



MEMORANDUM

To: Vermont Cannabis Control Board

From: Vermont Department of Public Service

Date: July 1, 2021

Subject: Act 164 – PSD Recommendations on Energy requirements for Cannabis Establishments in Vermont

Introduction

The Commissioner of the Department of Public Service (“Department” or “PSD”) is tasked with providing the Vermont Cannabis Control Board (“CCB”) with a recommendation regarding energy or efficiency requirements or standards for the operation of cannabis establishments, per Act 164 of 2020. The relevant section of Act 164 reads as follows:

- (c) On or before April 1, 2021, the Executive Director of the Cannabis Control Board, after consultation with the Commissioner of Public Service and the Chair of the Public Utility Commission, shall recommend to the General Assembly energy or efficiency requirements or standards for the operation of cannabis establishments in the State. The recommendations shall include:
- (1) recommended building energy standards for cannabis establishments if different from existing commercial building standards;
 - (2) recommended energy audits for cannabis establishments, including the recommended frequency of audits and who should perform the audits; and
 - (3) energy efficiency and conservation measures applicable to cannabis establishments

The Department provides the recommendations included in this memo for consideration by the CCB per the directive in Act 164. The Department is charged with updating and promulgating rules for the Vermont Commercial Building Energy Standards, as well as providing oversight of the state’s Energy Efficiency and Distributed Utilities. Therefore, the Department has focused our recommendations on energy standards, energy audits and energy usage tracking, Energy Efficiency Utility and Distributed Utility coordination, and other energy related recommendations.

The Department requests that the CCB consider these recommendations to ensure the development of cannabis establishments in Vermont will not have a detrimental impact on the state's electric grid and total energy use.

Statue Considerations

Act 164 requires recommendations on whether there should be building energy standards for cannabis establishments if *different from existing commercial building standards*, which appears to imply that existing commercial building standards at minimum would apply.

However, the existing Commercial Building Energy Standards (CBES) does not include any definitions or requirements for greenhouses as those would typically be exempt given the definitions and exemption of farm structures within the CBES statute (30 V.S.A. § 53) - see below.

"(a) Definitions. In this subchapter, "commercial buildings" means all buildings that are not residential buildings as defined in subdivision 51(a)(2) of this title or farm structures as defined in 24 V.S.A. § 4413."

24 V.S.A. § 4413 (d)(2)(A)

(A) "Farm structure" means a building, enclosure, or fence for housing livestock, raising horticultural or agronomic plants, or carrying out other practices associated with accepted agricultural or farming practices, including a silo, as "farming" is defined in 10 V.S.A. § 6001(22), but excludes a dwelling for human habitation.

However, the statute language in 7 V.S.A. § 869(a)(1), which was added through Act 164, makes it clear that cannabis growing establishments are not to be regulated as farming or considered an agricultural crop and therefore are not exempt from the existing CBES (see below).

7 V.S.A. § 869(a)(1)

"(a)(1) A cannabis establishment shall not be regulated as "farming" under the Required Agricultural Practices, 6 V.S.A. chapter 215, or other State law, and cannabis produced from cultivation shall not be considered an agricultural product or agricultural crop for the purposes of 32 V.S.A. chapter 124, 32 V.S.A. § 9741, or other relevant State law."

Therefore, the Department's recommendations include greenhouses as well as other commercial buildings.

Recommendations

Cannabis is the most energy-intensive agricultural crop in the United States.¹ Colorado has estimated that the cannabis industry may have used 1,115 thousand MWh to just produce dried flower product in a year (not including other products for edible, vapor, etc.), which is about 2% of CO's annual electric generation. This illustrates the importance of setting energy standards for this industry to ensure appropriate growth in Vermont.

¹ "Cannabis farming: utilities have power to make growing industry more energy efficient", March 7, 2019 by Austin Dowd, Slipstream blog. <https://slipstreaminc.org/blog/cannabis-farming-utilities-have-power-make-growing-industry-more-energy-efficient>. Original Source: Lokal_Profil CC BY-SA 2.5; Data obtained from National Conference of State Legislatures

Prior to drafting these recommendations PSD staff held several meetings with other state agencies (Agency of Agriculture & Division of Fire Safety), the Public Utilities Commissions, as well as stakeholders such as the Energy Efficiency Utilities (EEUs) and Resource Innovation Institute (RII) - a non-profit advocacy group that works with cannabis cultivators to optimize facilities for efficiency and productivity. The PSD also hired National Buildings Institute (NBI), a nationally recognized energy code consultancy firm, which has worked on developing energy code language specific to cannabis cultivation in other states and jurisdictions and has also worked as a subcontractor on our Building Energy Standard updates, to provide their consult and recommendations on this matter.

