AUSTRALIAN
RESEARCH
INDEPENDENT INVESTMENT RESEARCH

TNG Limited (ASX:TNG)

November 2017

INDEPENDENT
INVESTMENT RESEARCH

WHO IS IIR?

Independent Investment Research, "IIR", is an independent investment research house based in Australia and the United States. IIR specialises in the analysis of high quality commissioned research for Brokers, Family Offices and Fund Managers. IIR distributes its research in Asia, United States and the Americas. IIR does not participate in any corporate or capital raising activity and therefore it does not have any inherent bias that may result from research that is linked to any corporate/ capital raising activity.

IIR was established in 2004 under Aegis Equities Research Group of companies to provide investment research to a select group of retail and wholesale clients. Since March 2010, IIR (the Aegis Equities business was sold to Morningstar) has operated independently from Aegis by former Aegis senior executives/shareholders to provide clients with unparalleled research that covers listed and unlisted managed investments, listed companies, structured products, and IPOs.

IIR takes great pride in the quality and independence of our analysis, underpinned by high caliber staff and a transparent, proven and rigorous research methodology.

INDEPENDENCE OF RESEARCH ANALYSTS

Research analysts are not directly supervised by personnel from other areas of the Firm whose interests or functions may conflict with those of the research analysts. The evaluation and appraisal of research analysts for purposes of career advancement, remuneration and promotion is structured so that non-research personnel do not exert inappropriate influence over analysts.

Supervision and reporting lines: Analysts who publish research reports are supervised by, and report to, Research Management. Research analysts do not report to, and are not supervised by, any sales personnel nor do they have dealings with Sales personnel

Evaluation and remuneration: The remuneration of research analysts is determined on the basis of a number of factors, including quality, accuracy and value of research, productivity, experience, individual reputation, and evaluations by investor clients.

INDEPENDENCE – ACTIVITIES OF ANALYSTS

IIR restricts research analysts from performing roles that could prejudice, or appear to prejudice, the independence of their research.

Pitches: Research analysts are not permitted to participate in sales pitches for corporate mandates on behalf of a Broker and are not permitted to prepare or review materials for those pitches. Pitch materials by investor clients may not contain the promise of research coverage by IIR.

No promotion of issuers' transactions: Research analysts may not be involved in promotional or marketing activities of an issuer of a relevant investment that would reasonably be construed as representing the issuer. For this reason, analysts are not permitted to attend "road show" presentations by issuers that are corporate clients of the Firm relating to offerings of securities or any other investment banking transaction from that our clients may undertake from time to time. Analysts may, however, observe road shows remotely, without asking questions, by video link or telephone in order to help ensure that they have access to the same information as their investor clients.

Widely-attended conferences: Analysts are permitted to attend and speak at widely-attended conferences at which our firm has been invited to present our views. These widely-attended conferences may include investor presentations by corporate clients of the Firm.

Other permitted activities: Analysts may be consulted by Firm sales personnel on matters such as market and industry trends, conditions and developments and the structuring, pricing and expected market reception of securities offerings or other market operations. Analysts may also carry out preliminary due diligence and vetting of issuers that may be prospective research clients of ours.

INDUCEMENTS AND INAPPROPRIATE INFLUENCES

IIR prohibits research analysts from soliciting or receiving any inducement in respect of their publication of research and restricts certain communications between research analysts and personnel from other business areas within the Firm including management, which might be perceived to result in inappropriate influence on analysts' views.

Remuneration and other benefits: IIR procedures prohibit analysts from accepting any remuneration or other benefit from an issuer or any other party in respect of the publication of research and from offering or accepting any inducement (including the selective disclosure by an issuer of material information not generally available) for the publication of favourable research. These restrictions do not preclude the acceptance of reasonable hospitality in accordance with the Firm's general policies on entertainment, gifts and corporate hospitality.

DISCLAIMER

This publication has been prepared by Independent Investment Research (Aust) Pty Limited trading as Independent Investment Research ("IIR") (ABN 11 152 172 079), an corporate authorised representative of Australian Financial Services Licensee (AFSL no. 410381. IIR has been commissioned to prepare this independent research report (the "Report") and will receive fees for its preparation. Each company specified in the Report (the "Participants") has provided IIR with information about its current activities. While the information contained in this publication has been prepared with all reasonable care from sources that IIR believes are reliable, no responsibility or liability is accepted by IIR for any errors, omissions or misstatements however caused. In the event that updated or additional information is issued by the "Participants", subsequent to this publication, IIR is under no obligation to provide further research unless commissioned to do so. Any opinions, forecasts or recommendations reflects the judgment and assumptions of IIR as at the date of publication and may change without notice. IIR and each Participant in the Report, their officers, agents and employees exclude all liability whatsoever, in negligence or otherwise, for any loss or damage relating to this document to the full extent permitted by law. This publication is not and should not be construed as, an offer to sell or the solicitation of an offer to purchase or subscribe for any investment. Any opinion contained in the Report is unsolicited general information only. Neither IIR nor the Participants are aware that any recipient intends to rely on this Report or of the manner in which a recipient intends to use it. In preparing our information, it is not possible to take into consideration the investment objectives, financial situation or particular needs of any individual recipient. Investors should obtain individual financial advice from their investment advisor to determine whether opinions or recommendations (if any) contained in this publication are appropriate to their investment objectives, financial situation or particular needs before acting on such opinions or recommendations. This report is intended for the residents of Australia. It is not intended for any person(s) who is resident of any other country. This document does not constitute an offer of services in jurisdictions where IIR or its affiliates do not have the necessary licenses. IIR and/or the Participant, their officers, employees or its related bodies corporate may, from time to time hold positions in any securities included in this Report and may buy or sell such securities or engage in other transactions involving such securities. IIR and the Participant, their directors and associates declare that from time to time they may hold interests in and/or earn brokerage, fees or other benefits from the securities mentioned in this publication.

IIR, its officers, employees and its related bodies corporate have not and will not receive, whether directly or indirectly, any commission, fee, benefit or advantage, whether pecuniary or otherwise in connection with making any statements and/or recommendation (if any), contained in this Report. IIR discloses that from time to time it or its officers, employees and related bodies corporate may have an interest in the securities, directly or indirectly, which are the subject of these statements and/or recommendations (if any) and may buy or sell securities in the companies mentioned in this publication; may affect transactions which may not be consistent with the statements and/or recommendations (if any) in this publication; may have directorships in the companies mentioned in this publication; and/or may perform paid services for the companies that are the subject of such statements and/or recommendations (if any).

However, under no circumstances has IIR been influenced, either directly or indirectly, in making any statements and/or recommendations (if any) contained in this Report. The information contained in this publication must be read in conjunction with the Legal Notice that can be located at http://www.independentresearch.com.au/Public/Disclaimer.aspx.

THIS IS A COMMISSIONED RESEARCH REPORT.

The research process includes the following protocols to ensure independence is maintained at all times:

1) The research process has complete editorial independence from the company and this included in the contract with the company;
2) Our analyst has independence from the firm's management, as in, management/ sales team cannot influence the research in any way;
3) Our research does not provide a recommendation, in that, we do not provide a "Buy, Sell or Hold" on any stocks. This is left to the Adviser who knows their client and the individual portfolio of the client.
4) Our research process for valuation is usually more conservative than what is adopted in Broking firms in general sense. Our firm has a conservative bias on assumptions provided by management as compared to Broking firms.
5) All research mandates are settled upfront so as to remove any influence on ultimate report conclusion;
6) All staff are not allowed to trade in any stock or accept stock options before, during and after (for a period of 6 weeks) the research process.

For more information regarding our services please refer to our website www.independentresearch.com.au.

Contents

INDEPENDENT INVESTMENT RESEARCH

TNG Limited (ASX: TNG)

Initiation - November 2017

Note: This report is based on information provided by the company as at November 17 2017

Investment Profile	
Share Price - 23 Nov 2017	A$0.15
Price Target per share	A$0.41
Issued Capital:	
Ordinary Shares	804m
Listed Options	25.9m
Unlisted Options	12.5m
Fully Diluted	843m
Market Capitalisation	A120.7m
12 month L/H	A$0.11/$0.185
Cash and Liquid Investments	A$6.47 million

Board and Management
Mr Paul Burton: Managing Director
Mr Rex Turkington: Non-Executive Director
Mr Stuart Crow: Non-Executive Director
Mr John Davidson: Non-Executive Director
Mr Simon Robertson: Company Secretary
Mr Paul Vollant: GM, Business Development
Mr Phillipe Guillemaille: Titanium Business Manager
Mr Kim Grey: Exploration Manager

Major Shareholders	
WWB Investments	9.94%
Adsu Investmentsq	6.99%
Top 20	33.22%
Board and Management	3.61%

Price Chart

Senior Analyst – Mark Gordon

ADVANCING TO DEVELOPMENT

TNG Limited ("TNG" or "the Company") is targeting a mid-2018 Final Investment Decision ("FID") for its 100% owned Mount Peake Vanadium-Iron-Titanium Project ("Mount Peake" or "the Project"), located in the Northern Territory ("NT") of Australia.

A recently completed updated Feasibility Study ("FS") has confirmed the quality and robustness of the long life two stage project, which will use the proprietary TIVAN™ hydrometallurgical process and supplementary processing to extract maximum value from the titanomagnetite concentrate feed - planned products include premium grade V_2O_5, TiO_2 pigment and pig iron. The Company's modelling indicates a pre-tax NPV_8 of A$4.7 billion and an IRR of 44% for Mount Peake, with up-front capital estimated at A$853 million.

The timing of development is ideal to take advantage of the strong current metals cycle, including rising vanadium prices, which are forecast to remain strong for the foreseeable future; in addition TiO_2 and pig iron are expected to consolidate recent gains in prices.

KEY POINTS

Game changing technology: TIVAN™ has the potential to be a game changing processing technology, particularly in the ability to produce consistent high quality V_2O_5 at a relatively low cost, and without the need for roasting with its inherent environmental issues and high cost; the other key product is TiO_2 which can then be used for low cost pigment production.

Vanadium redox flow batteries: The possibility to produce consistently high quality V_2O_5 should result in a consistent supply of vanadium redox flow battery ("VRFB") electrolyte, the lack of which is hampering development of this promising grid based storage technology - successful TIVAN™ operation could therefore lead to an increase in the development of VRFBs, another field that TNG is exploring.

Robust project: The updated FS indicates a robust, high value project with good potential to extend the life past the current 17 years of production; our modelling, using more conservative metals prices supports the economic potential of Mount Peake.

Simple orebody: The morphology of the Mount Peake gabbro highlights a low strip ratio and low dilution conventional drill and blast mining operation.

Ready access to infrastructure: Both the Mount Peake mine site (near Alice Springs) and Darwin processing plant site are near infrastructure including gas, rail, road and, in the case of Darwin, port facilities.

Stable, well respected mining jurisdiction: The Northern Territory is a stable, well regarded mining jurisdiction, with the Government throwing its support behind the Project.

Strong management and technical team: The Company has management and technical personnel with extensive experience in the junior resources sector; in addition they hold some 3.61% of shares in the Company.

