life-of-Mine Strip Ratio	0.9
Estimated Production Costs	US$5,578/t V_2O_5, US$1,380/t TiO_2, US$137/t Pig Iron
Average overall OPEX	A$167/t of ore mined
Exchange rate	0.75 A$ to US$

Company Revenue Estimates for 100% of the Mount Peake Project

Metal pricing estimates	Unknown
Productive Life of Mine	15 years
Life of Mine Revenue	A$27.3 billion
Net Cash Flow	A$11.6 billion
Discount Rate	8%
Payback (Stage One)	4 years
Pre-tax IRR	41%
NPV8	A$4.9 billion

Hardman Fair Market Value Estimates for 100% of the Mount Peake Project

Parameters as above, except

Exchange rate	0.77 A$ to US$
Estimated Sales Prices	US$14,700/t V_2O_5, US$3,090/t TiO_2, US$360/t Pig Iron
Life of Mine Revenue	A$25.5 billion
Discount rate	12%
NPV12 on financing & permitting	A$3.3bn (exc interest, D&A)
Fair Market Value on current issue	A$4.63/sh

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