Based upon these discussions, as well as a review of available literature on the topic and NBI recommendations, the Department has developed the following recommendations in response to the areas laid out in Act 164.

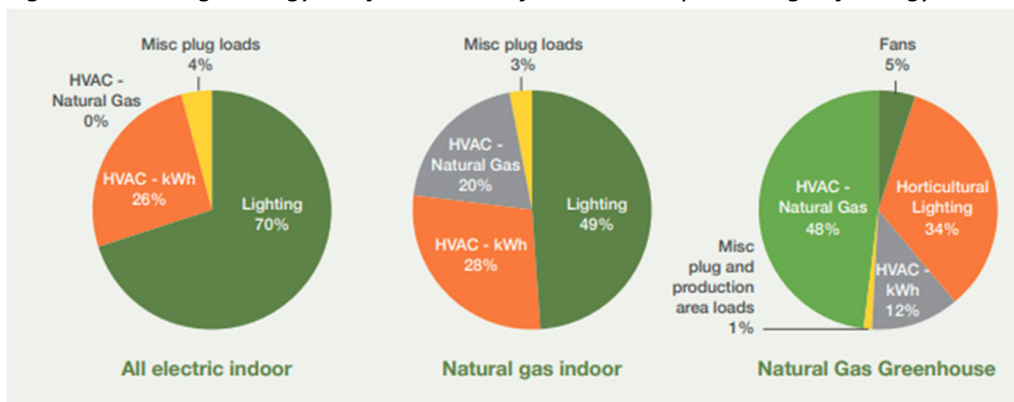
Energy Standards

The Department recommends energy standards for buildings used for cannabis cultivation that differ from the existing CBES in certain areas, as well as the development of standards for cannabis grown in greenhouses. For clarification purposes the recommendations below specify both when just meeting the existing CBES is recommended, as well as standards that exceed or are different from the current CBES. Specific energy standard language that could be inserted into the licensing requirements for cannabis establishments is included in Attachment A. The Department also recommends that these standards be reviewed no less than every three years and be updated on the same schedule as the Vermont CBES.

Background Information:

As shown in the graphic below, there are typically two types of facilities used for cannabis cultivation: greenhouses and indoor opaque walled buildings (although growing completely outdoors is also a possibility). For indoor cultivation facilities, lighting makes up a large percentage of the overall energy use (between 50 and 70% in these examples). For greenhouses, heating is responsible for a majority of the energy use.

Figure 1: "Average energy use for cannabis facilities as a percentage of energy used"²



Graphs from left: Energy Mix of All-Electric Indoor, Natural Gas Indoor, and Greenhouse Facilities in a Cold Climate

² Schimelpfenig, Gretchen. Energy Efficiency for Massachusetts Marijuana Cultivators, Resource Innovation Institute, Sept. 2020, resourceinnovationinstitute.wildapricot.org/RII-REPORTS/.

The PSD recommendations for building energy standards for cannabis establishments differ in many areas between these two types of growing facilities. The three main areas are:

- Envelope (floor, walls, and roof)
- Lighting (growing spaces)
 - Energy requirements
 - Technology requirements
- HVAC (heating and cooling of growing spaces)
 - Equipment requirements
 - Exemptions from CBES language
 - Ventilation requirements

Indoor Opaque-Walled Building Energy Standard Recommendations:

- Envelope – Shall meet CBES requirements, including air sealing and commissioning to ensure compliance with the standards.
- Lighting – All CBES lighting requirements shall be applicable to the non-growing areas of the buildings. Spaces used for growing cannabis shall be required to meet a specific Photosynthetic Photon Efficacy (PPE)³ equal to or greater than 1.9.
- HVAC – All equipment used to condition the air inside these facilities shall meet the efficiency requirements in CBES. This includes any fans and motors that are not equipment specific. Equipment serving growing spaces shall be exempt from the CBES requirements for economizers as well as heat recovery.⁴ All spaces within the facility should meet current ventilation requirements for warehouses as described in ASHRAE 62.1 which is incorporated into CBES. If a facility uses carbon dioxide enrichment, has extraction operations, or hazardous material handling, ventilation requirements in the Vermont Fire & Building Safety Code also apply. Where there is a conflict between these requirements, the Vermont Fire & Building Safety Code should take precedence.

