

**Final cost-benefit analysis
WAC 51-11R & WAC 51-11C
2015 Washington State Energy Code**

Prepared by the Washington State Building Code Council
December 31, 2015

I. Introduction

The State Building Code Council (Council) was established in 1974 by Revised Code of Washington (RCW) 19.27.070. It is a state agency created by the legislature to provide independent analysis and objective advice to the legislature and the Governor's Office on state building code issues. The Council establishes the minimum building, mechanical, fire, plumbing and energy code requirements necessary to promote the health, safety and welfare of the people of the state of Washington, by reviewing, developing and adopting the state building code.

The Council includes 15 voting members appointed by the Governor, four legislative ex-officio members appointed by each caucus, and an ex-officio member from the Department of Labor and Industries electrical section. The Council appoints over 100 volunteers to technical advisory groups to review the codes. All rules adopted by the Council must receive a majority vote of the voting members and must sit through a legislative session prior to enactment and are subject to change by the legislature.

Member	Entity Represented	Term Expires
Dave Kokot Council Chair Fire Code TAG Chair	Local government fire services official	1/5/16
Steve Simpson Council Vice Chair Plumbing Code TAG Chair	Construction building trades	1/5/17
The Hon. Mark Kulaas Legislative Committee Chair	City elected legislative body member, east side	1/5/16
Eric Vander Mey MVE Codes Comm. Chair Mechanical Code TAG Chair	Mechanical engineering profession	1/5/17
David Peden BFP Codes Comm. Chair Building Code TAG Chair	Structural engineering profession	1/5/16
James Tinner Residential Code TAG Chair	Local government building code enforcement official	1/5/18
Duane Jonlin Energy Code TAG Chair	Architectural design professional	1/5/17
Dean Roderick Bault	Representing community of persons with disabilities	1/5/17
Leanne Guier	City elected legislative body member or mayor, west side	1/5/18
David DeWitte	Mfrs, installers or suppliers of building materials or components	1/5/16
Paul Duffau	General public	1/5/16

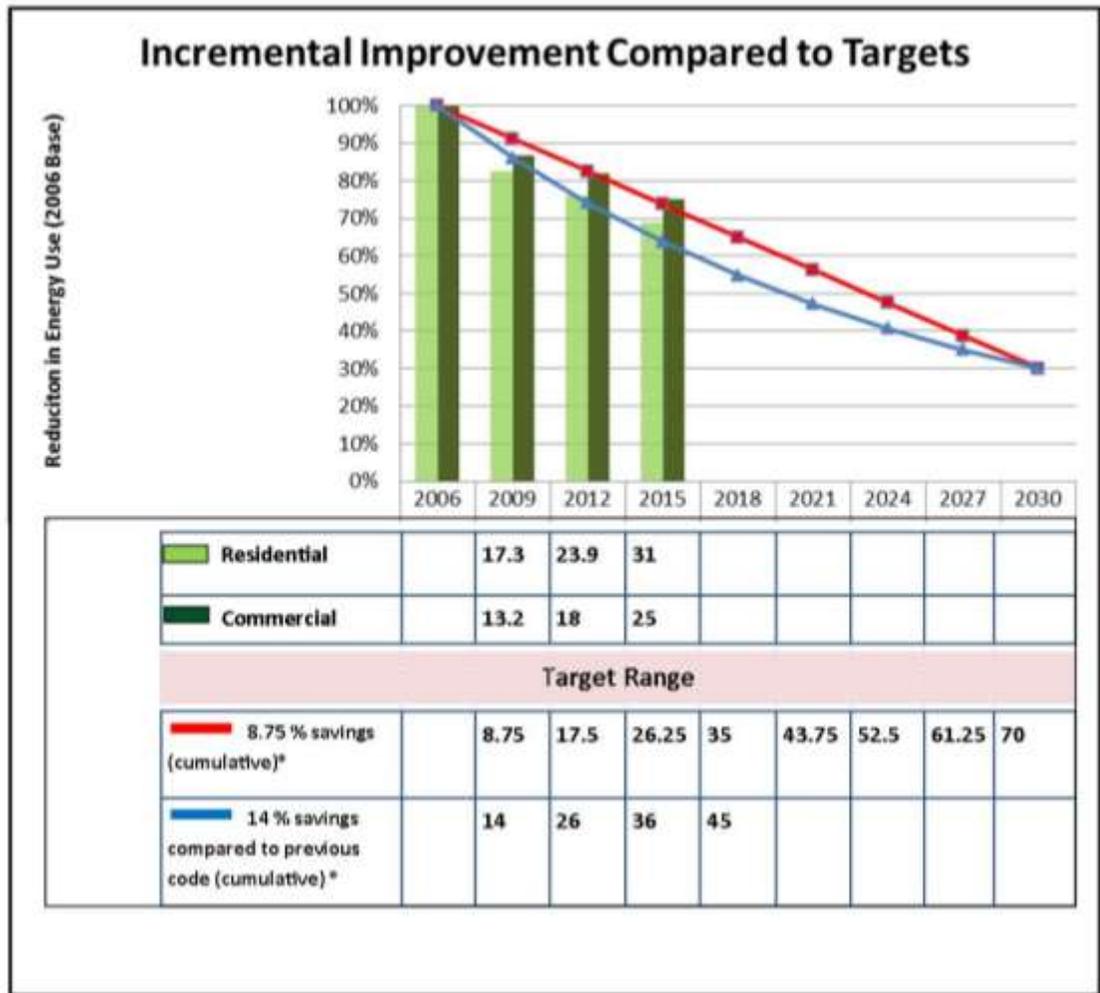
Member	Entity Represented	Term Expires
The Hon. Al French	County elected legislative body member or elected executive, east side	1/5/17
Diane Glenn	General construction, residential and multifamily housing	1/5/18
The Hon. Sandra Romero	County elected legislative body member or elected executive, west side	1/5/18
Doug Orth	General construction, commercial and industrial building construction	1/5/18
Stephen Thornton	Ex Officio Member Dept. of Labor & Industries	N/A
The Hon. Tana Senn	Ex Officio Legislative	N/A
The Hon. Vincent Buys	Ex Officio Legislative	N/A
The Hon. Jan Angel	Ex Officio Legislative	N/A
The Hon. Marko Liias	Ex Officio Legislative	N/A

