2018

WASHINGTON STATE ENERGY CODE
Progress toward 2030

Progress toward Reducing Energy Consumption in Buildings
Required by RCW 19.27A.160 (ESSSB 5854, Chapter 423, Laws of 2009)

2018 Report to the Legislature
September 1, 2020

Diane Glenn, Council Chair

Kjell Anderson, Energy Code Technical Advisory Group Chair and Mechanical, Ventilation and Energy Codes Committee Chair

DRAFT 03
8/20/2020

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Executive Summary:

On-Track Incremental improvement in the 2015 Washington State Energy Code

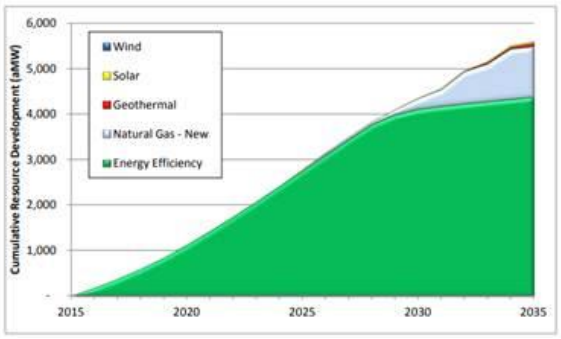
The Washington State Building Code Council (Council) submits this report to the Legislature as required by RCW 19.27A.160. The report addresses progress toward a 70 percent reduction in net annual energy consumption in newly constructed residential and nonresidential buildings by 2031, compared to the 2006 Washington State Energy Code (WSEC),

Building energy efficiency is the single largest factor in the region's future electric needs.

"The Northwest Power Act defines cost-effective energy efficiency as the resource of first choice when considering new resources." From 2021 Regional Power Plan https://www.nwcouncil.org/regional-power-planning-pacific-northwest

~~Also from: https://www.nwcouncil.org/sites/default/files/7thplanfinal_allchapters_1.pdf~~

Figure 1 - 1: Seventh Plan Resource Portfolio[1]



The 2018 WSECs are an incremental improvement over the 2015 codes. The 2018 WSECs are predicted to achieve between ** and ** percent cumulative energy savings for all new buildings compared to the 2006 WSEC and an estimated incremental savings between ** and ** percent for residential and between ** and ** percent for commercial from the 2015 codes.

A major impediment to the acceptance of the ever-increasing building energy consumption reduction is training for the designers, contractors and those responsible for compliance. A major impediment to training is funding. Adequate funding, or at least increased funding, will have immediate results in reducing building energy consumption. RCW 19.27A-150 (3)(c) calls for the Department of Commerce to Address the need for enhanced code training and enforcement.

Commented [BR(1]: Include Figure 1 (with new footnotes) from the 8/14/2020 Ecotope Modeling the Washington State Energy Code – 2006 & 2018 Baseline Energy Consumption Draft final Report.

Significant Measures

Significant measures for the Commercial Energy Code adopted by the Council that save energy compared to the 2015 WSEC:

Commented [BR(2)]: Include Table 14 (incorporating the information in Table 11) from the 8/14/2020 Ecotope Modeling the Washington State Energy Code – 2006 & 2018 Baseline Energy Consumption Draft final Report.

Section~~/Subject~~	Description of Significant Change~~Energy Saving/Year~~
C402.4.1.4	Section from 2015 WSEC removed that allowed buildings with DOAS high-performance mechanical systems were allowed to have a maximum 40% WWR (instead of 30% WWR) with the fenestration u-factors for 30% WWR.
C402.4.1.2	Building air barrier test must be passed. Design target for air barrier construction is lowered to 0.25 cfm/sf of building envelope but building must pass test at slightly higher criteria of 0.40 cfm/sf.
C403.1.1	HVAC Total System Performance Ration (HVAC TSPR) is a new section of code required for building prescriptively complying with the energy code. Required for office, retail, library and education occupancies and buildings. This is a simple energy model that must be performed to establish a higher efficiency mechanical system for these building types.
C403.3.5	Dedicated outdoor air system (DOAS) section revised to be required by space occupancy type. Additionally, A-1 and A-3 occupancies are added to be required to include DOAS.
C403.3.6	Residential apartments (Group R-2) dwelling and sleeping are required to have balanced ventilation system with minimum 60% effective heat recovery system.
C403.5 Exception 1	Exception 1 revised to clarify cooling systems associated with DOAS that are installed outdoors or in mechanical rooms are not exempt from airside economizer.
C406	Efficiency Package options section of the code was completely revised to require six credits. Credits are now tracked by the occupancy of the space of the building with different weighting of the 12 credits by occupancy type. Low energy and enclosed unconditioned areas of the building are only required to achieve three credits. Many of the credits revised to be more stringent or new higher efficiency credits were added.
C407	Total Building Performance Energy Modeling section of the code was modified to a new energy modeling protocol based on ASHRAE 90.1-2016 Appendix G. This was modified to be based on source carbon emissions savings instead of site energy savings for the proposed building in comparison to the baseline building. Code baseline building is now a more static baseline that is based on an ASHRAE 90.1-2004 building that is roughly equivalent to a 2006 WSEC building. Each code cycle till 2030 will compare to this baseline with a greater percentage of source carbon emissions savings at each code cycle.
Table C407.2	Mandatory requirements for C407 Total Building Performance Energy Modeling compliance sections is summarized in a single table. This includes

