Sprott | Equity Research

BOSS ENERGY (BOE AU)

Fully permitted and ready to restart Honeymoon: Initiating Coverage

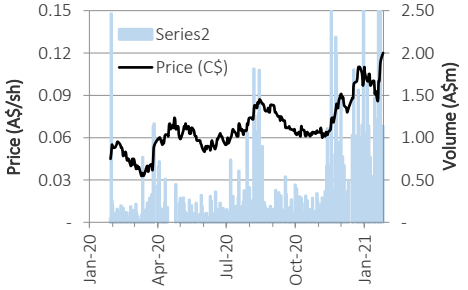
RECOMMENDATION: **BUY** *PRICE TARGET:* **A$0.16** *RISK RATING:* **HIGH**

SHARE DATA	A$0.12/sh
Shares (basic, FD)	1811 / 1977
52-week high/low	0.125 / 0.033
Market cap (A$m)	A$217m
Net cash (debt) (A$m)*	25
1.0xNAV8% @ US$50/oz (A$m)	360
1.0xNAV7% FD (A$/sh)	A$0.18
P/NAV (x)	0.66x
Average daily value (A$m, 3M)	0.79

FINANCIALS	FY24E	FY25E	FY26E
U3O8 produced (000lbs)	584	1,335	1,915
Revenue (A$m)	39	88	127
AISC (A$/lb)	50.55	32.25	26.37
Income (A$m)	(3.7)	15.3	29.5
EPS (A$/sh)	(0.00)	0.01	0.01
PER (x)	(71.0)	17.2x	8.9x
CFPS (A$/sh)	0.00	0.01	0.02
P/CF (x)	64.6x	6.3x	3.7x
EBITDA (A$m)	2.7	38.2	65.1
EV/EBITDA (x)	87.9x	5.8x	2.8x

NAV over time	2021E	2022E	2022E
1xNAV7% FD (A$/sh)	0.18	0.17	0.21
ROI to 1xNAV (% pa)	46%	21%	21%
1.2xNAV7% FD (A$/sh)	-	0.21	0.25
ROI to 1.2xNAV (% pa)	-100%	32%	28%

SOTP 1xNAV8% US$50/oz	A$m	A$/sh
Honeymoon NPV 1Q21	268	0.14
Other Assets	70	0.04
Central SG&A & fin costs 1Q21	(13.1)	(0.01)
Net cash + options	34.1	0.02
TOTAL	360	0.18



Source: S&P capital IQ

**including restricted cash and investments*

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High grade 72Mlb Australian ISR permitted and ready for restart

Boss Energy is nearing production restart of the Honeymoon ISR uranium mine in South Australia pending project finance and incentive pricing. Honeymoon produced from 2011-2013 and has A$170m of infrastructure in place including wellfields, a processing plant and site civils including a camp and airstrip. The resource includes 71.6Mlbs at 620ppm with a 2,595km^2 exploration package. The 2020 feasibility study forecasted annual production of 2Mlbs at AISC of A$40.20/lb (US$27.40/lb) with A$93m (~US$70m) of initial restart capex.

A scalable ISR with a large resource and attractive economics

ISR costs are most impacted by scale and grade, and Boss has the largest resource of the western-listed ISR restarts at 71.6Mlbs, with high grades at 620ppm. This results in the lowest AISC of the ISR development peer group at US$27.10/lb. With export permits for 3.3Mlbs, an exploration target of 190Mlbs, and 2,595km^2 of exploration tenements (unheard of in well-staked Wyoming), we believe Boss is best placed to become a globally relevant producer through the cycle. It already has a precedent – South Australia hosts a globally significant ISR producer that hasn't been laid low by the current market: Heathgate's Beverley Mine (~4.0Mlbs/year).

Fully permitted with a 2020 recent feasibility study

Though all ISR restarts market themselves based on being 'permitted and able to respond quickly to a price recovery, Boss has backed its stated intentions of a restart with action, and is one of only three restart projects to complete an FS in the last three years, along with Paladin and Peninsula. Boss has also increased the resource by 330%, completed field trails and pilot testing over this period. Despite trading at significantly higher multiples, none of US-listed ISR names have completed an economic study since 2016.

Key operating improvements identified and tested at pilot scale

Boss has identified key improvements including wellfield practices, a strong base anion resin, and NIMCIX columns for uranium recovery. We expect these changes to improve uranium recovery from the well field, reduce dilution, and improve uranium recovery and plant performance.

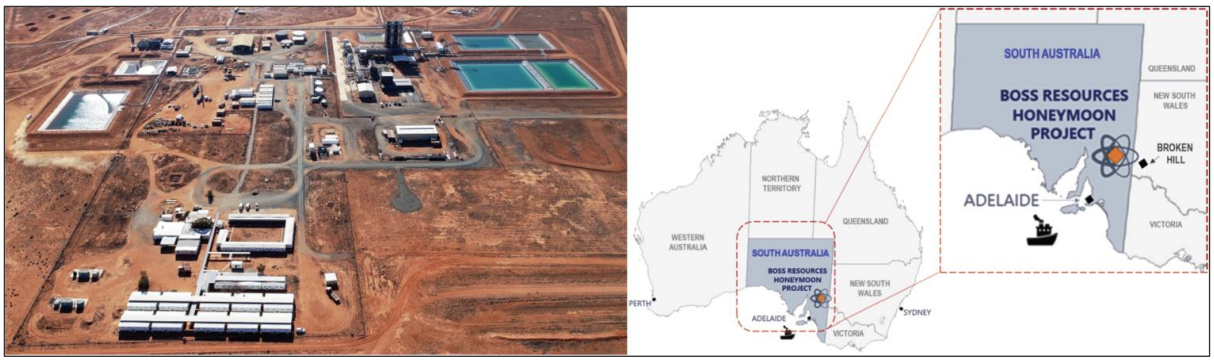
Initiate with BUY rating and A$0.16/sh price target

The average US ISR restart trades at US$4.88/lb EV/in-situ and has an average flagship project with 25.7Mlbs at 553ppm. Boss trades at US$2.15/lb with 71.6Mlbs at 620ppm U_3O_8 and is fully permitted for low-PH extraction with a feasibility study and the lowest cost profile of the group. We believe Boss has done the most to ensure operational readiness and is our pick of the group. Even better, Boss is trading at a discounted EV/lb multiple to the peer group and therefore represents greater upside in our view. We initiate with a BUY recommendation and A$0.16/sh price target based on 0.9x $NAV_{8\%\text{-}50/lb}$.

Australian uranium developer ready to restart production at the 72Mlb Honeymoon ISR-asset

Boss Energy is an ~A$200m market cap uranium company that is poised to restart production at the Honeymoon uranium ISR facility in South Australia. Honeymoon was built for A$170m by Uranium One and produced from 2011-2013 before being placed on care and maintenance due to low uranium prices. The project's key advantages are i) a large resource and land package, ii) good grades for an ISR at 620ppm, iii) significant installed infrastructure, iv) world-class jurisdiction, and v) addressable and identified operating improvement opportunities.

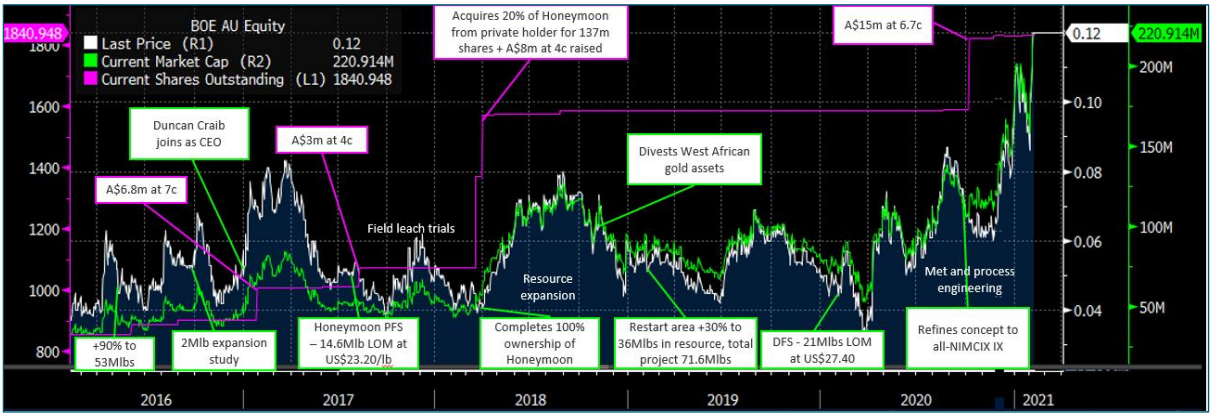
Figure 1: Aerial photo of Honeymoon project and project location



Source: Boss Resources

Boss acquired the asset in 2015 for A$2.44m upfront, A$7m in promissory notes (now paid) and A$2m in cash or shares on the later of commercial production or five years from closing and 10% of net operating cash flow up to an annual maximum of A$3m. Following this, Boss divested its other assets to focus on Honeymoon, and assembled a strong team of Australian uranium veterans to lead a restart of the project. These include CEO Duncan Craib (former CFO of Kalahari Metals and FD of CGN's Husab Mine in Namibia), Technical Director Bryn Jones (10 years of experience at the Beverley Mine in South Australia), NED Wyatt Buck (ex GM at Cameco's McArthur River and ex GM at Paladin Energy) and an owners team of operators.

