Oregon
Kate Brown, Governor

Department of Consumer and Business Services
Building Codes Division
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Construction Industry Energy Board and Residential and Manufactured Structures Board

Combined meeting agenda

Tuesday, June 9, 2020, 9:30 a.m.

Live audio-conference board meeting

Audio streamed via the Internet

I. Board business

A. Both boards are called to order
B. Roll call for the Construction Industry Energy Board
C. Roll call for the Residential and Manufactured Structures Board
D. Approval of agenda and order of business
E. Introduction of division interim Administrator Lori Graham
F. Introduction of new policy analyst for both boards Andrew Boulton
G. Welcome new Residential and Manufactured Structures Board member James Austin
H. 2020 Calendar of board meeting dates

II. Public comment

The division is taking extra precautions for public meetings given concerns regarding the Coronavirus/COVID-19, and is evaluating each meeting on a case by case basis. The public will not be able to give testimony during this audio-conference meeting. Written public comments can be sent to the boards coordinator prior to the meeting date. *(Additional instructions are at the end of the agenda*).

III. Reports

A. Program update for the Construction Industry Energy Board
B. Code adoption update
C. Board discussion on all license renewals extended until Jan. 15, 2021

IV. Communications

Update from Interim Administrator Lori Graham

V. New business - None

VI. Announcements - None

VII. Adjournment

Please read carefully

Temporary instructions for submitting public testimony for board meetings:

- Please submit testimony for consideration by board members no later than 4:00 p.m. the day before the scheduled meeting by email to debra.j.woods@oregon.gov.
- Include your name and the organization you represent (if any).
- List the board and agenda item to which your comments are related.
- Please include all related material.
- Expect an email from the boards coordinator, the chief inspector, or the chair of the board you are directing your question acknowledging that your testimony has been received and will be presented to the board.
- If you do not receive confirmation of your testimony within one business day or by 8:30 a.m. on the date of the board meeting, please resubmit your testimony.

Note: For information regarding re-appointments or board vacancies, please visit the Governor's website.

Agenda Item I.H.

Board meeting dates for 2020

Electrical & Elevator Board

Meets the fourth Thursday of every other month beginning in January:

January 23, 2020
~~March 26, 2020~~ **Postponed until further notice**
May 28, 2020
July 23, 2020
September 24, 2020
November 19, 2020 **Holiday schedule**

Board of Boiler Rules

Meets the first Tuesday quarterly beginning in March:

January 21, 2020 **Emergency board meeting**
~~March 3, 2020~~ **Canceled**
June 2, 2020
September 1, 2020
December 1, 2020

Building Codes Structures Board

Meets the first Wednesday quarterly beginning in February:

~~February 5, 2020~~ **Canceled**
~~May 6, 2020~~ **Conceled**
August 5, 2020
November 4, 2020

Mechanical Board

Meets the first Wednesday quarterly beginning in March:

~~March 4, 2020~~ **Canceled**
June 3, 2020
September 2, 2020
December 2, 2020

State Plumbing Board

Meets the third Thursday of every other month beginning in February:

~~February 20, 2020~~ **Rescheduled to Feb. 27, 2020, at 1:30 p.m.**
April 16, 2020
June 18, 2020
August 20, 2020
October 15, 2020
December 17, 2020

Residential &Manufactured Structures Board

Meets the first Wednesday quarterly beginning in January:

~~January 8, 2020~~ **Holiday schedule, canceled**
~~March 18, 2020~~ **~~Additional meeting~~ Postponed until further notice**
~~April 1, 2020~~ **Postponed until further notice**
June 9, 2020 **Additional meeting combined with CIEB**
July 8, 2020 **Holiday schedule**
Additional meeting between July and October
October 7, 2020

Construction Industry Energy Board

Meets at least twice a year on a Tuesday:

~~February 11, 2020~~ **~~Rescheduled to April 7, 2020~~ Postponed until further notice**
June 9, 2020 **Combined with RMSB**
October 20, 2020

Meetings are held at Building Codes Division in Conference Room A. 1535 Edgewater Street NW Salem Oregon 97309-0404

All board meetings begin at 9:30 a.m. unless otherwise publically noticed. Meetings may be canceled or rescheduled.

The calendar adjustments are to accommodate holidays and code adoptions. All board information is posted at the BCD website

Agenda Item IV.

State of Oregon **Board memo**

Building Codes Division **June 9, 2020**

To: Construction Industry Energy Board
Residential and Manufactured Structures Board

From: Lori Graham, Interim Administrator

Subject: Residential Code Adoption

Since the last Residential and Manufactured Structures Board and Construction Industry Energy Board meetings, several changes have occurred on which the division would like to update you. Given these changes, the purpose of this meeting is to solicit your feedback on moving forward.

Background:
Executive Orders
In October 2019 the division indicated its intention to present the Residential and Manufactured Structures Board and the Construction Industry Energy Board a code proposal package that would achieve equivalent performance to a Zero Energy Ready Home for consideration and adoption effective October 1, 2020. This would achieve compliance with Executive Order (EO) 17-20 three years early. Deadlines for residential construction in EO 17-20 are solar readiness by October 1, 2020, electric vehicle readiness by October 1, 2022, and Zero Energy Ready Homes (equivalent performance) by October 1, 2023.

On March 10, 2020, the Governor issued Executive Order 20-04, with performance based directives intended to build upon the ongoing prescriptive requirements of EO 17-20. EO 20-04 requires the division, through its advisory boards, to:

- Adopt building energy efficiency goals for 2030 for new residential and commercial construction, representing a 60 percent reduction in new building annual site consumption of energy from the adopted 2006 Oregon codes
- Evaluate and report on Oregon's current progress toward achieving the goal for new residential and commercial buildings, and options for achieving that goal over the next three code cycles
- Adopt a reach code on the same three year code cycle timeline

- Report to the Governor in September 2020 and every three years thereafter on current progress and options for achieving the goals

The Governor's office also asked the division to issue a report regarding EO 20-04 by May 15, 2020. That report is included in your board materials.

The division is working with the Oregon Department of Energy to baseline the 2006 codes used as a reference point in the executive order, and will update the boards on that work going forward. The Oregon Department of Energy is convening stakeholders to evaluate that work, and the board and industry are invited to participate in that public process.

The division has also been considering possible approaches to a Reach Code. The Reach Code is created by statute in ORS 455.500. That statute requires that the Reach Code be designed to increase energy efficiency, be "economically and technically feasible," and use "published and generally accepted codes and standards."

Previous editions of the Reach Code were developed with significant upfront expense and staff time. However, since the existing Oregon code system provides flexibility to designers and contractors to build above code, the Reach Code did not see much utilization by industry.

Code Adoption
In October the division indicated its intention to have staff develop a proposal to the board, laying out the division's position as a starting point, and creating a proposal for a Zero Energy Ready Home equivalent. On March 11, 2020, the division distributed a board packet for the planned April 1, 2020, Residential and Manufactured Structures Board meeting, proposing to adopt solar readiness for October 1, 2020, and to adopt the Zero Energy Ready Home program as the Reach Code. The division believed this approach would be consistent with the directive in EO 20-04 to adopt a Reach Code, given that there is no model code more efficient than what the division was proposing to adopt that could become the Reach Code. The division has subsequently received feedback that delaying adoption of the Zero Energy Ready Home until 2023 would not be consistent with the intent of EO 20-04.

Before the board meeting could take place, the impacts of COVID-19 caused the division to postpone the planned board meeting. Based on ongoing impacts, the division will not be able to adopt a full residential code with a printed book by October 1, 2020. The adoption of the residential, plumbing, and electrical codes has been delayed to April 1, 2021. The division does intend to adopt solar ready provisions, with board approval, as an interim amendment effective October 1, 2020, (in order to meet the deadline in EO 17-20) and will bring that proposal to a future meeting.

Because of the delay in code adoption, we have more time to consider the appropriate path forward. The purpose of this board meeting is to solicit feedback from board members about that path. After receiving feedback, the division will develop a formal proposal and timeline for the boards' consideration at a future meeting.

Discussion Questions:

1. Because of the previous ambitious timeline, a code committee was not appointed to consider the residential code provisions. If a code committee were appointed at the July Residential and Manufactured Structures Board meeting, it could meet and provide a recommendation to the board, using the division proposals as a starting point for their work. Given the new timeline, should a code committee be appointed to consider the code and make a recommendation to the board?

2. Does the board have feedback on how to best proceed with a Reach Code that will meet the requirements of EO 20-04 and statute, and be a useful value-added tool to builders and contractors desiring to build above code?

EXECUTIVE ORDER NO. 17-20

ACCELERATING EFFICIENCY IN OREGON'S BUILT ENVIRONMENT TO REDUCE GREENHOUSE GAS EMISSIONS AND ADDRESS CLIMATE CHANGE

WHEREAS, climate change presents a significant threat to our livelihoods, economic security, environment, health, and well-being.

WHEREAS, there has been an increase in extreme weather events, including more frequent and intense heat waves and wildfires. According to the Oregon Climate Change Research Institute and other regional studies, the best available science indicates Oregon is at risk of serious impacts to its natural resources due to climate change.

- Water resources are being affected by decreased winter snowpack, changes to seasonal runoff patterns, decreased precipitation in Eastern Oregon, and increased intensity and occurrence of flooding.
- Agricultural resources are being affected by increases in temperatures.
- Ocean acidification is increasing and there are changes in ocean currents.
- Significant parts of the Oregon coastal region, stretching 363 miles, will be impacted by an expected rise in sea level up to 1 to 4 feet by 2100, incurring billions of dollars of damages and losses to roadways and structures.
- Climate change impacts threaten the State's agricultural, fishing, timber, recreation, and tourism industries, thereby threatening the livelihood of the State's residents and an important source of Gross State Product for the state.

WHEREAS, energy efficiency leads to significant greenhouse gas reductions that are essential to meeting our state greenhouse gas reduction goals and addressing climate change.

WHEREAS, Oregon is committed to meeting the international Paris Agreement targets to reduce greenhouse gas emissions by 26 to 28 percent below 2005 levels by 2025.

WHEREAS, Oregon has adopted goals to reduce greenhouse gas emissions to 10 percent below 1990 levels by 2020 and at least 75 percent below 1990 levels by 2050 as described in ORS 468A.20.

WHEREAS, saving energy by using less energy in buildings is one of the least cost ways to achieve emissions reductions in the energy system – often with a net financial savings over the life of these energy efficiency measures, in particular as energy efficiency technology continues to improve.

WHEREAS, studies have found that building codes in Oregon have had a 97 percent compliance rate; and as building codes become more energy efficient, we will continue to strive toward excellence in construction and building codes, which are applicable statewide and provide uniformity and predictability for building owners and contractors and equity for residents and businesses.

WHEREAS, Oregon is an international leader in energy efficiency, has in-state energy efficiency expertise, and a skilled workforce to continue to be a leader; and Oregon can build on its reputation through emphasis on state leadership, building codes for newly constructed buildings, and retrofits for existing buildings.

WHEREAS, energy efficiency is a critical and growing portion of the State's clean energy economy. Investments in energy efficiency sustain a workforce of over 40,000 jobs statewide; 70 percent of these are small businesses with 11 employees or fewer. Investments in energy efficiency result in an average annual increase of gross state product of over $132 million, and the resulting reduction in energy costs generates an additional $32 million per year.

WHEREAS, low income and other underserved communities often struggle to access energy efficiency programs that will save them money and improve housing quality over the long-term and the State can take steps to implement policies that increase the availability of energy efficiency to these residents.

WHEREAS, state government has a responsibility to lead by example in its adoption of energy efficiency to achieve a more cost-effective and clean energy future.

WHEREAS, energy efficiency actions increase the health, safety, and resiliency of Oregon's buildings and homes, resulting in lower health care costs borne by the State and its residents.

WHEREAS, an energy system with distributed generation, energy efficiency, and storage capacity can build resiliency in the face of climate change related disruptions and other disasters.

NOW, THEREFORE, IT IS HEREBY DIRECTED AND ORDERED:

1. **Definition.** For purposes of this Executive Order, "state agency" shall be defined as any agency within the Executive Department as defined in ORS 174.112, other than the Oregon Secretary of State, Oregon State Treasury, Oregon Department of Justice, and Oregon Bureau of Labor and Industries.

2. **Statement of Policy.** It is the policy of the State of Oregon to establish an aggressive timeline to achieve net zero energy ready buildings as a standard practice in buildings across the state. Review and regular improvements to the energy provisions of the state building code will occur on at least a three-year cycle for residential and commercial buildings. Directives in this Executive Order related to energy efficiency, electric vehicle readiness, and solar installation readiness are essential to meeting this policy, as is a focus on retrofitting older, less-efficient buildings and demonstrating energy efficiency leadership in state-owned and state-leased buildings.

3. **Energy Efficiency Leadership in State Buildings**

   A. High Performance Energy Targets for Existing State Buildings. State agencies will use high performance energy use targets for remodels in all existing state-owned buildings. Department of Administrative Services (DAS) and Oregon Department of Energy (ODOE) are directed to consider ASHRAE 100 Standard pathways and work with all state agencies to adopt targets for any remodels that begin after the date of this executive order. State agencies that are not meeting energy use targets will work with ODOE and DAS to undertake energy retrofits to increase the efficiency of their buildings. ODOE is directed to report on and track all state-owned building energy use to guide agencies to implement tactical and achievable energy use reductions. ODOE will work with all agencies to benchmark and identify buildings for retrofits. A database of all eligible state-owned buildings will be created by June 1, 2018.

B. Carbon-Neutral Operations for New State Buildings. DAS and ODOE are directed to work with state agencies to ensure that new state owned buildings permitted after January 1, 2022 and used primarily for office and other commercial work space are designed to be able to operate as carbon-neutral buildings defined with full fuel-cycle considerations that are inclusive of, but not limited to, off-site renewable energy and other provisions of ASHRAE standard 189.1. In addition, DAS and ODOE are directed to analyze feasible options with the Department of Environmental Quality that would lower the embodied carbon of building materials in new construction of state buildings.

C. Statewide Plug-Load Strategy. DAS and ODOE are directed to develop a statewide plug-load management strategy and strategies for other occupant behavior changes to reduce energy uses not regulated by codes and standards. DAS and ODOE will develop a plug load strategy by January 1, 2019, and DAS will update policies for behavior-based efficiency by January 1, 2020.

D. Energy Efficient Equipment. DAS, with support from ODOE, is directed to ensure that all equipment purchased by the state meets high-efficiency energy and water use specifications by incorporating efficiency standards into procurement requirements. DAS and ODOE will develop procurement requirements in the 2018-19 fiscal year.

E. Lifecycle Cost Analysis. ODOE is directed to analyze state building costs, including lifecycle energy and water use costs or savings, when considering energy and water upgrades for state buildings. By January 1, 2019, ODOE, working with DAS, will develop analysis tools that can inform the high performance energy use targets and carbon neutral requirements for state buildings referenced above.

4. Increasing Energy and Water Efficiency in New Construction Across the State

A. Solar Ready Building Construction. The appropriate advisory board(s) and the Department of Business and Consumer Services Building Codes Division (BCD) are directed to conduct code amendment of the state

building code to require all newly constructed buildings will be ready for the installation of solar panels and related technologies by October 1, 2020 for residential structures and October 1, 2022 for commercial structures. BCD may establish limited specific exemptions to this solar-ready policy for buildings where solar applications are infeasible.

B. Electric Vehicle Ready Building Construction. The appropriate advisory board(s) and BCD are directed to conduct code amendment of the state building code to require that parking structures for all newly constructed residential and commercial buildings are ready to support the installation of at least a level 2 EV charger by October 1, 2022. BCD may establish limited specific exemptions related to types of parking lots, such as temporary parking lots.

C. Zero-Energy Ready Homes. The appropriate advisory board(s) and BCD are directed to conduct code amendment of the state building code to require newly constructed residential buildings to achieve at least equivalent performance levels with the 2017 U.S. Department of Energy Zero Energy Ready Standard by October 1, 2023.

D. Increasing Energy Efficiency in Commercial Construction. The appropriate advisory board(s) and BCD are directed to conduct code amendment of the state building code to require, by October 1, 2022, that newly constructed commercial buildings, averaged across building types, will exceed International Energy Conservation Code and ASHRAE 90.1 by achieving at least equivalent performance levels with the measurable prescriptive energy efficiency portions of the most current version of ASHRAE 189.1 that are construction-related.

