Technical Appendix P: Model Conservation Standards and Conservation Program Details

Contents

Introduction

The Northwest Power Act directs the Council to adopt and include in its power plan a conservation program that includes model conservation standards (MCS).[1] The MCS are applicable to (i) new and existing structures; (ii) utility, customer, and governmental conservation programs; and (iii) other consumer actions for achieving conservation. The Act requires that the standards reflect geographic and climatic differences within the region and other appropriate considerations. The Act also requires that the Council design the MCS to produce all power savings that are cost-effective for the region and economically feasible for consumers, taking into account financial assistance from the Bonneville Power Administration and the region's utilities. In addition to the requirements set forth in

[1] Northwest Power Act, Section 4(f)(1).

the Act, the Council believes the MCS in the plan should produce reliable savings and that the standards should, where possible, maintain and improve upon the occupant amenity levels (e.g., indoor air quality, comfort, window areas, architectural styles) found in typical buildings constructed before the first standards were adopted in 1983.

The Power Act provides for broad application of the MCS. In the earlier plans, a strong emphasis was needed to improve residential and commercial building construction practices beyond the existing codes. Beginning with the first standards adopted in 1983, the Council has adopted a total of eight model conservation standards. These include the standard for new electrically heated residential buildings, the standard for utility residential conservation programs, the standard for all new commercial buildings, the standard for utility commercial conservation programs, the standard for conversions to electric heating systems, the standard for conservation programs not covered explicitly by the other model conservation standards, and consistency in the application of federal and state appliance standards. Since the Council adopted its first MCS, all four states within the Northwest have adopted strong energy codes that largely incorporate the standards.

Model Conservation Standards

The MCS for the Ninth Power Plan has two distinct components. The first is that the Council adopts a region-wide standard for data centers based on the power usage effectiveness metric. This data center MCS references, and relies heavily on, ASHRAE 90.4-2022, *Energy Standards for Data Centers*. The second MCS for the Ninth Plan is for “retro-commissioning” of heat pumps. Retro-commissioning is essentially tuning up a heat pump to optimize its performance and reduce overall energy and demand.

Model Conservation Standard for Data Centers

The MCS for Data Centers in the Pacific Northwest for facilities over 300 kW is for Power Usage Effectiveness (PUE) to be at or below 1.20. These same data centers should also evaluate Peak Power Usage Effectiveness (PPUE). A PPUE value of 1.60 is recommended but not required. All new data centers shall report energy and water usage metrics (PUE, PPUE, and Water Usage Effectiveness, or WUE) to their local utility. Note that this MCS is not intended to apply to smaller facilities (e.g., data rooms in hospitals).

Background and Metrics

Data centers are a new large load coming to the region and this standard is aimed at ensuring that new data centers are being built efficiently. The most common metric for measuring data center electric efficiency is the Power Usage Effectiveness (PUE) metric. PUE represents the total data center electricity use divided by the total IT equipment electricity use:

$$PUE = \text{Total DC Energy Use}/\text{IT Equipment Energy Use}$$

A PUE of 1.0 means all data center energy is from the IT /server equipment and anything over that comes from other electricity uses such as air conditioning. Current modern data centers reach PUEs of 1.2.

Another metric that can be helpful for measuring the peak demand impacts of data centers is the Peak Power Usage Effectiveness (PPUE), which is the total peak demand in a single hour divided by the total IT peak load.

PPUE = Total peak load (single hour)/IT Peak Load

A third common metric used for data centers is Water Usage Effectiveness (WUE):

WUE = gallons of water consumed per kWh of electricity

The average is 0.5 gallons per kWh, but the amount depends heavily on the type of cooling system used: evaporative cooling will use significantly more water, but less electricity while vapor compression systems use no water but significantly more electricity.

The Council performed modeling of data centers[2] with a variety of cooling systems and in a variety of climate zones around the region. The objective was to evaluate the impacts of different mechanical system options for data center cooling. The results showed that overall, PUE values do not vary significantly by climate zone withing the region. Peak PUE values do vary more depending on the climate zone and cooling system type.

Data Center Model Conservation Standard

The MCS for data centers require all data centers over 300kW meet the following requirements:

All data centers to report to the utility:

- Energy consumption (electricity, natural gas, other)
- Water consumption
- PUE
- PPUE
- WUE

All new data centers are required to meet a **PUE of 1.20 or less.**

This requirement is three percent better than the 1.24 PUE specified by the ASHRAE 90.4 standard. ASHRAE 90.4 is fundamentally a voluntary performance standard and does not mandate the systems

[2] NWPCC Data Center Study: Climate Zones and Water Cooled Systems, PAE, May 22, 2026

or design approach used to meet the efficiency goal. However, Washington and Oregon have adopted ASHRAE 90.4 as the minimum performance for data centers in their states.

