U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Federal Metering Guidance

October 2022

FEMP Federal Energy Management Program

PNNL-29687

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PACIFIC NORTHWEST NATIONAL LABORATORY
operated by
BATTELLE
for the
UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC05-76RL01830

Printed in the United States of America

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Executive Summary

The Federal Energy Management Program (FEMP) recently updated the Federal Metering Guidance at the direction of the Energy Act of 2020, Sec. 1002(g).[1] The following requirements from the Act were added to this document:

- Water metering requirement, describing the process that agencies use to determine buildings appropriate for water meters and how to prioritize those buildings for water meters.
- The document requires agencies to submit new Metering Plans within 180 days of the publication of the updated guidance.

The metering determination process was updated to include feedback received from agencies and to ensure it meets the statutory requirements:

- The minimum building square footage threshold for metering has been set at 25,000 square feet for buildings that are not energy or water intensive.
- The minimum threshold for metering energy- and water-intensive buildings is 1,000 square feet.
- A new step is included for determining the practicability of installing advanced meters on a building in accordance with 42 U.S.C. § 8253(e).
- The building prioritization process now incorporates agencies' existing metered buildings, and specifies separate, parallel processes for prioritizing buildings for the installation of advanced energy and water meters.

The document includes an appendix with recommended best practices for comprehensive metering planning, including metering implementation, cybersecurity, data management and analysis, and program performance.

[1] The previous update to the Federal Metering Guidance was completed in 2014. It is available on the FEMP website at: https://www.energy.gov/eere/femp/downloads/federal-building-metering-guidance-usc-8253e-metering-energy-use

Contacts

U.S. Department of Energy FEMP Metering Resources

For more information on metering Federal facilities or to contact to FEMP about metering, please visit: https://www.energy.gov/eere/femp/metering-federal-buildings

In addition, for technical resources for Federal facilities and fleet optimization or to contact FEMP staff through the FEMP Assistance Request Portal, please visit: https://www.energy.gov/eere/femp/facility-and-fleet-optimization

List of Abbreviations

AGA	American Gas Association
AMI	Advanced Metering Infrastructure
ANSI	American National Standards Institute
CBECS	Commercial Buildings Energy Consumption Survey
CFR	Code of Federal Regulations
CSF	Cybersecurity Framework
DHS	Department of Homeland Security
DOD	Department of Defense
DOE	Department of Energy
EISA	Energy Independence and Security Act of 2007
EMIS	Energy management information system
EnMS	Energy management system
EO	Executive Order
EPA	Environmental Protection Agency
EPAct	Energy Policy Act of 2005
FedRAMP	Federal Risk and Authorization Management Program
FEMP	Federal Energy Management Program
FISMA	Federal Information Security Management Act of 2014
GSA	General Services Administration
HVAC	Heating, ventilation, and air conditioning
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
ISO	International Organization for Standardization
IT	Information technology
NECPA	National Energy Conservation Policy Act
NIST	National Institute of Standards and Technology
O&M	Operations and maintenance

OMB	Office of Management and Budget
RMF	Risk Management Framework
SP	Special Publication
U.S.C.	United States Code

Definitions

Advanced meter: An advanced meter records energy or water consumption data hourly or more frequently and provides for daily or more frequent transmittal of measurements over a communication network to a central data collection point. Advanced meters are usually able to record other physical quantities in addition to consumption. Related to an advanced meter, an advanced metering device is an electronic meter with built-in metering and communication capabilities, or a separate electronic device coupled to a standard meter that enables communication to the onsite automated metering infrastructure.

Advanced metering infrastructure (AMI): An integrated network of advanced meters, communications networks, and data management systems. Advanced metering infrastructure can refer broadly to an agency's entire portfolio of advanced meters and related assets (referred to in this document as the agency's "AMI system"), or more narrowly to the assets at a particular site or building.

Agency: An executive agency as defined in 5 U.S.C. § 551(1), including sub-agencies of the agency, and excluding the Government Accountability Office.

