



iCAP Energy Team  
October Meeting Agenda  
Friday, October 29<sup>th</sup>, 9:00 A.M.

*Zoom*

- **9:00** Introduction
  - Dr. Caleb Brooks
  - Mike Larsen
  - Dr. Donald Fournier
  - Dr. Clark Bullard
- **9:05** Review of Meeting Objectives
  - **Our goal is to understand whether MMR fits into the framework of our plan to achieve net-zero GHG by 2050**
- **9:05** Introduction to the Micro-Modular Nuclear reactor
- **9:10-9:20** Guest Speaker: Dr. Caleb Brooks
  - **Deployment would be a 15MW thermal system. If operated at full capacity, it can operate for 20 years without refueling. This can be a longer lifespan if the supply is less than 15MW**
  - **Goal of the project is to act as both a power source but also as an education and research tool.**
  - **Once the reactor is fueled, it would remain sealed.**
  - **The demonstration of this technology to be integrated with existing energy infrastructure is important to this project.**
  - **Production will be used for electricity, district heat, hydrogen production, and other high value processes**
  - **Plan is to co-locate the reactor with Abbott power plant**
  - **9:20-9:25** Questions
    - **Caleb: our purpose is to not let radiation out. We have no plan to allow the testing of radioactive materials.**

- **Gerard: You mentioned how fast it cools when it stops operating, Does this stop the runaway reactor?**
      - **Caleb: in previous disasters, the reactor was still generating a very high amount of energy. In the case of Fukushima, the wave took out the cooling systems. In Three Mile Island, safety pumps were turned off. In our case, no cooling pump is necessary because power is so low it naturally dissipates.**
    - **Bill: Can Mike Larson put 15 MW into context**
      - **Mike: In general, we are a 40-50 MW campus with a peak of 70 MW. A couple of these would power and heat the campus.**
- **9:25-9:35 Guest Speaker: Mike Larson**
  - **My goal is to take whatever technology I am given to heat and power the campus.**
  - **Abbott is a co-generation plant, it is the only source of heat for the campus. We are connected to the grid and can buy any amount of power from the grid, but we cannot buy heat.**
  - **Abbott power plant needs to be able to generate heat, this MMR program would be a potential direct replacement for our fossil fuel fired boilers while also generating electricity.**
  - **This reactor could plug in and immediately replace all of the fossil fuel being generated for heat on campus while possibly generating enough steam to power campus as well.**
  - **Electrifying the campus is a very expensive task, and right now we do not have the technology in place to provide sufficient green energy to campus to power everything. It is not practical to power the grid by solar wind and battery storage.**
  - **Looking at all of the technologies that exist today, nuclear energy is the one viable technology that provides us with the reliable power necessary.**
  - **Our current green energy generation is erratic, we need a technology that will reliably generate energy, and nuclear is the most exciting for achieving our goals.**
  - **The campus is a microgrid, and the microreactors would give us everything we need to be a self-sustaining clean microgrid.**

- **The University has an opportunity to become a leader in the area of nuclear through construction of the reactor. We can train the world on the things we learn. I think it would be great if we use this opportunity**
- **9:35-9:40 Questions**
  - **Paul: How cost effective is the project?**
    - **Mike, we have not conducted detailed analyses. If constructed, the company will operate and maintain. We do not anticipate the costs to be very expensive. Part of the point of the research is to develop This technology**
    - **Caleb: the major cost is the fuel, in our case it is leased from DOE so there will be no cost of fuel. When the reactor is done operating, the fuel is taken back to DOE for disposal. The costs are somewhat offset by fuel, but the University will handle the costs of location. The university is working to offset the majority of all costs. Our projection is to save \$2.5 million a year in fossil fuel costs**
  - **Paul: In terms of fuels, is this relatively new technology, what kind of longevity do we have?**
    - **Caleb: the fuels have been used in past reactors in countries around the world as in the US. Our proposed fuel is a safer evolution of that. It goes through extremely strict qualification standards that will be completed by the project.**
  - **Yun Kyu Yi: How much energy will this project actually supply**
    - **Caleb: with the intermediate molten salt storage, we could have a very large capacity for short periods of time, but on average we cannot go over 15 MW thermal power. We are around 40-50 Campus need.**
    - **Mike: with this we will be over 10% of campus energy supply. This reactor will be a big chunk of our campus energy needs and will help us co-generate.**
- **9:40-9:50 Guest Speaker: Mr. Donald Fournier**
  - **I am concerned about location. We have a 21<sup>st</sup> century system powering a 19<sup>th</sup> century system. Steam power is not efficient.**
  - **I am concerned with locating this reactor at the center of town and the edge of campus, I am not sure we have space if we want to**

