UW Seattle Campus Decarbonization Plan

UW Facilities

Initial Submittal to Dept. of Commerce

Version 1.0

June 30, 2025

UNIVERSITY *of* WASHINGTON

Contents

Exhibit No	Decarb Plan Reference Name	Attached Exhibit file name	Notes
1.0	UW Energy Renewal Program Introduction	UW Energy Renewal Program Introduction.pdf	Reader guide & introduction for ERP
1.1	UW ERP Part 1 – Baseline Assessment	UW ERP Phase 1 – Baseline Assessment.pdf	
1.2	UW ERP Part 2 – Project Identification	UW ERP Phase 2 – Project Identification.pdf	
1.3	UW ERP Part 2 Appendix - Project ID Appendices	UW ERP Phase 2 – Project ID_Appendices.pdf	
1.4	UW ERP Part 3 – Implementation Plan	UW ERP Phase 3 – Implementation Plan.pdf	
2.0	UW Seattle Building List	UW Seattle Campus Building List 6_12_2025.xlxs	
3.0	UW Community Engagement Plan	UW CEP_CCA.pd	CEP required for CCA fund recipients

1. Introduction

The UW Seattle Campus Decarbonization Plan (the Plan) is developed in accordance with the Washington State Administrative Code (WAC) Chapter 194-50-170 and the associated Department of Commerce, administrative rule referred to as the Clean Performance Standard (CBPS), Annex W.

The University of Washington, Seattle Campus is a wholly owned property of the State of Washington. The campus has been served by a UW-owned District Energy System (DES) for more than 120 years. Consistent with the Clean Building Performance Standard definition of a state-owned campus district energy system; This Plan submittal for approval to the Washington State Department of Commerce intends to fulfil the mandatory State Campus District Energy System compliance requirements for the Seattle Campus. The Plan anticipates a 15-year compliance process wherein updates on Plan progress will be submitted every five years through 2040 or until final compliance is reached. The publication history of the Plan is recorded in Table 1.

Table 1 UW Seattle Decarbonization Plan publication history

Publication Date	Publication Name	Notes
6/30/2025	Initial Submittal to Dept. of Commerce, Version 1.0	Uploaded to CBPS Compliance Portal 6/25/25

The purpose of the Plan is to establish the regulatory framework for the implementation of strategic phased, capital implementation investments necessary to eliminate the routine combustion of fossil fuels required to heat, cool, power and light over 19 million Gross Floor Area (GFA) in 277 buildings within the two UW, state owned, contiguous campus properties located in northeast Seattle. The Plan documents the mechanisms and investments required to complete this transformation by 2040.

The Plan intends to provide a high level, summary of these mechanisms and investments included in a large, complex campus decarbonization process. The Plan is

intentionally focused on state regulatory compliance information as required by the CBPS. Throughout the Plan, the reader will find reference to the attached three-part exhibit herein referred to as the University of Washington, Energy Renewal Plan (ERP).

The ERP is the detailed, comprehensive, engineering infrastructure implementation plan intended to guide the complex, multi-decade, multi-phase, capital development process required to transform a billion dollar plus utility asset that is the UW Seattle District Energy System from a fossil fuel driven, steam heat production and distribution plant into a highly efficient, renewable energy sourced, state of the art, energy transfer system.

The ERP is divided into multiple documents, and they are included in Exhibits 1.0 through 1.4. These documents are included in this submittal by reference and represent the complete and detailed scope of the Plan to decarbonize the UW Seattle campus:

- UW Energy Renewal Program Introduction
- UW ERP Part 1 – Baseline Assessment report provides an analysis of the existing and future campus load characteristics, and a discussion of engineering concepts and options explored.
- UW ERP Part 2 – Project Identification report provides detailed description of projects and priorities for sequencing the work.
- UW ERP Part 2 Appendices - provides additional support information for the projects.
- UW ERP Part 3 – Implementation Plan report documents an implementation plan, including funding and debt pathways, and project schedules.

UW wishes to recognize the significant contribution by the many talented and knowledgeable members of the consulting team of professionals led by Geoff McMahon and Robby Oylear of Affiliated Engineers NW, Inc. A full list of participants can be found in Exhibit 1.4 UW ERP Part 3 Implementation plan, Appendix 10.1.

"Washington state is leading the nation with energy efficiency performance standards for existing buildings. The building sector of our economy consumes 40% of total energy in the United States. Energy efficient and carbon free, "clean" buildings are essential to meeting our state energy goals."

2. Executive Summary

The target EUI for the UW Seattle campus is 145 kBTU/GFA/yr and the actual measured EUI for calendar year 2024 is 138 kBTU/GFA/yr. The UW Seattle campus is below the EUI target set by the Clean Building Performance Standard. The Plan provides information on how the campus will reduce greenhouse gases, as measured by metric tons of carbon dioxide (MTCO2) and further reduce EUI through energy efficiency improvements. Additional information about the EUI calculation is provided in Section 3.

New Technology: At the core of the plan to decarbonize the power plant is a technological evolution that allows us to change the way we heat buildings on campus. Presently, UW heats its buildings the same way most University campuses do, and that's by combusting natural gas in boilers to make high-pressure steam and then distributing the steam out to the campus buildings where it is transferred to each building's heating system. Under our plan, the UW would no longer combust natural gas for heating but rather would use electrically driven heat pumps to move energy from various sources to heat the buildings.

