



# Silex Systems Limited Operational Update

(ASX: SLX) (OTCQX: SILXY)

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CEO/Managing Director

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# Forward Looking Statements



Silex Systems is a research and development Company whose primary asset is the SILEX laser uranium enrichment technology, originally developed at the Company's technology facility in Sydney, Australia. The SILEX technology, licensed exclusively to GE-Hitachi Global Laser Enrichment LLC (GLE) in the USA, is currently in the engineering development stage and plans for commercial deployment remain subject to engineering and market risks. Silex also has an interest in a unique semiconductor technology known as 'cREO™' through its ownership of subsidiary Translucent Inc. The cREO™ technology is exclusively licensed to IQE Plc based in the UK. IQE is progressing the cREO™ technology towards commercial deployment in various advanced semiconductor products. The outcome of IQE's commercialisation program also remains subject to technology and market risks.

The commercial potential of these two technologies is currently unknown. Accordingly, the statements in this announcement regarding the future of the SILEX technology, the cREO™ technology and any associated commercial prospects are forward looking and actual results could be materially different from those expressed or implied by such forward looking statements as a result of various risk factors.

Some risk factors that could affect future results and commercial prospects include, but are not limited to: the outcome of the GLE restructure currently underway; results from the SILEX uranium enrichment engineering development program being conducted jointly by the Company and GLE; the demand for natural uranium and enriched uranium; the time taken to develop the SILEX technology; results from IQE's commercialisation program and the demand for cREO™ products, the potential development of competing technologies; the potential for third party claims against the Company's ownership of Intellectual Property; the potential impact of government regulations or policies in the USA, Australia or elsewhere; and the outcomes of various commercialisation strategies undertaken by the Company and/or its Licensees GLE and IQE.

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# Silex Systems Limited

Silex Systems (Silex) is an advanced technology company focussed on the commercialisation of its innovative SILEX laser enrichment technology for nuclear fuel production

# Key Activities and Status – 1H 2017



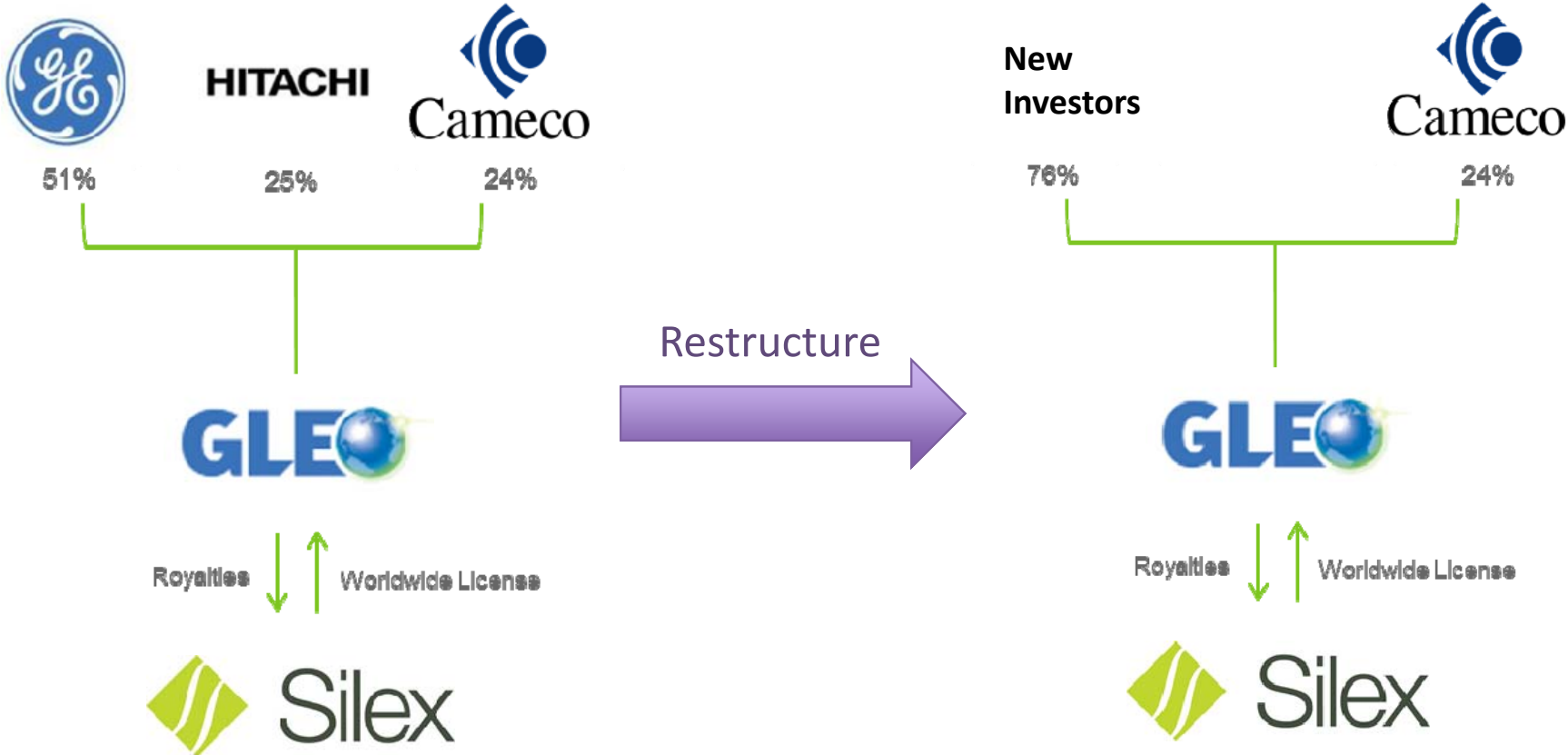
- The Company continues to focus on commercialisation of the SILEX technology as the best path forward to re-build value for shareholders when nuclear fuel markets return to growth
- Agreement between GLE and US Department of Energy signed 10 November 2016, involving potential Paducah Laser Enrichment Facility.
- A Term Sheet was executed with GE-Hitachi on 29 April 2016 providing the framework for a restructure of GLE – the exclusive licensee of the SILEX laser enrichment technology
- Silex is leading the search for new investors for GLE with discussions and due diligence activities advancing with a number of interested parties
- The SILEX technology engineering and economic validation program continues to make good progress in key program activities at both the Wilmington and Sydney project sites
- Translucent's unique 'cREO™' semiconductor materials technology was exclusively licensed to UK-based IQE Plc in September 2015 under a royalty-based license agreement
- IQE is advancing the cREO™ technology towards commercial deployment in several advanced semiconductor markets, potentially adding to future shareholder value
- Current cash reserves of approximately \$45 million