**expand. I think we should consider generating at south farm and generating electricity before thermal.**

- **I am not sure that this new reactor has not been tested before, it remains to be seen how well the technology will go.**
- **I am pro-nuclear but we seem to have economic problems with nuclear. I think the idea is great I just wish it was some place else.**
- **9:50-9:55 Questions**
  - **Bill: it is not the purpose of our committee to sponsor a debate around the technology. Your characterization is that we are using older technology and I can imagine a rebuttal is possible. I would point out that steam is a central method for energy generation on campus, and our master plan demonstrates that abandonment of the system would cost \$2.5 million. Much of this decisionmaking on campus has to do with whether to keep or not to keep the system.**
  - **Don: the US has been slow to converting to hot water for thermal. Other countries have used Hot water much more efficiently.**
  - **Mike: The reactor does not care if it is heating steam or water, but the cost of converting to water is huge. I would not want to link the two techs because they are complementary but separate.**
  - **Shannon: Have you considered whether there is existing infrastructure by the secondary site (south Farms) that would make the construction of the MMR viable thee.**
  - **Don: I don't think so, but it would be fairly simple to create energy connections, we do not have thermal connections from there.**
- **9:55-10:05 Guest Speaker: Dr. Clark Bullard**
  - **My background in energy started here in the 1970s. With a study on Nuclear and AES. Framing a scenario analysis is a very important step in the process. How will we put limits on it.**
  - **We can use futures to understand how the campus should be powered in 30 years. We can perform cost analysis of the various aspects and decide there, or we could set up a system of least costs, which is what we did at the national level. This is an important consideration to make.**

- **Don nailed the question, and Mike Larson noted that this is all about heat, with the co-generation providing additional benefits. I would start with reliability and try to envision what happens if the heat goes out, what is the source of heat? A reactor may be part of it, but what is the risk? Other universities around the world install heat pumps in the buildings to generate heat.**
- **You could have little heat pumps for every office, heat pumps for every building, or you could have central systems which we have three of around campus. Flexibility and reliability can come from a district heating system. I think you have to consider seriously, if we are going to have just one source of heat, what is the backup source. Electric driven heat pumps would be the cheapest tech with today's costs. The cost to me gets more expensive under extreme temperature conditions. In this case, you have complementarity between solar and temperatures.**
- **There is diversity in reliability**
- **10:05-10:10 Questions**
  - **Bill: I asked Dr. Bullard to present on short notice and I appreciate him coming prepared. He mentioned our charge which is to help frame this issue along with all energy issues on campus for an upcoming master plan. Our committee is trying to analyze these issues side by side for our master plan. I will point out that our committee adopted the POV to be a technical committee. We address the technical issues associated with energy use on campus.**
  - **Clark: The cost is so important, and we will have to tell the contractor to document what they did. There is very little fleshing out of the cost difference between steam and water. Abbott is a source for all of our cost data associated with changes. We need some good understanding of what the various products of Abbott power plant are costing us.**
  - **Mike: the baseline of operating the cost of the plant is included in our plans, we have some experience on potential for conversion of our physical infrastructure. We need to evaluate the conversion against everything else while still addressing the cost of everything.**
- **10:10-10:30 Discussion**

- **Damon:** if they want to use this MMR, it appears that Caleb wants to use it for research, and the intention does not appear to be a full power source. Am I correct in understanding the approach is experimental?
- **Bill:** I got a different impression in that even though we are a 40-50 MW campus, and the reactor is 15MW, the reactor's job is still to provide steam and energy to campus. Caleb's remarks make it seem that it is less a reactor than a method for bringing power to campus. I am happy to have a number that is lower than what the current total need for the campus is. There is a whole lot of work to do on conservation nfor this campus.
- **Paul:** I had a similar question to Damon in that I did not sense that there was a way to generate electricity. If we are using the reactor for thermal, sending it to south farms is not viable. We are starting at the low end of the reactor spot, so that helps with safety, but safety should be a major concern.
- **Tim:** It does sound like the reason this would be located at Abbott is to take advantage of steam infrastructure. My daughter lives on the proposed site, and living in town I think the safety risk is something the community would not get behind so readily. Cogeneration does appear to be necessary to make the system efficient.
- **Bill:** It is our job to prepare a brief the contractor can use to compare scenarios and reach the target. This MMR has a safety component to it. If I were the contractor writing the report I would like to have the safety and security issue designed by others.
- **10:30** Adjournment