Efficiency Gains: The pivot from natural gas combustion to electrically driven energy transfer isn't just a technological advance; it's also a major efficiency improvement depending on the type of heat pump. We are anticipating that the new system will be at

least 5 times more efficient if we convert the campus heating system from a high pressure steam system to a hot water system.

Not all heat pumps are equal: There are many different heat pumps in the marketplace today**,** including some that produce steam. UW could install a steam-producing heat pump and not have to make any other changes to its system. Unfortunately, the downside is that steam heat pumps are only twice as efficient. The loss of efficiency would result in a substantially greater demand for electricity and a much higher electrical bill.

I have great confidence in our ability to meet those challenges when I look at the incredible achievements of our UW community, like Professor David Baker's groundbreaking working in protein design, which earned this year's Nobel Prize in Chemistry. His work, like so much of the scholarship, teaching, research and innovation at the UW, is a testament to the promise and power of bringing together different disciplines and areas of knowledge in new and novel ways.

It is by building interdisciplinary teams of faculty, staff and students to translate these new ways of knowing and understanding into solutions and discoveries that we not only have the potential to change the world for the better, but are already doing so in countless ways. -Ana Mari Cauce (2024) In a time of transition, our commitment and care for each other are paramount, *PRESIDENTIAL BLOG https://www.washington.edu/president/2024/12/09/end-of-year-message-2024/*

Electrification: Regardless of how efficient heat pumps are, they will still consume more electricity than the current state, given we currently use natural gas. The existing Seattle City Light electrical service is already beyond its design limit and the UW demand already occasionally exceeds available power during peak cooling days. A new electrical substation dedicated to UW is required to address the existing and future needs of the campus.

Thermal Storage: To optimize the operation of the new heat pumps, thermal storage in the form of campus-scale hot water and cold water tanks are used. Because heat pumps operate best when fully on, thermal storage tanks can serve the purpose of adjusting for variations

in the energy demand from the campus, getting better performance and longer-life of the heat pumps. Further, the storage tanks can also be used for electrical peak demand management. This is an efficiency opportunity as well; UW is Seattle City Light's largest customer (as measured by annual consumption). As a "grid interactive" campus, UW thermal storage tanks could act as thermal batteries; drawing electricity during slack demand times to preheat or precool the storage tank (like charging your phone while you sleep) and conversely turning down the electricity demand and slowly using the retained heat and cool during the day as overall electrical demand in the city rises. Load shifting and load shedding can have a significant effect on the grid when coordinated at the scale of the campus. In addition to saving the UW money, these strategies also create benefits for all Seattle City Light customers by reducing the severity and duration of daily and seasonal peak demand events.

Convert to Hot Water: The fundamental problem with using steam to heat buildings is that it is too hot. Switching from steam to hot water (and lowering the temperature) will result in much less waste and much greater efficiency. Heat pumps are much more efficient and cost less to operate because modern compressor technology allows cheap (and sometime free) low temperature non-fossil fuel energy sources to be transformed into productive hot water. With the benefits of heat pumps (efficient use of electricity, and lower operating costs) comes with some bad news: switching to hot water means replacing *all* the steam distribution pipes in the tunnels and replacing *all* steam-based equipment in the buildings. The good news is that most of this equipment is at the end of its useful life and must be replaced anyway. Older building heating systems were designed to use much more energy and operate at higher temperatures than are required today by the modern building heating systems that replace them. These high temperatures are the limiting factor on how low the district temperature can go. Over time, as buildings are renovated, those temperatures can be reset and eventually the district heating system can lower its temperature and become even more efficient.

Steam isn't just for heating: The UW Medical Center/Montlake, as well as several research facilities, have process-based steam loads for equipment such as autoclaves, sterilizers, equipment washers, and specific research equipment. These steam loads are year-round. We anticipate having steam generators in buildings that need process steam. Some of this equipment can be replaced over time, making us less dependent upon steam production.

Sources of Energy Transfer: The greatest opportunity for heat sources to displace UW's natural gas use is with the heat that is extracted from the buildings via the campus chilled water (CCW) system. In addition to the steam boilers, UW also has 11 cooling machines (chillers) in two different energy plants. These chillers send cold water out to the buildings, extract warmth from the buildings, return warmer water back to the energy plant, and then get rid of the excess heat via a series of cooling towers (or "heat throwaway machines"). With the new energy system, the heat that is presently being thrown away can be recovered and used to heat buildings. This one source alone would displace 44% of our natural gas use.

Consolidate Cooling: Only half the campus buildings are presently connected to the CCW system. The remaining buildings either have their own chillers/cooling towers or they have no cooling at all. Not only are these decentralized chillers less efficient (due to load diversification), but they also get rid of their heat via their own cooling towers. As the building chillers reach the end of their life, instead of replacing them, we will connect those buildings to the central chilled water system, increasing the amount of waste heat that comes back to the power plant, displacing even more natural gas.

The Need for Other Sources: The downside of using waste heat from the cooling system is that it is seasonally incongruent with heating needs. The greatest amount of waste heat is produced in the summer, and the least amount is produced in the winter. So, other sources of heat are needed.

