Washington State Department of Commerce

# A Summary of District Energy System Decarbonization Plans

Alternative compliance pathway pursuant to section 4 of RCW 19.27A.260

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Report to the Legislature

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**CLEAN BUILDINGS PROGRAM**

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# Executive summary

## Legislative Mandate

The Washington State Legislature established the Clean Buildings Act, outlined in RCW 19.27A.210-260,[1] to improve the energy efficiency of large existing buildings and to put the state on a path to meet our greenhouse gas (GHG) reduction limits as outlined in RCW 70A.45.020.[2] With the enactment of House Bill 1390 in 2023, Washington became the first state in the nation to mandate comprehensive decarbonization plans for state owned campus-scale district energy systems, including the buildings connected to these systems. These plans, spanning over 15 years, must be submitted to the Washington State Department of Commerce (Commerce) by June 30, 2025, and provide a coordinated roadmap for transitioning district energy systems from fossil fuel infrastructure to modern, low-carbon energy networks.

This report satisfies the requirement in section 4 of RCW 19.27A.260:

> (4) The Department of Commerce must provide a summary report on the decarbonization plans required in subsection (3) of this section to the governor and the appropriate committees of the legislature by December 1, 2025.[3]

## Overview

This report outlines Washington's strategic approach to decarbonizing campus-scale district energy systems in alignment with the Clean Buildings Act and the greenhouse gas reduction targets outlined in RCW 70A.45.020. Examples of modernizing energy systems include, but are not limited to:

- Replace old steam boilers with newer technologies like low-temperature heating networks
- Use of high-efficiency electric heat pumps
- Install heat-recovery chillers
- Install geothermal systems

This approach represents a strategic shift from isolated, incremental building upgrades to implementing a broader, coordinated energy transformation strategy across entire district energy systems, leading to greater energy efficiency and significant reductions in greenhouse gas emissions. Washington's strategic approach to decarbonizing campus-scale district energy systems in large existing buildings puts the state on a path to meet its greenhouse gas reduction limits, leverage future energy networks, share heating and cooling resources, and utilize waste heat.

Commerce identified 32 state-owned campus district energy systems that met the definition outline in RCW 19.27A.260. Of those 32 state-owned systems, 27 submitted decarbonization plans on time. Alongside these submittals, two privately owned campus district energy systems opted in to submitted for review.  The submitted plans help the state better understand cost estimates for decarbonizing at the district scale. These plans identify capital investment needs in the billions of dollars across multiple budget cycles. The estimated costs range widely, depending on the size, complexity and condition of existing identified systems and infrastructure. While there is an expectation of long-term savings and associated benefits in energy and operations, institutions are facing significant hurdles, including high upfront costs to modernize, aging infrastructure and limitations within existing energy grid capacity. To move forward effectively and keep costs manageable, support from state investment, federal incentives and collaboration with utilities will be crucial.

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[1] Washington Legislature, "RCW 19.27A.210-260 State energy performance standard,"
[2] Washington Legislature, "RCW 70A.45.020 Greenhouse gas emissions reductions—Reporting requirements,"
[3] Washington State Legislature, "Revised Code of Washington 19.27A.260, subsection 4,"

### Common strategies emerging across plans include:

- **Electrification through air-source technologies** to reduce reliance on fossil fuels
- **Installation of ground-source heat pumps and heat-recovery chillers** to improve energy efficiency
- **Integration of geothermal and ambient-loop systems** to enable thermal exchange between buildings and the ground
- **Deployment of thermal energy storage** to manage peak electrical demand and enhance grid flexibility
- **Hybrid and phased implementation** aligned with capital renewal cycles for cost-effective transitions
- **Industrial symbiosis and waste-heat partnerships** with utilities and nearby facilities to maximize energy recovery

The decarbonization strategy presents an opportunity to invest in the required workforce for implementation. Transitioning to clean and efficient building systems will require a workforce of trained professionals, such as engineers, skilled tradespeople and facility managers proficient in building automation, electrification and district energy operations. Connecting these infrastructure projects with statewide training and apprenticeship programs will ensure Washington's decarbonization initiative delivers on projected economic and employment benefits.

Despite challenges such as high capital costs, electrical grid readiness and complex operational phases, the submitted decarbonization plans demonstrate that a clean energy transition across the state is possible and beneficial. These plans establish Washington as a national leader in district-level decarbonization. They combine energy efficiency, workforce development and climate action within a clear set of policies that integrate building performance standards, district level decarbonization and decarbonizing our electricity supply into a focused strategy.

## Possible next steps

Drawing on the analysis of the decarbonization plans, Commerce offers the following possible next steps to continue to advance this work and meet the state's goals around building decarbonization:

- **Consider developing a range of criteria for prioritizing investments**. A range of criteria is important to accurately evaluate priorities. These might include a focus on greenhouse gas (GHG) reductions, energy use intensity (EUI) reductions, shovel readiness, grid readiness and opportunities for financial leverage, including federal tax credits for ground source heat pumps.
- **Explore evaluating areas for grid readiness.** Grid readiness is key to ensuring district energy systems are viable and reliable. An evaluation of available grid capacity in the areas where these district energy systems are located would be valuable. This will enhance understanding of areas that will need infrastructure investments including substations and transformers.
- **Consider creating long-term plans.** Long-term planning is needed to map out how to proceed including sequencing of phased projects.
- **Explore expanding investments in workforce development.** Workforce readiness is critical to support initiatives to accelerate decarbonization, foster economic growth and position Washington as a leader in clean energy innovation.

# Introduction

## Background

The Washington State Legislature enacted the Clean Buildings Act (Chapter 285, Laws of 2019), becoming the first in the nation to establish a statewide performance standard for buildings. Commonly referred to as the Clean Buildings law. The Legislature enacted this law to enhance the energy performance of existing large buildings and to meet Washington's greenhouse gas (GHG) reduction targets, as outlined in RCW 70A.45.020. This statute applies to:

- **Tier 1** covered commercial buildings that are larger than 50,000 square feet
- **Tier 2** covered buildings that are larger than 20,000 square feet and multifamily residential buildings[4]

The Clean Buildings Performance Standard (CBPS) requires Tier 1 and Tier 2 covered building owners to benchmark their buildings' energy use and develop and implement an energy management plan, as well as an operations and maintenance program.[5] Tier 1 buildings are required to meet one of two energy performance metrics:

1) Meeting the energy use intensity target set by the state
2) Meeting the investment criteria by conducting an ASHRAE level 2 energy audit, and implementation of all cost-effective energy efficiency measures identified by a life cycle cost analysis[5]

The dates for Tier 1 compliance reporting, based on building size, start in June 2026 and continue through 2028. The Tier 2 reporting deadline is July 1, 2027. Building owners must submit documentation to the Department of Commerce according to the reporting schedule in WAC 194-50-080 and every five years thereafter.

