



STATE OF WASHINGTON

STATE BUILDING CODE COUNCIL

Washington State Energy Code Development Standard Energy Code Proposal Form

Log No. 121-B
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Rev. 8/26/21

Low Carbon District Heating
and Cooling or Heating Only
System.

Code being amended: Commercial Provisions Residential Provisions

Code Section # C406 Efficiency Packages and associated definitions in C202

Brief Description:

Add a definition of *low-carbon district heating and cooling (or heating only) system* to C202 and modify heating/cooling/service hot water related C406 sections to reward utilizing low-carbon district heating or cooling systems.

Update to same
definition as Proposal
122B

Proposed code change text: (Copy the existing text from the Integrated Draft, linked to [122B](#) for new text and ~~strikeout~~ for text to be deleted.)

C202 GENERAL DEFINITIONS (add the following definitions, which should be consistently defined if any other district energy related code proposals are adopted):

LOW-CARBON DISTRICT HEATING AND COOLING OR HEATING ONLY SYSTEM. Any system serving multiple buildings providing energy in the form of direct heating and cooling, or heating only to a building. Energy can be directly converted to meet building heating or cooling loads through a heat exchanger without requiring additional mechanical system input. Examples include, but are not limited to steam, hot water, and chilled water.

Documentation for the low-carbon district system must be available to demonstrate the following:

- 1. Distribution losses must be accounted for and may not exceed 10% of the annual load delivered to buildings served by the system.
- 2.1 25% of the annual district-system-net-load-met (sum of heating and cooling energy provided to attached buildings) comes from heat recovery between connected buildings, waste heat, or renewable energy resources and no more than 25% of the annual heat input to the system comes from fossil fuel or electric-resistance sources.
- or
- 2.2 No more than 10% of the system annual heat input to the system comes from fossil fuel or electric-resistance sources.

C406.2 More efficient HVAC equipment and fan performance. No less than 90 percent of the total HVAC capacity serving the total *conditioned floor area* of the entire building, or tenant space in accordance with Section C406.1.1, shall comply with Sections C406.2.1 through C406.2.3. For systems required to comply with Section C403.1.1, HVAC total system performance ratio, exceed the minimum requirement by 10 percent.

Exception: In low energy spaces complying with Section C402.1.1 and semi-heated spaces complying with Section C402.1.1.2, no less than 90 percent of the installed heating capacity is provided by electric infrared or gas-fired radiant heating equipment for localized heating applications. Stand-alone supply, return and exhaust fans shall comply with Section C406.2.3.

Exception: Conditioned areas which are served by a low-carbon district heating and cooling or heating only system.

C406.2.1 HVAC system selection. Equipment installed shall be types that are listed in Tables C403.3.2(1) through C403.3.2(12) or a combination thereof. Electric resistance heating does not meet this requirement.

Exception: Allowed equipment not listed in Tables C403.3.2(1) through C403.3.2(12):

1. Air-to-water heat pumps.
2. Heat recovery chillers.

C406.2.2 Minimum equipment efficiency. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.3.2(1) through C403.3.2(12) by 15 percent, in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all requirements by 15 percent.

Exceptions:

1. Equipment that is larger than the maximum through C403.3.2(12) shall utilize the va associated equipment type shown in the exception with the minimum equipment efficiency requirement.
2. Equipment complying with the exception with the minimum equipment efficiency requirement.
3. Compliance may be demonstrated by calculating a total weighted average percentage for all heating and cooling equipment combined. All equipment shall have efficiency that is no less than 5 percent better than the minimum required efficiency in Tables C403.3.2(1) through C403.3.2(12), and the resulting weighted average percentage for all equipment performance requirements shall exceed 15 percent. Calculation shall include heating and cooling capacities for all equipment, percentage better or worse than minimum required efficiency per Tables C403.3.2(1) through C403.3.2(12) for each performance requirement (SEER, EER/IEER, COP, HSPF, E_t , E_c and AFUE), and the total weighted average efficiency percentage.
4. Hot water boilers with input capacity greater than 2,500,000 Btu/h shall be considered to comply with this section with a minimum thermal efficiency of 95 percent E_t per the test procedure in 10 CFR Part 431.

