

Summary Background on Decision to Connect the UTLF (Undergraduate Teaching and Learning Facility) to the campus steam plant infrastructure.

Some students, faculty and staff have asked about the decision to connect the UTLF to the campus steam plant infrastructure. Information has been provided in response to those questions but we are also providing this write up to allow the information to be shared more broadly.

As noted below, the connection of the UTLF to the steam plant infrastructure is an exception to our most recent practice with mostly having all electric buildings. This exception is due to the fact that we must maintain the current steam plant infrastructure for the near term, since it supports approximately 5.5M gsf of campus space, and has historically not been well maintained. The campus has more recently focused its attention on improved maintenance of all utility infrastructure for the campus, including steam, and these efforts have led to efficiencies and reduction in consumption. When the MRB facility was brought on line (2018) a major issue in the steam line infrastructure was identified, basically off the SW side of that site and in the NE part of parking lot 19. Some interim measures were taken to stabilize the issues but it was determined at the time that a more extensive improvement was needed in that steam line infrastructure, to include possible connection back to the loop that exists at the PE/Athletics facility (one of the first campus buildings that was available when UCR opened in 1954). When the UTLF was sited in this location (lot 19) it would allow for the campus to make significant efficiency improvements in the steam infrastructure through that project funding.

General Background on campus Steam/Cooling Plants:

1. UCR has a steam plant and this is our main source of use for natural gas for the campus. The steam plant was developed in the early 1950's and was one of the original facilities available when UCR opened in 1954. We do not generate electricity with natural gas, like many of the UC campuses (which have cogeneration plants).
2. We cool our buildings mostly through a central plant that generates chilled water, but the energy source for this plant is electricity. That plant also has storage capacity for chilled water, to generate such off peak load/cost and hours.
3. It is true that some of the UC campuses are ahead of UCR in sustainability measures. We often look at UCI, which has had what we call an "insets" program for many decades (investing in utility efficiency projects). Many of the UC's have invested much more in their facilities over the past decades and many have more funding (normalized per student and overall) than UCR has had in the past. However, many of the UC's also invested long ago (exception may be UCSC, which brought its cogeneration plant on line about 2016) in cogeneration plants, which use natural gas to generate less expensive (and more reliable perhaps as well) electricity for their campuses. While this approach had many financial benefits in the past, they are now also faced with addressing the natural gas used in these plants, which in general consume more natural gas alone than our steam plant. In most cases these UC's have central steam plants and the cogeneration plants using natural gas, and they now must address both of these major natural gas uses.
4. UCB is one UC campus that is moving away from steam energy, and so is UCD as are some others. UCB was very fortunate to receive significant legislative support for their "Berkeley Clean Energy Campus" program, and in the 2023 California state legislative session they were approved for \$249M in funding for this specific project. That is great for them and we hope UCR can get levels of funding like this in the future as well.
5. UCR works closely with RPU (Riverside Public Utilities), as they are our primary electricity provider. We also have about 9MW of solar power on campus and we are expanding that capacity. We do not have a cogeneration plant that provides the campus with electricity, but we do have a significant solar array that provides electricity to the campus to offset what is otherwise purchased from RPU.
6. We have in fact reduced our energy consumption in the near term, while at the same time expanding the campus. We continue to invest in projects that will make our electrical system more efficient, as well as our steam plant.

- UCR developed a carbon “insets” program to allow us to invest resources into campus energy efficiency measures, rather than using those resources to buy carbon “offsets” that may not even be for projects in the area, region or even the United States. This is one way in which we can better utilize our finite resources to better improve our overall operations and address our sustainability goals.