Greenhouse Energy Standard Recommendations:

- Envelope⁵ – Shall meet a minimum of u-0.7. Additionally, compliance with the CBES C402.4.1 air barriers' should be encouraged but not required.
 - Due to the nature of greenhouses the ability to air seal these spaces is difficult. Therefore, it should be encouraged, but not required, that greenhouses carry out air-sealing as detailed within CBES.
- Lighting – Shall meet a Photosynthetic Photon Efficacy (PPE) equal to or greater than 1.7.
- HVAC – All equipment used to condition the air in these facilities shall meet the equipment efficiencies as described within CBES. This includes any fans and motors used that are not equipment specific. Equipment serving growing spaces shall be exempt from the CBES

³ PPE is the Photosynthetically Active Radiation photon output of a light source (measured in micromoles per second or $\mu\text{mol/s}$) divided by the input power (Watt) to produce that light. The higher the number the more efficient the light source is at both providing the correct spectrum of light for each watt of energy consumed to do so.

⁴ The reason for this exemption is the high heat and humidity environments that need to be maintained for an extended period of time for the growth of the plants. Economizers are used primarily to improve the HVAC equipment for the occupants of a building, in the case of growing environments they would be counterproductive. Similar issues occur with heat recovery as the high humidity environment can cause mold growth within the heat recovery units.

⁵ The three typical envelopes used for large greenhouses are glass, polycarbonate panels, and transparent/translucent plastic films. Overall glass and polycarbonate panels insulate better than plastic sheeting but have a higher initial cost, however plastic sheeting needs to be replaced regularly due to UV damage over time and can be more easily punctured. Code language is generally agnostic as to the materials used to create the envelope, as long as they meet all required safety standards and can perform to the specified requirements.

requirements for economizers as well as heat recovery. All spaces within the facility should meet current ventilation requirements for warehouses as described in ASHRAE 62.1 which is incorporated into CBES. If a facility uses carbon dioxide enrichment, has extraction operations, or hazardous material handling, ventilation requirements in the Vermont Fire & Building Safety Code also apply. Where there is a conflict between these requirements the Vermont Fire & Building Safety Code takes precedence.

- Low energy use greenhouses – The exemption in section C101.5.2 (1) for low energy buildings shall also apply to greenhouses. Therefore, if the total peak energy usage of the greenhouse doesn't exceed 3.4 Btu/hr/ft² for space conditioning, then the greenhouse is exempt from envelope requirements. This would allow for seasonal growing with some heat used to extend the growing period into the shoulder months.
- Low lighting load greenhouses – If a greenhouse has a total connected lighting load of less than 40 kW it is exempt from the lighting requirements.

Energy Audits

The Department is recommending that a system be established for self-reporting by the facility to the CCB of their energy consumption, measured against cannabis production, rather than regular energy audits. This would include annual and monthly production. This information would establish a baseline for the facility that can be used to show improved or decreased performance over time. The Department also recommends that once a baseline is established an audit should take place if the metric falls below the established baseline. The audit should be done by a third-party hired by the facility or the licensing authority. This information should be available to the PSD for review and recommendations.

Facilities could use the free U.S. Department of Environmental Protection (EPA) Energy Star Portfolio Manager to track energy use or could use a propriety software such as that created by RII that allows the tracking of energy and production on one platform.

Other Recommendations

These recommendations are divided into two sections: measures to be implemented and licensing conditions.

Measure Recommendations:

- All opaque-walled facilities shall be required to be solar-ready.⁶ For greenhouses, they would need to identify if they have an area suitable for on-site renewable energy using the same criteria as an opaque-walled facility and, if such an area is available, reserve space within their main electrical service panel to accommodate a renewable energy system.
- For facilities that choose to meet the CBES point requirements for Table C406.1 through the installation of solar, cannabis growing facilities would be required to install systems equaling a minimum of 0.5 Watts per square foot of floor area.
- Ventilation systems shall include provisions for a filter capable of removing or reducing odor from the drying plant if it is within 1 mile of other premises.