# GLE Restructure Overview



- A restructure of GLE was precipitated when GEH disclosed in April 2016 it was looking to exit due to changes in business priorities and continuing difficult market conditions
- Silex and GEH signed a term sheet on 29 April 2016 giving Silex an exclusive option to purchase GEH's 76% stake at a heavily discounted valuation
- The term sheet also gives Silex the right to assign part or all of this option to third parties
- Silex has since been leading the GLE restructure efforts to bring new investors into GLE
- A number of third parties are currently involved in varying stages of due diligence activities
- Silex intends to assign a majority of the GEH equity, but may decide to retain a minority interest in GLE to increase involvement as a shareholder

# GLE Restructure Overview





# SILEX Laser Uranium Enrichment Technology



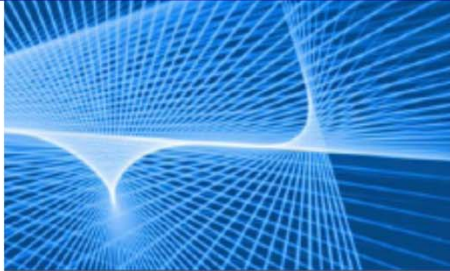




# Enrichment Technology Overview

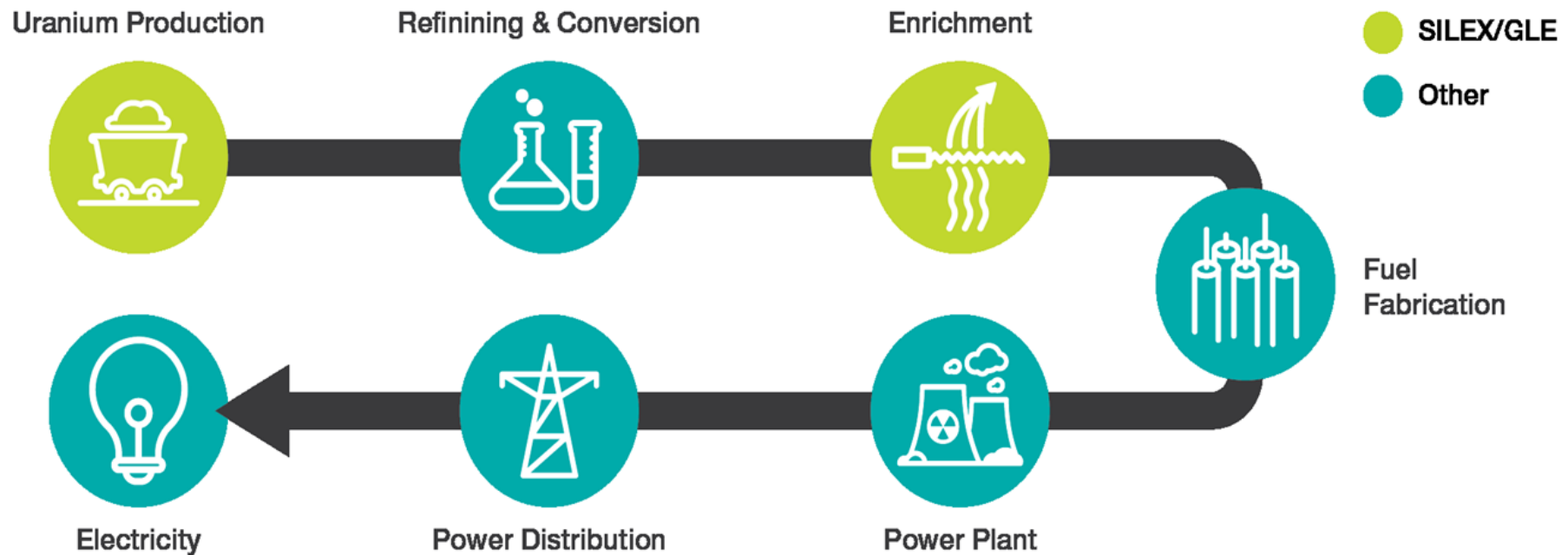
- SILEX - third generation laser enrichment technology
  - SILEX - **S**eparation of **I**sotopes by **L**aser **E**Xcitation
  - Highly selective laser (optical) excitation of  $^{235}\text{UF}_6$  to separate isotopes
  - Very high enrichment efficiency – expect low SWU\* costs
  - Only known large scale commercialisation program in the world today

## Uranium Enrichment Technology

Gaseous Diffusion	Centrifuge	Laser Excitation
		
<ul style="list-style-type: none"><li>■ 1<sup>st</sup> generation technology</li><li>■ <math>\beta = 1.004</math></li><li>■ High cost</li><li>■ Obsolete</li></ul>	<ul style="list-style-type: none"><li>■ 2<sup>nd</sup> generation technology</li><li>■ <math>\beta \sim 1.25</math></li><li>■ Lower cost</li><li>■ Current technology</li></ul>	<ul style="list-style-type: none"><li>■ 3<sup>rd</sup> generation technology</li><li>■ <math>\beta \sim 2 - 20^1</math></li><li>■ Most cost effective</li><li>■ Advancement beyond State-of-the-art</li></ul>