	the R-2 dwelling and sleeping unit HRV requirement making that mandatory. Not compliance with C406 is not required for C407 compliance buildings.
C407.3 Item #2	The reduction in annual carbon emissions of the proposed building design associated with onsite renewable energy cannot exceed 3% of the total carbon emissions of the baseline building design.
Table C407.3(1)	Carbon emissions factors were established for each fuel source with much debate over where to set the Electricity Carbon Emission factor.
C407.3.1	The proposed total building envelope UA shall be no more that 20 percent higher than the Allowed Total UA of a prescriptive building.
	NEW HEADER for other changes
C103.6.1	Clarification of requirements for record documents to include building envelope insulation and air barrier as well as final location and model number of mechanical, plumbing and electrical equipment installed.
C303.1.5	Addition of default thermal performance u-factors of Spandrel Panels and Glass Curtain Walls
C402.1.1	Reorganization and clarification of building envelope requirements for low energy buildings, semi-heated spaces, and greenhouses.
C402.1.2.1	New section added for standalone elevator hoistway envelope requirements for elevator hoistways that are not connected to a conditioned envelope.
Table C402.1.3	New R-value category added for mass trans deck slab edge. New footnotes and R-factors added for non-continuous insulation.
Equations 4-2 & 4-3	Proposed vs Allowable UA and SHGCxA calculation equations clarified.
C402.1.2.1.2	Thermal bridging for HVAC equipment supports and insulation under HVAC equipment requirements are added.
Table C402.4	Building envelope fenestration maximum U-factor categories revised to match model code new categories for curtainwall and site built in one category and all other vertical fenestration in a second category.
C402.4.1.1.1	Optimized daylighting section that allows 40% WWR made more stringent.
C402.4.1.1.2	High performance fenestration section revised to be more stringent.
~~**C402.4.1.4**~~	~~Section from 2015 WSEC removed that allowed buildings with DOAS high-performance mechanical systems were allowed to have a maximum 40% WWR (instead of 30% WWR) with the fenestration u-factors for 30% WWR.~~
~~**C402.4.1.2**~~	~~Building air barrier test must be passed. Design target for air barrier construction is lowered to 0.25 cfm/sf of building envelope but building must pass test at slightly higher criteria of 0.40 cfm/sf.~~
C402.5.7	Building vestibule requirements and exceptions clarified.
C403	Mechanical section of the code was completely reorganized by ICC for the 2018 IECC. Washington State reorganized all section numbering to correspond with 2018 IECC. C403.1: General C403.2: System Design C403.3: Equipment selection C403.4: HVAC system controls C403.5: Economizers C403.6 Requirements for mechanical systems serving multiple zones

Commented [BR(3]: Verify with Kjell and Diane if the lower level changes below should be included.

	C403.7: Ventilation and exhaust systems C403.8: Fan and fan controls C403.9: Heat rejection and heat recovery equipment C403.10: Construction of HVAC system elements C403.11: Mechanical systems located outside the building thermal envelope C403.12: High efficiency single-zone variable air volume (VAV) systems C403.13: Commissioning
~~**C403.1.1**~~	~~HVAC Total System Performance Ration (HVAC TSPR) is a new section of code required for building prescriptively complying with the energy code. Required for office, retail, library and education occupancies and buildings. This is a simple energy model that must be performed to establish a higher efficiency mechanical system for these building types.~~
C403.1.3	New section added to require data centers to comply with specific section of ASHRAE 90.4.
C403.2.2.2	New section added for exhaust systems limited to 150% of the Mechanical Code minimum exhaust flow rates.
C403.3.2.1	Clarification for how to report efficiency performance for air-to-water heat pumps added to the code.
Tables for Mechanical Equipment Efficiencies	Efficiency tables updated per ASHRAE 90.1-2016 efficiency requirements to match federal standards. New tables added from ASHRAE 90.1-2016.
~~**C403.3.5**~~	~~Dedicated outdoor air system (DOAS) section revised to be required by space occupancy type. Additionally, A-1 and A-3 occupancies are added to be required to include DOAS.~~
C403.3.5.1	DOAS energy recovery efficiencies increased to 60% sensible effectiveness or 50% enthalpy effectiveness minimum requirements. Fan power requirements clarified for DOAS ERV systems.
C403.3.5.2 & C403.3.5.3	DOAS code language revised per 2015 WSEC opinions to improve enforceability of 2018 WSEC.
~~**C403.3.6**~~	~~Residential apartments (Group R-2) dwelling and sleeping are required to have balanced ventilation system with minimum 60% effective heat recovery system.~~
C403.4.1.4	Outdoor air temperature interlock for entry vestibules that shut off heat when greater than 45 °F outside.
C403.4.1.6	Exterior doors switches (other than vestibules) that setback space heating and cooling control temperatures when doors are open.
C403.3.2.3, C403.4.2.4, and C403.4.2.5	New sections added for HVAC, exhaust, and transfer fan controls to automatically start/stop and disable systems during off-hours.
C403.4.7.1	New section added to require controls at combustion decorative vented appliances, fireplaces, and fire pits.
C403.5	Section revised to clarify air economizers are only required at new cooling systems.
~~**C403.5 Exception 1**~~	~~Exception 1 revised to clarify cooling systems associated with DOAS that are installed outdoors or in mechanical rooms are not exempt from airside~~

