Silex Systems Ltd

(SLX $1.02) Speculative Buy - Initiation of Coverage

EUROZ HARTLEYS

Analyst	Date	Price Target
Steven Clark	27th July 2021	$1.80/sh

Tails Never Fail

Key Points

- **We Initiate Coverage of SLX with a Speculative Buy rating and Price Target of $1.80/sh.**
- The SILEX process is a proprietary laser isotope separation technology employed to enrich uranium, silicon and other isotopes;
- It is the only privately held information that is classified by the U.S. and Australian governments;
- SLX (51% interest) and Cameco Corp. (49%, TSX: CCO, market cap ~US$7bn) recently completed the restructure of Global Laser Enrichment LLC (GLE);
- GLE has exclusive rights to:
  - commercialise the SILEX laser uranium enrichment technology;
  - access ~300kt of depleted uranium hexafluoride (UF_6) tails held by the US DOE in Paducah, Kentucky;
- There is a significant amount of value in the UF_6 tails waiting to be exploited;
- GLE proposes to construct a laser enrichment plant in Paducah to re-enrich high assay UF_6 tails (>0.25% U^{235}) to natural grade uranium (0.71% U^{235});
- Commercialisation via the Paducah Laser Enrichment Facility (PLEF) is asserted as commensurate to a Tier-1 uranium asset producing 5.2mlb U_3O_8 pa over a 30-year project life;
- Tier-1 uranium plays with inferior production profiles currently carry market capitalisations of >A$1bn;
- We value SLX's stake in the Paducah Project at A$334m ($NPV_{10}$), assuming:
  - Cameco exercises its option to acquire a further 26% stake in GLE from CY23 (CCO 75%, SLX 25% post-exercise) for A$160m;
  - Annual production of 2,000 MTU from re-enrichment of UF_6 tails from CY30 at avg. all-in costs of US$30/lb U_3O_8;
  - An additional 7% royalty stream on 100% of revenue generated by the SILEX technology is maintained by SLX;
- Our base case valuation ascribes no value to:
  - Enrichment of PLEF output to reactor grade fuel;
  - SLX's Zero-Spin Silicon Project, and;
  - SLX's revenue royalty stream on the cREO technology;
- We view the following as key catalysts for a rerating:
  - Uranium spot and term contract price increases;
  - Advancement of commercialisation to pilot scale;
  - Paducah site permitting;
  - Cameco option exercise;
  - Application of the SILEX technology to separation of alternative isotopes.

Silex Systems Ltd	Year End 30 June	
Share Price	1.02	A$/sh
Issued Capital		
Ordinary Fully Paid	172.8	m
Options	0.6	m
Dil FP Ordinary	**173.4**	**m**
Market Capitalisation	176.8	A$m
Enterprise Value	162.8	A$m
Cash (Jun-21e)	14.0	A$m
Debt (Jun-21e)	-	A$m

Directors

Craig Roy	Chairman
Michael Goldsworthy	Managing Director
Christopher Wilks	Non-Executive Director
Melissa Holzberger	Non-Executive Director

Substantial Shareholders

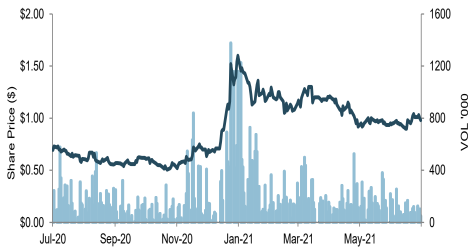
Jardvan Pty Ltd	17.3%

Company Details

enquiries@silex.com.au
www.silex.com.au

Lucas Heights Science and Technology Centre
New Illawarra Road
Lucas Heights NSW 2234

Share Price Chart



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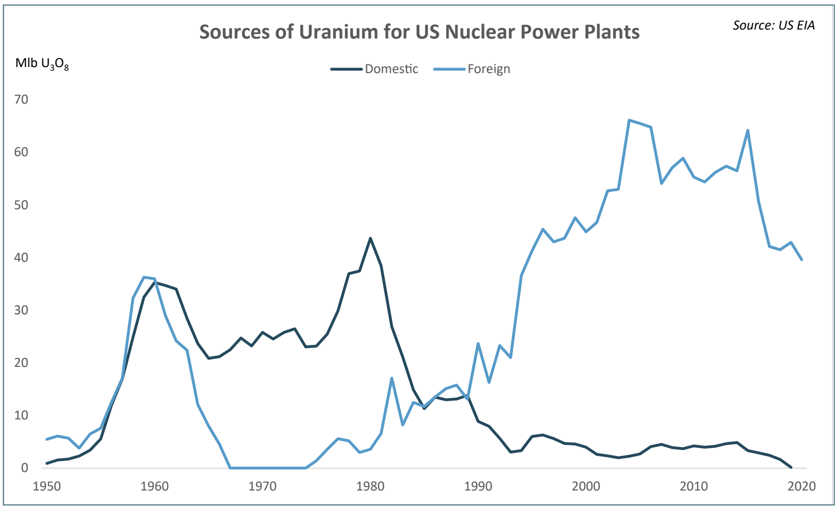
Key Variables

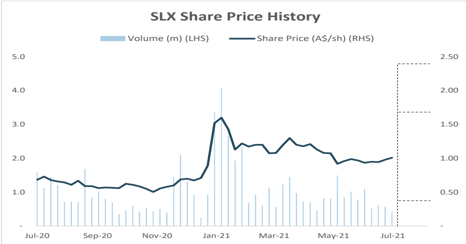
A$/sh		U$_3$O$_8$ Price (US$/lb)							
		35.0	40.0	45.0	50.0	55.0	60.0	65.0	70.0
AUD/USD (x)	0.78	0.93	1.09	1.24	1.40	1.56	1.71	1.87	2.03
	0.77	0.94	1.10	1.26	1.42	1.58	1.73	1.89	2.05
	0.76	0.95	1.11	1.27	1.43	1.59	1.75	1.92	2.08
	0.75	0.96	1.13	1.29	1.45	1.61	1.78	1.94	2.10
	0.74	0.97	1.14	1.30	1.47	1.63	1.80	1.96	2.13
	0.73	0.99	1.15	1.32	1.49	1.65	1.82	1.99	2.16
	0.72	1.00	1.17	1.34	1.51	1.68	1.85	2.02	2.18
	0.71	1.01	1.18	1.35	1.53	1.70	1.87	2.04	2.21
	0.70	1.02	1.20	1.37	1.55	1.72	1.90	2.07	2.24

