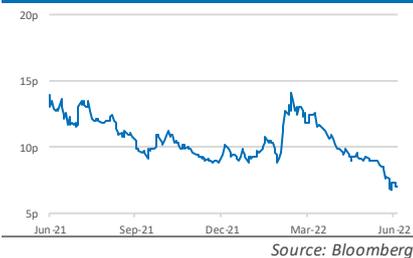


4 July 2022

**BMN LN Mining & Metals**

**Market data**

Price (p)	6.8
Valuation (p)	18.0
12m High (p)	15.4
12m Low (p)	6.7
Shares (m)	1,265
Mkt Cap (£m)	86.1

**Company summary**

Bushveld Minerals is an AIM-quoted vanadium development and production company. The group's key assets are the Vametco and Vanchem primary vanadium producing operations in South Africa. Bushveld also participates in the development of the downstream, and fast-growing, vanadium-redox flow battery market through its majority-owned Bushveld Energy subsidiary.

**Key forecasts**

	2021	2022e	2023e
Sales (\$m)	106.9	180.0	212.0
EBITDA (\$m)	(9.9)	34.1	52.4
EPS (\$/sh)	(0.03)	0.00	0.01
FCF (\$m)	(29.2)	6.1	29.6
EV/EBITDA (x)	na	3.9	2.5
P/E (x)	na	114.6	14.1
FCF yield (%)	na	5.8	28.2
Net debt (\$m)	62.2	58.0	(2.5)

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# Bushveld Minerals\*

## Vanchem Kiln 3 up and running as path mapped to longer-term consolidated target of 8,000t V pa

Completion of commissioning of Kiln 3 at Vanchem last month keeps Bushveld on track to end 2022 with a sustainable production run rate of 5,000-5,400t V pa, a solid platform from which to refocus on longer-term growth. Fully utilising the vast array of processing infrastructure at Vanchem to treat feed from an expanded mining and ore concentration operation at Vametco makes a lot of sense given the fixed component of costs at the former and the large mineral resource at the latter. Bushveld's recently announced plan to grow group production in phases to an ultimate rate of c.8,000t pa is a capital efficient route to unlocking these synergies, allowing the extra cash flow delivered by each stage to be leveraged for the next. The initiative could lower C1 unit cash costs at each operation by over 20%. The US\$151m estimated total capex is higher than previous expectations, but we believe it is significantly less than the expenditure that would be required to deliver the equivalent additional production capacity from a greenfield magnetite vanadium project. If achieved, we estimate the ultimate targeted rate could see group consolidated EBITDA rise to c.US\$100m pa (assuming a US\$40/kg FeV price). Bushveld will only proceed once it has demonstrated sustainable cash generation at its near-term target production rate of 5,000-5,400t pa, and once it has sufficient balance sheet strength to do so. Our 18p valuation conservatively incorporates just 0.5x our estimate of the NPV accretion from the planned expansion, suggesting ample scope for share price upside as further growth is delivered.

- Studies demonstrate optimal route for production growth:** Prefeasibility and feasibility studies of the potential for growing production at Bushveld's Vametco and Vanchem vanadium operations in South Africa have demonstrated that a phased expansion across the two operations could lift annualised production capabilities to a consolidated 8,000t V, up from the 5,000-5,400t level targeted by the end of this year following the ramp-up (now underway) of the recently-commissioned refurbished Kiln 3 at Vanchem. Total capex across the various phases is estimated at US\$151m. We believe this is significantly lower than the expenditure that would be required to deliver the equivalent production capacity uplift (2,600-3,000t pa) from a greenfield magnetite vanadium project. Bushveld estimates that C1 cash costs at each of Vametco and Vanchem could be lowered by over 20% relative to 2021 levels on completion of the phased growth programme.
- Capital efficient and provides long-term feed solution:** Each stage is value accretive, and the phased approach offers scope for the additional cash generation from each successive stage to be leveraged for the next. Moreover, the plan would see all four of Bushveld's existing processing kilns (Vametco's single Kiln and Kiln 1,2 and 3 at Vanchem) fully utilised, whilst ensuring (via a proposed expansion of ore concentration capacity at Vametco) a secure and stable feed for most of Vanchem's proposed processing capacity growth. With much of the planned growth to come from Vanchem (which has capability to produce a wider range of V products than Vametco) the proposed growth path would further enhance Bushveld's product diversification and market penetration potential.
- Decision to proceed contingent on targets being met and funding:** Bushveld is clear that this next stage of its long-term growth plan will only be pursued once its near-term target of delivering sustainable cash-generating production at the 2022 year-end target rate of 5,000-5,400t pa has been achieved. Moreover, it stresses that the plan will only be progressed in a phased manner (lowering initial capex exposure), and only when it is confident that it has sufficient balance sheet strength to proceed on securing funding.
- Earnings and margin accretive:** With hard-won operational stability now attained, increasing production rates further will allow Bushveld to unlock more substantial margin growth over the longer term. At our vanadium price assumption of US\$40/kg FeV, we estimate a phased expansion to 8,000t pa could see Bushveld's group-level consolidated EBITDA grow to at least US\$100m pa (at margins of over 35%), around double our forecast annualised EBITDA at next year's production capacity of 5,000-5,400t (which we think would sustain a c.25% margin). The expansion would increase our base-case NPV<sub>8%</sub> estimate by over 50% – our 18p/sh valuation includes just 0.5x of this incremental NPV uplift, reflecting our current uncertainty over timing, funding and detailed opex structure.

