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Leigh Creek Energy Limited

We see urea production as the best option

23 March 2020

Share Price: A$0.10

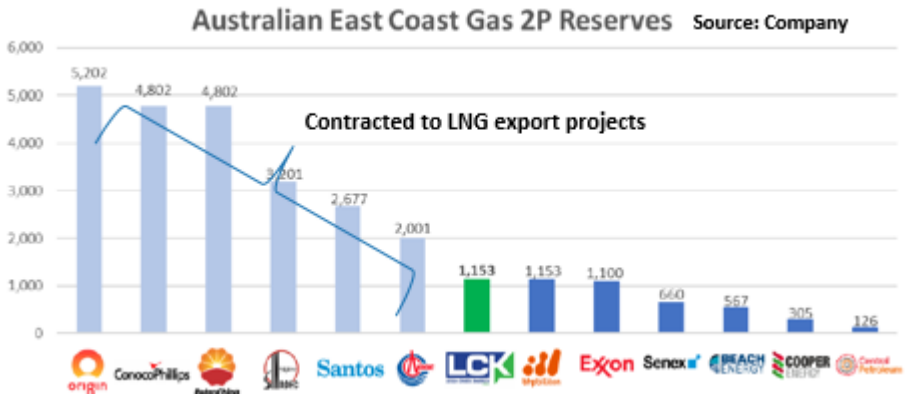
Target Price: A$0.60

Target upside: 500%

Recommendation
Speculative Buy

Risk Assessment
Higher

Following successful in-situ gasification (ISG) in 2019 at the Leigh Creek coal mine in South Australia, LCK announced a Petroleum Resources Management System (PRMS) 1,153PJ 2P Reserve for its Leigh Creek Energy Project (LCEP). **LCK is now firmly in Australia's energy Premiership with the group's 2P Reserves approximately the same size as the entire Cooper Basin and forming East Coast Australia's largest uncontracted and undeveloped 2P Reserve.**



LCK is currently evaluating two commercialisation options: using the syngas as a low-cost feedstock for on-site nitrogen fertiliser (urea, ammonia) production and/or, cleaning the syngas to pipeline quality and supplying product to the east coast market. While there is no guarantee when, of indeed if, a successful offtake or JV deal will be successfully negotiated, we note that management have indicated in recent announcements that LCK is "making significant progress on securing a strategic and cornerstone partner for our LCEP". We note recent press reports stating that the Victoria state government has recently axed a six-year conventional exploration ban; the decision to open-up Victorian onshore gas Resources could exert downward pressure on east coast gas prices over the next few years.

Valuation and Recommendation. A$0.60ps: Speculative Buy

The commencement of onshore gas exploration and development in Victoria is most likely to result in a potentially significant new source of gas for the east coast market and supports our view that the fertiliser production offers a more realistic path for commercialising the LCEP**.** In addition, LCK's syngas provides an input cost advantage relative to wholesale domestic natural gas prices, on-site manufacturing obviates the need for potentially complex negotiations with third party pipeline operators and, there is long-term domestic and international demand for fertilisers. We calculate the (pre-financing) $NPV_{6.5}$ of a 30-year LOM 2Mtpa urea operation at A$3.7bn, giving LCK an equity value of A$334m or A$0.55ps. Our EV/GJ peer comparison indicates an LCK valuation closer to A$0.64ps.

We believe that LCK offers exciting capital upside for speculative investors as the LCEP is progressively de-risked. Potential near-term share price catalysts include firming up of existing HOAs, and announcements on customer offtake, financing, or farm-in agreements.

Resources – Oil & Gas

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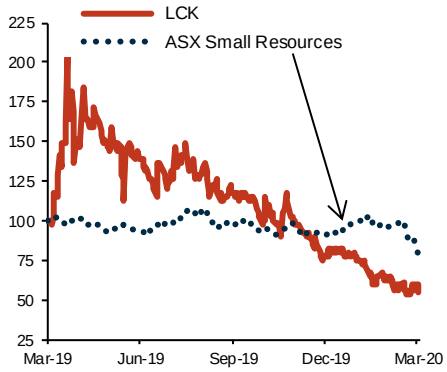
Leigh Creek Energy Ltd	
ASX Code	LCK
52- week range	A$0.10-A$0.43
Market Cap (diluted) (ASm)	67
Shares (FY19 diluted) (m)	605
Av Daily Turnover (shares)	1.9 million
ASX All Ordinaries	5,900
2019A BV per share (A$)	0.05
2019A EPS (A$)	-0.02
2019A Net Cash/(Debt) (A$m)	-0.9

Relative price performance



Financial Statements

Leigh Creek Energy Limited

Year ending June

Profit & Loss Statement (A$M)	FY19A	FY20E	FY21E	FY22E	FY23E
Revenue	0.0	0.0	0.0	0.0	0.0
Production/Pipeline costs	0.0	0.0	0.0	0.0	0.0
Corporate costs	(7.4)	(6.0)	(6.1)	(6.2)	(6.4)
PRRT	0.0	0.0	0.0	0.0	0.0
EBITDA	**(7)**	**(6)**	**(6.1)**	**(6.2)**	**(6.4)**
Depreciation & Amortisation	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)
Operating profit	**(7.5)**	**(6.1)**	**(6.2)**	**(6.3)**	**(6.4)**
NOI	0.0	6.5	0.0	0.0	0.0
EBIT	**(7.5)**	**0.4**	**(6.2)**	**(6.3)**	**(6.4)**
Interest income	0.1	0.1	0.1	0.0	0.0
Interest expense	(2.2)	(0.3)	(0.3)	(0.3)	(0.3)
Tax expense	0.0	0.0	0.0	0.0	0.0
Reported NPAT	(9.5)	0.2	(6.4)	(6.6)	(6.7)
Normalised NPAT	**(10)**	**(6)**	**(6.4)**	**(6.6)**	**(6.7)**
EBITDA Margin (%)	na	na	na	na	na
Operating profit margin (%)	na	na	na	na	na
EPS Reported (A$)	(0.02)	0.00	(0.01)	(0.01)	(0.01)
EPS Normalised (A$)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
EPS growth (%)	nm	nm	nm	nm	nm
DPS - Declared (A$)	0.00	0.00	0.00	0.00	0.00
Avg. no. of fully-diluted shares (m)	476	625	661	701	741
YE no. of fuly-diluted shares (m)	605	641	681	721	761

Cash Flow Statement (A$M)	FY19A	FY20E	FY21E	FY22E	FY23E
EBITDA	(7.4)	(6.0)	(6.1)	(6.2)	(6.4)
Investment in working capital	(2.0)	0.0	0.0	0.0	0.0
Tax expense	0.0	0.0	0.0	0.0	0.0
Operating Cash Flow	**(9.5)**	**(6.0)**	**(6.1)**	**(6.2)**	**(6.4)**
Capex	(20.3)	(2.0)	(2.0)	(2.0)	(2.0)
Other investments	0.0	0.0	0.0	0.0	0.0
Investing Cash Flow	**(20.3)**	**(2.0)**	**(2.0)**	**(2.0)**	**(2.0)**
Net interest received / (paid)	(2.0)	(0.3)	(0.3)	(0.3)	(0.3)
Debt drawdown / (repayment)	0.2	0.0	0.0	0.0	0.0
Dividends paid	0.0	0.0	0.0	0.0	0.0
Equity raised / (repaid)	13.9	1.6	8.0	8.0	8.0
Financing Cash Flow	**12.0**	**1.3**	**7.7**	**7.7**	**7.7**
Non-operating & Other (R&D rebate)	11.5	6.5	0.0	0.0	0.0
Inc/(Dec) in Cash	**(6.3)**	**(0.2)**	**(0.4)**	**(0.5)**	**(0.6)**

Balance Sheet (A$M)	FY19A	FY20E	FY21E	FY22E	FY23E
Cash & Equivalents	3.1	2.9	2.5	2.0	1.3
Receivables	6.5	6.5	6.5	6.5	6.5
Inventories	0.0	0.0	0.0	0.0	0.0
Other Current Assets	0.0	0.0	0.0	0.0	0.0
PPE and Exploration & Development	25.4	27.4	29.3	31.3	33.2
Deferred tax asset	0.0	0.0	0.0	0.0	0.0
Other Non Current Assets	0.0	0.0	0.0	0.0	0.0
Total Assets	**35.0**	**36.8**	**38.3**	**39.8**	**41.1**
Payables and other current Liabilities	1.3	1.3	1.3	1.3	1.3
Short Term Debt	4.0	4.0	4.0	4.0	4.0
Long Term Debt	0.0	0.0	0.0	0.0	0.0
Other Non Current Liabilities	0.0	0.0	0.0	0.0	0.0
Total Liabilities	**5.3**	**5.3**	**5.3**	**5.3**	**5.3**
Total Equity	**29.7**	**31.5**	**33.1**	**34.5**	**35.8**
Net Cash / (Debt)	(0.9)	(1.1)	(1.5)	(2.0)	(2.6)

Top 3 Shareholders	%	Date
China New Energy Group Ltd	24.2	
Crown Ascent Development Ltd	8.2	Aug-19
Citic Australia	2.8	

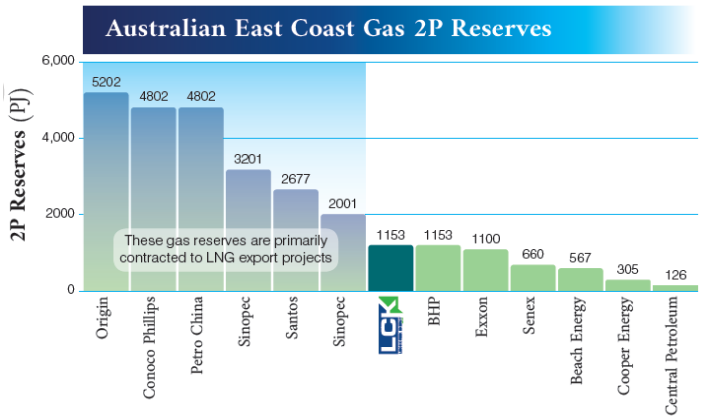
Source: Company, IRESS, State One Stockbroking forecasts

Potential Revenue and EBITDA to LCK from Urea Production	
Urea Price (FOB, A$/t)	**354**
Gas input costs (A$/t)	*42*
Processing costs (A$/t)	*96*
Road haulage/ port costs (A$/t)	*21*
Other (Royalties/Corporate) (A$/t)	*24*
Total costs (A$/t)	183
EBITDA (A$/t)	**171**
EBITDA margin (%)	48%

Assuming urea prices of US$215/t (real), and gas input costs of A$1/GJ, we estimate a urea EBITDA margin of A$171/t (EBITDA margin of 40%). ***Based on a 2Mtpa urea production facility, we calculate potential annual EBITDA of some A$340m.***

Gas Resources (PRMS)	Category	Syngas Energy (PJ)
PEL 650:LCEP	1P Reserves	-
	2P Reserves	**1,153**
	3P Reserves	1,608
	1C Contingent Resource	-
	2C Contingent Resource	1,469
	3C Contingent Resource	2,127

Note: PRMS = Petroleum Resources Management System



Leverage	FY19A	FY20E	FY21E	FY22E	FY23E
Net Debt/Equity	-3%	-4%	-5%	-6%	-7%
Gearing (ND/ND+E)	-3%	-4%	-5%	-6%	-8%
Interest Cover (x)	-3.7	1.6	-23.6	-23.4	-23.0

Valuation Ratios (x)	FY19A	FY20E	FY21E	FY22E	FY23E
Normalised P/E	na	na	na	na	na
Price/OP Cash Flow	na	na	na	na	na
Book value per share (A$)	0.05	0.05	0.05	0.05	0.05
EV/EBITDA	na	na	na	na	na
ROE (%)	na	na	na	na	na

Market cap sensitivity to Resource EV/GJe			
Resource unit EV (A$/GJe)	0.10	0.15	0.20
LCK 2P+ 2C Resource (PJ)	2,622	2,622	2,622
=> Resource EV (A$m)	256	387	518
=> Market capitalisation (A$m)	255	386	517
LCK share price value (A$)	**0.42**	**0.64**	**0.86**

Note: Per share valuation based on fully diluted number of shares

Company Overview:
Leigh Creek Energy (LCK) is an emerging unconventional gas producer. The company's key asset is 1,153PJ of 2P recoverable gas Reserves associated with 302Mt of coal Reserves at its flagship Leigh Creek Energy Project located at the shuttered Leigh Creek coal mine in Central South Australia (550km north of Adelaide). LCK has an oil and gas exploration licence (PEL 650) -which overlays the Leigh Creek coal mining licence. LCK is evaluating commercialisation opportunities including supplying pipeline gas to the tight east coast market and/or using the gas to produce nitrogen fertilisers.

