

**From:** [noreply@ntepa.nt.gov.au](mailto:noreply@ntepa.nt.gov.au)  
**To:** [eia NTEPA](#)  
**Subject:** TRM: NTEPA Consultation - Darwin Processing Facility  
**Date:** Monday, 19 April 2021 10:02:36 PM  
**Attachments:** [NTEPA-submission-in-support-of-TNG.pdf](#)

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Consultation title: Darwin Processing Facility

Closed date: 2021-04-19T23:59:00

### Your details

Full name:

Email address:

Telephone:

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Are you making this submission on behalf of an organisation? No

Organisation name:

### Submission contents

Enter your submission below.  
Maximum of 500 words:

This submission is in support of TNG Limited's proposal to build a titanomagnetite refinery on repurposed land at Middle Arm Darwin Harbour. It is rare to find a company in the Australian mining industry which voluntarily endeavours to modify mining & refining processes where it improves environmental outcomes over industry norms. It is rarer still to see technology developed in conjunction with the CSIRO be successfully commercialized by an Australian company. In the case of TNG, METS In Perth, the CSIRO & their engineering partner SMS Siemag, with this refinery they will have managed to commercialize the TIVAN process which promises to utilize more of the ore extracted than equivalent extraction processes achieve, reduce water use & waste (tailings/water) as a result. In the accompanying attachment the net inputs/outputs from TNG's proposed Darwin plant, one that value adds to Australian resources within Australia, are compared against equivalent industry producers where basic inputs/outputs are made available to the public. As the TIVAN process produces Titanium Dioxide (TiO<sub>2</sub>), Vanadium Pentoxide (V<sub>2</sub>O<sub>5</sub>) & Iron Ore (Fe<sub>2</sub>O<sub>3</sub>) from the same tonne of ore where industry norm is to produce only one of each of these from mining/refining processes, 3 companies have been identified to benchmark the TIVAN refinery against. TNG will produce 500ktpa of Fe<sub>2</sub>O<sub>3</sub>, 6,000tpa of V<sub>2</sub>O<sub>5</sub> & 100,000tpa of TiO<sub>2</sub>. As these other companies produce different quantities of the same commodities, the inputs have been appropriately ratioed in order to compare against TNG's numbers. Noting that any errors in the interpretation of this data are my own. A Future technology section has also been included demonstrating TNG & SMS development pipeline aimed at the decarbonisation of industrial processes. Having seen the result of what the TIVAN process will achieve, there is reason to believe they

will continue to pursue these technologies including green hydrogen & Direct Iron Reduction utilising Green Hydrogen to produce Steel. Having put these key figures together it has become clear that this approach demonstrates how Australian mining companies can in fact improve their environmental footprint whilst still supplying the world with the commodities it requires. This ESG approach coming from the mining industry should be supported & encouraged.

### **Submission files**

Attachment 1: NTEPA-submission-in-support-of-TNG.pdf, type application/pdf, 4.2 MB

Attachment 2: No file uploaded

Attachment 3: No file uploaded

Attachment 4: No file uploaded

Attachment 5: No file uploaded

### **Acknowledgement**

Before submitting this form please check one of the boxes below to indicate that you agree with one of the following statements:

I request that my submission be published with my identifying information removed