## **Vanchem Kiln 3 up and running – 5,000-5,400t pa in sight**

Reporting its 2021 full-year financial results last week, Bushveld announced that commissioning of the recently refurbished Kiln 3 at its Vanchem operation in South Africa was completed in June, the work coming in within budget. Once ramped up, Kiln 3 is expected to increase Vanchem's sustainable production run rate to up to 2,600t V pa by the end of this year (compared with achieved production of 1,138t in 2021). This would take total group consolidated (Vametco and Vanchem) production capability to 5,000-5,400t pa, up from the 2021 achieved total of 3,592t and 2022 full-year guidance (reiterated in the 2021 results) of 4,200-4,400t (weighted to H2).

## **Studies map-out sustainable growth path to 8,000t pa**

Bushveld recently published the key findings of studies of its plan to further grow group vanadium production beyond the 2022 year-exit target rate of 5,000-5,400t pa, to an ultimate target of c.8,000t V pa.

### *Background and context*

Following its acquisition of Vametco in 2017 Bushveld began investigating the potential to increase that operation's production capabilities from its then average annualised rate of around 2,800t V to a target of over 4,000t. However, it later concluded that the technical and capital risks associated with such an ambitious expansion were prohibitively high given that Vametco had never previously operated at such an elevated production level under its current single-kiln setup. Moreover, growth solely focussed on Vametco's existing infrastructure would further concentrate Bushveld's vanadium product range on that operation's main output Nitrovan, limiting the group's product diversification optionality.

The subsequent acquisition of Vanchem in 2019 greatly enhanced Bushveld's operational capacity and flexibility, as well as its product diversity, thus providing more options for growth. From that point on Bushveld modified its conceptual growth plans with a view to optimising each of Vametco and Vanchem in a way that would maximise synergies between the two (e.g. through sharing intermediate products, be that ore, mineral concentrate and/or intermediate-processed vanadium products) while enhancing the consolidated group's market penetration potential through product diversification.

Independent consultants METC South Africa and MSA Group were accordingly engaged to undertake prefeasibility and feasibility studies of the optimal structure to grow output across both assets. A key criteria was to maximise capital efficiency through utilisation of all of the group's processing kilns (the single Vametco Kiln and Kilns 1, 2 and 3 at Vanchem) whilst delivering a stable feed supply solution for Vanchem (which unlike Vametco does not have an adjacent direct-feed mine).

### *Phased approach optimal*

The studies concluded that a sustainable rate of 7,600-8,000t pa is optimal through a phased expansion requiring a total capex spend of c.US\$151m (R2.3bn) across the various stages. This would mark a 73-90% increase relative to group production guidance for 2022, and a 41-60% increase relative to the targeted 2022 year-exit rate of 5,000-5,400t pa that should be achievable following ramp-up (now underway) of the recently commissioned refurbished Kiln 3 at Vanchem.

We believe that the total capex requirement is significantly below the expenditure that would be required to build out from a greenfield magnetite vanadium project the equivalent production capacity of 2,600-3,000t pa that the studies determine would be delivered by the proposed expansion initiatives.

