

HVAC System Performance for Energy Codes

Building Energy Code Technical Brief

INTRODUCTION

The HVAC System Performance approach provides a methodology for evaluating overall heating, ventilation, and air conditioning (HVAC) system efficiency as opposed to component-level or whole-building-level evaluations traditionally done using the prescriptive or whole building performance approach. The Total Systems Performance Ratio (TSPR) metric is defined as a ratio of the annual heating and cooling loads of a building to the annual HVAC energy consumption for all components of all the systems in the building. The HVAC energy consumption can be represented as energy cost, site energy, source energy, or carbon emissions to better align with the policy and goals of the jurisdiction. A higher TSPR indicates a more efficient HVAC system. This approach can be adopted as an alternative to prescriptive requirements or as a minimum efficiency requirement that needs to be met in addition to the minimum prescriptive requirements.

Setting a base or advanced requirement prevents having a system with every least-efficient option being included in the building. Instead, a system must match the overall efficiency of a “reasonably good” target system that uses the federal minimum for equipment efficiency.

States and local governments have expressed interest to the U.S. Department of Energy in having energy code overlay requirements that support policy goals. This technical brief provides code language for TSPR analysis. An online software tool is also provided.

IMPACTS

- Improving the energy efficiency of commercial buildings directly benefits the planet and building owners by cutting down on both greenhouse gas emissions and energy bills.
- The base package of TSPR provides HVAC savings from 20% to 58% compared with a low-efficiency prescriptive system choice.
- An advanced option provides an additional 12.5% HVAC savings.
- Potential national U.S. annual savings for the base adoption:
 - 495 to 2,480 billion site BTUs
 - \$13.5 to \$66.3 million savings on energy bill
- Potential **added** national U.S. annual savings for the advanced adoption:
 - 450 to 2,240 billion site BTUs
 - \$12 to \$60 million savings on energy bill
- Annual savings shown will accrue year after year over each building’s life.

BACKGROUND

The U.S. Department of Energy (DOE) and Pacific Northwest National Laboratory have developed a

series of technical briefs supporting national, state, and local initiatives to update and advance building energy codes. Each brief is presented in a module-based format, centered on technologies, measures, or practices that can be incorporated as “plug-ins” to building energy codes. These are made available for adoption directly by state and local governments pursuing advanced energy savings and GHG emission reductions, or for future consideration as part of the national model energy codes, such as the International Energy Conservation Code or ASHRAE Standard 90.1. The collection of briefs supports DOE’s mission to provide technical assistance supporting states and local governments, helping them to successfully implement their building codes, as well as pursue energy and climate goals.

LEARN MORE

Find the full technical brief, including supporting technical information and sample code language, at https://www.energycodes.gov/sites/default/files/2021-07/TechBrief_HSP_July2021.pdf.

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