VALUATION SUMMARY

We have a base case, risked, post-tax price target of A$0.41/share for TNG, with an un-risked valuation of A$0.68/share - this is based on a diluted share structure of 2.4 billion shares to take account of our financing scenario.

We have used more conservative metals prices than those used by TNG (however with TNG's being supplied by reputable independent parties); our resultant value is still a multiple of the estimated Stage 1 up-front capital and shows a robust project.

We would expect this valuation to increase with ongoing de-risking of the Project, with key events including signing of offtake for titanium dioxide, completion of permitting and progress in financing.

TNG indicative base case valuation

Asset	Value (A$m)	Risk Factor	Risked	Risked/Share	Notes
Mount Peake	$1,632	60%	$979	$0.407	Post-tax NPV_8
Cash	$5.10	100%	$5.10	$0.002	As at September 30, 2017
Todd River Holding	$1.12	100%	$1.12	$0.000	As at November 23, 2017
Total	**$1,639**	**N/A**	**$986**	**$0.410**	

SWOT ANALYSIS

Strengths

- **Robust economics:** Both the TNG modelling and our valuation indicate a robust and viable project should all products be able to be sold.
- **Simple mineralisation:** The Mount Peake mineralisation is simple and homogenous, leading to low strip ratio and hence relatively low cost mining.
- **Innovative processing path:** TIVAN™ is an innovative hydrometallurgical process, that has the potential to extract maximum value in multiple products from titanomagnetite concentrates and particularly become a reliable source of V_2O_5 suitable for battery electrolyte - this has been demonstrated to date in pilot scale test work and forms the basis for the Project.
- **Tier 1 development partners:** TNG has partnered with global Tier 1 technical and commercial partners for the development of Mount Peake.
- **Well regarded jurisdiction:** The Northern Territory is a well regarded and stable mining jurisdiction, ranking 20th globally in the 2016 Fraser Institute Survey of Mining Companies; this has been reinforced with the support provided by the NT Government.
- **Close to infrastructure:** Both parts of the Project, namely the Mount Peake minesite and Darwin processing facility are close to key infrastructure, including road, rail, gas, and in the case of Darwin, port facilities. This has helped reduce estimated capex and opex.
- **Experienced people with skin in the game:** Company personnel have significant experience and success in the junior resources sector, and also have holdings in TNG, which aligns their interest with those of other shareholders.

Weaknesses

- **Titanium offtake:** Although vanadium and iron offtake agreements are in place, agreements are yet to be signed for titanium dioxide products, however discussions are well advanced, with closure planned for H1, 2018. The Company has appointed Philippe Guillemaille, who has over 25 years experience in the industry with leading TiO_2 players as Titanium Business Manager, and in addition options have already been identified by titanium trader Wogen Pacific, with whom TNG has an MoU.
- **New technology package:** Although most of the individual stages of the TIVAN™ process are well tried separately, the package has not been used as a whole in a commercial application - there will be some risk in the scale up from the successful pilot plant to full commercial production, however SMS, as part of any EPC contract, will be required to provide a process and product guarantee. Risks will also apply to operating costs, with, although these being calculated from first principles as part of the updated FS, there are no readily comparable operations to benchmark against.

Opportunities

- **Resource expansion:** Although the studies are based on a long life operation, there is the potential to increase resources at Mount Peake, and hence increase project life; the plant has been designed for a 40 year life.
- **Additional projects:** There is the potential to also source new ore by identifying additional deposits, else treating third party material.
- **Licencing:** Should TIVAN™ prove commercially viable TNG/SMS will be able to licence the technology to projects being developed by other parties.
- **Flow batteries:** There is the strong potential to grow the VRFB market in Australia - this will be aided should TIVAN™ prove successful and provide a reliable source of V_2O_5 for electrolyte.

Threats

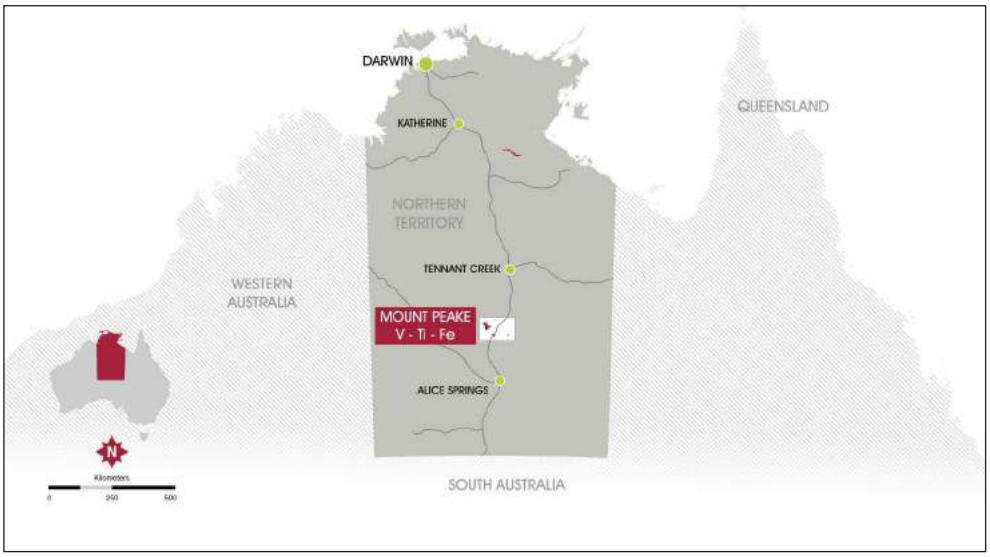
- **Funding:** Given the amount of up-front capital required, funding is a key aspect, however with the appointment of Gresham and the association with SMS (with their access to the German Export Credit Agencies ("ECA") TNG is addressing this issue - one key aspect to funding will be successfully negotiating titanium dioxide offtake.
- **Markets and metals prices:** These are threats to any resources projects, however modelling indicates that Mount Peake is reasonably robust and can absorb adverse movements in individual metals prices - the key threat will be exchange rates and adverse moves in two or three of the key metals at the same time.

OVERVIEW

STRATEGY AND PROJECT OVERVIEW

- TNG's strategy is the development of Mount Peake, which includes the mine and concentration plant near Alice Springs, and the planned TIVAN™ processing plant in Darwin (a key part of the strategy) - concentrate will be trucked 80km and then railed 1,180km to Darwin for downstream processing.
- The 100% TNG-owned TIVAN™ is a proprietary hydrometallurgical process, initially developed by TNG, Perth based Metallurgical Engineering Technical Services ("METS") and the Commonwealth Scientific and Industrial Research Organisation ("CSIRO"), designed to extract high purity vanadium, titanium and iron oxide products from titaniferous magnetite concentrates; subsequent work has been carried out in conjunction with the SMS Group ("SMS") a major European based global metallurgical engineering group.
- Should the commercialisation of the TIVAN™ process prove successful, it has the potential to be a game-changer in the vanadium industry - one key is that it has the potential to provide a reliable supply of high purity, battery grade V_2O_5, one thing that is reportedly lacking in the current market.
- This then may help drive the development of VRFBs, which has been stymied partly by the lack of suitable V_2O_5, which is required for the battery electrolyte. These batteries have the capacity for grid-scale power storage, with trials being run in a number of countries along with a number of successful commercial installations.
- As part of their strategy with partners TNG is looking at the development of the VRFB market in Australia, as well licencing of TIVAN™ should it prove successful.
- The Company has made major recent progress on the planned operation, and is looking to an FID in mid 2018 - work has included forging partnerships with various groups, including metallurgical, project development, financing and offtake partners.
- As part of their operations, TNG spun-out non-core gold and base metal assets into Todd River Resources (ASX: TRT, "Todd River") in early 2017 - the Company still holds 7 million shares, or 10.77% of Todd River.

Figure 1: Project location map



Source: TNG

FINANCIAL POSITION

- As of September 30, 2017, TNG had A$5.101 million in cash and no debt.
- In addition the Company holds 7 million shares (10.77%) in Todd River Resources (ASX: TRT), which is the result of the de-merger of the current Todd River assets from TNG in early 2017.
- Over the 12 months the Company spent A$4.416 million on development, and A$3.756 million on administration and wages; over the same period A$0.962 was received from the Federal Government in Research and Development refunds, following on from A$1.889 million received in the December quarter, 2015.

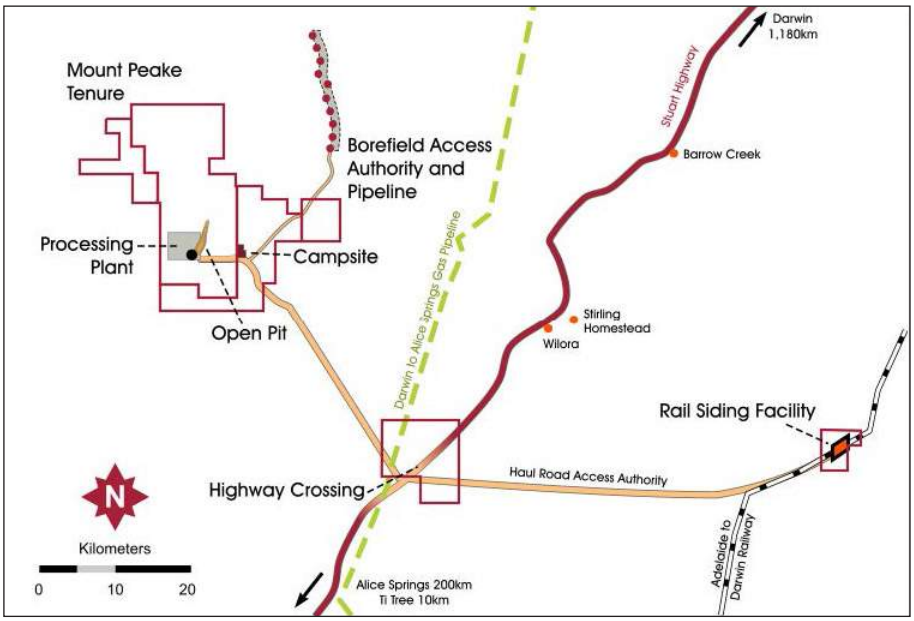
- The most recent capital raising was in December 2016, where the Company raised ~A$7 million in a fully subscribed SPP - this resulted in the issue of 51.74 million shares at a price of A$0.135/share; the offer included free attaching listed options on a 1 for 2 basis, with the options having an expiry date of June 15, 2018 and an exercise price of A$0.20 (subsequently adjusted to A$0.193/share).

MOUNT PEAKE VANADIUM-IRON-TITANIUM PROJECT

Location and Tenure

- Mount Peake includes five granted exploration licences ("EL"), one retention licence ("ELR, which covers the mineralisation and surrounding areas), four minerals licence applications ("MLA") and one access authority application ("AA"), located approximately 235km north of Alice Springs.
- The ELs cover 139 sub-blocks (~440km^2), with the ELR covering 1,194ha; all are in good standing, however two of the ELs are currently in the process of being renewed, with these two being peripheral to the main area of interest.
- The MLAs cover 3,612ha, which includes the mine and associated infrastructure; the access authority covers the proposed haul road from the concentrator to the proposed rail siding and the proposed bore field and pipeline (Figure 2).
- The Company is looking for grant of the minerals licences and access authorities upon approval of the EIS and a mining agreement with the Traditional Owners, expected in Q1, 2018.
- The site is well located with respect to infrastructure, being 80km via the planned haul road from the Adelaide-Darwin ("Ghan") rail line (and 1,180km via rail to Darwin) and 40km from the Sturt Highway and Alice Springs-Darwin gas pipeline.
- The Northern Territory Government has given in principle agreement for the proposed plant site in Darwin through the signing of a Project Facilitation Agreement ("PFA") - the site is located adjacent to the Ghan Rail and Darwin-Alice Springs gas pipeline (Figure 3) with negotiations for the acquisition ongoing.