Valuation

LCK is in the fortunate position of having established a significant gas Reserve (1,153PJ 2P) at a time when natural gas demand has tripled over the past five years in the east coast (EC) market and electricity supply interruptions and rising electricity prices have prompted state and Federal governments to relook at the country's energy mix for power generation.

LCK is currently evaluating two commercialisation options:

1) using the syngas as a low-cost feedstock for on-site nitrogen fertiliser (urea) production and/or,
2) converting the syngas to pipeline quality and supplying product to the east coast market.

Each option will require extensive capex (~A$3bn initial estimates) and will require numerous feasibility, financing, commercial, and environmental studies to be completed. Management indicates commercial project operations are not likely to begin before 2023 at the earliest.

Figure 1: Commercialisation options……natural gas sales or fertiliser production

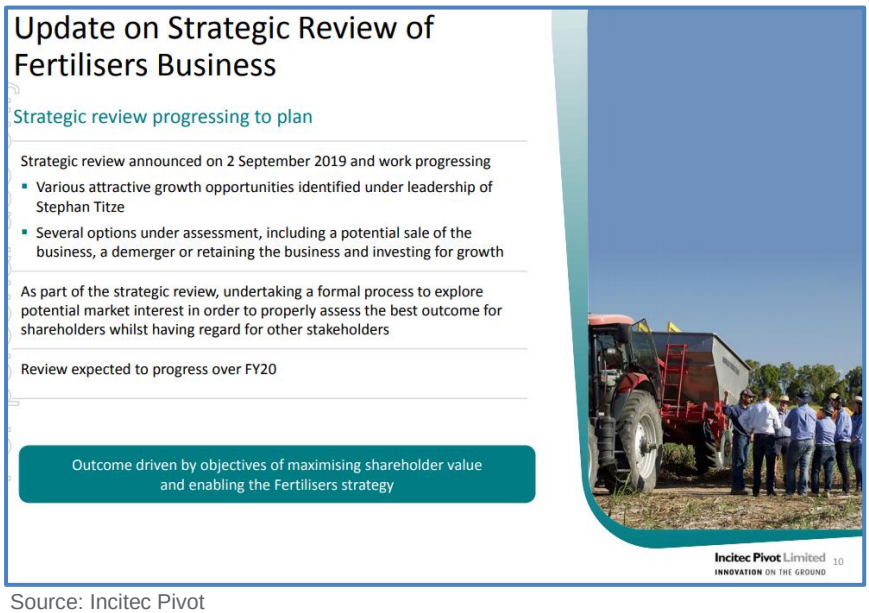
While LCK is currently negotiating with potential domestic market gas buyers and progressing with scoping aspects of the fertiliser business case, we suggest that, at this early stage in the process, it is problematic to determine an NPV-based valuation for LCK. What is clear, however, is that LCK's gas Reserve – the largest uncontracted, undeveloped gas Reserve in the east coast is a valuable asset.

Urea manufacturing – our preferred pathway for LCK to commercialise the LCEP

We believe that the fertiliser option - converting syngas to urea - not only offers LCK a greater financial return (NPV), but most importantly, has a more realistic chance of "getting off the ground".

- There are numerous large and small gas plays in Australia looking to source funding to develop their assets (onshore, offshore, conventional or unconventional (CSG)) and secure offtake and pipeline access agreements. However, Australia is a significant net importer of nitrogen fertiliser. **Limited domestic production of urea could make a new entrant a more attractive prospect for potential JV partners /funding providers.**
- Developing an in-situ fertiliser plant obviates the need to build a 150km 60PJpa-capacity pipeline linking Leigh Creek to APA Group's (ASX:APA) Moomba distribution hub, and remove the need to subsequentially enter into tariff negotiations with APA (to pipe the gas from Moomba to the east coast market).
- LCK's syngas is an immediate feedstock for the ammonia production stage with indicated production costs of A$1/GJ delivered to plant. Approximately 40GJ of gas is needed to produce 1 tonne of urea. At current east coast wholesale natural gas prices (~A$7/GJ), we calculate that domestic gas input costs alone equate to some A$280 per tonne of urea. Adding in industry average urea processing costs of US$50/t, and with the current urea price at some US$215/t (A$287/t @ out long-term AUD:USD exchange rate of US$0.75) one can understand why domestic urea producer Incitec Pivot (ASX:IPL) is looking to dispose of its fertiliser business.

Figure 2: Incitec Pivot – slide from FY19 annual results presentation



Source: Incitec Pivot

- A tyyssenkrupp study commissioned by LCK estimated capital costs for a 2Mtpa urea plant at A$3.27bn. This compares favourably to the A$4bn capex indicated by Perdaman Chemicals and Fertilisers (Perdaman) – a West Australian based multinational group – for a proposed 2Mtpa ammonia/urea plant at Karratha Western Australia with natural gas as feedstock supplied by Woodside Petroleum (ASX:WPL).
- Predicated on our modelling, we calculate that a urea plant will generate revenue equivalent to just under A$9/GJ of gas and EBITDA of ~A$4.20/GJ. In comparison, we estimate that supplying gas to the east coast market will generate a (significantly) lower EBITDA of ~A$2.80/GJ.

$NPV_{6.5}$ of fertiliser option

We calculate the post-tax NPV (6.5% discount rate) of a 30-year 2Mtpa urea project at A$3.7bn. Adjusted for project debt, we value LCK's equity value at A$334m or A$0.55 per share (pre-March 2020 capital raising).

Figure 3: NPV of LCEP: Fertiliser (urea) option

	Year				1	2	3	4	5	6	Year	LOM
	FY	2020	2021	2022	2023	2024	2025	2026	2027	2028	7-30	
Inventory - opening	PJ	2,400	2,400	2,400	2,400	2,320	2,240	2,160	2,080	2,000		
Inventory - closing	PJ	2,400	2,400	2,400	2,320	2,240	2,160	2,080	2,000	1,920		
Syngas production	PJ	-	-	-	80	80	80	80	80	80	1,920	2,400
Urea production	Mt	-	-	-	2.0	2.0	2.0	2.0	2.0	2.0		60
Urea price (FOB)	A$/t	333	340	347	354	361	368	375	383	391		-
Revenue	**A$m**	-	-	-	**707**	**722**	**736**	**751**	**766**	**781**		**28,701**
Gas input costs	A$m	-	-	-	(85)	(87)	(88)	(90)	(92)	(94)		(3,444)
Urea processing costs	A$m	-	-	-	(191)	(195)	(199)	(203)	(207)	(211)		(7,749)
Road haulage / port costs	A$m	-	-	-	(42)	(43)	(44)	(45)	(46)	(47)		(1,722)
State and gas vendor royalties	A$m	-	-	-	(42)	(43)	(44)	(45)	(46)	(47)		(1,722)
Admin/ Corporate	A$m	(5.0)	(5)	(5)	(5)	(5)	(6)	(6)	(6)	(6)		(231)
Total costs	A$m	(5.0)	(5)	(5)	(366)	(373)	(381)	(389)	(396)	(404)	(12,543)	(14,868)
EBITDA	**A$m**	**(5.0)**	**(5)**	**(5)**	**341**	**348**	**355**	**362**	**369**	**377**	**11,695**	**13,833**
PAT	A$m	(5.0)	(5)	(5)	273	279	284	290	296	302	10,009	11,716
Equity funding	A$m	-	-	-	-	-	-	-	-	-	-	-
Debt funding	A$m	-	1,675	1,675	-	-	-	-	-	-	-	3,350
Project capex	A$m	-	(1,635)	(1,635)	-	-	-	-	-	-	-	(3,270)
Sustaining capex	A$m	-	-	(50)	(2)	(2)	(2)	(2)	(2)	(50)	(210)	(320)
Cash flow	**A$m**	**(5)**	**35**	**(15)**	**271**	**277**	**282**	**288**	**293**	**252**	**9,799**	**11,475**
Discount rate		*6.5%*										
NPV: LCEP (Urea)	**A$m**	**3,684**										
....less Debt (A$m)		(3,350)										
= Equity value (A$m)		334										
Equity value per diluted share (A$)		0.55										

Source: Company, State One Stockbroking forecasts

Key Assumptions:

- **Inventory –** our forecast gas inventory of 2,400PJ is significantly above LCK's current estimated 2P Reserves of 1,153PJ. However, the Reserve was estimated from only one of the three coal seams which form the LCEP coal Resource. We assume that increases to gas Resources and upgrades to Reserves will be obtained from additional infill drilling and PCD plant operations over the project life.
- **Project life –** predicated on 40PJ of syngas input for 1Mt of urea output, our forecast 2,400PJ gas inventory equates to 30 years of production at 2Mtpa of urea.
- **Urea price –** we assume a constant urea price of US$250/ (real) and a constant exchange rate of US$0.75 for a urea price of A$333/t. The current spot urea price is A$336/t (US$215/t @ US$0.65).

