4/5/22

**INTERVIEW WITH**: Clark Bullard, Former MechE Professor, Experience in Thermal Systems

**CONCISE SUMMARY:**

On 4/5/22 the team spoke with Clark Bullard. In this meeting we were provided with valuable insight into the importance of conservation and updating the current steam heating system on campus. In his opinion, the University should focus on conservation mainly and purchase renewable energy from the grid. This would allow more resources to be put towards conservation, where there is currently a lot of energy being lost. Additionally, he stressed the importance of updating the campus heating system to something more modern, such as a hot water and heat pump system. The team found that this interview gave good insight and recommendations on a potential way to approach the energy transition.

**DETAILED INTERVIEW NOTES:**

**Questions:**

1. What is more important: Supply side or Demand side improvements?
   1. Conservation is probably most important
   2. Need to focus on making buildings two or 3 times more efficient
   3. Lots of past funding/legislature issues.

**General Notes:**

Building Energy Efficiency

* Efficiency should happen first, need money from legislature which will be difficult
* Buildings are not energy efficient
* For individual rooms- need separate hot and cold pipes
* Conversion from steam to water, investigate buildings that have already done this, recent buildings. Steam is used to heat hot water
* Chilled water 44 degrees, condensate is an issue
* Heating/cooling is done in a central location, and then this air is blown. Some amount of additional reheating is done in rooms

Issues with Steam

* Thinks it’s very silly to continue using steam- old technology, no one uses anymore
* Would need several microreactors to provide steam load- is this true?
* He guesses we need 75 MW for campus heating (5 reactors)
* Leaking steam tunnels, insulate pipes better
* Steam is hotter than it needs to be in most cases

Heat Pumps

* Transition to heat pumps, reverse air conditioning
* Heat pumps can provide heating for most situations
* Geothermal is fancy term for ground source heat pump
* Space will be a setback for geothermal
* Air Heat Pumps are less efficient than ground source because it takes more energy (since the indoor and outdoor air generally has a higher gradient)
* Could possibly replace Abbott with a heat pump station. To send through old steam tunnels
* GSHP: 55-degree ground to 75-degree room; normally about 20-degree gradient
* Balanced heating and cooling loads are not common, important to consider this as it is an obstacle

Hot Water

* Heating solution like district cooling system, chilled water
* District heating right now is steam heating, heating with hot water
* 300 steam to building (much too hot), only 150 hot waters needed
* 44-degree water to chill

His opinion: we should start buying off grid, stop trying to generate. Abbott is only viable because the steam byproduct

Charge departments for steam and electricity would give incentives

Would be a part of their budget

Some complications with splitting buildings amongst different departments, but doable

Use steam tunnels for hot water?

Need more insulation for windows

Conservation:

* Duplicate and empty offices
* Individual controls for rooms, give faculty control
* Department heads need to be charged for electricity, will give incentive
* Modern control systems, allows for spaces to adjust based on occupancy