On May 4, 2023, House Bill (HB) 1390 (Chapter 291, Laws of 2023) was signed into law, amending the Clean Buildings law to add a new section on compliance for buildings connected to district energy systems.[6] The amendment requires owners of campus district energy systems to submit a decarbonization plan to Commerce by June 30, 2025, and resubmit every five years thereafter, including a progress report on the implementation of the plan. The bill acknowledges that decarbonizing buildings is essential to meet the state's climate goals and highlights the benefits of upgrading existing district energy systems while considering the timeline for implementing these upgrades. The bill allows plans to be implemented over a 15-year timeline and provides Commerce with the authority to approve plans beyond this timeline where necessary.

District energy systems typically use a central plant to produce and distribute heating, cooling or both through a system of underground pipes to multiple buildings within a campus. This approach can eliminate the need for individual heating and cooling sources at each building.

Upgrading existing fossil fuel-fired district energy systems to decarbonized technologies has great potential to improve energy efficiency and reduce reliance on fossil fuels. This approach can often achieve greater energy efficiency and reductions in greenhouse gas emissions than a building-by-building incremental approach.

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[4] In 2022, the law was expanded to include buildings Tier 2 covered buildings
[5] The administrative rules for the Clean Buildings law consist of American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)[5] Standard 100-2018, Energy Efficiency in Existing Buildings, with state amendments Washington Administrative Code (WAC) 194-50,
[6] Washington State Legislature, "HB 1390 Campus District Energy Systems — Decarbonization Plans,"

Washington's public campuses and facilities create a significant workforce and economic development opportunity. The transition to clean energy and high-efficiency building systems will require skilled tradespeople, engineers, technicians, and energy managers trained in ever-advancing, state-of-the-art technologies such as high-efficiency heat pumps, thermal storage, building automation, and thermal energy networks. These projects generate local, long-term employment opportunities through design, construction, commissioning and ongoing maintenance of advanced energy systems. To realize these benefits, Washington will need targeted training programs and apprenticeships focused on electrification, energy modeling and system integration to keep the workforce in stride with advancements in technology.

Decarbonization of state-owned district energy systems and the buildings connected to them (such as campuses) will require significant investment and multiple budget cycles to complete. The first step is planning, so Washington can prioritize investments, strategically invest in the highest-impact projects and put these public institutions on a path to a decarbonized future. Having these plans will assist institutions, utilities, the private sector, and the state in gaining a better understanding of the scope of this work and in assembling a roadmap to make progress towards decarbonization requirements incrementally and meet Washington's greenhouse gas emissions limits as outlined in statute.

Complying with the district energy system decarbonization requirements of the standard (Normative Annex W) is mandatory for state campus district energy systems consisting of five buildings or more with a minimum aggregate of 100,000 square feet. It is optional for campus district energy systems consisting of three buildings or more, with a minimum aggregate area of 100,000 square feet, allowing private entities and smaller state campuses to opt into this compliance pathway. Compliance with the CBPS through Normative Annex W will enable campuses to delay meeting the energy use intensity target (EUIt) for the campus until the district energy systems decarbonization plan is fully implemented.[7]

## Legislative mandate

This report fulfills the requirement in section 4 of RCW 19.27A.260:

> (4) The Department of Commerce must provide a summary report on the decarbonization plans required in subsection (3) of this section to the governor and the appropriate committees of the legislature by December 1, 2025.[8]

## Rulemaking for decarbonizing district energy systems

In December 2023, Commerce initiated the rulemaking process by filing the CR-101. The rulemaking was to amend WAC 194-50 by adding a new chapter that codifies the general compliance and reporting requirements for participating campus district energy systems.

Commerce held four workshops from January to March 2024, with an average attendance of 105 participants at each workshop. The workshops focused on the proposed components of the decarbonization plans, compliance reporting and the alternate compliance pathway of the CBPS. Each rulemaking workshop was followed by a two-week comment period. Commerce received 20 written comments from universities, energy consultants, local governments and healthcare institutions in addition to dozens of emails and meetings with stakeholders.

[7] Normative Annex W is a provision within the Washington State Clean Buildings Performance Standard (CBPS) that outlines an alternative compliance pathway for campuses with district energy systems. It allows eligible campuses to defer meeting the energy use intensity target (EUIt) requirement until their approved district energy systems decarbonization plan is fully implemented, provided they meet specific planning and reporting criteria.
[8] Washington State Legislature, "Revised Code of Washington 19.27A.260, subsection 4,"

The CR-102 was filed on May 1, 2024, and the public hearing occurred on June 4, 2024. The CR-103 was filed on July 30, 2024, to finalize the rules for the decarbonization plans of participating campus district energy systems.

# Decarbonization plans summary

## Plan requirements

Decarbonization plans are mandatory for large state-owned campus district energy systems and optional for non-state-owned campus district energy systems. The rules instructed the designated representative of the campus district energy system to register or opt-in to the decarbonization plan process using the District Energy Systems Registration and Opt-in form.[9]

The statute defines a **state campus district energy system** as a district energy system that provides heating, cooling or heating and cooling to a campus through a distributed system providing steam, hot water or cool water to five or more buildings with more than 100,000 square feet of combined conditioned[10] space, where the system and all buildings connected to the system are owned by:

- The state of Washington; or
- A public-private partnership including one public building owner and one private entity

The statute defines a **campus district energy system as** a district energy system that provides heating, cooling, or heating and cooling to a campus through a distributed system providing steam, hot water, or cool water to three (3) or more buildings with more than 100,000 square feet of combined conditioned space, where the system and all buildings connected to the system are owned by:

- A single entity;
- A public-private partnership in which a private entity owns the systems providing heating, cooling, or heating and cooling to buildings owned by one public entity; or
- Two private entities in which one private entity owns the buildings connected to the system and another private entity owns the system providing heating, cooling, or heating and cooling to the buildings.

A decarbonization plan can span 15 years, and Commerce has the authority to approve plans beyond this timeline. Submitting decarbonization plans provides building owners with an alternative compliance pathway and flexible timeline to comply with the CBPS. These plans must include:

- Mechanisms to replace fossil fuels in the heating plants, including a schedule for replacement
- An evaluation of possible options to partner with nearby sources and uses of waste heat and cooling
- Examination of opportunities to add buildings or other facilities to the system once it is decarbonized, an incentivization strategy to encourage growth of a decarbonized system and requirements for facilities joining the system
- An evaluation, prioritization and scheduled plan of reducing energy use through conservation efforts both at the central plant and in the buildings connected to the district energy system that results in meeting the campus energy use intensity (EUI) target
- An energy management plan with an operations and maintenance program

[9] Washington State Department of Commerce, "District Energy Systems Registration and Opt-in form,"
[10] Conditioned space refers to areas within a building that are actively heated, cooled, or ventilated to maintain comfortable indoor temperatures for occupants. In other words, it's the interior space served by HVAC systems (heating, ventilation, and air conditioning).

