URENCO Next Generation Fuels

Conversion and Enrichment Options

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Discussion Points

1. URENCO – A brief introduction
2. LEU+ & HA-LEU – Working Definitions
3. Completing the Future Nuclear Fuel Supply Chain
4. Implementation of HA-LEU Enrichment at UUSA
5. Transport & Packaging Challenges
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URENCO – A Global Supplier
Capacity of 18,500 tSW/year

Capenhurst, UK
Capacity: 4,600 tSW/year

Eunice, USA
Capacity: 4,800 tSW/year

Head Office
Stoke Poges, United Kingdom

Almelo, The Netherlands
Capacity: 5,200 tSW/year

Gronau, Germany
Capacity: 3,900 tSW/year

UUSA – The National Enrichment Facility

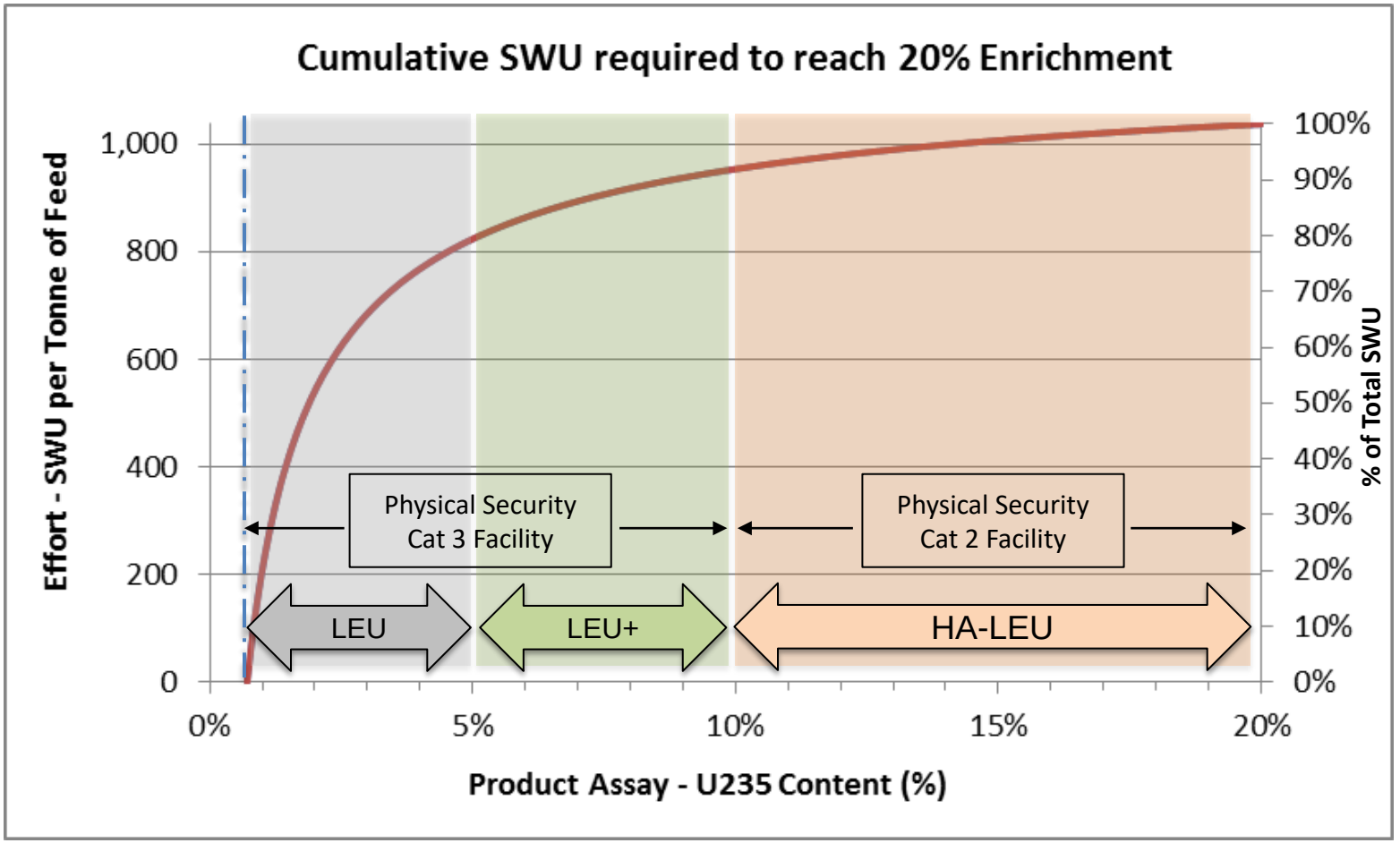
UUSA Today

- Located in southeast New Mexico on the boarder with Texas.
- NRC license issued in 2006 with operations commencing in 2010.
- First new nuclear facility in the US for more than 30 years.
- Only operating uranium enrichment plant in North America.
- Supportive community and New Mexico state legislature.

UUSA Future

- Available space on existing Category III nuclear licensed site for additional facilities.
- Scope for expansion to accommodate Category II Facility – HA-LEU.
- URENCO Technology Centre – laboratory.
- URENCO Advanced Nuclear Fuel Campus:
  - Co-location of facilities for the production of next generation.
  - Shared facilities, services and security.