ENVIRONMENTAL IMPACT, KNOWN & ENGINEERED CONSUMPTION  
**(TNG PRODUCTION QUANTITIES USED)**

## PRODUCT OUTPUT

TIVAN technology produces all 3 outputs  
2Mtpa mined ore

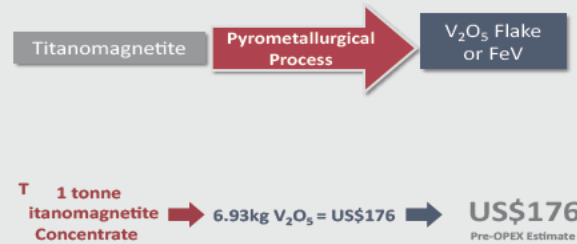
**TiO<sub>2</sub> 100,000 tpa**

**V<sub>2</sub>O<sub>5</sub> 6,000 tpa**

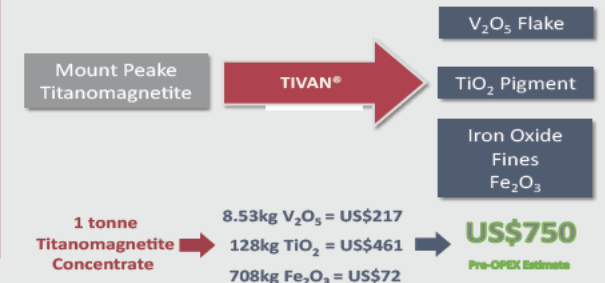
**Fe<sub>2</sub>O<sub>3</sub> 500,000 tpa**

## Processing Technology TIVAN® AUSTRALIAN /GERMAN TECHNOLOGY

### CONVENTIONAL PROCESS = 1 PRODUCT



### TIVAN® PROCESS = 3 PRODUCTS



Notes  
The TNG numbers are based on the most recently information provided by SMS. The pyrometallurgy number relies on the feed concentrate having the same composition as the TNG concentrate. This is required for this kind of comparison.  
Product price assumptions of US\$25,400/tonne for V<sub>2</sub>O<sub>5</sub> (US\$11.50/lb), US\$3,600.00/t TiO<sub>2</sub> pigment and US\$102.00/tonne for high grade Fe<sub>2</sub>O<sub>3</sub>

## INDUSTRY EXAMPLE

**5.583 GL**

(1.95+2.55+1.083)  
(TiO<sub>2</sub>+V<sub>2</sub>O<sub>5</sub>+Fe<sub>2</sub>O<sub>3</sub> eq production)

**3.839 GL**

(0.206+2.55+1.083)

**7.735 Mtpa**

(4.16+3.0705+0.5)

## TNG Limited

**3.85 GL<sup>1</sup>**

(1.733GL pa  
better than industry)

**0 GL (ZERO LIQUID DISCHARGE)<sup>2</sup>**

(100% better than industry)

**2 Mtpa**

(5.735Mtpa  
better than industry)

## CONSUMPTION/IMPACT

**ANNUAL WATER DEMAND**

**WASTE WATER DISCHARGED**

**MINED ORE**

<sup>1</sup> [https://ntepa.nt.gov.au/\\_data/assets/pdf\\_file/0004/986494/Main-Report-TNG-Supplement.PDF](https://ntepa.nt.gov.au/_data/assets/pdf_file/0004/986494/Main-Report-TNG-Supplement.PDF) See page 5,6,7 of EIS supplement for comparison table example

<sup>2</sup> <https://www.tngltd.com.au/wp-content/uploads/2020/12/61011542.pdf>

<sup>3</sup> <https://www.tngltd.com.au/wp-content/uploads/2020/02/6964804.pdf> Page 9