Background on Steam Infrastructure Between Lot 19 and MRB

We have first hand knowledge of the steam infrastructure challenges in the part of the campus west of MRB and between there and the PE/Athletics facility. When MRB was being finalized there was significant loss of steam condensate out near the parking lot 19 area. There was a good deal of analysis of what could address these infrastructure needs and requirements, and the issues were beyond just condensate. We implemented some short term repairs but still understood there were long term major issues we needed to address. At the time (2018) , we expected the Multi-Modal transportation center to be built in this area of campus and we had hoped that project could help us address this steam system issues. That project did not move forward, due to major budget challenges, and then COVID came along and it at diverted our attention off many of our regular projects. When we determined UTLF would go into lot 19 we knew this was a great opportunity to address this infrastructure issue as part of that project, and having the project on the steam line.

Recent New Facilities on UCR Campus and Energy Sources.

Listed below are the more recent new facilities UCR has added to the campus, or are in the process of adding to the campus, and their connection to the central steam plant. Information on the chilled water connection is also provided.

Multidisciplinary Research Building (In Operation)	Steam: Yes Chilled Water: Yes
Barn Expansion (In Operation)	Steam: No Chilled Water: No
Dundee (In Operation)	Steam: No Chilled Water: No
Glasgow (In Operation)	Steam: No Chilled Water: No
North District Phase 1 (In Operation)	Steam: No Chilled Water: No
North District Phase 2 (Construction started Fall 2023)	Steam: No Chilled Water: No
Student Health & Counseling Center (in operation)	Steam: No

	Chilled Water: No
School of Business (Under Construction)	Steam: No Chilled Water: Yes
Student Success Center (In Operation)	Steam: No Chilled Water: Yes
School of Medicine Education Building II (in operation)	Steam: No Chilled Water: Yes
Undergraduate Teaching & Learning Facility (Design Build Competition)	Steam: Yes Chilled Water: Yes
OASIS Park (Design Build Competition)	Steam: No Chilled Water: No

As you can see, connection to the central steam plant is an exception and not the rule. However, it is important to note that many issues go into the analysis of energy sources for a new building, and some of the ones above are not located anywhere near the current steam tunnels/infrastructure and the campus is not planning to expand that infrastructure, although we need to maintain it for the building that currently rely upon it.

Background on UCR Steam and Chilled Water Infrastructure

The two major centralized utilities we provide to most campus buildings are steam (heat, hot water, autoclaves, etc.) and chilled water (for air conditioning). Our central steam plant was constructed in the early 1950’s to serve the campus in an efficient manner, and has always had natural gas as an energy source. The existing steam plant, and the distribution infrastructure to the campus, has challenges from deferred maintenance like many of our other campus buildings, unfortunately, so we have been working on those issues (and others, like in the primary power infrastructure for campus). The current central plant supports the vast majority of campus buildings – about 5.5 million square feet, and the operations of those buildings directly rely on the current steam system. Our decarbonization goal (current campus study, which should be completed spring/summer 2024) is to find an alternative energy source for the steam plant for the future, so we can transition off natural gas. The consultants we will use and work with on this plan will also provide an estimate for costs to transition away from natural gas and a possible time frame (the costs are likely in the hundreds of millions of dollars and the time frame is unlikely to be in the next couple of years, but hopefully in a 10-15 or so year time frame to cover all the financing, construction and full implementation). Our central chilled water utility provides cooling for the vast majority of the campus buildings, but not all, and uses electricity as an energy source. Our electricity for the campus comes from our own solar systems (about 9MW or a little more with new systems coming on line) with the majority of the electricity coming from Riverside Public Utilities, the local electric provider. The RPU energy sources are varied, and currently (through 2027) include a significant source from a very large coal plant in southern Utah, and we work with RPU on their plans for future energy sources for their system.

Therefore, in the near term we must maintain the existing steam system, which has many accumulated needs and inefficiencies, in order for the campus to operate, and we continue to work on projects that will allow us to provide the same level of service to the campus but at a reduction in consumption of natural gas.

UCR Investments in Energy Efficiency

We have many facilities and infrastructure challenges, but also opportunities, to make significant improvements in the facilities and infrastructure operations of the UCR campus. There are many areas we need to focus on, unfortunately, and not just one, so we identify major opportunities for overall improvement when they arise. We have made much progress, but there is a long way to go in the future. The information below highlights some of the more recent investments in energy consumption reduction we have made.