A$/sh		Conversion Price (US$/kgU)							
		12.5	15.0	17.5	20.0	22.5	25.0	27.5	30.0
AUD/USD (x)	0.78	1.48	1.56	1.63	1.71	1.79	1.87	1.95	2.03
	0.77	1.49	1.57	1.65	1.73	1.81	1.89	1.97	2.05
	0.76	1.51	1.59	1.67	1.75	1.84	1.92	2.00	2.08
	0.75	1.53	1.61	1.69	1.78	1.86	1.94	2.02	2.10
	0.74	1.55	1.63	1.72	1.80	1.88	1.96	2.05	2.13
	0.73	1.57	1.65	1.74	1.82	1.91	1.99	2.07	2.16
	0.72	1.59	1.68	1.76	1.85	1.93	2.02	2.10	2.19
	0.71	1.61	1.70	1.78	1.87	1.96	2.04	2.13	2.22
	0.70	1.63	1.72	1.81	1.89	1.98	2.07	2.16	2.25

A$/sh		All-In Costs (US$/lb)							
		20.0	22.5	25.0	27.5	30.0	32.5	35.0	37.5
Discount Rate (%)	12%	1.55	1.50	1.45	1.40	1.35	1.31	1.26	1.21
	11%	1.78	1.72	1.67	1.61	1.55	1.50	1.44	1.39
	10%	2.06	1.99	1.93	1.86	1.80	1.73	1.67	1.60
	9%	2.40	2.33	2.25	2.18	2.10	2.02	1.95	1.87
	8%	2.83	2.74	2.65	2.56	2.47	2.38	2.29	2.20
	7%	3.35	3.25	3.14	3.03	2.93	2.82	2.71	2.61



Our Share Price Sensitivity



Our Market Sensitivity

Price Target: $1.80/sh
Valuation: $1.80/sh

Bull Scenario: $2.50/sh
LT uranium prices exceed EH forecasts and Cameco acquires an additional 26% stake in GLE. Non-uranium applications of the SILEX technology deliver material revenue streams as progression of GLE's commercialisation of the SILEX technology exceeds expectations.

Base Scenario: $1.80/sh
GLE progresses towards commercialisation of the SILEX technology in line with guided timelines. LT uranium prices rise to US$60/lb and Cameco acquires an additional 26% stake in GLE. Restoration of U.S. nuclear energy leadership provides strong tailwinds.

Bear Scenario: $0.40/sh
Uranium prices subside and sentiment weakens. GLE-DOE Sales Agreement for the Paducah Project is waived and commercialisation of the SILEX technology stalls.

Company Summary

Silex is an R&D development company whose primary asset is the SILEX laser enrichment technology, which has been under development for uranium enrichment jointly with its US-based licensee, GLE, for a number of years. Development operations continue in Sydney, Australia and Wilmington, North Carolina at GLE's Test Loop facility.

Disclaimer

The projections and information above is based on the set assumptions outlined. Due care and attention has been used in the preparation of this information. However actual results may vary from forecasts and any variation may be materially positive or negative. Forecasts by their very nature, are subject to uncertainty and contingencies, many of which are outside the control of Euroz Hartleys.

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Executive Summary

Cameco's LT investment provides third-party affirmation

The world's largest publicly traded uranium company in Cameco recently increased its 24% equity stake in GLE (held since 2008) to 49%. The Paducah Project presents as an avenue by which Cameco can satisfy a clear appetite for broadened fuel cycle participation, and we share Cameco's view that significant value lies in GLE's exclusive access to US DOE tails for re-enrichment purposes.

Potential free carry from CY23

Cameco holds an option to increase its stake in GLE to 75% by acquiring an additional 26% interest from SLX, which is exercisable from Jan'23 (being 2 years subsequent to the completion of the restructure of GLE). With reference to the valuation implied by the acquisition of Cameco's initial interest in GLE in 2008, our modelling assumes an inflow of A$160m upon Cameco exercising this option in mid-CY23.

A friend in the highest place a likely source of project finance

US$2bn is made available for facilities that employ innovative advanced nuclear facilities for the 'front-end' of the nuclear fuel cycle under the US DOE's federal loan guarantee authority for advanced nuclear projects. We note the definition of front-end nuclear facilities under the solicitation specifically includes projects or facilities that transform uranium tails to a higher isotopic content of U^{235} by laser isotope separation. SILEX is the only known laser enrichment technology currently in the process of commercialisation.

Environmentally conscious on account of Paducah clean-up

More than 60 years of uranium enrichment operations at the now-closed Paducah Gaseous Diffusion Plant (obsolete enrichment process) have generated hazardous radioactive waste and resulted in significant contamination issues. Remediation works are forecast by the US DOE to be completed in 2065 at an estimated total cost of ~US$17bn. The commercialisation of the SILEX technology via the Paducah Project is mutually beneficial through the lens of the US DOE given it will repurpose ~300kt of legacy waste that would have alternatively been deconverted by the US DOE with lower value extracted.

Optionality on expanded uranium enrichment market

Our valuation excludes any nominal valuation of GLE's planned expansion into the enrichment of natural uranium (PLEF output) to commercial-grade reactor fuel via additional capacity at Paducah. We see meaningful potential for GLE to disrupt a currently oligopolistic enrichment market dominated by four government-owned entities that enrich uranium to reactor-grade fuel via second generation centrifuge technologies.

Restoration of American nuclear energy leadership provides supportive backdrop

We note current bipartisan support for the reparation of a dangerously eroded US nuclear supply chain, which currently features domestic production of <0.1mlb pa, one domestic conversion facility (Honeywell Metropolis plant, due to restart in CY23) and one foreign-owned uranium enrichment plant. The SLX technology has the potential to provide a secure source of fuel supply to U.S. utilities which currently source <10% of deliveries from domestic suppliers.

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Valuation

Our SOTP valuation is outlined below:

	A$m	A$/sh
Paducah Laser Enrichment Facility	334.2	1.93
Corporate Overheads	(42.6)	(0.25)
Listed Investments	5.6	0.03
Cash (Jun-21e)	14.0	0.08
ITM Options	0.2	0.00
Total	**311.4**	**1.80**
Price Target	**1.0x NAV**	**1.80**

Our valuation is speculative in nature in the absence of available economic feasibility studies and an extensive timeline to commercial production (we assume first commercial cash flows from uranium enrichment in CY30).