Wastewater Energy Transfer: The first geographic (environmental) asset that UW can benefit from is the urban setting of its campus. The King County wastewater system partially circles the campus along the Burke Gilman Trail, gathering additional flows along the way. The maximum flows, and greatest heat recovery opportunities, are at the western edge of the campus near Benjamin Hall. In an urban setting, there is a lot of warmth in that water, and in UW's case that warmth represents another 25% reduction in natural gas. The warmth can be harvested and reused multiple times.

Waste Heat: ~70% of the natural gas that UW presently uses to heat buildings could be displaced by reusing heat that is presently either thrown away to the atmosphere or wasted down the sewer.

Deep Lake Heating/Cooling: Lake Washington is deep, which means at depth the temperature has very little variance throughout the year. Our proposal is to access that deep lake water and use it for heating in the winter, and cooling in the summer. From a heating perspective, this represents another 24% displacement of natural gas. From a cooling perspective, it would augment campus cooling systems with an additional 14,000 metric tons of cooling. This makes it effectively another chilled water plant, but without the substantial electrical consumption, by using naturally cold water, less electricity and realizing a lower operating cost. The extra capacity would enable UW to have additional cooling capacity to keep up with our changing summer climate without putting additional pressure on the electrical grid.

Ship Canal and the Salmon Part of the appeal for accessing the lake is to introduce more 'colder' water to the ship canal that is presently temperature-impaired and threatening salmon which migrate through the ship canal. Obtaining permits to use lake water may be the greatest barrier to seeing this portion of the project implemented. The Washington State Department of Ecology has indicated that discharging lake water to the temperature-impaired portions of the ship canal will be a 15+ year process.

Winter Peaks: Even with the three identified sources (cooling systems, wastewater energy, and Lake Washington), we will not be able to meet the thermal demands for the campus on peak winter days (approximately 7% of the annual load). Options to decarbonize the final 7% include purchasing RNG, using an electrode boiler, or carbon capture at the plant stack. A final consideration is to simply re-purpose the 3 newest steam boilers in the plant to operate on the coldest days of the year until such a time that a new technological advance can address winter peak loads.

Making Buildings More Efficient: In parallel with the central plant improvements, lowering the energy demand of campus buildings will result in additional operating savings which can be used to partially fund all these energy projects. Lab space offers substantial opportunities to save energy, as it is among our biggest energy consumers. About 1/3 (6M GSF) of campus connected to the district steam system is science research, laboratory and hospital space. These buildings use three to five times the energy that a typical commercial building uses because- for indoor air quality and health and safety reasons- they operate on 100% outside air. That means these buildings dump 100% of the conditioned volume air multiple times every hour and only in the newest buildings are we able to recover a meaningful amount of waste heat. The new hot water loop connected to heat pumps and thermal storage will allow nearly 100% of this waste heat to be recovered and re-used by all connected buildings.

3. Decarbonization Scope of Work

a. Summary of existing DES

The UW Seattle Campus and the UW Tower complex cover 700 urban acres on the shores of Lake Washington's Union Bay and connected to Portage Bay in Seattle, Washington. The two sites contain more than 19 million Gross Floor Area of conditioned space within 277 diverse structures. The entire contiguous land area of the campus is owned by the University of Washington except for a limited number of City of Seattle streets, alleyways, and rights-of-way. The structures contain both owned and leased facilities with a variety of internal and

external service providers responsible for facility management functions. The geographic extents of UW Seattle Campus and UW Tower complex are illustrated in Figure 1, below.

The UW decarbonization plan involves a comprehensive modernization of the existing Seattle campus district energy systems. Existing natural gas fired steam generation assets and distribution systems will be decommissioned or relegated to back-up status to support a transition to carbon-free, electrified heating and cooling. Refer to Exhibit 1.1 UW ERP Part 1 – Baseline Assessment, Section 3 for detailed analysis of existing systems.