\*SWU: Separative Work Unit – the marketable unit of enrichment  
1. Efficiency factor  $\beta$  is classified for the SILEX technology

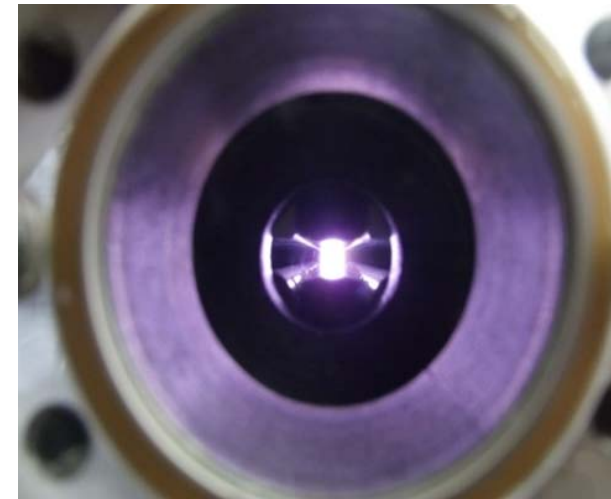
# SILEX and Nuclear Fuel Production



- The SILEX technology can be utilized to produce:
  - natural grade uranium via re-enrichment of tails inventories (e.g. Paducah)
  - enriched uranium for use as fuel in nuclear power reactors
- Uranium (~40%) and enrichment (~30%) comprise ~70% of the value in a fuel bundle (based on recent market pricing)

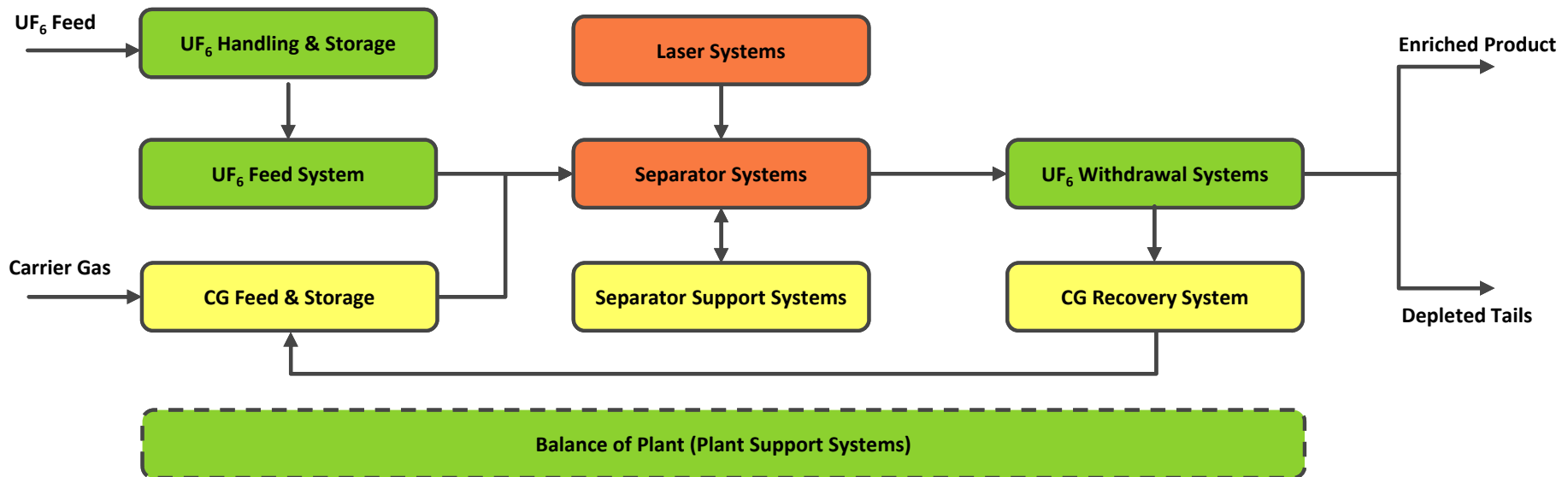
# GLE's Phased Approach to Commercialisation

- Phase I: 'Technology Validation' successfully completed in 2013
- Phase II: 'Economic Validation' is the focus for the next few years, including engineering scale-up of all laser and separator production equipment
- End point for Phase II is full scale demonstration with a prototype production module in ~2020 at the Test Loop facility in Wilmington, NC
- Phase III: First commercial plant construction – most likely Paducah, KY



Phase	Objectives	Status
Phase I	Test Loop technology demonstration and NRC commercial plant license approval	Completed 2013
Phase II	Economic and engineering validation for the initial commercial production module	Commenced in 2013
Phase III	Construction of the first full-scale commercial production facility	To be confirmed

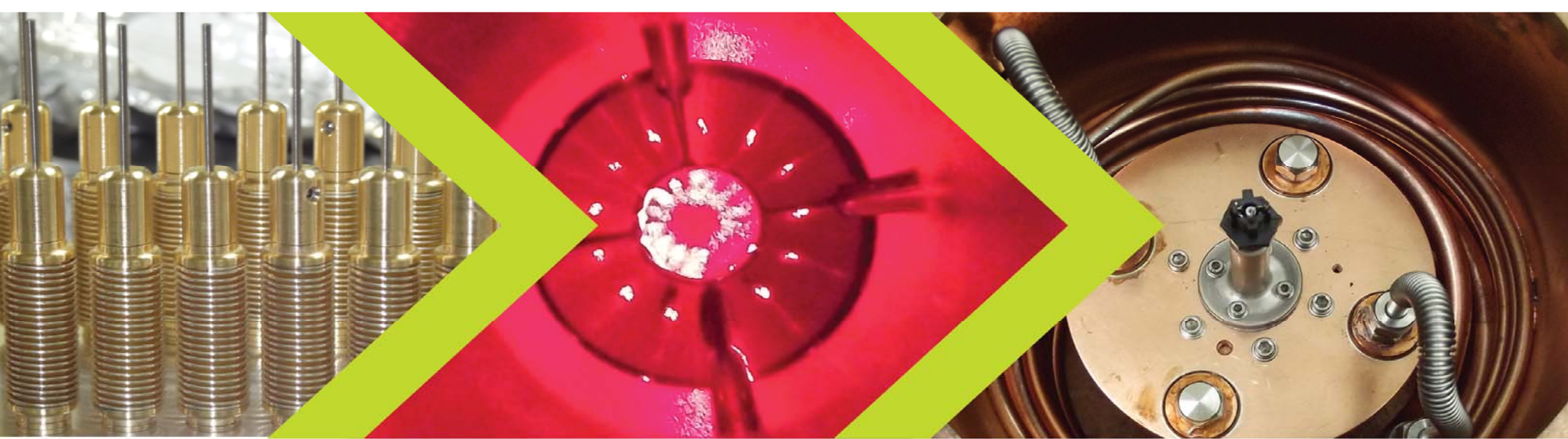
# SILEX Technology - Process Flow Diagram