Despite being developed privately since 1992, information relating to the SILEX technology has never been declassified by the US government under the terms of the Atomic Energy Act. Sensitivities around the classification of the SILEX technology contribute to limited public disclosure on the planned Paducah Laser Enrichment Facility. Many aspects of the SILEX process are also covered by proprietary restrictions.

Non-recurring cash flows

The License Agreement between GLE and SLX includes US$20m in payments to SLX triggered by various commercial development milestones. Our modelling recognises that each development milestone will be funded by Cameco and SLX via cash calls with reference to respective GLE ownership interests (we assume 75% Cameco / 25% SLX from CY23). Our financial model assumes timing of non-recurring items prior to commercialisation of the SILEX technology as follows:

Calendar Year	Amount (US$m)	Net SLX Amount (US$m)	Counterparty	Rationale
2023	160.0	160.0	Cameco	Payment for acquisition of additional 26% stake in GLE from SLX
2025	5.0	3.8	GLE	Commercial development milestone - commercial demonstration
2027	5.0	3.8	GLE	Commercial development milestone - commencement of PLEF EPC
2030	10.0	7.5	GLE	Commercial development milestone - commencement of operations
2031-35	(20.0)	(5.0)	GE-Hitachi	Deferred payments under GE-Hitachi sale agreement

Source: Euroz Hartleys, SLX

Cameco acquired a 24% stake in GLE for A$124m effective as of 19 June 2008, valuing the SILEX technology at A$514m, at which point in time the Test Loop Facility in Wilmington was the primary focus of GLE. We note that the purchase of Cameco's initial stake in GLE occurred prior to the achievement of the following significant milestones:

- **2012:** Approval of the first Construction and Operating License for a commercial laser enrichment plant – utilising the SILEX technology – in Wilmington, North Carolina by the US Nuclear Regulatory Commission.
- **2013:** Successful demonstration and validation of the SILEX technology at prototype scale via the Test Loop Facility, confirming the inherent efficiency of SILEX and triggering the receipt of a US$15m payment from GLE.

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- **2016:** GLE's acquisition of the exclusive right to purchase depleted UF_6 inventories from the US DOE, providing a reliable source of feedstock for commercialisation and paving the way for construction of the planned commercial laser enrichment facility in Paducah.

In recognition of the strategic value of the Paducah tails as an assured source of PLEF feedstock, along with the continuity of Cameco's investment in GLE since 2008, we apply a premium of 20% to the pro-rated valuation implied by Cameco's initial entry into GLE in assuming a capital inflow of A$160m in CY23.

Steady state cash flows

We assume commencement of production of natural grade uranium from the Paducah Laser Enrichment Facility in CY30 on conclusion of a 3-year construction period. We note the following assertions made by SLX in deriving the below high-level assumptions on steady state earnings:

- The PLEF production rate and subsequent sale of uranium into the market is likely to be regulated by the US government at 2,000 MTU per annum;
- Preliminary economic modelling of the Paducah Project indicates that it would rank as a large 'Tier 1' uranium mine with respect to the long-life and low-cost of production;
- Capital costs are guided by SLX to be half those of second generation centrifuge plant costs;
- An additional 7% revenue royalty will be derived directly by SLX on all revenue generated by the SILEX technology;

PLEF Steady State Modelling				
Variable	**Rationale**	**Units**	**EH Assumptions**	**EH @ Spot U_3O_8 Price**
Annual natural uranium production	US DOE production cap	MTU in the form of UF_6	2,000	2,000
Natural uranium production	1 kg U in UF_6 = 2.61285 lbs U_3O_8	Mlb U_3O_8	5.2	5.2
U_3O_8 price assumed	EHL Price Deck	US$/lb	60.0	32.5
Uranium conversion price	Spot Price	US$/kgU as UF_6	20.0	20.0
Initial capex	0.5x centrifuge plant capex	US$m	750.0	750.0
Steady state revenue	100% basis	US$m	416	273
SLX royalty revenue	7% of total revenue	US$m	29	19
SLX attributable revenue	25% basis	US$m	133	88
Total SLX revenue	**25% basis**	**US$m**	**162**	**107**
All-in unit costs (equivalency in lbs)	Upper end of Tier-1 cost curve	US$/lb	30.0	30.0
All-in costs	US$30/lb x 5.2mlb U_3O_8	US$m	156.0	156.0
SLX attributable expenditure	**25% basis**	**US$m**	**39.0**	**39.0**
Steady-state earnings	25% basis	US$m	123.4	67.7
After-tax free cash flow	25% basis	US$m	68.7	35.6
NPV_{10}		A$/sh	1.92	1.02

Source: Euroz Hartleys, Silex Systems Ltd, UxC

We see two key value drivers, being:

- the relative cost efficiency of the SILEX technology in comparison to existing uranium enrichment technologies, and;
- GLE's exclusive access to purchase 300kt of high assay (>0.25%) depleted UF_6 tails for re-enrichment purposes.

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In the absence of transparency on project economics, we conservatively assume equivalent unit operating costs at the upper end of the consensus definition of Tier-1 uranium assets at US$30/lb.

We anticipate GLE to realise a premium for the enrichment of the Paducah tails to natural grade uranium in the form of UF_6 considering the depleted UF_6 tails already capture the value of the mining, milling and conversion phases required for the enrichment of natural uranium in the form of UF_6 to reactor grade fuel. As opposed to uranium oxide concentrate (U_3O_8) produced from a mine, depleted UF_6 tails do not require preliminary conversion of U_3O_8 to UF_6 (gaseous form required for enrichment), and therefore our revenue modelling incorporates a premium equivalent to the conversion of 5.2mlb U_3O_8 per annum to UF_6.

Non-uranium revenue streams

SLX has two further potential revenue streams from the following projects:

- Commercialisation of the **Zero-Spin Silicon Project**, being the application of the SILEX technology to produce enriched silicon, a key enabling material for silicon quantum computers;
- Commercial adoption of the **Crystalline Rare Earth Oxide technology (cREO™)**, a 3% revenue royalty stream on a technology previously licensed to IQE Plc, a leading manufacturer of advanced semiconductor wafer products.

We conservatively assign nil value to these projects. Although both projects are forecast to have significant total addressable markets, we await further progress toward commercial uptake prior to assigning value to these non-core projects.

