

# Cal Poly Engineering East – Building 20, A Critical Analysis of Mechanical Needs and Distribution of Mechanical Resources

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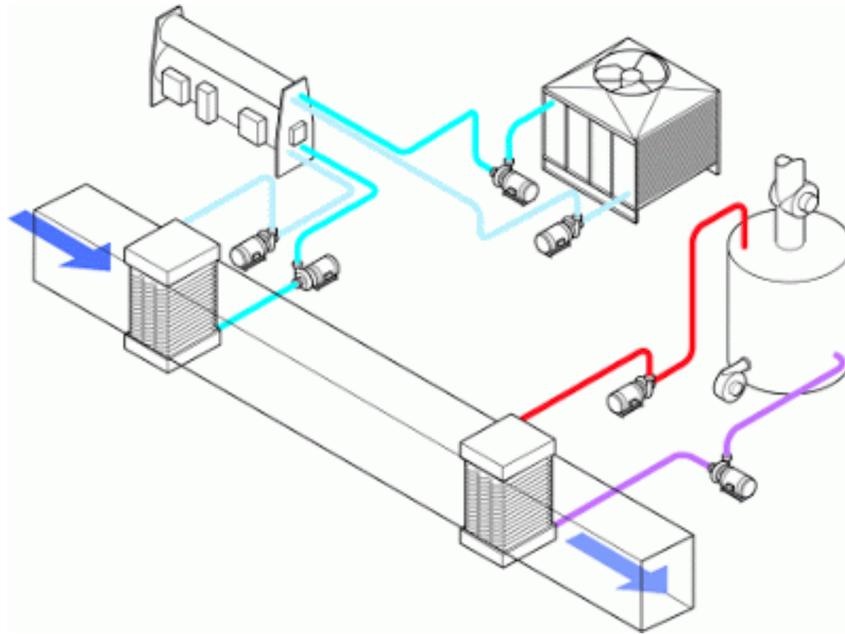
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Older buildings on the Cal Poly campus need renovation, particularly with the heating, ventilation, air-conditioning (addressed as HVAC) systems in the classrooms. The HVAC units within the old buildings are obsolete, inefficient, and are most likely due for replacement. The Engineering East building, also known as Building 20, is an example of a campus building that requires a quality HVAC system. By upgrading the HVAC, the building conditions can be positively enhanced through better cooling and ventilation, allowing students in the labs and classrooms to have a better experience within the building. This paper details the methodology behind installing a proper HVAC unit, while providing a proposal for Cal Poly Administration to consider a quality HVAC system for Engineering East. It also includes a survey answered by students who have or have had classes and labs in Building 20 and seeking their general opinions on whether their education could be improved with a better HVAC system. There are two additional interviews with the Electrical Engineering department head and with Cal Poly's project and facilities manager. The purpose of these interviews is to investigate their thoughts on the overall indoor air quality of Engineering East. From the results, Cal Poly Administration can be educated on how a better mechanical system can improve the education of both students and faculty members, which can ultimately influence their official decision on the concept of providing a quality HVAC unit in Building 20.

**Key Words:** Mechanical, HVAC, Indoor air quality, Comfort, Student satisfaction

## Introduction

Cal Poly San Luis Obispo was established in 1901 and is considered to be an older Polytechnic school. Some of the buildings on campus are also old, including Cal Poly's Engineering East – also known as Building 20 – which was constructed in 1958 and later renovated in the 1990s (Derickson 2019). However, during those renovations, while the initial chilled water system on campus was expanding to Building 20, only the heating unit made a successful connection whereas the chilled water pipes ended up stubbed out. As a result, Building 20 currently has access to only heating and not cooling, which poses a problem for both students and professors who spend a majority of their time in the classrooms and labs. Without a proper HVAC system, there is a lack of indoor comfort provided for occupants. Engineering East is an example of a building that requires a new and updated HVAC system in order to better provide its occupants with a comfortable experience as college students. The Engineering East building houses many labs, with heavy-duty lab equipment and computers that run nearly all day. As a result, the internal temperature of the lab rooms increases, which only worsens during the fall and spring quarters. With no proper ventilation, the heat continues to build up and circulate around the labs, causing students to feel the heated consequences that results from a poor HVAC unit. This also applies to classrooms, where both students and professor are experiencing the poor ventilation and lack of cooling systems. A poor HVAC system can negatively impact student and professor productivity, and with the outdated system in Building 20, a quality replacement may be required as the solution to better improve Engineering East.