Add the following match language of Proposal 122B:
Documentation for the low-carbon district system that is operational prior to the final inspection shall be provided to demonstrate that the definition of low-carbon district heating and cooling or heating only system is satisfied.

C406.8 Reduced energy use in service water heating. Buildings with service hot water heating equipment that serves the whole building, building addition or tenant space shall comply with Sections C406.8.1 and C406.8.2.

C406.8.1 Building type. Not less than 90 percent of the *conditioned floor area* of the whole building, building addition or tenant space shall be of the following types:

1. Group R-1: Boarding houses, hotels or motels.
2. Group I-2: Hospitals, psychiatric hospitals and nursing homes.
3. Group A-2: Restaurants and banquet halls or buildings containing food preparation areas.
4. Group F: Laundries.
5. Group R-2.
6. Group A-3: Health clubs and spas.
7. Buildings with a service hot water load of 10 percent or more of total building energy loads, as shown with an energy analysis as described in Section C407 or as shown through alternate service hot water load calculations showing a minimum service water energy use of 15 k/Btu per square foot per year, as approved by the building official.

C406.8.2 Load fraction. Not less than 60 percent of the annual service hot water heating energy use, or not less than 100 percent of the annual service hot water heating energy use in buildings with water-cooled systems subject to the requirements of Section C403.9.5 or qualifying for one of its exceptions, shall be provided by one or more of the following:

1. Service hot water system delivering heating requirements using heat pump technology with a minimum COP of 3.0. For air-source equipment, the COP rating will be reported at the design leaving heat pump water temperature with an entering air temperature of 60°F (15.6°C) or lower. For water-source equipment, the COP rating will be reported at the design leaving load water temperature with an entering water temperature of 74°F (23.3°C) or lower.
2. Waste heat recovery from service hot water, heat recovery chillers, building equipment, process equipment, or other approved system. Qualifying heat recovery must be above and beyond heat recovery required by other sections of this code.

- 3. On site renewable energy water-heating systems.
- 4. Low-carbon district heating and cooling or heating only systems.

C406.9 High performance service water heating in multifamily buildings. For a whole building, building addition, or tenant space with not less than 90 percent of the conditioned floor area being Group R-2 occupancy, not less than 90 percent of the annual building service hot water energy use shall be provided by a heat pump system with a minimum COP of 3.0 or from a low-carbon district heating and cooling or heating only system. This efficiency package is allowed be taken in addition to Section C406.8.2.

Purpose of code change:

District energy systems which utilize low-carbon fuel sources (which meet or are better than what would have been built on-site) should be encouraged as a method for achieving the state’s targeted carbon emission reductions. Proposed language adds more options for projects that utilize a low-carbon fuel source to meet the high input rated service compliance in section C406.

Definition section could be tweaked in future code cycles to allow for district energy to meet the high input rated service renewable or fossil fuel sources.

Note that C404.2.1 and C404.2.2 already have exceptions to allow for district energy to meet the high input rated service hot water requirements, but if those exceptions are amended, low-carbon district heating systems should be added back in as exceptions.

Note that this proposal includes excludes CHW-only district energy systems, as they do not offer the same opportunities to reduce net carbon emissions (heat rejection on-site with cooling towers utilizes significant amounts of water but not energy).

Your amendment must meet one of the following criteria. Select at least one:

- Addresses a critical life/safety need.
- The amendment clarifies the intent or application of the code.
- Addresses a specific state policy or statute. (Note that energy conservation is a state policy)
- Consistency with state or federal regulations.
- Addresses a unique character of the state.
- Corrects errors and omissions.

Check the building types that would be impacted by your code change:

- Single family/duplex/townhome
- Multi-family 4 + stories
- Institutional
- Multi-family 1 – 3 stories
- Commercial / Retail
- Industrial

Your name Clarence Clipper Email address clarence.clipper@centrioenergy.com
 Your organization Centrio Phone number 206-648-2026

Other contact name [Click here to enter text.](#)

Instructions: Send this form as an email attachment, along with any other documentation available, to: sbcc@des.wa.gov. For further information, call the State Building Code Council at 360-407-9278.