Funding

We assume cash and listed investments of A$20m at the commencement of FY22, with the remainder of SLX's listed investment in IQE Plc to be liquidated in FY22. We apply a risk adjustment factor of 80% to our valuation in recognition of potential equity dilution. We ultimately expect a significant portion of the Paducah Project's US$750m capital hurdle (and accordingly SLX's 25% share) to be funded by US government debt, noting the US DOE Loan Program Office's loan guarantee authority for Advanced Nuclear Energy Projects includes US$2bn specifically for front-end projects.

Enrichment of PLEF output to LEU

Our base case valuation excludes GLE's planned production of low enriched uranium (LEU, 5% U^{235}) via the enrichment of natural grade uranium in the form of UF_6. Rather than supply natural grade uranium produced from the initial plant to competitors for enrichment to LEU, additional capacity via a second stage enrichment plant at the Paducah site is planned to facilitate enrichment to LEU.

Although not incorporated into our valuation, we refer to the below assumptions in deriving the expectation of a facility with capacity of ~2.05 million Separative Work Units (SWU). Guidance is yet to be provided in respect of capital or operating costs for a second stage laser enrichment facility.

Variable	Rationale	Units	
Plant Feed	US DOE production cap	MTU in the form of UF_6	2,000
Tails assay	EHL estimate	% U_{235}	0.18
Feed assay	Natural grade	% U_{235}	0.71
Product assay	Upper end of LEU grade required for PWRs/BWRs	% U_{235}	5.00
EUP quantity	Urenco SWU calculator	kgU	220,337
Implied SWU capacity	Urenco SWU calculator	SWU	2,050,017

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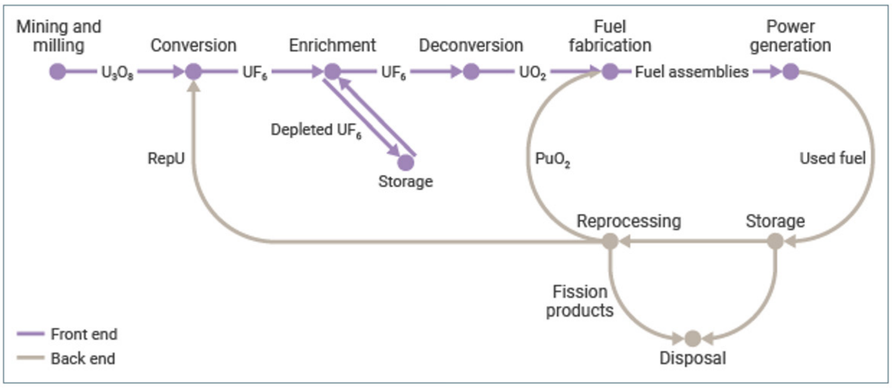
Uranium Enrichment

Uranium leaves the mine as the concentrate of a stable oxide (U_3O_8 or yellowcake) subsequent to milling. Uranium enrichment requires uranium as uranium hexafluoride (UF_6), a product of chemical conversion from U_3O_8. In order to use uranium in a nuclear reactor, it has to undergo mining and milling, conversion, enrichment and fuel fabrication, collectively referred to as the 'front-end' of the nuclear cycle.



Source: WNA

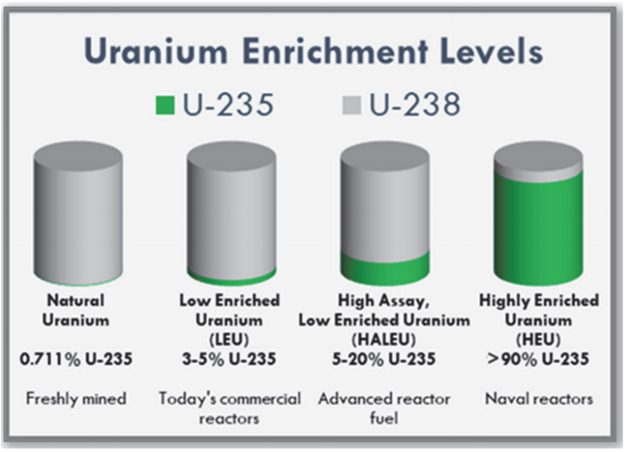
There are three naturally occurring isotopes of uranium:

Isotope	Natural abundance	Protons	Neutrons	Fissile nucleus?
U^{238}	99.3%	92	142	No
U^{235}	0.72%	92	143	Yes
U^{234}	0.01%	92	146	No

U^{235} is the only naturally occurring fissile isotope. The production of energy in nuclear reactors is from the 'fission' or splitting of the U^{235} atoms, a process which releases energy in the form of heat.

Natural uranium contains 0.7% of the U^{235} isotope. The remaining 99.3% is mostly the U^{238} isotope which does not contribute directly to the fission process. The difference in atomic mass between U^{235} and U^{238} allows the isotopes to be separated and makes it possible to enrich the percentage of U^{235} relative to U^{238}. All present and historic enrichment processes, directly or indirectly, make use of this small mass difference.

For the use of uranium as fuel in a light water reactor (LWR), the percentage of the fissile uranium isotope U^{235} has to be enriched from a content of 0.7% to 3-5% U^{235} (referred to as low-enriched uranium or LEU). This enables greater technical efficiency in reactor design and operation, particularly in larger reactors, and allows the use of ordinary water as a moderator.



Source: Centrus Energy

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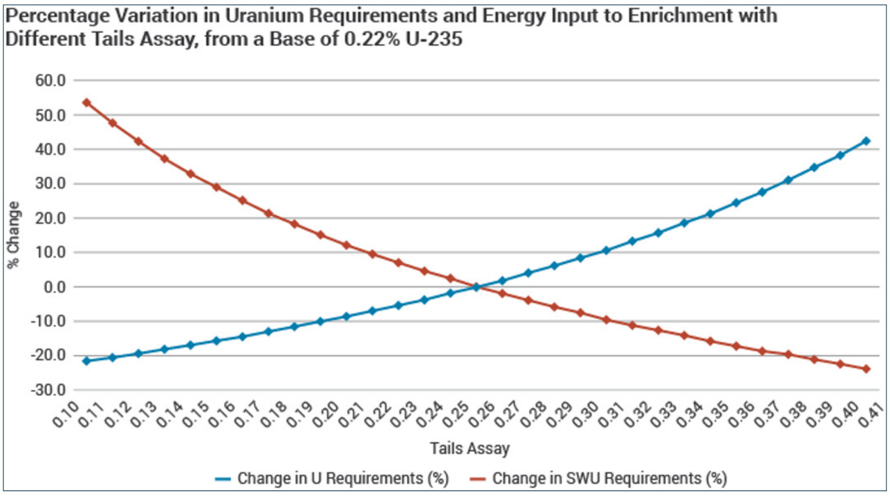
Depleted Uranium

Depleted uranium is a by-product from enriching natural uranium for use in nuclear power reactors. Every tonne of natural uranium produced and enriched for use in a nuclear reactor gives about 130kg of enriched fuel (3.5% or more U^{235}).