*Figure 1.* Graphic of a commonly found HVAC system and how it generally works  
*Source.* Proud Green Building

A proper mechanical system in a campus building can prove to be beneficial in multiple ways. The main function of mechanical systems, specifically HVAC, is to provide a level of comfort that is satisfying for building occupants year-round via indoor climate control and proper airflow. HVAC systems also maintain mold prevention, dust accumulation and general ventilation, all of which contribute to occupancy comfort and safety (EPA 2018). Building occupants can benefit greatly from a proper, well-maintained and upgraded HVAC system, since comfort levels are a large factor in productivity and occupant health (Primex 2017).

With the multitude of positive uses, quality HVAC systems are advantageous for both buildings and its inhabitants. However, the HVAC in Engineering East has yet to be renovated for the better, leaving the student occupants unsatisfied and uncomfortable with the current mechanical conditions.



*Figure 2.* Cal Poly’s Engineering East, otherwise known as Building 20

## Methodology

The methodology I have chosen for this study is a detailed analysis of qualitative data from student surveys, by specifically asking students who have or had classes in Building 20. The distributed survey questioned how Cal Poly students felt about the current conditions of the building, and whether improvements relating to HVAC were necessary or not.

A Google Form survey, titled “Make Your Education Cooler,” was sent out to the Electrical Engineering department, since the electrical engineering majors have most of their classes and labs in Building 20. The survey was also shared to students in the open labs located at Building 20 as well. The survey had four required questions – one short answer and three yes/no questions - along with one optional free response for anyone who wanted to write in additional comments.

The general description and questions were as followed:

“Make your education cooler! This survey is to see whether the Engineering East Building (BLDG 20) needs a new HVAC (heating, ventilation, air conditioning system). We are exploring the potential of whether a proposal for a new HVAC system is needed.”

- 1) Describe the temperature and humidity of the building. Is it hot, humid, cold, average, etc.?
- 2) Would improving the HVAC of the building help your experience as a student?
- 3) Would you enjoy having AC in the building for both labs and classrooms?
- 4) Would you enjoy having better ventilation in both labs and classrooms?
- 5) Share any other thoughts you believe will be helpful

There is also additional qualitative data, which was established by interviewing two key individuals – Dennis J. Derickson, the department head of Electrical Engineering and Dave Norton, the project manager for Cal Poly Facilities. The interviews went in-depth about their general thoughts of Building 20 and its current indoor air quality. The interviews also detailed into what is currently being done to improve the HVAC systems and what more can be done to accomplish said improvements. The results from both the survey and interviews were then analyzed in order to mitigate the concept that mechanical HVAC improvements are a necessary and beneficial requirement for the Engineering East building.

### *Current Proposal*

There is currently an undergoing proposition to install chilled water pipes in Building 20. This proposal was initiated by Derickson, and the job is set to begin this upcoming summer of 2019. The current proposal is not being accomplished through Cal Poly administration, but instead Derickson is the one to provide Cal Poly Facilities with money from grants and other sources to officially install the chilled water pipes (Norton 2019).

In the original proposal<sup>1</sup>, it suggests that specific lab rooms – the labs facing the south side of Building 20 - should have chilled water pipes connected, due to the excessive heat which contributes towards “a poor learning environment.” This suggestion to improve Engineering East’s HVAC system illustrates that the faculty who teach in Engineering East acknowledge that the HVAC is in poor condition and requires a major replacement for the better.

The construction estimate<sup>2</sup> for the proposal – as provided by Cal Poly Facilities - entails that HVAC will be installed for five of the rooms in Building 20, which are rooms 112, 113, 146, 147 and 148. The mechanical plans<sup>3</sup> for these chosen rooms are shown further in detail, and goes into what mechanical changes will occur to install the chilled

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<sup>1</sup> See Appendix A

<sup>2</sup> See Appendix B

<sup>3</sup> See Appendix C

water lines. The estimate was officially established and submitted on February 8, 2019, and states that chilled water lines will be connected to “existing HVAC Unit in room,” and cooling coils in the existing unit will “run condensate line[s] to exterior of building and drain into planters.”

### *New Proposal*

This new and suggested proposal<sup>4</sup> is to bring a new HVAC system to the entirety of Engineering East in order to better provide students with a more comfortable experience as occupants. Installing chilled water pipes in only five of the rooms is an improvement; However, it is not enough to maximize occupancy comfort or to take advantage of the full mechanical benefits of HVAC. By utilizing fully functioning HVAC in all of Building 20, students and professors are most likely be much more productive, especially in an improved learning environment since there will no longer be poor ventilation or heating conditions.

With this new proposal, there are also other concerning factors regarding cost and time. Although the building occupants would be satisfied with full-building HVAC, the potential cost can total to a large amount that Cal Poly cannot afford at this time. However, an alternate solution to the high costs would be the long-term cost efficiency. By purchasing a quality HVAC system and paying for the overall project costs, Building 20 will be able to have a proper mechanical system that can and will last much longer than its current one. This would make it much more cost-efficient to buy a pricier system now but pay for less in the future.