	~~economizer.~~
C403.5 Exception 7	Exception 7 added that air economizer is not required for units serving spaces with lights and equipment exceeding 5 watts/sf that have chilled water plants with condenser heat recovery.
C403.5 Exception 9	Exception 9 added to clarify that only DOAS ERV systems that do not have mechanical cooling are exempt from air economizers.
C403.5 Exception 10	Exception 10 added to clarify that only DOAS units not required to have energy recovery configured to modulate to provide only the minimum outdoor air are not required to have air economizers.
C403.6.10	High efficiency VAV system requirements clarified.
C403.7.3	Added section that doesn't allow ventilation air to multiple zones to be heated above 60 °F when the majority of the zones require cooling.
C403.7.6	Air economizer requirements clarified for energy recovery ventilation systems that require units with mechanical cooling to have energy recovery media bypass dampers or return air capability.
C403.7.6 Exception 10	Exception 10 limited to Group R-1 and R-3 dwelling and sleeping unit occupancies only.
C403.7.7.1	Kitchen exhaust system section reworked and clarified to be enforceable and more stringent.
C403.10	Ductwork insulation requirements clarified for all HVAC systems including ERV systems.
C403.12	High efficiency single-zone VAV systems section added for A-1, A-2, and A-3 occupancies specified in Table C403.3.5 may be used in lieu of DOAS ERV systems per Exception 2 of C403.3.5.
Table C404.2	Service water heating equipment efficiencies and equipment types updated per ASHRAE 90.1-2016.
C404.2.1 and C404.2.2	High input rated service water heating systems revised and split out Group R-1/R-2 from other that Group R-1/R-2 occupancies.
C404.7.1	Service hot water recirculating system requirements clarified, and new controls sections are added.
C404.9	New exception added to allow centralized metering for retirement homes and dormitories in lieu of metering of domestic hot water by dwelling unit.
C404.13	Added new section for control of service water pressure-booster systems based on language form ASHRAE 90.1-2016.
C405.1 & C405.1.1	Reorganization of requirements for the lighting and lighting controls for various types of residential dwelling units occupancies and residential sleeping unit occupancies.
C405.2	Lighting controls revisions including requirements for Luminaire level lighting controls, occupancy sensors controls, time switch controls, etc.
C405.2.4	New and revised daylighting lighting controls and definitions for sidelit zones and toplit zones.
C405.2.5	Revisions to the additional lighting controls section for display and other lighting.
C405.4	Revisions to the interior lighting power densities for both the building area method and the space-by-space method.
C405.7	New exception for dwelling unit metering allowed for retirement home and

	student housing buildings added to the code.
C405.11	New section added to limit voltage drop across the combination of feeders and branch circuits to not exceed 5%.
~~**C406**~~	~~Efficiency Package options section of the code was completely revised to require six credits. Credits are now tracked by the occupancy of the space of the building with different weighting of the 12 credits by occupancy type. Low energy and enclosed unconditioned areas of the building are only required to achieve three credits. Many of the credits revised to be more stringent or new higher efficiency credits were added.~~
~~**C407**~~	~~Total Building Performance Energy Modeling section of the code was modified to a new energy modeling protocol based on ASHRAE 90.1-2016 Appendix G. This was modified to be based on source carbon emissions savings instead of site energy savings for the proposed building in comparison to the baseline building. Code baseline building is now a more static baseline that is based on an ASHRAE 90.1-2004 building that is roughly equivalent to a 2006 WSEC building. Each code cycle till 2030 will compare to this baseline with a greater percentage of source carbon emissions savings at each code cycle.~~
~~Table C407.2~~	~~Mandatory requirements for C407 Total Building Performance Energy Modeling compliance sections is summarized in a single table. This includes the R-2 dwelling and sleeping unit HRV requirement making that mandatory. Not compliance with C406 is not required for C407 compliance buildings.~~
~~C407.3 Item #2~~	~~The reduction in annual carbon emissions of the proposed building design associated with onsite renewable energy cannot exceed 3% of the total carbon emissions of the baseline building design.~~
~~Table C407.3(1)~~	~~Carbon emissions factors were established for each fuel source with much debate over where to set the Electricity Carbon Emission factor.~~
~~C407.3.1~~	~~The proposed total building envelope UA shall be no more that 20 percent higher than the Allowed Total UA of a prescriptive building.~~
C408	Commissioning requirements updated to clarify requirements required to be documented in the construction documents including a narrative description of the activities during the commissioning process.
C408.1.2.1	Commissioning disclosure and conflict management plan required where certified commissioning professional is not directly with the building owner.
Figure C408.1.4.1	Commissioning Compliance Checklist updated.
C408.3	New requirements added for service water heating system commissioning.
C408.4	Controlled receptacle commissioning requirements added to the code.
C409.2.4	Sub-metering is required for site-generated renewable energy systems.
C409.3.4	Electrical vehicle charging energy use is required to be sub-metered as this is transportation energy and not building energy use. So this does not count toward the building operational EUI.
C411	New section added to require solar readiness provisions are required for all non-residential buildings that are 20 stories or less.
C502.1	Clarification added to the code to indicate which sections the additions to existing buildings must comply with. This includes C406 Efficiency Package