Figure 2: Figure 2: 5-year corporate history



Source Bloomberg, SCP, company disclosure

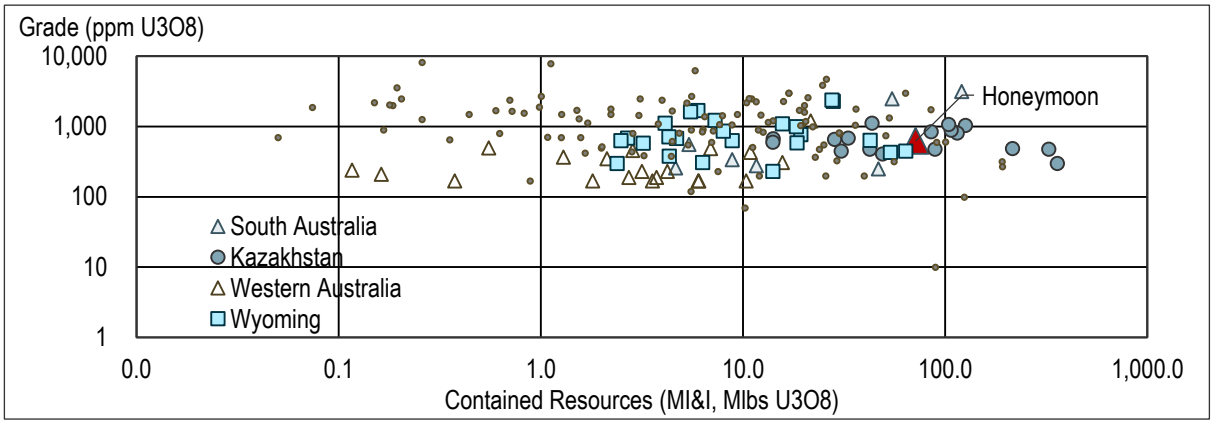
Since acquiring Honeymoon, Boss has increased the resource base from 16.6Mlbs to 71.6Mlbs; advanced the project through PEA, PFS and FS; and completed Field Leach Trials, met testing and now detailed engineering. The 2020 feasibility study base case mine plan includes a 12-year mine life at 2Mlbs per year with LOM production of 20.7Mlbs at cash costs of AISC of A$40.20/lb (US$27.40) at US$50/lb. An enhanced feasibility study is underway and expected in 1H21, incorporating IX instead of SX, which is well supported based on testing to date and previous operating results. We believe further project improvement is likely. Boss is permitted for 3.3Mlbs per year, has 40Mlbs of resources currently outside the mine plan, and has a 2,595km^2 land package that we believe is highly prospective for resource expansion.

Investment Thesis

Large resource gives Honeymoon an advantage over other ISR projects

At 71.6Mlbs at 620ppm U_3O_8, the Honeymoon project has the size and scale necessary to be meaningful on a global scale, and even better, at attractive grades for an ISR. Size is a major determinant of ISR economics, as evidenced by Kazatomprom's success on the global cost curve: Kazatomprom produced at an average cash cost of US$9.28/lb in 2019 with an average reserve grade of 710ppm (as at June 2018). While Kazatomprom does have some >1,000ppm assets, we believe the structural contributors to Kazatomprom's low costs are: i) large deposits, with several >100Mlbs; ii) low-pH lixiviant field leaching and iii) natural attenuation water treatment. As shown below, Honeymoon is already of an attractive size-grade combination and this can improve significantly due to Honeymoon's exploration potential. Even better, Boss is permitted for a low-pH leach operation and has similar water treatment requirements which provide a structural cost advantage over Boss's North American counterparts.

Figure 3: Conventional ISR-eligible deposits by size

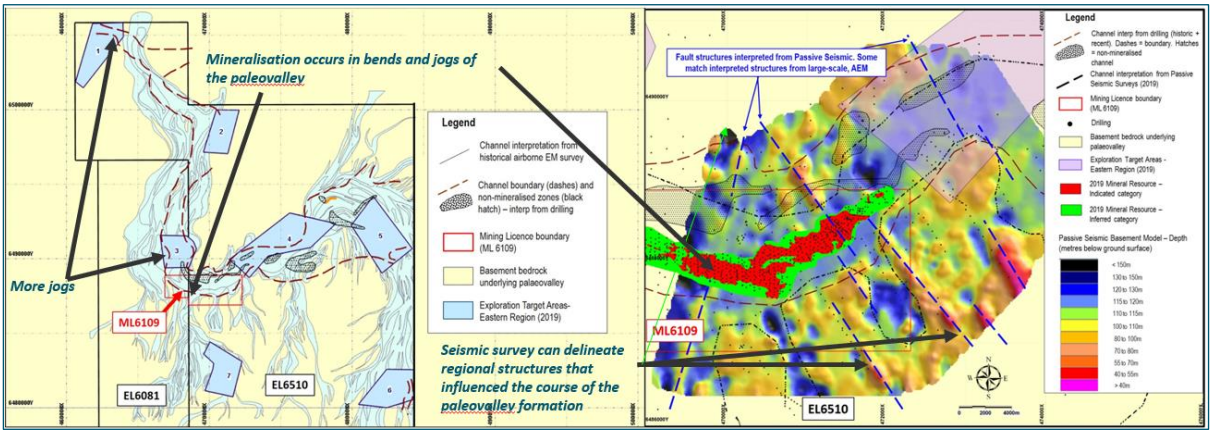


Source: S&P Market Intelligence, SCP

Scale can increase further with permits for 3.3Mlbs/yr and 2,595km^2 of exploration holdings

Boss has set out a public exploration target of 28-133Mt at 340-1080ppm for 58-190Mlbs of U_3O_8 at a 250ppm cut-off. We believe this is both ambitious and achievable. Firstly, Boss has already demonstrated success, increasing the resource size from 16.6Mlbs to 71.6Mlbs in four years, despite modest budgets. Secondly, mineralisation is well understood: it occurs at bends and jogs in the paleovalley and can be targeted using various geophysical anomalies followed by shallow (sub 130m) drilling. Third, Boss's landholdings are large and prolific, with 2,595km^2 covering the Billerroo and Yarramba paleovalleys. Finally, Boss has the permits to leverage new discoveries with export rights for 3.3Mlbs vs the current project scope of 2.0Mlbs. We expect this to have a significant impact on project economics. The FS forecasted cash costs to fall from A$49.49/lb to A$27.56/lb when production increases from 0.88Mlbs to 2.0Mlbs and we forecast cash costs of A$24.39/lb at 3.3Mlb/yr.

Figure 4: (A) Honeymoon west region licences and (B) passive seismic survey



Source: Boss Resources, SCP

The only project with permits and a 2020 feasibility study to back up 'ready to restart thesis'

Boss stands out in the uranium industry as the only company with a permitted project and 2020 feasibility study. Since acquisition, Boss consistently progressed the asset through scoping study (2016), field testing, PFS (2018), and FS (2020), and is currently finalising an Enhanced Feasibility Study for release in 1H21. We believe this enhanced level of technical study makes Boss more attractive than peers to financing and offtake counterparties. From a practical timing perspective, we believe this gives Boss a 12-24-month timing advantage compared to peers that will likely need to enhance their projects to at least PFS level to qualify for lending and offtake.

Figure 5: Permitted projects held by developers

Company	Boss	Paladin	Global Atomic	Peninsula	Ur Energy	Energy Fuels	UEC
Asset	Honeymoon	Langer Heinrich	Dasa	Lance	Lost Creek	Nichols Ranch	Texas Hub
Location	South Australia	Namibia	Niger	Wyoming	Wyoming	Wyoming	Texas
Permitted	✓	✓	✓	✓	✓	✓	Partial
Status	C&M	C&M	New project	C&M	C&M	C&M	C&M
Latest Study	2020 FS	2020 PFS	2020 PEA	2018 DFS	2016 PEA	2015 PEA	2017 Resource

Source: SCP research, Company disclosures

Key operational improvements identified and supported by detailed study work

The main issue experienced during ramp up in 2011-2013 was lower uranium tenor in solution than the nameplate design level of 0.75mg/L U_3O_8. This was not well suited for Uranium One's choice of solvent extraction (SX), as SX's advantage over ion exchange (IX) is at higher uranium tenors. Boss has addressed the key issues to improve uranium tenor but also moved to IX processing, which is more suitable for the redesigned life-of-mine target uranium tenor of 0.48mg/L.

Wellfield performance: 189 infill holes were completed in 2008; this should significantly improve wellfield contouring with the ore horizons. Wells will be cased to prevent blockages. Detailed met testing has been done to optimise solution for leaching and to supress gypsum scaling, this has resulted in pH lowering from 2.0 to 1.4, with higher iron content.

Plant changes: SX will be replaced with counter current ion exchange (NIMCIX), which is more suitable for lower uranium tenors, this should also prevent organic contamination in the final product through the use of resin instead of organics in the solvent extraction circuit. A strong base anion resin has been identified that is suitable for high chloride levels. Pilot test work achieved a 180x concentration factor from PLS to elution, this compares favourably to 100x for fixed bed IX (such as at Beverley) or 100x for Bufflex (such as at Rossing). Recent testing has shown high elution efficiency at ambient temperature (previous 50°C), saving A$9m of initial capex and A$1.80/lb compared to the FS due to reduced power costs.

Support test work: 189 infill holes for resource definition and mine planning were drilled in 2H18. A 10-week pilot plant trial was undertaken to confirm target pH and salinity levels and uranium tenors with positive results at 50mg/L. Australian Nuclear Science and Technology Organisation (ANSTO) testing and study work confirmed the viability of the strong base resin and NIMCIX adsorption and elution columns.

Opportunities: Solution stacking, where leach solution, in low grade areas or wellfields near the end of their useful life, is refortified with an oxidant and pumped sequentially to the next wellfield can reduce operating costs. The potential trade-off is some uranium loss, but lower costs compared to pumping and processing low concentration PLS at the plant. This is under further study, and would remove the need for additional column trains at lower grades, saving capex.

Table 1. Identified operating improvements

Opportunity for improvement	Identified solution
Scale was insufficient with 0.88Mlbs/yr nameplate	Project scale increased to 2Mlbs per year
Suboptimal wellfield contouring with the orebody	Additional infill drilling to ensure correct depth of well placement
Low uranium tenor in PLS	pH lowered from 2.0 to 1.4, ORP maintained over 450mV, higher iron levels at 3-5gpL
Gypsum scaling	pH <1.6, Fe ~3000mg/L, Cl >8500mg/L
Below design uranium tenor to elution plant	Change from SX to IX
Organic content in final product	Change from SX to IX, use of resin in adsorption
Low concentration in the eluate	Strong base anion resin adopted after successful test results

Source: Boss Energy

Valuation

We value Boss based on discounted cash flow analysis with our base case at a uranium price of US$50/lb. With FS all-in costs of A$47.50/lb, Honeymoon's valuation is highly sensitive to the uranium price. US$50/lb is the inflection point for Honeymoon, which generates a >20% IRR at US$50/lb with steeply rising economics at higher prices.