The balance is depleted uranium tails (U^{238}, typically with 0.22% U^{235} if from Western enrichment plants or 0.10% from Russian facilities). This major portion has been depleted in its fissile U^{235} isotope (and, incidentally, U^{234}) by the enrichment process. The tails assay (concentration of U^{235}) is an important quantity since it indirectly determines the amount of work that needs to be done on a particular quantity of uranium in order to produce a given product assay.

The capacity of enrichment plants is measured in terms of Separative Work Units (SWU). The SWU is a measure of the work expended during an enrichment process which indicates the energy input relative to the amount of uranium processed, the degree to which it is enriched (i.e. the extent of increase in the concentration of the U^{235} isotope relative to the remainder) and the level of depletion of the remainder (the tails). The unit is strictly kilogram separative work unit, and it measures the quantity of separative work performed to enrich a given amount of uranium a certain amount when feed and product quantities are expressed in kilograms.



Source: WNA

Depleted uranium tails are either stored as UF_6 or de-converted back to U_3O_8, which is more benign chemically and thus more suited for long-term storage. It is also less chemically toxic. The decision of whether to mine fresh uranium or exploit alternative sources (i.e. re-enrich depleted UF6 tails) is largely a matter of economics.

Depleted UF_6 stockpiles have a variable U^{235} composition and would typically require enrichment beyond what is needed for manufacturing reactor-grade fuel from natural uranium (i.e. tails typically have a 0.2% - 0.4% U^{235} content vs. natural grade uranium of 0.7%). The SILEX process is touted as an enrichment technology that will facilitate future economically viable recovery of the residual U^{235} contained in the UF_6 tails stored at Paducah given its cost efficiency relative to existing centrifuge technologies.

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Uranium Enrichment Technologies

All generations of previously commercialised enrichment processes require the prior conversion of U_3O_8 to UF_6 gas as feed material. Molecules of UF_6 with U^{235} atoms are ~1% lighter than the rest, and this difference in mass is the basis of previously commercialised enrichment processes. The product stream of enriched UF_6 obtained is then converted to the form of UO_2 for further processing to nuclear fuel assemblies.

Enrichment processes are broadly categorised as follows:

- **Gaseous Diffusion (1st Generation):** UF_6 is passed through semi-permeable membranes;
- **Centrifuge Process (2nd Generation):** A spinning centrifuge pushes heavier U^{238} towards the edges of the chamber, leaving a stream of enriched U^{235} in the middle;
- **Laser Isotope Separation (3rd Generation):** A tunable laser excites and ionizes the U^{235} in the mixed uranium feed;

	1st Generation	2nd Generation	3rd Generation
Enrichment Process	Gaseous Diffusion	Centrifuge	Laser Isotope Separation
Developed	1940s	1940s	2000s
Feed	UF_6	UF_6	UF_6
Previously commercialised?	Yes	Yes	No
Currently employed?	No (obsolete)	Yes	No
Process efficiency	1.004	~1.25	~2 - 20 (classified)
% of global enrichment (2000)[1]	50%	40%	0%
% of global enrichment (2010)[1]	25%	65%	0%
% of global enrichment (2020e)	0%	100%	0%

[1] Remaining balance is HEU ex weapons
Source: Euroz Hartleys, WNA

Laser enrichment processes are a third-generation technology that offer lower input costs, capital costs and lower tails assays. Laser enrichment processes are broadly categorised between atomic laser isotope separation and molecular laser isotope separation (SILEX is a molecular process).

The Atomic Vapour Laser Isotope Separation (AVLIS) technology uses finely tuned lasers to preferentially ionize and remove one isotope. Molecular Laser Isotope Separation (MLIS) uses finely tuned lasers to selectively change bond energies and electron states in molecules, resultantly forming a new molecule enriched in one isotope.

In 1985 the US DOE selected the AVLIS technology as having the best potential to provide a low-cost, environmentally sound method to enrich uranium, with the ultimate goal of replacing energy-inefficient gaseous diffusion plants in Kentucky and Ohio.

Pilot plant work undertaken on the technology through to 1999 verified the projections that the technology could achieve enrichment at costs comparable to those of gaseous diffusion. The development of the technology was halted in June 1999 as a consequence of declining prices for enrichment and significant cost increases to operate US gaseous diffusion plants.

The AVLIS technology was projected to use 95% less electricity and 20-30% less natural uranium than gaseous diffusion technology to produce each SWU/comparable amount of enriched product. USEC estimated that AVLIS production costs would be US$30 per SWU lower than gaseous diffusion. This translates into a much smaller plant and production costs substantially lower than those of either gaseous diffusion or gas centrifuge technology.

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The decision to halt commercialisation was not a reflection of the advantages and capability of the technology. After US$2bn in R&D, the AVLIS technology was abandoned in the US in favour of the SILEX technology and American Centrifuge Program.

SILEX is the only third generation enrichment technology currently at an advanced stage of commercialisation.

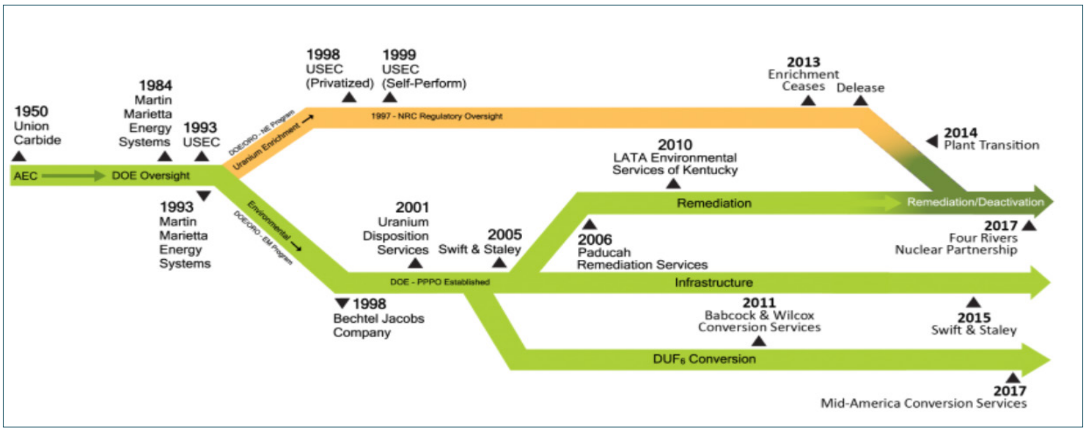
The Paducah Project

The Paducah Gaseous Diffusion Plant (PGDP) was opened in September 1952 to produce low-enriched uranium as feedstock for military purposes and subsequently commercial nuclear reactors from 1964.

