

Miranda Johnstone

Dr. Riskey

ENGL 101 HON

12 December 2023

From Coal to Natural Gas: The sustainability of the UW-Stout Heating Plant.



Fig 1. UW Stout Smokestack. Photo by Author on 15 November 2023.

When walking around any college campus, there is always one thing that sticks out to everyone. At UW-Stout, the first thing people look at is the large Bowman Hall Clock Tower. However, that isn't the tallest structure you will see, at it certainly wasn't the first thing I noticed. When driving down main street, you often see all the businesses and little shops, but just behind them, if you tilt your head up just a tad bit, you will see the UW Stout Heating Plant Smokestack rising from the ground. This formation is impossible to miss and has a sort of daunting presence on campus. The smokestack can be seen from

almost every place on campus, yet very few people actually know and understand what occurs inside the smokestack and the heating plant in general. Many students will simply glance at this structure connected to the UW-Stout heating plant and then move on with their day. However, when taking a closer look, there seems to be more to the Heating Plant than originally thought. This building is not only a purposeful building that provides heat and energy to our school, but it also plays a huge role in the sustainability and environmental plan that Stout prides itself in.

Heating Plants are common on college campuses, although many people do not entirely understand what actually takes place in a heating plant. In simple terms, a heating plant generates heat for various purposes. In a more complex explanation, heating plants generate steam, which is then transported to different buildings within its domain. This steam helps to create hot water, air condition, heat, laundry systems and more. The steam moves through different machines, such as HVAC units, refrigeration units, and hydronic heating systems, to heat or cool buildings. Heating Plants can use different fuels for generating the steam. Many plants use coal, however, recently many plants have begun transitioning to the use of natural gas. The heating plant at UW-Stout is the engine that runs our school. Without heat, we would not survive the frigid Menomonie winters. Brian Lorenz, the heating plant Supervisor said “Our purpose is to provide heat, hot water, and steam for the entire campus...It is a pretty important building, but as you saw our redundancy built in, we run things pretty tight here...it’s a good plant. That’s our purpose.” But aside from just that, our physical plant plays a huge role in our school’s mission of polytechnic. The heating plant symbolizing the ingenuity, innovation, and creativity that is UW-Stout’s culture. Although heating plants are extraordinarily complex buildings, from the outside, UW Stout’s Heating Plant is a curious-looking structure.

To the average college student at UW-Stout, the Heating Plant, located behind the library, looks like a regular building. The first time I came across this building, I was walking around at night while on the phone with a friend. Since I arrived at Stout, I had taken up a new hobby of taking nightly walks around campus, and that is how I discovered hidden gems that normally people didn’t know about. I passed by the building and had this sudden urge to stop and look at it. I noticed how absolutely curious I became after one glance. I ended up sending a picture of it to my friend to share what I was looking at.



Fig 2. UW Stout Heating Plant at nighttime. Photo by Author on 2 September 2023.

The first thing that caught my eye about the building was the light. During the nighttime, this building is lit up with tons of lights. But it wasn't just lit up, there was an entire wall of windows that allowed you to see inside. When I came back in the daytime, I noticed that the wall of windows was blacked out, or it seemed that way at least because you couldn't see inside. During the day, all the machines were hidden. It seemed almost as if in order to see the true functions of the building; you had to see it at night. This made me resonate with the Heating Plant on an interesting level. It felt almost as if there was an interesting story to this building, more than just what you see from the outside. The wall of windows provides a perfect opportunity for you to see all the fascinating things happening inside. That was the second thing I noticed, the machines inside. Being a technology and engineering fanatic, the different machines inside the plant blew me away. I was suddenly enthralled by the largeness of everything that my eyes could see, and I began to wonder about what I couldn't see. That's when I noticed the third thing: no one was inside. There was a minivan and a blue truck parked outside the building, but there were no people working. Not that I could see, anyway. Because I couldn't see anyone inside, it

made me wonder who works there? What exactly do they do? What is the purpose of this building? How does it help or hurt the campus? I suddenly had all these questions that required answers.