Figure 6:Summary of Honeymoon modelling inputs and outcomes

Category	Unit	FS	SCPe Modelled scenario			
Case		2020 FS	FS inputs	DFS at $60	SCPe at $50	SCPe at $60
Inventory	*mlbs*	34.0	34	>>	64	>>
Recovery	*%*	61.0%	61.0%	>>	62.8%	>>
Production LOM	*mlbs*	20.7	21	>>	40	>>
Steady state	*mlbs pa*	2.0	2.0	>>	3.3	>>
Cash costs	*A$/lb*	31.10	28.74	>>	24.58	>>
AISC	*A$/lb*	40.20	40.20	40.76	33.81	34.70
AIC	*A$/lb*	47.50	46.89	47.45	40.36	41.26
Mine life	*years*	12	12	12	15	>>
Fixed costs - stage I	*A$m/yr*	25.18	>>	>>	>>	>>
Fixed costs - stage II	*A$m/yr*	31.00	>>	>>	33.91	>>
Fixed costs - stage I	*A$/lb*	46.41	>>	>>	>>	>>
Fixed costs - stage II	*A$/lb*	15.50	>>	>>	10.28	>>
Variable costs - stage I	*A$/lb*	8.68	>>	>>	>>	>>
Variable costs - stage I	*A$/lb*	10.06	>>	>>	11.54	>>
Initial capex	*A$m*	92.9	93.0	>>	100.0	>>
Sustaining capex LOM	*A$m*	92.5	93.0	>>	149.4	>>
Deferred capex LOM	*A$m*	48.4	48.4	>>	123.4	>>
Uranium price	*US$/lb*	$50	>>	$60	$50	$60
Discount rate	*%*	8.0%	8.0%	8.0%	8.0%	8.0%
USD/AUD	*1 AUD =*	0.68	0.68	0.73	0.73	0.73
NPV at build start	*A$m*	166	157	217	271	432
IRR at build start	*%*	33.3%	28.1%	33.9%	27.9%	36.6%
EBITDA margin	*%*	50.1%	53.2%	57.6%	56.4%	62.8%
Average annual FCF	*A$m*	30	32	41	62	73
LOM FCF	*A$m*	365	380	495	743	1,102

Source: SCPe and Boss Resources. FS outcomes based on the 2020 FS.

Mine inventory

In addition to the 34Mlbs envisaged in the FS, drawn from the Honeymoon restart area in the Eastern tenements, we have added a combined 30Mlbs at 575ppm from the Gould's Dam and Jason's Deposits into our modelled mine plan. These areas are currently on exploration licences and will need to be mine permitted and we have assumed these permits are granted.

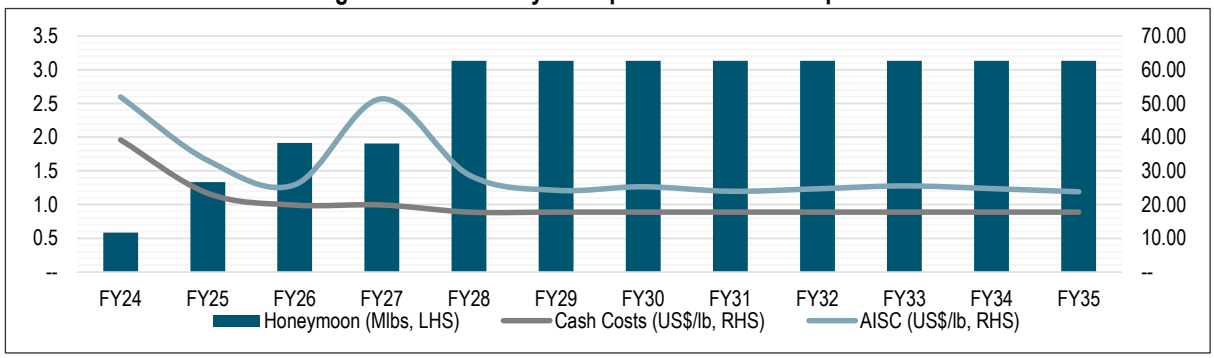
Capex and pre-production

The FS schedule envisaged a 52-week build with six-weeks of ramp up and first production in week 59. We have assumed an 18-month build with the timeline extended from the FS to allow for replacement of the SX columns with NIMCIX columns. We model build start in 2022, with first production in mid-calendar-2023; i.e. the start of fiscal 2024 since Boss trades on a June year-end. We assume A$100m of initial capex with ~A$10m of savings from power infrastructure, offset by capex to replace the two SX columns with NIMCIX units. We assume A$3m of exploration costs for the next three years for infill and step out drilling (all tenements), and mine planning and permitting for the exploration tenements that host Gould's Dam and Jason's Deposits. We model A$50m of capex in year 4 of production to increase production to 3.3Mlbs, with the addition of two additional IX columns. We add A$5.1m of sustaining capex per year to match our increased production rate for a total of A$13.2/year over the LOM including all sustaining and deferred capex, plus an additional A$25m for asset closure. In total we model A$379m of LOM capex, including initial, for a total of A$9.4/lb.

Production profile

We model first production in mid-2023 (fiscal 2024) with 583lbs in year one, increasing to 1.6Mlbs in year two of production, increasing to 3.3Mlbs in year four of production (FY27). We forecast LOM AISC of US$25.36/lb at a USD/AUD exchange rate of 0.73, below the US$27.20/lb at 0.68 in the FS, due to greater scale, offsetting moderately higher variable costs and a stronger AUD. We have added 30Mlbs to the LOM inventory, from the Gould's Dam and Jason's Deposits. We estimate a 61% overall recovery rate from in-situ to recovered U_3O_8, in line with the FS. We assume A$1.5m of corporate G&A costs pre-production and A$3m of G&A costs in production. The applicable tax rate is 30% with a 5% government and 1.5% native title royalty and A$80m of tax losses.

Figure 7: SCPe Honeymoon production and cost profile



Source: SCPe

Financing

We model A$100m of initial capex with A$16m of pre-production G&A, exploration and interest costs, and A$6m of working capital. We model A$60m of project debt at 12% cost of capital, A$30m of pre-paid offtake at US$50/lb (0.45Mlbs or 0.9% of LOM production) and A$30m of equity at the current spot equity price of A$0.12/sh.

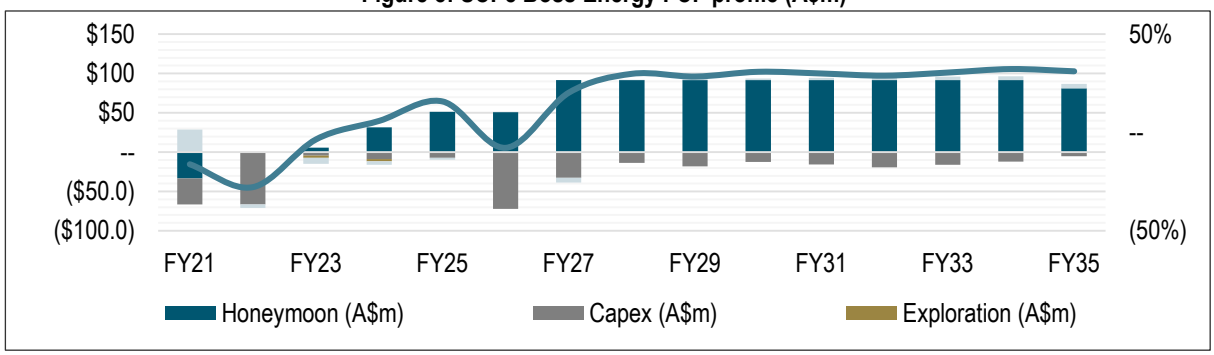
Share count

We estimate 2,185.5m shares fully diluted and fully funded. This consists of 1,811m shares currently outstanding, 118.5m share purchase options outstanding and in-the-money, and 47.3m performance share units. For the build raise we assume A$30m of equity at A$0.12/sh for an additional 208.3m shares to generate our 2,185.5m fully diluted and fully funded share count estimate.

Financial metrics

Boss enters the build with a clean balance sheet with no debt. We forecast maximum ND/NTM EBITDA of 1.1x immediately prior to production start, moving to net cash after two years of production. At US$50/lb we estimate a LOM EBITDA margin of 54.2%, and LOM FCF of A$825m including corporate costs and preproduction capex. We estimate A$26.5m of net income in year two of production rising to ~A$55m at 3.3Mlbs against A$100m of capex to 2.0Mlbs per year and SCPe A$150m to get to 3.3Mlbs, driving average return on capital employed (ROCE) of 30% in the first five years of production and ~20% return on assets. Overall we view the financial returns as very attractive, reflecting the low capex intensity of the project, with SCPe A$150m of capex to generate A$75-80m of FCF per year at 3.3Mlbs per year.

Figure 8: SCPe Boss Energy FCF profile (A$m)



Source: SCPe

Initiate with BUY recommendation and A$0.16/sh price target based on 0.9x $NAV_{8\%-50/lb}$

Our modelled estimates generate an $NPV_{8\%-50/lb}$ of A$268m for Honeymoon. To achieve this, we subtract A$13m for SG&A (assume A$1.5m per year pre-production and A$3.0m of corporate costs in production). We have added US$2/lb for current resources not in our SCPe mine plan (A$21m total), A$50m for exploration upside, A$15.8m for cash on balance sheet, A$8.9m for restricted cash, and A$9m for ITM options. That generates a fully diluted but pre-funded NAV estimate of A$360m. We add A$30m for assumed equity raised, and divide by 2,185m shares to generate a fully-funded, fully-diluted NAVPS estimate of A$0.18/sh. We initiate with a BUY rating and A$0.16/sh price target based on 0.90x NAV. While higher than our typical pre-producer multiple, Boss already has significant infrastructure in place and has completed extensive recent study work culminating in the FS and enhanced FS.