Appropriate: For the purposes of this Metering Guidance, the term appropriate applies to a Federal building that does not meet any of the criteria for exclusion from the metering requirement. If a building cannot be excluded, it is considered appropriate for metering.

Authorization to operate (ATO): The official management decision given by a senior Federal official or officials to authorize operation of an information system and to explicitly accept the risk to agency operations (including mission, functions, image, or reputation), agency assets, individuals, other organizations, and the Nation based on the implementation of an agreed-upon set of security and privacy controls. Authorization also applies to common controls inherited by agency information systems.[2]

Authorizing official: A senior agency official or executive within an agency with the authority to formally assume responsibility for operating an information system at an acceptable level of risk to agency operations and assets, individuals, other organizations, and the Nation. The authorizing official is responsible for granting the authorization to operate an information system.

Building function: The classification of a Federal building by its predominant use (e.g., office, warehouse, education) as defined by the Federal Real Property Profile.[3]

Cost effective: A term used to describe an investment for which life-cycle cost savings exceed life-cycle costs. When an advanced energy or water meter is installed on a building and the data from that advanced meter is used to identify energy or water conservation measures, the life-cycle cost savings resulting from those measures can justify the cost-effectiveness of the advanced meter. See 10 CFR Part 436, Subpart A and National Institute of Standards and Technology (NIST) Handbook 135, *Life-cycle Costing Manual for the Federal Energy Management Program*, for more information on performing life-cycle cost analysis.

Covered facility: A facility that an agency has designated as subject to the requirements of section 432 of the Energy Independence and Security Act of 2007 (EISA) (codified at 42 U.S.C. § 8253(f)), which requires agencies to designate covered facilities comprising at least 75 percent of their total facility energy or water use. A covered facility may be defined as a group of facilities at a single location or multiple locations managed as an integrated operation, or contractor-operated facilities owned by the Federal Government. A covered facility may also be a single building, if so identified by the agency.

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[2] See OMB Circular No. A-130 at: https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/circulars/A130/a130revised.pdf
[3] See the most recent GSA Guidance for Real Property Inventory Reporting at: https://www.gsa.gov/policy-regulations/policy/real-property-policy/asset-management/federal-real-property-council-frpc/frpc-guidance-library

Energy-intensive buildings: For the purposes of this Metering Guidance, the term "energy-intensive buildings" includes industrial buildings, manufacturing buildings, data centers, laboratories, inpatient health care and hospitals, food service, and food sales. This list of building types is not exhaustive, so agencies should carefully consider whether other buildings in their portfolios could be considered energy intensive. In general, energy-intensive buildings have higher than typical energy loads beyond standard building ventilation and thermal comfort operations, including uses such as computing, manufacturing, process loads, and increased ventilation requirements.

Energy management system (EnMS): A process for integrating energy management into existing business systems, enabling organizations to better manage their energy and sustain achieved savings. The global standard for EnMS is ISO 50001. Per Section 1002(g) of the Energy Act 2020, Federal facility energy managers must take into consideration the use of an EnMS to manage energy and water use at the facility and the applicability of the certification of the facility in accordance with ISO 50001.

Energy management information system (EMIS): A broad family of tools and services used to manage commercial building energy use. These technologies include energy information systems, fault detection and diagnostic systems, benchmarking and utility bill tracking tools, automated system optimization tools, and building automation systems.

Federal building: As defined in 42 U.S.C. § 8259(6), a Federal building is any building, structure, or facility, or part thereof, including the associated energy or water consuming support systems, which is constructed, renovated, leased, or purchased in whole or in part for use by the Federal Government, and which consumes energy or water; this term also means a collection of buildings, structures or facilities and the energy or water consuming support systems for such collection. For the purpose of this Metering Guidance, the term "building" is intended to refer to an individual structure.

Federal Risk and Authorization Management Program (FedRAMP): A government-wide program that provides a standardized approach to security assessment, authorization, and continuous monitoring for cloud products and services.

Information system: As defined in the Office of Management and Budget (OMB) Circular A-130, a discrete set of information resources organized for the collection, processing, maintenance, use, sharing, dissemination, or disposition of information. An agency's AMI system could meet this definition and thereby qualify as an information system.