There is also concern with construction on campus, as this can prove to cause a disturbance with both students and professors. A large-scale installation can be a major distraction, and unless construction can be completed during the summer, there will most likely be complaints from Cal Poly students. A project of this size can also be susceptible to delays, which only further contributes to overall dissatisfaction

### **Results**

The overall results from both survey and interviews revealed a consensus – Engineering East’s HVAC systems need improvements and that replacing the current HVAC for a higher-quality system would benefit both students and professors. The general response for the student survey illustrates that the 94 respondents would prefer a proper mechanical HVAC system for Building 20. The key interviews from Derickson and Norton reveal that both agree that Engineering East is in need of mechanical repairs, and improvements for Building 20 should be considered a necessity by both Cal Poly Facilities and Administration.

### *Survey Analysis*

From the distributed survey, the results revealed a strong positive response in favor of installing a newer and more efficient HVAC system in Building 20. For the first question, all students had similar statements, which was that the Engineering East building is generally hot, humid and overall uncomfortable for the building occupants. Other submitted comments included how the building is unbearable with the poor smells and that unbearable internal temperatures further contribute to the discomfort of occupants.

The next three questions also showed positive results, which was that all 94 respondents believed that HVAC improvements would help them as students, and overall proper ventilation would be beneficial in both the labs and classrooms. The 100% response rate reveals that surveyed students strongly believe that the Building 20’s HVAC system needs to be of better quality in order to improve Engineering East as a whole.

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<sup>4</sup> See Appendix D

Describe the temperature and humidity of the building. Is it hot, humid, cold, average, etc?

94 responses

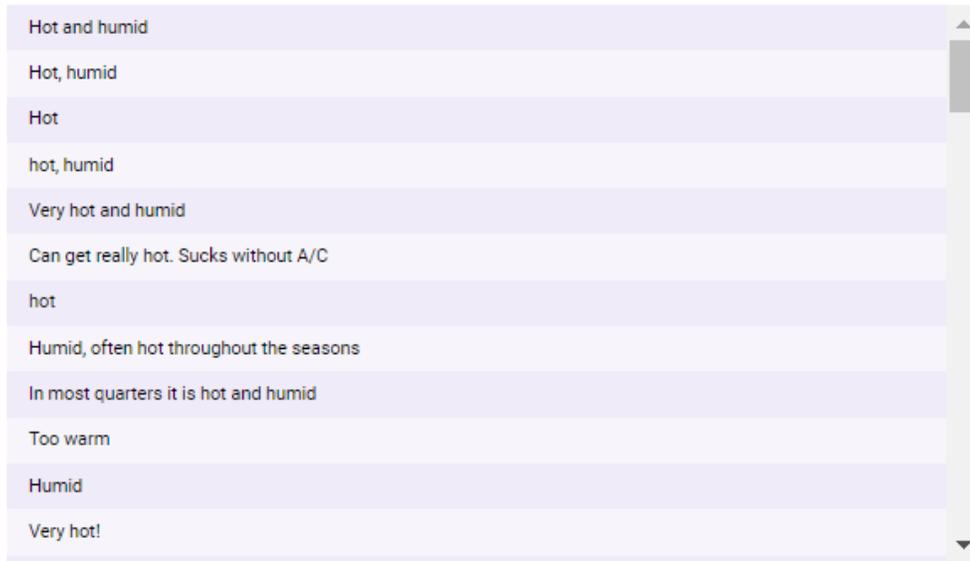


Figure 3: Responses when asked to describe temperature and humidity of Building 20

Would improving the HVAC of the building help your experience as a student?

94 responses



Figure 4: Results of survey when asked if students would have a better experience with improved HVAC

Would you enjoy having better ventilation in both labs and classrooms?

94 responses



Figure 5: Results of survey when asked if students would enjoy AC in both labs and classrooms

Would you enjoy having AC in the building for both labs and classrooms?

94 responses



Figure 6: Results of survey when asked if students would enjoy having better ventilation

For the optional free response, there were 43 respondents out of the 94 who answered the survey. All 43 responses were in favor for an improved HVAC system for Engineering East. Students also stated that Building 20 had poor ventilation in the labs and classrooms and that the heat made their student experience unbearable, forcing students to rearrange their schedules or even leave classes early to avoid the heat and humidity that accumulates within the building.

