LEU Workshop

April 29, 2020

Intro

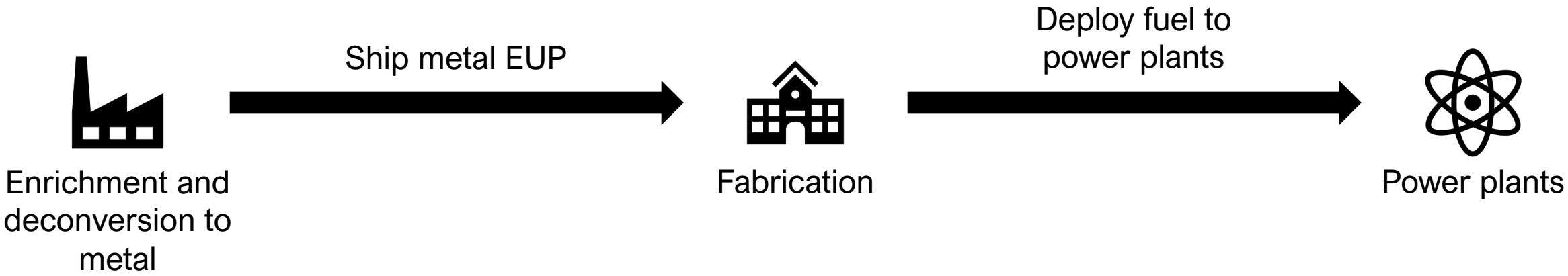
- Very small reactors (or microreactors) generally require LEU enriched to around 15-19.75% to realize performance objectives
- Larger core loads needed for longer lifetimes
- Near term needs
- Infrastructure challenges
- Different reactors need different specs in materials
  - Fast reactors can accommodate significant impurities
- It’s all about the economics…

Near term needs

- Oklo is working with INL for its first core load of fuel
- Unique fabrication considerations associated with residual contamination and impurities with recovered material
- Need fuel for subsequent units
- Gaps in infrastructure include:
  - Enrichment
  - Deconversion
  - Shipping
  - Fabrication

Vision for Deconversion

- Deconvert UF_6 to U metal at enrichment plants
- Easier to ship
- Usable for a variety of fabrication processes
- Catalyst for innovation in fuel fabrication
- Could attract onsite fuel fabrication



Shipping and Fabrication

- EUP shipping packages need to be available for use within 2 years, the sooner the better
- Ideally adaptable to metal EUP
- Oklo is working with INL on fuel fabrication for early cores
- Evaluating options for scaled fuel fabrication
- User-friendly fabrication facilities would help accelerate deployment
- Gaps in fresh fuel shipping

Possible government roles (1)

- Focus on cross-cutting opportunities!
- Expand enrichment capacity, develop HALEU inventory via downblending, all with a keen eye on economics
- Invest in infrastructure development for metal deconversion on-site at enrichment facilities
- Accelerate readiness and inventory of enriched material shipping containers
- Invest in establishing user-friendly fuel fabrication “hubs” or facilities

Possible government roles (2)

- Focus on economics, e.g. pay for performance approaches à la COTS where applicable
- Avoid technology-specific lock-in
- Be smart about how we license and regulate
- Incentivize a “real industry” outlook, not a subsidized or “contract-cronyism” one
  - Goal should be to drive to the cheapest EUP on a per kg process
  - We should avoid high cost legacy lock in that is often a side effect of certain federal subsidies and public-private partnerships
  - Help shed the legacy of artificial cost inflation
- Focus on bridging the near-term gaps in supply, demand, and demand signals, with the goal of establishing long term sustainability

Reactor-centric considerations

- Some fuel types and reactor types will require different specifications for fuel
  - TRISO will have different requirements than fast reactor fuel
- Take advantage of this, don't let the most limiting applications dictate costs or requirements
- Fast reactors can readily accommodate a range of impurities

Reactivity implications from changes in U-234 and U-236 content in uranium vector:

Reactor type	**Reactivity loss (pcm)**
Metal-fueled fast reactor 19.75% LEU	-146
TRISO-fueled gas-cooled reactor 19.75% LEU	-10,481
Oxide-fueled LWR 7% LEU	-1,250
Silicide-fueled LWR 7% LEU	-1,284
Graphite-moderated MSR 10% LEU	-2,567

Other fuel sources

- Other fissile material options are being considered, and in some cases are preferred by advanced reactor developers
- Plutonium-bearing and TRU-bearing fuels are of significant interest to fast reactor developers
  - Usable in each design, with most of the interest for liquid metal cooled reactors using metallic fuels and chloride salt reactors
  - Very different paradigm than MOX
  - Plutonium from fuel inventories slated for disposition, as well as TRU from used fuel
- There needs to be a conversation on these to help navigate and clear unnecessary or antiquated obstacles