Maximum extent practicable: Per 42 U.S.C. § 8253(e)(1), agencies are required to install advanced meters or advanced metering devices to the "maximum extent practicable." DOE interprets this phrase to mean that installation of an advanced meter or advanced metering device would not conflict with other Federal law; would not pose health and life safety issues; would not result in a request for products or materials not available; or would not prohibit accomplishment of agency mission and project objectives.

Risk Management Framework (RMF): A process developed by the National Institute of Standards and Technology by which agencies can assure the security of information and information systems and authorize the operation of those systems at an acceptable level of risk to agency operations and assets, individuals, other organizations, and the Nation.

Service entrance: The point of demarcation between a utility's service equipment and the customer's property. For electricity services, the service entrance would typically be the utility's meter; from there, electric current would flow to the customer's main breaker. A building could have multiple service entrances depending on its size.

Standard meter: An electromechanical or solid-state meter or phase controller that cumulatively measures and records aggregated usage data that are periodically retrieved for use in customer billing or energy

management. A meter that is not an advanced meter is considered to be a standard meter under this Metering Guidance.

Sub-agency: A bureau, service, or other component within an agency that manages its buildings and facilities separate from its parent agency.

Submeter: A meter that is subordinate to the main advanced meter on a building. Submeters record a portion of the total energy or water consumed by a building and may be used to isolate the consumption of a large energy- or water-consuming system or a building tenant.

Supply line: A main source of a utility's commodity. Examples could include a natural gas line supplying a building, or the main set of conductors supplying electricity. A building could have multiple supply lines of the same commodity depending on the building's size.

Water-intensive buildings: For the purposes of this Metering Guidance, the term "water-intensive buildings" includes chiller plants, steam plants, industrial buildings, manufacturing buildings, data centers, lodging, food service, food sales, recreation centers, vehicle wash stations, inpatient health care and hospitals, prisons, vehicle care, laboratories, and irrigation pump houses. This list of building types is not exhaustive, so agencies should carefully consider whether other buildings in their portfolios could be considered water intensive. In general, water-intensive buildings have high water use beyond standard operations, including high occupancy density, long operating hours, and/or water-intensive end-use equipment such as irrigation, cooling towers, and commercial kitchen equipment.

Federal Metering Guidance

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I. Background

The U.S. Department of Energy (DOE) is required by statute to establish guidelines for agencies to install meters on their Federal buildings for energy (electricity, natural gas, and steam) and water. (See 42 U.S.C. § 8253(e)). DOE issued guidance in February 2006 on the installation of electric meters in Federal buildings and issued updated guidance in November 2014 on the installation of energy and water meters in Federal buildings. This document serves as an update to the 2014 guidance.[4]

This document provides Federal agencies the following guidance:

- Describes the legislative authority for energy and water metering and the meter-related reporting requirements for Federal agencies.
- Specifies a method to verify the existence of currently installed building-level meters and to create an updated list of buildings to be metered with advanced energy and water meters.
- Explains the criteria for determining whether installing advanced energy and water meters on a building is practicable.
- Provides guidelines on prioritizing buildings for the implementation of advanced energy and water meters.
- Sets the schedule for agencies to update their Metering Plans and outlines the minimum required information that agencies shall provide.
- Discusses additional recommendations for an effective plan covering meter implementation, cybersecurity, data management and analysis, and program performance.

Authority

Pursuant to section 103 of the Energy Policy Act of 2005 (Pub. L. 109–58, "EPAct"), as amended, most recently by the Energy Act of 2020 (Pub. L. 116-260, Div. Z, Title I, §1002(g)), agencies are directed to meet the following metering requirements:

- By October 1, 2022, in accordance with DOE guidance, all Federal buildings shall, for the purposes of efficient use of energy and water and reduction in the cost of electricity and water in such buildings, be metered.
- Each agency shall use, to the maximum extent practicable, advanced meters or advanced metering devices that provide data at least daily and that measure at least hourly consumption of electricity and water in the Federal buildings of the agency.
- Not later than October 1, 2016, each agency shall provide for equivalent metering of natural gas and steam, in accordance with DOE guidance.
- Meter data shall be incorporated into Federal energy tracking systems and made available to Federal facility managers.