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	options section.
C503.2	Clarifications added for changes in space conditioning for alternations to existing buildings.
Table C503.4	Economizer compliance options for mechanical system alterations was updated to increase energy efficiency of existing building mechanical system alterations.
Appendix D	Appendix D added to outline the calculation method for the HVAC Total System Performance Ratio (TSPR).
Appendix E	Appendix E clarified that provisions in this appendix for renewable energy are not mandatory unless specifically referenced in the adopting ordinance by the cities or counties enforcing the code.
Appendix G	Appendix G added to the energy code for an alternate Outcome-Based Energy Budget pathway. This compliance pathway cannot be utilized unless specifically referenced in the adopting ordinance by the cities or counties enforcing the code.

Significant measures for the Residential Energy Code adopted by the Council that save energy compared to the 2015 WSEC:

Commented [BR(4]: Include Figure 2 from the 8/14/2020 Ecotope Modeling the Washington State Energy Code – 2006 & 2018 Baseline Energy Consumption Draft final Report.

Section ~~/Subject~~	Description of Significant Change ~~Energy Saving/Year~~
R402.4.1.2	Testing: Air leakage testing is standardized to a set ceiling height. An exception has been added for testing of some multi-family buildings.
R402.4.2.1	Gas fireplace efficiency: A new requirement for a minimum efficiency standard for fireplaces is added.
R403.1.3	Continuously burning pilot lights: A new general section is added to prohibit continuously burning pilot lights.
R403.3.6/R403.3.6.1	Buried ducts: A new section is added dealing with ducts buried in attic insulation.
R403.3.7	Ducts located in conditioned space: This new section sets requirements for ducts to be considered within conditioned space.
R403.7	Equipment sizing and efficiency rating: Language stating equipment had to meet federal requirements is replaced with a reference to the commercial efficiency tables with said requirements.
R405.3	Performance based compliance: Site energy use has been replaced with carbon emissions as a measuring metric for this compliance method. The emissions thresholds were adjusted to correlate with the requirements of Section R406 for other compliance methods.
R406	Additional energy efficiency requirements: This section has been significantly revised. The number of points has increased for all residences, and an additional equalization factor has been added based on the carbon emissions of the installed heating (New Table R406.2). Table R406.3 (previously R406.2) has been

	reformatted for clarity, moving the footnotes into the body of the table and revising the numbering of the options. The options and credits have been revised to base them on energy savings—each half point is roughly equivalent to 600 kWh. New options have been added for triple pane windows (1.2), a 49% UA reduction (1.6), advanced framing with 0.28 windows (1.7) tighter envelopes with ERV (2.4), various heat pump systems (3.5, 3.6), ducts buried in ceiling insulation (4.1), drain water heat recovery systems (5.1), heat pump water heating systems (5.4, 5.5, 5.6), and high efficiency appliances (7.1). HVAC efficiency requirements were modified based on federal minimums. The option for low flow fixtures has been removed since this is now a base requirement.
R407	Certified: Two passive house standards are now included as compliance options, PHIUS and PHI.

Method

Commented [BR(5]: Kjell will add statement that training is necessary to realize modeled savings

The SBCC conducted a national search for a consultant to evaluate building performance improvements as well as unregulated energy loads affecting buildings over the 2006 to 2018 code time The SBCC consulted with Ecotope.

To model the energy consumption, Ecotope followed the framework developed by the Regional Technical Forum as well as processes used to develop the State's residential energy code. Ecotope also relied on historical studies including building stock assessments, metering studies, and surveys. The consultant used EnergyPlus and Simple Energy Enthalpy Model programs to produce annual energy use estimates from all regulated and unregulated loads. Batch modeling processes were used to complete over 200 residential and 90 commercial modeling runs to simulate each prototype under various combinations of location, HVAC system, and code year.

Estimated Energy Savings

The estimated energy savings reported here were derived from the *Modeling the Washington State Energy Code – 2006 & 2018 Baseline Energy Consumption* report. See Appendix A.