<https://www.tngltd.com.au/wp-content/uploads/2019/10/69444694-1.pdf>

## PRODUCT OUTPUT

**TiO<sub>2</sub> Titanium Dioxide**  
**100,000tpa**

## INDUSTRY EXAMPLE

**1.95 GL<sup>4</sup>**  
(13.632 GL pa/7)

**0.206 GL**  
(1.442GL pa/7)

**4.16 Mt**  
(29,124kt/7)

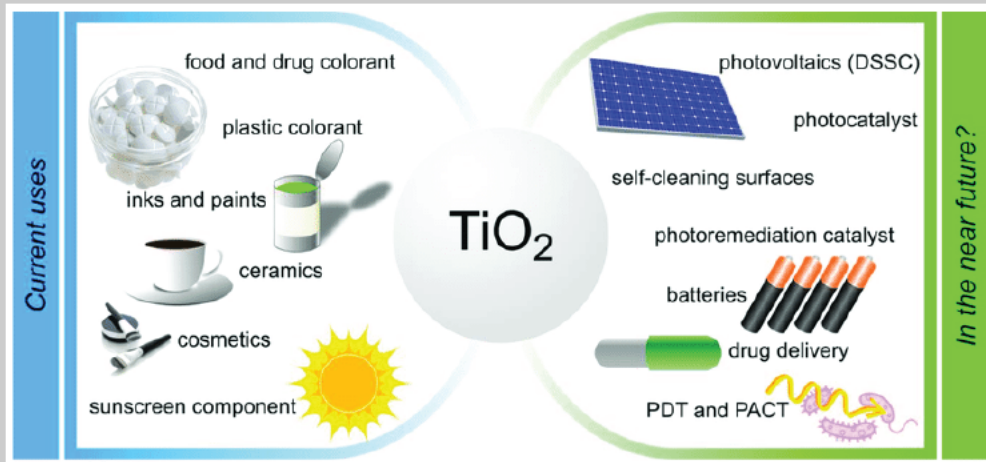
## CONSUMPTION/IMPACT

**ANNUAL WATER DEMAND**

**WASTE WATER DISCHARGED**

**MINED ORE**

## USES



4

Industry example - Iluka Pty Ltd TiO<sub>2</sub>, Zircon, Rutile Producer  
<https://iluka.com/2019-sustainability-report/environment/water-stewardship>  
<https://www.iluka.com/getattachment/0ff5efb9-4ba8-4f55-b0db-7aef68f42238/annual-report-2019-including-appendix-4e.aspx>

**Ore mined 29,124 kt from page 146 of iluka report**

Page 11 - Iluka's full year production of 702 thousand tonnes

As Iluka produced 702kt of product Reported quantities are divided by 7

5

[https://www.researchgate.net/figure/Current-applications-and-potential-future-use-of-TiO<sub>2</sub>-PDT-photodynamic-therapy-PACT\\_fig1\\_339479922](https://www.researchgate.net/figure/Current-applications-and-potential-future-use-of-TiO2-PDT-photodynamic-therapy-PACT_fig1_339479922)

## PRODUCT OUTPUT

**V2O5 Vanadium Pentoxide  
6,000 tpa**

## INDUSTRY EXAMPLE

**2.55 GL pa<sup>7</sup>**  
(1.25GL x 2.047)

**2.55 GL pa to tailings dam Est**  
(1.25GL x 2.047)

**3.0705 Mtpa**  
(1.5Mtpa x 2.047)

## CONSUMPTION/IMPACT

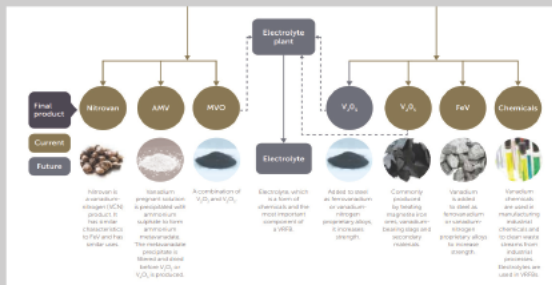
**ANNUAL WATER DEMAND**

**WASTE WATER DISCHARGED**

**MINED ORE**

## USES

6



6

Industry example - Bushveld Mineral primary Vanadium Producer

<http://www.bushveldminerals.com/wp-content/uploads/2020/06/Bushveld-Minerals-2019-Annual-Report-Financial-Results-1.pdf> , See page 47 of Annual.

7

Bushveld produced 2,931 mtV of Vanadium in 2019. Water consumption was 1,251,114 m3 or 1.25GL.

"Source : Bushveld Minerals 2019 Annual report

Page 4 - In 2019, we produced 2,931 mtV, which represents approximately three per cent of the global vanadium market - TNG will produce 2.047 times this amount from 2Mtpa ore mined

Page 57 - Licence there is an annual allocation of 1,624,811 m3 water resource from boreholes, storm water and open pit seepage and canals. In 2019, despite an increase in production, only 77 per cent (1,251,114 m3) of the total water allocation for abstraction was utilised

<http://www.bushveldminerals.com/wp-content/uploads/2020/06/Bushveld-Minerals-2019-Annual-Report-Financial-Results-1.pdf>

All Bushveld metrics have been multiplied by 2.047"