I reached out to the Heating Plant Supervisor, Brian Lorenz, and requested a tour of the Heating Plant. He graciously agreed, and he walked me inside the heating plant while explaining the processes inside and the purpose of the Heating Plant. (If you would like to go on your own virtual tour of the heating plant, please use the following link: <https://uwstout.github.io/VirtualFieldTripStudy/>)



Fig 3. UW Stout Heating Plant in daytime. Photo by Author on 29 November 2023.

As I walked up to the Heating Plant a brisk Wednesday morning, I looked up and was greeted with the colossal Smokestack. I stood for a moment and just stared in awe at the structure in front of me. The clanking and air movement that you can hear from the chimney creates a feeling of wonder and curiosity. It truly makes you want to know exactly what goes into the process that is generating this sound. Because the Heating Plant is a mechanical building, the sounds only improve the further into the building you go. After a few moments, I decided to walk into the heating plant. Going in through the North Entrance, it was an odd feeling, being inside a building I had looked at and wondered about for so long. I met Brian Lorenz as well as Brian Weisenbeck, another Heating Plant Supervisor, and we talked briefly about the main components of the heating plant. From there, Lorenz took me on a tour of the building.



Fig 4. UW Stout Heating Plant boiler system. “Learning Opportunities.” Learning Opportunities | Thermodynamics Virtual Field Trip, [uwstout.github.io/VirtualFieldTripStudy/infoPages/02-LearningMaps.html](http://uwstout.github.io/VirtualFieldTripStudy/infoPages/02-LearningMaps.html). Accessed 11 Dec. 2023.



### Main Floor of Heating Plant.mp3

File 1. “Sounds from the Main Floor Heating Plant”, MP3 file, November 29, 2023.

We started by walking down onto the main floor of the plant, where there are 4 main boilers as well as a ton of different tubes and pipes running through it. This was the machinery that I was able to see from the outside, but being up close, the machines and systems were so fascinating. The 4 main boilers that are almost 3 times the height of the average person generate more than just steam and heat for the campus. They create a sound that is unlike any other. It’s the sound of a running engine (File 1), the sound of machinery and mechanical processes working together, the true essence of the plant and its keynote sound. The 2 boilers that are currently in use for winter seem to be having a conversation. One will have a consistent whine, while the other has an inconsistent hissing sound. The two giants mimic each other at times and alternate in the releasing of air, in a sort of “psh” sound (File 2). Seamlessly, the sounds in the

main boiler room take over your hearing, making it difficult to have a conversation with another person. Brian has to almost yell to begin telling me about the amazing things that take place in this plant.



Steam Pshh.mp3

File 2. “Steam leaving the Boiler”, MP3 file, November 29, 2023.

The UW-Stout heating plant runs 24 hours a day, 7 days a week, and 270 days out of the year. Therefore, not all boilers are being run at the same time. The smaller boiler is mainly used in the summer and generates about 25,000 pounds per hour of steam. The two center boilers (originally coal burners that now burn gas) are used for general heating and they create about 45,000 pounds per hour of steam. Finally, the largest boiler on the end, which is only used in extreme winters, can generate about 89,000 pounds of steam per hour (Lorenz).



Fig 4. UW Stout Heating Plant basement room. Photo by Author on 29 November 2023.

When you go further into the plant, heading down another set of stairs, you enter the basement where all the water systems are. In the main room of the basement, you will find a condensate tank. This

tank is a main part of the plant's giant water loop. Water is pumped into the boilers which is turned into steam, that steam is sent out to the buildings on campus and leftover water is brought back into the plant where it is treated and pushed through this big tank which then pumps the water back into the plant. Water is constantly being rotated, similar to the general water cycle, to reuse water that is left over as to not waste water. There also is a water treatment room in the basement of the plant. Brian explained to me that the water they use needs to be pure and clean when used in the plant, it is so clean that it barely conducts electricity. If the water is not clean it will build up in the pipes of the boiler and it can become very dangerous. "Picture a tube, a pipe, with water. There's heat on the outside, heating that water up and boiling it into steam. If that water's got impurities, the impurities are gonna stick to the inside of the pipe. So now it acts like insulation. Now you have to add more heat, to get the same steam... Also if those [impurities] gets too thick, that pipe can actually overheat and burst, which is very dangerous" (Lorenz). In this water treatment room, the workers use water softeners, carbon filters, and reverse osmosis to ensure the safety of the water. All of these processes are built in to ensure that the plant is safe and running efficiently.