Figure 4: Five-year urea price history (US$/t)

Description: Urea, (Black Sea), bulk, spot, f.o.b. Black Sea (primarily Yuzhnyy) beginning July 1991; for 1985-91 (June) f.o.b. Eastern Europe

Source: indexmundi

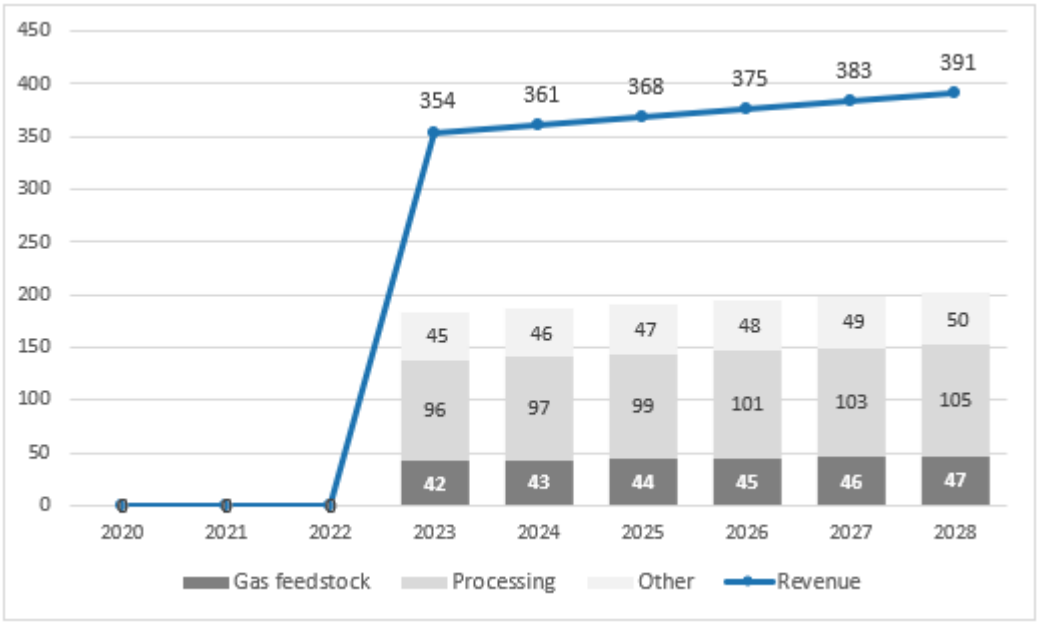
- **Urea processing costs –** A$90/t urea
- **Road haulage / port costs -** A$20/t urea
- **State and vendor royalties –** A$0.50/GJ
- **Project financing –** we assume pre-production capex of A$3.27bn in line with thyssenkrupp's estimated capital cost for a 2Mtpa plant. For the purposes of modelling, we assume this capital is 100% sourced from debt funding. In reality, we suspect that the project will be funded from a combination of debt, equity, and a partial project selldown to potential JV partners.
- **Discount rate of 6.5% –** predicated on our assumption of a 100% debt-funded project, we assume a discount rate equivalent to the cost of debt.
- **Field development –** we assume a capex spend of A$50 every six (6) years to maintain syngas output at 80PJ per annum.

Figure 5: Urea option: NPV assumptions

Price and cost assumptions		2020	2021	2022	2023	2024	2025	2026	2027	2028
Urea price (FOB, Black Sea)	**US$/t**	**250**	255	260	265	271	276	282	287	293
AUD:USD exchange rate	unit	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Gas production costs	A$/GJ	1.00	1.02	1.04	1.06	1.08	1.10	1.13	1.15	1.17
Royalty costs	A$/GJ	0.50	0.51	0.52	0.53	0.54	0.55	0.56	0.57	0.59
Processing costs	A$/t urea	90	92	94	96	97	99	101	103	105
Road haulage / port costs	A$/t urea	20	20	21	21	22	22	23	23	23
Admin/ Corporate/Other	A$m	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.9
Effective Corporate tax rate	%	0%	0%	0%	20%	20%	20%	20%	20%	20%
Gas unit data										
Revenue	A$/GJ	na	na	na	8.84	9.02	9.20	9.38	9.57	9.76
Total costs including royalty	A$/GJ	na	na	na	(4.58)	(4.67)	(4.76)	(4.86)	(4.95)	(5.05)
EBITDA	A$/GJ	na	na	na	4.27	4.35	4.44	4.53	4.62	4.71
EBITDA margin (%)	%	na	na	na	48%	48%	48%	48%	48%	48%
Urea price/cost										
Revenue	A$/t	na	na	na	354	361	368	375	383	391
Gas and processing costs	A$/t	na	na	na	(138)	(141)	(144)	(146)	(149)	(152)
Other costs	A$/t	na	na	na	(45)	(46)	(47)	(48)	(49)	(50)
EBITDA margin	A$/t	na	na	na	171	174	178	181	185	188
EBITDA margin	%	na	na	na	48%	48%	48%	48%	48%	48%

Source: Company, State One Stockbroking forecasts

Figure 6: Urea: unit revenue and costs (A$/t)



Source: State One Stockbroking forecasts

Based on our cost and revenue assumptions, we calculate unit EBITDA of ~A$170/t of urea, equivalent to an EBITDA margin of 48%.

Alternative valuation method: EV/GJ peer comparative

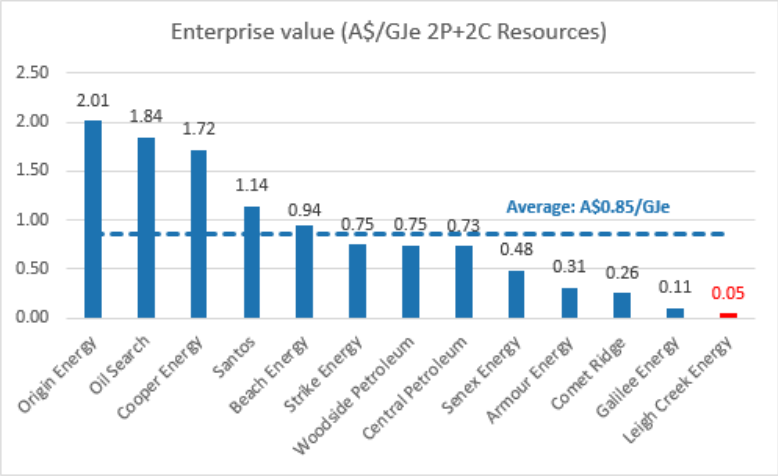
The share prices of global and domestic oil and gas plays have been negatively impacted in recent weeks by market reaction to the dispute between Saudi Arabia and Russia over oil production strategies. Broader market volatility over steps being taken by global governments to combat the COVID-19 pandemic have also had an impact. As a result, we suggest that oil and gas share prices at the end of 2019 give a better "undistorted" insight into EV/GJ valuations. At LCK's end-2019 enterprise value (EV) of A$125m we calculate that the market values LCK at A$0.05/GJe (rounded) – based on the group's 2P Reserves and 2C Resources of 2,622PJ of syngas. This is below the average A$0.22/GJ attached to unconventional gas (coal seam/shale) developers Comet Ridge (ASX:COI), Galilee Energy (ASX:GLL) and Strike Energy (ASX:STX), and significantly below the average of A$0.83/GJe attached to junior oil and gas producers and A$1.09/GJe attached to the ASX's energy "majors".

Figure 7: Selected ASX-listed oil and gas stocks: enterprise value per GJe

Company	Ticker	Share price (A$)	Total shares (million)	Mkt Cap (A$m)	Cash (A$m)	Debt (A$m)	EV (A$m)	1P	2P	2C	EV/1P	EV/2P	EV/ (2P+2C)	Gearing D/(D+E)
								price equivalent basis						
								PJe	PJe	PJe	A$/GJe	A$/GJe	A$/GJe	%
Large Cap "Majors"				**78,744**	**6,508**	**20,802**	**93,038**	**17,305**	**26,057**	**59,595**	**5.38**	**3.57**	**1.09**	**21%**
Beach Energy	BPT	2.44	2,279	5,561	172	0	5,389	2,201	3,673	2,031	2.45	1.47	0.94	0%
Oil Search	OSH	7.32	1,525	11,163	538	3,531	14,156	2,486	2,887	4,807	5.69	4.90	1.84	24%
Origin Energy	ORG	7.99	1,761	14,070	1,546	7,496	20,020	2,880	4,799	5,166	6.95	4.17	2.01	35%
Santos	STO	8.21	2,100	17,241	1,215	4,251	20,277	3,651	6,376	11,383	5.55	3.18	1.14	20%
Woodside Petroleum	WPL	32.60	942	30,709	3,037	5,524	33,196	6,087	8,322	36,208	5.45	3.99	0.75	15%
Junior Producers				**1,662**	**254**	**394**	**1,802**	**895**	**1,472**	**694**	**2.01**	**1.22**	**0.83**	**19%**
Armour Energy	AJQ	0.06	589	35	9	59	85	40	124	149	2.14	0.69	0.31	62%
Central Petroleum	CTP	0.18	782	137	18	82	201	136	166	107	1.47	1.21	0.73	37%
Cooper Energy	COE	0.57	1,700	969	164	214	1,019	256	354	238	3.98	2.88	1.72	18%
Senex Energy	SXY	0.35	1,487	520	63	40	498	463	828	199	1.07	0.60	0.48	7%
CSG/Shale explorers/developers				**864**	**36**	**3**	**830**	**18**	**172**	**3,587**	**46.13**	**4.83**	**0.22**	**0%**
Comet Ridge	COI	0.28	751	207	12.9	0	194	18	172	582	10.76	1.13	0.26	0%
Galilee Energy	GLL	0.98	282	276	11.5	0	265	0	0	2,508	-	-	0.11	0%
Strike Energy	STX	0.24	1,620	381	11	3	372	0	0	497	-	-	0.75	1%
UCG				**124**	**3.1**	**4.0**	**125**	**0**	**1,153**	**1,469**	**-**	**0.11**	**0.05**	**3%**
Leigh Creek Energy	LCK	0.21	605	124	3.1	4.0	125	0	1,153	1,469	-	0.11	0.05	3%

Source: Companies, IRESS, compiled by State One Stockbroking. Note for the purposes of peer comparison, we convert oil to GJ on a price equivalent basis of 1bbl oil = 8GJe, rather than the calorific or energy conversion rate of 1bbl oil = 6GJe

Figure 8: Peer comparative: EV/GJe



Source: Companies, IRESS, compiled by State One Stockbroking. Note: EV/GJ valuations based on end-2019 share prices

Although ASX-listed energy plays are trading at a (simple) peer-average EV of A$0.85/GJe, we suggest that the lower A$0.22/GJe attached to unconventional (CSG/Shale) developers is a more appropriate benchmark. Applying a more conservative A$0.15/GJ to LCK's 2P+2C Resource of 2,622PJ syngas - to account for the early stage nature of the LCEP commercialisation pathway - indicates a m'cap for LCK of A$386m or A$0.64 per fully-diluted share. Applying the unconventional gas developer average EV of A$0.22/GJe indicates a share price value closer to A$1.00.

Figure 9: EV/GJ valuation sensitivity

Resource unit EV (A$/GJe)	0.05	0.10	**0.15**	0.20	0.25
LCK 2P+ 2C Resource (PJ)	2,622	2,622	2,622	2,622	2,622
=> Resource EV (A$m)	125	256	387	518	649
Net debt (A$m)	-0.9	-0.9	-0.9	-0.9	-0.9
=> Market capitalisation (A$m)	124	255	386	517	648
LCK shares diluted (million)	*605*	*605*	*605*	*605*	*605*
LCK share price value (A$)	0.21	0.42	**0.64**	0.86	1.07

Source: State One Stockbroking

Recommendation

LCK's current commercialisation options include supplying pipeline gas to the EC market and/or on-site production of nitrogen-based fertilisers. **We believe that the urea route is the more likely path.** A simple average of our estimated Urea Project NPV of A$0.55ps and our EV/GJ peer comparison valuation of A$0.64ps indicates a target price for LCK of A$0.60ps. Thus, at current share price levels, we believe that LCK offers attractive upside potential. In addition, LCK has signed a HOA with its majority shareholder China New Energy Ltd, to commence ISG opportunities in China, while the recently announced farm-in of prospects in the Cooper and Eromanga Basins could offer additional upside potential.