Figure 9: SCPe Boss Energy NAV build up and NAV sensitivities

		A$/sh	
Asset	**A$m**	**Fully diluted**	**Fully Diluted + Funded**
Honeymoon NPV 1Q21	268	0.14	0.12
Central SG&A & fin costs 1Q21	-13	-0.01	-0.01
Lbs outside mine plan ($2.00/lb)	21	0.01	0.01
Exploration	50	0.03	0.02
Cash and restr. cash 4Q20	25	0.01	0.01
Debt 4Q20	0	0.00	0.00
ITM options	9	0.00	0.00
Equity issued for mine build	30	not included	0.01
Total	***360***	**0.19**	**0.18**
Shares outstanding	**(m)**		
Basic Shares (m)	1,811		
ITM Options (m)	119		
Shares issued for ITM converts (m)	0		
Convert share interest (m)	0		
Fully Diluted Shares (m)	**1,930**		
SCPe Fully Funded Shares (m)	**2,185**		
Market Multiples			
Share price (A$/sh)	0.12		
P/NAV fully diluted	0.64x		
P/NAV fully diluted + funded	0.67x		
Target price			
Fully diluted + funded target multiple	**0.90x**		
Target price (A$/sh)	**0.16**		

1xNAV sensitivity to gold price and discount / NAV multiple					
1xNAV Honeymoon (A$m)	$30/lb	$40/lb	$50/lb	$60/lb	$70/lb
10% discount	-53	71	200	329	459
9% discount	-49	86	226	367	508
8% discount	-44	103	**255**	409	562
7% discount	-40	121	288	456	624
6% discount	-33	143	326	509	693
5% discount	-26	167	368	569	771
Valuation (A$/sh)	$30/lb	$40/lb	$50/lb	$60/lb	$70/lb
0.50xNAV	0.01	0.04	0.08	0.12	0.17
0.75xNAV	0.01	0.07	0.12	0.19	0.25
1.00xNAV	0.02	0.09	**0.16**	0.21	0.29
1.25xNAV	0.02	0.09	0.16	0.25	0.34
1.50xNAV	0.02	0.10	0.20	0.30	0.40

Sources		**Uses**	
DFS capex	A$93m	SCPe 3Q20 cash + ITM options	A$25m
SCPe contingency	A$32m	Mine debt @ 60% gearing	A$60m
SCPe G&A + fin. cost to first Au	A$16m	Build Equity	A$30m
SCPe working capital	A$5m	Offtake	A$30m
Total uses	A$145m	Total proceeds	A$145m

Source:SCPe

The quality and volume of Boss's study work sets the company apart in our view. Like other ISR companies, typically with US-based projects, we think Boss's jurisdiction in South Australia is a significant advantage, and compared to US-based ISRs we believe Boss has a competitive advantage with a larger resource base, larger landholding, low-pH leach, and less demanding groundwater restoration requirements.

Figure 10: Comparison of permitted or near permitted 'quick start' uranium projects

	Boss	**Paladin**	**Global Atomic**	**Peninsula**	**Ur Energy**	**Berkeley**	**Energy Fuels**	**UEC**
Asset	Honeymoon	Langer Heinrich	Dasa	Lance	Lost Creek	Salamanca	Nichols Ranch	Texas Hub
Location	South Australia	Namibia	Niger	Wyoming	Wyoming	Spain	Wyoming	Texas
Status	Care / maintenance	Care / maintenance	PFS study work	Small scale prodn	Care / maintenance	Permitting	Care / maintenance	Resource
Permits	Permitted	Permitted	Permitted	Permitted	Permitted	Limbo	Permitted	Various
Ownership (%)	100%	75%	90%	100%	100%	100%	100%	100%
Study	2020 FS	2020 PFS	2020 PEA	2018 DFS	2016 PEA	2016 DFS	2015 PEA	2017 Resource
Mining	ISR	Open Pit	Open Pit	ISR	ISR	Open Pit	ISR	ISR
Resource Grade (ppm U3O8)	620 ppm	445 ppm	1,765 ppm	480 ppm	477 ppm	343 ppm	1,130 ppm	858 ppm
Resources (Mlbs U3O8)	71.6	119.7	189.2	53.6	21.0	81.4	9.0	19.2
Other projects (Mlbs U3O8)	--	--	Znrecycling in Turkey	--	8.8	--	101.8	74.1
Sales Royalty (%)	6.50%	3.50%	9.14%	6.30%	6.30%	2.44%	9.50%	various
Tax Rate (%)	30.0%	37.5%	30.0%	21.0%	21.0%	25.0%	21.0%	21.0%
Avg annual production (Mlbs)	2.0	4.5	3.2	2.0	0.8	3.5	0.6	--
LOM total production (Mlbs)	20.7	76.1	44.1	33.4	13.8	48.6	6.5	--
Initial Capex (US$m)	72.2	81.0	203.0	118.7	15.9	232.7	53.5 - spent	--
Initial capex intensity (US$/lb LOM)	3.49	1.06	4.60	3.55	1.15	4.79	8.18 spent	--
Operating cash cost (US$/lb)	21.07	27.00	13.52	31.77	14.58	15.40	11.36	--
AISC (US$/lb)	27.20	30.85	18.39	41.00	28.58	20.25	29.85	--
FD mkt cap (US$m)	181.4	638.5	240.4	102.2	183.6	125.3	728.0	458.3
Compared to basic market cap	*24%*	*17%*	*11%*	*0%*	*0%*	*3%*	*4%*	*7%*
Net cash and investments (US$m)	30.1	(124.1)	10.3	11.4	(4.3)	7.8	19.4	41.1
FD EV (US$m)	153.8	762.7	230.1	90.8	187.9	117.5	708.6	417.1
EV/Resource (US$/lb)	2.15	8.50	1.35	1.69	6.29	1.44	6.39	4.47

Source: SCPe, Bloomberg market data, company disclosure

What's more, Boss is currently trading at just 58% of the peer group weighted average EV/in-situ multiple. Boss has significant upside sensitivity to the uranium price, with the strongest inflection point between US$40-50/lb. Comparing and contrasting our top picks in the uranium sector, we view the Athabasca names as future top tier assets that are more cycle agnostic but longer lead time. Boss is our top pick for the more macro-driven, price-leveraged developers. We think in the early phases of the price breakout, projects in Tier-I jurisdictions will attract capital first and Boss's production readiness, scalable project and attractive valuation make it a natural first mover in our view.

Why we like Boss

1. Cost advantages vs other ISR developers including scale, low-pH leach, temperate climate
2. Superior operational readiness with permits in place and a 2020 FS
3. 2,595km^2 land package with significant exploration upside

Catalysts

- 1H 2021 (fiscal 2H21): Enhanced FS
- 1H22 (fiscal 2H22): SCPe construction start (price dependent)
- 2H23 (fiscal 1H23): SCPe first production
- FY28 (year 5): SCPe expansion to 3.3Mlbs per year run rate

Risks

Permitting: We view this risk as low. The restart area and processing facilities are already permitted for production up to 3.3Mlb per year. While exploration tenements need to be permitted to enable exploitation of other deposits outside the permitted restart area, we do not foresee factors that would suggest undue delay or risk to converting exploration tenements to mining leases.

Development: We view this as a low risk. The process plant, well fields and site support infrastructure are already in place. The restart includes process plant works, including replacement of the SX columns for IX, but given advantageous geography, climate, and access to a skilled workforce, we believe development risk is lower than at a typical mine development.

Geology: We view this as a relatively low risk. The deposit is well drilled with over 400,000m supporting the Resource estimate. This style of mineralisation is not prone to excessive grade smearing by high grade intercepts and ordinary kriging was used in geospatial grade estimates.

Mining: We view this risk as moderate but below peers in uranium. The deposit is hosted in permeable sediments which are amenable for ISR. Past operating data is available and challenges with uranium tenor experienced in 2011-2013 are identified and mitigated in Boss's development plan.

Processing: We view this risk as moderate. The change to IX is logical in our view, as this is a more suitable processing route for lower uranium tenors and is commonly used in SX. High chloride levels could present challenges but this to has been addressed by the choice of resin.

Logistics: We view this risk as low, due to favourable climate and South Australia's well established uranium mining industry.

Environmental: We view this risk as low. Existing groundwater in the region is noted as radioactive and highly saline, therefore of low quality for agricultural or other uses. Honeymoon is an existing fully permitted operation but currently in care and maintenance. A mining lease for the operation is in place and the Program for Environmental Protection and Remediation has been approved by the Department of State.