Subject to a successful restructure of GLE:

- Prototype commercial lasers expected to be complete in ~12 months
- Prototype separator systems to be completed over next ~2 years
- Full commercial prototype production module demonstration ~2020

- Mostly new technology
- Known technology adapted
- Same as gas centrifuge



# The Paducah and Wilmington Commercial Plant Opportunities



# Paducah Tails Re-Enrichment Opportunity

## *The path to commercialisation*

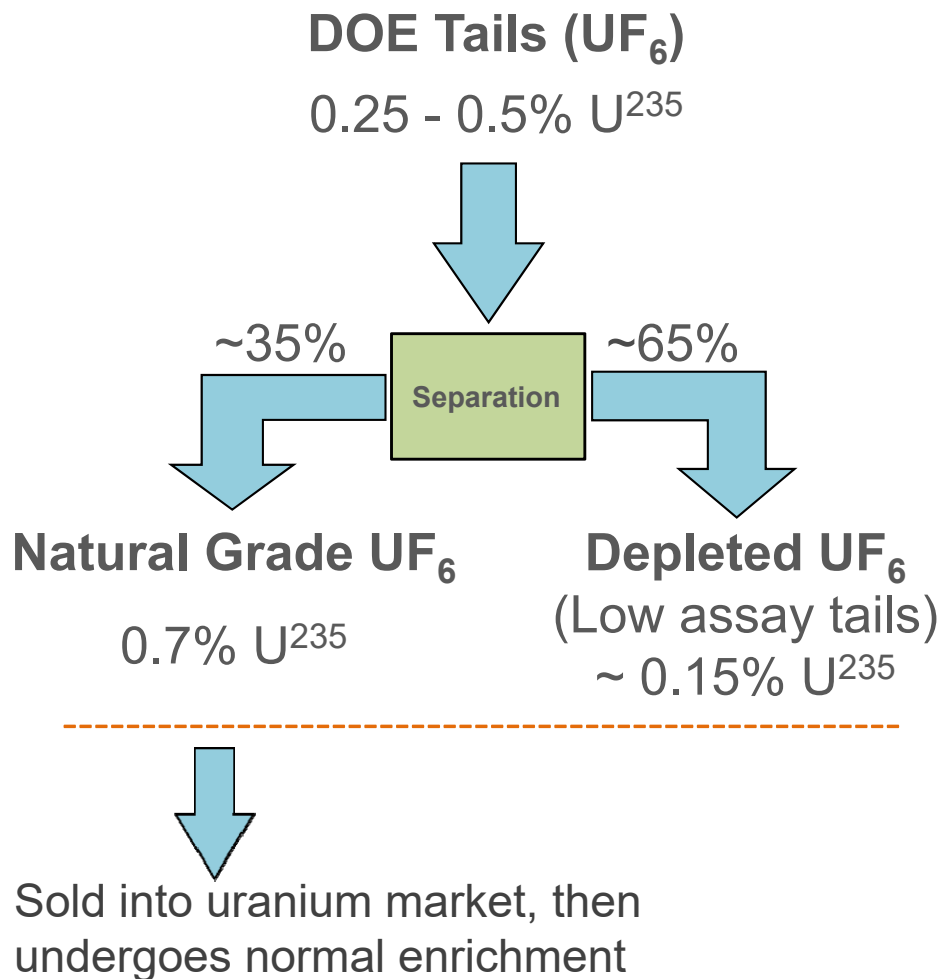
- Agreement between GLE and DOE signed 10 November 2016 involving the Paducah Laser Enrichment Facility
- Enrichment of DOE tails stockpiles equivalent to a large, low cost uranium mine operating for at least 40 years
- SILEX efficiency enables economic tails stripping capability
- The Paducah opportunity represents an ideal path to market – smaller plant and lower capital cost
- Possible funding of plant through the DOE's Loan Guarantee Program could help reduce finance costs
- Will allow full scale commercial deployment and provide foundation for future larger SWU plants
- Option to build adjacent plant (~4MSWU) to produce enriched uranium product up to 5%  $^{235}\text{U}$  being considered



Paducah Enrichment Plant Site

# Paducah Tails Re-Enrichment Opportunity

## A Tier 1 Uranium Production Asset



- The US DOE holds over 500,000 MTU of tails material from decades of enrichment operations
- Approximately ~300,000 MTU are regarded as 'high assay tails' (over ~0.25%)
- SILEX technology could recover around a third of these stockpiles as natural grade uranium
- Current estimates of production costs - Paducah is a 200 million pound Tier 1 uranium asset
- The uranium will be sold into the uranium market and then enriched to reactor grade fuel
- Potential exists to source and process other stockpiles of high assay tails around the world

