



Oregon

Kate Brown, Governor



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MEMORANDUM

To: Governor Kate Brown

From: Janine Benner, Director
Oregon Department of Energy

Date: December 28, 2018

Re: Executive Order 17-20
Key Expanding Industries and Building Code Amendments

The Oregon Department of Energy, in consultation with the Building Codes Division, is pleased to submit this report outlining recommendations and potential opportunities for high energy-use industries to realize cost savings and energy savings through building code amendments.

This report is a component of *Executive Order 17-20: Accelerating Efficiency in Oregon's Built Environment to Reduce Greenhouse Gas Emissions and Address Climate Change*, issued in November 2017 as a targeted directive to state agencies to address energy and climate impacts of buildings in Oregon. Through EO 17-20, ODOE, in consultation with the Building Codes Division, was directed 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. This report explains the relationship of building codes to industrial energy consumption, and provides an overview of two sectors – indoor agriculture and data centers – that are generally considered to be expanding, high energy-use industries.

To develop this report, ODOE worked in consultation with the Building Codes Division and leveraged existing efforts such as ongoing collaboration with stakeholders in the indoor agriculture community and the Northwest Power and Conservation Council's research in that sector. Data center opportunities were informed by national model codes that have recently been developed through consensus-based processes with significant industry involvement.

The Oregon Department of Energy is available to respond to any questions or comments about this report or the broader effort to improve the energy efficiency of the built environment. Our agency will continue to work in partnership with other state agencies and industry stakeholders to evaluate potential opportunities for cost savings and energy savings in high energy-use industries through building code amendments.

Built Environment Efficiency Working Group

Executive Order 17-20
*Key Expanding Industries
and Building Code
Amendments*

January 2019



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I. Executive Summary

On November 6, 2017, Governor Kate Brown issued **Executive Order 17-20: Accelerating Efficiency in Oregon’s Built Environment to Reduce Greenhouse Gas Emissions and Address Climate Change**.¹ This Executive Order established directives for energy efficiency leadership in state buildings, increasing energy and water efficiency in new construction, and increasing energy efficiency through retrofits of existing buildings. The Executive Order identified expanding, high energy-use industries as a potential area for cost and energy savings with respect to new building code amendments, and a specific directive 4.E: *Helping Key, Expanding Industries to Save Cost by Reducing their Energy Footprint* was included.

Excerpt from EO 17-20

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

E. Helping Key, Expanding Industries to Save Cost 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.

The Oregon Department of Energy (ODOE), in consultation with Oregon Building Codes Division (BCD), leveraged existing work with industry stakeholders and partners to consolidate a list of opportunities for cost and energy savings. A list of recommendations is below, with additional detail included in Section V of this report.

Recommendations:

- 1) Continue improvement of the Oregon Structural Specialty Code to address the building code-regulated portions of the high energy-use industries.
- 2) Continue to support energy efficiency benchmarking and best practice development in the Indoor Agriculture sector.
- 3) Evaluate industry standard references, such as *ANSI/ASHRAE Standard 90.4-2016 Energy Standard for Data Centers*, for applicability in Oregon.
- 4) Continue to support performance programs and incentives

¹ https://www.oregon.gov/gov/Documents/executive_orders/eo_17-20.pdf

II. Introduction

The Built Environment Efficiency Working Group (BEEWG) is a collaboration among state agencies working to implement Executive Order 17-20. The BEEWG includes representatives from the Department of Administrative Services, Oregon Department of Energy, the Building Codes Division, the Public Utility Commission, and Oregon Housing and Community Services. Each agency in the BEEWG works within its existing authority to implement the directives of EO 17-20; this report has been written to reflect the authority of the respective state agencies.

Related to building codes, the legislature has given BCD authority over the adoption of a statewide building code in ORS 455.020, “to govern the construction, reconstruction, alteration and repair of buildings and other structures and the installation of mechanical devices and equipment therein.” The code is not intended to create or designate any particular class or group of persons who will or should be especially protected or benefited by the code. BCD works to ensure that the code is applied in a uniform and consistent way across building types and occupancies, regardless of the specific or unique use of any particular owner or occupier post construction.

