

# NEW ENERGY CODE REQUIREMENT: HVAC TOTAL SYSTEM PERFORMANCE RATIO



On November 1, 2020, the HVAC Total System Performance Ratio (TSPR) goes into effect in the 2018 Washington State Energy Code (WSEC). This code update will save energy by requiring building designers to use more efficient HVAC systems evaluated on whole-system performance.

## THE VALUE OF TSPR

The new TSPR requirement levels the playing field for efficient technologies and promotes more efficient design approaches in the process. TSPR will:

- Result in more efficient HVAC systems
- Avoid complex energy modeling
- Reduce operating costs once the building is finished and occupied

By accounting for full-system HVAC efficiency, TSPR represents an important improvement on the prior WSEC, which disincentivized energy-efficient HVAC system types and designs by treating high- and low-performing HVAC systems equally. Instead of evaluating the HVAC system performance holistically, prior code only looked at the efficiency of equipment within the same category and separately evaluated each individual equipment type within the HVAC system.

## HOW TSPR IS CALCULATED

TSPR is a performance-based compliance path for HVAC systems. It is defined as the ratio of the sum of a building's annual heating and cooling load compared to the sum of the annual carbon emissions from energy consumption of the building's HVAC systems.

$$\text{TSPR} = \frac{\text{Annual HVAC Loads}}{\text{Annual HVAC Carbon Emissions}^1}$$

To comply with the WSEC, the proposed system TSPR must be greater than or equal to the baseline system TSPR and meet all other prescriptive code requirements.

The new code documentation includes an approach for engineers to calculate the performance ratio using simplified hourly building energy simulation by inputting the characteristics of the building and its mechanical systems into a software tool, developed by Pacific Northwest National Laboratory, as a module within the U.S. Department of Energy's Asset Scoring Tool.

» *To access the tool, visit:*  
**[buildingenergyscore.energy.gov](http://buildingenergyscore.energy.gov)**

<sup>1</sup>Carbon emissions factors are provided by the Washington State Department of Commerce.

### LEARN MORE

For more tools and resources on TSPR, including a Quick Start Guide and technical Help Desk, see the *Total System Performance Ratio* section at: **[buildingenergyscore.energy.gov/resources](http://buildingenergyscore.energy.gov/resources)**.



## BUILDING & HVAC REQUIREMENTS AND EXEMPTIONS

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### Requirements

TSPR is required for most libraries, office, educational, and retail occupancies. HVAC systems supported by the TSPR Tool (as referenced in WSEC C403.1.1) include:

1. Packaged Terminal Air Conditioner (PTAC)
2. Packaged Terminal Air Heat Pump (PTHP)
3. Packaged Single Zone Gas Furnace (PSZGF)
4. Packaged Single Zone Heat Pump, air to air only (PSZHP)
5. Variable Refrigerant Flow—air cooled only (VRF)
6. Four Pipe Fan Coil (FPFC)
7. Water Source Heat Pump (WSHP)
8. Ground Source Heat Pump (GSHP)
9. Packaged Variable Air Volume, dx cooling (PVAV)
10. Variable Air Volume, hydronic cooling (VAV)
11. Variable Air Volume with Fan Powered Terminal Units (VAVFPTU)
12. Dedicated Outdoor Air System, in conjunction with systems 1-8

### Exceptions

Buildings and HVAC systems exempt from TSPR include:

1. Buildings with conditioned floor area less than 5,000 sq. ft.
2. HVAC systems using district heating water, chilled water or steam
3. HVAC systems not included in WSEC 2018 Table D601.11.1
4. HVAC systems with chilled water supplied by absorption chillers, heat recovery chillers, water to water heat pumps, air to water heat pumps, or a combination of air and water cooled chillers on the same chilled water loop
5. HVAC systems served by heating water plants that include air to water or water to water heat pumps
6. Underfloor air distribution HVAC systems
7. Space conditioning systems that do not include mechanical cooling
8. Alterations to existing buildings that do not substantially replace the entire HVAC system
9. HVAC systems meeting all the requirements of the standard reference design HVAC system in Table D602.11, *Standard Design HVAC Systems*



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