II. Washington State Energy Code Goals

In 1990 the state legislature established the Washington state energy code (WSEC) in RCW19.27A. "The legislature finds that using energy efficiently in housing is one of the lowest cost ways to meet consumer demand for energy; that using energy efficiently helps protect citizens of the state from negative impacts due to changes in energy supply and cost; that using energy efficiently will help mitigate negative environmental impacts of energy use and resource development; and that using energy efficiently will help stretch our present energy resources into the future. The legislature further finds that the electricity surplus in the Northwest is dwindling as the population increases and the economy expands, and that the region will eventually need new sources of electricity generation. It is declared policy of the state of Washington that energy be used efficiently. It is the intent of this act to establish residential building standards that bring about the common use of energy efficient building methods, and to assure that such methods remain economically feasible and affordable to purchasers of newly constructed housing." [1990 c 2 ss1]

The law directs the Council to review the Washington state energy code every three years. Amendments adopted by the council must increase the energy efficiency of newly constructed buildings. In accordance with legislation passed in 2009, the WSEC must achieve a reduction in annual net energy consumption in buildings. By 2030, the WSEC must achieve a reduction of seventy percent compared to the 2006 WSEC. RCW19.27A.160. The law directs the Council to adopt state energy codes from 2013 through 2031 that incrementally move towards achieving the seventy percent reduction in annual net energy consumption. In each three year adoption cycle, the Council must adopt a code requiring increasingly energy efficient homes and buildings. The law allows the Council to defer implementation of energy code updates where the Council determines that economic, technological or process factors would significantly impede adoption or compliance.

In the 2012 Report to the Legislature, the Council established incremental improvement targets shown in the chart below.



Savings are estimates based on data and life cycle cost analysis presented to the Council by proponents of new amendments. The energy savings estimates in this report are estimates only -- not the result of an overall analytical comparison.

Historically the utilities have used the current code to model conservation savings. A more precise estimate of energy savings achieved by the 2015 WSEC may be available in 2016

[Link to 2015 report to the legislature](https://fortress.wa.gov/ga/apps/sbcc/File.ashx?cid=2498) (https://fortress.wa.gov/ga/apps/sbcc/File.ashx?cid=2498)

[Link to Energy code goals document](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5570) (https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5570)

The rule is needed to achieve the general goals and specific objectives of the statute. The legislature created the Washington state energy code and directed the Council to adopt rules. The WSEC has three compliance paths, and a menu of choices to achieve additional energy efficiency. The Council reviewed and considered alternate standards and voluntary programs, and determined that to achieve the legislative mandate requires a mandatory code.

III. Costs and Benefits of the Final Rule

WAC 51-11R and WAC 51-11C

General Benefits

The results of reduced energy use in buildings include avoiding the need for new power generation, reducing environmental impact, and providing local employment. The legislative findings state that energy efficiency is the cheapest, quickest, and cleanest way to meet rising energy needs, confront climate change, and boost our economy.