Mined Ore Page 160 - 1.5Mtpa [http://www.bushveldminerals.com/wp-content/uploads/2020/01/Independent-CPR\\_Vametco-Mine-RSA\\_-January\\_2020\\_Final.pdf](http://www.bushveldminerals.com/wp-content/uploads/2020/01/Independent-CPR_Vametco-Mine-RSA_-January_2020_Final.pdf)

## PRODUCT OUTPUT

**Fe<sub>2</sub>O<sub>3</sub> Iron Ore**  
**500,000 tpa**

## USES

**Steel**

## INDUSTRY EXAMPLE

**1.083 GL pa**  
(52GL/24Mtpa)

**1.083 GL pa Estimated**  
(52GL/24Mtpa)

**500,000 tpa**

## CONSUMPTION/ IMPACT

**ANNUAL WATER DEMAND**

**WASTE WATER DISCHARGED**

**MINED ORE**

<sup>8</sup> Industry Example - Citic Pacific - Sino Iron Cape Preston operations - beneficiation plant <https://citicpacificmining.com/our-operation/supporting-infrastructure>  
Citic produce 24Mtpa of ore & use 52GL pa of water. So equivalent is 1.083GL per 500,000 Tonnes ore

# ENVIRONMENTAL IMPACT, FUTURE TECHNOLOGIES

## PRODUCT OUTPUT

**STEEL**

## INDUSTRY EXAMPLE

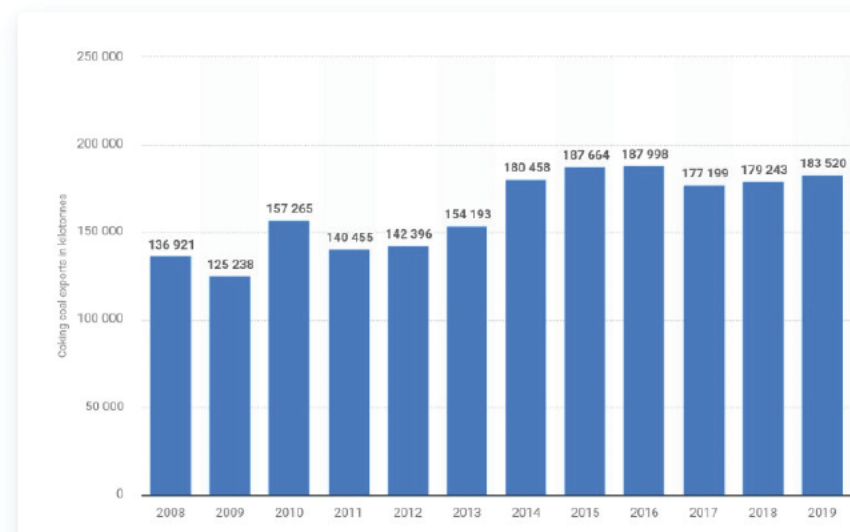
**435,540,000 Tonnes per annum of CO<sub>2</sub>eq from Australian exported coking coal**

## CONSUMPTION/IMPACT

**CO<sub>2</sub> emissions**

Energy & Environment › Energy

**Australian coking coal energy export volume from financ**<sup>9</sup>  
(in kilotonnes)



<sup>9</sup> <https://www.statista.com/statistics/985629/australia-coking-coal-energy-export-volume/>

Metallurgical coal is low in ash, moisture, sulfur and phosphorus content, and its rank is usually bituminous. For every KG of coal, approximately 2.38kg of CO<sub>2</sub> emissions are produced  
[https://www.engineeringtoolbox.com/co2-emission-fuels-d\\_1085.html](https://www.engineeringtoolbox.com/co2-emission-fuels-d_1085.html)