Figure 2: Mount Peake tenements and site layout



Source: TNG

Figure 3: Darwin plant location

Source: TNG

Project History

- TNG originally commenced drilling on the Project, targeting magnetite-hosted mineralisation in early 2009, following on from clearances by the Central Lands Council ("CLC").
- This led to the completion of a positive Scoping Study (announced to the market on July 29, 2009), which provided the impetus to continue work.
- Development of the hydrometallurgical TIVAN™ process, originally in association with METS, commenced in 2009, with this used as the processing route for the interim PFS, completed in November 2011, and final PFS, completed in July 2012.
- Continuing activities, including ongoing development and optimisation of the TIVAN™ process were targeted at the BFS, with the study completed in July 2015, this has subsequently been updated with ongoing work, particularly process optimisation in association with SMS.
- A significant update to the BFS was released in November 2017 - this incorporated continuing process optimisation, and will form the basis of the FID, financing and project engineering.

Project Agreements

- As part of the planned Project development, TNG has agreements in place covering major aspects, including project development, offtake and financing.
- These, along with other agreements are detailed below - the Company has targeted Tier 1 global groups for the various project agreements.
- In addition to the Companies listed below TNG has ongoing relationships with Snowden, METS, Como Engineers and McMahon Services.

WOOJIN - Vanadium Offtake

- TNG has signed a binding LoM offtake agreement with WOOJIN IND. Co. Ltd. ("WOOJIN") to purchase a minimum of 60% of the V_2O_5 and other vanadium products produced from Mount Peake on a take or pay basis, helping underpin project revenue.
- Prices will be set annually based upon the market price, with a floor price of 20% above the estimated cost of production.
- A technology transfer agreement has also been signed giving TNG access to WOOJIN's technology to convert V_2O_5 to ferrovanadium, with a plant to be installed at the Darwin refinery - this will allow TNG to diversify the product portfolio by production of the value added ferrovanadium, which is directly saleable to steel mills.
- WOOJIN's proprietary tecnology currently has the world's highest vanadium recovery rates, and has the potential to significantly enhance economic returns.

Gunvor - Iron Offtake

- TNG has signed a Binding Term Sheet with Gunvor (Singapore) ("Gunvor") for the LoM offtake of 60% of iron products produced from Mount Peake; prices will be on an FOB basis, with a fixed commission for global distribution, and with Guvnor also being able to provide logistics support.
- Guvnor is one of the world's largest independent commodity traders, with a turnover of US$93 billion in 2012, and the Company will now work towards completion of the final binding agreements with Guvnor.

Wogen Pacific - Titanium Offtake

- As announced to the market on November 16, 2016, TNG has entered into a MoU with Wogen Pacific, a leading global titanium trader.
- Subject to a satisfactory completion of due diligence, the parties may enter into Binding Agreements for:
  - Life-of-mine sales and marketing of Mount Peake's TiO_2 products by Wogen,
  - Facilitating the distribution of Mount Peake's TiO_2 products by Wogen to potential buyers and coordinating the sales process,
  - The pre-financing of Mount Peake's TiO_2 products by Wogen, and,
  - Any other mutually beneficial arrangements in relation to the sales, marketing and distribution of TiO_2 products from the Mount Peake Project.
- Wogen has extensive experience in the global titanium and mineral sands supply chains, including for raw, intermediate and finished materials.

SMS Group - TIVAN™ Development

- The Company has two agreements with SMS regarding development, licencing and financing of the proposed Darwin TIVAN™ refinery - the first of these, a binding HoA was announced to the market in February 2016, and covers the following development and financing facets:
  - Undertake full due diligence of all relevant aspects of the Mount Peake DFS relating to the TIVAN™ refinery,
  - Provide detailed engineering, design and final costings for the tender for construction of the refinery; and,
  - Provide assistance for arranging the funding the construction of the TIVAN™ refinery which includes the Export Credit Agencies (ECA's) or other structured finance.
- The second agreement, an MoU announced in May 2016, covers the joint commercial exploitation of the TIVAN™ technology, with key points listed below:
  - SMS to grant TNG the right to use its TIVAN™ IP in TNG's wholly or majority owned refineries for the processing of titanoferrous ores on the condition that those refineries are supplied by SMS,
  - In the event that TNG elects to procure such a refinery from another vendor, SMS shall grant TNG a license to use its TIVAN™ IP against payment of an adequate royalty (to be discussed) in each case,
  - TNG shall grant SMS as an equipment supplier and plant builder, as well as its respective customers the right to use TNG's TIVAN™ IP against payment of an adequate royalty (to be discussed) in each case, and,
  - Any future inventions and or any other IP by the Parties applicable to the processing of titanoferrous ores based on a hydrochloric acid or ferric chloride leach shall be disclosed to each other and licensed under the conditions outlined above.
- The MOU builds on a binding Heads of Agreement signed earlier, and allows for the pooling of both parties' IP in relation to the TIVAN™ process - SMS has developed significant IP in TNG's 100% owned TIVAN™ technology through its work on the development of the process with TNG.

Downer EDI - Project Development

- The Company has signed a non-binding development and operations MoU with the ASX-listed Downer EDI (ASX: DOW), a leading provider of services, including EPCM, to a wide range of industries including mining and mineral processing. The agreement is broad ranging, covering such items as:
  - Construction, operation and maintenance of the mine site processing plant,

- Building, ownership and operation of non-process infrastructure at the mine site,
- Construction of the Darwin refinery, and,
- Drill, blast load and haul of ore and waste at the mine site.

Sumitomo, Energy Made Clean - Vanadium Batteries

- In the December Quarter, 2016, the Company signed a strategic agreement with Sumitomo Electric Industries ("Sumitomo") and Energy Made Clean ("EMC", a subsidiary of Carnegie Clean Energy, ASX: CEE) to collaborate on the development of the VRFB) market in Australia.
- This follows on from TNG's success in producing high purity, commercial grade VRFB electrolyte from V_2O_5 produced in the TIVAN™ pilot plant, with the partnership also to explore the possibility of developing an electrolyte plant in Australia.
- Sumitomo is a world leader in VRB technology, with installations including a 15MW/60MWh battery in Hokkaido, Japan.
- We have included more information on VRFBs in the section on commodities and markets near the end of this report.

ECE/Wanlong Group - Development, Financing

- ECE/Wanlong is a major Chinese mineral exploration, development and mining group which in 2011 made a A$13.4 million investment in TNG.
- The group provides potential access to Chinese financing, EPCM services and final product customers.

Gresham Partners - Financing

- As announced to the market on September 20, 2016, TNG appointed independent advisory house Gresham Partners as the corporate advisor to assist in the financing and development of Mount Peake.
- Gresham's brief includes:
  - Developing the appropriate funding strategy for Mount Peake with a view to optimising the funding mix and maximising value to TNG's shareholders,
  - Preparing financial models in order to develop a robust internal valuation and cash flow assessment (including debt capacity) of the Project,
  - The identification of debt and equity funding sources,
  - The negotiation of equity and debt terms,
  - The negotiation of further off-take agreements to the extent that this supports the proposed funding of Mount Peake, and,
  - All other necessary aspects of the negotiation, execution and completion of the funding of the project.

KfW IPEX-Bank GmBH - Financing

- KfW IPEX-Bank is a German Government-owned bank, and a specialist in export and project financing, with a history of successful Export Credit Agency backed financing.
- The bank has had detailed briefings on the Project, and has provided an expression of interest in providing financing for Mount Peake subject to further due diligence and an updated financial model.

Permitting Status

- Key permitting steps include reaching a mining agreement with the Traditional Owners, and finalisation of the EIS, both for the Mount Peake Mine Site and the Darwin Plant Site.
- The mining agreement and finalisation of the mine site EIS are required for granting of the Minerals Licences at Mount Peake.
- With regards to the Traditional Owners' agreement, the Company has been in negotiations with the CLC (the representative for the Traditional Owners) for ~12 months, with the last six months being spent on finalisation; all other Traditional Owner approvals are in place.
- The Company expects that the mine site EIS will be approved in Q1, 2018, and the plant site EIS approved in Q2 2018 - the supplementary mine site study has recently been lodged with the relevant authorities for final approval.

- No time frame has yet been provided on the mining agreement with the CLC, however may be expected in early 2018.
- The Company is currently negotiating terms with the NT Government for the acquisition of the Darwin plant site.
- The Project is considered a "Major Project" by the NT Government, which allows for the coordination of permitting activities through a single Government agency; in addition the proposed plant is the subject of a "Project Facilitation Agreement", again which should help streamline the permitting process.

Geology and Resources

- The Mount Peake deposit is located within outliers of sediments of the Neoproterozoic Georgina Basin, which unconformably overlies units of the Aileron Province, a subdivision of the Palaeoproterozoic Arunta Group.
- The mineralisation is hosted within a flat-lying magnetite-bearing gabbro-norite sill, believed to be of Neoproterozoic to Cambrian age that has intruded the older units - drilling has indicated large thicknesses of mineralisation (up to 170m), and exhibits good lateral continuity between drillholes.
- The gabbro hosting the mineralisation is part of a 20km long x 10km wide NW trending sill or sill complex, with the mineralisation in the uppermost parts of the sill - the identified JORC- resources are confined to one part of the complex, with other areas yet to be defined, and which provide upside potential.
- Current resources (which were upgraded in 2013) are presented in Table 1, with 74% of the 160Mt deposit in the JORC Measured category, and 86% in the Measured and Indicated categories.
- Ore Reserves are presented in Table 2

Table 1: Mount Peake JORC 2012-compliant MRE

Mount Peake JORC 2012-compliant MRE						
Category	**Tonnes (Mt)**	**V_2O_5 %**	**TiO_2 %**	**Fe%**	**Al_2O_3 %**	**SiO_2 %**
Measured	118	0.29	5.48	23.64	8.18	32.81
Indicated	19.5	0.28	5.33	22.05	9.09	33.98
Inferred	22	0.22	4.41	19.06	10.38	37.79
TOTAL	**160**	**0.28**	**5.31**	**22.81**	**8.60**	**33.64**

Source: TNG

Table 2: Mount Peake JORC 2012-compliant Ore Reserves

Mount Peake JORC 2012-compliant Ore Reserves				
Category	**Tonnes (Mt)**	**V_2O_5 %**	**TiO_2 %**	**Fe%**
Proven	-	-	-	-
Probable	41.1	0.42	7.99	28.0
TOTAL	**41.1**	**0.42**	**7.99**	**28.0**

Source: TNG

- There is considerable resource upside potential, with additional intrusives being identified on the Company's tenements, but are yet to be tested in detail.