The reduction is based on reducing the mechanical loss component (MLC) from 0.14 to 0.10 in the relevant local climate zones, which is an achievable outcome for larger facilities. This effectively leaves electrical loss component (ELC) savings un-addressed.

Data Center Stretch Goals

In addition, local jurisdictions *may consider* stretch goals and targets as indicated below:

- New data centers over 300 kW could meet the following PUE values:
  - Air-cooled chillers shall meet PUE ≤ 1.17
  - Water cooled chillers shall meet PUE ≤ 1.14
  - Evaporatively cooled data centers shall meet PUE ≤ 1.10
- New data centers over 300 kW could meet the following PPUE values:
  - Air Cooled Chillers PPUE = 1.52
  - Water Cooled Chillers PPUE = 1.25
  - Evaporative cooling PPUE = 1.15
- All data centers shall evaluate and report WUE
- The cost of water consumption shall be included in the cost-effectiveness calculation

Model Conservation Standard for Heat Pump Retro-Commissioning

Background

According to the Air Conditioning Contractors of America (ACCA), a quality heat pump installation is characterized by four key areas:

- **Proper Design**: including load calculations and equipment selection
- **Proper Installation:** including static pressure, refrigerant charge, and controls
- **Proper (Air) Distribution:** including duct leakage and air balancing
- **Proper System Documentation and Owner Education**

Recent studies of heat pumps in the Northwest suggest that not all heat pumps are installed using these best practices, which often results in systems that do not operate as efficiently as they could. For example, there is evidence that load calculations are often not performed to properly size a heat pump. In this case, it is possible for the heat pump to be “undersized”, resulting in an overreliance on less efficient auxiliary heating sources. Systems can also be “oversized”, which can lead to other issues, such as short-cycling (a rapid on/off of the system that degrades overall performance).

Even if load calculations are performed and systems are sized correctly, there are other control settings and system checks that are critical to proper heat pump performance. For example, most heat pumps have control settings to “lock out”, or effectively disable, both the heat pump’s compressor and the auxiliary heating system under certain conditions. If these are not properly set, it is possible for a heat pump to not achieve its full efficiency potential.

Heat pumps that are not properly sized, commissioned, and controlled can lead to systems that put more demand on the electric grid, and cost more to consumers, than necessary.

Model Conservation Standard for Residential Ducted Heat Pump Retro-Commissioning

All heat pumps installed in the region should be properly commissioned, as well as properly sized and controlled, as outlined above. This MCS applies specifically to the retro-commissioning of existing residential ducted heat pumps already installed in the region, because this measure was found to be broadly cost-effective across the whole region. However, that does not diminish the fact that all heat pumps, including new installations in existing homes and new construction, should be properly commissioned, sized, and controlled for optimal efficiency.

The MCS requires that conservation program operators in the region, including Northwest utilities and Bonneville, offer programs to retroactively commission (“retro-commission”) existing residential ducted heat pumps that may benefit from doing so. Such programs could be offered broadly, without specific targeting of homes that could particularly benefit from retro-commissioning, or more preferably, through targeted mechanisms, such as:

- identifying likely candidates via high monthly energy usage and/or high hourly demand; or
- identifying likely candidates via existing home audit conservation programs.

Such targeting activities could help maximize overall program cost effectiveness and minimize the number of heat pumps that would not benefit as much from retro-commissioning.

The target age for heat pumps going through this MCS program is approximately two to five years old. Those heat pumps are both old enough that they likely would not have received a recent retro-commissioning, but also new enough that they are expected to be in operation for another ten years or more.

The core strategy of the heat pump retro-commissioning MCS is to ensure that the heat pump is prioritizing its compressor as much as possible for space heating, and similarly de-prioritizing its auxiliary, or backup, electric resistance system as much as possible. Certain control settings can significantly increase the use of the backup system, thereby increasing energy use, demand, and occupant utility bills. Such control settings include:

- compressor lockout: typically, an outdoor temperature setting at which the heat pump's compressor is turned off. This should typically be set to as low a temperature as allowed, or completely disabled, allowing the compressor to run as much as possible.
- auxiliary lockout: typically an outdoor temperature setting at which the heat pump's auxiliary system is turned off, although can often be overridden by other control settings. This should typically be set near the heat pump's "balance point," or the outdoor temperature at which the heat pump can serve the home's entire heating load.
- emergency heat: a setting that typically disables the compressor completely and runs on the auxiliary system exclusively. This should never be used unless the compressor and/or other major heat pump components have failed.
- thermostat droop: a temperature differential setting that determines when the auxiliary system is engaged. Should be set to where occupant is comfortable, but auxiliary system is not engaged unnecessarily.
- thermostat night setback: turning down the thermostat temperature significantly at night and reverting to a higher temperature during the day. Can lead to significant overuse of the auxiliary heating system. If home occupant(s) desire night setbacks, some thermostats with intelligent setback recovery features may be used to mitigate setback effects.