The PGDP was built in less than 2 years at a cost of ~US$800m. Capacity was reported to be 11.3m SWU/year in 1984. The method of enrichment was the use of gaseous diffusion membranes.

The PGDP was operated by the US DOE from 1952 prior to being leased to USEC, Inc. (now Centrus Energy Corp.) in July 1993. USEC undertook commercial operations through to 2013, at which point in time operations ceased on economic grounds with the facilities returned to the US DOE.

Project Timeline



Source: https://www.energy.gov/pppo/paducah-operations-timeline

The 2016 Sales Agreement between GLE and the US DOE provides GLE access to purchase stockpiles of depleted UF_6 tails inventories at the Paducah site owned by the DOE. Although detailed assays of the depleted UF_6 tails are not publicly disclosed, the US DOE has previously disclosed 300,000 MTU of depleted UF_6 inventories with assays greater than 0.25% U^{235} but less than 0.711% U^{235}, which we note excludes additional inventory assaying less than 0.25% U^{235}.

Previous uranium enrichment operations at the PGDP have generated radioactive waste and have also resulted in soil, ground water and surface water contamination. Cumulatively, US$2.5bn has been invested into site remediation activities since the 1990s, with total remediation costs forecasted to fall in the vicinity of US$17bn through to 2065.

Although depleted UF_6 does not present a serious radiological threat, it is a potential chemical hazard and is under safe management by DoE's cylinder and maintenance programme. The DOE is considering long-term plans to convert depleted UF_6 into a more environmentally acceptable and nonhazardous form (either an oxide or uranium metal) before final disposition of the tailings.

Silex Systems Ltd

(SLX $1.02) Speculative Buy - Initiation of Coverage

EUROZ HARTLEYS

SILEX Technology

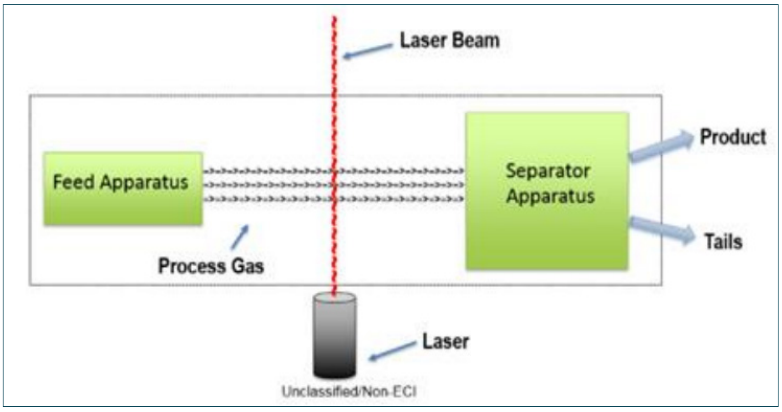
The SILEX technology is a unique laser-based process that has the potential to economically separate uranium isotopes, along with commercially valuable isotopes of several other elements. The technology was invented by Dr Michael Goldsworthy and Dr Horst Struve in the 1990's at Lucas Heights, Sydney.

In order to facilitate the potential commercial deployment of the technology in the United States, an Agreement for Cooperation between the governments of the United States and Australia was signed in May 2000. In June 2001, the technology was officially Classified by the United States and Australian governments, bringing the SILEX technology commercialisation project formally under the strict nuclear safeguards, security and regulatory protocols of each country.

SILEX has a number of advantages over other uranium enrichment processes, including:

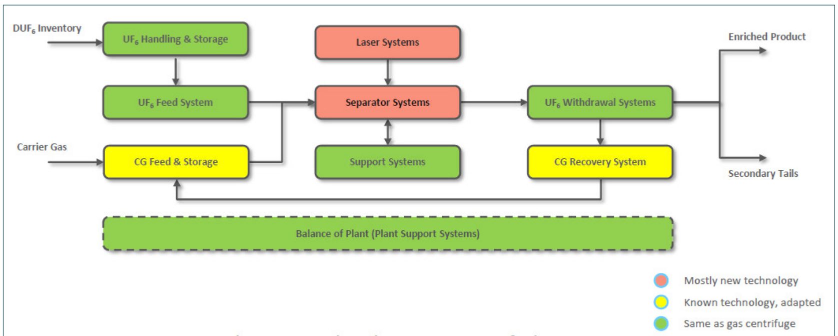
- Inherently higher efficiency resulting in lower enrichment costs;
- Smaller environmental footprint than centrifuge and diffusion plants;
- Greater flexibility in producing advanced fuels for next generation SMRs; and
- Comparatively lower enrichment plant capital costs.

The process uses a mixture of UF_6 with a carrier gas. The gas mixture is cooled to separate the resonance peaks for the two isotopes (U^{235} and U^{238}). A 16-um laser then selectively excites the UF_6^{235}. One or more infrared laser frequencies may be used.



Source: GLE

The product stream is enriched in U^{235} while the tails stream has an increased fraction of U^{238}. In a plant situation the two streams would be further processed to achieve the desired enrichment and physical form. Existing UF_6 enrichment technologies comprise 65% of the plant, whilst separator and laser systems comprise 35%.



Source: GLE

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EUROZ HARTLEYS

Zero-Spin Silicon

A variant of the SILEX laser isotope separation technology is capable of producing Zero-Spin Silicon or (ZS-Si). ZS-Si is a unique form of isotopically enriched silicon and a key enabling material for silicon-based quantum processors.