# NEW COAL MINES PLANNED FOR AUSTRALIA

Project	Company	State	Location	Type	Status	Annual Estimated Capacity		Resource	Estimated Start Commercial Operation
						New Capacity	Unit		
Alpha (mine and rail)	GVK Hancock Coal	QLD	120 km SV New Project	Feasible		40	mtpa	thermal coal	2024+
China First (Galilee Coal Project)	Waratah	QLD	36 km NE i New Project	Feasible		40	mtpa	thermal coal	2026+
China Stone	MacMines Austasia	QLD	270km sou New Project	Feasible		38	mtpa	thermal coal	2024+
Kevin's Corner	GVK	QLD	Galilee Bat New project	Feasible		30	mtpa	thermal coal	2024+
Wandoan	Glencore	Qld	60km N of New projec	Publicly anno		22	mtpa	thermal coal	2026+
Valeria	Glencore	QLD	27 km nort New Project	Feasible		20	mtpa	thermal and metallu	2026+
Moranbah South	Anglo American and Exaro Res	QLD	10 km sout New projec	Feasible		18	mtpa	metallurgical coal	2026+
Olive Downs	Pembroke Resources	QLD	25 km sout New projec	Feasible		15	mtpa	metallurgical coal	2022
Winchester South	Whitehaven Coal	QLD	150km SW New projec	Feasible		15	mtpa	metallurgical coal	2026+
Red Hill Mining	BHP Billiton / Mitsubishi Alliance	QLD	20km north New Project	Feasible		14.5	mtpa	thermal and metallu	2026+
Mt Pleasant Optimisation Project	Mach Energy	NSW	3 kilometre Expansion	Feasible		10.5	mtpa	thermal coal	2026+
Bulga Optimisation Project mod 3 and Bulga Underground mod 7	Glencore	NSW	15 k south Expansion	Feasible		10	mtpa	thermal and metallu	2023+
Carrichael (mine and rail)	Adani	QLD	160 km NV New Project	Committed		10	mtpa	thermal coal	2021
Dartbrook	Australian Pacific Coal	NSW	6 km north Expansion	Publicly anno		10	mtpa	thermal coal	2023+
Glendell Continued Operations (Modification 4)	Glencore	NSW	20 km nort Expansion	Publicly anno		10	mtpa	thermal and metallu	2022+
Watermark	Shenhua Energy	NSW	33 km SE i New projec	Feasible		10	mtpa	thermal and metallu	2023+
Narrabri Stage 3	Whitehaven Coal	NSW	17km south Expansion	Feasible		9	mtpa	thermal and metallu	2026+
Mount Owen Continued Operations (Modification 2)	Glencore	NSW	20 km nort Expansion	Committed		8.5	mtpa	thermal and metallu	2021+
North Surat - Taroom	New Hope Coal	QLD	3 km SE of New projec	Publicly anno		8	mtpa	thermal coal	2024+
Vickery	Whitehaven Coal	NSW	22 km N of Expansion	Feasible		8	mtpa	thermal and metallu	2024+
Saraj East	BHP and Mitsubishi	QLD	30 km nort New projec	Publicly anno		7	mtpa	metallurgical coal	2024
Springsure Creek	Adamekia Resources	QLD	40 km sout New projec	Feasible		7	mtpa	thermal coal	2023+
Bylong	Korean Electric Power Corporati	NSW	55 km nort New projec	Feasible		6.5	mtpa	thermal coal	2022
United-Wambo	Peabody and Glencore	NSW	16 km wes Expansion	Committed		6.5	mtpa	thermal and metallu	2020
Baralaba South	Baralaba Coal	QLD	10 km S of Expansion	Feasible		6	mtpa	thermal and metallu	2023
Grosvenor Phase 2	Anglo American	QLD	4km SE of Expansion	Feasible		6	mtpa	metallurgical coal	2026+
Spur Hill	Malabar Coal	NSW	15 km SW New projec	Feasible		6	mtpa	thermal and metallu	2024+
Teresa	United Mining Group	QLD	17 km N of New projec	Feasible		6	mtpa	thermal and metallu	2024+
Wards Well	BHP, Mitsui & Co	QLD	29km SW i New projec	Feasible		6	mtpa	metallurgical coal	2023
Taraborah	Shenhua Group	QLD	22 km W o New projec	Feasible		5.73	mtpa	thermal coal	2022+
Dendrobium Extension	South32	NSW	13 km sout Expansion	Feasible		5.2	mtpa	thermal and metallu	2026+
Elimatta	New Hope Coal	QLD	45 km SW New Project	Feasible		5	mtpa	thermal coal	2026+
Grosvenor West	Qinghai Kingho Group	QLD	10km NW i New Project	Publicly anno		5	mtpa	metallurgical coal	2026+
Mangoola Continued Operations	Glencore	NSW	20 km W o Expansion	Publicly anno		5	mtpa	thermal coal	2023+
Maxwell Underground Mine	Malabar Coal	NSW	15km SW i New projec	Publicly anno		5	mtpa	metallurgical coal	2026+