FY23 Approved "Inset" projects. Total project cost ~\$1M.

Location	Project	GHG Reduction & Gas Savings	Electric Savings (kWh/yr)	Natural Gas Savings (MMBtu/yr)
Bio Science	Airflow Optimization for Lab Spaces	24.2	117,946	-
Webber Hall	Replace Chilled Water Valves	14.6	71,155	-
Chung Hall	Add Split Systems to Server Rooms	63.7	309,782	-
Boyce Hall	Exhaust Fan VFD Retrofit	68.8	334,563	-
Bio Sciences	Exhaust Fan VFD Retrofit	27.3	132,964	-
Chemical Sciences	Airflow Optimization for Lab Spaces	197.7	961,770	-
Science Lab	Exhaust Fan VFD Retrofit	193.4	941,242	-
Science Lab	Airflow Optimization for Lab Spaces	76.2	370,617	-
Campus	Steam Pipe Insulation	364	-	6,799
Steam Plant	Automatic Boiler Blowdown	82	-	1,550

TOTAL	1,111.9	3,240,039	8,349
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Campus Electrical Investments.

- LED phase II: Relamping common areas, restrooms, and mechanical spaces: *starting in December*
- Glasgow roof top solar project: *In design*
- Central Plant VFD's: *In design*
- Central plant electrical infrastructure improvements: *In design*
- Orbach Library lighting system project: Lights were operating 24x7 and moved to standard system with lighting shut down, saving significant electrical consumption.
- Student Services lighting project: Changed original design to allow system to be shut down during hours when the building was not operating, saving significant electrical consumption.
- Exterior lighting retrofits (with GPS)

Campus Mechanical Investments.

- Chapman mechanical updates: improved operational and energy efficiency
- UOB mechanical: HVAC package unit replacement
- Skye Hall: 17 HVAC package units replaced
- Physics: In design for phased mechanical system upgrades
- Spieth Hall: HVAC, Lab exhaust and controls updates in design (some mechanical addressed with roof replacement)
- Rivera Library: Air handlers replacement
- SOM data center mechanical: Energy efficiency improvements

Campus Roof Replacement Projects.

- Spieth Hall: *Complete* (with significant mechanical included)
- Physics: *In construction*
- Orbach: *In bidding*

Campus Infrastructure Investments.

- Electrical infrastructure projects: Primary power V3 switch, Glen Mor switching improvements, Substation
 - Link to "**How Power Works**": <https://facilities.ucr.edu/how-power-works-presentation>
- Steam: Tunnel insulation, steam trap replacement, condensate return upgrades
 - Steam traps: 95 Failed Open, 115 Failed Closed (total 210)
 - Projected annual cost savings: \$287,200/year (*verification ongoing*)
 - ~6,400 Tons of CO2/year (*verification ongoing*)
 - New steam trap monitoring system pilot program – 20 meters installed
- Central Plant: Controls upgrade (*nearly complete*) and VFD project (*underway*)

Campus Major Building Renovations

- Pierce Hall: *Recently completed*
- Batchelor Hall: *Projected completion Spring 2024*

Phase 1: Solar Project Evaluation for Inflation Reduction Act (IRA) grant funding.

- School of Business: 216 kW
- Undergraduate Teaching and Learning (UTLF): 250kW
- Oasis: 367kW with infrastructure that can support 735kW

Based on preliminary data and our understanding of Solar Projects, it is likely the three (3) solar projects presented will be eligible to receive the IRC Section 48 credit. These requested were submitted mid November, 2023.

Based on the preliminary credit estimate calculation, UCR would likely be eligible for a tax credit amount between **\$2M - \$2.7M**

UCR is also submitted proposals for rooftop solar installations on ten (10) existing campus buildings, and will work to maximize our opportunities to increase in this area as well. Overall UCR will self-finance the campus costs, net of the credits, with payback annually from the utility savings. These requests were submitted mid November, 2023.