Updated Feasibility Study

- The updated FS was released to the market on November 20, 2017, and includes the result of optimisation work undertaken since the original July, 2015 Study.
- The overall strategy is similar to that of 2015, and includes mining and concentration at Mount Peake, and then trucking/railing concentrate to the proposed Darwin plant site - this includes 80km trucking and 1,180km on rail.
- The key parameters and results of the studies are presented in Table 3.
- This presents a base case study - the process plant has been designed with at least a 40 year operational life, with the opportunity to source extra feed.

Table 3: Mount Peake DFS comparisons

Mount Peake JORC 2012-compliant Ore REserves		
Key Physicals	**Updated DFS, November 2017**	**Initial DFS, July 2015**
Pre-production CAPEX (Stage 1 infrastructure, mine site, concentrator, process plant)	A$853 million	A$970 million
Stage 2 Capex (assumed funded out of cash flow)	A$969 million	A$792 million
IRR pre-tax	44%	41%
NPV (at 8% discounted)	A$4.7 billion	A$4.9 billion
NPV (at 10% discounted)	A$3.8 billion	A$4.0 billion
NPV (at 12% discounted)	A$3.1 billion	A$3.3 billion
Pay back	3 years	4 years
Pre-tax net annual average cash-flow	A$738 million	A$785 million
Life-of-mine net cash-flow	A$11.7 billion	A$11.6 billion
Product pricing	US$22.400/t $V2O_5$, US$3,500/t TiO_2 US$400/t pig iron, AUDUSD exchange rate 0.75	US$13,333/t V_2O_5, US$3,576/t TiO_2 US$437.50/t pig iron, AUDUSD exchange rate 0.75
Total operating costs	A$185 per tonne of ore processed	A$167 per tonne of ore processed
Year 1-4 - ore feed	3Mt pa	3Mt pa
Year 5-17 - ore feed	6Mt pa	6Mt pa
Scheduled mined material (Mt)	81	72
Strip Ratio	0.9:1	0.9:1
Head Grade	0.37% V_2O_5, 26.38% Fe, 6.87% TiO_2	0.38% V_2O_5, 27.1% Fe, 7.04% TiO_2
Overall metallurgical recovery[1]	81% V_2O_5, 71% Fe, 58% TiO_2	84% V_2O_5, 66% Fe, 69% TiO_2
Magnetic concentrate (Mt)	24.3	21.7
LoM Pig Iron (Mt)	10.6	9.6
LoM V_2O_5 (Mt)	0.243	0.265
LoM Titanium Pigment (Mt)	3.5	3.6

Source: Adapted from TNG, 1: IIR calculations for 2017 update, takes into account final product purities.

- The financial outcomes for the updated DFS are broadly similar for those delivered in 2015, although importantly the expected up-front capital costs are lower, IRR higher and payback period shorter.
- The Study proposes the production of three high value products:
  - +99% purity vanadium pentoxide,
  - +92.5% purity pigment grade titanium dioxide, produced through a chloride process plant, and,
  - Pig iron, in lieu of a previously considered high purity iron oxide product - this change in plans follows on from market studies.

Operating and Capital Costs

- The Company has estimated total operating costs, including mining, beneficiation, transport, processing and royalties to be in the order of A$185/tonne of ore processed - these figures have not been detailed further by the Company, given that some of the estimated TIVAN™ costs are commercial in confidence.
- Detailed capital costs are provided in Table 4; in addition a break down of estimated Build-Own-Operate-Transfer ("BOOT") third party capital and operating costs are presented in Table 5.
- The Company is of the view that it will beoperationally and commercially prudent to have some sections of the proposed operation, including the pigment plant amongst others to be constructed and operated by 3rd parties experienced in the relevant operations.

Table 4: Mount Peake capital cost estimates, A$ million

Mount Peake capital cost estimates, A$ million				
Category	**Updated, Nov 2017**		**DFS, July 2015**	
	Stage 1	**Stage 2**	**Stage 1**	**Stage 2**
Total Mining and Infrastructure Capex	A$207	A$122	A$208	A$67.1
Total Process Plant Capex	A$541	A$745	A$647	A$631
Total direct capex	**A$748**	**A$867**	**A$856**	**A$698**
EPCM (8%)	A$64	A$56	A$68.4	A$55.9
Contingency (5%)	A$41	A$46	A$46.2	A$37.7
Total capex	**A$853**	**A$969**	**A$970**	**A$792**

Source: TNG

Table 5: Mount Peake estimated BOOT costs, A$ million

Mount Peake estimated BOOT costs, A$ million		
Category	**Estimated capex**	**Estimated annual opex**
Acid Regeneration - BOOT (years 1-16)	A$212	A$23.9
Oxygen Plant - BOOT (years 1-16)	A$33	A$3.8
Pigment Plant - BOOT (years 1-16)	A$222	A$25.0
Chlor-Alkali Plant - BOOT (years 1-16)	A$95	A$10.7

Source: TNG

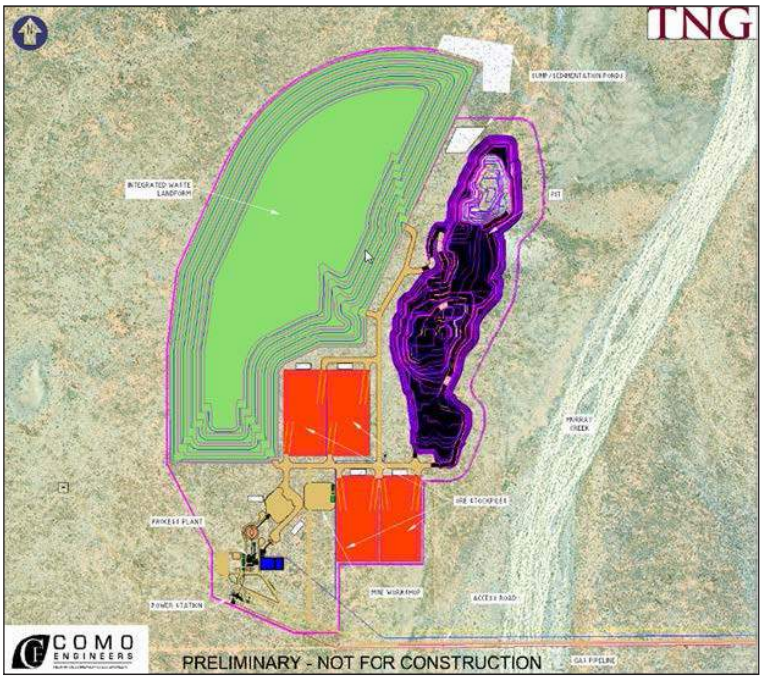
Product Pricing

- Prices for vanadium and titanium were provided by Roskills, and those for pig iron by Commodity Traders, Shanghai - these reflect the expectation that titanium dioxide and pig iron prices will remain firm after recent rises, and that there will be significant increases in vanadium pentoxide prices.
- All prices have been used on a real and not nominal basis.
- The AUD:USD exchange rate used is 0.75, which is indicative of the current rate and RBA forecasts.

Mining and Beneficiation

- It is planned to use standard drill and blast mining at Mount Peake, with the ultimate pit dimensions being ~2,000m long, 350m wide and 100m deep - the site layout is presented in Figure 4.

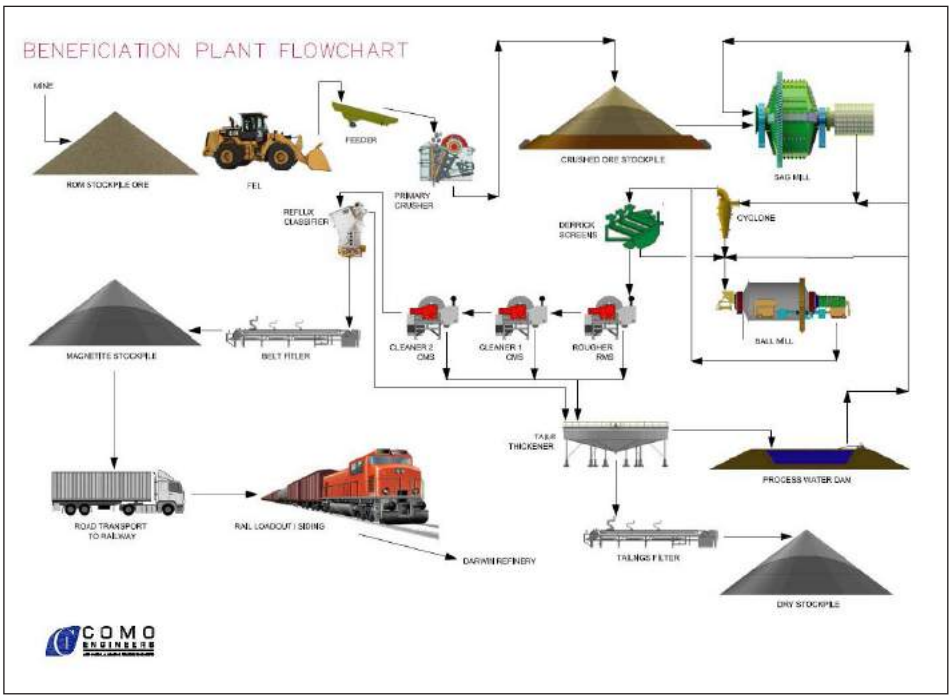
Figure 4: Mount Peake site layout



Source: TNG

- The planned mining inventory of 81Mt includes the Probable Reserves of 41.1Mt for the first eight years, followed by Measured Resources of 34Mt and Indicated Resources of 6Mt - Reserves have not been declared for the period subsequent to the initial eight years due to the uncertainty in forecasting metals prices past this period, however technically the Resources would support conversion.
- The proposed schedule includes mining of 3mtpa of ore for the first four years, with this ramping up to 6mtpa for subsequent years.
- The life of mine strip ratio is a low 0.9:1, with this, and the large size of the orebody resulting in a low mining dilution of 2%, with corresponding low ore losses.
- Concentrate production will be carried out at Mount Peake, with the proposed beneficiation flow sheet shown in Figure 5.

Figure 5: Beneficiation flowsheet



Source: TNG

- The planned beneficiation process will include primary crushing, SAG milling and then concentrating using magnetic separation.
- It is proposed to produce dry railings - this obviates the requirement for a wet tailings storage facility, and allows for tailings to be integrated with the mine waste dump; in addition it allows for increased recycling of process water.

Transport and Infrastructure

- Concentrate will be trucked ~80km to a purpose built siding on the Adelaide-Darwin rail, where it will be loaded onto dedicated trains for the journey to the TIVAN™ plant in Darwin.
- Power on site will be supplied by a gas fired power station, with gas supplied from the Alice Springs-Darwin gas pipeline via 40km spur pipeline.