Speculative Buy to A$0.60ps

We believe that LCK offers exciting capital upside for speculative investors as the LCEP is progressively de-risked. Recommendation: Speculative Buy. Risk: Higher

Risks

Risks to our estimated target price and forecast earnings profile include, but are not limited to:

- East coast gas and South Australian electricity prices. Domestic gas prices may be impacted by overseas LNG prices which in turn may be impacted by the US$ oil price and the USD:AUD exchange rate. SA electricity prices may be impacted by commercial and industrial demand and the increase in renewable energy (specifically wind and solar-generated electricity).
- Decline in east coast gas demand due to slower than expected demand for primary (gas) or secondary power (electricity), or an increase in renewable energy (wind, solar, battery).
- An increase in available gas to the domestic market: established east coast gas producers/developers may convert undeveloped 2P Reserves to Developed or convert Contingent Resources (2C) to 2P Reserves, or new gas explorers/developers appear.

- LCK meeting all licensing and approvals as per the Petroleum and Geothermal Energy Act (PGE) in South Australia, i.e., state approval to develop the LCEP.
- Community buy-in, i.e., establishing and maintaining a "social licence" to operate with landowners (indigenous and pastoral), and regional communities. We note that in LCK's September 2019 Quarterly Update, results from a Community Sentiment survey stated that "…potential benefits from the energy project outweigh the concerns. They have hope that the project will bring renewed prosperity to the area and are optimistic that new jobs, services and amenities will be available to them as a by-product of the Leigh Creek Energy Project".
- **Timely progression on gas and fertiliser commercialisation options.** Central to this progress is securing long-term gas and/or electricity offtake contracts/commercial arrangements and securing funding (cost of funding / funding mix). **There is no guarantee when, or if, commercial offtake agreements or JV partnerships will be successfully negotiated between LCK and potential third parties**.
- Technical risks associated with the ISG process, geology risks associated with the coal Resource, surface processing risks associating with cleaning the syngas to methane.
- Key personnel risk.
- **Working capital requirement**. With poor visibility on the timing of revenue/income streams, we assume near-term working capital and capex requirements of ~A$8mpa will be funded from FY21E via future capital raisings at an assumed issue price of A$0.20ps.

Fertilisers - Background

A fertiliser is any material of natural (i.e. guano, manure) or synthetic origin that is applied to soils or to plant tissues (usually leaves), and which supplies the plant with nutrients.

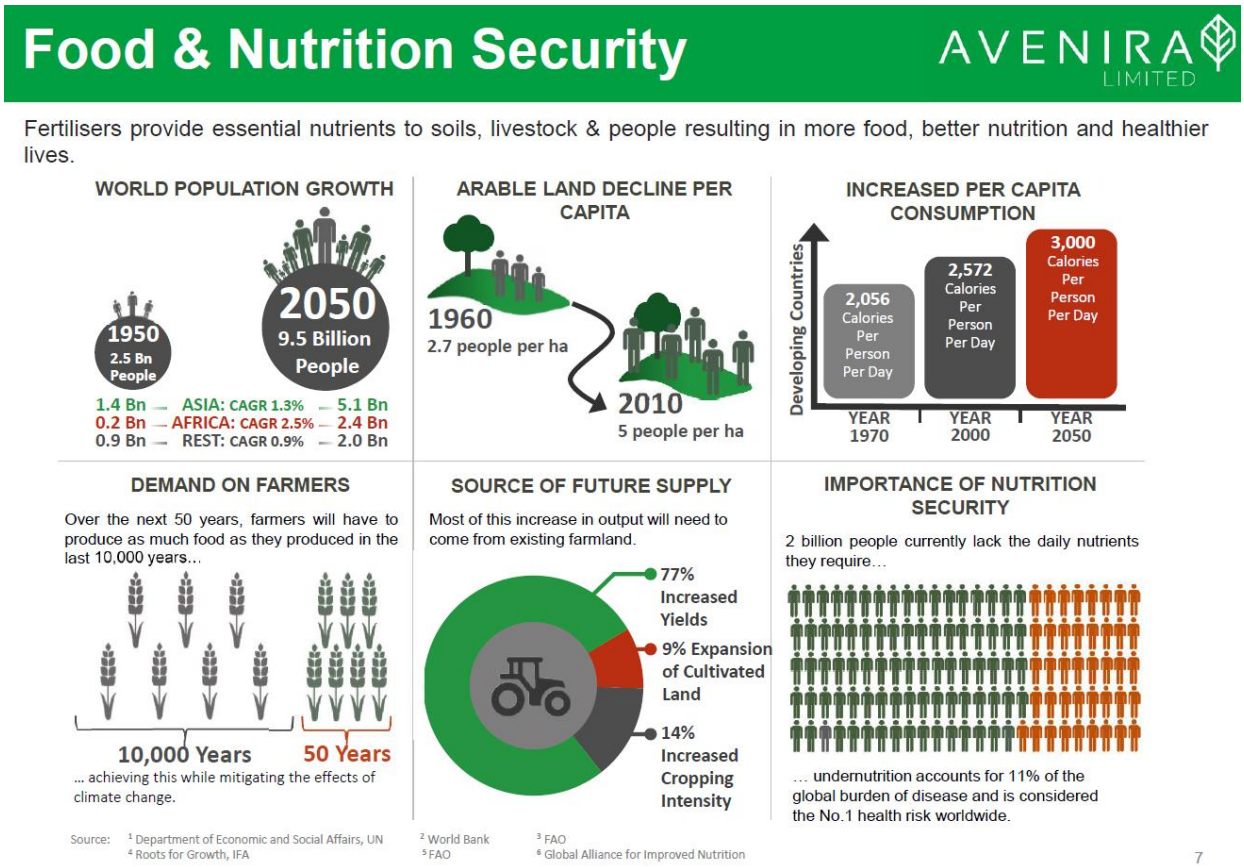
Fertilisers typically provide, in varying proportions:

- Three main macronutrients,
  - Nitrogen (N): leaf growth
  - Phosphorous (P): development of roots, flowers, seed, fruit
  - Potassium (K): stem growth, movement of water in plants.
- Three secondary macronutrients – Calcium, Magnesium, Sulphur.
- Micronutrients – Cu, Fe, Mn, Mo, Zn, B, other.

Fertilisers can be classified according to whether they provide a single nutrient (N, P, or K) or two or more nutrients (i.e., NPK fertilisers).

Over the past 40 years (1976-2016), N, P, and K consumption in fertilisers has grown at 1.4%, 1.7%, and 2.8%pa respectively. A growing global population, combined with economic uplift in developing countries (leading to increased demand for more protein-rich diets) will undoubtedly require an increase in (global) agricultural productivity. This is turn, is expected to increase fertiliser demand above historical CAGRs.

Figure 10: Factors driving fertiliser demand



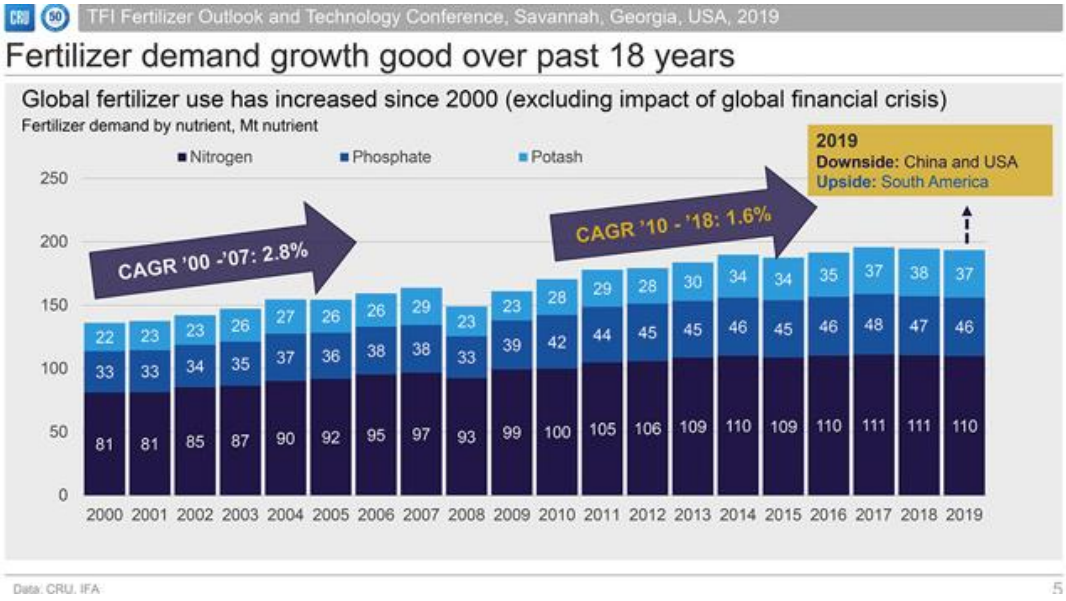
Source: Avenira

Nitrogen (N)

Globally, total fertiliser production by nutrient is ~200Mtpa, with nitrogen (N) accounting for some 55% of this total.

Nitrogen fixation, the process by which molecular nitrogen in the air (N_2) is converted to ammonia (NH_3) or related nitrogenous compounds in the soil, is vital for plants to survive and grow. However, only a very small number of plants, most notably legumes (such as peas, beans and lentils) can fix nitrogen from the atmosphere with the help of nitrogen fixing bacteria. Most plants must obtain nitrogen from the soil (bacteria, manure, decomposition), and for most crops being commercially grown across the world, this also means a reliance on synthetic nitrogen fertiliser.

Figure 11: Global fertiliser demand – by nutrient (Mt)



Source: DTN

The most common synthetic nitrogen fertiliser used in agriculture is urea ($CO(NH_2)_2$) - which has now largely replaced ammonium nitrate (used as an explosive in mining operations). Urea - commercially produced from liquid ammonia and liquid carbon dioxide - is a crystalline solid containing 48% nitrogen; in this form the nitrogen is readily converted to ammonia in the soil, is organic (containing carbon), can be incorporated in mixed fertilisers as well as being applied alone, and importantly, is more easily/safely transported and applicable as a fertiliser.

Australia fertiliser use

(Source: ABS, Land Management and Farming in Australia, 2016-17)

- An estimated 57,300 agricultural businesses applied 5 million tonnes of fertiliser to a total of 50 million hectares of agricultural land across Australia in 2016-17, a 4% decrease in the area to which fertilisers were applied.
- By area, ammonium phosphates continued to be the most widely used fertiliser in 2016-17. However, the area to which it was applied decreased by 8% to 13 million hectares and the tonnes applied decreased by 14% to 963,000 tonnes.

- Urea continues to be the most applied fertiliser in 2016-17, both by the amount applied and the number of businesses using it. While the area on which urea was applied decreased 5% to 11 million hectares, the amount applied was virtually unchanged from 2015-16 at 1.4 million tonnes. Nationally, 21,800 agricultural businesses applied urea in 2016-17, a 2% decrease from 2015-16.