Outlook

The Council continues making steady progress to achieve the goal of 70 percent net annual reduction in building energy consumption by 2031. The Council is mindful that with each code cycle the cost to achieve the additional energy reduction is higher than it was for the previous code.

Background

The WSEC is based on a national model code that is less energy efficient than the WSEC, therefore, the State adoption process requires significant work prior to considering new energy saving amendment proposals. This preliminary process alone requires approximately *** staff and volunteer hours.

Completing the code adoption process involves multiple additional steps of code development including technical advisory group review and revision, the Council's Mechanical Ventilation and Energy Standing Committee review, Council approval of proposed rules, public comments and hearings, and final action.

Transparency throughout the process is crucial requiring extensive staff support.

The public process for code development represents a major time commitment for preparation, meetings and reporting.

The energy code has historically drawn opposition due to differences in political and economic philosophies. Full consideration of these opposing perspectives has resulted in additional staff and volunteer time as well as the need, at times, for legal counsel.

The law mandates continuous improvement to energy efficiency in buildings. However, the law also states that if economic, technological, or process factors impede adoption, the Council may defer adoption, and that all measures standards or requirements must be technically feasible, commercially available and developed to yield the lowest overall cost ~~cost effective~~ to the building owners and ~~tenants~~occupant while meeting the energy reduction goals established under RCW 19.27A.160. Various stakeholders disagree on whether or not the new rules increasing energy efficiency in buildings are cost effective, and those who believe they are not advocate for deferral stating the economic burden and technological unknowns do not justify new regulations.

The Council does not operate in isolation. State law also directs the Department of Commerce to develop and implement a strategic plan for enhancing energy efficiency, which must be used to help direct the future code increases in RCW 19.27A.020, with targets for new buildings consistent with RCW 19.27A.160. While this legislation anticipates that the plan will help inform the WSEC update process, funding that would enable the anticipated level of planning and guidance from Commerce is lacking.

The Council consists of 15 voting members appointed by the Governor, four ex-officio legislators appointed by the Legislature, and the chief electrical inspector. The Council provides 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 updates the state building codes every three years, on schedule with updated editions of the national model codes. There was a one time extension to four years for the 2018 codes to accommodate a revision in the SBCC review process. The Energy Related Building Standards law (RCW 19.27A) directs the Council to update the Washington State Energy Code every three years, synchronized with the code development cycle. In each cycle, the Council must make an incremental step toward the 70 percent reduction by 2030.

Energy Code Development Process

The Council relies on a large number of volunteers to develop energy code amendments, submit proposals, participate in the technical review, and submit testimony for SBCC consideration at final adoption.

- Of *** proposals received, ** were significant energy saving proposals; the remainder were either editorial clarifications or not approved. Of the ** significant proposals, * were not adopted.
- The ** members of the Energy Code Technical Advisory Group each logged between 60 to 80 hours of meeting time and countless additional hours of review time over a **-month period.
- The Council used a form requiring more detailed information about energy savings and cost for each proposal. See Appendix *.

State and Federal Law on Building Energy Codes

The Washington State Legislature and the Governor's Office have directed the state Building Code Council to adopt energy codes. Federal Law also requires the state to meet minimum standards.

Targets set by the Climate Pollution Reduction--Energy Efficiency Act of 2009

The goal to reduce energy savings by 70 percent compared to 2006 by 2030 relates to an initiative of the American Institute of Architects (AIA). The AIA's Architecture 2030 Challenge was adopted in 2009 by the Washington State Legislature. As emphasized in testimony by Washington Environmental Council, Washington is one of nine states to adopt the Architecture 2030 initiative. According to the Architecture 2030 website, only California and Washington have adopted the 2030 challenge as mandatory for all buildings; other states have adopted Architecture 2030 for government buildings or directed that the challenge must be considered during administrative code adoption.

- Energy-Related Building Standards Law (RCW 19.27A)
- The Legislature directed the Council to reduce energy consumption in buildings, as codified in RCW 19.27A.160 **Residential and nonresidential construction — Energy consumption reduction — Council report:**

(1) Except as provided in subsection (2) of this section, residential and nonresidential construction permitted under the 2031 state energy code must achieve a 70 percent reduction in annual net energy consumption, using the adopted 2006 Washington State Energy Code as a baseline.

(2) The Council shall adopt state energy codes from 2013 through 2031 that incrementally move towards achieving the 70 percent reduction in annual net energy consumption as specified in subsection (1) of this section. The Council shall report its progress by December 31, 2012, and every three years thereafter. If the Council determines that economic, technological or process factors would significantly impede adoption of or compliance with this subsection, the Council may defer the implementation of the proposed energy code update and shall report its findings to the

Legislature by December 31st of the year prior to the year in which those codes would otherwise be enacted.

The International Energy Conservation Code (IECC) is the base model energy code adopted by the state of Washington. The IECC defines buildings in terms of "commercial" and "residential."

- Residential buildings are defined as detached one and two family dwellings and multiple single family dwellings (townhouses) as well as apartment buildings three stories and less in height.
- Commercial buildings are defined as all buildings other than residential buildings, and include residential apartment buildings over three stories.