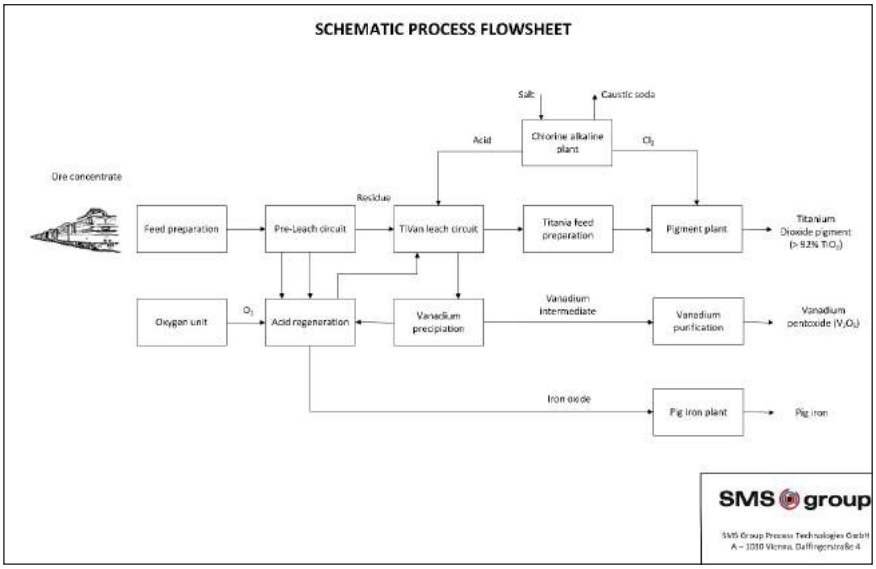
Processing

- The key to the success of Mount Peake is the proposed use of the TIVAN™ process, to enable multiple products to be produced from the single Mount Peake ore type (Figure 6).
- As mentioned earlier, TIVAN™ was initially developed by TNG, METS and the CSIRO, with more recent work, including optimisation, being carried out by SMS.
- The process, as originally planned, is a hydrometallurgical process, using hydrochloric acid to leach the magnetite concentrate.
- The process has been successfully tested to a pilot scale, with the original pilot plant work being completed in 2015,. and the results used in the original DFS.
- Key conclusions and results of the original pilot scale work included:
  - Demonstrated the commercial and technical viability of the TIVAN™ process,

- 93% recovery of vanadium to a +99% purity product,
- >90% titanium recovery to a +65% purity, low iron product, and,
- Production of a >99% purity iron oxide product.

- Ongoing optimisation and studies have resulted in the following, which are incorporated in the updated Study:
  - Development of a proprietary vanadium extraction circuit by SMS, to obviate the requirement for a capital intensive and complex solvent extraction process,
  - Additional chloride processing to refine the 65% TiO_2 product to a +92.5% pigment grade concentrate, and,
  - Production of pig iron on site to take advantage of the value add opportunity.
- Ongoing refinement work is ongoing to assess the suitability of the process for a wider range of titanomagnetite ore sources.

Figure 6: Darwin processing plant schematic



Source: TNG

- The location of the processing plant is ideal, given the ready access to required infrastructure and a stable workforce.

Planned Activities

- Upcoming activities will be concentrated on permitting, offtake and financing.
- On the technical front optimisation work will be ongoing.

Upside Potential

- There is the potential to find and delineate more mineralisation at Mount Peake, which, if of sufficient grade, could provide longer term supply to the Darwin plant - previous exploration work (Company release of April 14, 2014) has identified other gabbro targets within the Project area, with a number yet to be drill tested.
- Being located near the Port of Darwin, there is also the possibility to treat concentrates from other areas, potentially through toll treating arrangements, or sourcing and acquiring other projects for long term operations.
- As stated earlier, the Company has signed agreements to explore the VRFB market in Australia, and also should be in the position to produce electrolyte for the batteries.

PEERS

- Table 6 lists a number of peers of TNG sorted on decreasing enterprise value ("EV", converted to Australian dollars to allow direct comparisons) - the common thread is all have large resources hosted in mafic intrusives, however are looking at different strategies and are at different stages of development.
- Four of these companies are concentrating on vanadium only, with the other three, TNG, Neometals and Vanadiumcorp looking at the potential to extract vanadium, titanium and iron products using proprietary technologies.

- One general trend is an increase in EV with stage of development, with the producers (including Neometals which produces lithium) having the highest values - this highlights the potential for uplift in value for TNG as it moves to development and production.
- Given the different strategies there is no realistic way to directly compare values other than the trend as given above.

Table 6: TNG peers

Company	Code	Last AUD	EV AUD	Project	Notes
Largo Resources	LGO.TSX	$1.011	$655 m	Maracas Menchen Mine, Brazil	Operating, producing ~2,500t V2O5/qtr
Neometals	NMT.ASX	$0.435	$194 m	Mt Marion lithium and Kalgoorlie LiOH, Barrambie Titanium, WA	Main focus is Mt Marion, however developing "Neomet" hydromet process for Barrambie Ti, V, Fe
TNG Limited	TNG.ASX	$0.160	$125 m	Mount Peake development NT, VRFBs	Completed DFS, undertaking offtake, financing, permitting activities
Bushveld Minerals	BMN.LSE	$0.144	$116 m	Mokopane development, Vanmetco production (~28%) South Africa, VRFBs	Vametco is currently producing ~2,800tpa contained V metal, first order placed for a VRFB
Australian Vanadium	AVL.ASX	$0.021	$26 m	Gabanintha development WA, VSUN flow batteries	Working towards feasibility at Gabanintha, actively marketing batteries, with sales already made
Vanadium Corp	VRB.TSXV	$0.119	$24 m	Lac Dore V-Ti-Fe Quebec (PEA complete) and developing hydromet process	Looking at vanadium electrolyte production as a key part of the strategy, also plan to produce Ti, Fe products
Technology Metals	TMT.ASX	$0.255	$7 m	Gabanintha WA, drilling for resource upgrade	Along strike from AVL, initial resource, carrying out additional drilling

Source: IRESS, Company Reports, IIR analysis

VALUATION

- We have completed a valuation for TNG, including a risked DCF valuation for Mount Peake, and current valuations for cash and holdings in Mount Todd - our base case valuation is shown in Table 7 - this is post tax, and uses conservative metals prices.
- We have taken this more conservative approach given the added uncertainty in specialty metals and materials price forecasting over that for more mainstream metals, however have also included a valuation based on forecasts as used in the FS (Table 8).
- This highlights that the valuation for Mount Peake makes up over 99% of the overall Company valuation.
- The risked per share valuation is based on a conceptual funding scenario, with 30% of the estimated initial Mount Peake capital cost funded by equity raised at A$0.16/share - this results in a diluted capital base of 2.405 billion shares; we have modelled the 70% project finance at 8%, with a 10 year repayment period.
- The risk factor reflects financing and execution risk - we would expect the risk to decrease as the Project develops.
- As mentioned earlier the Project is currently based on a 17 year mine life - there is the potential for extending the project life however this is not included in our valuation.

Table 7: TNG indicative base case valuation

Asset	Value (A$m)	Risk Factor	Risked	Risked/Share	Notes
Mount Peake	$1,632	60%	$979	$0.407	Post-tax NPV_8
Cash	$5.10	100%	$5.10	$0.002	As at September 30, 2017
Todd River Holding	$1.12	100%	$1.12	$0.000	As at November 23, 2017
Total	**$1,639**	**N/A**	**$986**	**$0.410**	
Diluted Shares	2,405 m	Tax Status	Post Tax		30% equity funding
Mount Peake Prices	V_2O_5	Pig Iron	TiO_2	AUD:USD	
	$14,000/t	$350/t	$3,000/t	0.75	IIR scenario

Source: IIR analysis

- Table 8 highlights the similarities in our pre-tax value using TNG's forecast metal prices to the results as presented in the updated FS, and also shows the effect of the different pricing scenarios, with the NPVs using the TNG scenario being around double those using the conservative IIR scenario - this multiplier can be applied to all subsequent figures, including sensitivity tables.
- We note that the figures in Table 8 are using funded scenarios, however our unfunded pre-tax value using TNG's metals prices is ~A$4.5 billion, within 4% of the A$4.7 billion figure released by TNG.
- We have based our metal prices on the following (we do not have access to the confidential forecasts as used by the Company):
  - V_2O_5 - average prices over the past 8 years, which immediately post date a sharp spike in prices,
  - Pig iron - average prices since 2011, and,
  - TiO_2 - recent prices, which are representative of real prices over the last 15 years, discounting the sharp spike in 2011/2012.

Table 8: TNG comparative valuations

TNG comparative valuations				
	Project NPV_8		Risked NPV_8/Share	
Asset	Pre Tax	Post Tax	Pre Tax	Post Tax
Pricing - IIR	$2,315 m	$1,632 m	$0.58	$0.41
Pricing - TNG	$4,725 m	$3,373 m	$1.18	$0.84

Source: IIR analysis

- We have largely used inputs as presented by TNG in our model, including costs and the quantities of the different outputs - key inputs and outcomes for our base case are shown in Table 9.
- Note that the Stage 1 free cash flow includes the estimated A$969 million capex for the operation expansion - we have not included any provision for financing of the additional capex - under our pricing model additional funds will be required, however under the TNG model the expansion will be able to be funded out of cash flow.
- Although the nominal mining rate is 3mtpa in Stage 1 and 6mtpa in Stage 2, this actually varies over the life of mine with differing ore grades - the mining rate is set by the processing plant throughput, being 900,000tpa of concentrate in Stage 1 and 1,800,000tpa in Stage 2 - we have adjusted our mining rate to reconcile with the total ore mined of 81mt as presented in the updated FS.
- We have also back calculated the overall processing recoveries as shown below from head grade and final production figures as presented in the updated FS.
- Our modelling highlights the relatively high percentage of revenue attributable to titanium dioxide pigment (~60%) when compared to the other two products (each with ~20%).

Table 9: Mount Peake key inputs and outcomes

Mount Peake key inputs and outcomes				
Item	Units	Stage 1	Stage 2	Life of Mine
Life (excludes 2 year construction period)	Years	4	13	17
Ore Mined	mt	10.80	70.20	81.00
Annual ore Mined	mtpa	2.70	5.40	4.76
Strip Ratio	W:O	0.90:1	0.90:1	0.90:1
Waste Mined	mt	9.72	63.18	72.90
Concentrate Produced	mt	3.24	21.06	24.30
V_2O_5 Produced	kt	32	211	244
Annual V_2O_5	ktpa	8	16	14
Pig Iron Produced	kt	1,430	9,297	10,727
Annual Pig Iron	ktpa	358	715	631
TiO_2 Produced	kt	468	3,040	3,508
Annual TiO_2	ktpa	117	234	206
EBITDA	A$m	1,031	6,908	7,939

Mount Peake key inputs and outcomes				
Item	Units	Stage 1	Stage 2	Life of Mine
Annual EBITDA	A$m	258	531	467
Free Cash Flow	A$m	-430	4,945	4,515
Average annual FCF	A$m	-108	380	266
EBITDA Multiplier	-	5	5	5
Implied Value	A$m	1,289	2,657	2,335
Basis	Price Model	IIR	Tax Status	Post Tax
Metallurgical factors and prices				
		V_2O_5	Fe_2O_3/Pig Iron	TiO_2
Head Grade	-	0.37%	26.38%	6.87%
Overall Recovery	-	81%	71%	58%
Product Purity	-	99.60%	99%/92%	92%
Price - IIR	US$/t	14,000	350	3,000
Price - TNG	US$/t	22,400	410	3,500
LoM Revenue - IIR	A$ million	4,531	4,956	12,910
% of total	%	20%	22%	58%

Source: IIR analysis

- We have undertaken a sensitivity analysis of Mount Peake, with overall sensitivities presented in Table 10, and risked per share sensitivities shown in Table 11.
- This shows that the modelled project is reasonable robust, and can absorb 20% adverse movements in any of the key parameters.