## Decarbonization plan submissions

In response to the legislation and the Clean Buildings Performance Standard compliance pathways, public entities owning these systems have developed district energy system decarbonization plans. As of Oct. 1, 2025, 32 state campus district energy systems have been registered, while five privately owned campus district energy systems opted in. Three privately owned campuses later opted out after determining their plans were not feasible to pursue. Not all agencies or organizations that registered or opted in submitted a plan. Seven campuses belonging to the Department of Social and Health Services (DSHS) were unable to submit their plans on time. For a list of the campuses unable to submit their plans, see Appendix B. DSHS informed Commerce that it intends to develop a decarbonization plan pending its funding request.

A total of 27 plans were submitted. See Appendix A for a list of all the agencies, organizations and campuses that submitted a decarbonization plan. The following lists the campus activity types and the number of plans submitted for each:

- **Airport:** 1
- **College/University:** 16
- **Hospital:** 1
- **Nursing Home:** 2
- **Office:** 1
- **Prison/Incarceration:** 6

Refer to Table D-1 located in Appendix D for a table that summarizes building use types, individual building count for each plan, estimated capital ranges and a technical summary of all the decarbonization plans.

- All district energy system decarbonization plans are available in an online folder (link provided in the digital version of this report). Here is a link to a folder containing all district energy system decarbonization plans.

This report synthesizes the submitted plans, highlighting shared challenges, innovative strategies, budget implications and partnership opportunities. Each submitted plan aims to eliminate or significantly reduce reliance on fossil fuels, modernize energy infrastructure, comply with the building energy efficiency requirements of the CBPS and align with Washington's climate goals. While each institution faces unique challenges, their plans highlight common themes such as transitioning away from fossil fuel energy sources, investing in electrified heating and cooling systems with energy-efficient technology like heat pumps, and leveraging geothermal and heat recovery technologies. Furthermore, each decarbonization plan aims to align projects with long-term capital and master planning initiatives.

## Projected cost

The submitted plans outlined capital investment needs totaling billions of dollars over several budget cycles. Estimated costs vary widely depending on system scale, age and infrastructure complexity. Most institutions provided rough order-of-magnitude costs, recognizing these as early planning-level estimates subject to refinement through design. Major cost drivers include electrical capacity upgrades, conversion from steam to low-temperature hydronic networks, heat pump installations, geothermal installations, and distribution system modernization. While several campuses anticipate long-term operational savings, the upfront costs are substantial and exceed what can be met through standard maintenance budgets.

Not all decarbonization plans provided consistent budget details at the same level or structure. Some, like University of Washington (UW) Tacoma and the Capitol Campus, provide detailed, phased cost estimates aligned with state biennia — two-year budget periods — and capital planning standards. These estimates are predictable and contained within the Washington biennial budget development cycle.

In contrast, the Department of Corrections (DOC) plans to use life-cycle cost analyses, a method that evaluates overall costs over a facility's life span. These analyses compare broad scenarios — such as ground-source heat pumps, air-source heat pumps, decentralized systems and business as usual — without specific timelines or phasing details. This approach provides a comprehensive view of the decarbonization project's whole lifespan, rather than an incremental, detailed breakdown for a two-year budget cycle. Plans from Evergreen State College and Veterans Home fall in between, offering total project cost ranges and qualitative phasing, but lacking year-by-year breakdowns.

See Appendix C for a chart showing the projected low and high costs per biennium from 2025 to 2031, as well as the total projected low and high costs from all plans submitted for 2025 and beyond.

## Innovative ideas and strategies

The decarbonization plans reflect a deliberate shift from a conventional building-by-building equipment replacement strategy toward a more strategic, system-level innovative solution. Institutions recognize that compliance with the legislation is not solely a regulatory requirement, but also an opportunity to modernize energy infrastructure, reduce long-term operating costs, strengthen campus resilience and reduce greenhouse gas emissions. As a result, the submitted plans emphasize forward-looking solutions, such as geothermal exchange, heat recovery chillers, hybrid systems, and partnerships for waste heat utilization.

The diverse range of approaches reflects the mission of each institution, addressing unique conditions and parameters ranging from an international airport to the specialized needs of hospitals and colleges. This variety provides Washington with a portfolio of strategies that can be adapted, scaled and replicated, positioning the state as a national leader in institutional decarbonization.

### Common strategies emerging across plans include:

- Electrify through air-source and ground-source heat pumps and heat-recovery chillers
- Install geothermal and ambient-loop systems to exchange heat between buildings and the ground
- Use thermal energy storage to manage peak electrical demand
- Implement hybrid and phased implementation aligned with capital renewal cycles
- Pursue industrial symbiosis and waste-heat partnerships with utilities and nearby facilities

Reference Appendix E for a summary of innovative ideas, strategies and their advantages.

## Waste heat and cooling partnership opportunities

Overall, the decarbonization plans submitted demonstrate a substantial shift toward low-temperature, 4th- and 5th-generation district-energy systems. Not all campuses have waste heat and cooling partnership opportunities due to location. Geothermal and sewer heat recovery systems are the most common strategies for sustainable heating and cooling. District energy expansion and thermal energy networks are emerging as a collaborative model between state agencies and utilities. For a deeper understanding of waste heat and cooling partnership opportunities, review Appendix F.

## Projected energy use intensity

Not all plans included the projected energy use intensity (EUI) due to concerns about the data. All plans with a projected EUI showed a reduction, some more significant than others. Appendix G summarizes the projected EUI of the campus relative to the current weather normalized EUI (WNEUI). Weather-normalized energy use intensity (EUI) is a building’s energy use per square foot adjusted for typical weather conditions. Energy savings are represented in kBtu/sf/year and do not reflect total energy saved. Further evaluation of total energy reductions and disaggregation of energy saved by fuel type would help better define the cost-benefit of each project.

# Key challenges

Each institution has developed ambitious pathways for achieving decarbonization; however, these plans reveal a consistent set of barriers that could slow progress or inflate costs if left unaddressed. From outdated infrastructure and operational risks to disruptions in business operations, high upfront capital needs, and grid limitations, campuses across the state face challenges that are both technical and financial in nature. These obstacles highlight the need for strategic phasing, strong state and federal funding support and early collaboration with utilities and industry partners.