Fig 5. UW Stout Heating Plant water purifying room. Photo by Author on 29 November 2023.

While climbing back up the stairs to the main entrance, the sounds of the plant seem to follow you slowly combining with the other scattered sounds creating a full harmonic ensemble of noises to convey

the true purpose of the building, and it isn't until you are completely outside, that the music ends, and your ears start to notice the absence of the sounds. Upon exiting the Heating Plant, you feel different; you have just witnessed and experienced an array of sounds and noises that are difficult to explain, which is exactly what the Heating Plant is. A harmonious actor playing a role in powering the UW-Stout campus, while maintaining its sense of mystery and hidden secrets, only visible and available to those who are willing.

Brian Lorenz expressed to me that the biggest thing to remember about this plant is that it heats the entire campus. Therefore, "we can't go down, otherwise we would have to send all the students' home" (Lorenz). Due to the importance of the plant, there are countless systems of redundancy built in. On the main floor of the plant, in front of the boilers, there is an electronic control system which controls all the components of the boilers. In the past, they used pneumatic systems which were not very accurate and therefore very dangerous (Lorenz). There is also a plant worker in the control office at all hours of the day. This person's job is to watch all the monitors and make sure that everything is running smoothly. For every machine that is used in the heating plant, there is a backup system or duplicate of a machine to ensure that if anything were to happen in the plant, it would still be able to run and support the school. For the Turbine driven pump system, there are 4 electric pumps, which do the same job. 3 that run concurrently and one that is a backup for the original 3 in case the control panel for them breaks. Finally, although the heating plant is entirely run on natural gas, there is a fuel tank (big white tank outside of the building) that was built and filled in the case that if something was to happen to the water supply or supply of natural gas, they have a backup. Because fuel oil does not burn as clean or efficient as natural gas, it is rarely used in this plant, but if something were to happen, the plant could use that fuel oil to maintain its heating responsibilities (Lorenz). Redundancy is a huge deal for the heating plant because of the severe importance of this building in fueling the UW Stout campus.



Figure 6. Photograph of heating plant. 1965. UW-Stout Archival Negative. 1965\_244\_002. University Archives, University of Wisconsin-Stout, Menomonie, WI.

Michael Bowman, a Facilities Management Project Manager, also walked me through the history of the heating plant and how it has evolved over time. UW Stout has had 2 heating plant buildings in its history. The original Heating Plant was built behind Bowman Hall. It was built here because originally the Stout Campus was small and therefore the location of the plant was somewhat centralized. As the years went by, the UW Stout Campus began to expand with the building of multiple dorms, the current Student Center, and more. With the expansion of the campus, the location of the Heating Plant had to be moved. In 1962, the Heating Plant and Chimney Stack were built in its current location, across the street from Fryklund Hall and just behind the UW-Stout Library. This plant was about 2/3 the size it is today and only had 3 boilers, rather than 4 (Bowman). This heating plant began operation in 1965 but they operated by burning coal. The plant had coal-fired boilers and there was a coal bunker inside that plant that housed all the coal that the Heating Plant needed. This coal bunker is actually still in the current Heating Plant, it is not in use anymore, but when walking through it you can still see dust and residue from when the coal used to be there, despite it not being there for years (Lorenz). Often times burning coal is seen as a very unsafe, unhealthy way of creating heat as burning coal leads to more carbon emissions, however,

according to the Facilities Supervisor, Brian Lorenz, the coal that the heating plant received was from Kentucky, shipped up the Mississippi River, and was already a very safe type of coal. When the Stout heating plant burned the coal, they burned it exceptionally clean because of the machines and process they used inside the plant. Although burning coal is not a safe process for the environment, UW Stout never violated any regulations in coal emissions, therefore making it an example of a well-run system (Lorenz).



Fig 7. UW Stout Heating Plant old coal deposit room. Photo by Author on 29 November 2023.