[4] This Metering Guidance document and additional FEMP resources for metering in Federal buildings are available at: https://www.energy.gov/eere/femp/metering-federal-buildings

- For covered facilities, Federal facility energy managers must take into consideration the use of an energy management system (EnMS) to manage energy and water use at the facility and the applicability of the certification of the facility in accordance with ISO 50001.

- Not later than 180 days after the date this updated Metering Guidance document is issued, in a report submitted by the agency under 42 U.S.C. § 8258(a), each agency shall submit to DOE a Metering Plan describing how the agency will implement the metering requirement. (See Section III for details).

In developing guidance to carry out the statute, Congress directed DOE to:

- Establish exclusions from the metering requirements based on the *de minimis* quantity of energy and water use of a Federal building, industrial process, or structure.

- Take into consideration the cost of metering and the reduced cost of operations and maintenance expected to result from metering; the extent to which metering is expected to result in increased potential for energy and water management, increased potential for energy and water savings and energy and water efficiency improvements, and cost and energy and water savings due to utility contract aggregation; and DOE measurement and verification protocols.

- Establish priorities for types and locations of buildings to be metered based on cost effectiveness and a schedule of one or more dates on which the metering requirements shall take effect.

- Include recommendations concerning the amount of funds and the number of trained personnel necessary to gather and use the metering information to track and reduce energy and water use.

Energy and Water Use Reporting Requirements

Per 42 U.S.C. § 8253(e)(1), each agency is required to incorporate meter data into existing agency energy and water tracking systems and make data available to Federal facility managers.

In addition, 42 U.S.C. § 8253(f)(8) requires Federal agencies to benchmark metered buildings that are, or are part of, covered facilities. In August 2014, FEMP issued the Federal Energy Use Benchmarking Guidance,[5] which describes the provisions to follow to meet these requirements.

Under 42 U.S.C. § 8253(f)(8), agencies are also required to ensure that covered facility metered building monthly data are entered into a DOE-approved building energy use benchmarking system, such as the Environmental Protection Agency (EPA) ENERGY STAR Portfolio Manager®.

DOE recommends that agencies also benchmark building water use and performance for buildings that are metered for water consumption. Benchmarking can help agencies manage operations and performance by comparing annualized metrics for a specific property over time and among similar properties.

Finally, under 42 U.S.C. § 8258(a)(1), Federal agencies are required to annually report to FEMP the status of building meter implementation in the Annual Energy Management Data Report for electricity, natural gas, steam, and water meters. Agencies are required to report the following data for the current year:

- Cumulative number of buildings that are metered with standard meters;

- Cumulative number of buildings that are metered with advanced meters;

[5] See the Federal Energy Use Benchmarking Guidance at: https://www.energy.gov/eere/femp/downloads/federal-building-energy-use-benchmarking-guidance-august-2014-update

- Cumulative percentage of buildings that are metered with standard or advanced meters based on the total number of appropriate buildings (as determined based on the criteria in this Metering Guidance).

II. Metering Determination Process

This section outlines a three-step process for agencies to verify the existence of currently installed meters and determine which remaining buildings are appropriate for energy and water metering, identify buildings where the installation of advanced meters is practicable, and prioritize those buildings for advanced meter installation.

- *Step 1*: *Building Metering Verification and Identification*. Specifies a method to verify the existence of building-level meters and to create an updated list of buildings appropriate for metering.
- *Step 2*: *Advanced Meter Practicability in Appropriate Buildings.* Explains the criteria for determining the practicability of installing advanced meters on buildings that are appropriate for metering, as identified in Step 1. Per 42 U.S.C. § 8253(e)(1), agencies shall use advanced meters or advanced metering devices to the maximum extent practicable; if it is not practicable to install advanced meters on a building that is appropriate for metering, agencies must install standard meters.
- *Step 3*: *Advanced Meter Prioritization Process.* Provides instructions on how to prioritize buildings where advanced metering is practicable, as identified in Step 2.