## Aging and incompatible infrastructure

Many Washington campuses operate legacy steam or high-temperature hot water distribution systems that were designed and installed around fossil-fuel boilers decades ago. These systems run at temperatures far above what modern air-to-water or ground-source heat pumps can efficiently supply. For example, Highline College reported that its distribution requires 180°F water, making it incompatible with most electrified equipment unless the entire piping network is replaced. Eastern Washington University (EWU) faces a similar challenge, as its century-old steam plant accounts for 95% of its direct emissions. Clark College still operates aging boilers and chillers that are nearing the end of their life, with significant deferred maintenance needs. Replacing central plants, piping and building-level connections adds tens of millions of dollars beyond equipment costs.

## High capital costs and funding gaps

Across all district energy systems evaluated as part of the plans, the cost of implementation can be high, as can be the benefit. Even smaller colleges anticipate rough order-of-magnitude costs of $50 million to $150 million. Larger campuses, such as Eastern Washington University ($330 million to $370 million) and Seattle-Tacoma International Airport (SEA) ($300 million to $800 million), report costs that align with major infrastructure programs. The Capitol campus explored different options for decarbonization, and all require an upfront investment of $138 million to $222 million. The UW Seattle anticipates multi-phase investments exceeding $400 million as it transitions its 120-year-old district energy system. Leaders consistently note that these amounts exceed available capital budgets and will require state appropriations, federal incentives (e.g., Inflation Reduction Act tax credits) and innovative financing tools. Without external funding, payback periods can stretch from 50 to 100 years.

## Electrical infrastructure and grid readiness

Decarbonization requires a significant shift from natural gas to electricity, straining existing utility infrastructure in some locations of the grid. Eastern Washington University anticipates building a new substation in later phases. The Capitol campus strategies increase demand on the Puget Sound Energy (PSE) substation and medium-voltage campus grid. The Seattle-Tacoma Airport must coordinate with PSE and the Bonneville Power Administration to ensure sufficient capacity for geothermal systems and thermal storage. University of Washington campuses expect grid reinforcements to support the simultaneous electrification of dozens of buildings. These grid investments incur additional costs, require lengthy lead times and involve complex coordination with multiple stakeholders. If the electrical infrastructure is not addressed proactively, it could become a critical bottleneck or barrier to progress.

## Operational and phasing complexity

Campuses are 24/7 environments that house classrooms, labs, residences, hospitals, and critical operations. Phasing projects while maintaining uninterrupted service is a delicate balancing act. Highline College aligns its plan with building demolition and redevelopment schedules in 2029 and 2033 to minimize rework. Cascadia College and the UW Bothell Campus emphasize phasing over multiple biennia to integrate with capital renewal cycles. Hospitals and airports face even stricter requirements: UWMC Northwest Hospital must maintain patient safety, and the Seattle-Tacoma Airport cannot disrupt critical systems during peak travel. Major construction will disrupt legislative and administrative operations at the Capitol campus.

### Compliance deadlines and administrative burden

The legislation and the CBPS create a structured compliance timeline: plans are due in 2025, EMP and O&M are required by 2026, decarbonization plan reporting updates are scheduled for 2030 and 2035, and complete decarbonization is expected by 2040. While this offers a 15-year runway, many campuses highlight the administrative workload associated with benchmarking, reporting, and aligning with evolving codes and standards. Institutions like Edmonds College and UW Tacoma emphasize the need to establish new metering and monitoring systems to comply. Leaders worry that delays in the near term, from 2025 to 2030, will leave campuses scrambling to meet the 2040 deadline as aging infrastructure forces emergency replacements.

### Workforce, supply chain and technology readiness

Several plans highlight workforce limitations in the availability of skilled tradespeople, engineers, and commissioning agents familiar with large-scale electrification. State procurement cycles and global supply chain disruptions add risk to schedules and costs. Technology readiness is another concern: while heat recovery chillers and ground-source systems are proven, applying them at an airport or hospital scale requires design innovations that are not yet widely deployed in the U.S.

## Possible next steps

### Consider developing a range of criteria to prioritize investments

The legislature plays a vital role in ensuring that Washington invests in projects with the most significant potential impact. The legislature will need to determine what and how they want to prioritize investments in these district energy system decarbonization projects, as well as what outcomes are of most value. State agencies, such as Commerce, will need to continue informing policy decisions by providing as complete and reliable information as possible.

When making these policy decisions, a range of metrics could be considered to prioritize these investments. Possible next steps for the Legislature might include exploring a variety of prioritization criteria, such as greenhouse gas (GHG) emissions reductions, energy use intensity (EUI) reductions, cost and return on investment, shovel readiness, grid readiness, and opportunities for financial leverage, including currently available federal tax credits. Considering these options may help ensure that state resources are allocated to projects that yield the most positive outcomes and long-term value.

### Explore evaluating areas of grid readiness

Grid readiness is essential for the successful decarbonization of district energy systems as they shift to electric-powered technologies. Electrification increases demand on the power grid. A possible next step could be an evaluation of grid capacity in the relevant areas where these district energy systems are located. This would help clarify the infrastructure investments required, such as substations and transformers.

### Consider creating long-term plans for campus projects

Once the state has established criteria on what should be prioritized, the state can then compile a long-term plan to fund these decarbonization projects by the biennial budget cycle, including identifying funding leverage opportunities and creative financing strategies.

For example, the state could explore the viability of expanding the state’s green bank to provide low-interest financing for these projects. Evaluating existing funding and financing sources could better maximize Washington's investments further.

## Explore expanding investments in workforce development and pathways

Washington could consider expanding investment in workforce development initiatives, such as specialized training programs, partnerships with technical colleges and industry apprenticeships, to equip workers with the skills needed for HVAC electrification, energy modeling and advanced system integration. Taking these steps may help accelerate decarbonization, foster economic growth and position Washington as a leader in clean energy innovation while ensuring a just and equitable transition for all impacted workers.