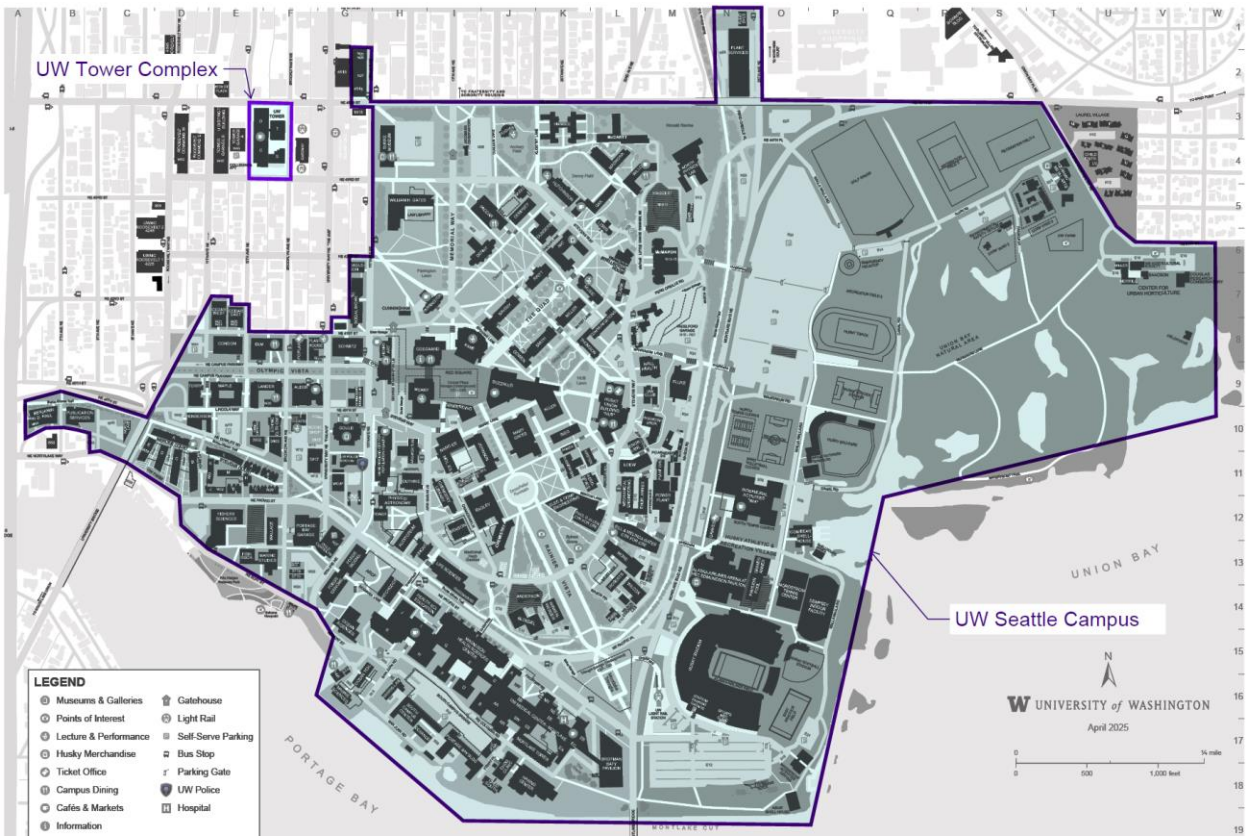

Figure 1 UW Seattle and UW Tower Campus

b. List of all buildings served by DES

Pursuant to CBPS normative annex W, section 6.8-2a, Table 2 below provides a summary of existing facilities within the boundaries of the two sites that contribute to the UW Seattle Campus Decarbonization Plan and are served or planned to be served in the future by a

campus DES. A complete detailed list of buildings is provided in Exhibit 2.0 UW Seattle Building List.

Table 2 Campus facility use summary

UW Seattle Campus, Decarbonization compliance pathway	Count of Facility #	Count of EUI Group	Total Area (GFA)
Education: University	175	126	12,403,652
Healthcare: Hospital	16	4	1,414,278
Mixed (Research Lab Bldg. w/ Classrm. Labs)	12	12	1,626,457
Technology/Science: Lab	32	22	3,121,652
Grand Total	**235**	**164**	**18,566,039**
UW Tower Campus, Decarbonization compliance pathway	**Count of Facility #**	**Count of EUI Group**	**Total Area (GFA)**
Education: University	4	1	553,974

c. EUI Target for Campus

The contiguous UW Seattle *"Campus-level"* Energy Use Intensity target (EUIt) is 145 kBTU/GFA/yr. The target is a blended average of the three (University, Technology/Science Laboratory and Hospital) building activity type targets found on campus, normalized by GFA. The calculation methodology can be reviewed in Exhibit 2.0, UW Seattle Building List, Due to the technical difficulties and lacking an automated spreadsheet upload process, UW did not attempt to complete the "*CBPS Compliance Form B"* via the CBPS online portal with this Plan. The following variables in calculation criteria were used in this submission:

- The campus is wholly located in climate zone 4C.
- The constituent portion of campus EUIt derived from buildings permitted after July 1, 2016 are assigned the CBPS prescribed reduced (lower) target for the effected GFA.
- The *CBPS, Table 7-3 Building Operating Shifts Normalization Factor* of 1.1 was applied to all campus buildings with the University building activity type target. All campus buildings operate at greater than 51 hours per week.

- A small minority of campus buildings (9%) are Technology/Science Laboratory buildings used for both research and teaching. Pursuant to *CBPS Table 7-1 Building Activity Types,* in these "mixed" buildings a blended target was developed based on the ratio of teaching to research GFA. In facilities where the % of research space is less than 75%, a blended average of the EUIt is used. The results of these calculations can be found in Table 3, Summary of mixed use facility EUI calculation.

Table 3 Summary of mixed use facility EUI calculation

Facility	Classroom (with classroom laboratories) GFA	Research Laboratory GFA	Percent Research	Weighted EUI Target
1008 - ECE - Elec & Comp Eng Bldg	22,182	38,389	63%	191
1104 - FTR - Fish Teach & Rsch	6,370	9,426	60%	187
1109 - MUE - Mueller Hall	4,401	4,765	52%	177
1168 - HST - Mag H.S.C./T	68,837	33,131	32%	153
1171 - MOR - More Hall	12,083	22,932	65%	194
1182 - EGA - Engineering Anx	4,439	10,234	70%	199
1200 - JHN - Johnson Hall	20,863	31,630	60%	187
1206 - BAG - Bagley Hall	34,559	68,473	66%	195
1242 - PAB - Physics/Astron Bldg	15,630	34,141	69%	198
1324 - HCK - Hitchcock Hall	24,526	29,850	55%	181
1332 - SIG - Sieg Building	9,132	7,190	44%	167
1347 - MEB - Mechanical Engr Bldg	14,731	29,567	67%	195
1352 - OCE - Oceanography Bldg	2,359	6,424	73%	203

d. Measured site EUI

In the calendar year 2024, the actual EUI (not weather normalized) of the Contiguous Seattle Campus was 138 kBTU/sqft/yr. This number is based on 18,566,039 square feet in the Energy Star Portfolio Manager. All electricity is provided by Seattle City Light (SCL) and natural gas is provided by Puget Sound Energy (PSE).