Step 1: Building Metering Verification and Identification

The instructions below describe the process that agencies should use to verify and identify the appropriate buildings to meter for energy and water.

Energy Metering Verification Process

Starting with a comprehensive list of the agency's real property, for each energy utility (electric, natural gas, and steam) perform the following steps to create a list of buildings that are appropriate to meter:

- Flag buildings with an existing agency-installed advanced energy meter or with a utility-installed advanced energy meter where the metered data is currently or is planned to be incorporated into the agency's energy and water tracking system.[6] Buildings that meet at least one of these conditions are considered to meet the statutory metering requirement. Remove these buildings from the list.
- Of the remaining buildings, flag which buildings are not metered and which buildings have standard energy meters installed.[7]
- From this list, exclude buildings that meet one or more of the criteria described below; the remaining buildings are considered appropriate for metering.

Exclusion Criteria

Agencies may exclude a Federal building from energy metering if it meets at least one of the criteria below:

- The Federal building is documented in a list of buildings planned for sale or demolition within the next five years.
- The Federal building is leased or owned, but the agency either does not pay the utility bill or does not pay the lessor for utilities based on actual consumption.

[6] A utility-installed advanced meter can be substituted for an agency-installed advanced meter at a building if data are collected at least hourly and the data are available to the agency and are incorporated into the agency's energy and water tracking system.
[7] Note: Federal buildings with existing standard meters may meet the metering requirement; however, agencies are required to install advanced energy and water meters to the maximum extent practicable, so some buildings with existing standard meters may need to be upgraded to advanced meters. See Step 2 for further instructions.

- The Federal building does not have an energy-consuming heating or cooling system or significant loads such as refrigeration, large lighting systems, food service equipment, or computing equipment. Examples of such buildings could include warehouses, outside parking garages, and hangars, among others.
- The Federal building generates electricity that is sold commercially to other parties in the course of regular business, and installing meters would require an impractical shutdown of service.
- The Federal building falls below the applicable *de minimis* threshold set forth as follows:
  - Energy-intensive buildings less than 1,000 square feet,[8] or
  - All other building types less than 25,000 square feet.[9]

Buildings not meeting any of the exclusion criteria enumerated above are considered appropriate for energy metering.

Water Metering Verification Process

Starting with a comprehensive list of the agency's real property, perform the following steps to create a list of buildings that are appropriate to meter for water:

- Flag buildings with an existing agency-installed advanced water meter or with a utility-installed advanced water meter where the metered data is currently or is planned to be incorporated into the agency's energy and water tracking system.[10] Buildings that meet at least one of these conditions are considered to meet the statutory metering requirement. Remove these buildings from the list.
- Of the remaining buildings, flag which buildings are not metered and which buildings have standard water meters installed.[11]
- From this list, exclude buildings that meet one or more of the criteria described below; the remaining buildings are considered appropriate for metering.

Exclusion Criteria

Agencies may exclude a Federal building from water metering if it meets at least one of the criteria below:

- The Federal building is documented in a list of buildings planned for sale or demolition within the next five years.
- The Federal building is leased or owned, but the agency either does not pay the water utility bill or does not pay the lessor for utilities based on actual consumption.

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[8] For the purposes of this Metering Guidance, "energy-intensive buildings" includes industrial buildings, manufacturing buildings, data centers, laboratories, inpatient health care and hospitals, food service, and food sales. This list of building types is not exhaustive, so agencies should carefully consider whether other buildings in their portfolios could be considered energy intensive. In general, energy-intensive buildings have higher than typical energy loads beyond standard building ventilation and thermal comfort operations, including uses such as computing, manufacturing, process loads, and increased ventilation requirements.

[9] The 25,000 square foot threshold was determined based on provisions in American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1-2019, which is the current standard for the design and construction of new Federal commercial and multi-family high-rise residential buildings under 10 CFR Part 433. That Standard identifies 25,000 square feet as a key threshold for distinguishing smaller, lower energy-consuming buildings from larger, higher energy-consuming ones. The Standard requires whole-building electrical energy monitoring (section 8.4.3) as well as whole-building energy monitoring (section 10.4.6); however, it provides an exception in both cases for buildings under 25,000 square feet.