# Appendix A: Submitted plans by campus and agency

List of campuses and agencies that submitted decarbonization plans:

1) Clark College — Main Campus
2) Department of Corrections
   - Airway Heights Corrections Center
   - Clallam Bay Corrections Center
   - Monroe Correctional Complex
   - Washington Corrections Center
   - Washington State Penitentiary
3) Department of Enterprise Services- Capitol Campus
4) Department of Veteran's Affairs
   - Washington Soldier's Home, Orting, WA
   - Washington Veterans Home, Port Orchard, WA
5) Edmonds College — Main campus
6) Port of Seattle — Seattle-Tacoma International Airport
7) Seattle Colleges District
   - Seattle Central Main Campus
   - North Seattle College Campus
8) Seattle Pacific University — Main Campus
9) Skagit Valley College — Mount Vernon Campus
10) Highline Community College — Highline College
11) Tacoma Community College — Tacoma Campus
12) Evergreen State College — Olympia
13) University of Washington
   - Montlake Campus
   - Tacoma Campus
   - UW Medical Center – Northwest
   - Bothell Campus and Cascadia College
14) Washington State University — Pullman and Vancouver Campus
15) Washington State Department of Children, Youth, and Families — Green Hill Campus
16) Western Washington University — Main Campus
17) Eastern Washington University — Main Campus
18) Central Washington University — Main Campus

# Appendix B: Unsubmitted plans by campus and agency

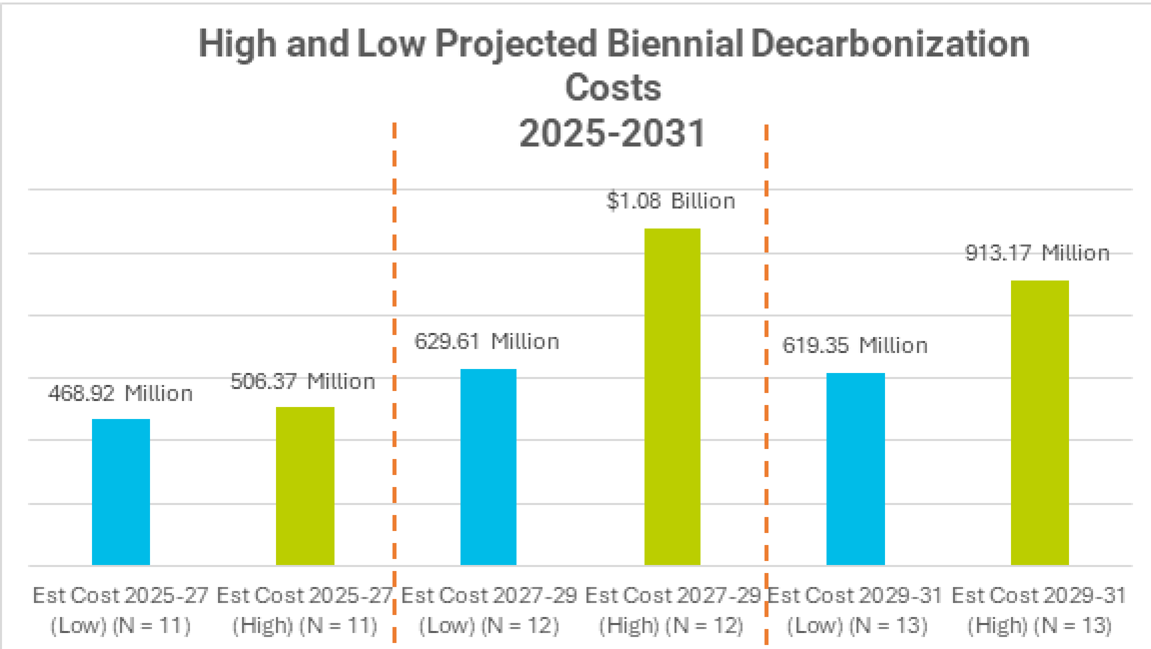
List of campuses and agencies that did not submit decarbonization plans before this report was written:

1) Washington State Department of Social Health Services
    - Eastern State Hospital
    - Fircrest School
    - Lakeland Village
    - Maple Lane
    - Rainier School
    - SCC McNeil Island
    - Western State Hospital

# Appendix C: Projected decarbonization cost

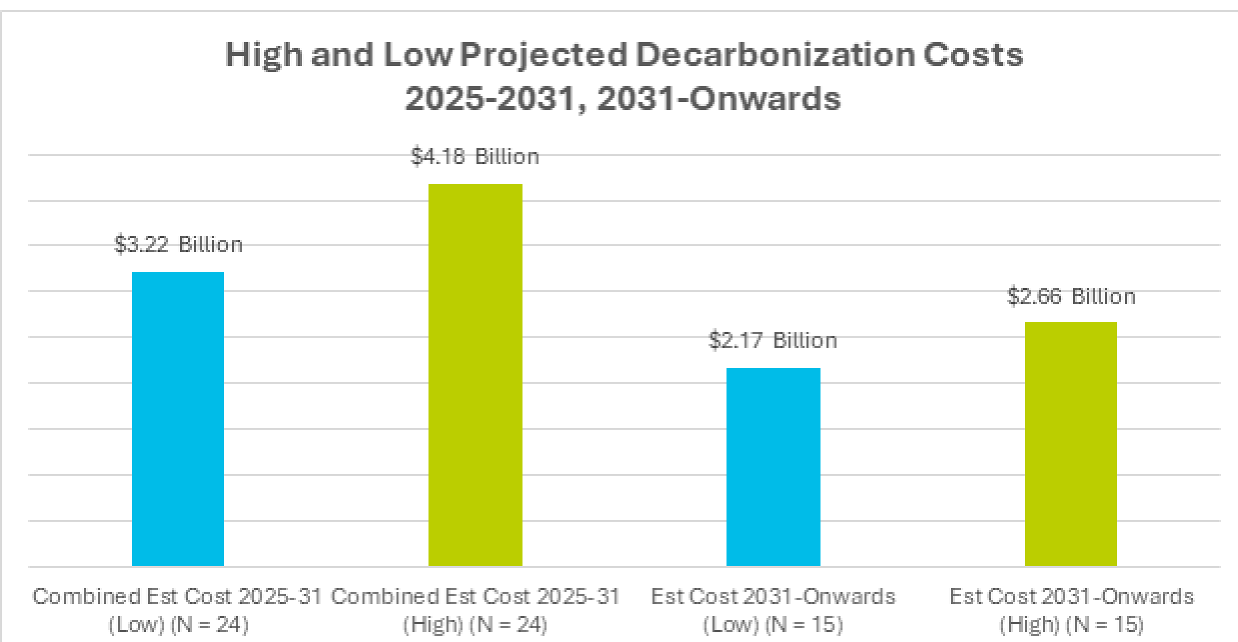
### Figure C-1: Projected high and low decarbonization cost per biennium from 2025 to 2031

This bar graph illustrates the projected low and high costs per biennium from 2025 to 2031, as well as the total projected low and high costs from all plans submitted for 2025 and beyond. “N” represents the number of submitted plans that included the information.