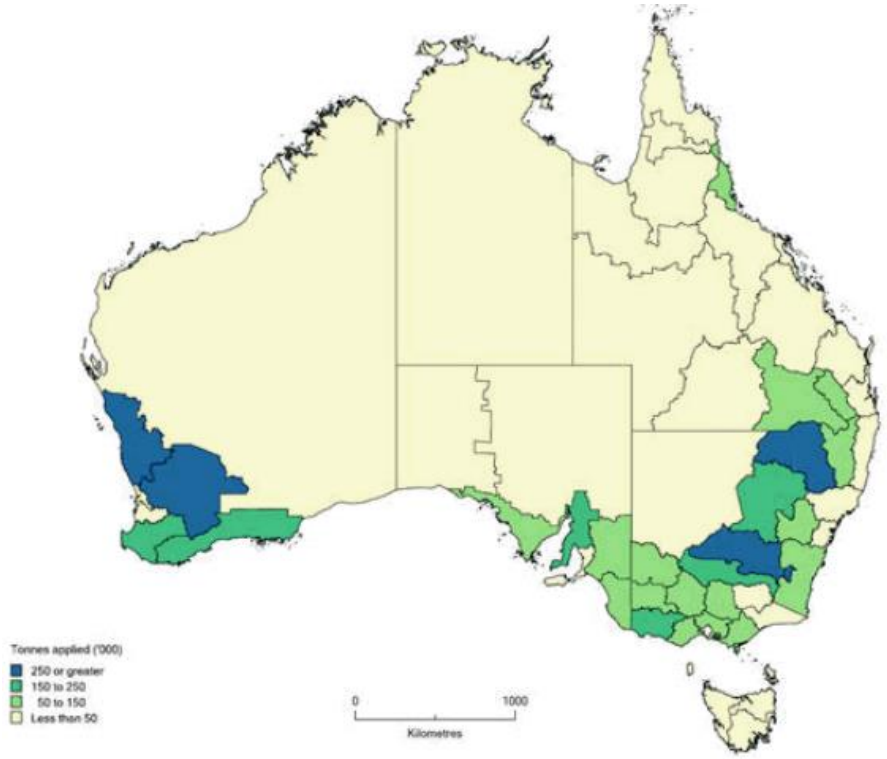
- Agricultural businesses in Western Australia continued to fertilise the largest areas of land with 19 million hectares reported in 2016-17 or 37% of Australia's total area of agricultural land fertilised. Both Western Australia and New South Wales (including the ACT) used the largest amounts of fertiliser during 2016-17 with both applying just over 1 million tonnes.

Figure 12: Fertiliser use in Australia (year ended 30 June 2017)

Fertiliser type	Area applied to ('000 ha)	Movement since 2015-16 %	Amount applied ('000 t)
Nitrate slow release fertiliser	1 635	5.9	151
Urea slow release fertiliser	2 471	103.1	291
Other slow release fertiliser	877	33.1	85
Urea	11 174	-5.0	1 387
Ammonium sulphate	1 464	-14.5	146
Urea ammonium nitrate	3 484	-11.5	na
Anhydrous ammonia	261	-19.7	35
Potassium nitrate	158	-43.1	25
Ammonium phosphates	13 192	-8.2	963
Other nitrogen based fertilisers	2 082	55.9	288
Single superphosphate	5 317	6.9	700
Double and/or triple superphosphate	1 575	23.4	176
Other phosphorous-based fertilisers	3 752	30.7	359
Muriate of potash and/or sulphate of potash	1 872	-19.2	140
All other fertilisers	1 068	-73.6	125
All fertilisers	**50 383**	**-4.3**	**4 873**

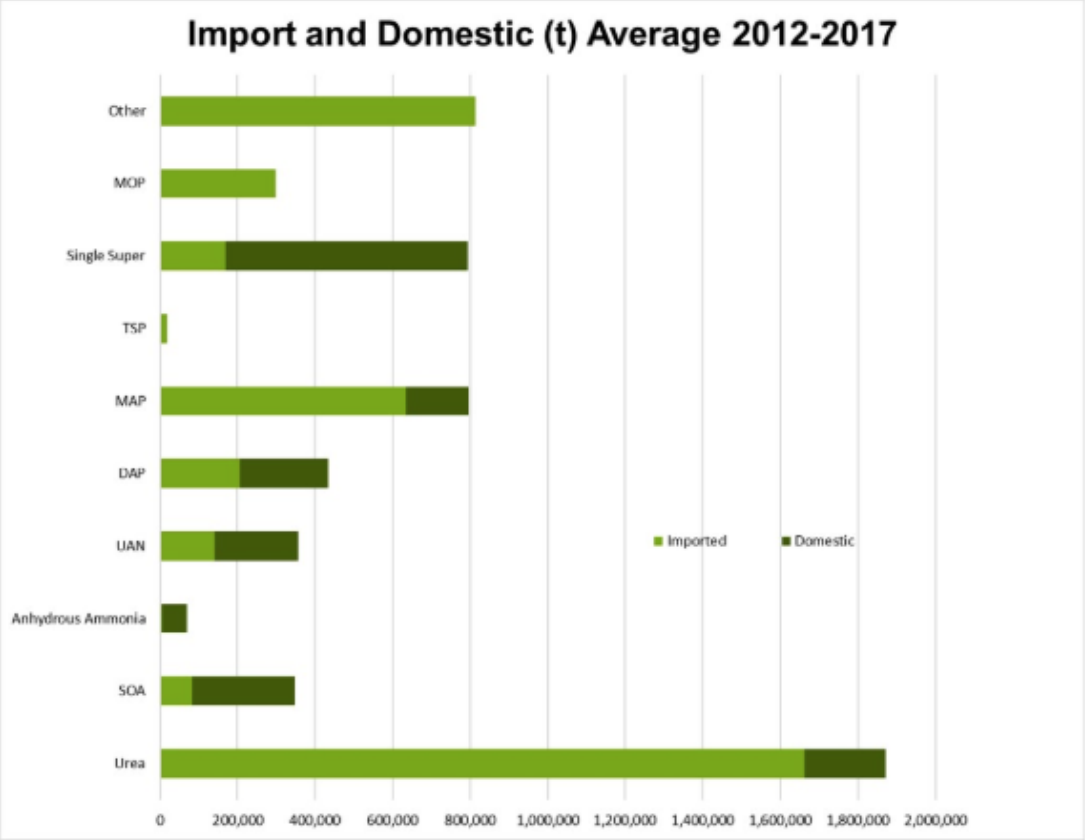
Source: ABS

Figure 13: Fertiliser applied by tonnes ('000t). Source: ABS



From 2002 to 2017 average sales of fertiliser in Australia was 5.4Mt, providing some 1Mt of nitrogen, 400kt of phosphorous and 200kt of potassium. Australia is heavily dependent on imported product and particularly dependent on imported urea. Some 90% of the country's urea requirement is imported, particularly from the Middle East (Saudi Arabia, Qatar, Kuwait), China, and the USA. Incitec Pivot's (ASX:IPL) is currently Australia's sole manufacturer of granular urea. IPL's fertiliser division is currently the subject of a strategic review that could lead to its sale. The strategic review was announced on the back of a challenging year which saw input costs (gas) rise and fertiliser demand fall as drought conditions caused a downturn in grain and crop conditions.

Figure 14: Australian fertiliser market



*The graph shows average fertilizer sales in Australia for the calendar years 2012 to 2017. *Domestic single super is manufactured from imported phosphate rock.*

Source: Fertiliser Australia

Perdaman Chemicals and Fertilisers (Perdaman) – a West Australian based multinational group - is proposing to develop a 2Mtpa ammonia/urea plant at Karratha Western Australia. The development, with an indicated development capex of A$4.3bn, has been named a Project of State Significance by the WA Government and received Major Project Status from the Federal Government. In November 2018, Perdaman signed a gas sale and purchase agreement with Woodside Petroleum (ASX:WPL); in August 2019, Perdaman signed a licensing and engineering contract for Haldor Topsoe's SynCOR Ammonia technology to be used at the plant. Financial close for the project is expected by the end of March 2020.

Leigh Creek Energy Project (LCEP)

Background

Leigh Creek Energy Limited (ASX:LCK) is an emerging gas company focused on developing its 100% owned Leigh Creek Energy Project (LCEP), located at Leigh Creek, 550km north of Adelaide in South Australia.

LCK - previously ASX-listed Marathon Resources Ltd - acquired the Project through the scrip acquisition of project owners, ARP TriEnergy Pty Ltd, in June 2015 (consideration: 138.3m LCK shares with a deemed value of A$27.6m, plus a royalty stream on production).

The company changed its name to Leigh Creek Energy Limited after a shareholder vote in August 2015.

The Project's key asset is 1,153PJ of PRMS-compliant 2P synthetic gas (syngas) Reserves and 1,469PJ of 2C syngas Resources, contained within 302Mt of JORC 2012-compliant Indicated and Inferred coal Resources.

Note: The 1,153PJ syngas Reserve derives from the Middle (or Main) coal seam- one of three coal seams that forms the group's coal Resource. Thus, the 2P Reserve relates to ~31% of coal available to the LCEP within the Telford Basin.

Figure 15: LCK coal and gas Resources (2019 versus 2018)

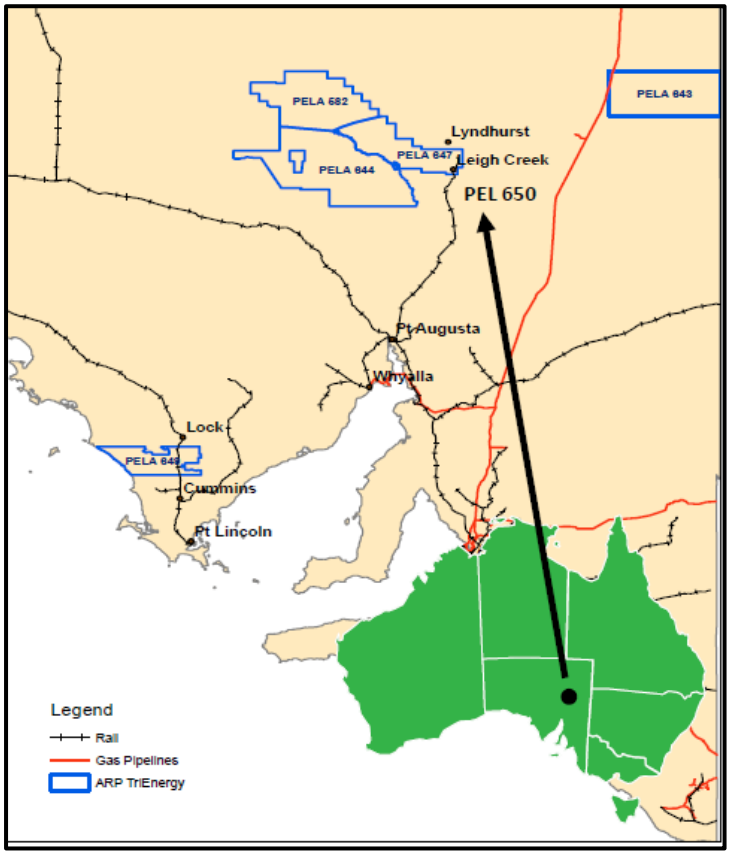
The Company's Coal Resource and equivalent Syngas Resource as at 30 June 2019, reported in accordance with 2012 Edition of the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code) guidelines and the 2018 Society of Petroleum Engineers (SPE) Petroleum Resources Management System (PRMS) guidelines (respectively), are:

Tenement	Location	Coal Resource Category	Coal Resources (Mt) 2018	Coal Resources (Mt) 2019	Syngas Resource Classification	Syngas Energy (Pj) 2018	Syngas Energy (Pj) 2019
Petroleum Exploration Licence 650	Leigh Creek	Indicated	–	186.6	1P Reserves	–	–
		Inferred	376.6	114.6	2P Reserves	–	1,153.2
					3P Reserves	–	1,608.3
					1C Resources	2,747.7	–
					2C Resources	2,963.9	1,469.0
					3C Resources	3,303.1	2,126.6

Source: Company

The gas Resource (Petroleum Resource Management System [PRMS]-compliant) is located within the 93km^2 Petroleum Exploration Licence PEL 650, which overlays Alinta Energy's Leigh Creek open-cut coal mine. Large-scale coal mining at Leigh Creek stopped in November 2015, and operations are currently limited to minor mining closure works. The captive Port Augusta coal-fired power stations fed by the Leigh Creek Coal Mine were shut in early May 2016 and have since been demolished. LCK also holds tenements surrounding, and to the north and west of PEL 650.