ODOE, under ORS 469.010, is tasked with promotion of efficient use of energy resources. ORS 469.030 provides that ODOE be a repository for energy resources, inform the public on energy conservation, and engage in research related to energy resources.

This report serves to fulfill directive 4E of EO 17-20 by providing a list of general recommendations regarding energy code application for high energy-use industries, with the focus on specific industries that were contemplated directly during development of the Executive Order. While industrial process energy is generally not within the scope of building codes and authority of BCD, the report provides more information on specific opportunities in the data center and indoor agriculture areas, in addition to highlighting the effects the existing energy code has on all facilities, including industrial facilities.

III. Industrial Sector and Building Codes

The Oregon building code is limited to the construction, reconstruction, alteration, and repair of buildings. The building code contains requirements for a building structure and its indoor space conditioning equipment that can affect its energy use. These include elements such as: building envelope insulation, windows, lighting, and equipment used for heating, ventilating, and cooling. The code also includes energy efficient methods for controlling a building’s mechanical and heating and cooling systems. These methods follow a building throughout its lifecycle.

However, the building code does not expand to “process loads” that are tenant specific and dependent on a particular occupant or use. This is true of building types such as commercial offices in which the building code does not regulate occupant-specific items that are plugged in

(plug loads), and is also true of industrial and manufacturing settings that often have very detailed, industry-specific, and proprietary needs for energy consumption to create a product. These industrial loads can differ widely both across and within an industry, and it is generally not possible or appropriate to regulate the energy consumption of a proprietary industry-specific process through a building code.

IV. Expanding Industries in Oregon

Oregon is fortunate to be currently experiencing growth across a range of sectors and industries. In the December 2018 Oregon Economic and Revenue Forecast (Volume XXXVIII, No. 4),² the Oregon Office of Economic Analysis describes that “Oregon’s expansion continues to outperform the typical state due to our industrial structure.” However, this growth is projected to slow in the coming years. Oregon’s labor market is also growing, and “standard measures of the labor market like unemployment rate suggests the Oregon economy is healthy.” Oregon’s total employment is forecasted to continue to grow in the short term across nearly all sectors analyzed. As a result, many industries in Oregon can be considered to be expanding in the current economic climate.

Additionally, the Northwest Power and Conservation Council (NWPPCC) forecasts³ expected growth rates in Oregon for certain economic categories, which are presented in Figure 1.

² <https://www.oregon.gov/das/OEA/Documents/forecast1218.pdf>

³ Data provided to ODOE from the Northwest Power and Conservation Council and is on file

