

COUGAR ENERGY INITIATIVE - Vancouver Campus Report

3.2 Vancouver

3.2.1 CAMPUS SUMMARY

The Vancouver campus is the only four-year research university in southwest Washington. The campus provides undergraduate and graduate studies. The Vancouver campus was established in 1989 and the first buildings on campus were completed in 1992.

The Vancouver campus is approximately 350-acres in size and is in an urban area of Southwest Washington State, 7 miles north of downtown Vancouver. The campus is comprised of 15 buildings and provides 590,000 square feet of university space used for general academics, teaching, and research labs, nursing, and veterinary programs as well as engineering and computer science programs.

The Vancouver campus will be required to comply with:

- **Clean Building Performance Standard** - Campus-level building energy performance (EUI).
- This campus' carbon emissions are below the threshold of the Climate Commitment Act and there are no district heating systems that would be governed under the CBPS Annex W requirements.
 - There is a district cooling system that would be governed under the CBPS Annex W requirements, however there are no fossil fuels used in the production of cooling so there are no anticipated upgrades required for compliance with those regulations.

3.2.2 EXISTING CONDITIONS AND BASELINE ASSESSMENT

3.2.2.1 District Energy Systems (Cooling)

The Vancouver campus utilizes a district cooling system that provides chilled water for building cooling loads.

The chilled water system provides services to 15 buildings, serving most of the campus. The chilled water system covers much of the campus region and is a single connected system with a single chilled water plant. Chilled water is typically direct buried across the site with vaults located at takeoffs from the main piping to each building.

The chilled water system is supplied by one chilled water plant located in the physical plant building. The plant has four chillers providing 1,650 tons of cooling. There is also a plate and frame heat exchanger which was added to the plant in 1997 as a water-side economizer between the cooling towers and the campus loop. Chilled water is distributed at 42°F.

Resiliency Scenarios

There is a redundancy issue on campus in that if the larger of the three chillers were to go offline during peak season, the remaining chillers would not have enough capacity to serve the campus. A load shedding scheme is needed to maintain critical loads under an equipment failure scenario.

3.2.2.2 Building Envelope

The first building on campus, Dengerink Administration Building (VDEN-6504), was constructed in 1992, and two other buildings were constructed prior to 1986 when the Washington State Energy code was first introduced. Primarily the campus buildings are brick veneer with insulated wood or metal construction beneath.

While there are some buildings on campus with poor envelope performance, at a campus-wide scale, building envelope improvements will not be a focus of campus energy efficiency measures to comply with CBPS due to the high first cost and long-term payback.

It is anticipated that the worst offenders of inefficient building envelopes will be addressed over time through building renewal efforts and/or replacement of old buildings with new.

3.2.2.3 Domestic Hot Water

Each building on campus has its own dedicated gas-fired hot water heater and inline recirc pump that provides potable hot water to the building. Lab buildings have additional hot water heaters that provide non-potable or laboratory hot water separately.

3.2.2.4 Heating, Ventilating, and Air Conditioning

Air Handling Systems

Between each of the buildings on campus there are many different air handling unit (AHU) system types. These are as follows per building:

1. Dengerink Administration Building (VDEN-6504): Variable volume heating and cooling fan system with terminal unit reheat and fan powered terminal units serving the lecture hall.
2. Classroom Building (VCLS-6502): Variable volume heating and cooling fan systems with terminal reheat.
3. Library Building (VLIB-6503): Variable volume heating and cooling fan systems with terminal reheat.
4. Firstenburg Student Commons (VFSC-6525): Single zone constant volume cooling fan system with chilled water cooling and a gas-fired duct heater and supplemental electric heating.
5. McLaskey Building (VMCB-6505): Variable volume heating and cooling fan systems with terminal reheat.
6. Physical Plant Building (VPP-6520): Single zone constant volume cooling fan systems with chilled water cooling and a gas-fired duct heaters and unit heater heating.
7. Science and Engineering Building (VSCI-6507): Variable volume heating and cooling fan systems with terminal reheat.
8. Facilities Operations Building (VFO-6521): Single zone variable volume heating and cooling fan systems. Mixture of hydronic and gas-fired heating.
9. Multimedia Classroom Building (VMMC-6508): Variable volume heating and cooling fan systems with terminal reheat.
10. Student Services Center (VSSC-6526): Variable volume heating and cooling fan systems with terminal unit and fan powered terminal unit reheat.
11. Clark College Building (VCCW-6509): Variable volume heating and cooling fan systems with terminal reheat.
12. Undergraduate Building (VUB-6510): Variable volume heating and cooling fan systems with terminal reheat.