According to the article “Stout’s heating plant becomes ‘guinea pig’”, from the Dunn County News written in September 1975, the Environmental Protection Agency launched a project at UW Stout, as well as several other locations including the heating plant at UW Eau Claire. This project was to test and see if western coal could be used to heat large campuses. Western coal is a safer type of coal, given that it has 2-4 times less sulfur than eastern coal and therefore produces less carbon emissions. However, it takes more western coal to produce the same amount of heat as eastern coal. After 2.5 years of this project, Stout submitted a review saying that burning the western coal was moderately successful, and although it was less money, it took more to heat the campus (“Stout’s heating plant becomes...”). Because of this report, it was clear that something had to be done to fix carbon emissions at college campuses. Additionally, in 2016 a report titled “Energy, Exergy and Environmental Quality of Hard Coal and

Natural Gas in Whole Life Cycle Concerning Home Heating” done by a variety of students at the Institute of Thermal Technology, Silesian University of Technology in Poland, showed a comparison between the burning of coal to produce heat and the use of Natural Gas. Figure 7 shows the different emissions between hard coal, oil, and natural gas. You can clearly see that Natural Gas emits less Nitric Oxide and Nitrogen Dioxide (NO<sub>x</sub>) by 1.05 g/kWh (gram per kilowatt-hour), less Sulfur Dioxide (SO<sub>2</sub>) by 2.48 g/kWh, less Carbon Dioxide (CO<sub>2</sub>) by 606 g/kWh, and finally less Methane (CH<sub>4</sub>) by 0.28 g/kWh. Natural Gas is much more attractive in recent studies because it emits less than half the amount of CO<sub>2</sub> emitted by hard coal. The one fear of using Natural Gas is that it still emits around a similar amount of methane, an extremely dangerous chemical that greatly effects climate change. Despite this report being released in 2016, just a year prior, Stout had begun its plans to move away from coal, to decrease its carbon emissions and commit to the use of Natural Gas.

Compound	Unit	Hard coal	Oil	Natural gas (from Russia)
NO <sub>x</sub>	g/kWh	1.44	1.27	0.39
SO <sub>2</sub>	g/kWh	2.52	2.31	0.04
CO <sub>2</sub>	g/kWh	989	886	383
CH <sub>4</sub>	g/kWh	1.67	1.08	1.39

Fig 8: Table 1. The values of direct emissions to the atmosphere of selected pollutants during the electricity production (Pikon p 1148).

The plan to end the use of coal in the UW-Stout Heating Plant and design a new model with natural gas boilers and fuel-oil backups began in 2015. Michael Bowman, a Facilities Management Project Manager, who was the key project manager on this project, explained the actual timeline of the project to me. It actually took 5 years for the project to actually begin. While being approved in 2017 and completing designs in 2018, construction began in May 2020. According to the article “Last scoop of coal marks end of an era to heat university”, Sarah Rykal, the UW- Stout Sustainability Manager said that there has been talk for years from students and faculty to move away from coal and now that the campus made the transition, “[t]his is a big step in the right direction for our campus”. UW Stout was one of the first five UW campuses to make the complete switch from coal to natural gas and heating oil. In June

2020 the UW System stopped providing coal to campuses based on a statewide contract, causing campuses to transition to the use of natural gas and fuel oil, which they not use at half the cost of coal and save a lot of time (Associated Press).

Despite the long planning, this project's construction only lasted about 5 months, ending in September 2020 (Bowman). The main reason this project was so quick to be constructed was that this was the campuses only heat source, and it would be an unsafe environment if the students living on campus did not have heat or hot water. Bowman also shared with me that this project had to be completed on time with minor issues. He stated that even with this being a \$4.2 million state funded project, there were only 22 RFI's (Request for Information: a submission of questions on a document or part of the process that needs clarifying) submitted, meaning that the project with woefully planned out, and highly successful. Finally, in July 2022, the project was officially closed out after a year of fine tuning and proper supervision (Bowman). Additionally, in 2021, the heating plant underwent some additional construction to refurbish the window wall on the outside of the plant. This window wall not only served as a way to see into the plant from the outside, but it also helped to provide cooling and climate control from within the plant. "Ultimately, the project will not only help conserve energy but improve overall aesthetics as well" (Mezera). The UW-Stout Heating Plant now runs entirely on natural gas, although not a renewable energy source, still burns clean and produces steam in a very sustainable way. Despite the successfulness of the transition to natural gas, there has been a lot of talk about moving towards geothermal heating for the UW Stout campus, which focuses on gathering heat from the Earth's natural heat sources underground (Bowman).