Add the following match language of Proposal 122B: Documentation for the low-carbon district system that is operational prior to the final inspection shall be provided to demonstrate that the definition of low-carbon district heating and cooling or heating only system is satisfied.

Economic Impact Data Sheet

Briefly summarize your proposal's primary economic impacts and benefits to building owners, tenants and businesses.

The biggest economic benefit of this proposal is that it introduces more options for projects to comply with energy code and invest in systems that provide long-term lower carbon operation. The ability to connect to a low carbon district HW/CHW system might be particularly attractive to existing buildings undergoing significant mechanical system replacement that likely do not have the mechanical space or structural capabilities required to retrofit with air-to-water-heat-pumping or heat recovery equipment. As more heat-pumping requirements are introduced to code, retrofits and existing buildings will have a hard are harder time complying with code unless more options are available.

Project capital cost savings can be significant for projects that only have to provide heat-exchangers instead of on-site heating and cooling equipment, and yet still source their heating and cooling from low carbon sources. This also frees up mechanical space that would otherwise have to be dedicated to heating and cooling equipment.

Provide your best estimate of the construction cost (or cost savings) of your code change proposal? (See OFM Life Cycle Cost [Analysis tool](#) and [Instructions](#); use these [Inputs](#). **Webinars on the tool can be found [Here](#) and [Here](#)**)

\$2.00-5.00/square foot ROM Capital Cost Savings (For residential projects, also provide \$ / dwelling unit)

Show calculations here, and list sources for costs/savings, or attach backup data pages

A project receiving HW and CHW from a district energy system only requires heat exchangers and pumps on-site vs. a stand alone plant that requires boilers and/or heat pumps for heat addition, cooling towers or fluid coolers for heat rejection and chillers or heat pumps for cooling and heat recovery.

Provide your best estimate of the annual energy savings (or additional energy use) for your code change proposal?

See energy discussion below - Highly dependent upon connected building loads) KWH/ square foot (or) KBTU/ square foot

(For residential projects, also provide KWH/KBTU / dwelling unit)

Show calculations here, and list sources for energy savings estimates, or attach backup data pages

Energy modeling of projects that have both office and residential towers on immediately adjacent sites (and thus can implement direct energy exchange between the cooling dominated offices and heating dominated residences), shows that there is a significant increase in heat recovery potential when the projects can exchange energy compared to any heat recovery available within each individual project. For example, a stand-alone residential tower might be able to meet ~10-15% of its gross annual heating load (space heating, DHW, pool etc) from on-site recovered heat (cooling). However, when connected to an equivalent sized office tower, with year-round heat-rejection needs, 40-60% of the gross heating load can be met by heat-recovery equipment.

District HW/CHW plants with diverse heating and cooling loads can introduce heat recovery potential to a much wider range of projects than would ever consider incorporating energy recovery on a one-off-site basis, as many simply don't have enough complimentary heating and cooling loads to even bother.

The exact energy savings that can be expected vary significantly based on the balance of loads on a given district energy system, and there may be times when heat must be added by district equipment to maintain a minimum loop temperature. That is why this proposal introduces language to define a "low carbon district heating and cooling or heating only system" with minimum % of heat that must come from heat-recovery and maximum % of heat that can come from fossil fuels or electric resistance (values that can be modified by the TAG or in future code cycles). This would

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

ensure that the energy code is only encouraging the most efficient district HW/CHW schemes while still allowing projects to gain the design flexibility introduced by connecting to such systems. The minimal allowance for fossil fuel or electric resistance inputs gives some flexibility for these large-scale systems to ramp up to full operation (year-one load balance might be significantly different than the established system operation).

List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

Allowing a straight forward path for prescriptive compliance (and achieving adequate C406 credits) for a project connecting to a low carbon district heating and cooling or heating only system should allow for LESS review time for an individual project, though the district system provider will have to work with code officials to initially establish that their system meets the low carbon designation, thus opening the door for projects to connect and take advantage of the proposed code language.

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.