Table 10: Un-risked Mount Peake sensitivity analysis

Un-risked Mount Peake sensitivity analysis						
Change	V_2O_5 Price	TiO_2 Price	Pig Iron Price	Exchange Rate	Opex	Capex
-15%	$1,468	$1,086	$1,449	$2,877	$2,317	$1,857
-10%	$1,537	$1,282	$1,524	$2,432	$2,103	$1,796
-5%	$1,606	$1,479	$1,600	$2,034	$1,889	$1,736
0%	$1,675	$1,675	$1,675	$1,675	$1,675	$1,675
5%	$1,744	$1,871	$1,750	$1,350	$1,461	$1,625
10%	$1,813	$2,068	$1,826	$1,055	$1,247	$1,564
15%	$1,882	$2,264	$1,901	$786	$1,033	$1,504

Source: IIR analysis

Table 11: Risked Mount Peake per share sensitivity analysis

Risked Mount Peake per share sensitivity analysis						
Change	V_2O_5 Price	TiO_2 Price	Pig Iron Price	Exchange Rate	Opex	Capex
-15%	$0.356	$0.260	$0.351	$0.707	$0.567	$0.490
-10%	$0.373	$0.309	$0.370	$0.596	$0.514	$0.460
-5%	$0.390	$0.358	$0.389	$0.497	$0.461	$0.432
0%	$0.407	$0.407	$0.407	$0.407	$0.407	$0.407
5%	$0.425	$0.456	$0.426	$0.326	$0.354	$0.383
10%	$0.442	$0.505	$0.445	$0.253	$0.301	$0.360
15%	$0.459	$0.554	$0.464	$0.185	$0.247	$0.339

Source: IIR analysis

- The first four columns are considered revenue factors, with these also being proxies for other revenue factors, including grade and metallurgical recovery; for example a 15% change in vanadium grade or recovery will have a similar affect on project economics as a 15% change in price as shown above; in the case of exchange rates, this can be considered as a proxy for changes in revenue factors for the combined metals.
- As can be seen the project is most sensitive to exchange rates (and hence to combined falls in metals prices), with changes in operating costs coming second; the project is least sensitive to changes in capital costs.

- Changes in the capital cost will also lead to changes in the diluted share structure.

CAPITAL STRUCTURE

- TNG has 804.5 million shares on issue.
- 25.87 listed options, with an exercise price of A$0.193 and an expiry date of June 15, 2018 were issued as part of the December 2016 SPP.
- In addition 12.5 million unlisted options are on issue; these include 1.5 million with a strike price of A$0.193 and an expiry date of September 7, 2019, and 11 million A$0.263 options with an expiry date of December 13, 2019.
- The exercise price of all options was decreased by A$0.007 following a ruling by the Australian Tax Office on the TRT in-specie distribution.
- The Board holds 3.61% of the shares, including 1.66% held by Mr Paul Burton.
- As of November 20, 2017 the Top 20 held 33.22%.

RISKS

- **Operational:** The key operational risk facing TNG will be the successful operation of the proposed TIVAN™ plant - this is mitigated to some extent in that pilot scale work has worked successfully, and in that the process largely uses well proven individual components.
- **Offtake:** This applies largely to the titanium offtake, for which binding agreements are yet to be signed; this is critical given that titanium products provide some 60% of the forecast total revenue, however as mentioned earlier the Company is looking to an agreement in H1, 2018.
- **Financing:** Successful financing will rely on offtake for at least part of the forecast titanium dioxide production; in addition the expected up front requirement of ~A$1 billion is a major amount, and even using an expected 30% equity component will lead to significant dilution for shareholders (however as our modelling suggests, there is still major upside in the current share price even with dilution is accounted for). The Company has however taken reasonable steps in ensuring successful financing, including the engagement of Gresham.
- **Permitting:** Given the work to date we do not see not obtaining permitting as a key risk, however there is the potential for permitting time frames to be longer than expected.
- **Markets and prices:** These are perennial issues facing resource developers; however our modelling indicates that the project is reasonably robust and in addition there is an inbuilt hedging with the three separate products being produced; changes in exchange rates will have the largest effect, however most forecasts have Australia moving lower against the USD, hence helping project economics.
- **Costs:** Increases in operating and capital costs are also perennial issues in resources projects, however, unlike prices and exchange rates, management has some control over costs. In the case of Mount Peake there are no equivalent processing operations to benchmark costs against, and, although costs have been accurately calculated from first principals there may be some uncertainty when in production.

BOARD AND MANAGEMENT

- **Mr Paul Burton – Managing Director:** Mr Burton is an Exploration Geologist and Geochemist with over 20 years' experience in exploration and mining throughout Australia and overseas. He previously held the positions of Exploration Manager and Exploration Director with the company and has been involved in the discovery and development of the company's main projects, including their Flagship project Mount Peake. He has also managed successful mineral exploration and feasibility study programs for a range of different commodities, with previous career appointments including senior and executive roles at Anglo American/De Beers Ltd, Normandy Mining Ltd and Minotaur Exploration Ltd.

  Mr Burton is a graduate of the University of Plymouth, UK (B.Sc Honours Geology), and of McGill University, Canada where he completed the M.Sc in Mineral Exploration. Mr Burton is a Member of Australian Institute of Mining and Metallurgy, Australian Institute of Company Directors (GAICD), Canadian Institute of Mining, Metallurgy and Petroleum

(CIM), a Fellow of the Association of Exploration Geochemists and a Member of the Institute of Directors, London.

- **Mr Rex Turkington – Non-Executive Director:** Mr Turkington is a highly experienced corporate advisor and economist who has worked extensively in the financial services and stockbroking industry in Australia, specializing in the exploration and mining sectors. He has extensive experience with equities, derivatives, foreign exchange and commodities, and has participated in numerous corporate initial public offerings and capital raisings for listed exploration and mining companies.

  Mr Turkington is currently a Director of an Australian corporate advisory company, offering corporate finance and investor relations advice to listed companies. He holds a first class Honors Degree in economics, BCA. GAICD. AAFSI. ADA1. (ASX), and is an Associate of the Securities Institute of Australia.

- **Mr Stuart Crow – Non-Executive Director:** Mr Crow has more than 25 years experience in all aspects of corporate finance and investor relations in Australia and international markets, and has owned and operated his own businesses in these areas for the last twelve years. He brings extensive working knowledge of capital markets to the Board.
- **Mr John Davidson – Non-Executive Director:** Mr Davidson is a highly-regarded renewable energy executive with more than 30 years' experience leading major strategic business initiatives, business transformation and capital raising initiatives in a diverse range of industries, particularly the renewable energy and technology sectors. He is the founder and Managing Director of Energy Made Clean (EMC), a leading Perth based renewable energy company providing off-grid power and utility-scale solutions, which was acquired by ASX-listed Carnegie Clean Energy in 2016. Mr Davidson has worked in strategic collaboration with TNG since 2015 on the promotion, development and growth of Australia's emerging Vanadium Redox Flow Battery ("VRF") market, which will help TNG to progress its strategy for full vertical integration of the vanadium supply chain. He was appointed to the Board in February 2017 as a Non-Executive Director. Mr Davidson is also an Executive Director of Carnegie Clean Energy (ASX: CCE).
- **Mr Simon Robertson - Company Secretary:** Mr Robertson gained a Bachelor of Business from Curtin University in Western Australia and Master of Applied Finance from Macquarie University in New South Wales. He is a member of the Institute of Chartered Accountants and the Chartered Secretaries Australia. Mr Robertson currently holds the position of Company Secretary for a number of publically listed companies and has experience in corporate finance, accounting and administration, capital raisings and ASX compliance and regulatory requirements.
- **Mr Paul Vollant - General Manager, Business Development:** Mr Vollant is highly experienced in the sales and marketing of metals and minerals in the commodity sector and has specialised in strategic metals, particularly vanadium and titanium. Mr Vollant is a business graduate of the ESDES Business School, in Lyon France, and was formerly with the Noble Group in London and Hong Kong. He is a founding Director of global commodity distribution company Element Commodities that's specialised in vanadium and titanium and a Director of the HLG Group. He is also a Non-Executive Director of Nairobi Securities Exchange.
- **Mr Philippe Guillemaille: Titanium Business Manager:** Mr Guillemaille is a highly experienced sales and marketing professional in the chemical industry. He has held positions as sales manager for Fuji Film (Japan), Metallgesellschaft (Germany) and Monsanto/Exxon Chemicals (U.S.) among others. He began his career in the TiO2 industry 20 years ago with Kronos and Argex Titanium. His academic studies include a degree from the Lyon Institute of Technology, France.
- **Mr Kim Grey - Exploration Manager:** Mr Grey has over 15 years experience as an exploration geologist, including senior roles with a number of Australian resource companies including Goldminex Resources, Mincor Resources and Norilsk Nickel Australia. He has been involved in the discovery and delineation of variety of ore deposits both in Australia and internationally, including nickel, gold, porphyry and sediment-hosted copper, heavy mineral sands, base metals, and industrial minerals.

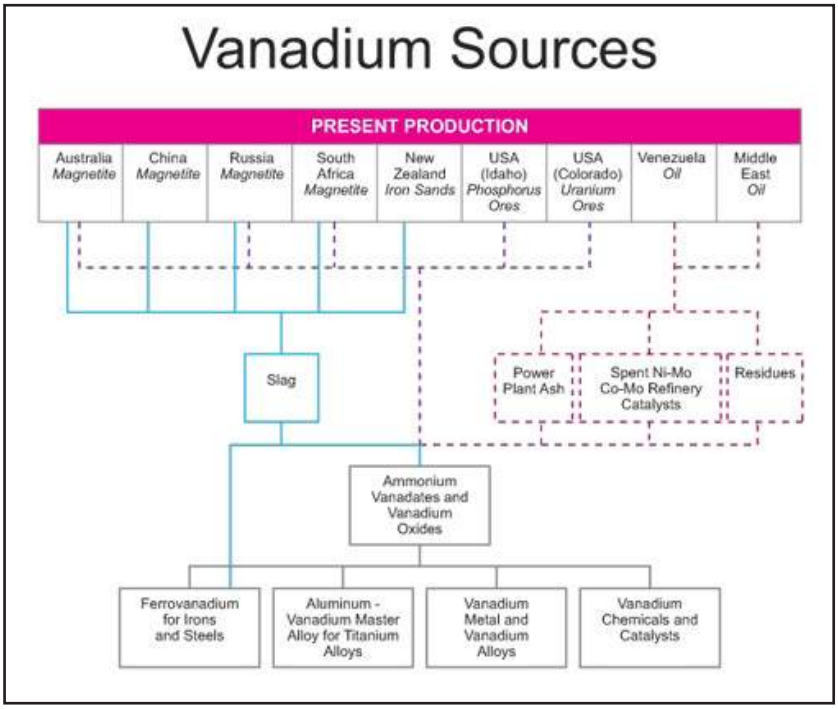
BACKGROUND – COMMODITIES AND MARKETS

VANADIUM AND VRFBS

Introduction

- The main use of vanadium is as a steel additive in high-strength steel, which accounts for about 92% of the current global demand of ~100,000t of vanadium metal (equivalent to ~180,000t V_2O_5, with the oxide containing 56% V).
- Other uses include chemicals, catalysts and in batteries - vanadium is produced as two main products – FeV for steel-making and V_2O_5 for chemical and battery applications.
- The largest source for vanadium is as a by-product from slag produced from the smelting of titaniferous magnetite ores for steelmaking – it is estimated that this accounts for ~60% of total supply, with 20% being derived from mining as a primary product and the remainder from secondary sources, including oil residues and fly ash.
- Supply is concentrated, with over 90% of vanadium products produced in South Africa, China, Russia and Brazil.
- New developments include Largo Resources Maracas Project in Brazil, which is now in full production, and exceeding the planned output of 6,500t of V_2O_5 per year, with a planned FeV plant to be added at a later date.