Since 2007 UW Stout has been committed to reducing their carbon footprint and providing a campus that follows a mantra of sustainability ("Sustainability"). The Heating Plant plays a huge role in our campus, by providing us with heat every single day, but also being a symbol of our dedication to making Stout a more environmentally friendly campus. The substance you see coming out of the 204-foot-tall smoke stake is a form of water vapor that is white in color and caused by the burning of the natural gas, it is not dangerous air or smoke, it is simply water that is emitted, by the plant, demonstrating its purpose to promoting a cleaner environment at UW-Stout. By making the transition from coal to

natural gas, UW Stout shows that it can be done, along with the transition being done by all other schools in the UW System. This massive shift can be used as a model for schools and buildings across the country. There can be a change made, however, there are always some difficulties. Despite Stout's ability to transition from coal to natural gas, not all facilities have this type of capabilities, some systems are just too big, some are too reliant on coal, and others simply don't want to make the shift because coal is "easier". For whatever reason, most large-scale companies and buildings refuse to change to a more sustainable way of heating. This is why it is important to keep the message alive and going. Every small choice you make to be more sustainable, whether that's recycling something that you almost threw in the garbage, or deciding to carpool with a friend so you aren't wasting gas, can help to make a difference, and here at UW Stout, we empower ourselves and each other to constantly make those changes every single day. The heating plant that you can see from any place on campus, is a testament to how passionate this school is to making the world a better place, not just by our decreased carbon emissions and use of natural gas as a heating source, but by creating students who will go on to change the world.

## Works Cited

- Associated Press. "5 UW Campuses Phase out Coal as Heating Source This Year." *The Daily Reporter - WI Construction News & Bids*, 9 Mar. 2020, [dailyreporter.com/2020/03/09/5-uw-campuses-phase-out-coal-as-heating-source-this-year/](https://dailyreporter.com/2020/03/09/5-uw-campuses-phase-out-coal-as-heating-source-this-year/).
- Bowman, Michael. Interview with author. 30 Nov. 2023.
- "Last Scoop of Coal Marks End of an Era to Heat University." *Stout*, 5 Mar. 2020, [www.uwstout.edu/about-us/news-center/last-scoop-coal-marks-end-era-heat-university](http://www.uwstout.edu/about-us/news-center/last-scoop-coal-marks-end-era-heat-university).
- Lorenz, Brian. Interview with author. 29 Nov. 2023.
- Mezera, Ryan. "A New, Sleek Look Added to the Heating Plant." *Stoutonia.com*, 14 Jan. 2022, [stoutonia.com/a-new-sleek-look-added-to-the-heating-plant/](http://stoutonia.com/a-new-sleek-look-added-to-the-heating-plant/).
- Pikon, Krzysztof, et al. "Energy, Exergy and Environmental Quality of Hard Coal and Natural Gas in Whole Life Cycle Concerning Home Heating." *Thermal Science*, vol. 20, no. 4, 2016, pp. 1147-1159. ProQuest, <https://login.ezproxy.lib.uwstout.edu/login?url=https://www.proquest.com/scholarly-journals/energy-exergy-environmental-quality-hard-coal/docview/2429762725/se-2>, doi:<https://doi.org/10.2298/TSCI160224158P>.
- "Stout's heating plant becomes 'guinea pig'" *Dunn County News*, 24 Sep. 1975, p. 18. <https://menomoniepubliclibrary.newspapers.com/image/542910931>
- "Sustainability." *Stout*, 19 Apr. 2023, [www.uwstout.edu/life-stout/sustainability](http://www.uwstout.edu/life-stout/sustainability).