RCW 19.27A.150: Strategic plan—Development and implementation.

- (1) To the extent that funding is appropriated specifically for the purposes of this section, the department of commerce shall develop and implement a strategic plan for enhancing energy efficiency in and reducing greenhouse gas emissions from homes, buildings, districts, and neighborhoods. The strategic plan must be used to help direct the future code increases in RCW 19.27A.020, with targets for new buildings consistent with RCW 19.27A.160. The strategic plan will identify barriers to achieving net zero energy use in homes and buildings and identify how to overcome these barriers in future energy code updates and through complementary policies.
- (2) The department of commerce must complete and release the strategic plan to the legislature and the council by December 31, 2010, and update the plan every three years.

Federal law influencing state code development and adoption

Federal law requires states to periodically certify that the energy code adopted in their jurisdiction meets or exceeds specific national reference standards. [1] This certification is to be submitted to the Secretary of the U.S. Department of Energy (DOE). The most recent rules require each state to report that their adopted commercial building energy code meets or exceeds American Society of Heating, Refrigerating and Air conditioning Engineers (ASHRAE) Standard 90.1-2013.

1-42 U.S.C 6833(b)(2)(B)(i)

Commercial Buildings

On Sept. 26, 2014, DOE issued a determination that Standard 90.1-2013 would achieve greater energy efficiency in buildings subject to the code. DOE estimates national savings in commercial buildings of approximately:

- 8.7% energy cost savings
- 8.5% source energy savings
- 7.6% site energy savings

State Certification

Upon publication of an affirmative determination, States are required to certify that they have reviewed the provisions of their commercial building code regarding energy efficiency, and, as necessary, updated their codes to meet or exceed the updated edition of Standard 90.1. Additionally, DOE provides guidance to States on submitting certification statements and requests for deadline extensions. State certifications for Standard 90.1-2013 must be submitted by September 26, 2016.

Residential Buildings

On June 11, 2015, DOE issued a determination that the 2015 IECC would achieve greater energy efficiency in buildings subject to the code. DOE estimates national savings in residential buildings of approximately:

Commented [BR(6]: Kjell wrote: What is the savings in relationship to? The numbers below are all <1% - are they correct?

- 0.73% energy cost savings
- 0.87% source energy savings
- 0.98% site energy savings

State Certification

Upon publication of an affirmative determination, States are required to certify that they have reviewed the provisions of their residential building code regarding energy efficiency, and made a determination as to whether it is appropriate for them to revise their code to meet or exceed the updated edition of the IECC. Additionally, DOE provides guidance to States on submitting certification statements and requests for deadline extensions. State certifications for the 2015 IECC must be submitted by June 12, 2017

Equipment Efficiency

Federal efficiency standards for building heating and cooling equipment must be applied. For residential and small commercial equipment this is primarily regulated by restricting the manufacture and sale of the equipment. Any minimum efficiency that is referenced in the energy code must be consistent with the minimum federal standards. For commercial energy codes this largely means adopting the minimum equipment efficiency tables listed in the most recent edition of ASHRAE Standard 90.1.

Most Recent Washington Certification

The most recent state certifications were submitted to the Department of Energy July 2013 by the Washington State Department of Commerce, State Energy Office. This certified that the state code in general provided greater energy efficiency than the commercial building reference standard ASHRAE 90.1 – 2010 and the residential standard, the 2012 International Energy

conservation code. There were a few specific measures where Washington did not meet the federal standards.[1]

Washington amendments to the 2018 IECC

2018 Energy Code Development

The Council relies on individuals and interest groups to submit proposals to improve the WSEC and meet the goals set by the Legislature. A complete list of proposals is posted on the Council website. **Full list of code change proposals link.** The amendment proposals include information on proponents, specific code language and data on the cost and benefit where the amendment has an impact.

Number of proposals	Approved as submitted	Approved as modified	Disapproved	Withdrawn
154	**44**	**72**	**18**	**20**

Of 116 proposed amendments integrated into the proposed rule:

- 15 were substantive
- 9 of those had a significant cost and benefit
- The remaining 101 items were editorial clarifications.

Technical Advisory Group (TAG) activities

The Energy Code TAG held 12 meetings in 2018-2019, each work session was typically 5 hours long. The TAG was composed of 21 members, plus several alternates, with 14 – 18 members typically in attendance at any one meeting, depending on the discussion topic. Proponents were invited to make a short presentation of their proposal(s), after which any TAG members can make a motion and a second to approve it. Straightforward code improvements are often approved or modified within a few minutes, while more substantial or controversial proposals were debated for hours and often extensively modified in the process. Some proposals were tabled, and the proponents and opponents asked to return with more information or compromise proposals.

As part of proposing a code change, proponents were required to provide recommended changes to the code text and to complete an updated form (See Appendix D). This form asked the proponent to provide a statement justifying the code change and provide some general information of the cost and benefits associated with the proposal. Proposals were required to show economic information, data estimating costs and benefits. Many of the adopted proposals were extensively modified during the TAG and Council processes, which would have reduced the value of the original cost/benefit analyses.