The phases were prioritised according to projected economic returns, with each phase value-accretive and delivering incremental additional cash flow that can be leverage for the next phase. The four key phases are as follows:

- ▶ **Stage 1:** Vametco ore concentrator upgrade – US\$32.9m capex
- ▶ **Stage 2:** Vanchem Kiln 2 refurbishment – US\$53.0m capex, c1,100t pa production increase
- ▶ **Stage 3:** Vanchem Kiln 1 refurbishment – US\$37.0m capex, c1,000t pa increase
- ▶ **Stage 4:** Vametco kiln capacity expansion – US\$28.2m capex, c600t pa increase

Stage 1 is an enabling step – an upgrade of Vametco’s ore concentration capabilities (primarily through the installation of a new SAG mill and associated ore crushing infrastructure) will ensure that both it and Vanchem have a reliable and stable feed to sustain up to a combined output of 6,800tV pa. The studies determined an overall capex requirement of US\$32.9m for Stage 1.

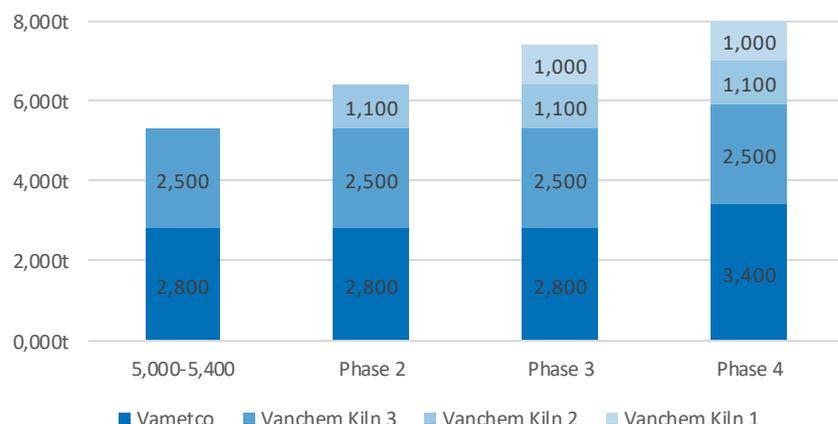
Stage 2 will focus on the refurbishment of Kiln 2 at Vanchem (including the construction of a new AMV circuit) to increase the latter’s overall production capability by 1,100t V pa to 3,600-3,700t pa. Stage 2 capex is estimated at US\$53m, making it the costliest part of the overall phased growth programme.

Stage 3 is a proposed refurbishment of Kiln 1 at Vanchem, which had been the operation’s focus of production following Bushveld’s acquisition of Vanchem until the recent refurbishment of Kiln 3, which has replaced it. This would increase Vanchem’s total production capability by a further 1,000t V pa, to a final target of 4,600-4,700t pa. The studies estimate total capex of US\$37m for Stage 2.

Stage 4 involves increasing Vametco’s production capacity by around 600t pa, to a sustainable level of 3,400t V pa (compared with c.2,800t pa currently). This is to be achieved through a capacity expansion of the operation’s single kiln and an upgrade of associated downstream processing infrastructure, leveraging the upstream ore concentrator upgrade of Stage 1. Stage 3 has a capex requirement of US\$28.2m.

Bushveld estimates that at a production rate of 8,000t pa, its C1 cash costs of production (excluding royalties, selling costs and G&A) could be more than 20% lower at each operation compared with 2021 levels (when C1 cash costs were US\$24.0/kg at Vametco and US\$30.6/kg at Vanchem).

Figure 1: Conceptual growth path to c.8,000t pa V production by processing kiln



Source: ARC estimates, based on data published by Bushveld Minerals

### *Project execution schedule*

At its 2022 year-exit targeted steady-state group production rate of 5,000-5,400t V pa, Bushveld should be significantly cash generative at prevailing vanadium pricing and would not require any additional capital expenditure (beyond steady-state sustaining, which we estimate at c.US\$5-6m pa from the end of this year) to maintain production at that level.

The company is clear that the proposed production expansion initiatives will therefore only be pursued once its near-term goal of delivering sustainably cash-flow positive production at 5,000-5,400t pa has been demonstrated *and* once its balance sheet has been sufficiently strengthened – and/or additional funding has been secured – to confidently progress.