E. Helping Key, Expanding Industries to Save Costs by Reducing their Energy Footprint. ODOE, in consultation with BCD, is directed to work with industry stakeholders to identify key high-energy use industries that have the potential to realize significant cost savings and energy savings through building code amendments as it relates to their industrial building types. ODOE and BCD are directed to provide the Governor with a report of its analysis and findings by January 1, 2019.

F. Improved State Standards for Appliances. ODOE is directed to work with appliance industry stakeholders to identify categories of appliances for improved efficiency standards, while considering appliance standards of other states, potential efficiency gains, potential costs, and supply chains for the regional market for appliances. ODOE is directed to provide the Governor with a report of its analysis and identify categories of appliances for improved efficiency by November 1, 2018.

G. High Efficiency Water Fixtures. The appropriate advisory board(s) and BCD are directed to conduct code amendment of the state building code to require high-efficiency water fixtures in all new buildings by January 1, 2020.

H. Increased Water Efficiency in On-Site Reuse. The appropriate advisory board(s) and BCD are directed to conduct code amendment of the state building code to require water efficiency improvements in all newly constructed commercial buildings through standards for capture and safe reuse of water for irrigation purposes by October 1, 2025.

5. Increasing Energy Efficiency through Retrofits of Existing Buildings Across the State

A. Energy Trust of Oregon Pilot Programs. Oregon Public Utility Commission (PUC) is directed to work with the Energy Trust of Oregon and interested stakeholders to expand meter-based savings pilot programs, including pay-for-performance pilot programs, by January 1, 2019. PUC shall consider inclusion of pilot programs, which do not significantly raise energy efficiency delivery costs, and that focus on existing single family homes, multi-family residential buildings, commercial buildings, and methods to incentivize energy efficiency in building stock that is significantly below current building code requirements.

B. Prioritizing Energy Efficiency in Affordable Housing to Reduce Utility Bills. ODOE, PUC, and Oregon Housing and Community Services (OHCS) are directed to work together to assess energy use in all affordable housing stock and develop a ten-year plan for achieving

maximum efficiency, as well as a continuum of efficiency levels up to maximum efficiency in affordable housing across the state by January 1, 2019. As part of the assessment, the agencies shall consider new resources and best practices and shall seek assistance from Energy Trust of Oregon and Bonneville Power Administration. OHCS is directed to expand its existing multi-family energy program and green energy path requirements, including a manufactured home replacement program through pilot programs and initiatives, while considering multiple values from energy efficiency improvements, such as health and habitability.

C. Coordination of Data. ODOE and PUC are directed to support and assist private sector partners in efforts to coordinate sharing of data that shows projected energy use reductions in the region. This data will be made available to the public to inform energy efficiency policies, as appropriate, by January 1, 2020.

D. Evaluation of Energy and Resiliency Efforts. ODOE and PUC are directed to evaluate the state's distributed energy resources and the efficiency of energy systems needed to improve Oregon's recovery from a disaster situation. ODOE and PUC are directed to provide the Governor with a report of their analysis and findings by January 1, 2019.

6. **Analysis of Cost**. State agencies are expected to implement this Executive Order using the least cost methods available. ODOE and BCD, in consultation with DAS, PUC, and OHCS, are directed to adopt a cost-analysis tool through a process that involves meaningful public input by December 1, 2019. State agencies shall use this cost analysis tool to determine whether any directive in this Executive Order should be deferred for one year or, if specific to a building code related directive, to the next building code cycle, due to significant cost at the time of implementation of that directive. All state agency processes for determining deferment of a directive in this Executive Order must include at least one public meeting that allows interested stakeholders to provide input.

7. **Implementation.** The implementation of this Executive Order shall be coordinated through a Built Environment Efficiency Working Group, which will also identify any structural barriers or barriers to information sharing that may slow the progress of any directive in this Executive Order. The Built Environment Efficiency Working Group will review directives in this Executive Order, seek input from interested stakeholders, and recommend opportunities to provide equitable access to clean energy by removing barriers to achieving energy efficiency in the built environment to the Governor and state agencies. The Built Environment Efficiency Working Group shall include the following agencies: DAS, ODOE, BCD, PUC, and OHCS. Agencies shall implement each directive in this Executive Order using their existing internal processes and established rulemaking procedures, including recommendations from any boards. This Executive Order is intended to be consistent with obligations under federal and state law and shall be interpreted as to not violate any requirement of federal or state law.

8. The Governor encourages the Secretary of State, the State Treasurer, the Attorney General, and the Commissioner of the Bureau of Labor and Industries to adopt policies and practices to accelerate efficiency in the built environment consistent with measures in this Executive Order. DAS and ODOE are directed to assist the above-mentioned officials and entities of state government in accomplishing these objectives as they may request.

Done at Portland, Oregon, this 10th day of November, 2017.

Kate Brown
GOVERNOR

ATTEST:

Dennis Richardson
SECRETARY OF STATE

EXECUTIVE ORDER NO. 20-04

DIRECTING STATE AGENCIES TO TAKE ACTIONS TO REDUCE AND REGULATE GREENHOUSE GAS EMISSIONS

WHEREAS, climate change and ocean acidification caused by greenhouse gas (GHG) emissions are having significant detrimental effects on public health and on Oregon's economic vitality, natural resources, and environment; and

WHEREAS, climate change has a disproportionate effect on the physical, mental, financial, and cultural wellbeing of impacted communities, such as Native American tribes, communities of color, rural communities, coastal communities, lower-income households, and other communities traditionally underrepresented in public processes, who typically have fewer resources for adapting to climate change and are therefore the most vulnerable to displacement, adverse health effects, job loss, property damage, and other effects of climate change; and

WHEREAS, climate change is contributing to an increase in the frequency and severity of wildfires in Oregon, endangering public health and safety and damaging rural economies; and

WHEREAS, the world's leading climate scientists, including those in the Oregon Climate Change Research Institute, predict that these serious impacts of climate change will worsen if prompt action is not taken to curb emissions; and

WHEREAS, the Intergovernmental Panel on Climate Change has identified limiting global warming to 2 degrees Celsius or less as necessary to avoid potentially catastrophic climate change impacts, and remaining below this threshold requires accelerated reductions in GHG emissions to levels at least 80 percent below 1990 levels by 2050; and

WHEREAS, Oregon, as a member of the U.S. Climate Alliance, has committed to implementing policies to advance the emissions reduction goals of the international Paris Agreement; and

WHEREAS, GHG emissions present a significant threat to Oregon's public health, economy, safety, and environment; and

EXECUTIVE ORDER NO. 20-04
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WHEREAS, the transition from fossil fuels to cleaner energy resources can significantly reduce emissions and increase energy security and the resilience of Oregon communities in the face of climate change; and

WHEREAS, emissions from the transportation sector are the single largest source of GHG emissions in Oregon; and

WHEREAS, actions to reduce GHG emissions in Oregon's transportation sector will provide substantial public health co-benefits by reducing air pollutants from the combustion of gasoline and diesel fuel that are harmful to human health; and

WHEREAS, the rapid transition from internal combustion engines to zero-emission vehicles will play a key role in reducing emissions from the transportation sector and advancing the state's GHG emissions reduction goals; and

WHEREAS, zero-emission vehicles provide multiple benefits to Oregonians, including lower operating, maintenance, and fuel costs, and lower emissions of GHGs and other pollutants; and

WHEREAS, the Legislature established ambitious goals for the adoption of zero-emission vehicles in Senate Bill 1044 (2019); and

WHEREAS, rapid actions and investments by Oregon's utility sector to reduce GHG emissions and improve the resilience of the energy system in the face of climate change and wildfire risk can reduce risks for utility customers; and

WHEREAS, transitioning the traditional natural gas supply to renewable natural gas can significantly reduce GHG emissions; and

WHEREAS, energy efficiency standards in the built environment can reduce operating costs, save renters and homeowners money on their utility bills, improve the comfort and habitability of dwellings, and reduce GHG emissions; and

WHEREAS, product energy efficiency standards reduce costs for consumers, save energy, and reduce GHG emissions; and

WHEREAS, in the absence of effective federal engagement on these issues, it is the responsibility of individual states to take immediate actions to address climate change and ocean acidification; and

WHEREAS, after thorough hearings within the Oregon Legislature, a majority of both chambers support addressing climate change, and the failure of the Oregon Legislature to attain quorum has thwarted legislative action to achieve science-based GHG emissions reduction goals; and

WHEREAS, given the urgency and severity of the risks from climate change and ocean acidification, and the failure of the Legislature to address these immediate harms, the executive branch has a responsibility to the electorate, and a scientific, economic, and moral imperative to reduce GHG emissions and to reduce the worst risks of climate change and ocean acidification for future generations, to the greatest extent possible within existing laws; and

WHEREAS, existing laws grant authority to state agencies to take actions to regulate and encourage a reduction of GHG emissions in a variety of circumstances; and

WHEREAS, the Legislature through the Emergency Board took action on March 9, 2020, to provide permanent funding to the executive branch to pursue executive action on reducing GHG emissions; and

WHEREAS, considering climate change in agency planning and decision making will help inform decisions regarding climate change risks and avoid higher mitigation and adaptation costs in the future; and

WHEREAS, all agencies with jurisdiction over the sources of GHG emissions will need to continue to develop and implement programs that reduce emissions to reach the state's GHG goals; and

WHEREAS, all agencies with jurisdiction over natural and working landscapes in Oregon will need to prepare and plan for the impacts of climate change and take actions to encourage carbon sequestration and storage; and

WHEREAS, the Legislature previously established the goal of achieving GHG levels "at least 75 percent below 1990 levels" by 2050, and our State has an urgent, moral obligation to set and achieve more ambitious GHG reduction goals.

NOW, THEREFORE, IT IS HEREBY DIRECTED AND ORDERED:

1. **State Agencies**. The following state commissions and state agencies are subject to the directives set forth in this Executive Order:

   A. Business Oregon;

   B. Department of Administrative Services (DAS);

   C. Department of Consumer and Business Services Building Codes Division (BCD);

   D. Department of Land Conservation and Development (DLCD) and Land Conservation and Development Commission (LCDC);

   E. Environmental Justice Task Force;

   F. Environmental Quality Commission (EQC) and Department of Environmental Quality (DEQ);

   G. Oregon Department of Agriculture (ODA);

   H. Oregon Department of Energy (ODOE);

   I. Oregon Department of Fish and Wildlife (ODFW);

   J. Oregon Department of Forestry (ODF);

   K. Oregon Department of Transportation (ODOT) and Oregon Transportation Commission (OTC);

   L. Oregon Global Warming Commission;

   M. Oregon Health Authority (OHA);

   N. Oregon Water Resources Department (OWRD);

   O. Oregon Watershed Enhancement Board (OWEB); and

   P. Public Utility Commission of Oregon (PUC).

2. **GHG Emissions Reduction Goals**. Consistent with the minimum GHG reduction goals set forth in ORS 468A.205(1)(c), this Executive Order establishes science-based GHG emissions reduction goals, and calls for the State of Oregon to reduce its GHG emissions (1) at least 45 percent below 1990 emissions levels by 2035; and (2) at least 80 percent below 1990 emissions levels by 2050.

3. **General Directives to State Agencies**. From the date of this Executive Order, the state commissions and state agencies listed in paragraph 1 are directed to take the following actions:

   A. GHG Reduction Goals. Agencies shall exercise any and all authority and discretion vested in them by law to help facilitate Oregon's achievement of the GHG emissions reduction goals set forth in paragraph 2 of this Executive Order.

   B. Expedited Agency Processes. To the full extent allowed by law, agencies shall prioritize and expedite any processes and procedures, including but not limited to rulemaking processes and agency dockets, that could accelerate reductions in GHG emissions.

   C. Agency Decisions. To the full extent allowed by law, agencies shall consider and integrate climate change, climate change impacts, and the state's GHG emissions reduction goals into their planning, budgets, investments, and policy making decisions. While carrying out that directive, agencies are directed to:

      (1) Prioritize actions that reduce GHG emissions in a cost-effective manner;

      (2) Prioritize actions that will help vulnerable populations and impacted communities adapt to climate change impacts; and

      (3) Consult with the Environmental Justice Task Force when evaluating climate change mitigation and adaptation priorities and actions.

   D. Report on Proposed Actions. The following agencies are directed to report to the Governor by May 15, 2020, on proposed actions within their statutory authority to reduce GHG emissions and mitigate climate change impacts: DEQ, DLCD, ODA, ODOE, ODFW, ODF, ODOT, OWRD, OWEB, and PUC.

E. Participation in Interagency Workgroup on Climate Impacts to Impacted Communities. The Governor's Office will convene an interagency workgroup on climate impacts to impacted communities to develop strategies to guide state climate actions, with participation by the following agencies and commissions: DEQ, DLCD, ODA, ODF, ODFW, ODOE, ODOT, OHA, OWEB, OWRD, PUC, Environmental Justice Task Force, Oregon Global Warming Commission, Oregon Parks and Recreation Department, and Oregon Sustainability Board.

4. Directives to the Environmental Quality Commission and the Department of Environmental Quality. In addition to the general directives set forth in paragraph 3, the EQC and DEQ are directed to take the following actions:

A. Oregon's Clean Fuel Standards. Pursuant to its authority under ORS 468A.265 *et seq.* and other applicable laws, the EQC and DEQ shall take actions necessary to amend the low carbon fuel standards, and the schedule to phase in implementation of those standards, with the goal of reducing the average amount of GHG emissions per unit of fuel energy by 20 percent below 2015 levels by 2030, and 25 percent below 2015 levels by 2035.

B. Clean Fuel Credits for Electrification. The EQC and DEQ are directed to advance methods accelerating the generation and aggregation of clean fuels credits by utilities that can advance the transportation electrification goals set forth in Senate Bill 1044 (2019).

C. Sector-specific GHG Cap and Reduce Program. Pursuant to its authority under ORS 468A.005 *et seq.* and other applicable laws, the EQC and DEQ shall take actions necessary to:

(1) Cap and reduce GHG emissions from large stationary sources of GHG emissions, consistent with the science-based emissions reduction goals set forth in paragraph 2 of this Executive Order;

(2) Cap and reduce GHG emissions from transportation fuels, including gasoline and diesel fuel, consistent with the science-based emissions reduction goals set forth in paragraph 2 of this Executive Order; and

(3) Cap and reduce GHG emissions from all other liquid and gaseous fuels, including natural gas, consistent with the science-based emissions reduction goals set forth in paragraph 2 of this Executive Order.

D. Regulation of Landfill Methane Emissions. The EQC and DEQ shall take actions necessary to reduce methane gas emissions from landfills, as defined in ORS 459.005(14), that are aligned with the most stringent standards and requirements for reducing methane gas emissions from landfills adopted among the states having a boundary with Oregon.

E. Reduction of Food Waste. The EQC and DEQ are directed to take actions necessary to prevent and recover food waste, with the goal of reducing food waste by 50 percent by 2030, to reduce GHG emissions resulting from such waste, including but not limited to engaging with states and other jurisdictions, industry, food retailers, and brand manufacturers to develop and implement strategies to prevent and recover food waste.

F. Timeline and Implementation.

(1) No later than May 15, 2020, DEQ shall submit a report to the Governor regarding an estimated timeline for rulemaking necessary for implementing the directives of paragraph 4(A)–(B) and paragraph 4(D)–(E), above.

(2) DEQ shall submit a preliminary report to the Governor by May 15, 2020, regarding program options to cap and reduce emissions from large stationary sources, transportation fuels, and other liquid and gaseous fuels that can commence no later than January 1, 2022. A final report shall be due by June 30, 2020.

(3) Reports submitted pursuant to paragraph 4 of this Executive Order also should detail DEQ's plans to engage impacted communities during the rulemaking process, in a manner consistent with ORS chapter 183.

5. **Directives to the Public Utility Commission of Oregon**. In addition to the general directives set forth in paragraph 3, the PUC is directed to consider the following factors and values, consistent with state law:

A. Statement of Public Interest. It is in the interest of utility customers and the public generally for the utility sector to take actions that result in rapid reductions of GHG emissions, at reasonable costs, to levels consistent with the GHG emissions reduction goals set forth in paragraph 2 of this Executive Order, including transitioning to clean energy resources and expanding low carbon transportation choices for Oregonians.