e. DES load and capacity; current and future projections

The City of Seattle 2019 Major Institution Master Plan (MIMP) for the UW Seattle campus governs the boundaries and maximum square footage allowed on the campus. The MIMP entitles the University to develop an additional six million square feet. The decarbonization plan includes the future square footage in the projected load calculations; it should be noted this is development *capacity*, as opposed to a plan or commitment by the University to develop this much new space. Future cooling and heating load projections are provided in Exhibit 1.2 UW ERP Part 2 - Project Identification report, Section 3.2 Campus Heating and Cooling Load Projections. Future decarbonization plan progress submittals (5-year updates) will provide an updated list of buildings, load analysis, target EUIt and actual EUI.

Future campus energy demand and DES production capacity are key planning inputs. The Plan relies upon the ERP report evaluation of the existing cooling and heating loads on campus to validate peak loads and develop hourly, campus-level, cooling, and heating load profiles. This information informs the design of options developed for future production and distribution upgrades included in the Plan. The baseline cooling and heating load assessment is also used to understand the potential campus-level electrical impacts of these upgrades. Table 4 below summarizes the present day and future campus loads (demand) and proposed capacities (plant equipment).

Table 4 Present day and future campus DES load and capacity summary

Utility Category	Present Day Load [MW]	Present Day Capacity [MW]	Future Load [MW]	Future Capacity [MW]	Comments
Heating Plants	100	216	81	88	Present day load is based on 2022 data
Cooling Plants	65	58	123	130	Present day load is based on 2022 data without distributed chillers
Electrical System	52	46.2	114	135	Capacity information is provided in N+1 mode
Process Steam	7.3	216	No longer served by central steam. Distributed Systems used.		

f. Description of proposed DES

The plan includes recovering heat from campus waste sources, the King County sewer, and Lake Washington, while upgrading the Power Plant and West Central Utility Plant with thermal energy storage, electric boilers, and heat recovery chillers. The plan also enhances the campus electrical system's capacity and reliability, constructs a new hot water distribution network using existing tunnels and buried utilities, and expands the chilled water distribution system. A new substation will connect Seattle City Light and the University's electrical infrastructure, ensuring future increases in electrical demand are accommodated. To complete the electrified heating system, individual building systems will be retrofitted with new hot water to hot water heat exchangers, pumps, and hot water coils in air-handling units, while individual building cooling towers and chillers will be removed and tied into centralized cooling at campus utility plants. Campus-wide steam distribution systems for autoclaves, glass wash and cage wash equipment will be phased out in favor of localized steam generation where necessary. The plan anticipates existing Central Power Plant, natural gas and oil fired Boilers-4, 6, and 7 will continue to provide steam in a backup role for the purposes of hot water generation within the Power Plant at the completion of the plan as part of a contingency plan if there are disruptions form the electrical grid. Modern digital controls, metering, and advanced data analytics will also be installed to support the efficient operation and control of all new systems. As the plan relates to Energy Efficiency Measures: a significant portion of the campus heat demand will be met through recovery of waste heat generated by critical campus processes which, under current operating conditions, is cooled by the campus cooling water and the heat ultimately rejected into the atmosphere via campus cooling towers. In the future, Heat recovery chillers are used to produce chilled water to absorb this heat from the processes and upgrade the temperature of that heat source to a level usable in heating other areas of the campus where it is needed. This process of recovering campus waste heat is very efficient since both sides of the process produce useful energy. Recovery of campus waste heat can result in a chiller COP > 5.5. A detailed description of proposed district energy systems is provided in Exhibit 1.2 UW ERP Part 2 - Project Identification report, Section 4.0. The projects are organized into the

following categories: Energy Sources, Plant Upgrades, Utility Distribution, Building Systems and System Analytics. The plan does not include cost or scope to provision campus residential facilities for environmental cooling.

4. Proposed Campus Performance Metric

a. Compliance pathway

The UW is pursuing compliance via *CBPS, Section 4.1.4 District Energy Systems Decarbonization*. The campus seeks compliance and has established an Energy Use Intensity target according to CBPS Section 7. The campus EUIt is based on a blended average of all GFA across the contiguous campus. All campus buildings regardless of building size contribute to the blended average EUIt. Non-conditioned building GFA is reported in Exhibit 2.0 UW Seattle Building List for clarity but excluded from the EUI and EUIt calculations.

b. Proposed EUIt

Implementation of the Decarbonization Plan will not change the campus target (EUIt). Changes to the campus EUIt over time are a function of programmatic trends in space use and building lifecycle status. These variables are outside the scope of the Decarbonization Plan. However, campus space use is closely monitored, and changes in building use and building status are updated in ESPM at least annually. The campus EUIt will be reported to Commerce via future progress and final Plan reports.

c. Projected EUI

The implementation of the decarbonization plan will reduce the total EUI of the campus due to the high coefficient of performance of heat pumps. The total campus EUI after implementation is expected to be 86.5 kBTU/SqFt.Yr.