Figure 1: Forecasted Annual Growth Rates by Economic Category, 2013-2035

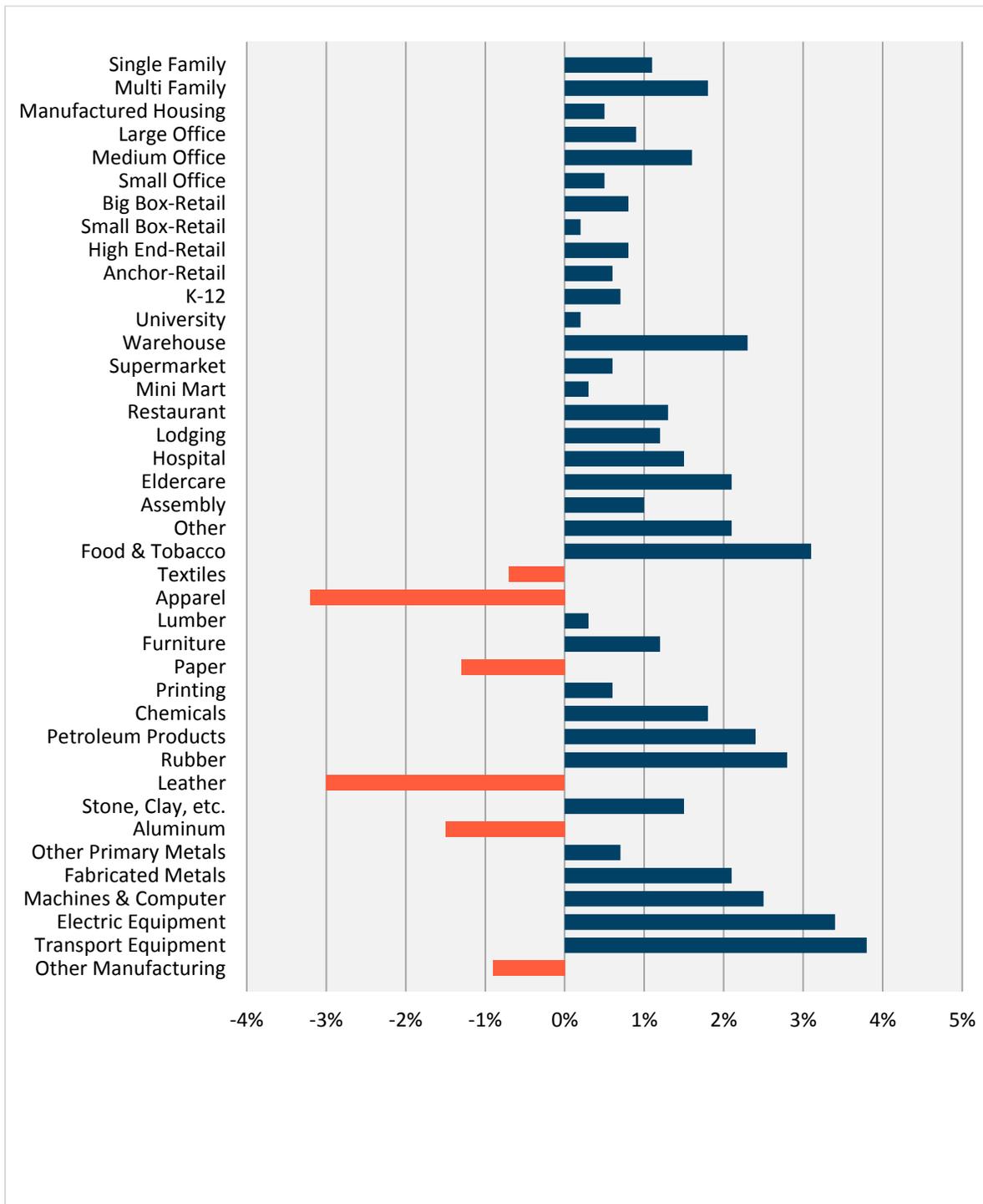


Figure 1 depicts average annual growth rates, in terms of square footage for the commercial and residential building sectors, and production for the manufacturing sectors. While sector expansion and contraction is subject to complex economic cycles, growth across a variety of industries is forecasted in the short and medium term.

Many of the industrial and manufacturing sector categories in Figure 1 may constitute relatively high energy-use industries, though the scope of the buildings code does not cover the elements (such process-specific equipment) that provide value-added, manufacturing production capacity and that impact the “high-energy” nature of these industries. Given the broad applicability of what might constitute an expanding, high energy-use industry in Oregon, this report focuses on data centers and indoor agriculture, which were two industries discussed during development of this directive of the Executive Order.

V. Recommendations

- 1) Continue improvement of Chapter 13 of the Oregon Structural Specialty Code to address the building code-regulated portions of the high energy-use industries.** Many industries in Oregon are experiencing expansion and growth. While the utility consumption of many of the more energy-intensive industries is dominated by process loads, there still remains an opportunity to affect the overall energy performance of these facilities with improvements to the building code-regulated aspects of the buildings. Depending on the facility, the code-regulated building aspects have a varied level of effect on overall energy consumption. Continual improvements to Chapter 13 of the Oregon Structural Specialty Code toward a progressively efficient energy code can have positive, cost-effective impacts across the board for the commercial and industrial sectors, including the high energy-use industries. Also, as seen in Figure 1, many other sectors in Oregon are expected to grow (such as commercial offices, schools, retail, housing, healthcare, etc.), and Oregon’s continued code leadership and development will have a positive impact on the energy efficiency of new construction in these sectors, as well as the industrial sector.
- 2) Continue to support energy efficiency benchmarking and best practice development in the indoor agriculture sector.** The indoor agriculture sector, specifically cannabis cultivation, has expanded since the legalization of recreational cannabis production and consumption in 2015 by House Bill 3400. Oregon has experienced a quick increase in the number of licensed grow operations and indoor canopy area, though the number of new licenses has slowed as the market becomes more established and the Oregon Liquor Control Commission (OLCC) implements practices to administer and manage the ongoing licensing program.⁴