B. Regulatory Considerations. Executive Order 00-06, which ensures that the PUC maintains its independence in decision making, is reaffirmed. The directives in this Executive Order are consistent with Executive Order 00-06. When carrying out its regulatory functions, the PUC is directed to:

(1) Determine whether utility portfolios and customer programs reduce risks and costs to utility customers by making rapid progress towards reducing GHG emissions consistent with Oregon's reduction goals;

(2) Encourage electric companies to support transportation electrification infrastructure that supports GHG reductions, helps achieve the transportation electrification goals set forth in Senate Bill 1044 (2019), and is reasonably expected to result in long-term benefit to customers;

(3) Prioritize proceedings and activities, to the extent consistent with other legal requirements, that advance decarbonization in the utility sector, and exercise its broad statutory authority to reduce GHG emissions, mitigate energy burden experienced by utility customers, and ensure system reliability and resource adequacy;

(4) Evaluate electric companies' risk-based wildfire protection plans and planned activities to protect public safety, reduce risks to utility customers, and promote energy system resilience in the face of increased wildfire frequency and severity, and in consideration of the recommendations made by the Governor's Council on Wildfire Response 2019 Report and Recommendations;

(5) Convening periodic workshops for purposes of assisting electric companies, consumer-owned utilities, and operators of electrical distribution systems to develop and share best practices for mitigating wildfire risk; and

(6) In cooperation with Oregon Housing and Community Services, establish a public process to address and mitigate differential energy burdens and other inequities of affordability and environmental justice, including rate design and other programs to mitigate energy burden.

6. **Directives to the Department of Consumer and Business Services Building Codes Division**. In addition to the general directives set forth in paragraph 3, BCD is directed to take the following actions:

A. Energy Efficiency Goal for New Construction. BCD, through its advisory boards and committees, and in cooperation with ODOE, is directed to adopt building energy efficiency goals for 2030 for new residential and commercial construction. That goal shall represent at least a 60 percent reduction in new building annual site consumption of energy, excluding electricity used for transportation or appliances, from the 2006 Oregon residential and commercial codes.

B. Code Progress and Updates. BCD, through its advisory boards and committees, and in cooperation with ODOE, is directed to evaluate and report on Oregon's current progress toward achieving the goal for new residential and commercial buildings, pursuant to paragraph 6(A) of this Executive Order, and options for achieving steady progress toward the goal over the next three code cycles (2023, 2026, and 2029). Pursuant to its authority under ORS 455.500, BCD also is directed to update the Reach Code on the same timeline. No later than September 15, 2020, BCD should submit a report to the Governor on current progress and options for achieving the goals over the next three code cycles. The report should be updated every three years thereafter.

C. Baseline Metrics and Reductions. BCD, in cooperation with ODOE, is directed to agree on metrics, based on best practice and academic research, to inform the baseline and reductions associated with the code updates set forth in paragraph 6(B).

7. **Directives to the Oregon Department of Energy**. In addition to the general directives set forth in paragraph 3, ODOE is directed to take the following actions:

   A. Energy Efficiency Standards. ODOE is directed to pursue emissions reductions by establishing and updating energy efficiency standards for products at least to levels equivalent to the most stringent standards among West Coast jurisdictions, including grid-connected appliances that can be utilized to manage end-use flexible electrical loads. ODOE also is directed to periodically evaluate and update those standards, as practicable, to remain at least equivalent to the most stringent standards among West Coast jurisdictions.

   B. Rulemaking. ODOE is directed to take actions necessary to establish and update energy efficiency standards for products sold or installed in Oregon that include but are not limited to the following:

      (1) High CRI fluorescent lamps;

      (2) Computers and computer monitors;

      (3) Faucets;

      (4) Shower heads;

      (5) Commercial fryers;

      (6) Commercial dishwashers;

      (7) Commercial steam cookers;

      (8) Residential ventilating fans;

      (9) Electric storage water heaters; and

      (10) Portable electric spas.

   C. Timeline. Any rulemaking necessary to implement the directives set forth in paragraph 7(B) should be completed by September 1, 2020.

   D. Third-Party Validation for Cost Savings. ODOE, in cooperation with BCD, is directed to contract with a third party consulting firm to assess cost implications, including long-term energy cost savings, of the energy efficiency and building code actions set forth in paragraph 6(A)–(B) of this Executive Order.

8. **Directives to the Department of Administrative Services**. In addition to the general directives set forth in paragraph 3, DAS is directed to take the following actions:

   A. Procurement Model for Zero-Emission Vehicles. DAS is directed to develop a statewide policy and plan for state agencies to follow for procuring zero-emission vehicles, which local governments and special government bodies may use as a model program for furthering adoption of zero-emission vehicles for their fleets. The model program shall provide for a rate of procurement of zero-emission vehicles consistent with the findings and goals set forth in ORS 283.398 and the provisions of ORS 283.327. The model program may provide for DAS to participate in, sponsor, conduct, or administer cooperative procurements in accordance with ORS 279A.200 to ORS 279A.225, under which DAS, local governments, and special government bodies may procure zero-emission vehicles.

   B. GHG Implications of Contracting. DAS is directed to review existing state procurement laws and practices to identify potential improvements that can reduce GHG emissions, consistent with the GHG reduction goals set forth in paragraph 2 of this Executive Order. DAS shall provide a report to the Governor no later than September 15, 2020, detailing options.

   C. GHG Reduction Goals and Electrification Goals. DAS is directed to support the state in meeting the GHG reduction goals set forth in paragraph 2 of this Executive Order, and the zero-emission vehicle adoption goals set forth in Senate Bill 1044 (2019), through the rapid conversion of state fleets to zero-emission vehicles, and the expansion of electric vehicle charging infrastructure for public buildings. DAS shall provide a report to the Governor no later than September 15, 2020, detailing its plan.

9. **Directives to the Oregon Transportation Commission, Oregon Department of Transportation, Land Conservation and Development Commission, Environmental Quality Commission, and Oregon Department of Energy**.

A. In a letter from the Governor, dated September 23, 2019, the OTC, LCDC, EQC, and ODOE were directed to prioritize implementation of the Statewide Transportation Strategy, adopted by the OTC. Those agencies are further directed to include the following elements in their implementation of the Statewide Transportation Strategy:

(1) Establishment of GHG emissions reduction performance metrics; and

(2) Amendments to the Transportation Planning Rule that direct changes to the transportation plans of metropolitan planning areas to meet GHG reduction goals.

B. ODOT and DLCD are directed to identify and implement means to provide financial and technical assistance to metropolitan planning areas for amendment to transportation and land use plans that meet the state GHG reduction goals, or more stringent goals adopted by a metropolitan planning area.

C. Implementation of the directives set forth in paragraph 9(A)–(B) shall be at the highest level within the agencies, with regular and direct reporting to the Governor. The first report shall be made to the Governor no later than June 30, 2020.

10. **Directives to the Oregon Department of Transportation**. In addition to the general directives set forth in paragraph 3, ODOT is directed to take the following actions:

A. In consultation with DEQ, ODOE, other appropriate state agencies, and public utilities, ODOT is directed to conduct a statewide transportation electrification infrastructure needs analysis, with particular focus on rural areas of the state, across use types and vehicle classes, to facilitate the transportation electrification goals set forth in Senate Bill 1044 (2019). The study should be completed no later than June 30, 2021.

B. ODOT is directed to develop and apply a process for evaluating the GHG emissions implications of transportation projects as part of its regular capital planning and Statewide Transportation Improvement Program planning processes. ODOT shall provide a report on the process to the Governor no later than June 30, 2021.

11. **Directives to Oregon Health Authority**. In addition to the general directives set forth in paragraph 3, OHA is directed to take the following actions:

    A. OHA is directed to deliver a report to the Governor, the Oregon Global Warming Commission, and the Environmental Justice Task Force no later than September 1, 2020, on the public health impacts of climate change in Oregon, with particular emphasis on the risks faced by vulnerable communities, including Oregon's nine federally recognized Native American tribes, communities of color, low income communities, and rural communities. OHA is directed to update the report annually.

    B. OHA is directed to study the impacts of climate change on youth depression and mental health in Oregon and deliver a report to the Governor no later than June 30, 2021.

    C. OHA and the Oregon Occupational Safety and Health Administration (OSHA) are directed to jointly develop a proposal for standards to protect workplace employees from exposure to wildfire smoke and excessive heat. The proposal should be completed no later than June 30, 2021.

12. **Directives to Oregon Global Warming Commission**. In addition to the general directives set forth in paragraph 3, the Global Warming Commission is directed to take the following actions:

    A. In coordination with ODA, ODF, and OWEB, the Oregon Global Warming Commission is directed to submit a proposal to the Governor for consideration of adoption of state goals for carbon sequestration and storage by Oregon's natural and working landscapes, including forests, wetlands, and agricultural lands, based on best available science. The proposal shall be submitted no later than June 30, 2021.

    B. Consistent with its reporting requirements in House Bill 3543 (2007), the Oregon Global Warming Commission shall also include reporting on progress toward the GHG reduction goals set forth in paragraph 2 of this Executive Order, and the zero-emission vehicle adoption goals set forth in SB 1044 (2019).

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13. **Effectiveness**. This Executive Order will remain in effect unless and until it is superseded by statute or another Executive Order.

Done at Salem, Oregon, this 10th day of March, 2020.

Kate Brown
GOVERNOR

ATTEST:

Bev Clarno
SECRETARY OF STATE

Executive Order 20-04: Directive 3(D) Report

Oregon Building Codes Division

DCBS | Consumer and Business Services

State of Oregon
Building Codes Division
Better Buildings for Oregon

Background

Executive Order 20-04 was signed by Governor Brown on March 10, 2020. It is intended to build on Executive Order 17-20, and further Oregon's goal of reducing greenhouse gas emissions. The EO provides 13 directives to multiple state agencies, including directives to specific agencies with reporting requirements and deadlines. The first reporting deadline is on May 15, 2020, and requires the specified state agencies to report on proposed actions within their statutory authority to reduce green house gases and mitigate climate change impacts. While the Department of Consumer and Business Services Building Codes Division (BCD) is not a mandated reporter in the EO, the Governor's office requested BCD also provide a report.

BCD Statutory Authority

BCD, in partnership with its seven advisory boards, has statutory authority to adopt and amend a state building code. BCD does not have statutory authority to unilaterally adopt or amend the building code, and requires approval from the appropriate advisory board. Historically, BCD has worked with its advisory boards to adopt some of the most energy efficient building codes in the country. Oregon's state codes are based on national model codes and incorporate additional energy efficiency measures. Oregon was the first state in the country to adopt the ASHRAE 90.1-2016 standard as a statewide, mandatory code, and is among the national leaders in energy efficiency for both residential and commercial construction.

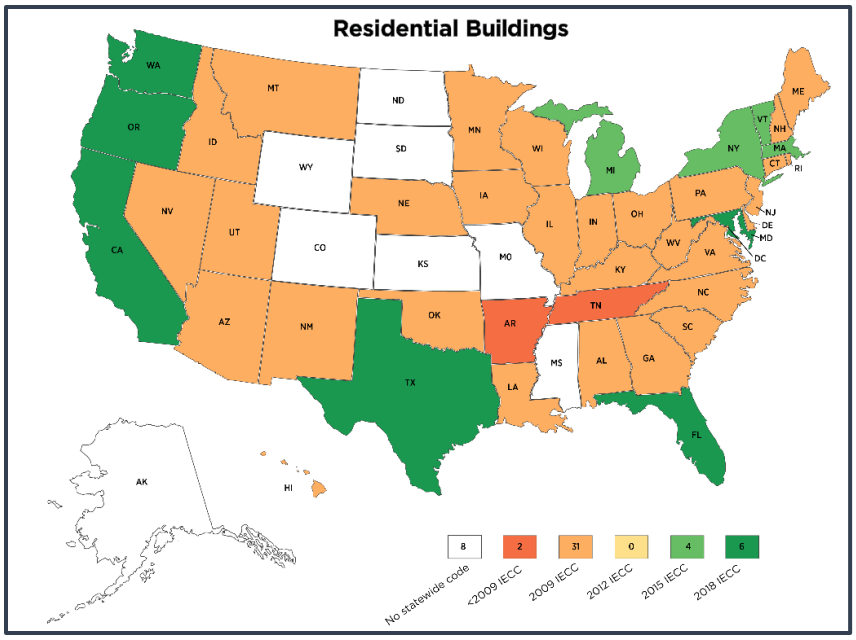

Figure 1: Status of state energy code adoption: Residential buildings (US Dept of Energy)

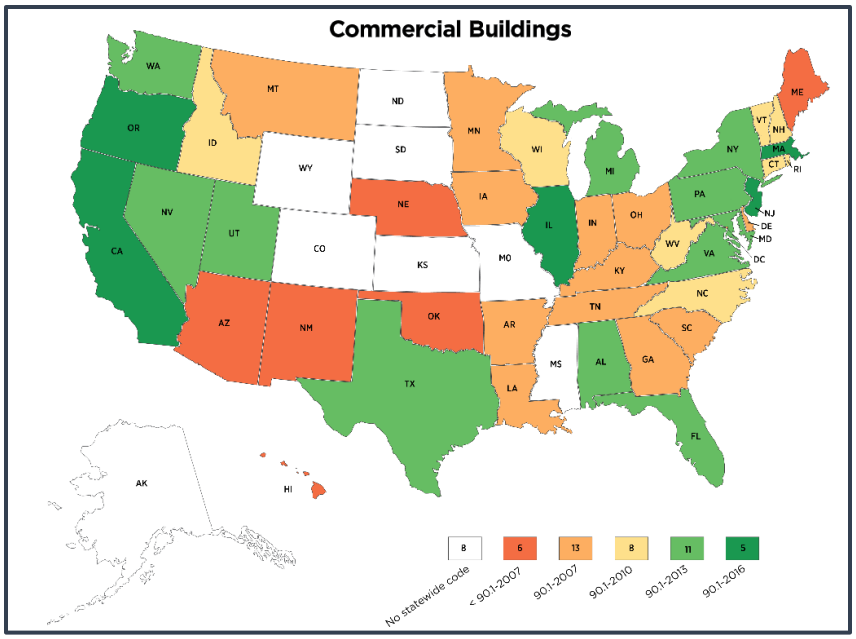

Figure 2: Status of state energy code adoption: Commercial buildings (US Dept of Energy)

BCD has been able to keep Oregon as a national leader for energy efficient building codes by utilizing its existing statutory authority to adopt uniform statewide building codes that are technically and economically feasible. These codes are required statewide, creating consistency and predictability. This approach also helps Oregon achieve extremely high compliance rates as contractors are able to train their workers to one standard, regardless of the jurisdiction a project is in.

As part of Oregon's unique building code system, Oregon statute requires both the appropriate advisory board and BCD to jointly approve of any code change. This approach ensures that the stakeholder advisory boards are partners in the code change process, and that important construction industry stakeholders are able to have their voices heard. This partnership between the construction industry, the boards, and BCD has created one of the leading energy efficiency codes in the country, while providing predictability and stability to the construction industry.

Current statutory authority will allow BCD, with its advisory boards, to continue to adopt increasingly energy efficient model codes on a predictable timeline. This will maintain Oregon's place as a national leader for both residential and commercial energy efficiency, reduce the built environment's greenhouse gas emissions, and establish a path for Oregon buildings to achieve net-zero energy use.

BCD will propose to the boards that they maintain their role in energy efficiency leadership by continuing to adopt and update energy codes in Oregon on a predictable three-year schedule, based on the most recent published versions of national model codes. The commercial energy code will continue to be based off the most recent published version of the ASHRAE 90.1

standard, while the residential energy code will continue to advance the existing Oregon residential energy code provisions, which exceed published national model codes. BCD will continue to work with the boards to make amendments as necessary to meet the goals as outlined in Executive Orders 17-20 and 20-04.

Additional Information

The Governor's office has requested additional information in response to the following:

1. **The agency's plans for implementation of the specific directives, including articulation of clear deliverables, outcomes, timelines, and identification of lead staff.**

BCD is directly responsible for directives 6(A), 6(B), and 6(C) in EO 20-04.