### Optional: Share any other thoughts you believe will be helpful

43 responses

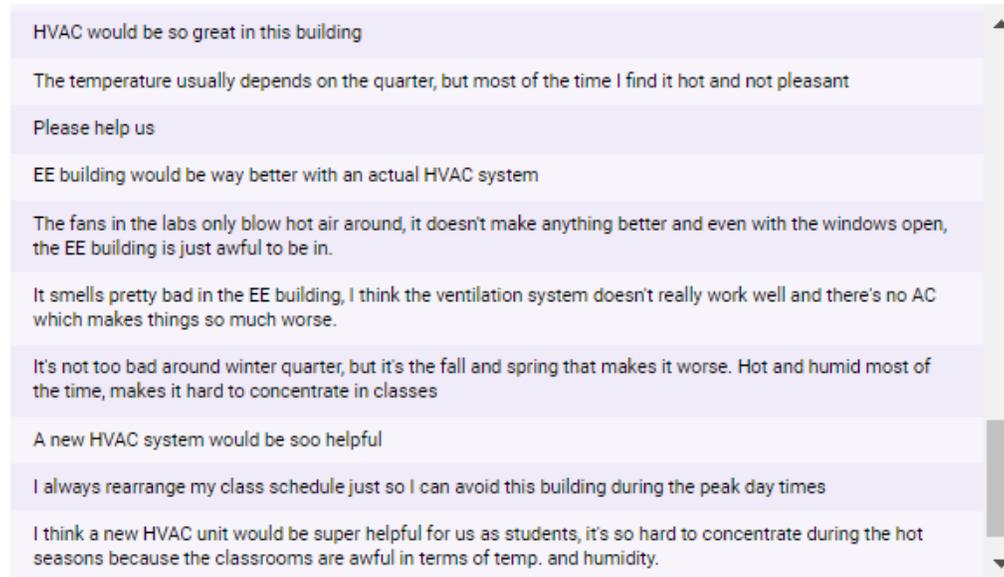


Figure 7: Results of survey when asked if students had any other thoughts to share about BLDG 20's HVAC

Other suggestions included that if the HVAC system were to be replaced, potential construction should occur during the summer as to not disturb students during regular quarters. Additional comments mentioned how the electrical engineering equipment is heat sensitive, and that not only would better HVAC benefit occupants but also help save costs on lab equipment since the heat contributes to a shorter lifespan in terms of usage.

### Interviews

The interview results revealed that both interviewees felt that the HVAC system for Building 20 could be improved for both lecturers and students.

Derickson also teaches in Building 20 every quarter. From the interview it was revealed that he feels that a better HVAC system is necessary, and that his teaching experience at Cal Poly could better improve for both instructor and student. Due to the heat in the classrooms, he notes that students do not pay as much attention since their attention is diverted to trying to leave as soon as possible (Derickson 2019).

Although Derickson states that he feels fortunate to have a building for the Electrical Engineering department, the main downside is the lack of cooling, especially during the hotter seasons. The installed fans do not help, but instead continuously blow hot air around the room, which results in students struggling in classes out of discomfort. The Engineering East building essentially has no control over temperature other than opening windows and running the fans, which emphasizes the need for HVAC system improvements (Derickson 2019).

Norton is also the project manager assigned to installing chilled water lines in Engineering East's five rooms. He was also responsible for Building 20's interior remodeling last summer and revealed that he has heard multiple

complaints about the heat and poor ventilation from others during the remodeling project. Norton states that the job for installing the water pipes will be completed through Cal Poly Engineering Services, and that new control wires are being put in to run into the Siemens control system, which will give the building faculty the ability to monitor the main system through the computer (Norton 2019).

Norton also emphasizes that the cost to put proper AC for the whole building would be an extraneous amount, and that looked to be more cost-effective to only install the water pipes in five of the rooms. The current budget would not be enough to cover costs for the entirety of Building 20, and this includes money from both Derickson's grants and the potential budget from Cal Poly Administration and the state. According to Norton, Cal Poly Facilities does not have the money to add in upgraded AC for the entirety of Building 20, and that unless HVAC upgrades were considered as an infrastructure upgrade, there is not enough money to install and upgrade an entirely new mechanical system for Engineering East. For campus buildings, they are prioritized based on needs, and safety is of utmost priority. Since HVAC is not inherently seen as a large concern, it is often overlooked by Cal Poly Administration (Norton 2019).

## Conclusions

Overall, from both the survey and interviews that were conducted, the overwhelming response is that an improved HVAC unit is required for Engineering East - Building 20. The 94 survey responses were similar in that the Engineering East building was in need for a quality HVAC system, and that the heat, humidity and poor ventilation had a negative effect on their experience as Cal Poly students. Respondents also emphasized that with better AC and ventilation, it would improve their student experience while also providing future Cal Poly students with better labs and classrooms. In both interviews, Derickson and Norton highlight the importance on the new upcoming HVAC in the five labs yet emphasize that it would still be more beneficial if the entirety of Building 20 had a full-functioning and upgraded mechanical system. Although Cal Poly Administration may not currently see the importance of HVAC for their older buildings on campus, it should be noted that mechanical systems are imperative to student and faculty comfort and that the results from research outline the importance of a proper quality HVAC system.

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