The option to implement the growth path in stages substantially reduces the upfront capital requirement, enabling incremental production to be added relatively quickly, cash generation from which can then be leveraged for the subsequent phase.

Stage 1 is prioritised first as the concentrator upgrade at Vametco will facilitate increased ore concentrate production to enable both its own and Vanchem's growth (whilst intermediate products can also be shared between the plants) – the wider plan assumes production output of up to 6,800t V pa will be supplied from Vametco concentrate post-Stage 1 (with the balance of ore requirements supplied through development of either the group's Mokopane or Brits resources, or through third parties). Stage 1 (including an associated power-supply upgrade) is expected to take up to 24 months to implement. Most of the Stage 1 work can be undertaken away from the current plant setup and will therefore not affect existing operations. Stage 2 – the Vanchem Kiln 2 refurbishment – is expected to take 18-24 months. Stage 3 – Vanchem Kiln 1 refurbishment – is estimated to have a similar execution timeframe. The final phase of the growth plan – the Stage 4 upgrade and capacity expansion of Vametco's kiln – is expected to take around 12-18 months to complete following the Stage 3 work at Vanchem.

The conceptual schedule includes allowance for detailed engineering for the various modifications. We understand that all requisite environmental authorisations for the necessary work at Vametco are already in place, but an environmental impact assessment will be required for the proposed new AMV plant under the planned Stage 2 work at Vanchem.

### *Vametco VRFB supported mini grid project gathers momentum*

Meanwhile, construction of a long-planned vanadium redox-flow battery (VRFB) hybrid mini-grid at Vametco is poised to commence after funding for the project's engineering, procurement and construction (EPC) was recently secured.

South Africa's ABSA bank has approved a R64m (c.US\$4.1m) loan to part fund the R113m (c.US\$7.1m) capex project, which is owned by Bushveld's 84%-controlled energy subsidiary Bushveld Energy Ltd. The latter has completed the development and achieved financial closing for a 3.5MW solar PV plus a 1MW/4MWh VRFB hybrid mini grid that will operate as a funded independent power producer. Bushveld Energy and South African investment group NESAs Investment Holdings – whose affiliate NESAs Power has signed an EPC agreement to deliver the project on a 'turn-key' basis – have formed a special purpose vehicle (SPV) to fund and develop the project, to which NESAs has provided 60% of the equity and Bushveld Energy 40%.

Bushveld Energy will recognise a development fee of R5.6m as revenue from the project upon financial close.

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The hybrid mini-grid is expected to provide around 11% of Vametco's electricity requirements (Vametco has signed a 25-year purchase agreement for the power), but perhaps just as importantly it will demonstrate the applicability of long-duration VRFB systems for use in conjunction with renewable energy generation.

Vametco has sold 26t of vanadium for the VRFB battery at prevailing market rates, with conversion to electrolyte currently underway at an overseas facility. The VRFB unit will be supplied by CellCube, a VRFB equipment manufacturer in which Bushveld owns an indirect 25.25% interest.

Site preparation for the mini grid at Vametco began in Q1 2022, and construction is expected to be completed in H1 2023.

## Valuation

We have updated our sum-of-the parts valuation to incorporate the now greater level of detail on the company’s growth plans for both Vametco and Vanchem.

The capex estimates concluded by the feasibility studies are somewhat higher than our previous assumptions, which were based on (admittedly now dated) prior public ‘ball-park’ guidance provided by the company. However, our modelling of these now more fully fleshed-out expansion plans confirms our prior estimate that, once fully executed, these initiatives could see Bushveld’s annualised EBITDA grow to over US\$100m (at our US\$40/kg long-term realised vanadium price assumption). This is around double our EBITDA estimate for next year when the company should be operating at its base-case near-term production goal of 5,000-5,400t pa (a rate it is targeting from the end of 2022).

In arriving at our 18p per share risk-adjusted valuation, we apply a 0.9x multiple to our base-case NPV estimate of Vametco-Vanchem assuming a sustained 5,000-5,400t V pa production rate from 2023 onwards. We then include the incremental upside from our estimate of a phased ramp-up (over five years) to 8,000t pa at 0.5x NPV (the higher risk haircut reflecting uncertainty over timing and financing of the expansion initiatives, technical risk around delivery, and resource-to-reserve conversion risk at Vametco). Our risked NAV of 18p equates to 0.7x our fully un-risked sum-of-the-parts.