### Figure C-2: Projected decarbonization cost from 2025 and beyond

This bar graph illustrates the projected total costs for 2025 to 2031 and beyond. “N” represents the number of submitted plans that included the information.



# Appendix D: Comparative summary of decarbonization plans

This table summarizes building use types, individual building count, estimated capital ranges and a technical summary of all the decarbonization plans provided by institutions across Washington. Values are preliminary, based on submitted plans and reasonable rough order of magnitude estimates where plans did not provide firm numbers.

### Table D-1: Summary of building types, counts, capital ranges and technical details from institutional decarbonization plans

| Organization/Campus | Building Use Type | Building Count | Combined Estimated Capital Range in millions 2025-2031 | Technical Summary |
|---|---|---|---|---|
| **Clark College** | College/ University | 34 | $19 | The carbon emissions reduction path over time displays carbon reductions, costs, and project phasing in a single diagram. Phase out existing natural gas boilers in favor of utilizing four-pipe HRC to serve its H/C needs. |
| **Washington State Department of Corrections – Airway Heights Corrections Center** | Prison/ Incarceration | 18 | $230 to $260 | Proposed district energy systems will replace the current high-temperature, high-pressure network with a centralized low-temperature hot and chilled water plant using a modern 4-pipe distribution system. |
| **Washington State Department of Corrections – Clallam Bay Corrections Center** | Prison/ Incarceration | 8 | $67 to $100 | Proposed district energy systems will incorporate heat recovery chillers (HRC), geothermal heat sourcing, and the existing propane condensing boilers to meet peak and backup load demands. |
| **Washington State Department of Corrections – Monroe Correctional Complex** | Prison/ Incarceration | 48 | $277 to $290 | The proposed district system involves a centralized HW/CHW plant utilizing a new 4-pipe distribution system, including HRC coupled with geothermal heat sourcing and NG condensing boilers for peak loads and backup. |
| **Washington State Department of Corrections – Washington Corrections Center** | Prison/ Incarceration | 21 | $215 to $241 | Replacing the existing low-pressure steam system with 4th-generation four pipe low-temp district energy systems with a heat recovery chiller. |
| **Washington State Department of Corrections – Washington State Penitentiary** | Prison/ Incarceration | 16 | $281 to $241 | Replacing the existing low-pressure steam system with 4th-generation 4-pipe low-temp district energy systems with a heat recovery chiller. |
| **Washington State Department of Enterprise Services – Capitol Campus** | Office, Lodging and Library | 11 | $130 to $200 | Conversion to 5th generation design on East Campus, 4-pipe hydronic heat pump plant with heat recovery chillers providing hot and chilled water to the historic buildings, with limited mechanical space located on West Campus. |
| **Department of Veterans Affairs/Soldiers Home, Orting** | Mixed-Use | 21 | $16 to $25 | Replacing the existing low-pressure steam system with a low-temperature open-loop ground source heat pump loop. |

| Organization/Campus | Building Use Type | Building Count | Combined Estimated Capital Range in millions 2025-2031 | Technical Summary |
|---|---|---|---|---|
| **Department of Veteran's Affairs/Veteran's Home, Port Orchard** | Mixed-Use | 10 | $21 to $32 | Replacing the existing low-pressure steam system with a low-temperature open-loop ground source heat pump loop. |
| **Edmonds College** | College/ University | NA | $11 | The plan proposes to remove natural gas-fired units and replace them with all-electric equivalents, decarbonizing at the individual building level. |
| **Port of Seattle – Seattle-Tacoma International Airport** | Airport | 4 | No data reported | Proposes transitioning from steam to a next-generation district energy system that replaces the existing equipment with high-efficiency water source heat pumps, heat recovery chillers, closed-loop geothermal and thermal energy storage. |
| **Seattle Colleges – Seattle Central College** | College/ University | 5 | $26 to $34 | Replacement of existing purchased steam and natural gas boilers with a closed-loop air-to-air and water-to-water heat pump. |
| **Seattle Colleges – North Seattle College** | College/ University | 6 | $20 to $40 | Replace existing natural gas boilers with CO2 heat pumps. |
| **Seattle Pacific University** | College/ University | 8 | $83 to $101 | Proposed is a heat pump-based loop, utilizing nearby ship canal water. |
| **Skagit Valley College** | College/ University | 11 | $56 to $141 | Replace the existing natural gas steam system with a heat pump-based steam system. |
| **Highline College** | College/ University | 32 | $106 to $139 | Proposed solution to remove a large number of buildings from district energy systems and use AWHP at the individual building level |
| **Tacoma Community College** | College/ University | 24 | $10 | Replacing natural boilers with heat pumps locally |
| **Evergreen State College** | College/ University | 55 | $9 to $14 | Replace the existing district heating and cooling system with decentralized air-to-water heat pumps, thereby rolling back the existing district energy system and avoiding modernization through electrification. |
| **University of Washington Seattle** | College/ University | 239 | $1,000 to $1,600 | Replacement of large steam system and natural gas boilers with a low-temperature hot water system with recovered heat from sewer, Lake Washington and campus waste heat. |

| Organization/Campus | Building Use Type | Building Count | Combined Estimated Capital Range in millions 2025-2031 | Technical Summary |
|---|---|---|---|---|
| **University of Washington Tacoma** | College/ University | 23 | $6 | Replace natural gas boilers with air source heat pumps. |
| **UW Medical Center – Northwest** | College/ University | 6 | $9 | Replace natural gas boilers with air source heat pumps. |
| **University of Washington Bothell and Cascadia College** | College/ University | 16 | $22 | Replace natural gas boilers with air source heat pumps. |
| **Washington State University Pullman and Washington State University Vancouver** | College/ University | 528 | $139 | Two campuses with different plans. Create a decentralized, open-loop nodal ground source heat pump system, utilizing building-level heat pumps where a district system is not feasible. |
| **DCYF Green Hill School** | College/ University | 17 | No data reported | No data reported |
| **Western Washington University** | College/ University | 54 | $51 | Replacing the existing low-pressure steam system. Several options are presented, including a 4th-generation 4-pipe low-temperature district energy system with heat recovery and geothermal. Depending on which route they choose. |
| **Eastern Washington University** | College/ University | 45 | $330 to $370 | Nodal geothermal network design with 4th generation district heating and cooling, with a careful building mechanical and electrical distribution system upgrade plan. |
| **Central Washington University** | College/ University | 55 | $118 to 172 | Proposed a nodal open-loop geothermal system with a 4-pipe distribution system upgrade. |

# Appendix E: Summary of ideas and strategies

## Heat recovery chillers and heat pumps

Heat recovery chillers (HRCs) are cooling systems that capture waste heat generated during the cooling process and utilize it for heating purposes. Typically, traditional chillers release excess heat into the air through cooling towers. In contrast, HRCs redirect this heat into a hot-water loop for heating spaces or providing domestic hot water. This ability to cool and heat simultaneously makes HRCs very efficient, especially in large buildings like campuses or hospitals, where some areas require cooling while others require heating. HRCs are crucial for modern district energy systems that prioritize the use of less fossil fuel and lower operating costs.