[1] Washington State Department of Commerce, 2012 Washington State Energy Code compared to National Reference Standards, July 2013. http://www.commerce.wa.gov/Documents/2012-energy-code-comparison.pdf

Goals for Energy Code Development

Making buildings more energy efficient has been identified as a priority by the Legislature and the Washington State Building Code Council (Council). Improved energy efficiency:

- Saves money
- Creates good local jobs
- Enhances energy security
- Reduces pollution that causes global warming
- Speeds economic recovery
- Reduces need to invest in costly new generation

The Washington State Building Code Council (Council) finds that the following provides a guide to the Goals of the Washington State Energy Code (WSEC) per RCW 19.27A for both Residential & Nonresidential Buildings:

1. Per RCW 19.27A.020(2)(a) The Washington state energy code shall be designed to construct increasingly energy efficient homes and buildings that help achieve the broader goal of building zero fossil-fuel greenhouse gas emission homes and buildings by the year 2031.

2. The WSEC must achieve a reduction in annual net energy consumption in buildings

a. By 2030, the code must achieve a reduction of 70 percent compared to the 2006 Washington State Energy Code. This reduction includes both the building site energy that is regulated and typical unregulated energy use (see footnote 1 for definitions). Energy consumption for electric vehicle charging and industrial processes is not included in the building energy use reduction targets. Site renewable energy production is included towards the net annual reduction goals.
b. Each code cycle, the Council must adopt a code requiring increasingly energy efficient homes and buildings
c. The Council must determine and evaluate the costs and benefits of the WSEC

3~~2~~. The Council must adopt more stringent energy codes

a. The Legislature finds that energy efficiency is the cheapest, quickest, and cleanest way to meet rising energy needs, confront climate change, and boost our economy
b. The Legislature promotes super-efficient, low-energy use building codes
c. 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.

~~d. In addition, RCW 19.27A.020 states that the Washington state energy code shall be designed to: "construct increasingly energy efficient homes and buildings that help achieve the broader goal of building zero fossil fuel greenhouse gas emission homes and buildings by the year 2031"~~

43. The Council must evaluate and determine the costs and the benefits

a. The Legislature finds making homes, businesses, and public institutions more energy efficient will save money, create good local jobs, enhance energy security, reduce pollution that causes global warming, and speed economic recovery while reducing the need to invest in costly new generation
b. Any new measures, standards, or requirements adopted by the Council must be technically feasible, commercially available, and ~~cost-effective~~developed to yield the lowest overall cost to the building owners and ~~tenants~~occupants while meeting the energy reduction goals established under RCW 19.27A.160.
c. The Council has adopted a definition of cost-effectiveness based RCW 39.35 recommended by Department of Commerce
d. Executive Order 14-04 from Washington Governor Jay Inslee directs the Council to "achieve early and widespread deployment of energy-neutral buildings prior to the 2031 statutory requirement in RCW 19.27A.160"
e. A guide on how to evaluate cost-effectiveness is therefore defined by the Council as a code change that has a net present savings over a 50-year life-cycle of a building utilizing the Life Cycle Cost Tool (LCCT) as developed by the Washington State Office of Financial Management (OFM). The method 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. (http://www.ofm.wa.gov/budget/facilities/costanalysis.asp). The cost-effectiveness analysis shall use the average useful life years from the Appendix 7 of the BOMA Preventive Maintenance Guidebook for all building components that are evaluated (https://icap.sustainability.illinois.edu/files/projectupdate/2289/Project%20Lifespan%20Estimates.pdf). An alternate method of cost effectiveness analysis or determining average useful life years of building components may be applied.
f. If the council determines that economic, technological, or process factors would significantly impede adoption of or compliance with incremental progress towards the 70 percent reduction in annual net energy consumption, the council may defer the implementation of the proposed energy code update and shall report its findings to the Legislature by December 31st of the year prior to the year in which those codes would otherwise be enacted.

45. The Council has established rules for amendment of the WSEC

a. Residential energy code covers residential buildings including single family homes, townhouses, and multi-family dwelling unit buildings that are 3 stories and less.
b. Commercial energy code covers all non-residential dwelling unit buildings and residential buildings that are 4 stories and more and all residential sleeping unit buildings regardless of the number of stories.

c. The International Energy Conservation Code is the base document for the development of the WSEC. Washington state amendments are integrated into the base document.
d. In considering amendments to the state energy code, the Council established and consulted with a technical advisory group including representatives of appropriate state agencies, local governments, general contractors, building owners and managers, design professionals, utilities, and other interested and affected parties

Footnote 1: ASHRAE 90.1-2016 defines regulated and unregulated energy use as follows:

Regulated energy use: energy used by building systems and components with requirements prescribed in Sections 5 through 10. This includes energy used for HVAC, lighting, service water heating, motors, transformers, vertical transportation, refrigeration equipment, computer-room cooling equipment, and other building systems, components, and processes with requirements prescribed in Sections 5 through 10.