In the indoor cannabis sector, process lighting and HVAC make up the great majority of facility energy consumption. The NWPPCC estimates that lighting accounts for approximately 66 percent of the electricity consumption in indoor cannabis cultivation, while HVAC (cooling, heating, ventilation, dehumidification, and pumping) accounts for

⁴ https://www.oregon.gov/olcc/marijuana/Documents/Application_Pause_FAQ_Final.pdf

33 percent, with the small one percent remainder to other miscellaneous equipment.⁵ This estimation was based on a survey of producers, with assistance from stakeholders such as growers, ODOE, OLCC, industry organizations (Resource Innovation Institute), Energy Trust of Oregon, Portland General Electric, and others.

As part of the survey, the NWPCC collected energy consumption and licensed grow canopy data to calculate an energy intensity metric of kilowatt-hours per square foot (kWh/ft²). While industrial process efficiency is more accurately characterized by production-based metrics (such as energy use per pound of output), the data with which to calculate this is often proprietary and not readily available. Therefore, an area-based metric such as kWh/ft² can serve as a proxy. Significant work, such as that being done by the Resource Innovation Institute (RII), is already underway in the industry to better define an industry production-based performance metric.⁶

Based on the data collected in the NWPCC survey, indoor grow operations average an energy intensity of 128 kWh/ft². This compares well with the Indoor Cannabis Cultivator Energy Use Estimator that ODOE developed to support industry and submittal of the required electricity estimates to OLCC for licensing.⁷ The calculator provides a range of 20-200 kWh/ft², and allows selection of a limited number of basic operating characteristics to estimate where the operation may fall within that range. Additionally, ODOE worked with OLCC to collect and analyze the energy data that is self-reported by growers with each license renewal. Based on preliminary data reported through May 2018, indoor grow operations averaged approximately 86 kWh/ft². This is slightly lower than the results of the NWPCC survey, but is still in the same magnitude and also well within the 20-200 kWh/ft² range originally estimated. The range of 86-128 kWh/ft² represents an estimate for average indoor grow energy intensity at this time, though individual operations can vary significantly and improved future data collection could adjust these values. Data from Resource Innovation Institute⁸ suggest a higher average at above 200 kWh/ft², so additional data and research is needed in this area.

Energy data collected by OLCC is preliminary, but will become more refined and robust as more growers renew their licenses and establish consistent operational profiles. With the passage of HB 3400, the legislature had the foresight to require the reporting of electricity and water consumption with license application and renewal. ODOE has collaborated to support OLCC on this, and will continue to work with OLCC and industry partners to use this data as it is available to perform energy consumption analysis and establish energy benchmarks for this industry.

⁵ Northwest Power and Conservation Council, Memorandum Cannabis Production Impact on Load (Results of Survey), M. Jourabchi, June 5 2018

⁶<https://resourceinnovation.org/>

⁷ <https://energy.odoe.state.or.us/cannabis>

⁸ The 2018 Cannabis Energy Report – New Frontier Data, Scale Microgrid Solutions, Resource Innovation Institute

While indoor cannabis production is typically considered to be highly energy intensive, the NWPCC report notes that production efficiency in this sector has improved over time as more states legalize recreational cannabis, production operations expand, and growers are subject to more competitive markets. Additionally, more of the industry has trended toward outdoor grow environments, or toward mixed grow and greenhouse grow environments, which have lower energy intensity than a pure indoor grow operation. While indoor grow environments demonstrate an energy intensity of 128 kWh/ft² according to the NWPCC survey, outdoor grows demonstrate an energy intensity of approximately 1 kWh/ft² per the NWPCC survey and ODOE/OLCC data.