# Wilmington Enrichment Plant Opportunity

## *NRC License obtained in 2012*

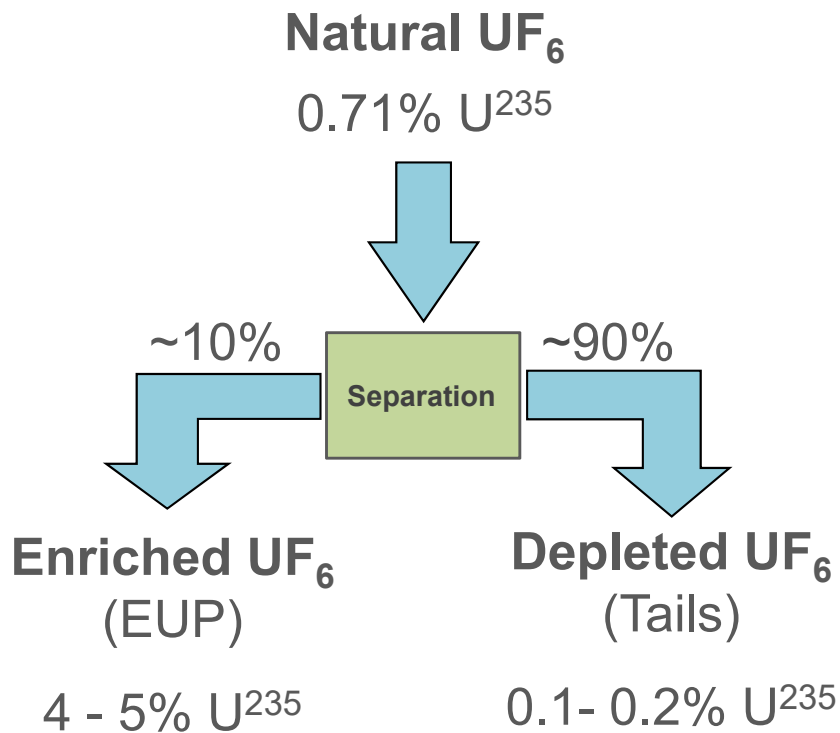
- US enrichment demand currently ~15 MSWU total
- Current enrichment capacity in the US is only one third of US requirements (4.7 MSWU - URENCO USA)
- Positive support from US utilities for a new low-cost US-based SWU supplier
- GLE submitted application for a proposed 6MSWU enrichment plant in Wilmington, NC to the NRC in 2009
- NRC approved a combined construction and operating license (COL) for the Wilmington plant proposal in 2012
- The Wilmington plant COL approval is the first license in the world for a laser enrichment facility
- Potential Wilmington enrichment plant site conveniently located next to GNF's fuel fabrication plant



GE Hitachi HQ, Wilmington, NC



# Uranium Enrichment with SILEX Technology



- Production of nuclear fuel with enriched uranium product (EUP) - up to 5% U<sup>235</sup>
- Technically difficult process with high barriers to entry
- Nearly all enrichment is currently performed with gas centrifuge technology
- SILEX laser technology inherently much higher efficiency → lower overall costs
- SILEX capital costs potentially half (or less) of centrifuge capital costs



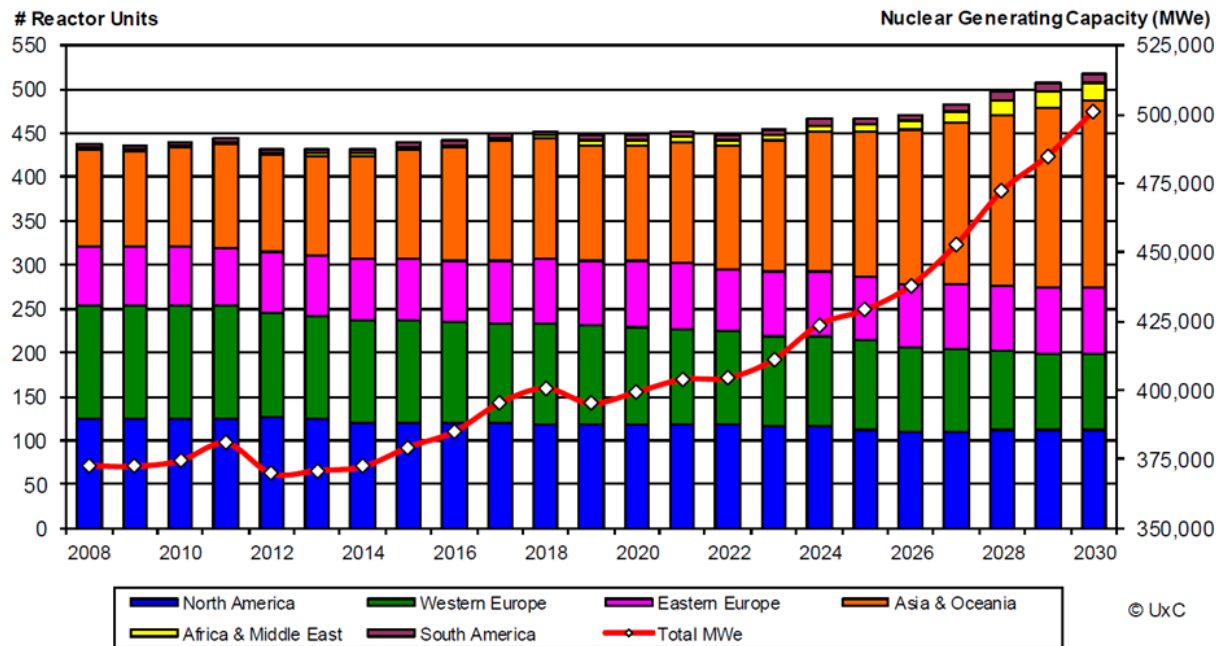
# The Market Outlook – Uranium and Enrichment



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# Nuclear Power Forecasted to Grow Through 2030