URENCO Working Definitions: LEU / LEU+ / HA-LEU



U235 Enrichment Levels

Feed 0.711%
Natural Uranium

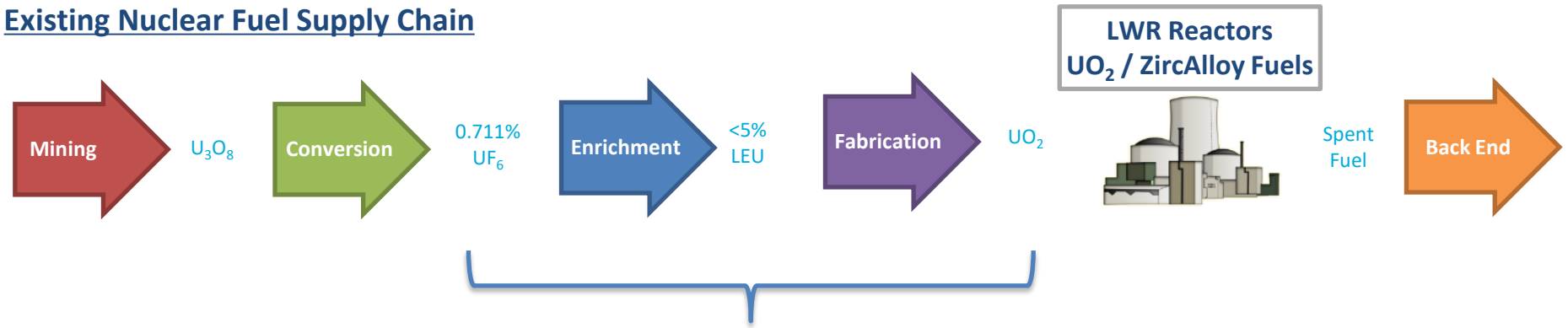
LEU <5%
Civil Nuclear Reactors

LEU+ 5% - 10%
Extended Fuel Cycles & ATFs

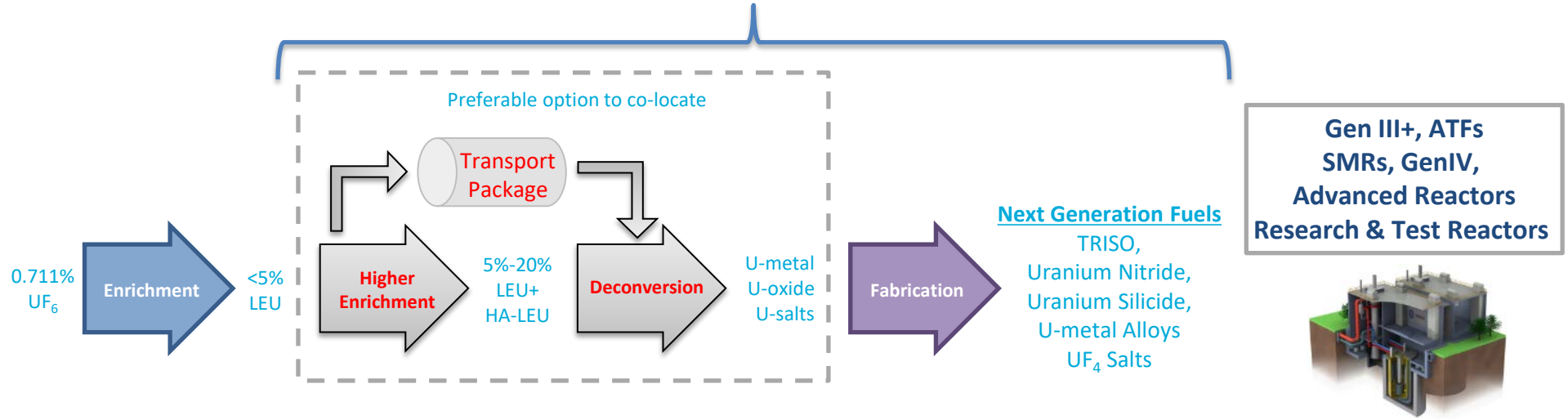
HA-LEU 10% - 20%
Test, Research and Gen IV Reactors

The Future Nuclear Fuel Supply Chain

Existing Nuclear Fuel Supply Chain



Completing the Future Nuclear Fuel Supply Chain



HA-LEU Fuel Cycle Requirements

A sustainable HA-LEU fuel cycle includes three fundamental capabilities:

1. Higher Enrichment Facility
   - to produce HA-LEU in the form of uranium hexafluoride (UF_6) up to 19.75%
2. Deconversion Facility
   - to (de)convert HA-LEU UF_6 into U-metal, U-oxides and/or U-salts