Directive 6(A):

This directive requires BCD, through its advisory boards, and in cooperation with the Oregon Department of Energy (ODOE), to adopt a building energy efficiency goal for 2030 that represents a 60% reduction in building site energy consumption from the residential and commercial energy codes that were in effect in 2006.

BCD has had discussions with ODOE to determine the 2006 baseline and both agencies have made substantial progress towards determining the 2006 baseline. The baseline will incorporate existing analysis and determinations made by ASHRAE and the Pacific Northwest National Laboratory. This work between BCD and ODOE has been ongoing as a result of EO 17-20, and includes the same methodologies used for determining the US DOE Zero Energy Ready Home equivalent.

With the baseline determined, the performance based target of a 60% reduction can be calculated and incorporate prescriptive measures from EO 17-20. This approach will be communicated to the Residential and Manufactured Structures Board, Building Codes Structures Board, and the Construction Industry Energy Board. The performance based 60% reduction goal will then be accomplished via regularly scheduled code updates which take place on approximately three-year cycles.

BCD already has Oregon codes modeled and calculated via independent third-party evaluation for federal verification purposes. Verification also enables BCD to ensure that any increased costs in construction due to additional code requirements result in meaningful energy savings for Oregonians. These evaluations will continue, and will provide the required reporting mechanism to measure progress on the 60% reduction goal.

Lead BCD Staff: Mark Heizer, Mechanical and Energy Code Engineer; Kelly Thomas, Energy Policy Analyst

Directive 6(B):

This directive has three subparts each with a different directive to BCD. These three subparts result in two different requirements (1) a reporting requirement, and (2) a requirement to adopt and update the Reach code on a regular, predictable cycle.

Reporting: The first requirement directs BCD, through its advisory boards, and in cooperation with ODOE, to report on the progress and options to meet the goal established by Directive 6(A), and submit that report to the Governor no later than September 15, 2020, with updates every three years thereafter. To implement this directive BCD will continue to update the residential and commercial energy codes on approximately three-year cycles. BCD currently uses the University of Oregon to provide an independent third-party verification of its code adoption progress. BCD will continue to use an independent third-party verification institute to provide data on code efficiency progress. This data can then be used to demonstrate progress towards the goal established under directive 6(A). The appropriate advisory boards and BCD can use this data to inform future decisions about code amendments, as well as provide the basis for the reporting requirements.

Reach code: The second requirement directs BCD to update the Reach code on the same timeline as code adoption. By statute the Reach code consists of optional provisions that a builder may choose to utilize, separate from the state building code.

Codes are typically updated on three-year cycles, resulting in a Reach code being adopted on approximately three-year cycles for the residential and structural code. Previous editions of the Reach code were developed with significant upfront expense and staff time. However, since the existing Oregon code system provides flexibility to designers and contractors to build above code, the Reach code did not see much utilization in the industry. Because a code item cannot be in both the Reach code and the state code at the same time, BCD focused its efforts on including all technically and economically feasible energy code items in the state building code to achieve immediate results in the construction industry. BCD's approach resulted in Oregon having some of the most efficient energy codes in the country with effective code enforcement and nation leading code compliance rates. This combination creates real world savings for Oregonians. These results were only able to be achieved through strong partnership with the advisory boards and construction industry stakeholders, who are ultimately responsible for turning code requirements into real world buildings.

The Reach code is created by statute in ORS 455.500. That statute requires that the Reach code be designed to increase energy efficiency, be "economically and technically feasible," and use "published and generally accepted codes and standards." BCD will continue to review both prescriptive and performance based approaches to designing an effective Reach code that meets

statutory requirements. BCD, in consultation with the appropriate advisory boards, will update the Reach code on three-year cycles in alignment with specialty code update cycles.

Lead BCD Staff: Mark Heizer, Mechanical and Energy Code Engineer; Kelly Thomas, Energy Policy Analyst

Directive 6(C):

This directive requires BCD, in cooperation with ODOE, to agree on metrics, based on best practice and academic research, to inform the baseline and reductions associated with the code updates set forth in section 6(B).

BCD staff will continue working with ODOE to determine the baseline code efficiency from 2006 as required by section 6(A), using existing agreed upon methodologies used to determine EO 17-20 prescriptive code requirement equivalencies. This baseline will be used to measure reductions for each code adoption under section 6(B), and captured in the reporting requirements under that same section, and create a path to reach the performance based goals of EO 20-04.

Lead BCD Staff: Mark Heizer, Mechanical and Energy Code Engineer; Kelly Thomas, Energy Policy Analyst

2. **Description of anticipated processes for advancing the work and engaging stakeholders; for example, workshops, rulemakings, etc.**

BCD incorporates various opportunities for stakeholders and members of the public to engage in the code change process. Under existing statutory authority, BCD is required to get advisory board approval for any specialty code update. This process involves engaging with stakeholder representatives on the advisory boards (see the following page) as well as public input at board meetings. The board's code change process has also included the ability for public comment either at the code committee level, the board level, or both.

Once a code change has been approved by the appropriate advisory board, BCD undertakes formal rulemaking. BCD policy has always been to include at least one public hearing on code adoption rules, providing another opportunity for public feedback. BCD sends out regular updates on code change processes and maintains a website with all code change information. BCD also sends out notifications to its subscriber lists and publishes all opportunities for the public to engage in the process.

In addition to the opportunities for public engagement in the code change process, existing statute provides the opportunity for any member of the public to present a code amendment at any board meeting. These amendments do not need to be timed with an existing code cycle, and have been successfully used by stakeholders to get code amendments passed before the next scheduled code update.

State Plumbing Board ORS 693.115 – Seven Members	A journeyman plumber with 10 or more years of experience in the trade
	A licensed plumbing contractor
	A local plumbing inspector who is also a journeyman plumber
	A registered professional mechanical engineer
	An officer or employee of the Oregon Health Authority
	A plumbing equipment supplier who otherwise qualifies to sit on the board by industry experience OR a building official
	A member of the general public
Construction Industry Energy Board ORS 455.492 – Eleven Members	Two members of the Electrical and Elevator Board who have electrical experience, to be selected by the Electrical and Elevator Board
	Two members of the Residential and Manufactured Structures Board who have practical experience in either the residential structure industry or the manufactured structure industry, to be selected by the Residential and Manufactured Structure Board
	Two members of the Building Codes Structures Board with practical experience in construction, to be selected by the Building Codes Structures Board.
	Two Members of the Plumbing Board with practical experience in construction, to be selected by the Plumbing Board
	Two members of the Mechanical Board with practical experience in construction, to be selected by the Mechanical Board
	An employee or officer of the state Department of Energy appointed by the director of the state Department of Energy
Mechanical Board ORS 455.140 – Ten Members	A representative of the plumbing industry
	A sheet metal and air conditioner installer
	A municipal mechanical inspector with the highest level of certification issued by the Department of Consumer and Business Services
	A Heating Ventilation and Air Conditioning Contractor
	A Heating Ventilation and Air Conditioning Installer
	A Sheet Metal and air conditioner installer
	An insulation craftsperson with experience with heat and frost insulation
	A representative of a natural gas company or other utility
	A member of the general public not receiving a compensation from any interest represented by one of the other represented stakeholders
	At least one member of the board must be an owner or operator of a contracting business with 10 or fewer employees at the time of their appointment
Electrical and Elevator Board ORS 455.138 – Fifteen Members	A fire and casualty underwriter
	A representative of industrial plants regularly employing licensed electricians
	A representative of the power and light industry
	An electrical equipment supplier who otherwise qualifies by experience and training in the industry
	Two journeyman electricians
	An electrical inspector
	Two electrical contractors
	A municipal building official
	A journeyman elevator installer
	An owner or manager of a commercial office building
	A member of the general public not receiving a compensation from any interest represented by one of the other represented stakeholders
Residential and Manufactured Structures Board ORS 455.135 – Eleven Members	A contractor specializing in the construction of residential structures
	A contractor specializing in remodeling of residential structures
	A contractor specializing in multi family structures three stories or fewer above grade
	A home designer or architect
	A building official
	A representative of residential building trade subcontractors
	A structural engineer
	A representative of a utility or energy supplier
	A manufacturer of manufactured dwellings
	A seller or distributor of manufactured dwellings
	A member of the general public not receiving a compensation from any interest represented by one of the other represented stakeholders
Building Codes Structures Board ORS 455.132 – Nine Members	An architect or engineer
	A general contractor specializing in buildings more than three stories above grade
	A contractor specializing in heavy industry construction
	A representative of the building trade
	A representative of a utility or energy provider
	A representative of a fire protection agency
	A building official
	An owner or manager of a commercial office building
	A representative selected from a list of individuals recommended by the Oregon Disabilities Commission

3. Description of the anticipated process for collaborating with ODOE and other relevant agencies as indicated by EO 20-04.

BCD and ODOE staff are in regular contact and collaborate on a variety of issues where there is overlap between BCD's mission to ensure safe building construction while supporting a positive business environment, and ODOE's mission to lead Oregon to a safe, clean, and sustainable energy future. ODOE also has representation on the Construction Industry Energy Board, providing opportunity to not only collaborate with BCD staff on a working level, but to interact directly with BCD stakeholders and board members. BCD and ODOE staff collaborate on industry conference presentations and share information and ideas on a regular basis.

BCD also collaborates with other state agencies through staff communications, board meetings, committees, and workgroups as needed. BCD intends to continue working with all relevant stakeholders, to execute the directives contained in EO 20-04.

4. Description of how work on EO 20-04 builds on, and complements EO 17-20.

The BCD related directives in EO 17-20 set out specific deliverables and timelines that generally align with existing BCD statutes, procedures, and processes. BCD and its advisory boards are still in the process of implementing all of the code related directives from EO 17-20. EO 20-04 directs BCD to achieve a performance based goal by 2030 for the state building codes. BCD anticipates using the existing specific, prescriptive directives from EO 17-20, model codes, and existing stakeholder and industry needs to meet the performance based goals of EO 20-04. By leveraging the existing and ongoing work of EO 17-20, and normally scheduled code updates, BCD plans on integrating the additional performance based goals from EO 20-04 into the state building code. Through this approach, BCD anticipates that it will be able to meet the performance reductions in EO 20-04 by 2030.

Conclusion

BCD, with its advisory boards and stakeholders, looks forward to continuing Oregon's national leadership on energy efficiency for new construction. When changing codes, the relevant advisory board must make a finding that "the added cost, if any, is necessary to the health and safety of the occupants or the public or necessary to conserve scare resources." This balance between cost and efficiency is challenging when the easiest, most cost effective measures are already in the code. BCD and its boards are up to the challenge.

Attached are the principles BCD uses to guide our work and ensure the decisions BCD makes strike the correct balance. Achieving this balance provides predictable building codes based on technically and economically feasible model codes, providing all Oregonians with safe, energy efficient buildings to live and work in. BCD looks forward to continuing its work with its advisory boards, other state agencies, and stakeholders to continue Oregon's energy efficiency leadership.

Principles for Code Adoption

BCD has developed several principles to make sure the building code achieves our mission, which is to work with Oregonians to ensure safe building construction while supporting a positive business climate. Here are some of the principles that guide our work when considering revisions to the building code:

Take a long view. A long term strategy ensures predictability in the code. Code cycles generally vary from 3-6 years, and different states can be at different stages in the code cycle at a given time. It takes significant time to develop revisions to the code, and it is important to ensure stakeholders, boards, labor, and industry have the time and space to develop the best possible standards.

Coordinated approach. Oregon relies on builders, labor, contractors, and stakeholders to participate in policy work by leading the discussion through the seven advisory boards that assist in directing code adoption. Their expertise results in a better building code. Adopting the building code is not enough, labor and industry have to be trained to follow the code, and inspectors have to be trained to ensure compliance with the code. Rigorous training for labor, industry and inspectors mean that from the beginning of a project to its completion, all parties involved have the tools necessary to ensure the standards that are carefully developed through the code process are followed. BCD doesn't just set policy goals, it achieves them.

Focus on performance and choice. It is important in the building code not to create narrow paths that benefit particular companies or industries, but to instead ensure construction practices are the safest and most efficient for all buildings in Oregon. Proponents of proprietary products, testing, and inspection techniques may have incentives beyond what is safest, most efficient, and most cost effective. BCD's duty to all Oregonians, including labor, industry, and other stakeholder groups is to focus on creating choices to achieve technically feasible, safe, efficient, and cost effective buildings.

Evidence based. BCD collects evidence and best practices from across the nation and the world to develop codes that best suit Oregonians. There are a lot of voices in the discussion about how to best increase building efficiency, and as discussed above, some of those voices have incentives to support specific products, methods or testing that may not lead to more efficient codes. Our goal is always to rely on good research to make evidence-based decisions.

Independent verification. BCD utilizes an independent review process to verify that Oregon is achieving its efficiency goals. First through the University of Idaho, and now through the University of Oregon, BCD submits the commercial and residential energy codes for review to ensure Oregon is on pace to remain a national leader and that BCD is making data driven decisions about efficiency standards.

Consistency across the state. Any building in this state, whether urban, rural, affordable or extravagant, is built to the same efficiency standards. All Oregonians should have the benefit of a safe, affordable, and efficient home. This advantage of consistent, predictable codes, creates extremely high compliance rates and is part of what makes the Oregon model unique. Other states may say they have adopted a particular cutting-edge code, but if local jurisdictions never adopt it, state or local inspectors never enforce it, and labor is not trained to it, it is only as good as the paper it's written on. That's not the case in Oregon.

Residential energy provisions

These amendments are proposed for the following chapters of the 2018 IRC:

- Chapter 3 – Building Planning: *Toilet and bathing facilities and mechanical ventilation*
- Chapter 11 – Energy Efficiency: *Entire chapter*
- Chapter 15 – Exhaust Systems: *Mechanical ventilation*
- Chapter 16 – Duct Systems: *Joints, seams and connections, and ductwork installation location*

The amendments are depicted as follows:

- ~~Strikethrough~~ text represents deleted language.
- Underlined text represents added language.

Chapter 3, Building Planning. The following provisions modify the indicated sections of the 2018 IRC:

R303.3 Toilet and bathing facilities ventilation.

R303.3.1 Rooms with bathing or spa facilities. Any room with a bathtub, shower or spa facility shall be provided with mechanical ventilation designed and installed in accordance with Section M1505.5.

R303.3.2 Rooms without bathing or spa facilities. Water closet compartments ~~and other similar~~ or toilet rooms without bathtub, shower or spa facilities shall be provided with an aggregate glazing area ~~in windows~~ of not less than 3 square feet (0.3 m^2), one-half of which shall be openable.

Exception: The glazed areas shall not be required where artificial light and a ~~local exhaust~~ mechanical ventilation system are provided. The minimum ~~local exhaust~~ ventilation rates shall be ~~determined~~ in accordance with ~~Section M1505. Exhaust air from the space shall be exhausted directly to the outdoors~~ Table M1505.5.

R303.4 Mechanical ventilation. ~~Where the air infiltration rate of a *dwelling unit* is 5 air changes per hour or less where tested with a blower door at a pressure of 0.2 inch w.c (50 Pa) in accordance with Section N1102.4.1.2, the~~ Each *dwelling unit* shall be provided with whole-house mechanical ventilation in accordance with Section M1505.4.

Chapter 11, Energy Efficiency. The following provisions replace Chapter 11 of the 2018 IRC:

SECTION N1101
SCOPE

N1101.1 General. The provisions of this chapter regulate the exterior envelope, as well as the design, construction and selection of heating, ventilating and air-conditioning systems, lighting and piping insulation required for the purpose of effective conservation of energy within a building or structure governed by this code.

All conditioned spaces within residential buildings shall comply with Table N1101.1(1) and ~~two~~ one additional measure~~s~~ from Table N1101.1(2).

Exceptions:

1. Application to existing buildings shall comply with Section N1101.2.
2. Application to additions shall comply with Section N1101.3.
3. Heated or cooled detached accessory structures that are not habitable shall meet the following envelope requirements without any additional measures: Walls: R-21/*U*-0.064; Roofs: R-38/*U*-0.027 (attic) or R-20 continuous insulation/*U*-0.048 (above deck); Windows: *U*-0.35; Opaque doors: *U*-0.70; Roll-up doors: *U*-0.50.