Figure 16: Location of LCEP and other licences



Source: Company

Note: LCK has indicated that it is looking to relinquish areas within PEL650 that do not have resources of interest

Since acquiring the Leigh Creek Energy Project in mid-2015, LCK has progressed on several key commercial, geological, and technical developments.

- The announcement in December 2015 of a JORC 2012-compliant maiden Inferred Resource of 377Mt of coal, followed by gasification test work on coal samples, and a subsequent PRMS-compliant estimated gas Resource (2C) of 2,964PJ in January 2016.
- A non-binding Heads of Agreement (HOA) signed with APT Pipelines, a subsidiary of APA Group (ASX:APA), which will allow the development of conceptual plans for the interconnection of the LCEP via a new pipeline with the east coast (EC) gas markets.
- A HOA signed with Shanghai Electric Power Generation Group, to establish a joint venture company in South Australia, with the intent to build, own and operate a gas-fired power station.

- A request by China Communications construction Company Ltd (CCCC) for LCK to sign a Heads of Agreement (HoA), providing joint opportunities for investing and developing infrastructure projects in South Australia.
- An initial five-year Gas Storage Exploration Licence (overlaying the Leigh Creek PEL 650), obtained from the Government of South Australia, Department of State Development; this gives LCK optionality between storing gas, or delivering gas to EC customers or a local power station (as per HOAs with APA and Shanghai Electric). It may allow sequestration of CO_2.
- **The announcement in March 2019 of an upgrade in the SPE-PRMS Resource to a Reserve following the successful operation of a Pre-Commercial Demonstration (PCD) plant.**
- A binding HOA signed in August 2019 with major shareholder China New Energy Ltd to commence ISG in China with a focus on hydrogen and fertiliser production.

Pre-Commercial Demonstration (PCD) Plant: Oct 2018-June 2019

A significant portion of the group's energies between 2016 and 2018 was directed at engaging with relevant local bodies and state government departments and obtaining approval for a pre-commercial gas production plant to be installed and operated at the Leigh Creek mine site. In September 2018, LCK received final approval for PCD operations. PCD operations commenced in October 2018 and were completed and the facility decommissioned by June 2019. The objectives of the PCD plant were:

- Technology validation: to demonstrate the ability to produce commercial quantities of syngas which would allow for the Resource (2C) classification to be upgraded to Reserves (2P),
- To get data on the minor constituents within gas composition, process control fundamentals, shutdown capabilities, and costs; all this data will ultimately feed into the process plant design and,
- To demonstrate to stakeholders (government, community, investors) that ISG could be safely carried out at the Leigh Creek site, with minimal impact on the environment.

The PCD operations were a success, producing syngas at over 1Mcf per day (with maximum flows recorded of over 7Mcfpd) and allowing for a significant component of the Resource to be upgraded to a 2P Reserve classification. On completion of plant shutdown in June 2019, LCK confirmed that there were no reportable incidents (injuries) at the site, that the process was operated and shutdown in a safe, regulated, and controlled manner, and that the company's monitoring regime has confirmed no environmental impacts or safety issues.

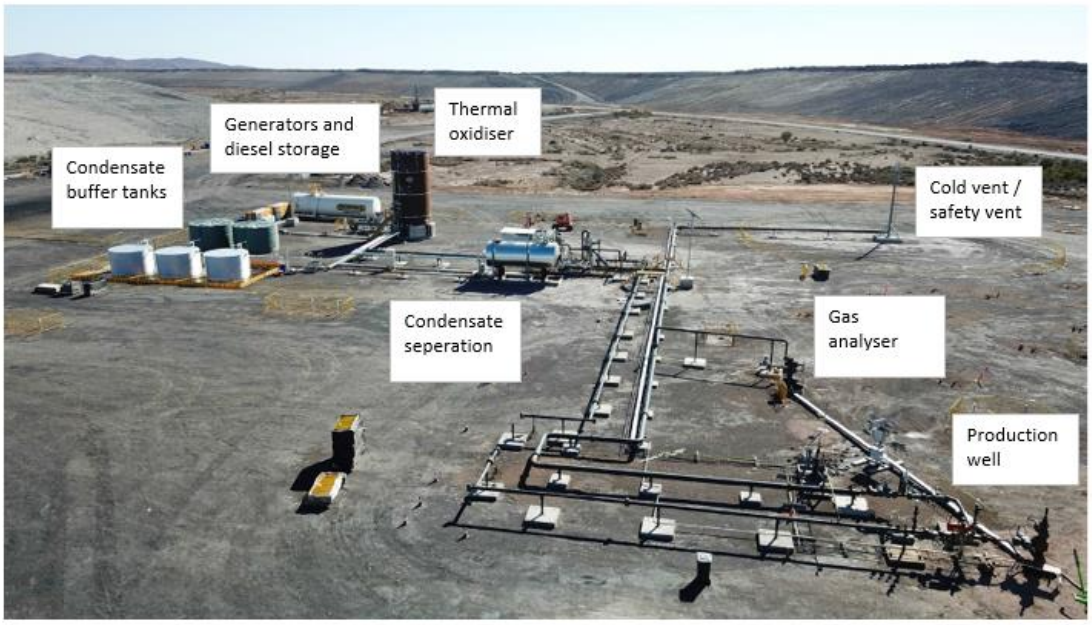
Furthermore, on 2 August 2019, LCK announced that it has substantively concluded its PCD data review with the South Australian Government Regulator. This confirmed that:

1. The PCD was operated in accordance with the approved Environmental Impact Report (EIR) and Statement of Environmental Objectives (SEO) without any environmental of safety incidents.

2. The PCD shutdown process would continue to be monitored as required by the EIR and SEO, and that LCK would provide a full Closure Report once monitoring was complete, and
3. The Regulator and LCK had agreed a process for the commercial phases of the LCEP.

Total expenditure associated with the gas demonstration was some A$18m (A$5m for site assessment, environmental base line studies, water monitoring wells, A$10m for plant and equipment, skids, thermal oxidiser, diesel storage, A$3m for admin and staffing).

Figure 17: PCD Plant infrastructure



Source: Company, State One Stockbroking

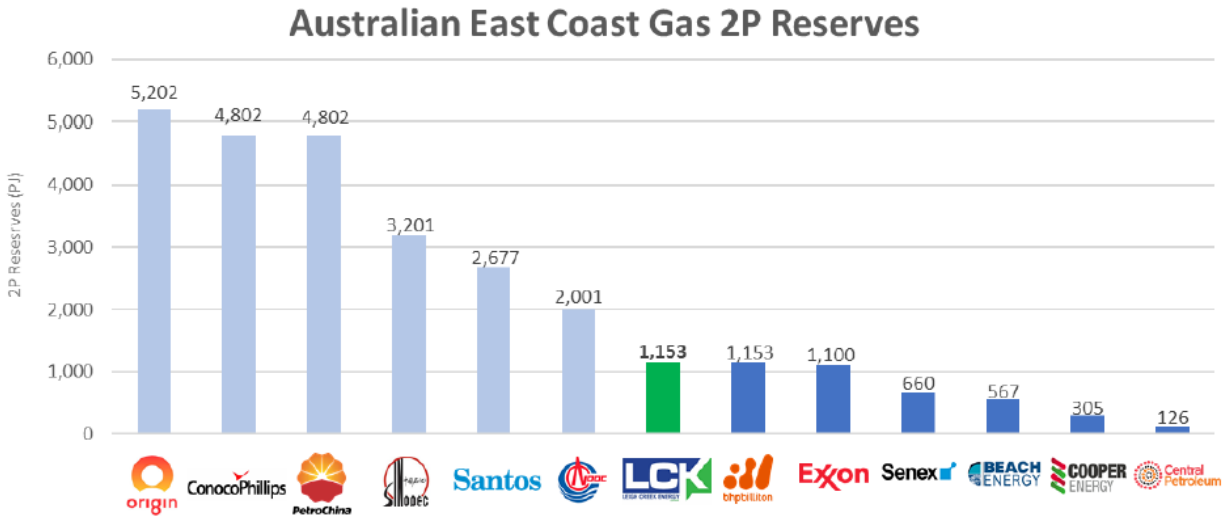
Figure 18: PCD Plant location at Leigh Creek: note barren/undeveloped landscape

Source: Company

2P Reserve comparison ……

The successful production of commercial gases at commercial quantities at the PCD Plant allowed for PRMS certification of 1,153PJ of 2P Reserves in March 2019. LCK's syngas Reserve now represents one of Eastern Australia's largest undeveloped and uncontracted gas reserves.

Figure 19: Peer comparison: 2P Gas Reserves



Source: Australian Energy Regulator 2018

NB: Light blue colour denotes that gas reserves for Origin Energy, ConocoPhillips, PetroChina, Sinopec, SANTOS and CNOCC are contracted to LNG export projects

Source: Company

….. a catalyst for renewed commercialisation discussions

The March 2019 2P Reserve announcement has "kickstarted" the advancement of negotiations with multiple potential strategic partners with significant energy operations domestically and in key international markets.

In a May 2019 announcement, management stated that "The Company had already been in discussions with over a dozen potential partners prior to the (March 2019 Resource upgrade) announcement and has held a significant number of meetings with those interested parties since then. Several of these partners have engaged with LCK over a considerable amount of time, however, they required an independent reserve report and production data from the PCD before they could progress negotiations on a commercial basis".

Commercial discussions with other parties vary from Gas Sales Agreements and HOAs to LCK's willingness to accept an investment or strategic funding and/or project finance. Discussions have progressed to the point where LCK has engaged legal counsel to draft and document these commercial arrangements.

Management is actively investigating funding options and opportunities to enter into binding agreements with offtake partners

Although management have indicated that the two main commercialisation options being considered are (1) pipeline gas sales to the EC and/or (2) feedstock for high-value nitrogen fertilisers, we suggest that corporate activity either at the project (LCEP) or equity level, should not be ruled out. We note that Beach Energy's 2017 purchase of Origin Energy's LatticeEnergy for A$1.585bn equated to ~A$1.19/2C GJ; Mitsui's 2018 acquisition of AWE for A$602m equated to ~A$1.17/2C GJ. More recently, Australia Pacific LNG's Feb 2019 US$165m acquisition of Origin Energy's Ironbark Gas Project (129PJ 2P Reserve) equates to A$1.79/GJ. We calculate that LCK is currently trading at A$0.11 per 2P GJ (A$0.05 per 2P+2C GJ).