13. Engineering and Computer Science Building (VECS-6523): Variable volume heating and cooling fan systems with terminal unit and fan powered terminal unit reheat.
14. Life Science Building (VLSB-6524): Variable volume heating and cooling fan systems (100% OSA) with terminal unit and fan powered terminal unit reheat and active chilled beams/sensible fan coil units.

Hydronic Systems

There is no district heating system on campus, all heating is produced at the building level. The building-level heating systems are typically comprised of gas-fired heating hot water boilers which generate heating water for terminal reheat and AHU heating coils. There is no heating water system in VFSC (6525) or VPP (6520). VFSC has gas-fired duct heaters and supplemental electric unit heaters while VPP has both gas-fired duct heaters and unit heaters.

Building heating water temperature setpoints range from 120°F to 180°F. In some buildings the supply temperature is reset downward as outside air temperature rises.

3.2.2.5 Refrigeration

There is a small quantity of refrigeration systems associated with labs and foodservice on campus.

Refrigeration is not anticipated to be a significant portion of the campus energy use and will not be a focus of campus energy efficiency measures to comply with CBPS.

3.2.2.6 Lighting

Lighting and lighting control systems have maintained energy conservation through compliance with state energy code requirements enforced at the time of construction or building renovation. Savings associated with potential lighting retrofits are not anticipated to represent a significant percentage of the campus energy use and will not be a focus of campus energy efficiency measures to comply with CBPS.

3.2.2.7 Controls

The campus uses Siemens Building Technologies as their control system. The new VLSB (6524) building was built under the Desigo software while the rest of the

campus is still on Insight. WSU is discussing conversion of the remaining buildings to the Desigo software in the future.

3.2.2.8 Electric Power Distribution and On-Site Power Generation

Clark Public Utilities District provides underground primary service at 12.47kV from a single feed to exterior rated service entrance equipment located north of the WSU Entrance Rd and east of parking area "Gray 1". From primary service entrance equipment, a 400A rated feeder routes underground and terminates on medium voltage switchgear located in the Physical Plant Building (VPP-6520).

Medium voltage distribution switchgear at PPB serves 200A feeders routed on campus in pairs to create service loops. Feeder pair "A" and "B" creates one service loop. Feeder pair "C" and "D" creates a second loop. These loops are distributed throughout the campus via an underground vault system running North/South through the center of campus underneath the Mt. St. Helens Corridor. Loops A&B run south from the VPP and loops C&D run north. Vaults and switches placed along the utility corridor, feed campus buildings. Infrastructure is available to feed future buildings.

On-site power generation is implemented using two (1000kW and 350kW) 480V standby generators located at the PPB. These generators are connected in parallel to a 2000A, 480V switchboard. Power is distributed from here to several campus buildings via an underground vault system that runs North/South through the center of campus underneath the Mt. St. Helens Corridor. Buildings are provided with circuit breakers that are tapped onto these feeders, with provisions made for future connections. This system provides backup power for both Emergency and Optional Standby loads.

3.2.3 CBPS COMPLIANCE ASSESSMENT

3.2.3.1 Compliance Pathway

The Vancouver campus will be pursuing **campus-level** compliance with CBPS; the campus also needs to comply with Annex W's decarbonization requirements due to the campus's chilled water system, which qualifies as a district energy system (DES). The chilled water system is already free from fossil fuels, so compliance will not require changes to equipment. Table 3.2.3.1-1 shows the compliance status of the Vancouver campus. The campus is currently in compliance with CPBS as **the**

included buildings are below the campus EUI of 107 kBtu/SF by 4 kBtu/SF, or 3% of the target.