⁶ Appendix CA of CBES details where solar is considered feasible.

- The use of thermal curtains to retain heat within the greenhouse space during the night and winter periods shall be required.

Licensing Recommendations:

- As part of the license application process an “Ability to serve” letter must be secured by the applicant from the applicable Distributed Utility (DU) to demonstrate that the location in which they intend to establish a cannabis establishment has sufficient line capacity to power the facility and that the DU is aware of how much service the facility would require.
- A license for a facility should only be granted if the applicant can demonstrate that an excessive or uneconomic demand will not be placed on electric distribution services. This can be demonstrated through a statement by the DU in the ability to serve letter regarding whether serving the facility will require capital upgrades to distribution lines and/or other infrastructure and if these upgrades were already within the utility’s capital upgrade plans. If not, then an estimated cost for such upgrades should be provided along with a plan on how these upgrades would take place without unreasonable burden to the ratepayer, potentially in the form of a MOU similar to those used for line extensions.
- An energy management plan should be required to be completed and submitted prior to the issuance of a license. The Plan should detail energy requirement compliance and areas where requirements will be exceeded (if any). Areas to be covered within the plan would be envelope (including any air sealing), specification of lighting that will be utilized, HVAC, and any load controls measures to be implemented. This plan should also detail any areas where they have or will work with an EEU or DU to improve the buildings overall energy profile and would be eligible to receive incentives. Adherence to the minimums established in this plan should be a condition of operating.

Conclusion

The Department of Public Service encourages the CCB to adopt the recommendations in the memo to ensure the appropriate development of cannabis establishments in Vermont. Department staff are available to discuss these recommendations further and provide additional information that would be helpful to the CCB in forming their final recommendations to the General Assembly and in promulgating rules for cannabis establishments.

Attachment A: Energy Standard Language

In general, the PSD recommends the Cannabis Control Board (CCB) apply current building envelope requirements, lighting control requirements, ventilation requirements and pump requirements in the Vermont Commercial Building Energy Standards (CBES) to cannabis operations in buildings. The PSD also recommends that these requirements be applied to cannabis operations in greenhouses, with the exception of the building envelope requirements. Ventilation requirements currently in the International Building Code (IBC) and the Vermont Fire & Building Safety Code should also be applied to cannabis operations. Areas where Vermont could increase the stringency of its code to apply to cannabis facilities are outlined in Table 1 below and described in more detail in the remaining text of the Attachment.

Table 1: Summary of Recommended Code Requirements for Cannabis Establishments

	Greenhouses [PSD1]	Buildings
Envelope	0.7 U-factor	CBES
Lighting	PPE \geq 1.7, CBES	PPE \geq 1.9, CBES
Ventilation	CBES, IBC, Fire	CBES, IBC, Fire
Heating and Dehumidification Equipment	CBES+	CBES+
Renewable Requirement	0.5W/s.f of floor area	0.5W/s.f of floor area
Fan Efficacy	2021 IECC	2021 IECC
Pumps	CBES	CBES

PSD recommends that the CCB include the following specific language outlining how these requirements would apply to existing facilities. Recommended language that describes when the code applies to modification to existing facilities is below:

(a) Controlled Environment Horticulture Spaces.

- 1. Indoor Growing, Space-Conditioning Systems and Dehumidification.** All newly installed heating, ventilation, air conditioning systems or dehumidification systems in buildings with indoor growing shall meet applicable requirements.
- 2. Greenhouses, Building Envelope and Space-Conditioning and Dehumidification Systems.** A greenhouse being converted to the conditioned greenhouse or additions to a conditioned greenhouse shall meet applicable requirements.
- 3. Indoor Growing and Greenhouses, Horticultural Lighting.** Alterations to horticultural lighting systems that increase lighting wattage or include adding, replacing, or altering 10 percent or more of the horticultural luminaires serving an enclosed space shall meet the requirements.
EXCEPTION: Any alteration limited to adding lighting controls or replacing lamps, ballasts, or drivers.

4. **Change of Occupancy.** For alterations that change the occupancy classification of the building, the requirements apply to the occupancy that will exist after the alterations.

PSD also recommends that the CCB include specific requirements for benchmarking the performance of cannabis facilities and for regularly assessing potential energy improvements for these facilities.