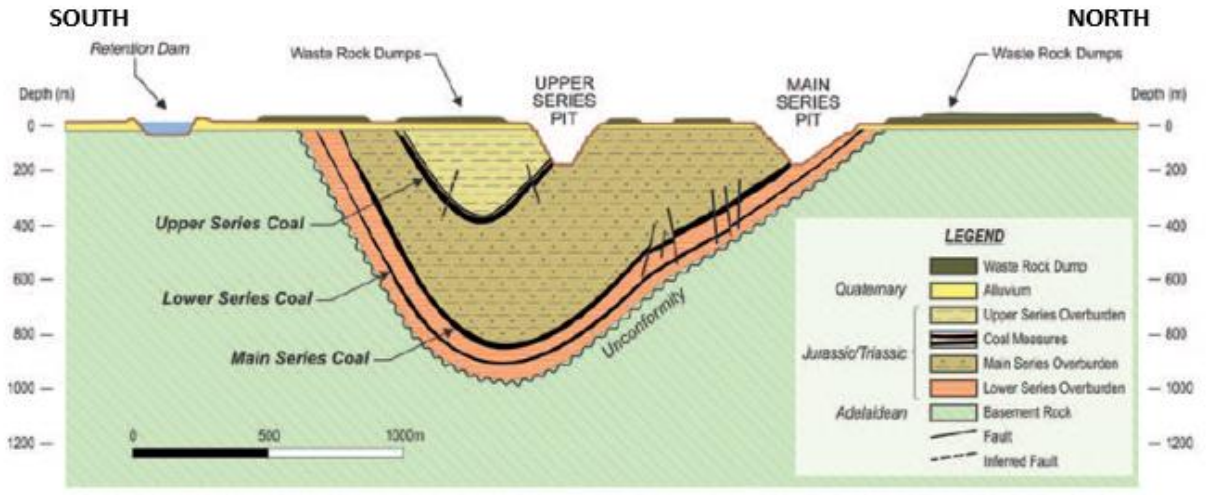
Leigh Creek Mine

Leigh Creek Coalfield, which closed in November 2015, operated for over 100 years

The Leigh Creek coal mine, closed November 2015, operated as a "captive mine", railing up to 2.5Mtpa of low-grade, sub-bituminous black coal 260km south to Alinta Energy's Port Augusta Power Stations (closed in early May 2016). The power stations, mining rights at Leigh Creek coal mine, and Leigh Creek town (population 500) are owned by the South Australian government but were operated by Alinta Energy.

The coal occurs in several nested bowl-shaped seams, forming part of the Telford Basin syncline, each several metres thick (the Main Series coal seam is up to 18m thick in the open cut mine).

Figure 20: Telford Basin: schematic cross-section



Source: Company, State One Stockbroking

In December 2015, LCK announced a JORC 2012-compliant maiden Inferred Resource of 377Mt for the Leigh Creek coal mine. The Resource estimate was largely based on an extensive database of geological and drill-hole data provided by Alinta Energy. Following drilling by LCK between 2016 and 2018, the Resource was upgraded in 2019 to 187Mt of Indicated Resource and 115Mt of Inferred Resource. Management believes that further significant Resource extensions and upgrades (with potential increases to syngas Reserves and Resources) can be achieved from additional relatively modest infill drilling and seismic survey programmes, and further production testing.

Note: A prior study of Leigh Creek coal by Golder Associates in 1985 confirmed the suitability of the deposit (seam thickness, seam continuity, roof rock competence, ground water movement etc) for ISG

The syngas produced from the PCD operations was derived from the Main Series coal seam located at a depth of ~500m south in the Main Series. At these levels, gasification rates benefitted from coal seam thickness and increased hydrostatic pressure. Note: LCK's PCD operations achieved commercial rates of gas production from only one of the three coal seams. Reserve certification is expected to increase on the back of further drilling, seismic work, and production testing on the deeper parts of the Upper Series coal seam and the Lower Series coal seam.

Mining at the Leigh Creek Coalfield has been going on for over 100 years intermittently, and permanently since the 1940's till the recent mine closure.

However, except for some limited grading of waste heaps, the 7.5km x 4.5km mine site (Telford Basin) is largely un-rehabilitated. The mine closure has been completed as per SA Government approved mine closure plans; LCK is not responsible or required to do any rehabilitation activities, i.e., drainage control (surface water and groundwater), return of overburden and/or topsoil preservation, contour ripping, seeding with native vegetation, grading, sediment control, mine subsidence evaluation, dust control, solid waste control, infrastructure reclamation, etc.

Government and Social

At present, there are several moratoriums and/or restrictions impeding or preventing onshore coal seam gas (CSG) development in NSW, Victoria, Tasmania, and the Northern Territory (although recently a framework has been put in place by the NT Government for onshore gas development). In Queensland, there is a total ban on ISG development as it is deemed incompatible with the state's environmental and economic (CSG) needs. The Queensland government's negative stance towards ISG also stems, we suggest, from the state's unwillingness to have competing gas-extraction technologies competing over, and looking to exploit, the same coalfields. In effect, the Queensland government, not surprisingly in our view, favours more established CSG developers to supply Gladstone's massive (1,500PJpa) CSG-based LNG operations. In comparison to Queensland, South Australia, has a far smaller coal resource to exploit. The Leigh Creek coalfield is self-contained, is remote from major centres, in a largely un-rehabilitated pre-existing mine site with little surrounding agriculture, and critically, lies outside (to the south) of the State and Federal "legislatively sensitive" Great Artesian Basin. In addition, the Leigh Creek coal is not associated with CSG. We believe that with the recent closure of the Port Augusta coal-fired power station, ISG represents the only opportunity to monetise the Leigh Creek coal assets. The South Australian government is, we believe, committed to the responsible development of state natural resources, including ISG (note: ISG is specifically contemplated and supported by the state's Petroleum & Geothermal Energy Act). SA's 2012 Unconventional Gas Policy states that "(environmental issues) can be mitigated through careful project design, site selection and monitoring" and "ISG has enormous potential for harnessing the energy of coal resources that would otherwise be too expensive or difficult to reach". The PGE Act allows for incremental approvals and progress, while the SA Department of State Development (DSD) has a clear process - comprising 1) licencing, 2) environmental assessment, and 3) activity notification and approval – that should, in our view, facilitate project development.

South Australia – a supportive environment for unconventional gas development

Outside of offering the potential to contribute to the state's energy (gas) and/or fertiliser supply, the development of the LCEP would contribute to the state's revenue base and create much-needed jobs. The unemployment rate in SA is over 7 per cent compared to a country-side average of under 6 per cent. The closure of the Leigh Creek coal mine and Port Augusta power stations, and the uncertainty surrounding the Whyalla steel mill, add to the pressing need to find new regional employment opportunities. The future of the Leigh Creek town is, we suspect, of particular concern to the SA government. The town (20km south of the coal mine) was, until recently, operated by Alinta, but is now the sole responsibility of the state government, and is a key service hub, particularly for education & health, for the north-central region of the state. We believe that the government would be supportive of a company which could provide employment opportunities to the town's population and help maintain the town's key regional position.

Increasing need to find long-term quality employment opportunities in regional SA, and for the residents of the Leigh Creek town in particular

In-Situ Gasification (ISG)

Underground Coal Gasification (UCG) or In-Situ Gasification (ISG) is the process by which coal is converted to gases in-situ (i.e., while the coal is still underground) via a chemical reaction. ISG can be used to monetise coal resources that are either uneconomic to mine by conventional open cut or underground coal mining methods, or are inaccessible due to depth, geology or other mining and safety considerations.

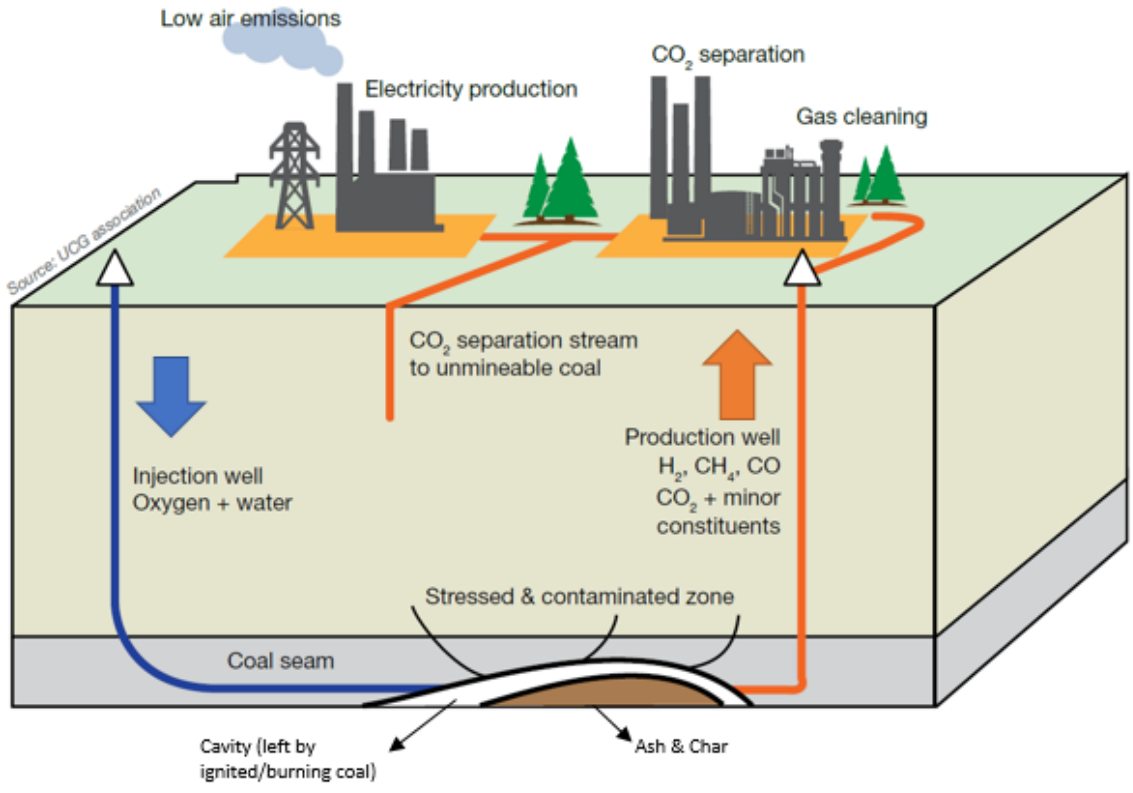
ISG is a very different process from that used to extract coal seam gas (CSG). ISG involves converting coal to a synthesised gas (syngas) - a mixture of hydrogen, carbon monoxide, carbon dioxide, methane, water vapour - via a chemical reaction. This syngas is then brought to surface, where it can be fully cleaned and processed to a synthetic natural gas (methane) or partially cleaned to feed modified gas-powered electricity generators, of used in downstream value-added processing (i.e., fertiliser manufacturing). In comparison, the CSG process involves dewatering coal seams to release coal seam gas (which is primarily a naturally occurring methane gas).

CSG coal is older and has decomposed partly into gaseous form; ISG coal has not decomposed – there is no gas until ISG processes are applied.

Process

ISG typically employs a minimum of two wells (an injection well and a production well) partly drilled into coal seam, often with a separate ignition well. An oxidant (air, oxygen enriched air, water/steam) is supplied via the injection well to the underground gasification chamber (section of partially ignited coal bed), and the resultant syngas is extracted via the production well to the surface for treatment and use.