5. Proposed metering configuration

a. DES heating and cooling plant metering vs. building level metering

Campus metering infrastructure for each DES utility (steam, chilled water, electricity and UW owned natural gas) are fully metered. Future modifications included in the Plan will enhance and expand the metering infrastructure, see Exhibit 1.2 UW ERP Part 2 - Project Identification report Appendix 9.13 Scope of Work Document for detailed descriptions of metering requirements. Metering at individual campus buildings (or connected building group) necessary to calculate a building level EUI is currently incomplete. Metering at building connections to DES utilities is the subject of a significant capital modernization effort underway on Campus. Currently, accounting of utility metering for both the Seattle and UW Tower campuses reveals:

- 16.8 million GFA (87.5%) of the two combined campuses' conditioned spaces are fully metered and reporting a building/energy group level EUI.
- An additional $1 million dollars is allocated in FY25-27 biennium to fully meter an additional 1 million GFA (5%).
- Future funding will be required in FY27-29 to fully meter the remaining 1 million GFA (5%).
- New buildings and new utility connections will be fully metered per Washington state Energy Code see Exhibit 1.2 UW ERP Part 2 - Project Identification report Appendix 9.13 Scope of Work Document for metering requirements.

b. Metering required for benchmarking metrics (EUI)

Campus level energy consumption required to calculate a campus EUI is measured using a dedicated group of SCL and PSE revenue grade meters serving the Campus DES and a discrete group of directly connected buildings. Consumption data is collected by the utilities, transmitted digitally to the UW and uploaded monthly to Energy Star Portfolio Manager by UW staff.

c. End use metering of DES backup heating plant

Exhibit 1.2 UW ERP Part 2 - Project Identification report Appendix 9.13 Scope of Work Document describes the metering scope required for the new hot water utility, expanded campus chilled utility and metering of DES generation assets including back-up boilers. Metering of flow and supply and return temperatures at the DES plants will provide all data required to ensure 100% of the design load is served by non-carbon fuel sources and a minimum 90% of the measured campus heating demand in the compliance reporting year is met by carbon free fuel sources.

6. Recommended DES plan considerations

a. Distribution network upgrades

The connection of the main power plant and WCUP to the campus buildings represents the largest effort in terms of cost, schedule, and disruption to the campus. The campus steam heating and cooling systems are currently installed within miles of utility tunnels. This utility tunnel system, initiated in 1901, extends through most of the campus, and the plan proposes an extension to this system. The replacement of the steam heating system with a primary heating water (PHW) system and expansion of the CCW system will be through a combination of the existing utility tunnels, new utility tunnels, and new segments of direct-bury piping. Main distribution lines of electrical power and information technologies are also through the utility tunnel system and direct-bury utilities. Further information about the distribution networks for hot water, chilled water and electrical power is provided in Exhibit 1.2 UW ERP Part 2 - Project Identification report, Section 4.3.

b. On-site energy storage facilities

Thermal energy storage plays two important roles in campus waste heat recovery. The primary role is to allow for campus-scale heat recovery chillers to operate at a high capacity, often greater than the instantaneous need for heating and cooling. Thermal energy storage also allows recovery of energy with less dependency on the loads being needed at the same

instant in time. The plan includes two separate thermal storage water tanks, one for cold water and one for hot water. Further information about the cold and hot water thermal energy storage facilities is provided in Exhibit 1.2 UW ERP Part 2 - Project Identification report, Section 4.1.2 with additional discussion starting on page 116.

c. Labor and workforce

An early estimate of the total number of workforce hours on the full decarbonization effort is that it will require 2.4 million hours to complete. Assuming a ratio of 1,500 hrs. per FTE the total number of FTE to work on the project is 1,600. In addition to the total number of hours, it is worth noting that UW's capital project standard contract agreement follows the State's requirement of 15% apprenticeship participation, and apprentices must be registered in the State of Washington.

d. Options for public-private partnerships

In developing the implementation plan, the University and consultant team developed a financial model to assess various funding sources, including public-private partnerships (P3). The team explored various levels of P3 participation: the entire district energy system (such as The Ohio State University), energy systems, and individual components of the plan. Feedback on the success or pitfalls of P3's from other universities was gathered through peer networks. In the various funding scenarios modeled, Scenario 4 included P3's for the sewer heat recovery and lake interface projects. Further information about the sewer heat recovery and lake interface projects are provided in Exhibit 1.2 UW ERP Part 2 - Project Identification report, Sections 4.1.3 and 4.1.4 respectively. Financial analysis of the implementation plan with P3's is provided in Exhibit 1.4 UW ERP Part 3 – Implementation Plan, Section 4.4.5 and Section 5.0.

e. Options for Incorporation of Industrial symbiosis

Opportunities to Incorporate industrial symbiosis in the Plan include the sewer heat recovery facility. Further information about the proposed sewer heat recovery system is provided in Exhibit 1.2 UW ERP Part 2 - Project Identification report, Section 4.1.3

7. Utility engagement

a. Engagement with SCL, PSE, King County metro

To develop this decarbonization plan, the University engaged with Seattle City Light, King County (Wastewater Treatment division) and Puget Sound Energy.