## Nuclear Generating Capacity Forecast



Source: UxC Uranium Market Outlook, Q4 2016

### Key Statistics

- ✓ 10 percent of global electricity
- ✓ 447 operable reactors currently
- ✓ 60 new plants under construction
- ✓ 164 plants planned
- ✓ 347 plants proposed

Source: World Nuclear Association – January 2017

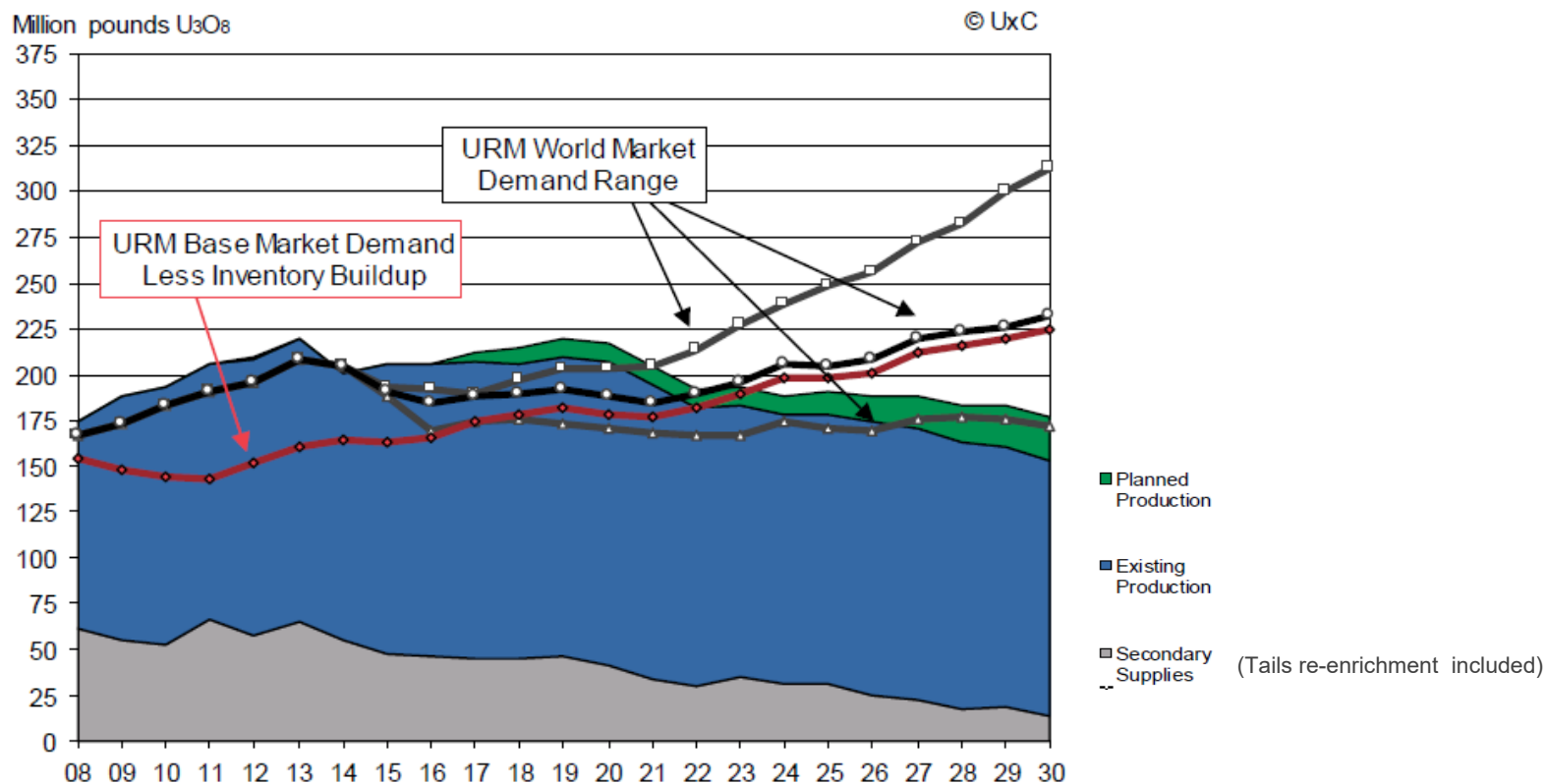
### Reactor new build dependent on country policies

- Strong growth: China, UK, Middle East, Poland, Hungary
- Nuclear power expected to play key role in global CO<sub>2</sub> emissions reduction
- COP21 in Dec 2015, more than 180 countries pledged to meet global warming targets