3. Fabrication Facilities
   - to manufacture the specific fuel types required by the various reactor designs

Packaging and transportation solutions are also required:

- A certified transport package (cylinder and protective overpack) will need to be developed to store and transport production volumes of HA-LEU as UF_6

Implementation of HA-LEU Enrichment at UUSA

No “Show Stopper”:

- There are no treaty considerations or export control restrictions associated with HA-LEU production at UUSA.

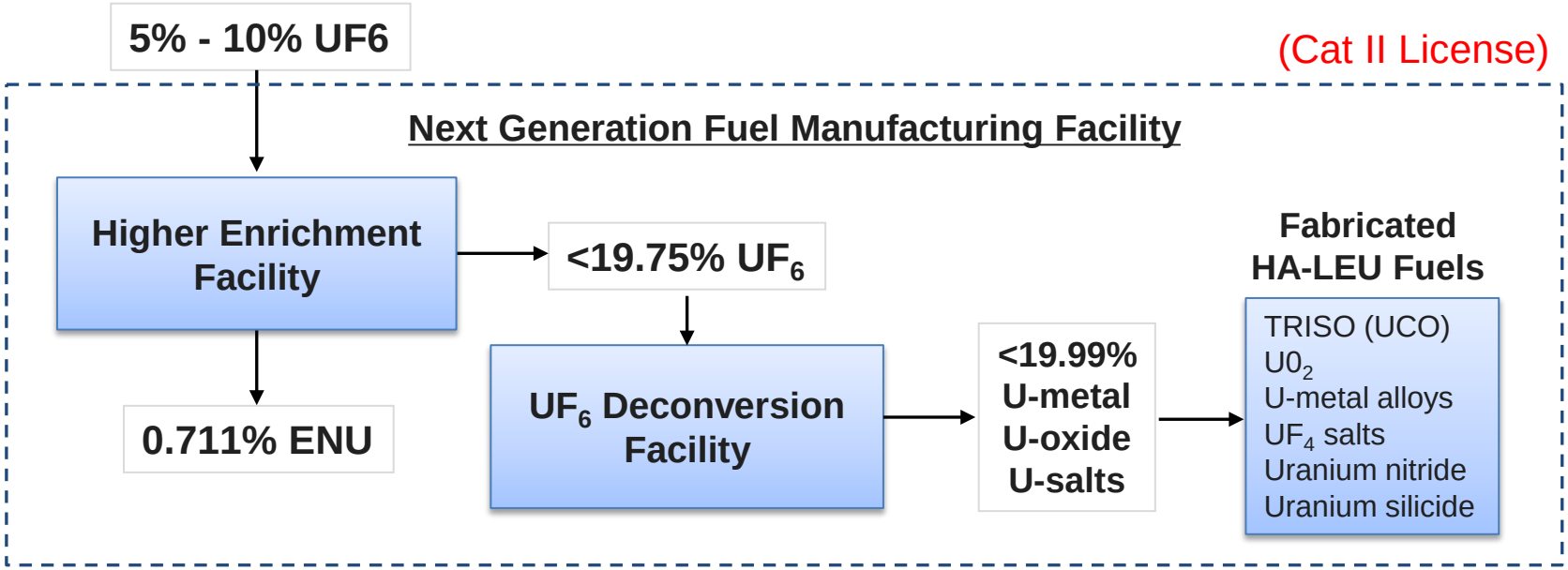
- URENCO’s existing advanced gas centrifuges are capable of producing the full span of HA-LEU enrichments without further development or testing.