Heat pumps work by moving thermal energy, rather than creating it through the burning of fuel. They use a refrigeration cycle to transfer thermal energy from sources such as air, water, or the ground to another location for heating or cooling. Because heat pumps run on electricity and do not burn fuel, they are key to plans for electrifying buildings and reducing carbon emissions. A key innovative element is shifting the district energy system from high-temperature to low-temperature water, which improves compatibility with heat pumps.

- Clark College and Seattle-Tacoma International (SEA) Airport are using heat recovery chillers (HRCs) to provide heating and cooling simultaneously. This is particularly powerful for campuses with significant simultaneous heating and cooling loads (e.g., labs, data centers or airports).
- Highline College also evaluates localized heat pump systems for specific buildings that do not connect efficiently to a central system.
- Airway Heights Corrections Center's (AHCC) plan evaluates multiple pathways — Ground Source Heat Pump and Air Source Heat Pump hot-water systems, as well as decentralized options.
- Evergreen has chosen a decentralized approach, converting buildings individually with air-source heat pumps. This modular strategy aligns upgrades with capital renewal cycles, minimizes upfront operational disruption and allows future integration with geothermal systems if feasible.
- University of Washington Tacoma's plan proposes to centralize to an all-electric heating plant using 14 rooftop air-source carbon dioxide heat pumps, with an 11,200 MBH (thousand British thermal units per hour) peak capacity.

**HRCs and heat pumps strategy advantages**: results in higher efficiency, lower operational costs and reduced emissions without needing entirely new distribution systems in some cases.

## Geothermal and ground-source systems

Geothermal and ground-source systems use the relatively constant temperature of the earth to provide heating and cooling for buildings. They work by circulating water or a refrigerant through underground pipes, either in wells or horizontal loops, that absorb or release heat depending on the season. They enable campuses to share thermal energy among multiple buildings, significantly reducing fossil fuel use.

- Eastern Washington University (EWU) proposes a nodal "GeoEco" strategy: multiple decentralized geothermal plants serving clusters of buildings. This avoids the cost of replacing its whole distribution system at once and allows phased deployment.
- SEA Airport evaluates large-scale closed-loop geothermal paired with thermal storage tanks, a unique solution at an airport scale.
- The WA Soldiers Home identifies open-loop geothermal as its preferred option, recognizing abundant groundwater resources and utilizing available Inflation Reduction Act (IRA) tax credits.

- The WA Veterans Home in Port Orchard proposes an open-loop geothermal heat pump plant with potential for sewer effluent heat recovery. Conversion of selected buildings to hot-water systems is planned, with steam retained for laundry until alternatives are developed. Phased, modular rollout is emphasized.

**Geothermal and ground-source systems strategy advantage**: long-term renewable heating source that reduces reliance on fossil fuels and utility grid electricity.

## Hybrid and phased approaches

Highline College blends centralized and localized systems. Some buildings will be converted to connect to a hybrid district system, driven by a critical assessment of the aging and increasingly unreliable utilidor network, a tunnel for steam pipe and other utilities.

- Cascadia College and the University of Washington Bothell's plan develops a seven-phase roadmap: audit → conservation → infrastructure replacement → building-level retrofits. This plan creates a manageable funding cadence for the duration of the plan.
- Capitol campus will pursue a hybrid ambient temperature loop strategy with distributed heat pumps and a central plant.
- Hybrid and Phased Approaches Strategy advantage: flexibility, reduces risk of stranded assets, aligns with capital renewal schedules.

## Industrial symbiosis and waste heat partnerships

Industrial Symbiosis refers to the collaboration between nearby organizations, such as campuses, industries, utilities, or municipalities, to share energy, water, or material resources that would otherwise be wasted. Waste Heat Partnerships are practical applications of industrial symbiosis. They involve agreements between institutions and external entities, such as cities, ports, or utilities, to exchange thermal energy through connected pipelines or district energy networks. By reusing this heat instead of venting it to the atmosphere, partners reduce fuel use, lower emissions and improve regional energy efficiency.

Together, these models exemplify cross-sector collaboration that transforms waste streams into shared, low-carbon energy resources.

- SEA Airport explores multiple industrial symbiosis ideas: sewer heat recovery with King County Wastewater, glycol recovery from aircraft de-icing and even glycerol reuse from biodiesel production.
- University of Washington (UW) Seattle considers formal partnerships with nearby energy users to capture waste heat and reduce duplication of infrastructure.
- WA Soldiers Home evaluates wastewater effluent recovery as a secondary heating source.

**Industrial symbiosis and waste heat partnerships offer an advantage in** shared infrastructure and lower lifecycle costs through partnerships.

## Thermal energy storage

Thermal energy storage (TES) systems store thermal energy for use at a later time, helping to balance energy demand and supply. They improve energy efficiency, grid flexibility and resiliency by allowing campuses to shift loads, reduce peak electrical demand and optimize the performance of heat pumps or chillers.

- SEA Airport integrates thermal storage tanks to shift energy use and flatten peaks of demand, an essential strategy for airports with variable occupancy and flight schedules.
- UW Seattle and Cascadia/UW Bothell note thermal storage as an option for load balancing in future phases.

**TES strategy advantage** reduces grid stress, cuts peak demand charges and provides resilience.

## Electrification with carbon capture backup

Electrification with carbon capture and storage (CCS) backup enables campuses to achieve deep decarbonization without compromising operational continuity or energy security.

Carbon Capture Backup refers to maintaining limited fossil-fuel backup systems for resilience or peak demand that are equipped with carbon capture or offset mechanisms to minimize emissions when they operate. These systems can capture carbon dioxide from combustion exhaust for reuse or safe storage, providing reliability during extreme weather or grid outages while maintaining a low overall carbon footprint.

- EWU proposes maintaining its existing steam system as a backup with carbon capture technology, while transitioning to geothermal for daily electricity loads. This is unusual among campuses and demonstrates a creative way to preserve resilience without abandoning the decarbonization pathway.

**An electrification strategy with carbon capture backup ensures resilience against** extreme weather while pursuing electrification.

## Ambient temperature loop

An ambient temperature loop (ATL) is a type of low-temperature district energy system that distributes water at or near the natural ambient ground temperature through a network of underground pipes connecting multiple buildings.