Ticker:BOE AU	**Price / mkt cap:**	A$0.12/sh, A$217m	**Market P/NAV:**	0.66x	**Assets:** Honeymoon
J Chan / B Gaspar	**Rec / PT:**	BUY / A$0.16	**1xNAV$_{2Q20}$ FD:**	C$0.18/sh	**Location:** South Australia

Group-level SOTP valuation	4Q20	**1Q21**			
		A$m	**O/ship**	**NAVx**	**A$/sh**
Honeymoon NPV 1Q21		268.3	100%	1.0x	0.14
Central SG&A & fin costs 1Q21		(13.1)	--	1.0x	(0.01)
Lbs outside mine plan ($2.00/lb)		20.8	100%	1.0x	0.01
Exploration		50.0	100%	1.0x	0.03
Cash and restr. cash 4Q20		24.7	--	1.0x	0.01
Debt 4Q20		--	--	1.0x	--
ITM options		9.4	--	1.0x	0.00
1xNAV8% US$50/lb		**360**			**0.18**
Assumed build equity issuance		30.0			0.01
1xNAV fully funded8% US$50/lb		**390**			**0.18**
P/NAV (x):					**0.67x**
Target multiples		**Multiple**			**A$/sh**
Target P/NAV Multiple		**0.90x**			**0.16**
Target price					**0.16**

Sources		**Uses**	
DFS capex	A$93m	SCPe 3Q20 cash + ITM options	A$25m
SCPe contingency	A$32m	Mine debt @ 60% gearing	A$60m
SCPe G&A + fin. cost to first Au	A$16m	Build Equity	A$30m
SCPe working capital	A$5m	Offtake	A$30m
Total uses	A$145m	Total proceeds	A$145m

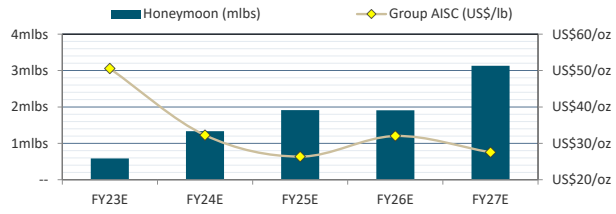
1xNAV sensitivity to gold price and discount / NAV multiple

1xNAV Honeymoon (A$m)	$30/lb	$40/lb	$50/lb	$60/lb	$70/lb
10% discount	(53)	71	200	329	459
9% discount	(49)	86	226	367	508
8% discount	(44)	103	**255**	409	562
7% discount	(40)	121	288	456	624
6% discount	(33)	143	326	509	693
5% discount	(26)	167	368	569	771
Valuation (A$/sh)	$30/lb	$40/lb	$50/lb	$60/lb	$70/lb
0.50xNAV	0.01	0.04	0.08	0.12	0.17
0.75xNAV	0.01	0.07	0.12	0.19	0.25
1.00xNAV	0.02	0.09	**0.16**	0.21	0.29
1.25xNAV	0.02	0.09	0.16	0.25	0.34
1.50xNAV	0.02	0.10	0.20	0.30	0.40

Valuation over time	**1Q21E**	**1Q22E**	**1Q23E**	**1Q24E**	**1Q25E**
Mines NPV (A$m)	290	349	449	487	504
Cntrl G&A & fin costs (A$m)	(11)	(8)	(4)	4	11
Net cash at 1Q (A$m)	4	(31)	(43)	(31)	7
Other Assets + Options	59	59	59	59	59
1xNAV (A$m)	342	370	461	519	582
P/NAV (x):	0.7x	0.7x	0.6x	0.5x	0.5x
1xNAV share px FD (A$/sh)	0.18	0.17	0.21	0.24	0.27
ROI to equity holder (% pa)	*46%*	*21%*	*21%*	*19%*	*17%*

Resource / Reserve	**kt**	**ppm U3O8**	**Mlbs**	**EV/lb U3O8**
Measured, ind. & inf. - Honeymoon	52,400	619.8	71.6	2.15
DFS mine inventory	22,792	676.6	34.0	4.52
SCPe Mine inventory	46,459	624.9	64.0	2.40

Production (100%)	**FY23E**	**FY24E**	**FY25E**	**FY26E**	**FY27E**
Honeymoon (000mlbs U3O8)	0.6	1.3	1.9	1.9	3.1
Honeymoon cash cost (US$/lb)	41.30	25.86	22.44	22.48	20.41
Honeymoon AISC (US$/lb)	50.55	32.25	26.37	32.03	27.55



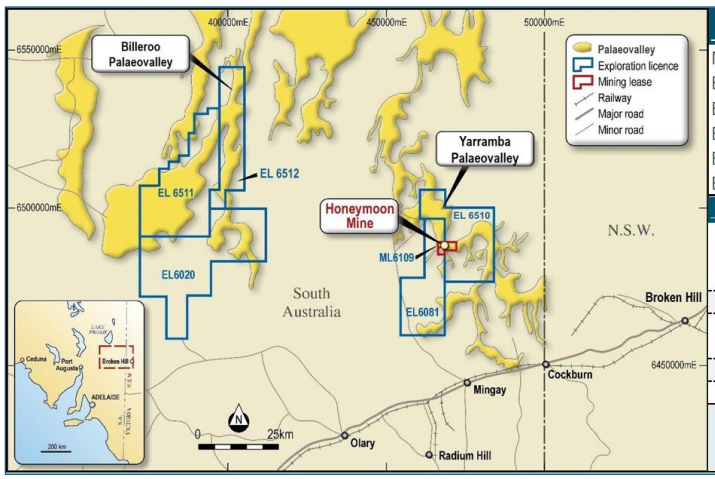
Share data					
Basic shares (m): 1811.3		FD + options (m):	1977.1	FD + FF	2185.5
Commodity price	**FY23E**	**FY24E**	**FY25E**	**FY26E**	**FY27E**
Uranium price (US$/lb)	50.0	50.0	50.0	50.0	50.0
Ratio analysis	**FY23E**	**FY24E**	**FY25E**	**FY26E**	**FY27E**
FD shares out (m)	2185.5	2185.5	2185.5	2185.5	2185.5
EPS (A$/sh)	(0.002)	0.007	0.014	0.014	0.026
CFPS before w/c (A$/sh)	0.00	0.01	0.02	0.02	0.04
FCFPS pre growth (A$/sh)	(0.00)	0.01	0.02	0.01	0.02
FCF/sh (A$/sh)	(0.00)	0.01	0.02	(0.01)	0.02
FCF yield - pre growth (%)	(2%)	7%	16%	11%	20%
FCF yield (%)	(4%)	6%	16%	(8%)	20%
EBITDA margin (%)	7%	43%	51%	51%	56%
FCF margin (%)	(24%)	18%	33%	(16%)	26%
ROA (%)	(3%)	11%	18%	16%	27%
ROE (%)	(8%)	26%	33%	25%	32%
ROCE (%)	(3%)	18%	29%	30%	41%
EV (A$m)	235	223	185	208	159
PER (x)	(71.0)	17.2x	8.9x	8.8x	4.7x
P/CF (x)	64.6x	6.3x	3.7x	3.7x	2.1x
EV/EBITDA (x)	87.9x	5.8x	2.8x	3.2x	1.4x
Income statement	**FY23E**	**FY24E**	**FY25E**	**FY26E**	**FY27E**
Revenue (A$m)	39	88	127	127	208
COGS (A$m)	(33)	(47)	(59)	(59)	(88)
Gross profit (A$m)	**6**	**41**	**68**	**68**	**120**
G&A & central	(3)	(3)	(3)	(3)	(3)
Depreciation	(7)	(15)	(22)	(22)	(36)
Impairment & other (A$m)	--	--	--	--	--
Net finance costs (A$m)	0	0	0	0	0
Tax (A$m)	--	(8)	(14)	(14)	(25)
Minority interest (A$m)	--	(2)	(3)	(3)	(3)
Net income attr. (A$m)	**(4)**	**13**	**27**	**27**	**53**
EBITDA	*3*	*38*	*65*	*65*	*117*
Cash flow	**FY23E**	**FY24E**	**FY25E**	**FY26E**	**FY27E**
Profit/(loss) after tax (A$m)	(4)	15	30	30	56
Add non-cash items (A$m)	7	15	22	22	36
Less wkg cap / other (A$m)	(5)	(3)	(3)	0	(6)
Cash flow ops (A$m)	**(2)**	**27**	**49**	**51**	**86**
PP&E (A$m)	(4)	(9)	(7)	(72)	(33)
Other (A$m)	--	--	--	--	--
Cash flow inv. (A$m)	**(7)**	**(12)**	**(7)**	**(72)**	**(33)**
Debt draw (repayment) (A$m)	(8)	(8)	(8)	(8)	(30)
Equity issuance (A$m)	--	--	--	--	--
Other (A$m)	(3)	(3)	(3)	(3)	(3)
Cash flow fin. (A$m)	**(11)**	**(11)**	**(11)**	**(11)**	**(33)**
Net change post forex (A$m)	(20)	5	31	(31)	20
FCF (A$m)	*(9)*	*15*	*41*	*(21)*	*53*
Balance sheet	**FY23E**	**FY24E**	**FY25E**	**FY26E**	**FY27E**
Cash (A$m)	18	23	53	22	42
Accounts receivable (A$m)	1	3	5	5	8
Inventories (A$m)	8	12	15	15	22
PPE & exploration (A$m)	110	106	92	142	139
Other (A$m)	0	0	0	0	0
Total assets (A$m)	**137**	**144**	**164**	**183**	**210**
Debt (A$m)	53	45	38	30	--
Other liabilities (A$m)	41	39	38	34	35
Shareholders equity (A$m)	139	139	139	139	139
Retained earnings (A$m)	(95)	(79)	(50)	(20)	36
Minority int. & other (A$m)	--	--	--	--	--
Liabilities+equity (A$m)	**137**	**144**	**164**	**183**	**210**
Net Cash	(43)	(31)	7	(17)	33
Net Debt to NTM EBITDA (x)	*1.1x*	*0.5x*	*(0.1)*	*0.1x*	*(0.3)*

FY: Financial year to 30 June

Honeymoon Uranium Project, South Australia (100% Boss Energy)

Honeymoon is located 80km NW of Broken Hill, near the South Australia / New South Wales state border. Mineralisation was discovered in 1972 and became viable through the development of ISR extraction methods in the 1970s. The project was acquired by Southern Cross Resources (later became Uranium One) in 1997, which achieved construction approval in 2008 and built the project from 2009-2011. The project was put on care and maintenance in 2013 and has been maintained in good standing. Infrastructure in place includes an SX processing facility (nameplate 0.88Mlbs/yr), four well fields, a vehicle fleet, a 150-person camp, administrative buildings and an airstrip.