Rolleston (phase 2)	Glencore, Sumisha, IRCA	QLD	16 W of R Expansion	Feasible		5	mtpa	thermal coal	2025+
The Range	Stanmore Coal	QLD	24 km SE i New projec	Feasible		5	mtpa	thermal coal	2026+
Wallarrah 2	Korea Resources Corp / Sojitz C	NSW	NW of Wy i New projec	Feasible		5	mtpa	thermal coal	2024+
Eagle Downs	Aquila Resources, South32	QLD	25 km SE i New Project	Feasible		4.5	mtpa	metallurgical coal	2023
New Acland (Stage 3 extension)	New Hope Coal	QLD	177 km W Expansion	Feasible		4.5	mtpa	thermal coal	2022+
Hillalng	Shandong Energy Group	QLD	15km east New projec	Feasible		4.2	mtpa	thermal and metallu	2023+
Liddell new mining area	Glencore & Mitsui	NSW	25 kms noi Expansion	Publicly anno		4	mtpa	thermal and metallu	2023
North Surat - Collingwood	New Hope Coal	QLD	12 km NE i New projec	Publicly anno		4	mtpa	thermal coal	2024+
Willunga/Vermont East	Pembroke Resources	QLD	75 km NE i New projec	Feasible		4	mtpa	thermal and metallu	2026+
Talwood	Aquila Resources	QLD	35 km N of New projec	Publicly anno		3.6	mtpa	thermal and metallu	2026+
Tahmoor South	SIMEC Group	QLD	80 k SW o New projec	Feasible		3.5	mtpa	metallurgical coal	2022
Codrilla	Peabody Energy	QLD	62 km SE i New Project	Publicly anno		3.2	mtpa	metallurgical coal	2026+
Angus Place Extension Underground	Centennial Coal	NSW	15 k north Expansion	Publicly anno		3	mtpa	thermal coal	2022+
Hume	Hume Coal (POSCO)	NSW	3km west i New Project	Feasible		3	mtpa	thermal and metallu	2023+
Minyango	Bounty Mining	QLD	3km S of B New projec	Publicly anno		3	mtpa	thermal coal	2026+
South Galilee	Alpha Coal Pty Ltd and AMCI (A	QLD	160 km we New projec	Feasible		3	mtpa	thermal coal	2026+
Wilton-Fairhill	Futura Resources	QLD	70 km NW New Project	Feasible		3	mtpa	metallurgical coal	2023+
Ironbark No. 1	Fitzroy Australia Resources	QLD	35km NE c New projec	Feasible		2.7	mtpa	thermal and metallu	2023
Belview	Stanmore Coal	QLD	10 km E of New Project	Publicly anno		2.6	mtpa	thermal and metallu	2024+
Washpool	Aquila Resources	QLD	60 km NE i New projec	Feasible		2.6	mtpa	metallurgical coal	2024
North Surat - Woori	New Hope Coal	QLD	19 km S of New projec	Publicly anno		2.5	mtpa	thermal coal	2024+
Ashton South East opencut	Yancoal Australia	NSW	14 km NW Expansion	Feasible		2.4	mtpa	thermal and metallu	2026+
Chain Valley Extension	Delta Coal	NSW	40 km S of Expansion	Publicly anno		2	mtpa	thermal coal	2023+
Styx (Central Queensland Coal)	Minerology	QLD	139km NW New projec	Feasible		2	mtpa	thermal and metallu	2025+
Moorlands	Cuesta Coal Limited	QLD	25 km W o New projec	Publicly anno		1.9	mtpa	thermal coal	2026+
Walton	Aquila Resources	QLD	20km east New projec	Feasible		1.6	mtpa	metallurgical coal	2024+
New Lenton	New Hope Coal, MPC	QLD	20 km E of New projec	Feasible		1.5	mtpa	thermal and metallu	2023+
Dysart East	Bengal Energy	QLD	5km NE of New projec	Feasible		1.24	mtpa	metallurgical coal	2024
Airy Increase Production (mod 2 and 3)	Centennial Coal	NSW	40km north Expansion	Feasible		1.2	mtpa	thermal coal	2021+
Stratford extension	Yancoal Australia	NSW	95km of Ne Expansion	Committed		1.2	mtpa	thermal coal	2020
Isaac Plains Complex (Isaac Downs)	Stanmore Coal	QLD	7km SE of Expansion	Feasible		1	mtpa	thermal and metallu	2022+
Colton	New Hope Coal	QLD	11km N of New Project	Publicly anno		0.5	mtpa	metallurgical coal	2024+
Comet Ridge	Bowen Coking Coal	QLD	20 km S o New Project	Feasible		0.4	mtpa	thermal and metallu	2026+
Mandalong Southern Extension	Centennial Mandalong Pty Ltd (ENSW	QLD	25km SW i Expansion	Committed		0	mtpa	thermal coal	2021
Aquila open cut and underground	Anglo-American and Mitsui & Cc	QLD	210km wes Expansion	Publicly announced				metallurgical coal	2022