Since 1980, efficiency has met over half of the new demand for electric power in buildings and saves Washington state residents, businesses and public institutions \$2 billion annually. The green building sector is outpacing overall construction growth and will generate 2.3 million jobs nationwide this year.

The Council adopted a method to evaluate energy code proposals to assure the measures are cost effective to the building owner and tenants as required by law. The benefits of energy efficiency in new buildings must outweigh the initial investment needed to meet the code. New code proposals must have a positive net present value when calculated in accordance with the Life Cycle Cost Tool (LCCT) as developed by the Washington State Office of Financial Management (OFM). The methodology of the LCCT is based on the NIST Handbook 135 methodology and utilizes specific inputs as determined by the Council with guidance from the Washington State Department of Commerce.

General Costs

The Council accepts proposals to amend the WSEC to meet the legislative goals. The statewide code amendment proposal process is defined in WAC 51-04 and the Council by-laws. Proposals must increase the energy efficiency in buildings. Each proponent must identify where a proposed amendment has an economic impact and must quantify costs. The Council developed a specific set of forms for the Washington state energy code, so proponents could identify where a proposed amendment was editorial, technical or a policy change.

The Council received 154 proposals to improve the Washington state energy code. The energy code technical advisory group (TAG) recommended approval of 116 amendments as submitted or as modified. Of those, the TAG identified 21 as editorial corrections, and 87 as technical corrections. The remaining 8 proposed amendments were identified by the TAG as having a significant cost.

The proposed rule for WAC 51-11R residential contains 16 state amendments. The proposed rule for WAC 51-11C contains 100 state amendments. The final rule modified proposed amendments as noted below.

The 2015 International Energy Conservation Code (IECC) is the baseline code from which the state amendments create the Washington state energy code. The Pacific Northwest National Laboratory (PNNL) prepared an analysis of national cost-effectiveness of the 2015 IECC for the federal Department of Energy. The PNNL studies found the amendments in the 2015 IECC to be cost effective with a simple payback over the 2012 IECC of 1.6 years in Washington state's climate zone 5.

[Link to National Cost-effectiveness of the Residential Provisions of the 2015 IECC, PNNL](https://www.energycodes.gov/national-cost-effectiveness-residential-provisions-2015-iecc)
(<https://www.energycodes.gov/national-cost-effectiveness-residential-provisions-2015-iecc>)

[Link to Energy & Energy Cost Savings Analysis of the 2015 IECC for Commercial Buildings, PNNL](https://www.energycodes.gov/energy-and-energy-cost-savings-analysis-2015-iecc-commercial-buildings)
(<https://www.energycodes.gov/energy-and-energy-cost-savings-analysis-2015-iecc-commercial-buildings>)

IV. Probable costs and benefits of significant amendments

The Washington State Energy Code TAG identified the following proposed state amendments with potential significant cost:

Proposal Number	Section/Subject	<i>Economic Workgroup Comments</i>	<i>Final Rule</i>
15-E009	R403.7.1 Ductless mini-split heat pumps	Look at costs outside of the Tacoma area. Note that there is a side benefit of cooling being provided without additional cost.	adopted
15-E012 (Mod 2)	R406.2 Additional Requirements	Look at analysis of Option 2 point requirements, small house requirement in particular.	modified
15-E029&E036	Table C402.1.1 Appendix A Mass Walls	Requesting more information on the analysis done by the minority report proponents.	Not adopted
15-E070	C403.2.6.1 Dedicated Outdoor Air Systems	Look at a model for east of the Cascades	modified
15-E098	C405.14 Controlled Receptacles		adopted
15-E114	C405.4.2 Lighting Power Allowance		adopted
15-E121	C406 Additional Requirements	Looking for more cost benefit data from the proponents, example analyses	modified

15-E009

WAC 51-11R Section R403.7.1

A new Section R403.7.1 was added that requires all IRC buildings heated using electric resistance zonal heating to use a ductless mini-split heat pump in the largest zone, unless the total installed heating in the dwelling is less than 2 kW.

[Link to New Construction DHP Case Study Report June 2015](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5533)
(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5533)

[Link to Energy Code Minority Report](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5574)
(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5574)

On a split decision the Council voted to adopt based on the positive cost benefit.