In order to optimize these settings, it is important to understand important characteristics about the home's heating load and duct system. A table of specific recommended actions is provided in Table P - 1 below to serve as a general guide for what a MCS-compliant program should include. Importantly, an MCS-compliant retro-commissioning program would require more actions than the typical "heat pump tune-ups" already offered in much of the HVAC market; rather, a compliant program would include actions such as:

- accurate estimate of home heating load, to understand heat pump balance point and properly set auxiliary lockout
- testing of system airflow and total external static pressure, to ensure minimum requirements
- checking of thermostat and other system control settings
- checking of sufficient refrigerant charge and refrigerant line leaks and condition
- other activities as outlined in the table below

Table P - 1: A general guide for recommended actions in a MCS-compliant heat pump retro-commissioning program.

Equipment	Item	Recommended Action
Thermostat	Compressor Lockout	- Disable or set to as low of a temperature as allowed
	Auxiliary Lockout	- Set to 35°F as default. May be set lower depending on technician-verified heat pump balance point.
	Night Setback	- Verify need for night setback with home occupant. It setback is desired, enable intelligent setback recovery mode, if available.
	Emergency Heat Mode	- Verify system is not operating in emergency heat or similar auxiliary-only mode. Educate home occupant on implications of this setting.
	Supply Fan Setting	- Check to see if fan is set to On or Auto. Set to Auto, unless occupant desires constant fan.
	Thermostat Compatibility	- Check to see if thermostat is compatible with heat pump system.
Outdoor Unit	Coil Condition	- Check to see if coils are clean or dirty. Clean if needed.
	Refrigerant Leaks	- Check coil and flare connections (if present) for leaks using ultrasonic leak detector.
	Refrigerant Line Set	- Check to see if insulation is in good condition. If not, replace.
	Clearances/Airflow	- Ensure outdoor unit has proper clearances from snow and for airflow. For example, if side discharge, make sure unit is not blowing into a fence or wall.
Indoor Unit (Air Handler) and Ducts	Airflow	- Check airflow using TrueFlow plate or equivalent. Is airflow between 325 and 400 CFM per ton?
	Filter Condition	- Check condition. If dirty, clean or replace.
	Filter Size	- Check filter and filter grille size. Filter area should be at least 2 feet for each 400 CFM of airflow.
	Total External Static Pressure (TESP)	- Check TESP to make sure it is less than 0.8 in. water column (WC), and ideally near 0.3 to 0.6 in. WC. If greater than 1 in. WC, look for possible causes (e.g., plenum is too small).
	Refrigerant Leaks	- Check coil for leaks using an ultrasonic leak detector.
	Coil Condition	- Check coil for dust buildup, and clean if needed.
	Air Leaks	- Check for air leaks near the air handling unit, such as the cabinet seams or plenum connections.
	Condensate Drain Pans	- Was condensate pan and trap installed correctly? Does it need cleaning? Is there a secondary drain pan in the attic? If so, is there a leak sensor?
	Supply Registers	- Are supply registers unobstructed and providing conditioned air?

Other Conservation Program Details

Additional Guidance for Heat Pump Ready Homes

The Conservation Program in Chapter 5 includes a recommendation for conservation programs in the region to promote the concept of making homes "heat pump ready." While there are a number of actions that can technically fall under the umbrella of making homes more heat pump ready, this specific recommendation is focused on weatherizing, air sealing, and improving the duct systems of homes before they receive a heat pump, as this is a highly effective way of ensuring that heat pumps operate as efficiently as possible.

How much weatherization, air sealing, and duct improvements are enough before a heat pump installation? While there is not a single correct answer to this question, the Council, informed by its advisory committees, believes some general guidance on this topic could be useful for conservation program operators in the region pursuing heat pump readiness. Table P - 2 below provides general guidance on minimum and preferred weatherization, air sealing, and duct characteristic levels for installing a heat pump in an existing home in the region. Note that this guidance is intended primarily for homes built before energy codes (e.g., pre-1980), as these homes are the most likely to not meet the specifications in the table below.

Table P - 2: Recommended minimum and preferred efficiency levels for a heat pump ready home.