Table 3.2.3.1-1: Vancouver Campus CBPS Snapshot

<i>Buildings in Scope</i>	15
<i>Gross Square Feet</i>	525,026
<i>Current EUI</i>	103
<i>CPBS EUI</i>	107
<i>Required Reduction</i>	n/a

Note: Table 3.2.3.1-1 does include data for non-covered buildings.

The campus is made up entirely of the College/University building type. Total campus energy use is split into electricity and natural gas use, which comprise 48 kBtu/SF and 55 kBtu/SF, respectively. Figure 3.2.3.1-1 shows EUI for the campus broken out by utility type.

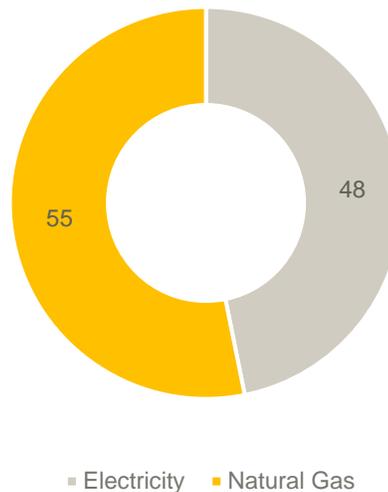


Figure 3.2.3.1-1: Vancouver EUI by Utility

The campus’s emissions from electricity and natural gas use are approximately 2,698 MT of CO₂e annually, based on Clark PUD’s 2023 fuel mix. Natural gas use accounts for 57% of total emissions, and these emissions will not decrease as the

grid decarbonizes; Figure 3.2.3.1-2 shows the emissions related to each campus utility.

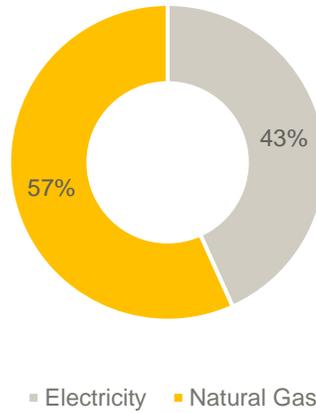


Figure 3.2.3.1-2: Vancouver Emissions by Utility

3.2.3.2 **Report Template Information (EUI, Building Activity Type, Occupancy)**

Table 3.2.3.2-1 summarizes building energy use intensity (EUI, in kBtu/SF), CPBS use type, operating hours, EUI target adjusted for operating hours, current operational EUI and greenhouse gas emissions. Note that some small non-covered buildings show zero energy use as they are not sub-metered; their energy use is reflected in the campus totals.

Table 3.2.3.2-1: Vancouver Campus CBPS Summary Table

PROPERTY INFORMATION		CBPS EUIt ANALYSIS						CURRENT EUI AND EMISSIONS			
Prop #	Building Name	Area (sf)	CBPS Activity Type	EUIt	Oper. Hrs/Wk	SNF	Adj. EUIt	Elec.	Nat. Gas	Total	Emissions (MT CO2e)
6502	Classroom Building	62,049	College/ University	102	<50	0.9	92	44	120	164	536
6503	Library Building	43,704	College/ University	102	50-167	1.1	112	22	38	60	139
6504	Dengerink Administration Building	30,162	College/ University	102	<50	0.9	92	33	68	100	160
6505	Mcclaskey Building	21,776	College/ University	102	<50	0.9	92	18	31	49	56
6507	Science & Engineering Building	63,656	College/ University	102	50-167	1.1	112	64	85	149	497
6508	Multimedia/ Classroom Building	51,555	College/ University	102	50-167	1.1	112	25	35	60	162
6509	Clark Center	64,810	College/ University	102	50-167	1.1	112	40	38	78	266
6510	Undergraduate Building	58,811	College/ University	102	50-167	1.1	112	20	24	44	135
6520	Central Physical Plant Building	15,264	College/ University	102	50-167	1.1	112	302	61	362	288
6521	Physical Plant Maintenance Shop Bldg	14,000	College/ University	102	50-167	1.1	112	0	46	46	34
6522	Equipment Storage Building	3,015	College/ University	102	50-167	1.1	112	-	-	-	-
6523	Engineering And Computer Science Bldg	60,364	College/ University	102	50-167	1.1	112	67	84	151	480
6525	Firstenburg Student Commons	15,228	College/ University	102	50-167	1.1	112	23	3	26	21
6526	Student Services Center	19,185	College/ University	102	<50	0.9	92	28	13	42	42
6530	Annex Building	1,447	College/ University	102	50-167	1.1	112	-	-	-	-
Campus Totals		525,026					107	48	55	103	2,698