Figure 21: Schematic diagram of traditional vertical well UCG process



Source: UCG Association, State One Stockbroking

Although ISG is conceptually very simple, the development of a working system has proved more difficult in practice. The main problems are accurate in-seam drilling, controlling the reaction within the seam, producing a consistent gas quality, and environmental concerns (particularly underground water/aquifer contamination and geotechnical stability). Meaningful experiments cannot be carried out in the laboratory, resulting in the need for expensive and time consuming gas (flare) demonstration trials. Comprehensive site and safety/environmental studies and economic evaluations are also required to convince financial investors and permitting authorities to support commercial projects. Pleasingly for ISG, the science of coal gasification is well understood and all surface equipment for gas processing is standard and readily available.

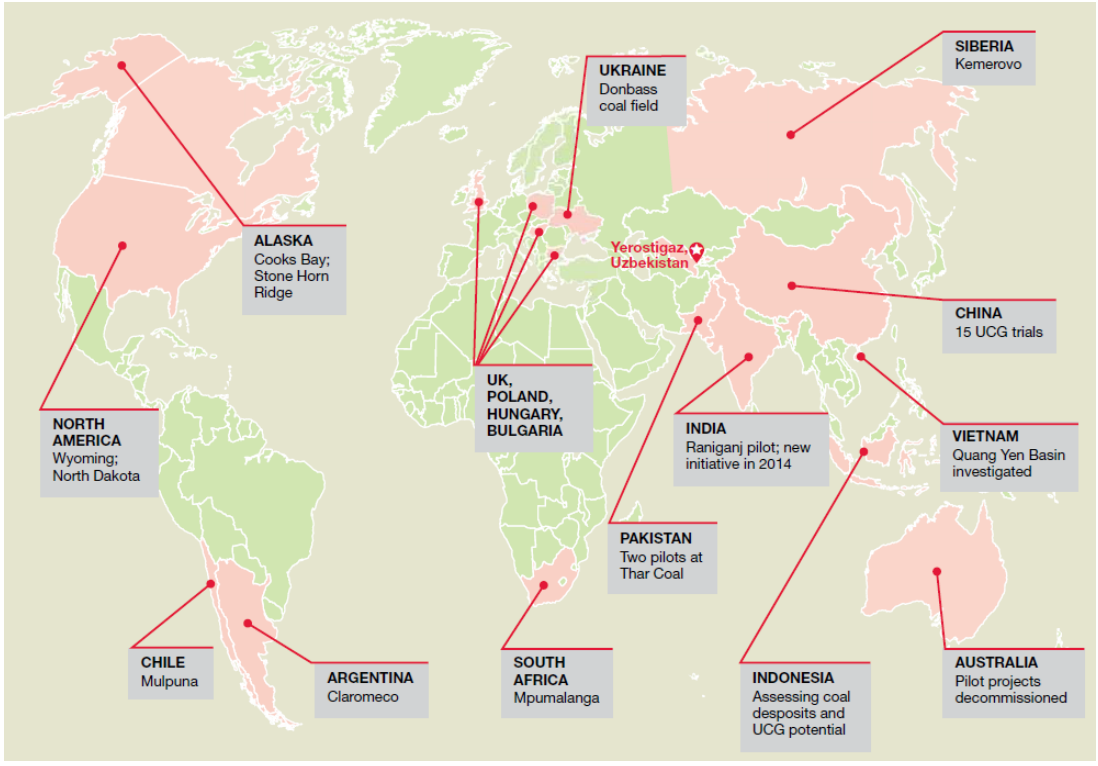
Few operational ISG plants in the world……but numerous developments

Projects: limited number of operations globally

The only commercial UCG facility currently operating in the world is in **Uzbekistan** where the Yerostigaz gasification plant (which uses Linc Energy's UCG technology) produces some 14PJpa of syngas (1 million m^3/d). After successfully completing a demonstration project, Swan Hills Synfuels is looking to develop a deep (1,400m) UCG project in Alberta, **Canada**, tied to a proposed 300MW combined-cycle power station. This project is on hold due to low gas prices in North America. A project to develop a 100MW UCG-fired pilot plant at the 4,110MW Majuba power station in **South Africa** was effectively abandoned in 2015 after disappointing gas production results. .

Nevertheless, development work on UCG Projects is taking place around the world as part of a broader global initiative to find clean-energy solutions and monetise stranded coal resources.

Figure 22: Worldwide ISG projects; a snapshot



Source: the chemical engineer (Feb 2014)

ISG in Australia

Prior to LCK's PCD facility at Leigh Creek, three separate ISG technology pilot plants were developed in Queensland: Cougar Energy's (now Moreton Resources ASX: MRV) Kingaroy Project, Singapore listed Linc Energy's Chinchilla Project, and Carbon Energy's Bloodwood Creek Project. Liquidators for Carbon Energy were appointed June 2019, delisted from ASX on 29 August 2019).

- The Kingaroy Project was closed down by the QLD government in mid-2010 on the back of water tests which showed a single low benzene contamination result.
- Despite operational success, Linc Energy's Chinchilla Project was abandoned in November 2013 on the back of rising opposition from regional environmental and farming activist groups, and - according to Linc's Peter Bond - an apparent lack of support from a State government which seemed to favour the rival CSG industry. Linc Energy is currently being sued by the QLD government for causing environmental damage to a 175km^2 swathe of southern Queensland farmland. In a Magistrates hearing during early 2016 the Chief Scientist representing the Qld government agreed that chemicals recovered from soil were naturally occurring across the region and could not be attributed directly to Linc Energy.
- Carbon Energy's pilot plant at Bloodswood Creek has been dismantled and the area is currently being rehabilitated. Approval of the Decommissioning Report and Rehabilitation Plan for Bloodswood Creek was seen as a key step for the company to proceed with commercialisation of its Blue Gum Project in the Surat Basin (2P Reserves of 1,128PJ, 3P + 2C Resources of 13,810PJ). However, **in mid-April 2016, the Ministers for Natural Resources and Mining (DNRM) and Environment and Heritage Protection (DEHP), elected to place a complete ban on UCG in Queensland**. Following Carbon Energy's liquidation, it is uncertain what is happening with the group's keyseam® USG technology and its licencing agreements and JVs in China.

ISG pilot plants in Australia prior to LCK:

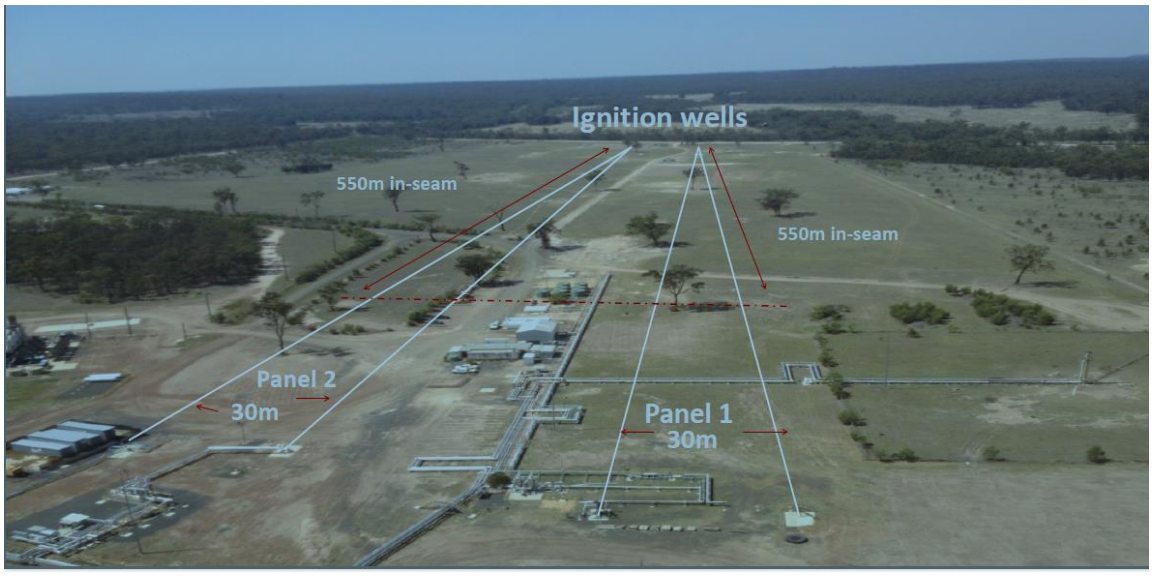
Cougar Energy

Linc Energy

Carbon Energy

…were all in Queensland

Figure 23: Carbon Energy's Bloodwood Creek Pilot Site (as in 2012)



Source: Carbon Energy

Chairman and MD information (Source: 2019 Annual Report)

Leigh Creek Energy Limited is a public company incorporated and domiciled in Australia and listed on the Australian Securities Exchange.

The directors present their report together with the financial statements of the consolidated entity, being Leigh Creek Energy Limited ("the Company" or "Leigh Creek Energy") and its controlled entities ("the Group") for the year ended 30 June 2019.

Directors

The names of the directors in office at any time during or since the end of the year are:

Daniel Justyn Peters (appointed 28 November 2014)
Phillip Staveley (appointed 5 December2017)
Gregory English (appointed 22 September 2015)
Murray Chatfield (appointed 30 June 2016)
Zhe Wang (appointed 1 July 2017)
Zheng Xiaojiang (appointed 5 December 2017)

Directors have been in office since the start of the financial year to the date of this report unless otherwise stated.

Information on continuing Directors

Daniel Justyn Peters LLB, BA (Politics/Jurisprudence) GDLP

Executive Chairman

Audit and Risk Committee Member

Director since 2014

Experience & expertise

Mr Peters joined Linc Energy soon after its listing on the ASX when Linc Energy was considered a world leader in underground coal gasification. In his six years at Linc Energy Mr Peters held the positions of General Manager Environment and Government Relations, General Manager Business Development, Executive General Manager North Asia and finished as Executive General Manager of Investor Relations.

Prior to joining Linc Energy Mr Peters was employed as National Property and Environment Manager and head of North Asia for Airservices Australia, and prior to his time with Airservices Australia Mr Peters was employed at the Queensland Environmental Protection Authority (EPA) as head of Investigations and Compliance and as acting Director of Central and Northern Regions. He managed the integration of the environmental regulation of the Queensland Mining Industry into the EPA. His experience across a broad range of business units from both government and private sector will prove invaluable in developing the Leigh Creek Energy project.

Other current listed directorships: None

Previous listed directorships (last three years)

Emperor Energy Ltd – resigned 27 March 2019

Phillip Staveley CPA, BA (Acc) (Hons), Dipl Btr

Managing Director

Director since 2017

Experience & expertise

Mr Staveley is a qualified Accountant who has 30 years' experience working in the resources sector.

He started his career in the oil and gas sector working for Schlumberger in London, followed by a number of years with SAGASCO and SAOG (South Australian Oil and Gas Company). He spent almost ten years with Normandy Mining Ltd. Whilst with Normandy he fulfilled a number of planning, finance, M&A and commercial roles, including the establishment of a Group Supply Function and three years based in Rio de Janeiro as the CFO of TVX Normandy Americas.

Since 1998 he has been involved in mining and contracting companies in the position of CFO and more latterly, CEO roles with an emphasis on strategy and corporate finance.

Other current listed directorships: None

Previous listed directorships (last three years)

Oakdale Resources Limited

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