N1101.2 Application to existing buildings. Alteration and repairs, historic buildings and change of use or occupancy to buildings, structures or portions thereof shall comply with the requirements in Sections N1101.2.1 through N1101.2.3.

N1101.2.1 Alteration and repair. Alterations and repairs affecting energy conservation measures shall conform to the requirements specified in this chapter.

Alterations or repairs which affect components of existing conditioned spaces regulated in this chapter, those components shall comply with this chapter.

Exception: The minimum component requirements as specified in Table N1101.2 may be used to the maximum extent practical.

N1101.2.2 Historic buildings. The building official may modify the specific requirements of this chapter for historic buildings and require in lieu thereof alternative requirements that will result in a reasonable degree of energy efficiency. This modification may be allowed for those buildings specifically designated as historically significant by the state historic preservation office(r) or by official action of a local government.

N1101.2.3 Change of occupancy or use. Definition of "Change of use" for purposes of Section N1101.2.3 is a change of use in an existing residential building and shall include any of the following: any unconditioned spaces such as an attached garage, basement, porch, or canopy that are to become conditioned spaces; any unconditioned, inhabitable space that is to become conditioned space, such as a large attic.

N1101.2.3.1 Change of use. A building that changes use, without any changes to the components regulated in this chapter, is required to comply with Table N1101.2 to the greatest extent practical. Changes of use that are greater than 30 percent of the existing building heated floor area or more than 400 square feet (37 m^2) in area, whichever is less, shall be required to select one measure from Table N1101.3.

N1101.2.3.2 Change of occupancy. Alteration and repair of conditioned nonresidential buildings, such as a small church or school, that are changing occupancy to residential shall use Table N1101.2 to the greatest extent practical and select one measure from Table N1101.1(2), or one measure from Table N1101.3.

Exception: The minimum component requirements shall be disregarded when thermal performance calculations are completed for change of use to Group R occupancy, when such calculations demonstrate similar performance to the requirements of Table N1101.2.

TABLE N1101.2
EXISTING BUILDING COMPONENT REQUIREMENTS

BUILDING COMPONENTS	REQUIRED PERFORMANCE	EQUIV. VALUE
Wall insulation	*U*-0.083	R-15
Flat ceiling	*U*-0.025	R-49
Vaulted ceiling > 10 inches nominal rafter depth	*U*-0.040	R-25
Vaulted ceiling > 8 inches nominal rafter depth	*U*-0.047	R-21
Underfloor > 10 inches nominal joist depth	*U*-0.028	R-30
Underfloor > 8 inches nominal joist depth	*U*-0.039	R-25
Slab edge perimeter	F-0.52	R-15
Windows	*U*-0.30	*U*-0.30
Skylights	~~*U*-0.60~~ *U*-0.50	~~*U*-0.60~~ *U*-0.50
Exterior doors	*U*-0.20	R-5
Exterior doors with > 2.5 ft^2 glazing	*U*-0.40	R-2.5
Forced air ducts	n/a	R-8

For SI: inch = 25.4 mm, 1 square foot = 0.0929 m^2.

N1101.3 Additions. Additions to existing buildings or structures may be made without making the entire building or structure comply if the new additions comply with the requirements of this chapter.

N1101.3.1 Large additions. Additions that are equal to or more than ~~40 percent of the existing building heated floor area or~~ 600 square feet (55 m^2) in ~~area, whichever is less, shall~~ area shall be required to comply with Table N1101.1(2).

N1101.3.2 Small additions. Additions that are less than ~~40 percent of the existing building heated floor area or less than~~ 600 square feet (55 m^2) in ~~area, whichever is less, shall~~ area shall be required to select one measure from Table N1101.1(2) or comply with Table N1101.3.

Exception: Additions that are less than ~~15 percent of existing building heated floor area or 200~~ 225 square feet (~~18.58~~ 20.9 m^2) in area, whichever is less, shall not be required to comply with Table N1101.1(2) or Table N1101.3.

TABLE N1101.1(1)
PRESCRIPTIVE ENVELOPE REQUIREMENTS [a]

BUILDING COMPONENT	STANDARD BASE CASE		LOG HOMES ONLY	
	Required Performance	Equiv. Value [b]	Required Performance	Equiv. Value [b]
Wall insulation—above grade	*U*-0.059[c]	R-21 Intermediate [c]	Note d	Note d
Wall insulation—below grade [e]	C-0.063	R-15/R-21	C-0.063	R-15/R-21
Flat ceilings [f]	*U*-0.021	R-49	*U*-0.020	R-49 A[h]
Vaulted ceilings [g]	*U*-0.033	R-30 Rafter or R-30A[g,h] Scissor Truss	*U*-0.027	R-38A[h]
Underfloors	*U*-0.033	R-30	*U*-0.033	R-30
Slab edge perimeter [m]	F-0.520	R-15	F-0.520	R-15
Heated slab interior [i]	n/a	R-10	n/a	R-10
Windows[j]	~~*U*-0.30~~ *U*-0.27	~~*U*-0.30~~ *U*-0.27	~~*U*-0.30~~ *U*-0.27	~~*U*-0.30~~ *U*-0.27
~~Window area limitation [j]~~	~~n/a~~	~~n/a~~	~~n/a~~	~~n/a~~
Skylights [l]	*U*-0.50	*U*-0.50	*U*-0.50	*U*-0.50
Exterior doors [m] [k]	*U*-0.20	*U*-0.20	*U*-0.54	*U*-0.54
Exterior doors with > 2.5 ft^2 glazing [n] [l]	*U*-0.40	*U*-0.40	*U*-0.40	*U*-0.40
~~Forced air duct insulation~~	~~n/a~~	~~R-8~~	~~n/a~~	~~R-8~~

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m^2, 1 degree = 0.0175 rad, n/a = not applicable.

a. As allowed in Section N1104.1, thermal performance of a component may be adjusted provided that overall heat loss does not exceed the total resulting from conformance to the required *U*-factor standards. Calculations to document equivalent heat loss shall be performed using the procedure and approved *U*-factors contained in Table N1104.1(1).

b. *R*-values used in this table are nominal for the insulation only in standard wood framed construction and not for the entire assembly.

c. Wall insulation requirements apply to all exterior wood framed, concrete or masonry walls that are above grade. This includes cripple walls and rim joist areas. Nominal compliance with R-21 insulation and Intermediate Framing (N1104.5.2) with insulated headers.

d. The wall component shall be a minimum solid log or timber wall thickness of 3.5 inches (90 mm).

e. Below-grade wood, concrete or masonry walls include all walls that are below grade and do not include those portions of such wall that extend more than 24 inches (609.6 mm) above grade. R-21 for insulation in framed cavity; R-15 continuous insulation.

f. Insulation levels for ceilings that have limited attic/rafter depth such as dormers, bay windows or similar architectural features totaling not more than 150 square feet (13.9 m^2) in area may be reduced to not less than R-21. When reduced, the cavity shall be filled (except for required ventilation spaces). R-49 insulation installed to minimum 6-inches depth at top plate at exterior of structure to achieve *U*-factor.

g. Vaulted ceiling surface area exceeding 50 percent of the total heated space floor area shall have a *U*-factor no greater than *U*-0.026 (equivalent to R-38 rafter or scissor truss with R-38 advanced framing).

h. A = Advanced frame construction. See Section N1104.6.

i. Heated slab interior applies to concrete slab floors (both on and below grade) that incorporate a radiant heating system within the slab. Insulation shall be installed underneath the entire slab.

j. Sliding glass doors shall comply with window performance requirements. Windows exempt from testing in accordance with Section NF1111.2, Item 3 shall comply with window performance requirements if constructed with thermal break aluminum or wood, or vinyl, or fiberglass frames and double-pane glazing with low-emissivity coatings of 0.10 or less. Buildings designed to incorporate passive solar elements may include glazing with a *U*-factor greater than 0.35 by using Table N1104.1(1) to demonstrate equivalence to building envelope requirements.

~~k. Reduced window area may not be used as a trade-off criterion for thermal performance of any component.~~

~~**Exception:** Table N1101.1(2), Envelope Measure 6: calculation allows baseline case 15 percent of total wall area as window when design case utilizes window area of less than 15 percent.~~

~~l. Skylight area installed at 2 percent or less of total heated space floor area shall be deemed to satisfy this requirement with vinyl, wood or thermally broken aluminum frames and double-pane glazing with low-emissivity coatings. Skylight *U*-factor is tested in the 20-degree (0.35 rad) overhead plane in accordance with NFRC standards.~~

k.~~m~~. A maximum of 28 square feet (2.6 m^2) of exterior door area per dwelling unit can have a *U*-factor of 0.54 or less.

l.~~n~~. Glazing that is either double pane with low-e coating on one surface, or triple pane shall be deemed to comply with this *U*-0.30 requirement.

m. Minimum 24” horizontal or vertical below grade.

TABLE N1101.1(2)
ADDITIONAL MEASURES

1	**HIGH EFFICIENCY HVAC SYSTEM [a]** a. Gas-fired furnace or boiler AFUE 94%, or b. Air source heat pump HSPF 10.0/14.0 SEER cooling, or c. Ground source heat pump COP 3.5 or Energy Star rated
2	**HIGH EFFICIENCY WATER HEATING SYSTEM [c]** a. Natural gas/propane water heater with minimum UEF 0.90, or b. Electric heat pump water heater with minimum 2.0 COP, or c. Natural gas/propane tankless/instantaneous heater with minimum 0.80 UEF and Drain Water Heat Recovery Unit installed on minimum of one shower/tub-shower
3	**WALL INSULATION UPGRADE** Exterior walls—*U*-0.045/R-21 conventional framing with R-5.0 continuous insulation
4	**ADVANCED ENVELOPE** Windows—*U*-0.21 (Area weighted average), and Flat ceiling [e]—*U*-0.017/R-60, and Framed floors—*U*-0.026/R-38 or slab edge insulation to F-0.048 or less (R-10 for 48"; R-15 for 36" or R-5 fully insulated slab)
5	**DUCTLESS HEAT PUMP** For dwelling units with all electric heat provide: Ductless heat pump of minimum HSPF 10 in primary zone replaces zonal electric heat sources, and Programmable thermostat for all heaters in bedrooms
6	**HIGH EFFICIENCY THERMAL ENVELOPE UA [g]** Proposed UA is 8% lower than the code UA

For SI: 1 square foot = 0.093 m^2, 1 watt per square foot = 10.8 W/m^2.

a. Appliances located within the building thermal envelope shall have sealed combustion air installed. Combustion air shall be ducted directly from the outdoors.
b. All duct joints and seams sealed with listed mastic; tape is only allowed at appliance or equipment connections (for service and replacement). Meet sealing criteria of Performance Tested Comfort Systems program administered by the Bonneville Power Administration (BPA).
c. Residential water heaters less than 55 gallon storage volume.
d. A total of 5 percent of an HVAC system's ductwork shall be permitted to be located outside of the conditioned space. Ducts located outside the conditioned space shall have insulation installed as required in this code.
e. The maximum vaulted ceiling surface area shall not be greater than 50 percent of the total heated space floor area unless vaulted area has a *U*-factor no greater than *U*-0.026.
f. Continuous air barrier. Additional requirement for sealing of all interior vertical wall covering to top plate framing. Sealing with foam gasket, caulk or other approved sealant listed for sealing wall covering material to structural material (example: gypsum board to wood stud framing).
g. Table N1104.1(1) Standard base case design, Code UA shall be at least 8 percent less than the Proposed UA. ~~Buildings with fenestration less than 15 percent of the total vertical wall area may adjust the Code UA to have 15 percent of the wall area as fenestration.~~

TABLE N1101.3
SMALL ADDITION ADDITIONAL MEASURES (Select one)

1	Increase the ceiling insulation of the existing portion of the home as specified in Table N1101.2.
2	Replace all existing single-pane wood or aluminum windows to the *U*-factor as specified in Table N1101.2
3	Insulate the existing floor, crawlspace or basement wall systems as specified in Table N1101.2 and install 100 percent of permanently installed lighting fixtures as CFL, LED, or linear fluorescent or a minimum efficacy of 40 lumens per watt as specified in Section N1107.2.
4	Test the entire dwelling with a blower door and exhibit no more than ~~6.0~~ 4.5 air changes per hour @ 50 Pascals.
5	Seal and performance test the duct system.
6	Replace existing ~~78~~ 80 percent AFUE or less gas furnace with a 92 percent AFUE or greater system.
7	Replace existing electric radiant space heaters with a ductless mini split system with a minimum HSPF of 10.0.
8	Replace existing electric forced air furnace with an air source heat pump with a minimum HSPF of 9.5.
9	Replace existing water heater with a water heater meeting: Natural gas/propane water heater with minimum UEF 0.90, or Electric heat pump water heater with minimum 2.0 COP. ~~Conservation Measure D~~

N1101.4 Information on plans and specifications. Plans and specifications shall show in sufficient detail all pertinent data and features of the building and the equipment and systems as herein governed, including, but not limited to: exterior envelope component materials; *R*-values of insulating materials; HVAC equipment efficiency performance and system controls, lighting, additional measure from Table N1101.1(2), and other pertinent data to indicate conformance with the requirements of this chapter.

SECTION N1102
DEFINITIONS

AFUE (ANNUAL FUEL UTILIZATION EFFICIENCY). The energy output divided by the energy input, calculated on an annual basis and including part load and cycling effects. AFUE ratings shall be determined using the U.S. Department of Energy test procedures (10 CFR Part 430).

AUTOMATIC. Self-acting, operating by its own mechanism when actuated by some impersonal influence, such as a change in current strength, pressure, temperature or mechanical configuration. (See also "Manual.")

BALANCED VENTILATION. Any combination of concurrently operating mechanical exhaust and mechanical

supply whereby the total mechanical exhaust airflow rate is within 10 percent of the total mechanical supply airflow rate.

BASEMENT WALL. The opaque portion of walls which encloses a basement and is partially or totally below grade walls.

BELOW GRADE WALLS. The walls or the portion of walls entirely below the finished grade or which extend 2 feet (610 mm) or less above the finished grade.

BTU (British Thermal Unit). The amount of heat required to raise the temperature of 1 pound (0.454 kg) of water (about 1 pint) from 59ºF to 60ºF (15ºC to 16ºC).

BUILDING THERMAL ENVELOPE. That element of a building which encloses conditioned spaces through which thermal energy may be transmitted to or from the exterior or to or from unconditioned spaces.

C (Thermal Conductance). See "Thermal conductance."

CONDITIONED SPACE. A space within the building, separated from unconditioned space by the ~~exterior~~ building thermal envelope, which by introduction of conditioned air, by heated and/or cooled surfaces, or by air or heat transfer from directly conditioned spaces is maintained at temperatures of 55ºF (13ºC) or higher for heating and/or 85ºF (29.4ºC) or below for cooling. (Enclosed corridors between conditioned spaces shall be considered as conditioned space. Spaces where temperatures fall between this range by virtue of ambient conditions shall not be considered as conditioned space.)

COOLED SPACE. A space within a building provided with a mechanical cooling supply.

EXTERIOR DOOR. A permanently installed operable barrier by which an entry is closed and opened. Exterior doors include doors between conditioned and unconditioned spaces, such as a door between a kitchen and garage.

EXTERIOR ENVELOPE. See "Building envelope."

EXTERIOR WALL. Any member, or group of members, which defines the exterior boundaries of the conditioned space and which has a slope of 60 degrees (1.05 rad) or greater with the horizontal plane.

EXTERIOR WINDOW. An opening, especially in the wall of a building, for admission of light or air that is usually closed by casement or sashes containing transparent material (such as glass) and in some cases capable of being opened and shut. All areas, including frames, in the shell of a conditioned space that let in natural light, including skylights, sliding glass doors, glass block walls and the glazed portions of the doors.

When calculating the energy performance of the exterior envelope, the area of the window shall be the total area of glazing measured using the rough opening dimensions, and including the glass, sash and frame.

FENESTRATION. Windows and doors in the exterior envelope. See the definitions for "Exterior door" and "Exterior window."