Figure 7: Vanadium sources



Source: Vanitec

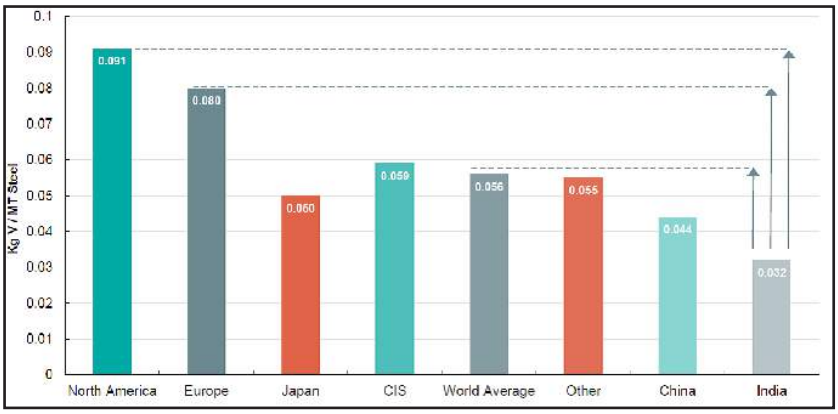
Demand Drivers

Steelmaking

- The key demand driver at the current time is as an additive in steel – demand for vanadium closely follows the production of steel. This includes two factors – firstly the natural organic growth in steel production and secondly increasing vanadium intensity in steel with the move to lighter weight and higher strength steels – the addition of just 0.2% vanadium to steel increases steel potentially strength by up to 100% and reduces weight in relevant applications by up to 30%
- This second factor is particularly relevant in China, where there is increasing vanadium intensity in rebar due to changes in building standards, partly following on from the 2008 earthquake - there is still a fair way to go with this and thus significant potential growth in use in this application.

- Roskill estimate that, although steel production will only grow at 1% CAGR over coming years, the increasing intensity of vanadium in steel along with other end uses will result in a long term demand growth of 3.45% CAGR from ~100,000tpa V in 2015 to 140,000tpa contained V in 2025, with supply deficits from 2018.
- The graph below shows the relative vanadium intensities in rebar between various jurisdictions.

Figure 8: Vanadium steelmaking intensity

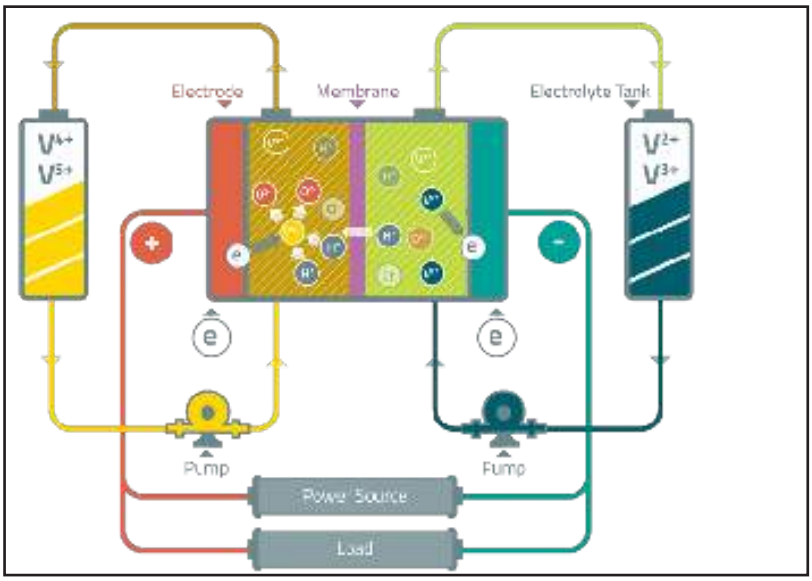


Source: Australian Vanadium

Energy Storage – VRFB's and Li-Ion Batteries

- The blue sky in demand is in grid scale battery usage. The key here will be the adoption of VRFB's that have the capacity for multi-megawatt scale storage - this makes them useful for grid scale applications, including grid balancing, and storing energy from variable output sources, including wind turbines and solar cells.
- The batteries are inherently simple, relying on the changing redox state of vanadium to store and then supply power.
- Other attributes of these batteries include:
  - Scalability
  - Long lifespan – up to 20 years
  - Up to a 1 year charge retention
  - 100% discharge without damage
  - Only one element – V in various oxidation states – in electrolyte.

Figure 9: VRFB schematic



Source: Australian Vanadium

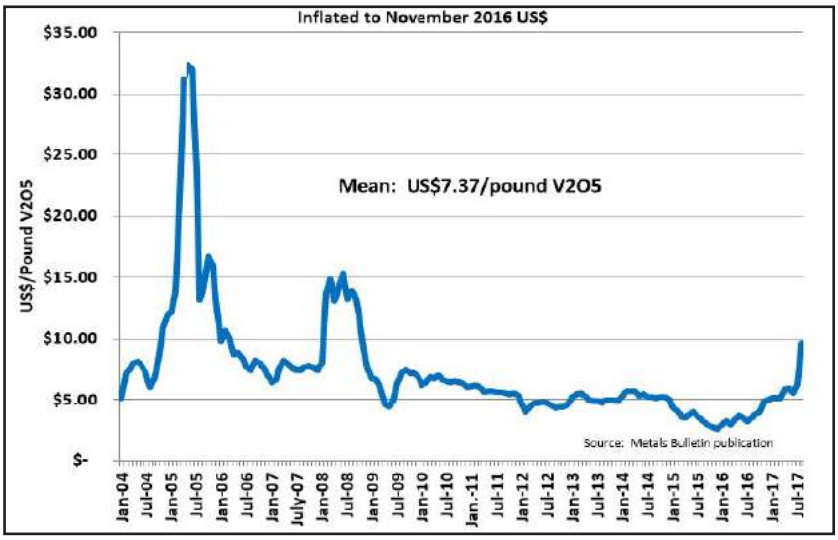
- There are widely differing forecasts on the growth in VRFB's, however some commentators see the potential for VRFBs to provide up to 30% of the growing energy storage market, with some forecasting an additional demand of 300,000t of vanadium over coming years to meet this need.

- There are a number of active VRFB developments globally at the moment, reportedly with the largest being the commissioning of a US$200 million, 15MW/60MWh facility by Sumitomo on the Japanese island of Hokkaido.
- Development of these has been partly hamstrung by the lack of a suitable battery grade V_2O_5 supply – batteries require a higher purity product than that used in steelmaking.
- Some forecasts see the Australian energy storage market reaching 3,000MWh by 2030 – should the VRFB penetration reach an estimated 30% of the market this will result in the requirement of 900MWh of VRFB capacity over the same period.
- Australia is an ideal market for fringe-of-grid and off-grid storage facilities given the extended power networks and large off-grid areas.
- Assuming a capital intensity of A$1,000,000/MWh, this equates to a A$900 million market.
- Given a usage intensity of 7.25t of V (12.94t of V_2O_5) per MWh of capacity, there is the potential for a total domestic market of over 11,000t of V_2O_5 in electrolyte over coming years if the above forecasts come to fruition.
- Electrolytes generally require a concentration of ~145g/l of V (260g/l of V_2O_5), with 5,000l of electrolyte required for a 100kWh unit – this equates to a potential demand for 90 million litres of electrolyte over the period to 2030.
- There is also significant forecast demand (~1/3 of that for VFRB's) for vanadium in Li-ion batteries.

Pricing

- Figure 10 presents real V_2O_5 prices adjusted to November 2016 - this highlights recent recoveries to ~US$22/kg (US$10/lb) in prices largely due to de-stocking of inventories over recent years and supply constraints due to rationalisation of the iron ore industry in China (with vanadium being a major by-product) along with environmental constraints leading to a sharp decline in production.
- This has followed a period of sustained falls in prices, largely post the GFC.
- The 30 year average price has been US$11/kg V_2O_5, with the inflation adjusted mean since 2014 being ~US$16/kg as shown in Figure 10 (note that Figure 10 is in US$/pound, with one kg = 2.205 pounds).
- It is expected that pricing may remain reasonable strong, although as shown in Figure 10 vanadium pricing has been volatile over recent times.
- The market is not particularly transparent, and also prices do not correlate with steel production even though this is the key demand driver.

Figure 10: FeV price chart



Source: Largo presentation

TITANIUM DIOXIDE

Uses and Production

- The majority (90%) of titanium dioxide is used in the pigment industry, being used in various products, including paints, coatings, paper and inks.

- It is a key white pigment in that it has a high refractive index (whiteness), provides UV protection and is non-toxic.
- Other uses include as a metal (military, aerospace and speciality applications) and for welding rod core wire.
- The bulk of feedstock currently comes from the mineral sands industry (67%), with the remainder being produced from blast furnace slag from titanium bearing ores - there is currently no hydrometallurgical production directly from titanomagnetite concentrate as is planned for Mount Peake.
- There are two main pigment production routes – chloride and sulphate, with chloride generally being cleaner and requiring higher grade feedstocks.
- The majority of Chinese capacity is for sulphate grade feedstock; western producers generally use the chloride process (as is proposed for Mount Peake).
- According to the USGS, installed pigment production in 2016 was 7,400,000t, with 2,940,000t (40%) being in China, and with the US coming second with 1,340,000t (18%) of installed production capacity; current Australian capacity is 280,000t (~4%).
- Planned average annual production from Mount Peake would account for some 3% of global capacity.
- Actual global production is closely aligned to world economic conditions, which can result in significant swings in demand and hence pricing; the cost and availability of feedstocks also affects pigment pricing.