[10] A utility-installed advanced meter can be substituted for an agency-installed advanced meter at a building if data are collected at least hourly and the data are available to the agency and are incorporated into the agency's energy and water tracking system.

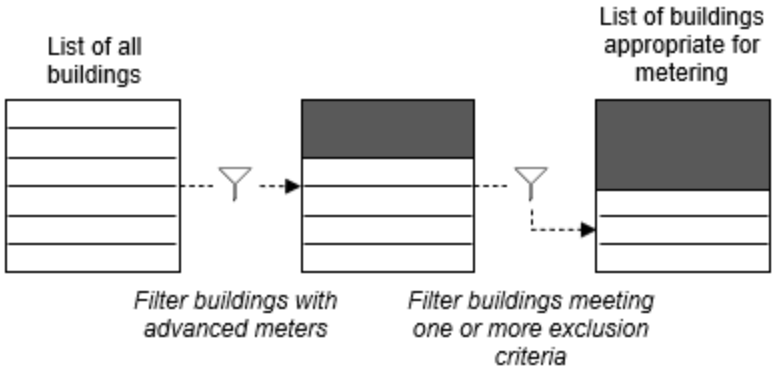
[11] Note: Federal buildings with existing standard meters may meet the metering requirement; however, agencies are required to install advanced energy and water meters to the maximum extent practicable, so some buildings with existing standard meters may need to be upgraded to advanced meters. See Step 2 for further instructions.

- The Federal building falls below one of the *de minimis* thresholds set forth as follows:
  - Buildings less than 1,000 square feet for the following water-intensive building types: chiller plants, steam plants, industrial buildings, manufacturing buildings, data centers, lodging, food service, food sales, recreation centers, vehicle wash stations, inpatient health care and hospitals, prisons, laboratories, and other water intensive building types deemed by the agency[12], unless water supplied to the building[13] is used to irrigate landscape greater than 25,000 square feet[14], or
  - All other building types less than 25,000 square feet[15], unless water supplied to the building is used to irrigate landscape greater than 25,000 square feet

Buildings not meeting any of the exclusion criteria enumerated above are considered appropriate for water metering.

Summary Flow Chart

The diagram below summarizes the general process for creating a list of buildings appropriate for metering.



Step 2: Advanced Meter Practicability in Appropriate Buildings

The instructions below apply to Federal buildings that are appropriate for metering per Step 1.

Federal statute mandates the installation of energy (electric, natural gas, and steam) and water meters at buildings considered appropriate for metering under Step 1. To the maximum extent practicable, Federal agencies are required to install advanced meters or advanced metering devices that provide data at least daily and that measure at least hourly consumption.

[12] The list of water intensive building types is not exhaustive, so agencies should carefully consider whether other buildings in their portfolios could be considered water intensive. In general, water-intensive buildings have high water use beyond standard operations, including high occupancy density, long operating hours, and/or water-intensive end-use equipment such as irrigation, cooling towers, and commercial kitchen equipment.
[13] Buildings that house irrigation pump stations, which supply irrigation to landscapes such as athletic fields and golf courses, do not meet the exclusion criteria and should be metered.
[14] Water metering exclusions for irrigated landscape less than 25,000 square feet is derived from the ASHRAE Standard 189.1 – Standard for the Design of High-Performance Green Buildings.
[15] The 25,000 square foot threshold was included to provide a *de minimis* size consistent with the energy metering requirement.

For the purposes of the advanced meter requirements, DOE interprets the term "maximum extent practicable" to mean that installation of an advanced meter or advanced metering device:

1. Would not conflict with other Federal laws;
2. Would not pose health and life safety issues;
3. Would not result in a request for products or materials not available; or
4. Would not prohibit accomplishment of agency mission and project objectives.