PSD recommends that growing facilities provide annual data to the CCB on energy consumption by fuel (monthly, including consumption and demand), on-site energy generation (monthly), water consumption (gallons per month), and cannabis yield by weight (annual) every year. Facilities should be required to use either Cannabis PowerScore or ENERGY STAR Portfolio Manager to provide this data. If using ENERGY STAR Portfolio Manager, PSD recommends that the Cannabis Control Board require cannabis facilities to provide read only access to ENERGY STAR Portfolio Manager. Cannabis growers should also provide separately, the annual cannabis yield by weight and calculated production efficiency (grams per kWh). If using Cannabis PowerScore, PSD recommends growers provide the Cannabis PowerScore report number, production efficiency (grams per kWh) and monthly energy consumption/generation and water usage breakdown. Finally, PSD recommends that the CCB provide the PSD access to all benchmarking data provided by growing facilities.

In addition to benchmarking requirements, PSD recommends that the Cannabis Control Board require growers, when applying for a license with the Cannabis Control Board and every five years thereafter, to address how its written operating procedures include the following:

1. How the cultivator will ensure on a regular basis that equipment is maintained, calibrated and operating properly, including maintain operations manuals and operating procedures for all major energy using equipment, including, but not limited to horticultural lighting, HVAC systems, dehumidification systems.
2. How the cultivator regularly assesses opportunities to reduce energy and water usage, which should include:
 - a. Identification of potential energy use reduction opportunities (such as natural lighting and energy efficiency measures), and a plan for implementation of such opportunities;
 - b. Consideration of opportunities for renewable energy generation, including, where applicable, identification of building plans, available upon inspection, showing where energy generators could be placed on the site, and an explanation of why the identified opportunities were not pursued, if applicable;
 - c. Strategies to reduce electric demand (such as lighting schedules, active load management, and energy storage); and
 - d. Engagement with energy efficiency programs offered by Efficiency Vermont, Burlington Electric Department, or Vermont Gas Systems.

PSD recommends the CCB adopt the 2021 International Energy Conservation Standard (IECC) definition of a greenhouse.

GREENHOUSE: *a structure or a thermally isolated area of a building that maintains a specialized sunlit environment exclusively used for, and essential to, the cultivation, protection or maintenance of plants. Greenhouses are those that are erected for a period of 180 days or more.*

PSD recommends the CCB adopt an amended version of the 2021 IECC U-factor requirements for Greenhouses shown below. This amendment would require non-opaque elements of greenhouses with moderate energy usage to have a U-factor of less than or equal to 0.7.

C402.1.1 Low-energy buildings. The following low-energy buildings, or portions thereof separated from the remainder of the building by thermal envelope assemblies complying with this section, shall be exempt from the building thermal envelope provisions of Section C402.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h x ft² (10.7 W/m) or 1.0 watt per square foot (10.7 W/m) of floor area for space conditioning purposes.
2. Those that do not contain conditioned space.
3. Non-opaque building thermal envelope assemblies in *greenhouses* that have an average U-factor less than or equal to 0.7 BTU/hr-ft²-°F

Minimum PPE requirements for luminaires for greenhouses and indoor growing operations would be a PPE of 1.7 for greenhouses and a PPE of 1.9 for indoor growing operations. Highly efficient double ended HPS, ceramic metal halide and LEDs could meet these PPE requirements. Grow operations with a total connected lighting load of less than 40kW are exempted. CBES currently requires time switch lighting controls for these applications. Example code language is provided below:

C405.4 Lighting for plant growth and maintenance.

Permanently installed luminaires used for plant growth and maintenance shall meet the following requirement:

Photosynthetic photon efficacy of not less than 1.7 $\mu\text{mol}/\text{J}$ for *greenhouses* and not less than 1.9 $\mu\text{mol}/\text{J}$ for all other indoor growing spaces, rated in accordance with ANSI/ASABE S640.

Exception: Buildings with no more than 40kW of aggregate horticultural lighting load.

Greenhouses and indoor growing operations should meet current ventilation requirements in CBES and the IBC which refers to the International Mechanical Code (IMC). Ventilation rates for warehouses as defined in ASHRAE 62.1 referenced in CBES and the IMC may be the most appropriate for grow operations (minimum ventilation rate of 0.06 cfm/ft²). If a grow facility uses carbon dioxide enrichment, has extraction operations, or hazardous material handling, ventilation requirements in the Vermont Fire & Building Safety Code also apply and can supersede the ventilation requirements described in CBES and ASHRAE 62.1.