15-E012

WAC 51-11R Section R406.2 Additional energy efficiency requirements

Section R406 was expanded to include all low-rise residential dwelling and sleeping units, not just IRC buildings. Two options are presented regarding the increased number of points required. The table changes are the same in both options. The first option shows an across the board increase of 2 credits per dwelling unit, reflecting the increase in efficiency needed to stay on track to meeting the goals of RCW 19.27A.160. Option 2 presents a minority report which presents a proportional increase across the three sizes of dwelling units, designed to mitigate the costs of the across the board increase.

[Link to Life Cycle Cost Analysis](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5181)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5181)

[Link to Secondary Analysis](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5580)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5580)

[Link to BIAW minority report](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5534)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5534)

Final Rule: The Council modified requirements for additional points, reducing the impact on small and medium sized detached single family residences.

15-E029 & E036

WAC 51-11C Table C402.1.1 Opaque Thermal Envelope Assembly Requirements

Two options are presented for the Mass wall category. Option 1 (15-E029) uses the value from the 2015 IECC (and 2012 IECC) and deletes the footnote allowing uninsulated walls for some building types. Option 2 (015-E036) also deletes the footnote, but increases the R-value to that of the 2012 Seattle Energy Code.

[Link to CMU Evaluation Report from Mike Kennedy](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5575)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5575)

[Link to Analysis of Next Generation Nonresidential Energy Codes Kennedy, Mike](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5576)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5576)

[Link to Minority Report-Mass walls](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5515)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5515)

[Link to Report on Alternate Approach to Masonry Walls 1](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5577)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5577)

[Link to Report on Alternate Approach to Masonry Walls 2](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5578)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5578)

Final Rule: The Council did not adopt this proposed rule. The code remains as published in 2012, no added cost , no added energy savings.

15-E070

WAC 51-11C Section C403.2.6.1 Dedicated Outdoor Air Systems

New Section C403.2.6.1 mandates dedicated outdoor air systems (DOAS) in certain occupancy types (office, retail, education, libraries and fire stations) to separate the ventilation system and heating/cooling system to reduce fan energy use. Section C403.2.6.1.1 allows the code official to waive this requirement if it is shown to be impractical. Section C403.2.6.1.2 sets fan control requirements for DOAS systems.

[Link to Installation Costs Memo](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5061)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5061)

[Link to Energy Savings Memo](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5062)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5062)

[Link to Additional Information Requested of Proponent](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5573)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5573)

[Link to Minority Report E070 DOAS](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5559)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5559)

Final Rule: The Council modified the rule to provide a method to use an alternate system and delayed implementation until 2017.

15-E098

WAC 51-11C Section C405.10 Controlled Receptacles

A new requirement was added in Section **C405.10** for 50 percent of receptacles to be controlled by time switches or occupancy sensors, allowing power to be cut to non-essential electronics when not needed. This is a current requirement in both the Seattle Energy Code and ASHRAE 90.1.

[Link to Plug load profiles and Energy Savings](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5572)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5572)

Final Rule: The Council adopted this amendment as submitted.

15-E114

WAC 51-11C Section C405.4.2 Lighting Power Allowance

Both the Building Area Method and Space by Space Method were decreased by 20 percent over those proposed in the Integrated Draft. The values in the Integrated Draft reflected the more stringent value of either the 2015 International Energy Conservation Code or the 2012 Washington State Energy Code.

[Link to Lighting Life Cycle Cost Analysis](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5579)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5579)

Final Rule: The Council adopted this amendment as submitted.

15-E121

WAC 51-11C Section C406 Additional Requirements

The 2015 IECC revised the requirements for additional efficiency options, adding more options and simplifying the others provided. The Council determined this would be an efficient, tested method of gaining energy efficiency and incorporated it into the WSEC. All buildings are now required to achieve two credits from the available options. Based on the earlier change to the lighting power allowance, the lighting power option reduced the values from C405.2 by 15 percent.

[Link to Original IECC Proposal Reason Statement](https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5581)

(https://fortress.wa.gov/ga/apps/SBCC/File.ashx?cid=5581)

Final Rule: The Council adopted this amendment as submitted.

V. Alternatives Considered

The Council considered alternatives to the proposed rule. During the 2012 through 2015 code adoption cycle, the Council received 154 proposals to amend the Washington state energy code. Among the

proposals were alternatives to compliance such as locally sponsored incentive programs. The Council found that maintaining a minimum prescriptive code with performance alternatives provides flexibility for local certification programs. The Council considered an “outcome” based code to allow maximum design choice to meet a preset goal. The Council determined that this alternative would place too great a burden on both the design and enforcement community at this time. Based on the review process of the proposals received, the Council has determined the proposed rule is the least burdensome version of the rule, for those who are required to comply, given the goals and objectives of the law for the Council to increase the energy efficiency of buildings.