Table 12: Titanium dioxide products sold, 2014

Titanium dioxide products sold, 2014			
Product, approximate market share	TiO2%	Notes	End Uses
Rutile – 10%	95-97	Mined product	Pigments, metal
Synthetic rutile – 3%	88-95	Upgraded from ilmenite in a furnace	Pigments
Ilmenite			
Sulphate – 42%	52-54	Processed to pigment - sulphate processing	Pigments
Chloride – 12%	8-62	Processed to pigment - chloride processing	
Slag			
Sulphate – 11%	80-85	Upgraded from sulphate ilmenite in a furnace	Pigments
Chloride – 19%	85-90	Upgraded from chloride ilmenite in a furnace	
Upgraded – 3%	95	Upgraded from ilmenite	

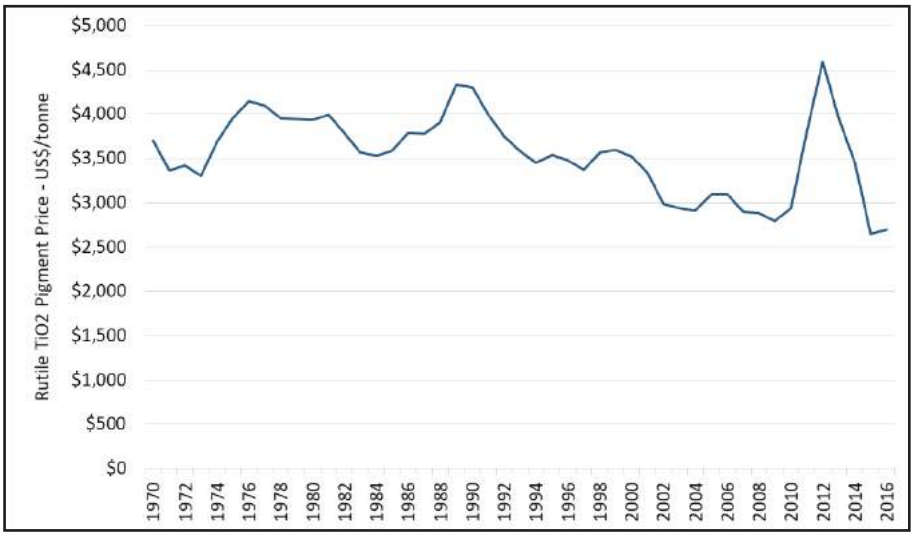
Source: Iluka.

Pricing

- The mineral sands and downstream pigment markets are relatively opaque – prices are generally fixed between the producer and buyer, and until 2009-2010 were largely on long term contracts, leading to relatively stable prices.
- More recently, changes in demand and supply have led to contracts more commonly being negotiated quarterly or half yearly.
- A recent feature of pricing was a sharp decrease in prices in 2013, which continued into 2016 – this followed slowing in demand during 2012, largely due to weakening global economic conditions.
- There were also significant price increases in feedstocks starting in 2010 - this was as a result of supply constraints enabling producers to renegotiate prices away from long term contracts, which were a disincentive on bringing on new production, with feedstock prices feeding into pigment prices.
- Until 2010 titanium dioxide product prices tended to follow annual GDP growth of around 3%.
- It is forecast by TZMI that there may be a deficit of up to one million TiO_2 units (around 2 Mt of feedstock) by 2020-2021, with prices now increasing due to tightening markets.
- Again feedstock prices are feeding into pigment markets - over recent quarters we have seen sustained rises in pigment prices following a sharp fall off after a peak from 2011 to 2013, with prices rising by over 20% since the beginning of 2016.
- This has resulted in recent prices of ~US$3,200/tonne, with this rising trend forecast to continue.

- Real prices (using 2016 dollars) from 1970 to 2016 are shown in Figure 10 - note that these are average annual prices - as mentioned earlier prices have generally been negotiated on a quarterly basis since 2011.

Figure 11: Real historic US$ TiO_2 pigment prices - 2016 dollars

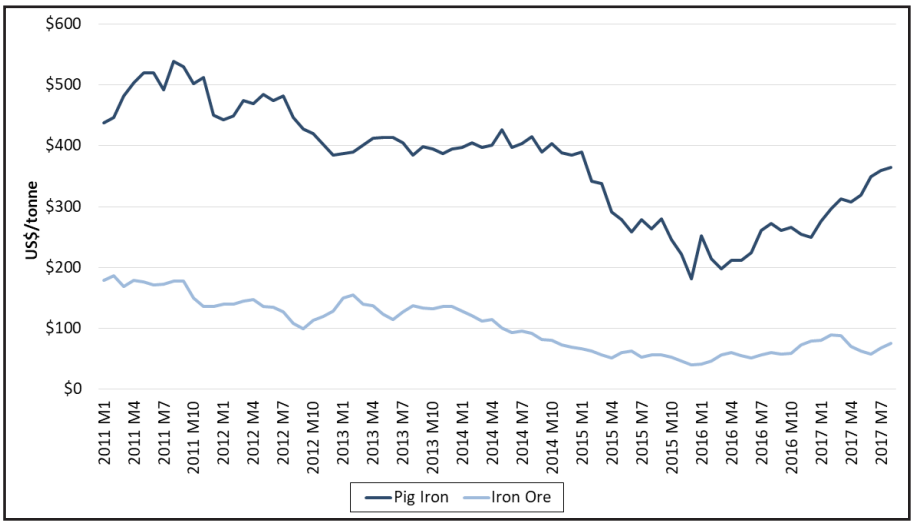


Source: TNG/Artikol

PIG IRON

- Pig iron is a semi-finished metallic form of iron, produced by reduction of iron ore in a furnace, which is then smelted to remove impurities and form steel.
- Pig iron generally contains significant impurities, including carbon (commonly between 3.5-4.5%), phosphorous and silica amongst others, and contains ~90-94% iron.
- 2016 production was estimated by the USGS at 1.15 billion tonnes, with China producing some 60% of this; Australia, given that it exports the majority of its iron ore, is not a significant producer of pig iron or steel.
- With an expected average annual output of ~600kt, TNG will only be a minor player in the market, and will have no trouble in selling its product - this is reinforced by the offtake agreement with Gunvor.
- Pig iron prices tend to largely follow those of iron ore, with a fixed margin due to the processing costs (Figure 12)

Figure 12: Nominal Brazil export pig iron and 62% Fe iron ore prices, 2011 to present



Source: Index Mundi, Steelonthenet

DISCLAIMER

(a) Disclaimer

The information, reports, financial models, forecasts, strategies, audio broadcasts and other media (referred to as "Content" throughout this Legal Notice), provided on this web site has been prepared and issued by Altavista Research Pty Ltd trading as Independent Investment Research "IIR", Independent Investment Research Holdings Pty Ltd (ACN 155 226 074), as authorised to publish research under an Australian Financial Securities Licence (AFSL No 420170) which allows Independent Investment Research to offer financial service advice to retail and wholesale clients. Users of this web site should not act on any Content without first seeking professional advice. Whilst the Content contained on this web site has been prepared with all reasonable care from sources which we believe are reliable, no responsibility or liability is accepted by Independent Investment Research, for any errors or omissions or misstatements however caused. Any opinions, forecasts or recommendations reflect our judgement and assumptions at the date of publication or broadcast and may change without notice. Content on this web site is not and should not be construed as an offer to sell or the solicitation of an offer to purchase or subscribe for any investment. We are not aware that any user intends to rely on the Content provided or of the manner in which a user intends to use it. In preparing our Content it is not possible to take into consideration the investment objectives, financial situation or particular needs of any individual user.

Access by any user to this website does not create a client relationship between Independent Investment Research and the user. Users seeking to invest must obtain individual financial advice to determine whether recommendations are appropriate to their investment objectives, personal financial situation or particular needs, before acting on any recommendations. Any Content is not for public circulation or reproduction, whether in whole or in part and is not to be disclosed to any person other than the intended user, without the prior written consent of Independent Investment Research.

(b) Disclosure of Interest

General

Independent Investment Research, its officers, employees, consultants and its related bodies corporate have not and will not receive, whether directly or indirectly: any commission; fee; benefit; or advantage, whether pecuniary or otherwise, in connection with making any recommendation contained on this web site. Independent Investment Research, discloses that from time to time, it or its officers, employees and its related bodies corporate: may have an interest in the securities, directly or indirectly, which are the subject of these recommendations; may buy or sell securities in the companies mentioned in the Content; may effect transactions which may not be consistent with the recommendations in the Content; may have directorships in the companies mentioned in the Content; and/or perform paid services for the companies that are the subject of such recommendations.

However, under no circumstances, has Independent Investment Research been influenced, either directly or indirectly, in making any recommendations contained on this web site.

Corporate Research

Independent Investment Research has or may have, received a fee either directly by a company itself or by a third party, to provide coverage and/or corporate research (the "Fee"). Where a Fee has been received, Independent Investment Research does not publish:

Buy / Hold / Sell recommendations for the security or managed investment schemes.

(c) Copyright Protection

All Content at this web site is protected by copyright. Apart from any use permitted under the Copyright Act (Cth) 1968, you must not copy, frame, modify, transmit or distribute the material at this web site, without seeking the prior written consent of the copyright owner. Content on this web site is owned by the business Independent Investment Research. Users are prohibited from copying, distributing, transmitting, displaying, publishing, selling, licensing, creating derivative works or using any content on the web site for commercial or public purposes

(d) Trade Marks

The trade marks and logos displayed on this web site belong to Independent Investment Research or other parties. Such trade marks include registered trade marks and trade marks pending registration. Users are prohibited from using any of these trade marks, without seeking the prior written consent of IIR or such third party, which may own the trade mark content on this web site.

(e) Limitation of Liability

To the fullest extent permitted by the law, Independent Investment Research and any of its officers, employees, agents, consultants or related bodies corporate disclaim any liability, whether based in contract, tort, strict liability or otherwise, for any direct, indirect, incidental, consequential or special damages arising out of or in any way connected with the use of any Content made available on this web site by any person or entity.

(f) No Warranties

Independent Investment Research does not make any claims, promises, guarantees, representations or warranties regarding the accuracy, completeness or fitness for purpose of the Content made available on this web site. All information on this web site is provided to you on an as is basis, without warranty of any kind either express or implied. To the extent that research can be provided by third parties, Independent Investment Research makes no warranty or representation as to the accuracy or completeness of such information displayed on this site, and accepts no liability for errors or omissions arising from such third party information. To the fullest extent permitted by law, under no circumstances will Independent Investment Research be liable for any loss or damage caused by users reliance upon information obtained through this web site. It is the responsibility of the user to evaluate the accuracy, completeness or usefulness of any information, opinion, general advice or other content made available through this web site. Furthermore, Independent Investment Research does not warrant or represent that this web site is error free or free from viruses or defects. A user must do all that is necessary (including using virus checking software) to satisfy itself that accessing this website will not adversely affect its system.

For further information, please contact IIR at: client.services@independentresearch.com.au

INDEPENDENT
INVESTMENT RESEARCH

Independent Investment Research (Aust.) Pty Limited

SYDNEY OFFICE
Level 1, 350 George Street
Sydney NSW 2000
Phone: +61 2 8001 6693
Main Fax: +61 2 8072 2170
ABN 11 152 172 079

MELBOURNE OFFICE
Level 7, 20–22 Albert Road
South Melbourne VIC 3205
Phone: +61 3 8678 1766
Main Fax: +61 3 8678 1826

HONG KONG OFFICE
1303 COFCO Tower
262 Gloucester Road
Causeway Bay, Hong Kong

DENVER OFFICE
200 Quebec Street
300-111, Denver Colorado USA
Phone: +1 161 412 444 724

MAILING ADDRESS
PO Box H297 Australia Square
NSW 1215