FLOOR AREA. The area included within the surrounding exterior walls of a building or portion thereof, exclusive of courts. The floor area of a building or portion thereof, not provided with surrounding exterior walls shall be the usable area under the horizontal projection of the roof or floor above.

GLAZING. All areas including frames in the shell of a conditioned space that let in natural light, including windows, clerestories, skylights, sliding glass doors, glass block walls and the glazed portion of doors.

GROSS AREA OF EXTERIOR WALLS. Consists of wall areas, as measured on the exterior, including foundation walls above grade; peripheral edges of floors; window areas, including sash; and door areas, where such surfaces are exposed to outdoor air and enclose a heated or mechanically cooled space.

HEATED SPACE. A space within a building served by a mechanical, electrical or combustion source of heat. Spaces within a basement shall be defined as heated when any of the following apply: the space is finished, or has heating registers or contains heating devices.

HIGH-~~EFFICACY LAMPS~~ EFFICIENCY LIGHT SOURCE. Compact fluorescent lamps, T-8 or smaller diameter linear fluorescent lamps, LED lamps, fixture-integrated illumination devices, or lamps with a minimum efficacy of not less than 65 lumens per watt, or luminaires with an efficacy of not less than 45 lumens per watt:

~~1. 60 lumens per watt for lamps over 40 watts.~~
~~2. 50 lumens per watt for lamps over 15 watts to 40 watts.~~
~~3. 40 lumens per watt for lamps 15 watts or less.~~

HSPF (HEATING SEASONAL PERFORMANCE FACTOR). The total heating output of a heat pump during its normal annual usage period for heating divided by the total electric power input in watt-hours during the same period.

HUMIDISTAT. An instrument which measures changes in humidity and controls a device or devices to maintain a desired humidity.

HVAC (HEATING, VENTILATING AND AIR-CONDITIONING) SYSTEM. Refers to the equipment, distribution network, and terminals that provide either collectively or individually the processes of heating, ventilating, and/or air-conditioning processes to a building.

K (THERMAL CONDUCTIVITY). See "Thermal conductivity."

MANUAL (nonautomatic). Action requires human intervention as the basis for control (see "Automatic").

OTHER BUILDINGS. All buildings and structures, or portions thereof, that are not defined as residential buildings (see "Residential buildings").

PERM RATING (DRY CUP). The measure of the ability of a material of specific thickness to transmit moisture in terms of the amount of moisture transmitted per unit time for a specified area and differential pressure. Dry cup perm rating is expressed in grains/hr/ft^2, inches of Hg. Permeance may be measured by using ASTM E96-72 or other approved dry cup method. The closer the dry cup perm rating approaches zero, the better the vapor retarder. Permeability is defined as the permeance of a material for specified unit length (perm/in).

***R* (THERMAL RESISTANCE).** See "Thermal resistance."

***Rt* (THERMAL RESISTANCE TOTAL).** See "Thermal resistance total."

RESIDENTIAL BUILDINGS. Buildings and structures, or portions thereof, housing Group R occupancies which are three stories or less in height.

THERMAL CONDUCTANCE (*C*). The constant time rate of heat flow through a unit area of a body induced by a unit temperature difference between the surfaces [Btu/(h · ft^2 · °F)].

It is the reciprocal of thermal resistance (see "Thermal resistance").

THERMAL CONDUCTIVITY (*K*). The rate of heat flow through 1 square foot (0.0929 m^2) of a homogeneous material 1-inch (25.4 mm) thick when there is a temperature difference of 1°F (-17.2°C) between the opposite faces of the material, expressed as Btu/h per square foot per °F temperature difference. Thermal conductivity is similar to thermal conductance (*C*), except thermal conductance applies to the actual thickness of the material.

THERMAL RESISTANCE (*R*). The measure of the resistance of a material or building component to the passage of heat, has the value of (hr · ft^2 · °F)/Btu, and is the reciprocal of thermal conductance.

THERMAL RESISTANCE TOTAL (*Rt*). The sum of the resistance for all of the individual components of the assembly, including framing members, multiple layer connections, insulation and air films expressed in (°F · ft^2 · Btu/h).

THERMAL TRANSMITTANCE (*U*). The coefficient of heat transfer. It is the time rate of heat flow per unit area under steady state conditions from the fluid on the warm side of the barrier to the fluid on the cold side, per unit temperature difference between the two fluids, Btu/(hr · ft^2 · °F).

THERMOSTAT. An instrument that measures changes in temperature and controls a device or devices to maintain a desired temperature.

TOTAL SOLAR RESOURCE FRACTION. The fraction of usable solar energy that is received by the solar panel/collector throughout the year. This accounts for the impacts due to external shading, collector tilt and collector orientation.

***U* (THERMAL TRANSMITTANCE).** See "Thermal transmittance."

VAULTED CEILING. A residential building is a ceiling with a minimum slope of 2 in 12.

WINDOW. See "Exterior window."

ZONE. A space or group of spaces within a building with heating or cooling requirements sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device.

SECTION N1103
ALTERNATIVE SYSTEMS

Alternative designs may be approved by the *building official* when it can be demonstrated that the proposed annual energy consumption will not exceed that of a similar building with similar forms of energy requirements designed in accordance with the provisions of this chapter. The only allowed trade-offs in this analysis are between building envelope components.

Proposed alternative designs submitted as requests for exception to the standard design criteria must be accompanied by an energy analysis prepared in accordance with criteria specified in Part II, Alternative Systems Analysis.

N1103.1 Design parameters. For calculations under this section, the following design parameters shall apply:

The outside temperature shall be taken from the 99-percent winter temperature values and the 1-percent summer temperature values listed in ASHRAE *Handbook of Fundamentals*. For areas not listed, the designer should obtain the most reliable design temperatures available. Selected values are subject to approval of the *building official*.

SECTION N1104
EXTERIOR ENVELOPE REQUIREMENTS

N1104.1 General. This section provides, minimum requirements for exterior envelope construction.

Exterior building envelope shall comply with Table N1101.1(1) or may be demonstrated using Table N1104.1(1). The requirements specified in Table N1101.1(2) shall apply to both Tables N1101.1(1) and N1104.1(1).

Buildings designed to incorporate passive solar elements may use Table N1104.1(1) to demonstrate building envelope requirements in this code, in addition to requirements specified in Table N1101.1(2).

N1104.2 Insulation materials. Insulation materials shall be installed in accordance with manufacturer's listing and installation instructions and this code. Insulation *R*-values shall be specified as required in 16 CFR Ch. I (1-1-91 Edition) Part 460—Labeling and Advertising of Home Insulation. Cellulose insulation shall conform to Interim Safety Standard for Cellulose Insulation (16 CFR Part 1209) issued by the Consumer Product Safety Commission July 6, 1979 (44FR 39938). Foam plastic shall be as specified in Section R316.

N1104.2.1 Insulation clearance restriction. Blown, poured, batt and spray-on type insulation applied from above the ceiling level shall be limited ~~in~~ to vented attic spaces where roof slope is 4 units vertical in 12 units horizontal (33.3-percent slope) or greater and there is at least 44 inches (1118 mm) of headroom at the roof ridge. (Clear headroom is defined as the distance from the top of the bottom chord of the truss or ceiling joists to the underside of the roof sheathing.) Netted or other applications that allow for verification of insulation application shall be allowed for low-slope roofs.

N1104.2.2 Batt-type insulation. Batt-type insulation shall be installed flush against the warm side of the cavity insofar as practicable.

N1104.2.3 Insulation protection. Insulation exposed to the exterior shall be protected from physical and solar damage.

N1104.2.4 Clearances. Recessed light fixtures shall be IC-labeled for direct insulation contact.

Thermal insulation shall not be installed within 3 inches (76 mm) of any metal chimney or gas vent that is not listed for insulation clearances.

A permanent sleeve of fine wire mesh screen, sheet metal or other noncombustible material shall be installed to maintain the required clearances.

N1104.2.5 Baffles. Baffles of a durable rigid material shall be provided to prevent obstruction of vent openings and to deflect incoming air above the surface of porous insulation so as to prevent wind-washing and blowing of loose material. Thermal insulation shall not be installed in a manner that would obstruct openings required for attic ventilation.

~~**N1104.2.6 Air barriers.** An air barrier shall be provided on every vertical portion of air permeable insulation and on the warm side of horizontal, air-permeable insulation.~~

~~**Exception:** Unvented attics, continuous insulation walls and similar conditions where an impermeable insulation layer forms an air barrier.~~

N1104.2.6 ~~**N1104.2.7**~~ **Below grade exterior insulation.** Below grade exterior insulation shall meet the following conditions:

1. The insulation shall be a material that is approved for below grade applications in wet environments.
2. Insulation shall be installed from the top of the footing to the top of the concrete basement wall.
3. Insulation shall be adequately protected from the elements (ultraviolet and mechanical) in accordance with manufacturer's specifications.
4. The top of the insulation shall be installed in a manner to allow water run-off and prevent pooling.

N1104.2.7 ~~**N1104.2.8**~~ **Recessed lighting fixtures.** Recessed lighting fixtures installed within the building envelope shall meet one of the following requirements.

1. Type IC-rated, manufactured with no penetrations between the inside of the recessed fixture and ceiling cavity, and the annular space between the ceiling cutout and lighting fixture shall be sealed.
2. Type IC-rated in accordance with ASTM E283 with no more than 2.0 cubic feet per minute (cfm) (0.944 L/s) air movement from the conditioned space to the ceiling cavity at 1.57 psi pressure (75 Pa) difference shall be labeled and the annular space between the ceiling cutout and lighting fixture shall be sealed.
3. Type IC-rated installed inside a sealed box constructed from a minimum 0.5-inch-thick (12.7 mm) gypsum wallboard or constructed from a preformed polymeric vapor retarder or other air-tight assembly manufactured for this purpose.

N1104.2.8 ~~**N1104.2.9**~~ **Doors and pull-down stairs to unconditioned spaces.** Service doors between unconditioned and conditioned spaces shall meet the thermal requirements of Sections N1104.2.9.1 and N1104.2.9.2.

N1104.2.8.1 ~~**N1104.2.9.1**~~ **Vertical doors.** *U*-factors for vertical doors providing access from conditioned to unconditioned spaces shall comply with the exterior door provisions of Table N1101.1(1).

N1104.2.8.2 ~~**N1104.2.9.2**~~ **Pull-down stairs.** Horizontal pull-down stair-type access hatches in ceiling assemblies that provide access from conditioned to unconditioned spaces shall have a maximum average *U*-factor of *U*-0.10 or an *R*-value of not less than R-10, have a net area of the framed opening not exceeding 13.5 square feet, and have the perimeter of the hatch weather-stripped.

N1104.3 Exterior doors. Doors shall be tested according to the requirements of Section N1104.4. When calculating the energy performance of the exterior envelope, the area of doors shall be the actual unit size.

Exceptions:

1. Unglazed doors that are not tested according to the requirements of Section N1104.4 shall be assigned a default *U*-value of 0.54.
2. Sliding glass doors and swinging glass doors shall meet the specifications for windows and shall be treated as such.
3. Doors that incorporate glazed areas more than 2.5 square feet (0.23 m^2) in area shall be considered exterior doors with greater than or equal to 2.5 square feet (0.23 m^2) glazing. Doors shall meet the air leakage requirements of Section N1104.8.

N1104.4 Windows. All windows installed in Oregon shall meet the requirements of Part III, Fenestration Standard.

1. Decorative or unique architectural feature glazing not exceeding 1 percent of the heated space floor area is exempt from thermal performance requirements and does not need to be included in Table N1104.1(1) calculations.
2. Glass block assemblies may use a *U*-factor of 0.51.
3. The *U*-factor for windows may be a weighted average of total window area when all other building envelope measures are in compliance with performance requirements specified in this code. This calculation shall be provided to the building official and the windows that are less than required for prescriptive compliance shall be identified on the plans.

N1104.4.1 Thermal performance labeling. Labels shall be either:

1. National Fenestration Rating Council (NFRC) certified product; or
2. State-approved for windows produced in low volume. All windows shall have labeling:
   - 2.1. That is imprinted, not handwritten,
   - 2.2. Facing the interior of the room,
3. Attached to the window until the building inspector inspects and verifies the labeling, and
4. List the *U*-factor.

   Exceptions:

   1. Labeling is not required for decorative or unique architectural feature glazing not exceeding 1 percent of the heated space floor area.
   2. Portions of labels for windows produced in low volume may be handwritten.

TABLE N1104.1(1)
RESIDENTIAL THERMAL PERFORMANCE CALCULATIONS

BUILDING COMPONENTS [b]	STANDARD BASE CASE [a]			PROPOSED A		ALTERNATIVE	
	Areas [c]	*U*-factor	Areas × *U*	*R*-value[d]	Areas [c]	*U*-factor [e]	Areas x *U*
Flat ceilings		0.021					
Vaulted ceilings [f]		0.033					
Conventional wood-framed walls		0.059					
Underfloor		0.033					
Slab edge		F = 0.52[g]					
Below grade walls		C = 0.063[g]					
Windows		~~0.30~~ 0.27					
Skylights		0.50					
Exterior doors [h]		0.2					
Doors with > 2.5 ft^2 glazing		0.4					
CODE UA =				Proposed UA [i] =			

a. Base path 1 represents Standard Base Case from Table N1101.1(1). *U*-factors shall be adjusted to match selected Envelope Measure [Table N1101.1(2)].

b. Performance trade-offs are limited to those listed in column 1. Heat plant efficiency, duct insulation levels, passive and active solar heating, air infiltration and similar measures including those not regulated by code may not be considered in this method of calculation.

c. Areas from plan take-offs. All areas must be the same for both Standard Base Case and Proposed Alternate. The vaulted ceiling surface area for Standard Base Case must be the actual surface area from the plan take-off not to exceed 50 percent of the total heated space floor area. Any roof areas in excess of 50 percent for Base Case must be entered at *U*-0.021 (R-49) with "Flat Ceilings" area.

d. Minimum Component Requirements in so far as practicable: Walls R-15/*U*-0.080; Floors R-21/*U*-0.047; Flat Ceilings R-38/*U*-0.031; Vaults R-21/*U*-0.055; Below-Grade Wood, Concrete or Masonry Walls R-15/C-0.069; Slab Edge R-10/F-0.52; Duct Insulation R-8. *R*-values used in this table are nominal, for the insulation only and not for the entire assembly. Window and skylight *U*-values shall not exceed 0.65 (CL65). A single door not to exceed 28 square feet (2.6 m^2) per dwelling unit is permitted to be excluded from the thermal performance calculations. All other Door-values shall not exceed 0.54 (Nominal R-2).

e. *U*-factors for wood frame ceilings, walls and floor assemblies shall be as specified in Table N1104.1(2). *U*-factors for other assemblies, which include steel framing, brick or other masonry, stucco, etc., shall be calculated using ASHRAE *Handbook of Fundamentals procedures*.

f. Vaulted area, unless insulated to R-38, 0.027, may not exceed 50 percent of the total heated space floor area.

g. F = The heat loss coefficient, Btu/h/ft^2/°F per foot of perimeter. C= the heat loss coefficient Btu/h/ft^2-°F per square foot of underground wall.

h. A maximum of 28 square feet (2.6 m^2) of exterior door area per dwelling unit can have a *U*-factor of 0.54 or less. Default *U*-factor for an unglazed wood door is 0.54.

i. Proposed UA must be less than or equal to CODE UA. For compliance with Envelope Measure 6, the Proposed UA must be a minimum of 8 percent less than the CODE UA.