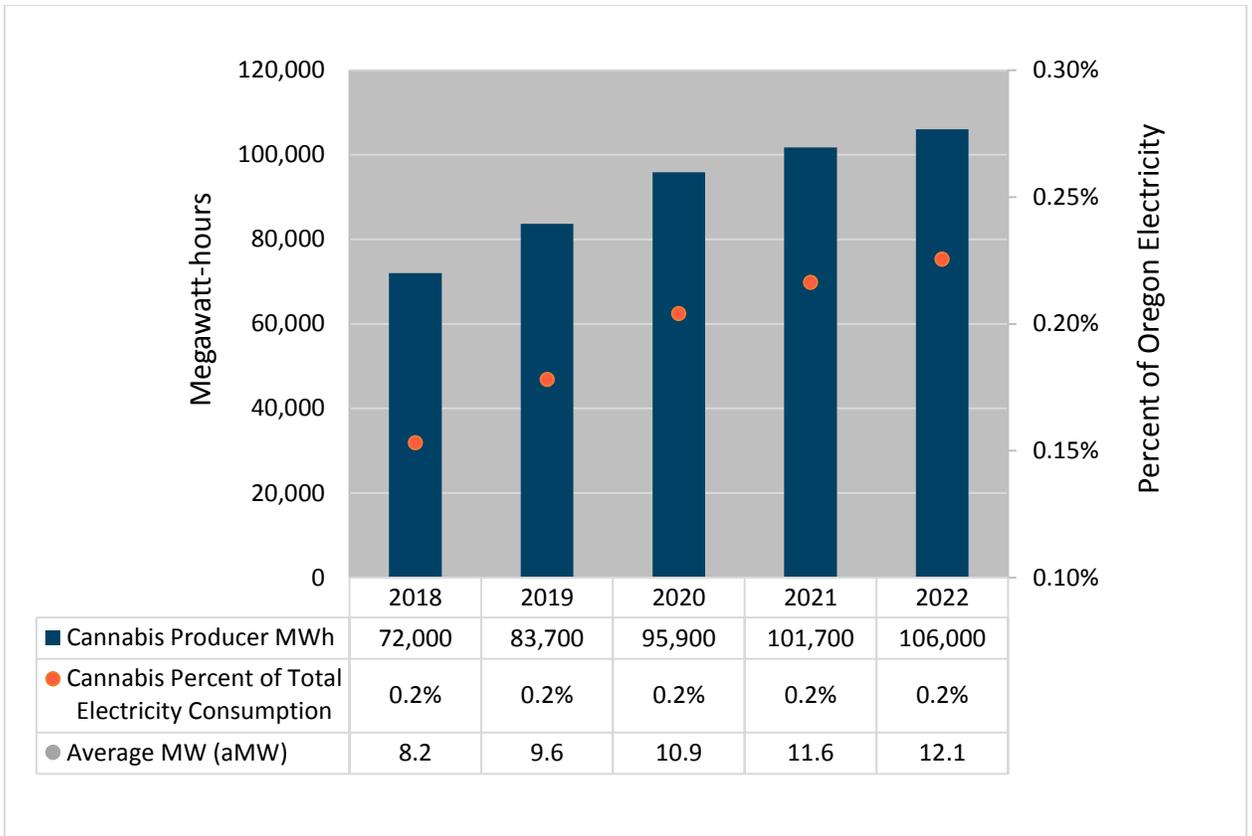
Industry efficiency is improving, though there remain various opportunities for additional energy efficiency gains. Process, or “grow,” lighting, which represents the majority of energy use in many indoor grow operations, has a strong potential for energy efficiency improvement through a shift from more traditional high intensity discharge (HID) lamps toward high-efficiency LED lighting, though this must be balanced with operational, plant health, and productivity considerations. Oregon has been at the forefront of discussions of a code application for agricultural lighting, with a recent public proposal that focused on high efficiency lighting and subsequent code committee and code board discussions⁹ that are still in process. Oregon agencies continue to work with industry and consider industry-supported efficiency measures as they are applicable and appropriate for the energy code. The main other high-energy consumption end-use in indoor agriculture is HVAC. Based on the NWPCC survey, the largest energy use in this category is for cooling, followed by ventilation, dehumidification, then heating. Similar to lighting, energy code proposals around ventilation and dehumidification efficiency were made and are under consideration. There are a variety of HVAC, specifically cooling, solutions that can meet the needs of indoor agriculture, and some are more energy efficient than others. Right-sized, optimized designs that specify efficient solutions specific to indoor agriculture offer a primary opportunity for energy savings.