Natural silicon consists of 3 isotopes: 92.2% Si-28, 3.1% Si-30 (each with zero electron spin) and 4.7% Si-29 (with a spin state of ½). The presence of Si-29 in concentrations above 100ppm (0.01%) prevents effective QC performance, so ZS-Si must be produced by isotopic elimination of Si-29.

A major challenge in the pursuit of CQC2T/SQC's 'silicon spin qubit' approach (favoured over other methods because of its enormous potential in terms of scalability and reliability), is the availability of the key enabling material for the silicon QC processor chip – ZS-Si.

The inherent efficiency of the SILEX laser isotope separation technology potentially means that concentrations of Si-29 well below 100ppm could be achieved. The lower the concentration of Si-29, the better a silicon quantum processor will perform in terms of computational power, accuracy and reliability.

SLX's ZS-Si Project has been proven in concept in Jun'20 in conjunction with project partners Silicon Quantum Computing Pty Ltd (SQC) and UNSW under the first stage of a three-stage project.

Project Phase	Status	Milestone
Stage 1	Completed	Established 'proof-of-concept' for the LIS process
Stage 2	Underway, targeting completion in Q4 CY21	Validation of the LIS technology and scalability for ZS-Si production. Design, construction and operation of scaled-up prototype equipment with the objective of verifying scalability and economics.
Stage 3	Pending, targeting completion in Q4 CY22	Full technology demonstration for ZS-Si production at commercial pilot scale. Planned production of initial commercial quanitities of ZS-Si from a pilot production facility.

SLX guides to achieve commercial production of ZS-Si in CY23 at a run rate of 5kg per annum. Cost of development will be split between SILEX and R&D partners SQC and UNSW. We estimate that SLX's share of expenditure to fall in the vicinity of ~$1.5m net of R&D tax incentives.

The first commercial quantities of ZS-Si produced from the pilot facility will be purchased by SQC under a $1.8m product offtake agreement executed in Dec'19 with SQC.

The higher the purity of enriched silicon, the higher the price. Incremental capex will decrease as the project is scaled up given upfront capex is inclusive of one-off costs. In the absence of details of project economics (expected in Dec'21), we expect favourable margins given access to existing infrastructure, along with the fact that enrichment of silicon is a matter of kilograms vs tonnes of uranium.

Current centrifuge production of enriched silicon is limited and costly, with SLX guiding to produce at a much higher purity at lower cost.

The global quantum computing industry has recently been forecast by CSIRO Futures to be worth around $50 billion in 2040, with an annual growth rate of 6% ('Growing Australia's Quantum Technology Industry', Report by CSIRO Futures, May 2020). A large proportion of this value will relate to hardware, of which silicon-based quantum computers are anticipated to play a significant role.

Whilst acknowledging the significant upside of SLX's ZS-Si Project, we conservatively ascribe no value to the project in the absence of project economics and an immature market.

Silex Systems Ltd

(SLX $1.02) Speculative Buy - Initiation of Coverage

EUROZ HARTLEYS

Crystalline Rare Earth Oxides Technology (cREO)

A subsidiary of SLX (Translucent Inc.) has previously developed a novel set of semiconductor materials (Crystalline Rare Earth Oxides) for application in the manufacturing of semiconductor devices.

The cREO technology has the potential to improve performance and lower the cost of production of compound semiconductor devices such as chips for wireless communications equipment and power electronics devices.

The cREO technology was purchased by a UK-based company in IQE Plc (LSE: IQE, market cap £400m, CY20 revenue: £140m) in early CY18. IQE is a leading manufacturer of advanced semiconductor wafer products for the global semiconductor industry and is a key player in the emerging 5G wireless technologies market.

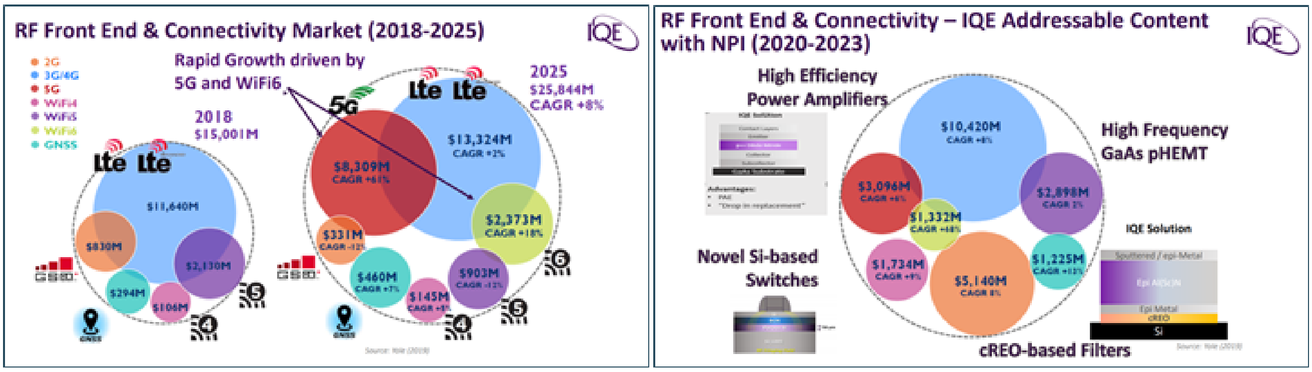
Consideration for the purchase of the cREO technology was:

- US$5m in IQE shares;
- Minimum annual royalties of US$400k per annum through CY24;
- Perpetual royalty of at least 3% payable to SLX on the sale of any IQE products that utilise the cREO technology;

IQE has developed a high frequency (RF) filter technology (IQepiMo™) for 5G handsets which is built on the cREO technology platform. Bulk acoustic wave filters are compact, low-cost RF filters that can be used to remove or accept signals that fall in certain areas of the radio spectrum and convert electrical energy into acoustic energy.

In Feb'21 IQE announced that data from customer and partner device trials indicated significant improvement in the performance of its 5G filter device (in comparison to incumbent technology) when tested at the top end of the frequency range used in current 5G applications. The 5G industry is finding it difficult to achieve high levels of performance at higher frequencies using conventional filter technology.

Industry analysts forecast the front-end and connectivity markets for 5G handsets to expand at a CAGR of 61% to US$8bn by CY25. The total addressable segment for IQE's cREO-based filters is expected to grow to US$3.1bn by CY23. Assumption of minor penetration of IQE's offerings containing the cREO technology implies material upside. This of course excludes the potential application of cREO beyond 5G mobile handset components.