TABLE N1104.1(2)
APPROVED DEFAULT *U*-FACTORS

FLAT CEILINGS [a]		
Insulation	**Type**	***U*-Factor**
R-38	Conventional framing	0.027
R-38	Advanced framing [c]	0.026
R-49	Conventional framing	0.021
R-49	Advanced framing [c]	0.020
R-60	Conventional framing	0.017
VAULTED CEILINGS [a]		
Insulation	**Type**	***U*-Factor**
R-21	Rafter framings	0.050
R-30	Rafter framing	0.032
R-38	Rafter framing	0.026
R-21	Scissors truss	0.052
R-30	Scissors truss	0.034
R-38	Scissors truss	0.027
R-49	Scissors truss	0.021
R-30	Advance scissors truss [c]	0.032
R-38	Advance scissors truss [c]	0.026
R-49	Advance scissors truss [c]	0.020
EPS FOAM CORE PANEL VAULTED CEILINGS		
Insulation	**Type**	***U*-Factor**
R-29	$8^1/_4$″ EPS foam core panel	0.034
R-37	$10^1/_4$″ EPS foam core panel	0.027
R-44	$12^1/_4$″ EPS foam core panel	0.023
FLOORS [a]		
Insulation	**Type**	***U*-Factor**
R-21	Underfloor	0.046
R-25	Underfloor	0.039
R-30	Underfloor	0.033
R-38	Underfloor	0.026
SLAB-ON-GRADE		
Insulation	**Type**	***F*-Factor [f]**
R-10	Slab edge 24”	0.54
R-15	Slab edge 24”	0.52
EPS FOAM CORE PANEL EXTERIOR WALLS		
Insulation	**Type**	***U*-Factor**
R-14.88	$4^1/_2$″ EPS foam core panel	0.059
R-22.58	$6^1/_4$″ EPS foam core panel	0.040
R-29.31	$8^1/_4$″ EPS foam core panel	0.031
BELOW GRADE WALLS		
Insulation	**Type**	***C*-Factor**
R-10 c.i.	R-10 continuous insulation	0.085
R-15 c.i.	R-15 continuous insulation	0.063
R-13	R-13 cavity and air space	0.080
R-21	R-21 cavity and air space	0.063

EXTERIOR WALLS[a]			
Insulation	**Insulation Sheathing**	**Framing**	***U*-Factor**
R-15	0	Conventional framing	0.083
R-15	0	Intermediate framing[b]	0.078
R-19	0	Conventional framing	0.067
R-19	0	Intermediate framing[b]	0.063
R-19	0	Advance framing[d]	0.062
R-21	0	Conventional framing	0.063
R-21	0	Intermediate framing[b]	0.059
R-21	0	Advance framing[d]	0.057
R-13	3.5[e]	Conventional framing	0.065
R-13	5[e]	Conventional framing	0.059
R-13	7[e]	Conventional framing	0.053
R-13	3.5[e]	Advance framing [d]	0.062
R-13	5[e]	Advance framing [d]	0.056
R-13	7[e]	Advance framing [d]	0.050
R-15	3.5[e]	Conventional framing	0.062
R-15	5[e]	Conventional framing	0.056
R-15	7[e]	Conventional framing	0.050
R-15	3.5[e]	Advance framing [d]	0.057
R-15	5[e]	Advance framing [d]	0.052
R-15	7[e]	Advance framing [d]	0.047
R-19	3.5[e]	Conventional framing	0.052
R-19	5[e]	Conventional framing	0.048
R-19	7[e]	Conventional framing	0.044
R-19	3.5[e]	Advance framing [d]	0.049
R-19	5[e]	Advance framing [d]	0.046
R-19	7[e]	Advance framing [d]	0.042
R-21	3.5[e]	Conventional framing	0.049
R-21	5[e]	Conventional framing	0.045
R-21	7[e]	Conventional framing	0.041
R-21	3.5[e]	Advance framing [d]	0.046
R-21	5[e]	Advance framing [d]	0.043
R-21	7[e]	Advance framing [d]	0.039

For SI: 1 inch = 25.4 mm.

a. *U*-factors are for wood frame construction. *U*-factors for other assemblies which include steel framing, brick or other masonry, stucco, etc., shall be calculated using standard ASHRAE *Handbook of Fundamentals* procedures.

b. Intermediate framing consists of wall studs placed at a minimum 16 inches (406 mm) on center with insulated headers. Voids in headers shall be insulated with rigid insulation having a minimum *R*-value of 4 per 1-inch (25.4 mm) (W/m^3-k) thickness.

c. Advanced framing construction for ceilings as defined in Section N1104.6.

d. Advanced framing construction for walls as defined in Section N1104.5.1

e. Insulation sheathing shall be rigid insulation material, installed continuously over entire exterior or interior of wall (excluding partition walls).

f. *F*-Factor is heat loss coefficient in Btu/h/°F per lineal foot of concrete slab perimeter for 24 inches (610 mm) below grade.

N1104.4.2 Combined products. When different window types are combined, mulled together by the manufacturer or manufactured to fit a framed rough opening, a single label may be used.

Exception: A solarium shall have one label providing a description of each of the glazed surfaces, such as the front, overhead and each side.

N1104.4.3 Air leakage requirements. ~~Windows shall comply with the air leakage requirements of Section N1104.8.~~ Air infiltration rates for all exterior windows, swinging doors and sliding glass doors shall be certified in accordance with ASTM E283 "Standard Test Methods for Rate of Air Leakage through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen." Tests shall be conducted at a differential pressure of 1.57 pounds per square foot (75 Pa) [equivalent to 25 mph (40 km/h) wind condition].

1. Windows—0.37 cubic feet per minute (cfm) per foot (0.17 L/s per m) of sash crack.
2. Swinging doors—0.37 cfm per square foot (0.17 L/s per m^2) of door area.
3. Sliding doors—0.37 cfm per square foot (0.17 L/s per m^2) of door area.

Exception: Site-built windows.

N1104.4.4 Alterations. New windows shall have a maximum *U*-factor as required by Table N1101.1(1).

Exceptions:

1. Decorative or unique architectural feature glazing not exceeding 1 percent of the heated space floor area may be exempt from thermal performance requirements and Table N1104.1(1) calculations.
2. Where necessary to retain architectural consistency with remaining windows in the building, new windows shall have a maximum *U*-value of 0.65.

N1104.5 Walls.

N1104.5.1 Advanced framing for walls. Advanced framing for walls is an optional construction method. Advanced framing, when used to qualify a design under the requirements of Table N1104.1(1), shall meet the following requirements:

1. Walls. Walls shall be framed with 2 × studs at 24 inches (610 mm) on center and shall include the following, as detailed in Items 2 and 3.
2. Corners and intersections. Exterior wall and ceiling corners shall be fully insulated through the use of three-stud corners configured to allow full insulation into the corner, or two-stud corners and drywall backup clips or other approved technique. Intersections of interior partition walls with exterior walls shall be fully insulated through the use of single backer boards, mid-height blocking with drywall clips or other approved technique.
3. Headers. Voids in headers 1 inch (25.4 mm) or greater in thickness shall be insulated with rigid insulation that has a value of R-4 per 1 inch (25.4 mm) or greater. Nonstructural headers (such as in gable-end walls) can be eliminated and replaced with insulation to achieve equivalent levels as the surrounding area.

N1104.5.2 Intermediate framing for walls. Intermediate framing for walls is an optional construction method. Intermediate framing, when used to achieve improved wall performance under the requirements of Table 1101.1(1) or Table N1104.1(2), shall meet the following requirements:

1. Walls. Walls shall be framed with 2 × studs at 16 inches (610 mm) on center and shall include the following, as detailed in Items 2 and 3.
2. Corners and intersections. Exterior wall and ceiling corners shall be fully insulated through the use of three-stud corners configured to allow full insulation into the corner, or two-stud corners and drywall backup clips or other approved technique. Intersections of interior partition walls with exterior walls shall be fully insulated through the use of single backer boards, mid-height blocking with drywall clips or other approved technique.
3. Headers. Voids in headers 1 inch (25.4 mm) to 2 inches (51 mm) ~~or greater~~ in thickness shall be insulated with ~~rigid~~ insulation that has a value of R-4 or greater per 1 inch (25.4 mm) thickness. Voids in headers greater than 2 inches (51 mm) in depth shall be insulated to a minimum level of R-10. Nonstructural headers (such as in gable-end walls) ~~can~~ shall be eliminated and replaced with insulation to achieve equivalent thermal performance levels as the surrounding area.

N1104.5.3 Below-grade walls. Walls enclosing heated spaces below grade shall be insulated from the bottom of the above-grade sub-floor downward to the top of the below-grade finished floor.

N1104.6 Roof/ceiling: advanced framing for ceilings. Advanced framing for ceilings is an optional construction method. Advanced framing, when used to qualify a design under the requirements of Section N1104.1, shall meet the following requirements.

Framing techniques shall be used in attics and ceilings to provide full insulating value to the outside of exterior walls. This may be accomplished through the use of extra-depth or oversized trusses, double rafters, special insulation components installed at the edge of the wall, or other approved combinations of framing and insulation. The entire surface of the exterior ceiling shall be insulated to the required value including attic hatches, structural members, electrical fixtures (where allowed by the code) and plumbing penetrations.

N1104.7 Slab-on-grade floors. For slab-on-grade floors, the perimeter of the floor shall be insulated.

The insulation shall extend downward from the top of the slab for a minimum of 24 inches (610 mm) or downward to the bottom of the slab, then horizontally beneath the slab for a minimum total distance of 24 inches (610 mm).

Exception: For monolithic slabs, the insulation shall extend downward from the top of the slab to the bottom of the thickened edge.

N1104.7.1 Slab-on-grade floors with hydronic heat. For slab-on-grade floors that incorporate hydronic heating, in addition to perimeter insulation, the entire underside of slab shall be insulated to R-10.

N1104.8 Air leakage. The building thermal envelope shall be constructed to limit air leakage in accordance with this section.

N1104.8.1 Air barriers. A continuous air barrier shall be installed and fully aligned with the building thermal envelope on every vertical portion of air-permeable insulation and on the warm side of horizontal, air-permeable insulation. Air-permeable insulation shall not be used as a sealing material.

Exception: Unvented attics, continuous insulation walls, and similar conditions where an impermeable insulation layer forms an air barrier.

N1104.8.2 Sealing required. Exterior joints around windows and door frames, between wall cavities and window or door frames, between wall and foundation, between wall and roof, between wall panels, at penetrations or utility services through walls, floors and roofs and all other openings in the exterior envelope shall be sealed in a manner approved by the *building official*. See Table N1104.8 for a list of minimum air sealing locations.

N1104.8.2.1 Top plate sealing. At all walls in contact with vented attics, the wall covering (gypsum board or other) shall be sealed to the top plate with caulk, sealant, gasket or other *approved* material.

N1104.9 Moisture control. To ensure the effectiveness of insulation materials and reduce the hazard of decay and other degradation due to condensation within the structure, moisture-control measures shall be included in all buildings and structures or portions thereof regulated by this chapter.

N1104.9.1 Vapor retarders. Vapor retarders shall be installed in accordance with Section R318.

N1104.9.2 Ground cover. A ground cover shall be installed in the crawl space for both new and existing buildings when insulation is installed. Ground cover shall be installed in accordance with Chapter 4.

SECTION N1105
HEATING, VENTILATING AND AIR-CONDITIONING SYSTEMS

N1105.1 General. This section provides minimum requirements for heating, ventilating and air-conditioning systems.

N1105.2 Insulation of ducts. All new duct systems, or new portions thereof, exposed to unconditioned spaces, and buried ductwork within insulation that meets the exception to Section N1105.3 shall be insulated ~~according to Table N1101.1(1)~~ to minimum R-8.

Exceptions:

1. The replacement or addition of a furnace, air conditioner or heat pump shall not require existing ducts to be insulated to current code.
2. Exhaust and intake ductwork.

N1105.3 Installation of ducts. All new duct systems and air handling equipment and appliances shall be located fully within the building thermal envelope.

Exceptions:

1. Ventilation intake ductwork and exhaust ductwork.
2. Up to 5 percent of the length of an HVAC system ductwork shall be permitted to be located outside of the thermal envelope.
3. Ducts deeply buried in insulation in accordance with N1105.3.1.

N1105.3.1 Ducts deeply buried in insulation. Duct systems not located fully within the thermal envelope shall be considered deeply buried where meeting all of the following conditions:

1. Ducts must be located directly on the ceiling or where a duct is located on a truss bottom chord, the bottom of the duct shall be located no more than 6 inches (152 mm) above the ceiling.
2. Insulation shall be installed to fill gaps and voids between the duct and the ceiling, and a minimum of R-19 insulation shall be installed above the duct between the duct and unconditioned attic.
3. Insulation depth marker flags shall be installed on the ducts every 10 feet (3048 mm) or as *approved* by the *building official*.

N1105.3 HVAC controls. All heating, ventilating and air-conditioning systems shall be provided controls as specified herein.

N1105.3.1 Temperature. Each heating, ventilating and air-conditioning system shall be provided with at least one thermostat for the regulation of temperature. Each thermostat shall be capable of being set from 55ºF to 75ºF (13ºC to 24ºC) where used to control heating only and from 70ºF to 85ºF (21ºC to 29ºC) where used to control cooling only. Where used to control both heating and cooling, it shall be capable of being set from 55ºF to 85ºF (13ºC to 29ºC) and shall be capable of operating the system heating and cooling in sequence. It shall be capable of providing a temperature range of at least 5ºF (-15ºC) within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

N1105.3.2 Humidity. If a heating, ventilating and air-conditioning system is equipped with a means for adding moisture to maintain specific selected relative humidity in spaces or zones, a humidistat shall be provided. This device shall be capable of being set to prevent new energy from being used to produce space relative humidity above 30 percent. Where a humidistat is used in a heating, ventilating and air-conditioning system for controlling moisture removal to maintain specific selected relative humidity in spaces or zones, it shall be capable of being set to prevent new energy from being used to produce a space-relative humidity below 60 percent.

N1105.3.3 Temperature zoning. Each separate heating, ventilating and air-conditioning system shall be provided at least one thermostat for regulation of space temperature. In addition, a readily accessible manual or automatic means shall be provided to partially restrict or shut off the heating or cooling input to each zone or floor, excluding unheated or non-cooled basements and garages.

N1105.3.4 Setback and shutoff. The thermostat, or an alternative means such as switch or clock, shall provide a readily accessible manual or automatic means for reducing the

energy required for heating and cooling during periods of nonuse or reduced need.

Exceptions:

1. Where it can be shown that setback or shutdown will not result in a decrease in overall building energy.
2. Equipment with full load demand of 2 kilowatt (6.826 Btu/h) or less may be controlled by readily accessible off-hour controls.

Lowering thermostat set points to reduce energy consumption of heating system shall not cause energy to be expended to reach the reduced setting.

N1105.3.4.1 Heat pump controls. All heat pump system thermostats shall be capable of manual setback and limiting the use of supplemental heat during warm-up periods.

N1105.3.4.1.1 Outdoor thermostat required. An outdoor thermostat or factory installed temperature sensor with electronic controls shall be used to lock out supplemental heat based on outdoor air temperature. The lock-out temperature shall be set at 400ºF (40ºC). There shall be no compressor lock-out temperature.

N1105.4 Outside combustion air. See Section R1006 for required outside combustion air for masonry fireplaces, factory-built fireplace(s) and factory-built stoves.

N1105.5 Equipment performance requirements.

~~**N1105.5.1 Exhaust fans.** Bathroom exhaust fans shall be Energy Star Labeled.~~

N1105.5.1 Ventilation Fan Efficiency. Bathroom exhaust fans and outdoor ventilation air supply fans shall be Energy Star certified.

N1105.6 Heat recovery ventilator. Whole house ventilation systems shall include an energy recovery ventilator with a fan efficiency of not less than 1.2 cfm/watt and a heat recovery rating of not less than 66 percent.

Exception: Whole house ventilation systems that meet the exception to Section M1505.4.3 for the 30 percent ventilation rate reduction.

SECTION N1106
PIPING INSULATION

N1106.1 Mechanical system piping insulation. Mechanical system piping capable of carrying fluids above 105ºF (40.5ºC) or below 55ºF (13ºC) shall be insulated to a minimum of R-3.

N1106.2 Domestic and service hot water systems. Domestic hot water piping ~~located outside the building thermal envelope~~ shall be insulated to a minimum of R-3~~.~~ at the following locations:

1. Pipe located outside the building thermal envelope.
2. The first 8 feet (2438 mm) of pipe into and out of a water heater.
3. Recirculating water piping.

SECTION N1107
LIGHTING

N1107.1 General. The provisions of this section apply to lighting equipment, related controls and electric circuits serving all conditioned and unconditioned interior floor space and exterior building facades of all dwelling units and guest rooms within residential buildings and structures, or portions thereof.

N1107.2 High-efficiency interior lighting ~~efficacy lamps~~. All permanently installed lighting fixtures shall be *high efficiency light sources* ~~contain high efficacy lamps. Screw-in compact fluorescent and LED lamps comply with this requirement~~.