Seattle City Light: The University, consultant team and Seattle City Light met on a regular basis starting in February 2024 to discuss current service levels, risks to power capacity and reliability and the proposed new UW Substation to mitigate the risks identified. The University continues to have regular meetings with Seattle City Light to develop the public partnership required to move the new UW Substation forward. Further information about the UW Substation is provided in Exhibit 1.2 UW ERP Part 2 - Project Identification report, Section 4.2.4.

King County: The Sewer Heat Recovery Program was authorized by the King County Council in 2020 to create a pilot program to allow 3 projects to recover the waste heat from the King County Metro sewer lines. During the development of the project identification and implementation plan phases, the University and consultant team met with King County Wastewater Treatment division to gather temperature data in the vicinity of the University campus, understand flows, temperature ranges, amount of energy possible, and requirements for the pilot program application process. Given the very positive information and helpful King County staff, the sewer water heat recovery project provides an excellent opportunity to tap into an existing underutilized heat source. Further information about the

proposed sewer heat recovery system is provided in Exhibit 1.2 UW ERP Part 2 - Project Identification report, Section 4.1.3

Puget Sound Energy: The University of Washington has actively been promoting its plans to decarbonize and share its plans with multiple interested agencies including Puget Sound Energy (PSE). The University of Washington Seattle campus is a schedule 87 "non-exclusive interruptible service with firm option" customer of Puget Sound Energy (PSE). This rate is available to any non-residential customer whose requirements exceed 1,000,000 Therms per year. UW's decarbonization efforts will move UW to a new schedule 85 rate. Further, UW will still have a need for providing process steam loads for autoclaves, sterilizers, cage washers, and other research equipment. PSE has indicated that some of the efficiency improvements to conserve natural gas by recovering waste heat may be eligible for incentives from PSE. Use of renewable natural gas (RNG) could be a desired solution to the challenge of addressing these process loads. UW will work with PSE on the availability of RNG, and whether available volumes enable RNG to be a viable option.

8. Proposed implementation timeline

a. Energy Management Plan (EMP) timeline

The UW Seattle Campus EMP will be submitted to Commerce by December 1, 2025. The Plan is intended to cover the entire campus in a single document. The initial 2025 version of the Plan will focus on efficiency measures, sustainability programs and compliance documentation in major facilities greater than 220,000 GFA. Subsequent submittals will document graduated compliance of remaining buildings through conditional compliance provisions of the standard. The Plan will apply to all buildings connected to the campus DES. The final Plan submittal documenting compliance for buildings not covered, connected to the district energy system, will be submitted no later than December 1, 2029.

b. Operations & Maintenance (O&M) Program timeline

The UW Seattle Campus O&M Program implementation Report will be submitted to Commerce by December 1, 2025. The Report is intended to cover the entire campus in a single document. The initial 2025 version of the Report will focus on preventative maintenance processes and compliance documentation for major facilities greater than 220,000 GFA. Subsequent submittals will document graduated compliance of remaining buildings through conditional compliance provisions of the standard. The Report will apply to all buildings connected to the campus DES. The final Report submittal documenting compliance for buildings not covered, connected to the district energy system, will be submitted no later than December 1, 2029.

c. Timeline for Energy Efficiency Measures (EEM) required to meet the standard

While no campus EEM are required to meet the campus EUI benchmarking target; UW is committed to a robust energy efficiency program. The program, created in 2014 has audited 11 million campus GFA, identified some 394 cost effective opportunities in 112 major campus buildings, and completed 55 projects worth nearly $6 million dollars, resulting in more than $1.3 million in annual energy savings. The program has cut campus utility spending by 4% annually, shaving 5.5 points off the campus EUI over the last 10 years.

Table 5 Cumulative Energy Savings 2014-2024

Resource Conservation Projects	Totals
Annual Electric Cost Savings	$597,132
Annual Gas Cost Savings	$532,258
Total Cost Savings	$1,129,389
Resource Conservation Investment	$5,937,281
Incentives Received	$3,256,306
Simple Payback (Years - After Incentives)	2.4
Savings to Investment (15 year Life)	6.3

d. Proposed Decarbonization Plan, project timeline

The plan is comprised of 47 projects, each with their own duration for funding, design, entitlements, construction and start-up. The overall timeline for the decarbonization plan depends on the availability of funding sources, entitlement challenges, future opportunities, and constraints. The overall goal is to complete the plan within 10-15 years. A summary of project schedules for each funding scenario is provided in Exhibit 1.4 UW ERP Part 3 Implementation plan, Section 3.0. Additional details for individual project schedules are provided in Exhibit 1.4 UW ERP Part 3 Implementation plan, Appendix 10.4.2 Project Preliminary Milestone Schedules.

e. Phases of decarbonization plan

Due to uncertainty around the level of state funding available in each biennium, the University has developed multiple project sequencing and funding scenarios to maintain flexibility. Project sequencing is driven by key factors, such as the desire to reuse existing tunnels for hot water distribution, the long permitting timeline for the Lake Water Interface project, and the need to ensure reliability and redundancy for critical buildings in the campus region south of Pacific St (University of Washington Medical Center/Montlake and Magnuson Health Science Buildings). Reusing existing tunnels has the most significant impact on project sequencing, as it requires replacing current heating and cooling services in place, which must be carefully coordinated with building conversions and installation of new heating systems. The phased implementation begins with upgrades to utility plants, followed by hot water distribution and building conversions progressing outward from the plants. Priority is given to deploying the Lake Interface and Sewer Heat Recovery systems early in the sequence, with the final phases focusing on completing campus-wide conversions and eliminating the remaining fossil fuel use. The project sequence diagrams provide a high-level view of the potential funding, design, and construction timelines for each of the four funding scenarios. The diagrams are provided in Exhibit 1.4 UW ERP Part 3 Implementation plan, Appendix 10.4.1 Project Sequence Diagrams.