Figure 11: Asset location, tenements and reserves and resources (JORC-compliant)



Tenement	Name	Area (km^2)	Expiry
ML 6109	Honeymoon Mine	10	07 Feb 2023
EL 6510	Yarramba	452	28 May 2022
EL 6511	Katchwilleroo Dam	652	28 May 2022
EL 6512	Gould's Dam	334	28 May 2022
EL 6020	Glenorchy	778	22 Feb 2022
EL 6081	South Eagle	379	25 Sep 2022

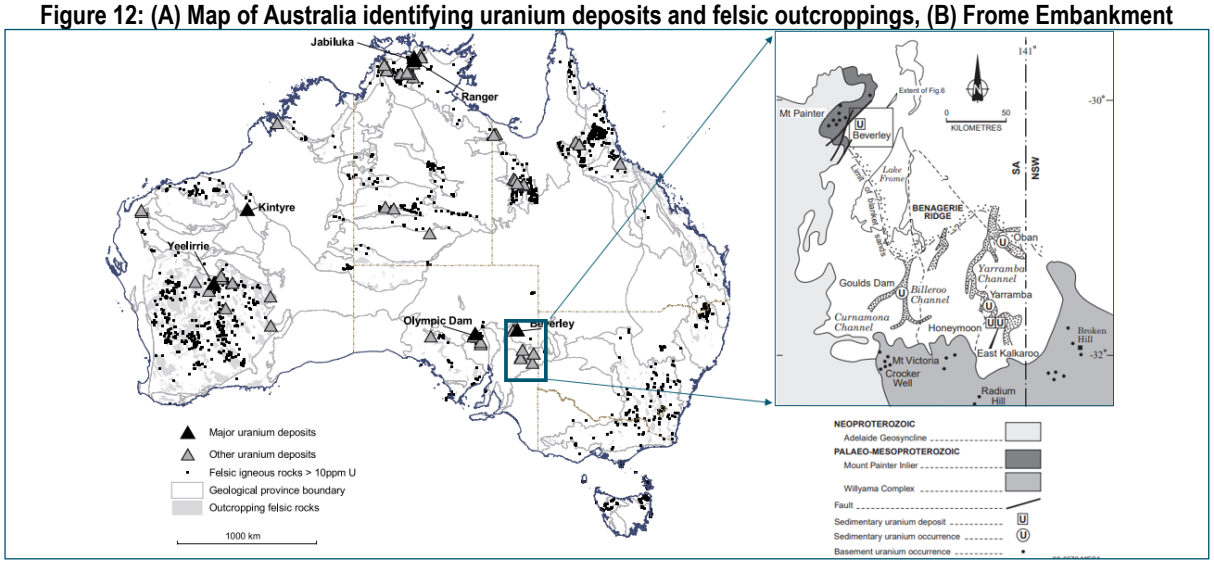
Area	Category	Tonnes (kt)	ppm U_3O_8	klbs U3O8
Honeymoon	Measured	3,100	1,100	7,600
	Indicated	14,000	610	19,000
	Inferred	7,000	590	9,100
	Total	**24,100**	**672**	**35,700**
Gould's Dam	Indicated	4,400	650	6,300
	Inferred	17,700	480	18,700
	Total	**22,100**	**513**	**25,000**
Jason's	Inferred	6,200	790	10,700
Total	M&I	21,500	694	32,900
	Inferred	30,900	565	38,500
	Total	**52,400**	**620**	**71,600**

Source: Boss Energy

Geology

Mineralisation in the Frome embankment, which includes the Beverley, Gould's Dam and Honeymoon deposits, is believed to be mobilised from Precambrian-aged uranium-enriched felsic inliers, mobilised in low temperature oxidising conditions and precipitated by redox reactions. Beverly is located in the NE of the district and believed to be related to the Mt Painter Inlier, while Honeymoon and Gould's Dam are believed to be related to the Olarian Orogeny (Proterozoic aged). Most of the mineralisation occurs in sediments of the Paleocene-Eocene Eyre Formation, which represents the first phase of sedimentation onto the Lake Eyre Basin, which stretches from central Australia to central Queensland to central South Australia. In the north this occurs in the form of broad interconnecting fluvial systems but in the south deposition occurred as a series of paleovalleys.

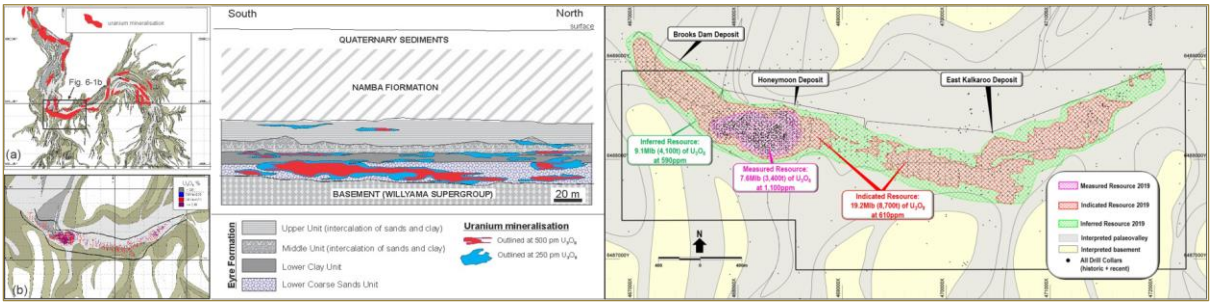
Figure 12: (A) Map of Australia identifying uranium deposits and felsic outcroppings, (B) Frome Embankment



Source: Geoscience Australia (December 2005); Mike Dentith & Mark Randell (2003) Sandstone-type uranium deposits in South Australia and North America: A comparison of their geophysical characteristics, ASEG Extended Abstracts, 2003:3, 223-248, DOI: 10.1071/ASEGSpec12_18

Boss's licence packages contain large sections of the Billeroo and Yarramba Paleovalleys, which host the Gould's Dam (Billeroo), Jason's (Yarramba) and Kalkaroo deposits, respectively. Mineralisation is hosted in the Eyre formation, a basal package ~70-130m below surface, in areas where the sands are pinched between an overlying clay unit and the base of the paleovalley. Deposition occurred at the oxidation/redox boundary in crescent shaped orebodies located at bends in the paleovalley where elevated sulphide-rich material concentrations caused reduction reactions and precipitation of uranium. The Honeymoon deposit is located between 100-120m below surface, while the Brooks Dam and East Kalkaroo are 80-110m below surface.

Figure 13: Cross section through Gould's Dam, Honeymoon and East Kalkaroo Deposits, Domains of the Honeymoon Restart Area, plan view of Honeymoon and East Kalkaroo, and 2019 plan view showing enlarged resource



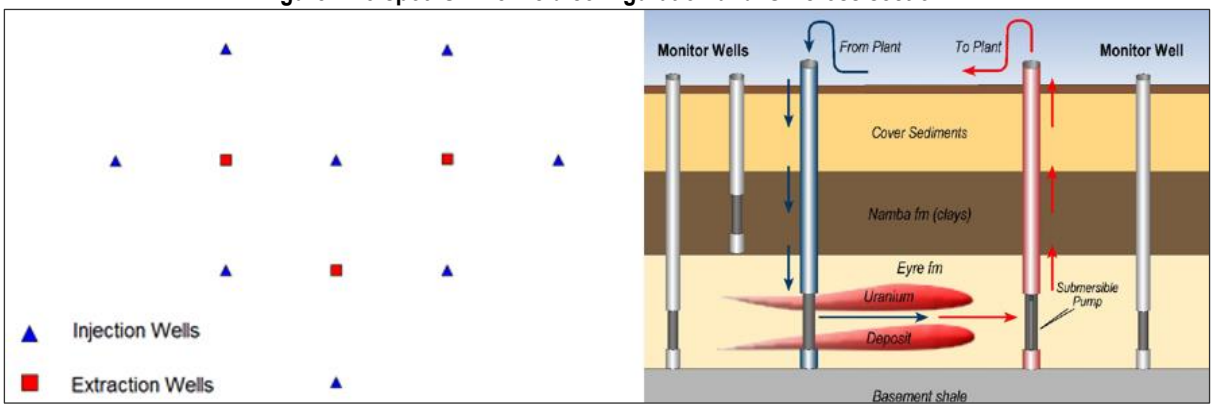
Source: Boss Energy

The restart area focuses on the Brooks Dam, Honeymoon and East Kalkaroo deposits in the Yarramba paleovalley, with a total resource of 36Mlbs at 660ppm. The resource is supported by 189 infill holes for 23,386m of vertically drilled holes with average spacing of 80x40m for indicated and 40x20m for measured. Boss's drilling had a success rate of 96%, validating the company's understanding of the orebody. Grade was estimated using Ordinary Kriging. Boss has identified an exploration target range of 58-190Mlbs consisting of 28-133Mt at 340-1,080ppm over its Billeroo and Yarramba licence areas; we believe this is ambitious but reasonable. Boss has successfully used passive seismic surveys to identify basement structures that influenced jogs and bends within the paleovalleys during their formation. Resistivity surveys followed by targeting moderate resistivity lows (indicative of high sulphide material) proximate to resistivity highs, to identify oxidation-redox boundaries located within bends and jogs of the paleovalley, is likely to be a successful exploration technique in our view.

Mining and processing

The ISR process: Lixiviant is pumped into injection wells to oxidise and leach uranium from the orebody into solution and then pumped from extraction wells to the process plant. At the process plant, uranium is either i) in IX (ion exchange), concentrated from solution onto a resin or polymer and then stripped using a strong acid or chloride solution; or ii) in SX, a continuous liquid loading / stripping cycle is used – an organic liquid removes uranium from solution and then ammonia is used to strip the loaded organic liquid, followed by ammonia precipitation.