Element	Item	Recommended Minimum/Preferred Efficiency Level
Building Shell	Wall Insulation	Filled wall cavity (~R11 for 2x4 walls, ~R19 for 2x6 walls) or R10 continuous
	Attic/Roof Insulation	Attics: R38 cavity minimum, R49-60 preferred Sloped Ceiling/Roof: R19 cavity or R15 continuous
	Floor/Foundation Insulation	Insulated floor: R19 cavity minimum, R25 preferred Insulated foundation walls: R10 continuous minimum, R15 continuous preferred
	Windows	U-0.5 (double-pane) minimum, U-0.3 (double-pane) preferred
	Air Leakage	9 ACH50[3] maximum, 6 ACH50 preferred
Duct System	Duct Insulation	Rigid duct (unconditioned space): R6 minimum, R8 preferred Flex duct (unconditioned space): R4 minimum, R6 preferred
	Duct Leakage	15% leakage to outside maximum; 10% or less preferred
	Duct Airflow	325 CFM per ton minimum, 400 CFM per ton preferred (or manufacturer specification)
	Duct Total External Static Pressure (TESP)	0.8 in. water column (WC) maximum; 0.3 to 0.5 in. WC preferred (or manufacturer specification)

[3] Air Changes per Hour, at 50 Pascals.

Surcharge Recommendation

The Power Act authorizes the Council to recommend a surcharge and the Bonneville Administrator may thereafter impose such a surcharge on customers that have not implemented conservation measures that achieve energy savings comparable to those which would be obtained under the MCS in the plan. The Council does not recommend a surcharge to the Administrator under Section 4(f) (2) of the Act at this time.

The Council intends to continue to track regional progress toward the Plan's MCS and will review its decision on the recommendation should accomplishment of these goals appear to be in jeopardy. Should utilities fail to enact these standards, then Bonneville may need the ability to recover the cost of securing those savings. In this instance the Council may wish to recommend that the Administrator be granted the authority to place a surcharge on that customer's rates to recover those costs.

Surcharge Methodology

Section 4(f)(2) of the Northwest Power Act directs the Council to include a surcharge methodology in the power plan. The surcharge must, per the Act, be no less than 10 percent and no more than 50 percent of the Administrator's applicable rates for a customer's load or portion of load. The surcharge is to be applied to Bonneville customers for those portions of their regional loads that are within states or political subdivisions that have not, or on customers who have not, implemented conservation measures that achieve savings of electricity comparable to those that would be obtained under the model conservation standards.

The purpose of the surcharge is twofold: 1) to recover costs imposed on the region's electric system by failure to adopt the model conservation standards or achieve equivalent electricity savings; and 2) to provide a strong incentive to utilities and state and local jurisdictions to adopt and enforce the standards or comparable alternatives. The surcharge mechanism in the Act was intended to ensure that Bonneville's utility customers were not shielded from paying the full marginal cost of meeting load growth.

As stated above, the Council does not recommend that the Administrator invoke the surcharge provisions of the Act at this time. However, the Act requires that the Council's plan set forth a methodology for surcharge calculation for Bonneville's administrator to follow.

Should the Council alter its current recommendation to authorize the Bonneville administrator to impose surcharges, the method for calculation is set out below.

Identification of Customers Subject to Surcharge

The administrator should identify those customers, states or political subdivisions that have failed to comply with the model conservation standards set forth within this chapter.

Calculation of Surcharge

The annual surcharge for non-complying customers or customers in non-complying jurisdictions is to be calculated by the Bonneville administrator as follows:

1. If the customer is purchasing firm power from Bonneville under a power sales contract and is not exchanging under a residential purchase and sales agreement, the surcharge is 10 percent of the cost to the customer of all firm power purchased from Bonneville under the power sales contract for that portion of the customer's load in jurisdictions not implementing the model conservation standards or comparable programs.
2. If the customer is not purchasing firm power from Bonneville under a power sales contract, but is exchanging (or is deemed to be exchanging) under a residential purchase and sales agreement, the surcharge is 10 percent of the cost to the customer of the power purchased (or deemed to be purchased) from Bonneville in the exchange for that portion of the customer's load in jurisdictions not implementing the model conservation standards or comparable programs.

If the customer is purchasing firm power from Bonneville under a power sales contract and also is exchanging (or is deemed to be exchanging) under a residential purchase and sales agreement, the surcharge is: a) 10 percent of the cost to the customer of firm power purchased under the power sales contract; plus b) 10 percent of the cost to the customer of power purchased from Bonneville in the exchange (or deemed to be purchased) multiplied by the fraction of the utility's exchange load originally served by the utility's own resources.

Evaluation of Alternatives and Electricity Savings

A method of determining the estimated electrical energy savings of an alternative conservation plan should be developed in consultation with the Council and included in Bonneville's policy to implement the surcharge.