9. Other considerations

a. Community Engagement Plan

The Climate Commitment Act (CCA) requires agencies that receive more than $2 million from the CCA Account to complete a community engagement plan (RCW 70A.02.050) to describe how they will engage with overburdened communities. Since a primary source of funds for the decarbonization plan is the CCA Account and the University has received more than $2 million dollars to date, the University coordinated with the Environmental Justice Council to align the CCA's community engagement plan requirement with the Department of Commerce's decarbonization plan submission. The community engagement plan outlines the collective impact of the University and how our capital project process engages communities at the local, regional, State and global levels. Further information is provided in Exhibit 3.0 UW Community Engagement Plan.

b. Funding mechanisms

The decarbonization plan is a significant long-term investment for the University. The total first-cost budget for the decarbonization plan is $1.6 billion (in 2024 dollars). The total cost of the decarbonization plan will depend on the funding scenario as the present-day dollars increase over time due to escalation. Due to the large capital investment, the University explored multiple funding sources and mechanisms including Federal tax credits and grants, State of Washington Climate Committee Act funds, State bond account funds, University debt, donations, partnerships with local utilities, and public-private partnerships (P3's). Funding scenario 4 included CCA funds, federal direct pay tax credits, partnership with Seattle City Light, and public-private partnerships. Information regarding IRA funding is provided in Exhibit 1.4 UW ERP Part 3 Implementation plan, Section 6.0. At the time the plan was developed, it was assumed that the majority of funding would be from the State's CCA Account.

c. Cost projections

The foundation for the cost projections is cost estimates of individual projects with assumptions about scopes of work, entitlement, and construction durations. The total first-cost budget for the decarbonization plan is $1.6 billion (in 2024 dollars). The financial analysis of the decarbonization plan evaluates multiple scenarios and considers various inputs, including project timelines, capital costs, operational costs, tax credits and incentives, delivery models, inflation/escalation rates, and financial parameters. In addition to the four funding scenarios, the model also included a business-as-usual case for comparison. The financial model provides cash flow, life-cycle cost, and net present value (NPV) analysis. The analysis indicates that the decarbonization plan has a lower NPV than the business-as-usual case.

Further, an important metric for this analysis is the incremental cost of the proposed plan relative to the status quo, divided by the carbon emissions being eliminated over the life of the plan. The resulting value is $147/MTCO2e. Further information regarding the financial model, net present value for the scenarios and business-as-usual case is provided in Exhibit 1.4 UW ERP Part 3 Implementation plan, Section 4.0 Financing Modeling. Further information regarding individual project's first cost is provided in Exhibit 1.4 UW ERP Part 3 Implementation plan, Appendix 10.3 Detailed Cost Estimates.

d. Current expended costs

The current expended cost of implementing the Plan is $3 million in Climate Commitment Act revenues used to develop the Plan document.

e. Changes to the plan that are required to meet changes in codes, laws and standards, include any future reductions in EUIt.

At this point in time, there are no anticipated changes to the decarbonization plan to meet current codes, laws and standards. Changes based on future codes and laws will be highlighted in the five-year update to the decarbonization plan. The University and

consultant team reviewed current codes and laws, and further information is provided Exhibit 1.4 UW ERP Part 3 Implementation plan, Section 7.0. The University has identified challenges in the current Seattle Existing Building Code and Seattle Energy Code and is discussing code changes or clarifications with the City of Seattle Department of Construction Inspections (SDCI). The campus district energy system, number of buildings, and the length of time to fully implement the decarbonization plan create challenges in the existing code for compliance and efficient renovations.

10. Exhibits

Exhibit No	Decarb Plan Reference Name	Attached Exhibit file name	Notes
1.0	UW Energy Renewal Program Introduction	UW Energy Renewal Program Introduction.pdf	Reader guide & introduction for ERP
1.1	UW ERP Part 1 – Baseline Assessment	UW ERP Phase 1 – Baseline Assessment.pdf	
1.2	UW ERP Part 2 – Project Identification	UW ERP Phase 2 – Project Identification.pdf	
1.3	UW ERP Part 2 Appendix - Project ID Appendices	UW ERP Phase 2 – Project ID_Appendices.pdf	
1.4	UW ERP Part 3 – Implementation Plan	UW ERP Phase 3 – Implementation Plan.pdf	
2.0	UW Seattle Building List	UW Seattle Campus Building List 6_12_2025.xlxs	
3.0	UW Community Engagement Plan	UW CEP_CCA.pd	CEP required for CCA fund recipients