The overall magnitude of an industry’s energy consumption footprint is important when determining the impact that energy efficiency measures and potential energy code changes could have on a statewide level. The chart below provides an estimate of the total electricity consumption¹⁰ in Oregon related to growing cannabis.

Figure 2: Oregon Cannabis Producer Electricity Consumption

⁹ <https://www.oregon.gov/bcd/codes-stand/code-adoption/Pages/2019-osscc-adoption.aspx>

¹⁰ The 2018 Cannabis Energy Report – New Frontier Data, Scale Microgrid Solutions, Resource Innovation Institute



**Note: NWPC calculates a potential annual Oregon demand of 44 average Megawatts (or 385,000 MWh) based on if all licensed grow operations and canopy areas are operating at capacity.*

Figure 2 illustrates that the indoor agricultural industry is growing in Oregon and projected to increase overall electricity consumption in the near term. However, the overall statewide consumption of the industry under the projected scenario still remains relatively low at approximately 0.2 percent of Oregon’s electricity consumption. Additionally, the Oregon Office of Economic Analysis projects increasing tax revenue in each upcoming biennia through 2025-2027,¹¹ indicating that the industry is expected to expand.

In this recently established legal market, there are encouraging developments in utility efficiency programs and voluntary market rating systems, such as the Resource Innovation Institute’s PowerScore¹² that have the ability to continue to drive the market, both new and existing facilities, toward more energy efficient solutions.

¹¹ <https://www.oregon.gov/das/OEA/Documents/forecast1218.pdf>, Table B.11

¹² <https://www.cannabispowerscore.org/>
<https://resourceinnovation.org/blog/welcome-to-the-cannabis-powerscore-an-energy-benchmarking-tool-for-growers-of-all-types/>

- 3) Evaluate industry standard references, such as *ANSI/ASHRAE Standard 90.4-2016 Energy Standard for Data Centers, for applicability in Oregon.*** Data centers, like indoor agriculture, was an industry discussed in the development of EO 17-20. Recently, there has been significant work at the national level by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) with development of a consensus data center energy standard, known as *ANSI/ASHRAE Standard 90.4-2016 Energy Standard for Data Centers*.¹³ This standard was developed to address the energy consumption characteristics in data centers, with the acknowledgement that data centers are very different than commercial buildings and require a separate focus. The standard uses a performance-based approach, rather than prescriptive, meaning that it establishes the overall energy efficiency of data center electric and mechanical systems, but does not list specific technologies or design elements that must be included to achieve the required level of efficiency.

Oregon often references national model codes and standards as the basis for state standards, with a recent example of incorporating national standards developed by ASHRAE as part of *Statewide Alternate Method 18-02 Oregon Zero Code Efficiency Standard*. A Statewide Alternate Method, or SAM, is an additional builder choice that may be used for statewide code compliance. This SAM 18-02 references *ASHRAE Standard 90.1-2016 Energy Standard for Buildings Except Low-Rise Residential Buildings*. As a continuation of referencing contemporary consensus standards that are nationally recognized and vetted, Oregon has an opportunity to evaluate ASHRAE Standard 90.4 for data centers as an applicable state code with the potential for significant cost savings and energy savings. Oregon agencies continue to work with all appropriate stakeholders, including but not limited to industry, utilities, efficiency programs, engineers, and contractors, to evaluate the specific efficiency gains, savings, cost, and feasibility to inform if state adoption of a national model standard for data centers is appropriate.

- 4) Continue to Support Performance Programs and Incentives.** Voluntary efficiency programs, supported by performance based programs and utility incentives, can also serve to reduce energy consumption in high energy-use industries. Programs such as these complement building code efforts well, and achieve energy savings where building codes are generally not applicable.

¹³ <https://www.ashrae.org/about/news/2016/data-center-standard-published-by-ashrae>

FOR MORE INFORMATION

<https://www.oregon.gov/energy/Get-Involved/Pages/BEEWG.aspx>