- We estimate that if detailed design, site permits, and contractor selection were undertaken in parallel with the regulatory licensing process, we could construct, commission and start-up a HA-LEU production unit within 24 months of regulatory licensing approval.

URENCO Advanced Nuclear Fuel Campus

'3-Box' Model:

- Co-location of higher enrichment, deconversion and fuel fabrication facilities.
- Satisfying the requirements of a number next generation fuel types for HA-LEU.
- Leverages existing site characterization data, site infrastructure, and regulator familiarity



Transportation & Packaging Challenges

Addressing the issues related to the transport of enriched uranium between 5% and 20%, there are a number of steps required to arrive at a viable long-term solution:

Government and Industry should look at this question as two distinct pathways

1. LEU+ (5% -10%)

   EITHER: Use of existing 30B cylinder with DN30 overpack:

   - Requires analytical confirmation for regulatory/license exemption to 10% as a long-term solution
   - DN30 overpack can be demonstrated to be a safer and more robust option over the UX-30

   OR: Development of a New Cylinder with moderation control

   - Requires Industry and Regulatory backing for design, testing and manufacture of a long-term solution

2. HA-LEU (10% - 20%) - use of existing 5B cylinder:

   - Requires development of a modified DN30 overpack with integrated 5B storage racks
   - May need development of a more robust solution with increased capacity as HA-LEU volumes develop

Cylinder Model	Diameter (inches / mm)	Maximum Enrichment	Maximum UF6 (lbs / kg)
1S	1.5 / 38.1	100.00%	1.0 / 0.5
2S	3.5 / 88.9	100.00%	4.9 / 2.2
5B	5.0 / 127	100.00%	54.9 / 24.9
8A	8.0 / 203.2	12.5%	255 / 115.7
30B	**30 / 762**	**5%**	**5020 / 2277**

A call to action

Industry Task Force

NRC, DOT, National Labs, Industry Groups, Enrichers, Fabricators, Utilities

- Leadership to prioritize the issues, develop the project plan and channel resources
- Aggregate demand and specifications of reactor developers
- Make a consistent and coherent ask of Government

The Role of Government

- Sustained and dedicated funding:
  - Special funding profile so that interdependent projects are not competing for the same finite resource, i.e. Next Generation Fuels vs Advanced Reactors vs Transport.
- DOE “Wholesale Buyer” of HA-LEU
  - Purchase of initial HA-LEU output to enable industry to invest in commercial facilities of a minimum economic scale ahead of nascent demand.

Closing Remarks

1. It is imperative that the enrichment, deconversion and fabrication facilities - and the concordant packaging solutions - be developed on concurrent schedules.
2. Regulatory resources are required to support the licensing framework needed for the development of a HA-LEU fuel cycle.
3. The timing of front-end fuel cycle development for next generation fuels must match the forecast aggregate demand of advanced reactor vendors coming to market.
4. Companies making investments in HA-LEU facilities need to be sufficiently assured of a reasonable and necessary economic return.
5. There is a role for national Governments and NGOs to both stimulate and facilitate this exciting next phase in the growth of the nuclear industry.

URENCO USA
The National Enrichment Facility

Thank You

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