Figure 14 5-spot ISR wellfield configuration and ISR cross section



Source: World Nuclear Association, Boss Energy

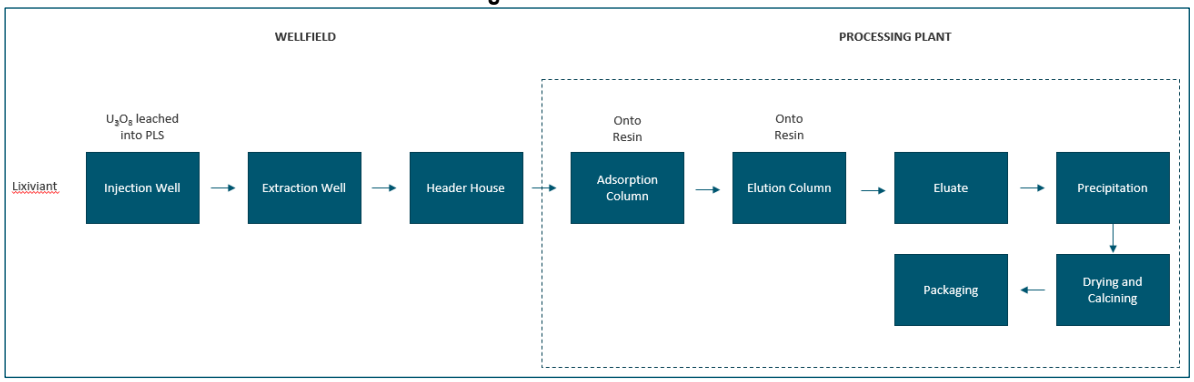
Specific considerations for Honeymoon: In our view Boss's test and study work has optimised the process to enable a lower cost operating regime. For context, Honeymoon operated using a 2.0pH lixiviant, and solvent exchange adsorption and precipitation from 2011-2013. Boss's test work indicates amenability to a lower pH (<1.5) lixiviant and ion exchange (IX) adsorption and elution process; these are both in line with lower cost ISR operations globally, notably in Kazakhstan.

Lower pH and higher iron content to improve leaching**:** Low pH lixiviant ISR operations achieve higher uranium recoveries (70-90% for acid leach vs ~60-70% for alkaline leach) with lower operating costs except in carbonaceous settings and/or where there is >2% calcium in the orebody, due to high acid consumption. Advantages of low-pH leaching include faster leach kinetics, more downstream processing options and less viscous solution. In the case of Honeymoon, test work by Boss indicated higher extraction and pregnant leach solution (PLS) loading after lowering pH to 1.4 from 2.0 and increasing iron content from 0.5g/L to 3-5g/L. The lower pH increases overall oxidation while higher ferric content improves leach recovery rate. Test recoveries increased to an average of 96.3% into PLS. Gypsum scaling is managed by keeping EH above 700mV, pH <1.6, Fe ~3g/L and Cl >8.5g/L.

SX vs IX**:** IX is lower capex and opex than SX. SX is preferable where high chloride concentrate is found within the PLS (as is the case at Honeymoon with chloride concentration of 8.8g/L), as in IX the chloride can compete with the uranium for binding positions to the resin in traditional weak base anion IX, resulting in low uranium loading. It is also more advantageous with higher uranium tenors, typically >0.9g/L. The Australian Nuclear Science and Technology Organisation successful tested and trialled a strong base anion resin that is capable of achieving high U_3O_8 loading of up to 50g/L from a pregnant leach solution containing 50mg/L at Honeymoon's chloride content. Pilot scale testing of the adsorption and elution process delivered a 180x upgrade in concentration, averaging 9g/L.

Wellfield design: The Honeymoon wellfield plan includes a 5-spot well pattern with 45m well spacing with 16 extraction wells and 25 injection wells per 62,500m^2. Economic cut-offs include a minimum grade of 400ppm, minimum grade-thickness of 1800m-ppm for a single mining horizon and subsequent mining horizons can support a lower GT of 500m-ppm. There are three mineralised horizons: basal, middle and upper. Horizons are leached from the bottom up. Once the bottom horizon is depleted, the well is grouted and re-completed to access the next ore level. The wellfields are designed to target measured and indicated material but 18% of the FS mine plan includes inferred and unclassified material, as lower confidence material cannot be selectively stockpiled or avoided within the horizon, unlike a conventional hardrock mine.

Figure 15: ISR Flowsheet



Source: SCP Research

Plant: The plant is currently configured for 0.88Mlbspa with an SX elution circuit, optimised for a uranium tenor of ~75mg/L U_3O_8. The updated plan is to replace the SX columns with two NIMCIX IX (continuous counter-current ion exchange) columns, which are lower cost to operate and are more applicable to lower uranium tenor operations. In the adsorption columns, uranium is adsorbed from the PLS onto resins, which are then eluted in the elution columns to a low volume concentrated eluate (9g/L U_3O_8) for precipitation. Spent resins are conditioned with an acidic solution and returns to the adsorption column. Resins will be regenerated periodically to control the build-up of silica.

Site Infrastructure

Climate: Both climate and topography are attractive for operating an ISR operation in our view. The area receives low precipitation at ~250-300mm per year (similar to San Diego, CA) with average daily temperatures ranging from 9C in winter and 25C in summer. The topography is flat.

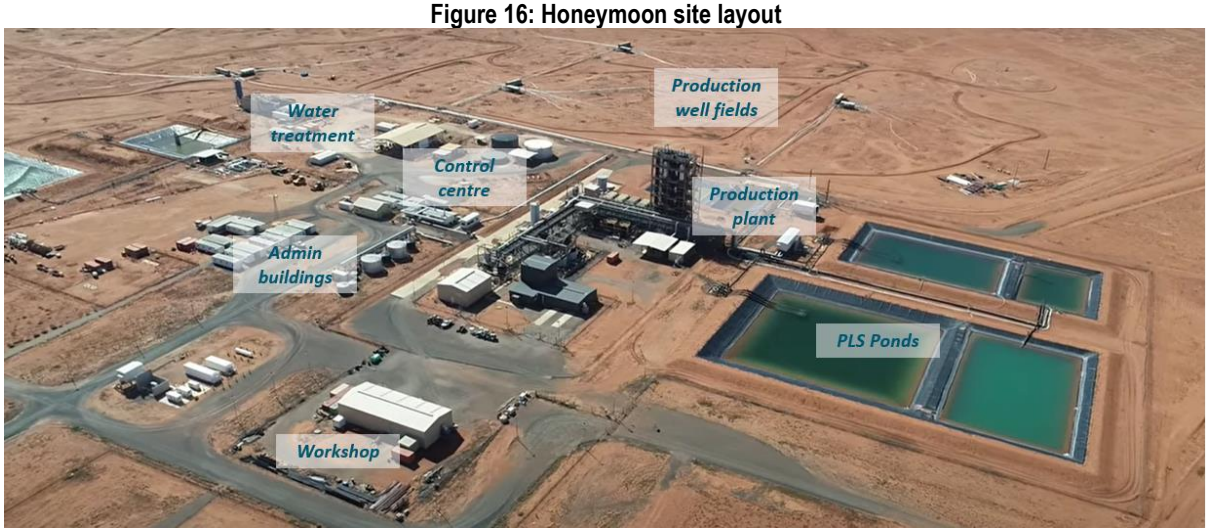
Access: The project is accessible from the sealed Barrier Highway from Broken Hill or Adelaide followed by a 44km unsealed public access road and a 23km privately maintained access road. The access roads require re-sheeting; this is included in the pre-production capex budget. There is an airstrip at Honeymoon designed for planes up to 50 passengers.

Water for the project will be obtained from the existing groundwater bore-field. Potable water will be produced by a containerised reverse osmosis plant.

Civils: A 150-person mining camp, administration buildings, a 75km power line and a fleet of vehicles, spares and other associated equipment are already constructed and maintained in good standing.

Environmental: Groundwater in the Frome basin is high salinity and is not life bearing therefore natural attenuation is permitted by the environmental authorities. Groundwater quality monitoring is required and Honeymoon is permitted in good standing with environmental monitoring in place.

Figure 16: Honeymoon site layout



Source: Boss Resources, SCPe

Mine plan and economics

Capex: The FS estimated capital costs of A$34.7m for refurbishment of the existing facilities (0.88Mlbs/year) and A$58.2m for stage II (2Mlbs/year), comprising the installation of a two parallel NIMCIX adsorption-elution trains, precipitation circuit enlargement and associated other upgrades. Total estimated deferred capital (non-sustaining) totalled A$48.4m over the LOM for new wellfield equipment (A$16.5m), wellfield header extension (A$11.6m) and a third NIMCIX column train (A$20.3m). Since the FS, Boss has indicated plans to replace the SX circuit with NIMCIX, to run four NIMCIX column trains. This is not expected to vary the total capex estimate of ~A$93m, and we see potential for this to lower LOM deferred capex.

Opex: The FS estimated A$35.7/lb of operating costs over the LOM. Stage I (SX only at 0.54Mlbs per year) operating costs totalled A$49.49/lb including A$40.85of fixed costs per lb (A$22.3m per year) and A$8.34/lb of variable reagent cost and A$0.30/lb of power costs. Stage 2 (2Mlbs per year) costs fall to A$27.56/lb including A$17.34/lb of fixed costs (A$28.1m per year), A$10.04/lb of reagents and A$0.18/lb of power costs. Subsequent testing showed sufficient elution at 21°C, enabling US$6.3m in capex savings and US$1.22/lb in opex savings. We expect the capex savings to net out capex to replacing two SX column trains with NIMCIX column trains.

Development timeline: Honeymoon is fully permitted for restart therefore the main lead times are financing and construction. The FS included a 52-week build and 9-week ramp-up with first production in week 59 (from the existing SX circuit) and first production from IX within 20 months. We have modelled an 18-month build with progressive ramp up in the first year of production (583klbs in year one).