# UxC Market Views

## Uranium Market Outlook

### Uranium Mid-Case Supply and Demand Forecast



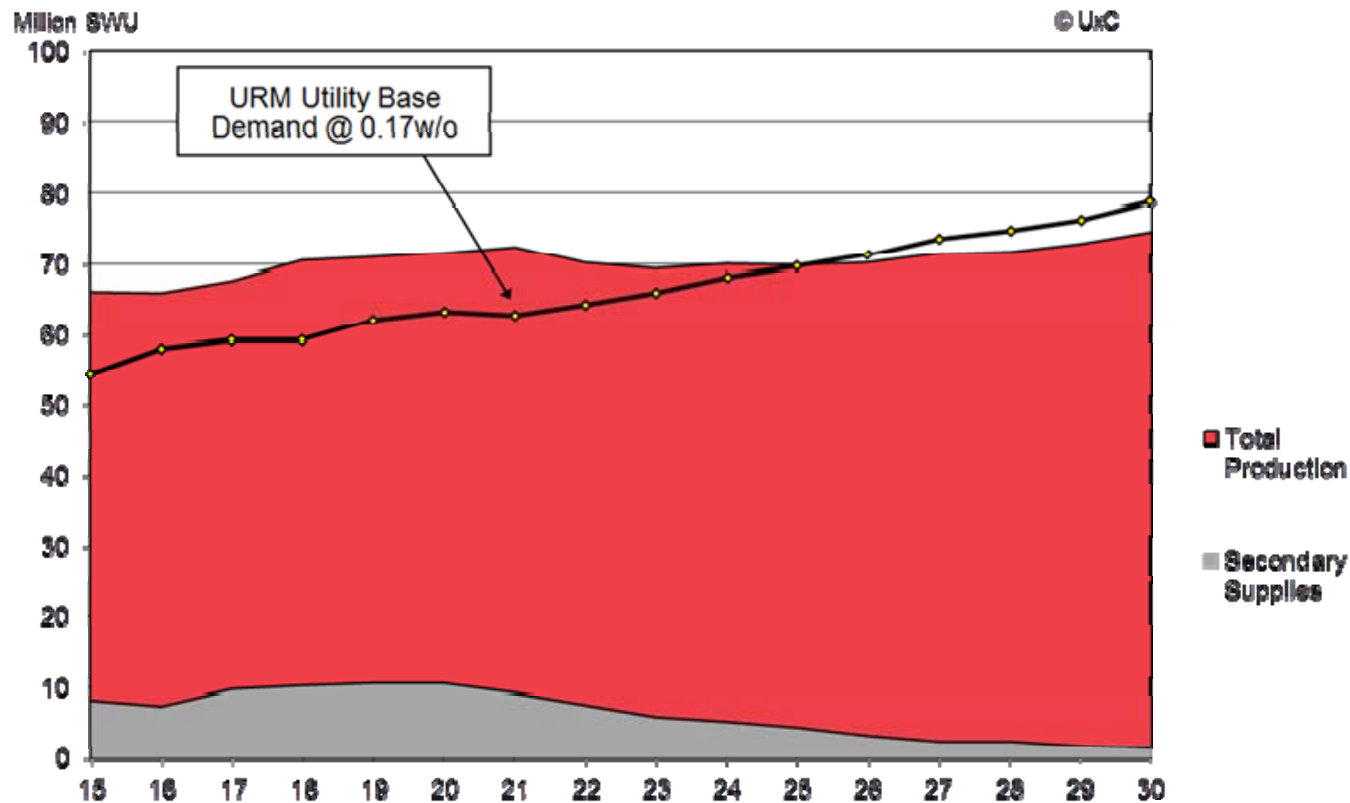
Source: UxC Uranium Market Outlook, Q4 2016

- Uranium supplies not sufficient to meet demand after ~2023 (mid case) - new production needed
- Secondary uranium supplies include production from underfeeding and tails re-enrichment

# UxC Market Views

## Enrichment Market Outlook

Base Case Enrichment Supply and Demand Forecast



Source: UxC Enrichment Market Outlook, Q4 2016

- Base case forecast shows market back in balance ~2024 and then going into supply shortage
- By mid-2020s, additional SWU supply will be needed to meet forecast market demand

# Enrichment Market Considerations

- **High barriers to entry for new players**
  - Highly restricted access to sensitive nuclear technology
  - Only four producers: URENCO, AREVA, Tenex, China (~90% state owned in total)
  - High technology hurdle – long history of failed laser enrichment programs
- **Important geopolitical dimension – Russia and China’s rising influence**
  - Russia is largest enricher, China the fastest growing
  - Potential for trade restrictions, supply disruptions
  - May become a concern to nuclear utilities - support for second US supplier
- **Market conditions support GLE market entry in mid 2020’s**
  - U and SWU price recovery and uncovered demand expected to increase
  - Demand could increase as ‘accessible’ supply decreases



***Point to a significant window of opportunity for GLE***



# Translucent Inc – cREO™ Technology



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# The Translucent – IQE Agreement

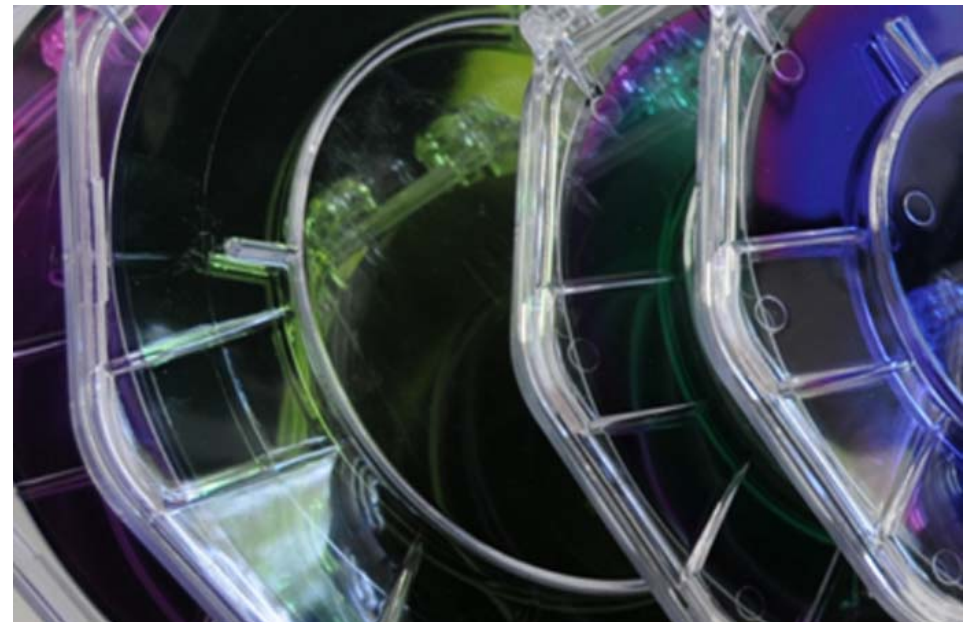
- Translucent's innovative 'Rare Earth Oxide' (cREO™) technology has commercial application to advanced semiconductor devices and chips
- Translucent signed an exclusive license agreement in September 2015 with UK-based IQE - world's leading semiconductor epiwafer supplier
- Initial license fee of US\$1.4 million in IQE shares received March 2016 – currently worth approximately ~US\$3 million
- The agreement provides a 30-month license for IQE to develop and commercialise initial products incorporating the cREO™ materials
- IQE can elect to purchase the cREO™ technology with payment of a further US\$5 million (in cash or IQE shares) within the license period
- ***A royalty of up to 6% of IQE's revenues derived from use of the technology will be payable to Translucent – potentially significant in target high volume semiconductor sectors***