Source: IQE Plc

We conservatively assign no value to the perpetual 3% royalty stream prior to commercial sale of RF filters containing the cREO technology.

Silex Systems Ltd

(SLX $1.02) Speculative Buy - Initiation of Coverage

EUROZ HARTLEYS

Key Risks

SLX is currently undertaking the commercialisation of its proprietary and classified technology to re-enrich depleted uranium tails, which we note is yet to be proven at commercial scale. More than >US$400m invested in the technology to date. Key risks to our investment thesis include but are not limited to:

Market Risk – General market risk.

Uranium Price Risk – The future of the commercial development of the SILEX technology is heavily dependent on a recovery in global demand for natural and enriched uranium. Market valuation is inextricably linked to prevailing uranium sector sentiment.

Regulatory Risk – Our valuation rests heavily on the granting of US government approvals for the construction of the Paducah Plant and the GLE-DOE sales agreement remaining in effect. Given the political sensitivity of uranium, prevailing government regulations and policies in the US and/or Australia may adversely impact the commercialisation of the SILEX technology. We believe this risk is partially mitigated by the US NRC's previous award of a Construction and Operating License to GLE for the Test Loop Facility in Wilmington, North Carolina.

Financing Risk – SLX is a research and development company requiring ongoing capital for the SILEX technology commercialisation program. Given a lack of recurring operating cash flow, a debt-funded business model is entirely inappropriate at this stage of the company's evolution. Consequently, equity capital will be required to fund the completion of the commercialisation program.

GLE Investment Risk – Commercialisation of the SILEX technology and funding thereof is contingent on Cameco maintaining its 49% interest in GLE. Potential divestment of Cameco's interest in GLE would likely halt the commercialisation program. We consider this risk low given Cameco's continued investment in GLE since 2008.

Foreign Exchange Risk – SLX's reporting currency is AUD, however the Company operates internationally and is exposed to foreign exchange risk arising from exposure to the US dollar. Adverse foreign exchange fluctuations may negatively impact forecast cash flows.

Execution Risk – The SILEX technology is yet to be proven at commercial scale, with a Test Loop Facility the current focus of GLE. Our forecasts of commercial cash flows are contingent on the ability of the SILEX technology to enrich depleted UF_6 tails to natural uranium grade at scale.

Competition Risk – Potential development of, or competition from alternative uranium enrichment technologies may impact potential market share and in turn forecast cash flows. We view this risk as low on account of the limited number of alternative enrichment technologies developed subsequent to the obsolescence of the gaseous diffusion process.

Non-Core Project Risk – Although we ascribe no valuation to SLX's Zero-Spin Silicon Project and revenue royalty stream on IQE's commercialisatoin of the cREO technology, potential discontinuation of the commercialisation of either of these ventures may adversely impact market valuation.

We Initiate Coverage with a Speculative Buy recommendation, primarily reflective of uranium price and sentiment risk, regulatory and execution risk. We have applied a risk-adjustment factor of 80% to our NPV_{10} valuation in recognition of the potential for equity dilution.

Silex Systems Ltd

(SLX $1.02) Speculative Buy - Initiation of Coverage

EUROZ HARTLEYS

Board of Directors & Executive Management

Craig Roy – Chair & Non-Executive Director

Interests in shares and options: 175,000 FPO

Independent Non-Executive Director and Chair since Jan'19. Former Deputy CEO of the CSIRO. Extensive experience as a company director and is currently a Non-Executive Director of Sydney Water and Chair of the Australian Research Data Commons.

Michael Goldsworthy – Managing Director / CEO

Interests in shares and options: 5,999,055 FPO, 100,000 PRs

CEO/MD of SLX for 28 years. Founder of the Company and co-inventor of the SILEX uranium enrichment technology.

Christopher Wilks – Non-Executive Director

Interests in shares and options: 2,814,021 FPO

Non-Executive Director for 31 years. Finance director and CFO of Sonic Healthcare Ltd. Various directorships of public companies held over the years.

Melissa Holzberger – Non-Executive Director

Interests in shares and options: 27,777 FPO

Independent Non-Executive Director since Jan'19. Experienced company director, commercial lawyer and international nuclear specialist.

Julie Ducie – CFO/Company Secretary

Interests in shares and options: 20,000 FPO, 400,000 Options

CFO & Company Secretary since Feb'12. Held a senior finance position in the Construction industry in the Middle East prior to joining Silex.

Silex Systems Ltd

(SLX $1.02) Speculative Buy - Initiation of Coverage

EUROZ HARTLEYS

Top 20 Shareholders

The 20 largest quoted equity security holders as at 7 July 2021 are outlined below:

	Shares Held (m)	Shares Held (%)
JARDVAN PTY LTD	29.8	17.3%
HILLBOI NOMINEES PTY LTD	4.0	2.3%
MR PAUL COZZI	3.0	1.7%
THROVENA PTY LTD	3.0	1.7%
POLLY PTY LTD	2.8	1.6%
MAJENTA HOLDINGS PTY LTD	2.7	1.6%
MAJENTA HOLDINGS PTY LTD <GOLDSWORTHY SUPER FUND NC>	2.5	1.5%
HSBC CUSTODY NOMINEES (AUSTRALIA) LIMITED	2.4	1.4%
SILICON QUANTUM COMPUTING PTY LTD	2.3	1.3%
HAMLAC PTY LTD	2.0	1.2%
QUINTAL PTY LTD <HARKEN FAMILY NC>	2.0	1.2%
SPORRAN LEAN PTY LTD <SPORRAN LEAN S/F NC>	1.8	1.0%
DEERING NOMINEES PTY LTD	1.7	1.0%
BNP PARIBAS NOMINEES PTY LTD ACF CLEARSTREAM	1.4	0.8%
MR PETER JAMES THOMAS + MS HELEN THOMAS <PETER THOMAS SUPER FUND NC>	1.4	0.8%
MR XIANGYANG WU	1.3	0.8%
POLLY PTY LTD	1.3	0.7%
MR CHRISTOPHER DAVID WILKS	1.3	0.7%
EUGOB NOMINEES PTY LTD	1.2	0.7%
MORGAN STANLEY AUSTRALIA SECURITIES (NOMINEE) PTY LIMITED <NO 1 ACCOUNT>	1.2	0.7%
Top 20 Total	**69.0**	**40.0%**
Total Remaining Holders Balance	**103.7**	**60.0%**

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