3.2.4 **CAMPUS DECARBONIZATION PLAN (CBPS ANNEX W)**

3.2.4.1 **Utility Plant Decarbonization**

The Vancouver campus is served by an all-electric cooling-only district energy system that provides chilled water to 15 buildings. Per Annex W of the Clean Buildings Standard, WSU must provide a decarbonization plan that evaluates options to replace fossil fuel heating.

3.2.4.2 **Decarbonization Option Evaluation**

District Energy Heating Plant

The addition of a district-level heating plant (such as a hot water loop served by a central heat pump heating plant) would be challenging to implement across the campus. There are several factors influencing the difficulty of providing a new district level heating plant:

- There is not an existing pathway for heating water systems across the campus. An entirely new buried utility system would be required that would have significant conflicts with existing underground utilities requiring difficult crossings.
- Existing central plant only provides cooling. There is not room within this plant to locate new electrified heating equipment. Existing cooling equipment is not rated for high-temperature duty and cannot be used to generate heat. The addition of a new electrified district heating plant would require:
 - Expansion of the structure currently housing the centralized cooling equipment.
 - Replacement of existing cooling equipment with machines rated for heating duty.
- There is not a readily available source of heat to capture during winter operation to act as the source for a heat pump system. An electrified district heat pump system would require the addition of a high-cost geothermal bore field.
- There is a variety of hot water temperatures that individual buildings operate at (120F to 180F) which would require replacement of existing heating infrastructure within buildings.

Building-level Heating System Decarbonization

WSU will evaluate options to reduce or eliminate on-site fossil fuel heating use for buildings at equipment end-of-life and during major building renovations. Alternatives to fossil fuel heating will be evaluated at the time of renovation and implemented based on code requirements, financial viability, and university sustainability commitments.

Most of the buildings on campus are currently served by natural gas boilers providing hot water to hydronic heating systems. Future replacements could include air-to-water heat pumps, heat recovery chillers and/or ground source heat pumps. Some of the buildings operate with hot water temperatures in excess of 130F (up to 180F) and will require renovations to heating coils and controls to operate at a lower hot water temperature suitable for heat pump operation. Individual electric capacity studies will be conducted to determine capacity of the current infrastructure to support heat pump heating loads.

VFSC and VPP have gas-fired duct heaters and unit heaters, which could be replaced with electric resistance heaters at the end of life.

Waste Heat and Cooling Evaluation

The WSU Vancouver campus is not located close to any adjacent source of waste heat, such as a manufacturing facility or industrial plant.

There may be future opportunity to implement heat recovery chillers at the chilled water plant, thereby capturing waste heat from the chilled water district energy system, but a more extensive engineering study would be necessary to identify potential uses of the recaptured heat (such as heating adjacent buildings on campus) and conduct a lifecycle cost assessment. This option is currently not being considered by the university but could be part of a future strategic plan to improve campus energy efficiency.

Renewable Natural Gas

Purchasing renewable natural gas (RNG) could contribute to the decarbonization of natural gas heating systems on campus. NW Natural is currently running pilot programs to procure RNG from agricultural waste at its Shell New Energies Junction City facility and from a wastewater treatment plant in Eugene, OR. WSU will continue to monitor NW Natural's RNG expansion availability for purchase through

the existing gas infrastructure. The university will evaluate whether the use of RNG can contribute to campus decarbonization strategies.

Utility Engagement

Clark Public Utilities District has been consulted on current electrical capacity available at the campus. Since WSU is currently pursuing the campus-level performance compliance with the CBPS, no investigation of additional electrical loads has been conducted to date. The university will engage Clark PUD when evaluating replacement of fossil fuel heating systems in the future.