Figure 2: Risk-adjusted sum-of-the-parts valuation\*

		Unrisked		Risk	Riskd
		US\$m	GBp/sh	multiple	GBp/sh
Base production case	NPV <sub>8%</sub>	313	20	0.9x	18
Growth case upside	NPV <sub>8%</sub>	165	11	0.5x	5
Bushveld Energy	nominal	25	2		2
Corporate-level costs	NPV <sub>8%</sub>	(81)	(5)		(5)
<b>EV</b>		<b>421</b>	<b>27</b>		<b>20</b>
Cash	at end-2021	15	1		1
Bank debt	at end-2021	(7)	(0)		(0)
Convertible debt	at end-2021	(35)	(2)		(2)
<b>NAV</b>		<b>395</b>	<b>26</b>	<b>0.7</b>	<b>18</b>

\*Assumes long-term US\$40/kg realised FeV price, R15.50:US\$1 FX rate and 1,265m shares on issue

Source: ARC estimates

Figure 3 below illustrates the sensitivity of our un-risked NAV estimate to changes in realised vanadium price and ZAR rate assumptions.

Figure 3: Un-risked NAV<sub>8%</sub> (GBp) sensitivity to vanadium price and FX rate

		Average realised vanadium price (US\$/kg V, FeV basis)						
		32.50	35.00	37.50	40.00*	42.50	45.00	47.50
USD/ZAR rate	14.50	0	7	14	20	26	33	39
	15.00	3	10	16	23	29	35	42
	15.50*	6	12	19	<b>26</b>	32	38	45
	16.00	8	15	21	28	34	40	47
	16.50	11	17	24	30	36	43	49

\*Valuation base-case assumptions

Source: ARC estimates

## Summary forecasts

Figures 4-6 below and overleaf summarise our key operational and financial forecasts for the next couple of years at our base-case scenario of 5,000-5,400t V pa functional production capability from end-2022. Were Bushveld to elect to commence its outlined growth plan during this period, our net and free cash flow estimates would be reduced accordingly in-line with the expenditure profile.

Our estimates assume that the US\$35m of outstanding convertible loan notes (before accrued interest) with Orion Mine Finance are converted at maturity in Q4 2023, as our company valuation exceeds the 17p note conversion price. Bushveld's shares are currently trading significantly below the conversion price – were the notes together with accrued interest to be redeemed (partially or in full), our forecast 2023 net cash flow and year-end cash balance would be reduced in kind accordingly.

Figure 4: Summary operational forecasts and macro assumptions

		2019	2020	2021	2022E	2023E
Vanadium production	t V	2,931	3,631	3,592	4,350	5,100
Sales volumes	t V	2,392	3,842	3,314	4,500	5,285
Average realised vanadium price (FeV basis)	US\$/kg V	49	23	32	40	40
C1 cash production costs	US\$/kg V	18.0	19.6	26.1	25.3	24.3
Group all-in sustaining cash costs*	US\$/kg V	37.0	29.0	37.0	34.4	32.0
South African Rand	ZAR:USD	14.4	16.5	14.8	15.5	15.5

\*Including royalties, marketing costs, G&A, corporate overheads and sustaining capex (excludes depreciation and financing costs). Source: ARCEstimates