The CCB should also adopt heating and cooling equipment requirements listed in section C403.3 of the 2021 IECC.

The PSD recommends adopting an amended version of Table C403.5(2) in the 2018 IECC. This table was removed from the Vermont CBES in the adoption process because it did not apply to Vermont's climate zones. An amended version of this table could allow greenhouses and indoor grow facilities to be exempt from economizer requirements if they install high-efficiency cooling equipment with an EER or IPLV that is at least 20 percent more efficient than CBES HVAC efficiency requirements.

Additional requirements for dehumidification should be considered for Vermont. HVAC and dehumidification are a significant energy load in cannabis operations and on-site heat recovery for

dehumidification systems is an important tool to reduce energy use in cooler climates. Example code language is provided below:

1. Stand-alone dehumidifiers that meet the following minimum integrated energy factors:
 - a. Minimum integrated energy factor of 1.77 L/kWh for product case volumes of 8.0 cubic feet or less;
 - b. Minimum integrated energy factor of 2.41 L/kWh for product case volumes greater than 8.0 cubic feet.
2. Integrated HVAC system with on-site heat recovery designed to fulfill at least 75 percent of the annual energy for dehumidification reheat;
3. Chilled water system with on-site heat recovery designed to fulfill at least 75 percent of the annual energy for dehumidification reheat; or
4. Solid or liquid desiccant dehumidification system for system designs that require dewpoint of 50°F or less.

For buildings utilized for drying plant that are located within 1 mile of other promises, provision should be made to minimize or neutralize associated odors through the use of filters or other applicable means.

The PSD recommends that the CCB adopt an amended version of the renewable energy requirements approved for ASHRAE 90.1-2019 as an Addendum to the standard⁷. This code amendment would require buildings to meet Appendix CA of CBES and be solar ready. If solar is chosen to meet the requirements of Section C406 of CBES then the requirement would be for renewable energy of not less than 0.5 W per square foot of gross conditioned floor area. The three exceptions are written to ensure that the requirement is not being applied to buildings without adequate space on the roof, to buildings that are in areas of the country where there is insufficient solar radiation, and to buildings where solar access is wholly or partially blocked.

C406.5 On site renewable energy. Each building site shall have equipment for on-site renewable energy with a rated capacity of not less than 0.5 W/ft² (5.4 W/m²) multiplied by the sum of the gross conditioned floor area of the three largest floors.

Exceptions:

1. Any building located where an unshaded flat plate collector oriented towards the equator and tilted at an angle from horizontal equal to the latitude receives an annual daily average incident solar radiation less than 3.5 kWh/m²·day (1.1 kBtu/ft²·day).
2. Any building where more than 80 percent of the roof area is covered by any combination of equipment other than for on-site renewable energy systems, planters, vegetated space, skylights, or occupied roof deck.
3. Any building where more than 50 percent of roof area is shaded from direct-beam sunlight by natural objects or by structures that are not part of the building for more than 2,500 annual hours between 8:00 AM and 4:00 PM.

The PSD recommends that the CCB update requirements for fans in section C403.8.3 and C403.8.5 to those published in the 2021 IECC. These sections increase the efficiency requirement of normal and low-capacity fans and utilize a new metric (Fan Efficiency Index).

⁷ "Addendum by" to ASHRAE 90.1-2019 is posted at https://www.ashrae.org/file%20library/technical%20resources/standards%20and%20guidelines/standards%20addenda/90_1_2019_by_ck_cp_20200731.pdf

In 2016, DOE issued the first energy conservation standard for certain clean water pumps manufactured on January 27, 2020. Regulations are in the Code of Federal Regulations (CFR) Title 10, Chapter II, Subchapter D, Part 431, Subpart Y. These efficiency requirements are not included in CBES but could be adopted to ensure clean water pumps that do not meet these requirements are not installed.⁸

⁸ *Electronic Code of Federal Regulations: Title 10 → Chapter II → Subchapter D → Part 431*, U.S. Government Publishing Office, www.ecfr.gov/cgi-bin/retrieveECFR?n=pt10.3.431#sp10.3.431.y pumps.org/DOE_Rulemaking.aspx.