# cREO™ - IQE Development Program

- cREO™ technology was transferred to IQE's Greensboro, North Carolina manufacturing facility for the completion of initial product development activities over the remaining license period to March 2018
- Product development focus is on high volume sectors such as wireless communications chips and power electronics devices which require higher performance semiconductor materials
- IQE have been producing cREO™ templates on silicon wafers using Translucent's production reactors for approximately 1 year
- Semiconductor characteristics of the templates being produced by IQE are mostly consistent with those previously achieved by Translucent
- Templates continue to be produced for testing and qualification activities within the IQE Group and with selected commercial partners



# cREO™ - Initial Applications

## cREO™ Substrates



- High efficiency power conversion devices
- Next-gen high performance wireless communications chips



### Power electronics applications



Electric vehicle power converters



Motor controllers for electrical appliances



Lighting power converters (e.g. street lights)



DC/AC conversion (e.g. solar inverters)

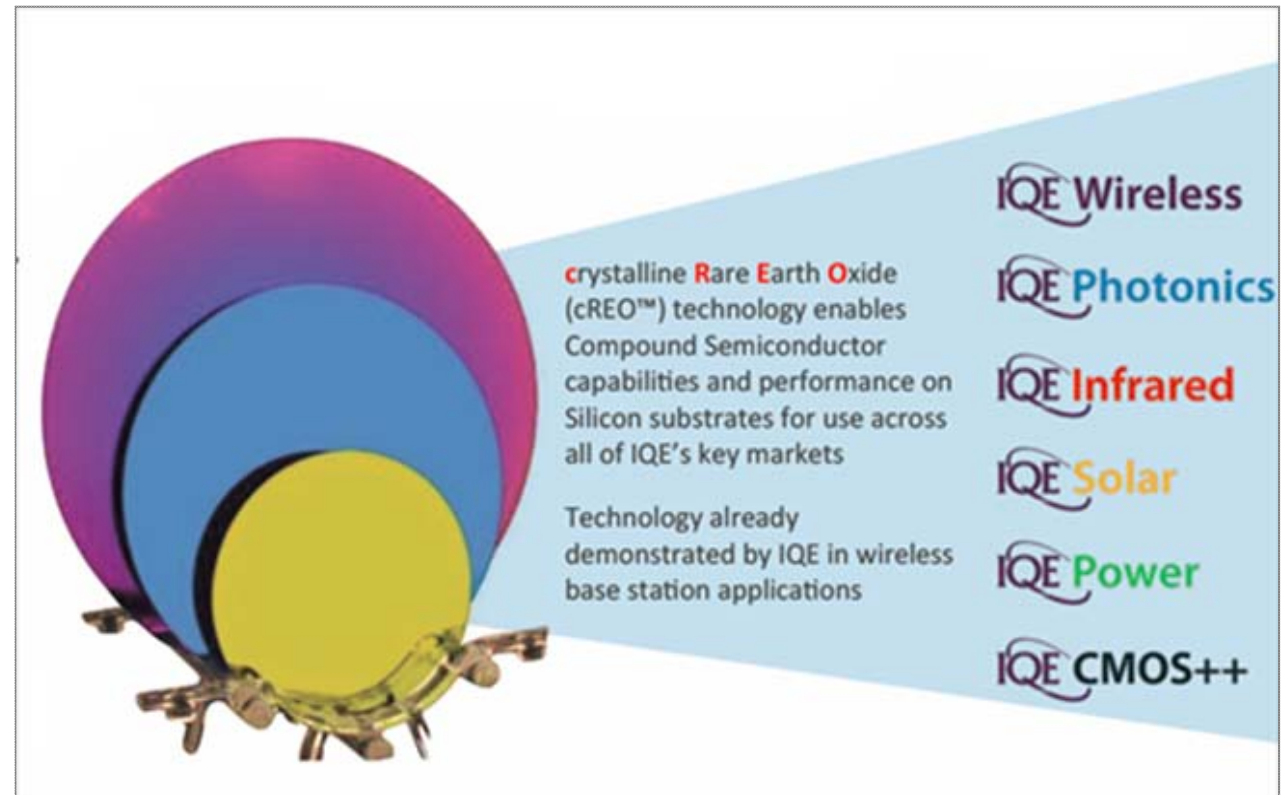
### Wireless communications



Mobile phone chips

# cREO™ - IQE Commercialisation Outlook

- The technology is protected by a wide ranging IP portfolio consisting of 82 granted patents and 2 additional patent applications
- cREO™ technology has the potential to be applied across all six of IQE's key market sectors
- Initial target market sectors for cREO™ technology (wireless and power) are forecast to grow strongly over the next decade



Source: [iqep.com/markets/cmos/creo/](http://iqep.com/markets/cmos/creo/)



## Summary and Outlook

# Summary and Outlook



- Unique third generation SILEX laser enrichment technology at advanced stage of development
- Inherently high efficiency provides cost advantages with increased operational flexibility
- Restructure of GLE continuing with a number of parties at advanced stages of due diligence
- Paducah opportunity provides path to market – agreement signed between DOE and GLE
- Commercial production remains dependent primarily on economic validation, prevailing market conditions and regulatory approvals
- Medium to long-term fundamentals for growth of nuclear power globally remain positive
- Translucent cREO™ technology being advanced by IQE towards commercial deployment in several advanced semiconductor markets, potentially providing additional shareholder value
- Silex is well placed to execute its business development plans to complete the GLE restructure and capitalise on a recovery in uranium prices through the SILEX Technology



Thank you



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