Unregulated energy use: energy used by building systems and components that is not regulated energy use. (See regulated energy use.)

Life Cycle Cost Analysis of Energy Code Measures

Evaluating costs and benefits

In order to evaluate proposals to improve energy efficiency in buildings, the Council adopted the Life Cycle Cost Tool (LCCT-Appendix B) developed by the Washington State Office of Financial Management (OFM). All measures must be ~~cost effective~~technically feasible, commercially available and developed to yield the lowest overall cost to the building owner and occupant while meeting the energy reduction goals established under RCW 19.27A.160, and the Council determined that a net present savings over a 50 year period meets the cost effectiveness criteria.

The Council established an Economic Workgroup to review the proposed amendment and the economic criteria. The workgroup met twice to review the TAG recommendations. The workgroup is composed of Council members. Minutes and meeting documents for the Economic Workgroup are available on the Council website.

Some members of the workgroup expressed concern over the 50 year life cycle. For some of the measures, 50 years exceeds the expected life of the equipment. Future replacements costs and available technology are not known. The Workgroup did adopt the goals stated earlier in Section 3 of this report, with an explanation that the Life Cycle Cost Analysis would factor in equipment replacement costs and use an agreed upon set of parameters for inflation, discounts, and fuel escalation among other costs.

The methodology used to calculate the energy savings achieved through code for a large population of buildings is that used for development of the Northwest Power Plan. This method is most appropriate for documenting the costs and savings for broad application of the energy code. The NPPC model has accurately forecast energy use in the region for several decades.

In some cases, costs for measures based on estimates provided by code amendment proponents varied widely. In those cases, the Council considered a range of costs and values such as years to positive cash flow as well as net present value. Information on the Life cycle cost analysis presented during the 2018 code adoption is available on the Council website.

New Measures Bring Incremental Improvements

An initial estimate of savings under the 2018 WSEC provides some round figures based on initial proposals, TAG review and input, and public testimony.

A comparison between the 2006 code and the 2018 code was performed to provide an accurate representation of savings, and then the actual energy use of new construction should be monitored to validate the estimates. See Appendix *

For residential buildings, defined as one and two family and town houses regulated by the International Residential Code, and apartment buildings three stories and under, the incremental improvements have followed the more aggressive progress and appear to exceed the steady incremental savings target.

Commented [BR(7]: Verify

For commercial buildings, which include all buildings not covered by residential, the progress has followed the steady track and appears to fall just outside the target. The state law directs the Council to "incrementally move toward" the 70 percent reduction in energy use. The improvement targets are based on equivalent savings in each three year cycle through 2030.

Moving toward 2021 and 2031 targets for building energy savings

The code development process involves several stages over the three year cycle, all of which must engage stakeholders and be transparent:

- Preliminary process to examine national model code and align proposed updates with state mandates. The 2021 IECC, on which Washington will base the 2021 WA Energy Code, will soon be published.
- Technical advisory group review and revision
- Council approval of proposed rules
- Public process, including taking public comments and holding hearings
- Final revision and action

Commented [BR(8]: Eric noted that some of the data on IECC energy savings needs to be updated to the 2018 DOE determination data.

The path to achieve the 70% energy use reduction required by 2031 (RCW 19.27A) will involve continuing and accelerating the transformation of the building industry. While training is not the purview of the Council, we understand that this significant transformation requires robust training to be successfully implemented. The energy code has become more complex and incorporates more testing and skill and will continue to do so as we get closer to 2031. This will need to be paired with increasingly robust funding of training for designers, contractors, trades, and other parties to implement the energy codes.

Commented [BR(9]: Poppy Storm will furnish suggested language addressing market and knowledge and supply of equipment..

There are several new considerations that have a relationship with the energy code development:

- 2019 Clean Buildings Law. This requires audits and potential retrofits of new and existing buildings that use more energy than the average building of that type. Deep energy retrofits will fall under the energy code as will new buildings built under the new energy code that do not meet the energy use targets. Rule-making is ongoing and the state building code council should be proactive to ensure that new buildings built to code are likely to meet the energy use targets.

- 2019 Clean Energy Transformation Act. This requires electric utilities to supply Washington customers with carbon neutral electricity by 2030, with limited offsets possible. By 2045, utilities must supply Washington customers with electricity that is 100% renewable or non-emitting, with no provision for offsets. This means that the carbon emissions from Washington buildings that do not combust fossil fuels will reach zero within the reasonable lifetime of buildings built under current and future codes. RCW 19.27A.020 states that the Washington state energy code shall be designed to: "construct increasingly energy efficient homes and buildings that help achieve the broader goal of building zero fossil-fuel greenhouse gas emission homes and buildings by the year 2031." With the electricity sector required to have zero fossil fuel emissions, this means that the code council has a pathway to achieve zero fossil fuel greenhouse gas emissions homes and buildings by pursuing efficient electrification.