Australian exports of Coking (metallurgical) coal in 2019 was **183 Million tonnes**. Of the top 10 in tonnes per annum of new coal mines planned, **5 are for metallurgical coal**.

If just these 5 projects are built, new capacity will be **20+18+15+15+14.5 Million tonnes per annum or 82.5 Mtpa**,

**Current** coking coal 183Mtpa x 2.38 = **435,540,000 Tonnes** per annum of CO2eq.

**New Capacity** from just 5 mines 82.5Mtpa x 2.38 = **196,350,000 tpa of CO2eq**

# TNG & SMS DECARBONISATION OF INDUSTRIAL PROCESSES

- TNG TO PARTNER WITH SMS GROUP FOR DEVELOPMENT OF CARBON-NEUTRAL HYDROGEN TECHNOLOGY TO BE APPLIED TO THE TIVAN® PROCESS <sup>11</sup>
- TNG ADVANCES GREEN ENERGY STRATEGY WITH ESTABLISHMENT OF VANADIUM REDOX FLOW BATTERY BUSINESS <sup>12</sup>
- ON THE PATH TO GREEN STEEL WITH INNOVATION AND DIGITALIZATION (SMS SIEMAG) <sup>13</sup>
- TNG LIMITED AND SMS GROUP BANK ON TURQUOISE HYDROGEN (H<sub>2</sub>) PRODUCED FROM METHANE FOR CARBON-NEUTRAL PRE-REDUCTION OF TITANOMAGNETITE ORES <sup>14</sup>
- HYDROGEN IS OF CENTRAL IMPORTANCE TO SMS GROUP <sup>15</sup>

<sup>11</sup> <https://www.tngltd.com.au/wp-content/uploads/2020/09/6996337.pdf>

<sup>12</sup> <https://www.tngltd.com.au/wp-content/uploads/2020/11/61005450.pdf>

<sup>13</sup> <https://www.sms-group.com/sms-group-magazine/overview/sms-digital-only/on-the-path-to-green-steel-with-innovation-and-digitalization/>

<sup>14</sup> <https://www.sms-group.com/press-media/press-releases/press-detail/tng-limited-and-sms-group-bank-on-turquoise-hydrogen-h2-produced-from-methane-for-carbon-neutral-pre-reduction-of-titanomagnetite-ores-1494/>

<sup>15</sup> <https://www.sms-group.com/sms-group-magazine/overview/hydrogen-is-of-central-importance-to-sms-group/>