- Ambient temperature loop (ATL) is the Capitol Campus' preferred strategy. The ATL is a fifth-generation district energy system designed to transport water through a campus-wide piping network at ambient temperatures (60°F to 80°F), rather than at the high steam or hot-water temperatures characteristic of traditional systems.
- Each building connects to the loop via electric heat pumps, which "lift" the temperature up for heating or "reject" heat back into the loop for cooling.

**ATL Strategy advantage:** lowest lifecycle cost, flexible phasing, scalable and adaptable because it can integrate future technologies like sewer heat recovery or large-scale thermal storage.

## 4-Pipe hot/chilled water network

A 4-pipe hot/chilled water network is an advanced district energy system that uses four separate pipes—two for heating water (supply and return) and two for chilled water (supply and return).

This setup enables buildings to receive heating and cooling simultaneously, depending on their individual needs.

- Washington State Penitentiary (WSP) proposes that its 4th-generation district energy system would convert steam to a 4-pipe hot/chilled water network, expanding service to 88% of campus space.
- WSP expands the network to serve 41 buildings. A 4-pipe layout future-proofs the system, allowing new buildings to connect easily without waiting for seasonal changeovers.
- A 4-pipe layout future-proofs the system: new buildings can connect easily without waiting for seasonal changeovers.

**4-Pipe Hot/Chilled water network strategy advantage:** It is not just an equipment replacement — it’s a modernization of campus infrastructure that allows WSP to operate like a 21st-century energy district: flexible, efficient and resilient, while aligning with state decarbonization goals.

## Utility and funding integration

- Cascadia/UW Bothell and UWMC Northwest Hospital actively partner with utilities (Seattle City Light, Tacoma Power, Puget Sound Energy) to align decarbonization with grid planning and incentive programs.
- WA Soldiers Home specifically notes the Inflation Reduction Act geothermal tax credits as part of its financial case.

# Appendix F: Summary of waste heat and cooling partnership opportunities

## Campuses with established waste-heat and cooling partnerships

Primary research and urban campuses such as the University of Washington (Seattle, Tacoma, and Bothell/Cascadia), Western Washington University, Washington State University Pullman, and the Capitol Campus — lead with detailed strategies for heat-recovery chillers (HRCs), geothermal exchange, ambient-temperature loops (ATL), and district energy modernization.

These projects capture waste heat from cooling and laboratory operations, reuse energy through low-temperature water loops and create capacity for future regional or utility partnerships. Facilities such as the UW Medical Center, Clallam Bay Corrections Center, Airway Heights and SEA-Tac Airport are similarly advancing geothermal or sewer-heat recovery and district-scale energy sharing. These investments position them to meet or exceed CBPS targets while demonstrating inter-agency collaboration and long-term operational savings.

## Campuses are still in early or feasibility phases

Several smaller colleges, including Highline College, Skagit Valley College, North Seattle College, Seattle Central College, Edmonds College and Clark College, recognize potential for district-energy upgrades or heat-recovery integration, but have not yet defined partnerships.

Their plans generally refer to future collaboration with local utilities but lack confirmed waste-heat sources or commitments to a thermal-energy network. The Evergreen State College similarly outlines building-level heat-pump upgrades that could connect to future geothermal systems but have no active waste-heat recovery or cooling-partnership program.

## Facilities without current waste-heat or cooling opportunities

The Veterans Home in Port Orchard, the Soldiers Home in Orting, and Tacoma Community College do not yet feature waste-heat recovery or partnership components in their current phase of planning. These campuses are focusing on foundational electrification, HVAC modernization, and energy-management improvements, with the potential to add heat-recovery systems as the infrastructure matures. Similarly, a few correctional complexes (e.g., the Washington Corrections Center and the Washington State Penitentiary) reference geothermal or sewer-heat studies conceptually but report no operational partnerships currently.

# Appendix G: Summary projected energy use intensity

The projected energy use intensity (EUI) values submitted by institutions vary widely, depending on building type, system design, and decarbonization strategy. Most plans estimate post-project EUIs that reflect significant reductions from current baselines, particularly for campuses transitioning to centralized or high-efficiency systems. However, some projections remain preliminary or based on modeled assumptions rather than measured data. This summary provides a comparative snapshot of estimated EUIs across institutions, highlighting both the range of expected performance and the variability in data quality and methodology.

### Table G-1: Projected energy use intensity (EUI) and weather normalized energy use intensity (WNEUI) estimates by institution

| Campus Name | EUI Target | WNEUI | Projected EUI | EUI Reduction |
|---|---|---|---|---|
| Washington Corrections Center | 101 | 217.7 | 84 | 134 |
| Washington Soldiers Home – Orting | 93.5 | 164.6 | 52.3 | 112 |
| Washington Veterans Home – Port Orchard | 92 | 183.6 | 87.5 | 96 |
| Monroe Correctional Complex | 101 | 172.1 | 78 | 94 |
| Airway Heights Corrections Center | 106 | 190.2 | 106 | 84 |
| Seattle-Tacoma International Airport | N/A | 94.3 | 17.2 | 77 |
| Washington State Penitentiary | 106 | 143 | 76 | 67 |
| UWMC Northwest Hospital and Medical Center | 215 | 271.2 | 204.7 | 67 |
| Central Washington University | 112 | 116 | 52 | 64 |
| Eastern Washington University | 112 | 120 | 60 | 60 |
| Capitol Campus | 58 | 101.8 | 47.6 | 54 |
| University of Washington Seattle | 145 | 138 | 86.46 | 52 |
| The Evergreen State College | 126.5 | 100 | 53 | 47 |
| Washington State University — Pullman | 135 | 147 | 112 | 35 |
| Clallam Bay Corrections Center | 101 | 101.5 | 71 | 31 |
| Edmonds Community College Main campus | 110.7 | 79.1 | 53 | 26 |
| Clark College Main Campus | 96 | 82 | 58 | 24 |

| Campus Name | EUI Target | WNEUI | Projected EUI | EUI Reduction |
|---|---|---|---|---|
| **Skagit Valley CC Mount Vernon Campus** | 90.7 | 97.4 | 77.9 | 20 |
| **University of Washington Bothell and Cascadia College** | 110.4 | 54.6 | 42.3 | 12 |
| **Highline College** | 112.2 | 79.8 | 70 | 10 |
| **Tacoma Community College** | 110.7 | 82.4 | 75 | 7 |
| **North Seattle College** | 112.2 | 45.8 | 39.17 | 7 |
| **University of Washington Tacoma** | 107.6 | 58 | 54 | 4 |