The building official shall be notified in writing at the final inspection that the permanently installed lighting fixtures have met this requirement.

Exception: Two permanently installed lighting fixtures are not required to ~~have high efficacy lamps.~~ be high-efficiency light sources when controlled by a dimmer or automatic control.

N1107.3 High-~~efficacy~~ efficiency exterior lighting. All exterior lighting fixtures affixed to the exterior of the building shall ~~contain~~ be high-~~efficacy lamps~~ efficiency light sources.

Exception: Two permanently installed lighting fixtures are not required to ~~have high efficacy lamps~~ be high-efficiency light sources when controlled by automatic control.

N1107.4 Solar ready. ~~Reserved. This section will be updated with an interim amendment. See Oregon.gov/bcd.~~ A square metal junction box not less than 4 inches by 4 inches (102 mm by 102 mm) with a metal box cover shall be provided within 24 inches (610 mm) horizontally or vertically of the main electrical panel. A minimum ¾-inch metal raceway shall extend from the junction box to a capped roof termination or to an accessible location in the *attic* with a vertical clearance of not less than 36 inches (914 mm). Where the raceway terminates in the attic, the termination shall be located not less than 6 inches (152 mm) above the insulation. The end of the raceway shall be marked as "RESERVED FOR SOLAR."

~~**N1107.5 Electric vehicles.** Reserved. This section will be updated with an interim amendment. See Oregon.gov/bcd.~~

SECTION N1108
PLUMBING FIXTURE EFFICIENCY

N1108.1 General. This section shall apply to plumbing fixture efficiency.

N1108.1.1 ~~**Water closets.**~~ **Fixture efficiency.** Fixture efficiency shall be per the *Plumbing Code*. ~~Water closets shall be EPA WaterSense labeled, with an effective flush volume not exceeding 1.28 gallons per flush~~.

~~**N1108.1.2 Shower heads.** Shower heads shall be EPA WaterSense labeled, with maximum flow rate not exceeding 2.0 gallons per minute.~~

TABLE N1104.8
AIR BARRIER INSTALLATION AND AIR SEALING REQUIREMENTS

COMPONENT	AIR BARRIER CRITERIA
General requirements	A continuous air barrier shall be installed in alignment with the building thermal envelope.
	Breaks or joints in the air barrier shall be sealed.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the air barrier shall be sealed.
	Access openings, drop down stairs, or knee wall doors to unconditioned attic spaces shall be gasketed and sealed.
Walls	The junction of the foundation and sill plate shall be sealed.
	The junction of the top plate and the top of interior walls shall be sealed between wall cavities and windows or door frames.
	All penetrations or utility services through the top and bottom plates.
	Knee walls shall be sealed.
Windows, skylights and doors	The space between framing and skylights, and the jambs of windows and doors shall be sealed.
Rim/band joists	Rim/band joists shall be a part of the thermal envelope and have a continuous air barrier.
Floors Including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge of insulation.
Crawl space walls	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shafts opening to exterior or unconditioned space shall be sealed.
Garage separation	Air sealing shall be provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope shall be sealed to the finished surface.
Shower/tub on exterior walls	The air barrier installed at exterior walls adjacent to showers and tubs shall separate the wall from the shower or tub.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed.
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.
Concealed sprinklers	Where required to be sealed, concealed fire sprinklers shall only be sealed in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.

SECTION NA1109
ALTERNATIVE SYSTEMS ANALYSIS

This section provides an alternative method of demonstrating code compliance with this chapter by demonstrating that such deviation will result in an annual energy consumption equal to or less than a building that is in compliance with this chapter.

NA1109.1 ~~Equivalent~~ Annual energy consumption. The baseline design, conforming to requirements specified in this chapter and the proposed design shall be analyzed using the same procedures. The analyses shall use equal floor area and equal environmental requirements. The comparison shall be expressed in Btu input per gross building square foot of conditioned space per year (MJ/m^2 per year). The annual energy use of the proposed building shall be 8 percent less than the code baseline prescriptive requirements without the application of additional measures in accordance with Table N1101.1(2).

NA1109.2 Basis for comparison. Both baseline and proposed alternative designs shall include parameters as specified in Table NA1109.2.

NA1109.2.1 Internal heat gain. The total internal heat gain shall be calculated by Equation NA1109.2.1(1). For single zone calculations, the daily total sensible internal gains (Btu/day) shall be determined by Equation NA1109.2.1(2). For multiple zone HVAC systems, the daily total sensible internal gains (Btu/day) shall be determined by Equation NA1109.2.1(2) for the living zone and Equation NA1109.2.1(3) for the sleeping zone. The daily total latent load for each zone shall be determined using Equation NA1109.2.1(4).

Internal heat gains shall be distributed over the day according to the profile in Table NA1109.2.

Where multiple zone space conditioning is modeled, the profile shown for Zone 2 shall be used for bedrooms and bathrooms; the profile shown for Zone 1 shall be used for all other conditioned rooms. Where single zone space conditioning is modeled, the hourly profile for single-zone designs shall be used.

Equation NA1109.2.1(1)

Total Heat Gains = Sensible Heat Gains + Latent Heat Gains

Equation NA1109.2.1(2)

Single Zone or Living Zone: Sensible Heat Gains = (Floor Area of Zone 15 Btu/day ft^2) + (Number of living units 20,000 Btu/day)

Equation NA1109.2.1(3)

Sleeping Zone: Sensible Heat Gains = Floor Area of Zone 15 Btu/day ft^2

Equation NA1109.2.1(4)

Latent Heat Gains = 0.2 Sensible Heat Gains

TABLE NA1109.2
BASIS FOR COMPARISON

INPUT PARAMETERS FOR ANALYSIS		
Parameter	**Proposed Building**	**Code Baseline**
Building Envelope		
Opaque construction materials	As designed	Code minimum
Fenestration performance	As designed	Code minimum
Shading devices	As designed	Same as proposed
Window area	As designed	Same as proposed
Skylight area	As designed	Same as proposed[~~b~~a]
Building orientation	As designed	Same as proposed
Solar gain	As designed	Same as proposed
Building infiltration	0.3~~5~~ ACH Natural	Same as proposed
HVAC Systems		
HVAC system type(s)	As designed	Same as proposed
HVAC efficiency	Code efficiencies[~~c~~b]	Same as proposed[~~c~~b]
Heating fuel	As designed	Same as proposed
Cooling fuel	As designed	Same as proposed
Temperature setpoints	As designed	Same as proposed
Equipment capacity	As designed	Same as proposed
Mechanical ventilation	As designed	Same as proposed
Lighting		
Artificial lighting	As designed	Code required
Daylighting	As designed	Same as proposed
Design Conditions		
Building occupancy	As designed	Same as proposed
Building operational schedules	As designed	Same as proposed
Climatic data	As designed	Same as proposed
Internal loads	As designed	Same as proposed
Cooking fuel	As designed	Same as proposed

~~a. For a single-family dwelling unit, detached or attached (townhouse) only, code baseline window area may be 13 percent of heated space floor area when proposed building has less than 13 percent of heated space floor area in windows.~~

a. ~~b.~~ Code baseline skylight area shall be same as proposed up to a maximum of two percent of the heated space floor area.

b. ~~c.~~ Systems not regulated by code, such as electric heat, shall comply with standard equipment efficiency for such equipment.

NA1109.2.2 Thermostat set-points. In the analysis for both the baseline and proposed designs, all conditioned spaces shall be maintained at the specified thermostat setpoints at all times except for minor deviations at thermostat setback and setup and when outdoor conditions exceed normal design conditions.

If the specified equipment in the proposed design is too small to meet the load, its capacity shall be increased in the calculations. If equipment to meet a load is not included in the design, such equipment shall be assumed in the calculations and its energy use included. In no case shall the energy use of proposed design be reduced by not conditioning its spaces.

For central space conditioning systems without zonal control, the entire conditioned floor area shall be on thermostatically controlled zone. The thermostat settings shall

be those listed for a single zone in Table NA1109.2.2. For multiple zone designs, the multi-zone thermostat settings in Table NA1109.2.2 shall be used. Zone 1 represents all conditioned spaces other than Zone 2 (bedrooms and bathrooms). The effect of heat transfer between zones, including nonclosable openings shall be included in the calculation

TABLE NA1109.2.2
THERMOSTAT SETTINGS (°F)

TIME OF DAY	SINGLE ZONE		MULTIPLE ZONE			
			Zone 1 Living		Zone 2 Sleeping	
	Heat	Cool	Heat	Cool	Heat	Cool
6 – 9 a.m.	68	78	68	78	68	78
9 a.m. – 5 p.m.	68	78	68	78	60	85
5 – 11 p.m.	68	78	68	78	68	78
11 p.m. – 6 a.m.	60	78	60	85	60	78

N**A1109.3 Analysis procedure.** The analysis of the annual energy usage of the standard and the proposed alternative building and system designs shall meet the following criteria:

NA1109.3.1 The building heating/cooling load calculation procedure used for annual energy consumption analysis shall be of sufficient detail to permit the evaluation of effect of building data (such as orientation, size, shape, transfer characteristics of mass, air, moisture, and heat) and hourly climatic data.

NA1109.3.2 The calculation procedure used to simulate the operation of the building and its service systems through a full year operating period shall be of sufficient detail to permit the evaluation of the effect of system design, climatic factors operational characteristics, and mechanical equipment on annual energy usage. Manufacturer's data or comparable field test data shall be used when available in the simulation of all systems and equipment. The calculation procedure shall be based on 8760 hours of operation of the building and its service systems and shall utilize techniques recommended in the appropriate ASHRAE publications or produce results consistent with such recommended procedures.

NA1109.3.2.1 The calculation procedure shall explicitly cover the following items:

1. Climatic data: coincident hourly data for temperatures, solar radiation, wind and humidity of typical days in the year representing seasonal variation.
2. Building data: orientation, size, shape, mass, air, moisture and heat transfer characteristics.
3. Operational characteristics: temperature, humidity, ventilation, illumination, control mode for occupied and non-occupied hours.
4. Mechanical equipment: design capacity, part load profile.
5. Internal heat generation: lighting, equipment, number of people during occupied and non-occupied periods.

NA1109.4 Documentation. Proposed alternative designs, submitted as requests for exception to the standard design criteria, shall be accompanied by an energy analysis comparison report prepared by a registered engineer. The report shall provide sufficient technical detail describing the differences between the two building and systems designs and on the data used in and resulting from the comparative analysis.

NA1109.4.1 The documentation shall demonstrate that the analysis used is consistent with the techniques and procedures specified in this section and the following ASHRAE documents:

1. 2001 ASHRAE *Handbook of Fundamentals*.
2. 2000 ASHRAE *Handbook of HVAC Systems and Equipment*.
3. ASHRAE *Principles of Heating, Ventilating and Air Conditioning*.

Chapter 15, Exhaust Systems. The following provisions modify the indication sections of the 2017 ORSC:

SECTION M1505
MECHANICAL VENTILATION

M1505.1 General. Where Section R303.3 requires toilet rooms, bathrooms, and rooms with bathing or spa facilities to be mechanically ventilated, the ventilation equipment shall be installed in accordance with this section. Where local exhaust or whole-house mechanical ventilation is provided, the equipment shall be designed in accordance with this section and the applicable provisions of Chapter 11.

M1505.2 Recirculation of air. Exhaust air from range hoods, bathrooms, ~~and~~ toilet rooms, and rooms with bathing or spa facilities shall not be recirculated within a residence or circulated to another *dwelling unit* and shall be exhausted directly to the outdoors. Exhaust air from bathrooms, toilet rooms and kitchens shall not discharge into an *attic*, crawl space or other areas inside the building. This section shall not prohibit the installation of ductless range hoods in accordance with the exception to Section M1503.3.

M1505.3 Exhaust equipment. Exhaust equipment serving single *dwelling units* shall be *listed* and *labeled* as providing the minimum required airflow in accordance with ANSI/ AMCA 210-ANSI/ASHRAE 51.

M1505.4 Whole-house mechanical ventilation system. Whole-house mechanical ventilation systems shall be designed in accordance with Sections M1505.4.1 through M1505.4.4.

M1505.4.1 System design. The whole-house ventilation system shall consist of one or more supply or exhaust fans, or a combination of such, and associated ducts and controls. The whole house ventilation system shall provide *balanced ventilation*. Local exhaust or supply fans are permitted to serve as part of such a system. Outdoor air ~~ducts connected~~ ventilation provided by a supply fan ducted to the return side of an air handler shall be considered as providing supply ventilation for the balanced system.

M1505.4.2 System controls. The whole-house mechanical ventilation system shall be provided with controls that enable manual override.

M1505.4.3 Mechanical ventilation rate. The whole-house mechanical ventilation system shall provide outdoor air at a continuous rate as determined in accordance with Table M1505.4.3(1) or Equation 15-1.

Ventilation rate in cubic feet per minute =
(0.01 × total square foot area of house) +
[7.5 × (number of bedrooms + 1)]

Equation 15-1

Exception:

1. The whole-house mechanical ventilation system is permitted to operate intermittently where the system has controls that enable operation for not less than 25 percent of each 4-hour segment and the ventilation rate prescribed in Table M1505.4.3(1) is multiplied by the factor determined in accordance with Table M1505.4.3(2).
2. The minimum mechanical ventilation rate determined in accordance with Table M1505.4.3(1) or Equation 15- 1 shall be permitted to be reduced by 30 percent, provided that all of the following conditions are met:
   - 2.1 A ducted system supplies ventilation air directly to each sleeping room and to one or more of the following rooms:
     - a. Living room
     - b. Dining room
     - c. Kitchen
   - 2.2. Where ventilation is distributed by a central furnace, the thermostat shall include a ventilation mode for the fan operation to circulate a minimum of 15 minutes per hour.

M1505.5 Exhaust ventilation rate. Ventilation systems shall be designed to have the capacity to exhaust the minimum air flow rate determined in accordance with Table M1505.5. Exhaust flow ratings shall be source specific ventilation systems in accordance with the Home Ventilating Institute (HVI) or Air Movement and Control Association (AMCA) residential ventilation standards. Fans shall be *Energy Star* in accordance with Section N1105.5.

Chapter 16, Duct Systems. The following provisions modify the indicated sections of the 2018 IRC:

M1601.4.1 Joints, seams and connections. Longitudinal and transverse joints, seams and connections in metallic and nonmetallic ducts shall be constructed as specified in SMACNA HVAC *Duct Construction Standards—Metal and Flexible* and NAIMA *Fibrous Glass Duct Construction Standards*. Joints, longitudinal and transverse seams, and connections in ductwork shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, liquid sealants or tapes. Tape shall not be used to seal metal ductwork or be used as the only sealing method between metal duct and flexible or fibrous duct; tape is permitted to be used with metal duct at connections to equipment and exhaust duct requiring future maintenance or replacement. Tapes and mastics used to seal fibrous glass ductwork shall be *listed* and *labeled* in accordance with UL 181A and shall be marked "181A-P" for pressure-sensitive tape, "181 A-M" for mastic or "181 A-H" for heat-sensitive tape.

Tapes and mastics used to seal metallic and flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked "181 B-FX" for pressure-sensitive tape or "181 BM" for mastic. Duct connections to flanges of air distribution system equipment shall be sealed and mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked 181B-C. Crimp joints for round metallic ducts shall have a contact lap of not less than 1 inch (25 mm) and shall be mechanically fastened by means of not less than three sheet-metal screws or rivets equally spaced around the joint.

Closure systems used to seal all ductwork shall be installed in accordance with the manufacturers' instructions.

Exception:

1. Spray polyurethane foam shall be permitted to be applied without additional joint seals.
2. Where a duct connection is made that is partially without access, three screws or rivets shall be equally spaced on the exposed portion of the joint so as to prevent a hinge effect.
3. For ducts having a static pressure classification of less than 2 inches of water column (500 Pa), additional closure systems shall not be required for continuously welded joints and seams and locking-type joints and seams. This exception shall not apply to snap-lock and button-lock type joints and seams that are located outside of conditioned spaces.

M1601.4.11 Ductwork installation location. All supply and return ductwork shall be installed within the building thermal envelope in accordance with Section N1105.3.