Figure 5: Summary Bushveld Minerals consolidated income statement

Income Statement		2019	2020	2021	2022E	2023E
Revenue	US\$m	116.5	90.0	106.9	180.0	212.0
Cost of sales	US\$m	(56.2)	(91.3)	(102.8)	(131.2)	(145.0)
Other income	US\$m	0.9	2.3	2.6	2.3	2.6
Selling and distribution costs	US\$m	(7.6)	(4.8)	(6.4)	(7.9)	(9.2)
Administrative and other costs	US\$m	(31.4)	(29.0)	(29.6)	(26.5)	(24.0)
<b>Operating profit/(loss)</b>	<b>US\$m</b>	<b>22.3</b>	<b>(32.8)</b>	<b>(29.3)</b>	<b>16.7</b>	<b>36.5</b>
Net finance costs	US\$m	1.9	(4.7)	(11.2)	(7.3)	(7.3)
Exceptional non-cash items	US\$m	59.1	(0.2)	(1.9)	0.0	0.0
Share of profit/(loss) from JVs	US\$m	0.0	0.0	(4.4)	0.0	0.0
<b>Profit/(loss) before tax</b>	<b>US\$m</b>	<b>83.3</b>	<b>(37.7)</b>	<b>(46.8)</b>	<b>9.5</b>	<b>29.1</b>
Tax	US\$m	(14.0)	0.5	4.7	(2.8)	(14.0)
<b>Net profit/(loss)</b>	<b>US\$m</b>	<b>69.2</b>	<b>(37.2)</b>	<b>(42.1)</b>	<b>6.6</b>	<b>15.1</b>
Cash Flow Statement		2019	2020	2021	2022E	2023E
Operational CF before WC changes	US\$m	23.9	(18.4)	(7.1)	34.3	40.4
Working capital changes	US\$m	4.6	1.3	(5.0)	(5.8)	(5.1)
<b>Cash flow from operations</b>	<b>US\$m</b>	<b>28.5</b>	<b>(17.1)</b>	<b>(12.1)</b>	<b>28.5</b>	<b>35.3</b>
Capex and investments	US\$m	(17.7)	(11.2)	(29.4)	(22.1)	(5.8)
Other	US\$m	(32.0)	(2.2)	12.3	(0.3)	0.2
<b>Cash flow from investing activities</b>	<b>US\$m</b>	<b>(49.7)</b>	<b>(13.3)</b>	<b>(17.2)</b>	<b>(22.4)</b>	<b>(5.7)</b>
Net borrowings	US\$m	18.6	49.4	(4.7)	(7.5)	(1.0)
Finance costs and other	US\$m	(5.3)	(2.0)	(2.3)	(4.0)	(4.6)
<b>Cash flow from financing activities</b>	<b>US\$m</b>	<b>13.3</b>	<b>47.4</b>	<b>(7.0)</b>	<b>(11.5)</b>	<b>(5.6)</b>
Increase/(decrease) in cash	US\$m	(8.0)	17.0	(36.3)	(5.4)	24.0

<b>Balance Sheet</b>		<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022E</b>	<b>2023E</b>
Cash	US\$m	34.0	50.5	15.4	10.0	34.0
P,P&E	US\$m	185.3	167.6	153.1	149.8	139.7
Intangible assets	US\$m	59.4	59.0	59.3	59.3	59.3
Other assets	US\$m	56.1	78.8	72.9	80.2	83.7
<b>Total assets</b>	<b>US\$m</b>	<b>334.8</b>	<b>355.9</b>	<b>300.7</b>	<b>299.2</b>	<b>316.6</b>
Payables	US\$m	15.7	22.1	39.1	32.5	30.9
Debt	US\$m	41.8	85.8	77.6	68.1	31.5
Other liabilities	US\$m	36.2	34.0	33.1	32.6	32.6
<b>Total liabilities</b>	<b>US\$m</b>	<b>93.7</b>	<b>141.9</b>	<b>149.9</b>	<b>133.1</b>	<b>95.0</b>
Total equity	US\$m	241.1	214.0	150.8	166.1	221.6
<b>Total liabilities &amp; equity</b>	<b>US\$m</b>	<b>334.8</b>	<b>355.9</b>	<b>300.7</b>	<b>299.2</b>	<b>316.6</b>

Source: ARC estimates

Figure 6: Key financial measurements and ratios

		<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022E</b>	<b>2023E</b>
Shares in issue	m	1,153.0	1,192.2	1,259.8	1,265.5	1,476.0
EBITDA	US\$m	32.6	(14.9)	(9.9)	34.1	52.4
EBITDA margin	%	28%	na	na	19%	25%
EPS	US\$/sh	0.05	(0.03)	(0.03)	0.00	0.01
Net profit margin	%	53%	na	na	1%	4%
Free cash flow	US\$m	(21.3)	(30.5)	(29.2)	6.1	29.6
Net debt/(cash)	US\$m	7.7	33.7	62.2	58.0	(2.5)
EV/EBITDA	x	4.0	na	na	3.9	2.5
FCF yield	%	na	na	na	5.8%	28.2%

Source: ARC estimates

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