Joseph Specht, February 11, 2025

Summary: This presentation was given by Ross Radel, who got his PhD from UW-Madison after growing up on a dairy farm and being scouted by a professor. Before working at Shine, he did fusion work for his PhD and at Sandia National Lab for 8 years. After working on fusion, he worked on space fission systems until one of the graduate students he received his PhD alongside reached out and asked him to join his company Phoenix. After joining Phoenix, the company split into two companies: Phoenix, which worked on imagine, and Shine, which worked on isotope production. These companies later coalesced during covid to form Shine Technologies. Shine has had four phases in place to ensure they will be able to produce commercially viable fusion without requiring government funding. The first is low-yield fusion systems that use DT fusion for imagining and irradiation. During the first phase, Shine developed neutron generators with neutron fluxes over two orders of magnitude higher than the leading competition. These neutron generators are used to image sensitive technologies, like ejection seats, in a non-destructive manner to ensure successful operation. Additionally, Shine has provided neutron irradiation services where they irradiate what their customers supply for material testing. After establishing the second phase, Shine began medical isotope production. During the second phase, they produced Lu-177 and Mo-99, which are important isotopes in the medical industry. Lu-177 is used for cancer treatment while Mo-99 is a diagnostic tool for cancer and heart disease. Shine estimates that they will produce enough Mo-99 to supply >50% of domestic demand. The third phase is when Shine began recycling used nuclear fuel to provide domestic recycled fuel in the form of MOX and a HALEU alternative. To recycle the fuel, Shine uses voloxidation for reprocessing, applies CoDCon extraction to create a U/Pu blend, removes minor actinides, harvest platinum group metals and rare earth elements, and repackages the recycled fuel for further use. Shine estimates >95% of waste volume is suitable for recycling. The biggest hurdle in the way for Phase 3 is government policy. The US does not want people reprocessing fuel and would need to update the Nuclear Waste Policy act for change to occur. Finally, Phase 4 has not begun, but is setting up fusion drivers to surpass engineering break-even (Q>20) fusion yields.

Response: I believe Shine will be one of the most successful fusion companies once they turn their attention towards fusion. Their business model of producing highly sought after products to ensure they have the financial capital required to develop fusion reactors is brilliant. Most of the fusion companies I have seen are receiving funding through venture capital and government subsidies, which are inherently risky considering the past of fusion energy. By establishing themselves before specifying into fusion, Shine has created a pathway where they can fund their own research and development without external support. Additionally, Shine made one of the most important decisions any company can make – they moved their research scientists to different projects after completing their previous work. Once phase 1 was complete, the researchers working on this project were not fired, but moved to work on a different phase of the company. By keeping their scientists around, Shine has fostered a culture where employees know they will be taken care of when their project is over. Additionally, Shine does not have to retrain new employees as those who are moving to a new project have been working there for years. By keeping employees long term and performing excellent research, Shine has shown they are dedicated to their end goal. I was impressed with how many different projects Shine has completed. They used both sides of the nuclear engineering coin, fusion and fission, to provide high-value products to seemingly disconnected industries. However, looking from a macro perspective, it is clear all their projects are culminating towards the deployment of fusion energy.