Appendix I: ISR Overview

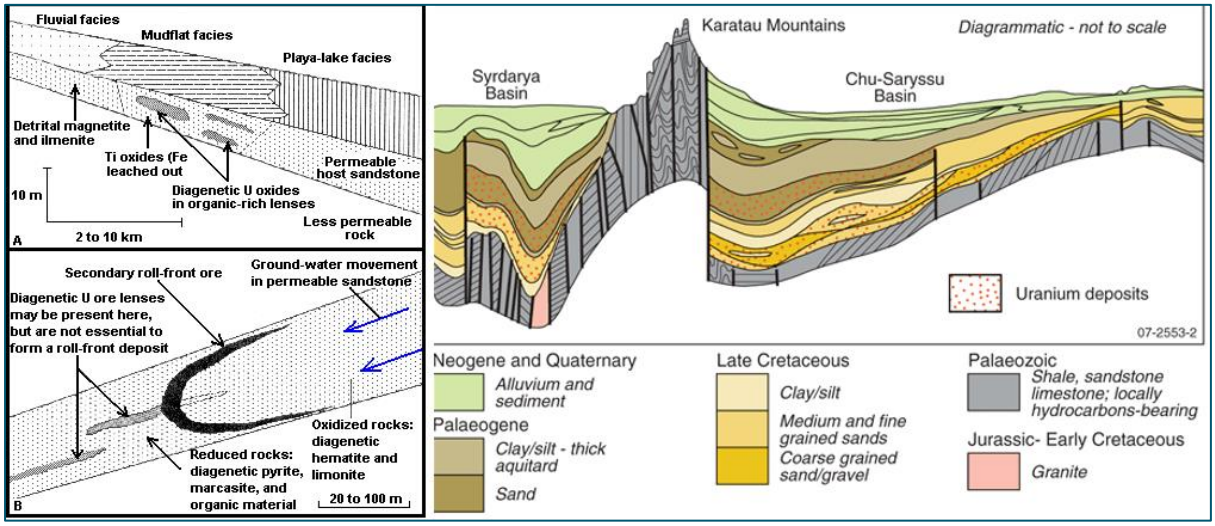
The History

In-situ recovery (ISR), also referred to as in-situ leaching (ISL) was developed in the 1960s as a lower cost means of extracting mineralization than typical hard-rock mining methods, and was widely adopted in the USSR in the 1970s. Solution is injected into the orebody, utilizing the native groundwater to extract the mineralization.

Geology:

Uranium deposits amenable to ISR occur in permeable sand or sandstones, confined above or below by impermeable strata and were formed by the lateral movement of groundwater bearing uranium minerals through the aquifer, precipitated by a fall in oxygen content (reduction) on an oxidation/reduction interface. Uranium minerals typically occur as uraninite (oxide) or coffinite (silicate). The deposits can be extensive sheet-like bodies, or crescent shaped deposits formed in paleovalleys (roll-front). Exploration should identify the paleovalleys, potentially by identifying structures that influence paleovalley formation. Resistivity contrasts are often useful for identifying the oxidation/reduction boundaries that caused precipitation.

Figure 17: Diagenetic and roll front U-mineralisation, (B) Cross-section of Chu-Sarysu and Syrdarya basins of Kazakhstan



Source: (A) USGS, (B) Geoscience Australia

Operating considerations

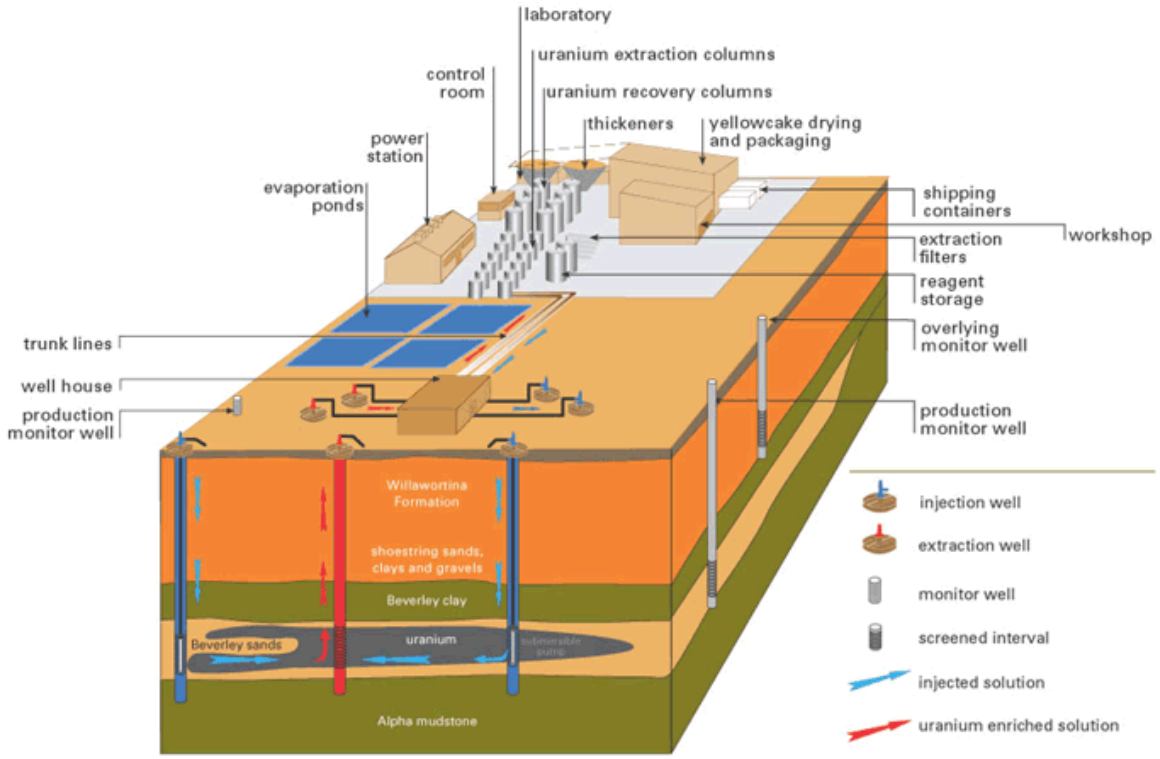
Lixiviant

Typically, low-pH lixiviant is preferred as better recoveries (70-90% for acidic vs 60-70% for alkaline) are achieved. In Australia, hydrogen peroxide is used while in Kazakhstan, sulphuric acid is used. If there is significant acid consuming materials in the orebody (typically limestone or gypsum), an alkaline leach is used, usually sodium bicarbonate in the USA. Kazakh orebodies often have high carbonate levels but high concentrations of sulphuric acid are used to overcome this, roughly 5x the reagent consumption levels of the Beverly Mine in South Australia. Lixiviant regimes are a key driver of economics. US ISR operations tend to be higher cost as a result of alkaline leaching. Kazakh operations benefitted significantly from the high availability of sulphuric acid post 2010 through the expansion of hydrocarbon, copper and zinc refining/smelting in country, which created the high availability of low-cost sulphuric acid that enabled the rapid growth of uranium production in Kazakhstan.

IX vs SX

Ion exchanges (IX) is typically lower capex and operating cost. SX is preferable under two circumstances: high uranium tenors (concentrations) or if there are high concentrations of nitrates or chlorides in the pregnant leach solution. Since ISR operations are typically lower uranium tenor (than for example an Athabasca hard rock facility), IX is typically preferred for ISRs. Remote ion exchange satellite plants are common in the US and at Four Mile in Australia to commercialize small orebodies distant from a central processing plant.

Figure 18: Representative diagram of the Beverly ISR operation



Source: (A) USGS, (B) Geoscience Australia

Groundwater remediation

In the US, legislation requires that groundwater is restored to the greater of potable, or to enable land use to return to its pre-mining state. This imposes significant costs on operators. In Kazakhstan, natural attenuation is allowed as high carbonate levels have shown in monitoring to mitigate the impact of solution mining. At most Australian uranium deposits, particularly South Australia, the ground water in the sandstone deposits is highly saline, often radioactive, and unusable for human or animal purposes, therefore natural attenuation is also permitted.

Learnings from currently producing ISR operations

Overleaf we show contained pounds, grades and cash costs for Kazatomprom's ISR operations as well as resources and cash costs for Heathgate Resources' Beverley operation in South Australia. From the below we draw several inferences. Grades are certainly a factor that influences costs but Kazatomprom is able to profitably produce well below 1000ppm. In our view the decisive factors are large scale operations, low-pH lixiviant, availability of high volumes of low cost sulphuric acid, low power costs, and ability to rely on natural attention for groundwater remediation. Based on the above, we believe South Australia shares many of the same natural advantages, though with higher reagent costs, but lower reagent consumption. US operations are more likely to face cost pressures due to smaller deposits, alkaline leaching and higher groundwater remediation costs, although they have some advantages including low-cost power and the use of centralized mill facilities and remote IX resin loading.

Figure 19: Kazatomprom ISR 2019 production and costs and 2018 Reserves

	2019 actual		June 2018 Reserves		
Asset (100% basis)	Production (Mlbs U3O8)	Cash cost (US$/lb)	Mt	%U3O8	Mlbs
Karatau	6.8	6.12	59.3	0.096%	125.0
Akbastau	4.0	7.38	49.6	0.104%	114.1
Akdala	2.0	8.43	10.2	0.067%	15.1
South Inkai	4.3	8.49	100.6	0.045%	99.3
Katco	8.5	9.03	57.6	0.143%	181.7
Kharasan	4.2	10.42	20.0	0.132%	58.2
Inkai	8.3	12.43	57.6	0.123%	155.7
Zarechnoye	2.0	12.55	8.0	0.071%	12.5
Subtotal	***40.0***	***9.32***	***362.9***	***0.095%***	***761.7***
Other Kazatomprom (100% basis)	12.1	n/a	*521.8*	*0.054%*	*620.3*
Total Kazatomprom (100% basis)	**52.1**	**9.28**	***884.7***	***0.071%***	***1,382.0***
Beverley (MII Resources)	**4.7**	**9.57**	***9.9***	***0.250%***	***54.6***
Honeymoon (MIII Resources)	--	--	***52.4***	***0.062%***	***71.6***

Source: SCP, Kazatomprom 2018 IPO Prospectus, Boss Resources, Kazatomprom asset level production and group cash costs from company disclosure, individual asset cash costs from S&P Market Intelligence

While Kazatomprom does have impressive reserves and resources, at a ~60Mlb/yr production rate, its resources will decline, therefore other producing regions such as the Athabasca, Australia, Namibia and Niger will be important to maintain global uranium production over the next 10-20 years. Kazatomprom, like any sensible miner, is mining its highest grade and best projects and will be subject to grade decline.

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