DOE notes that significant life-cycle costs to install advanced meters in a Federal building could prohibit the accomplishment of agency mission or project objectives, such as meeting energy or water cost savings goals or other budgetary metrics. If applicable, the agency should develop a method, consistent with 10 CFR Part 436, Subpart A and NIST Handbook 135, for evaluating how and when advanced meter life-cycle costs could prohibit the accomplishment of agency mission and project objectives. The agency must include a description of the method in its Metering Plan.

The installation of advanced meters is considered practicable when the above criteria are satisfied at buildings identified as appropriate for metering under Step 1. If an agency determines that an advanced meter is not practicable for a building, then pursuant to 42 U.S.C. 8253(e)(3), the agency must document that determination and include it in the agency Metering Plan submitted to DOE, if available at the time of submission. If it is not practicable to install advanced meters on a building, then the agency must install standard meters.

Step 3: Advanced Meter Prioritization Process

The instructions below apply to Federal buildings that are appropriate for metering per Step 1 and where advanced metering is practicable per Step 2. For the remaining buildings that are appropriate for metering but where advanced meters are not found to be practicable, agencies must install standard meters, but may prioritize them however they see fit.

DOE recognizes that agencies may not have the resources necessary for the immediate implementation of advanced meters at all Federal buildings identified under Step 2. Accordingly, agencies with resource constraints are expected to prioritize the order in which advanced meters are to be installed at their Federal buildings. The process below prioritizes building types by expected cost effectiveness. Note that the cost effectiveness of an advanced meter depends on many factors, such as:

- The type of advanced meter installed;
- The amount of energy or water used at the building;
- The relative efficiency of energy or water use at the building;
- Energy and water utility rates;
- The extent to which meter data are used to identify opportunities for energy- or water-saving measures;
- The implementation of those measures.

Metering is most cost effective at high energy- or water-consuming buildings, where advanced meters provide insight into building operations and energy and water managers use those insights to improve building performance.

Advanced Energy Meter Prioritization

For the purpose of maximizing cost effectiveness, it is recommended that agencies use the following process to prioritize the installation of advanced energy (electricity, natural gas, and steam) meters for each service entrance or supply line leading to each building identified in Step 2.

Split the list of buildings into two groups: (A) buildings that are part of a covered facility, and (B) buildings that are not part of a covered facility.

For buildings in group (A), agencies should prioritize advanced meter installation in the following order:

1. Energy-intensive buildings: industrial buildings, manufacturing buildings, data centers[16], laboratories, inpatient health care and hospitals, food service, food sales, and any other buildings determined by the agency to be energy intensive;[17]

2. Mission-critical buildings with large energy-consuming processes (e.g., training systems, communication transmitters, ship cold iron services);

3. Self-generated electricity including fossil, biofuel, and renewable energy sources, supplied to an installation (campus) and central plants serving multiple buildings at an installation (campus);

4. Remainder of buildings, largest first.

Once all buildings that are part of a covered facility have been ranked, repeat the previous step for buildings in group (B) using the same prioritization of building types listed in the previous step.

Advanced Water Meter Prioritization

For the purpose of maximizing cost effectiveness, it is recommended agencies use the following process to prioritize the installation of advanced water meters for each supply line leading to the buildings identified in Step 2.

Split the list of buildings into two groups: (A) buildings that are part of a covered facility, and (B) buildings that are not part of a covered facility.

For buildings in group (A), agencies should prioritize advanced meter installation in the following order:

1. Water-intensive buildings: chiller plants, steam plants, industrial buildings, manufacturing buildings, data centers, lodging, food service, food sales, recreation centers, vehicle wash stations, inpatient health care and hospitals, prisons, laboratories, irrigation pump stations, and any other buildings determined by the agency to be water intensive;[18]

2. Buildings with irrigated landscape greater than 25,000 square feet;

3. Mission-critical buildings with large water-consuming processes (e.g., cooling towers, steam boilers, and water purification);

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[16] Current OMB policy on Federal data centers is articulated in memorandum M-19-19, "Update to Data Center Optimization Initiative (DCOI)". In that document, it states that "agencies will be expected to have advanced energy metering and sub-metering, sufficient to accurately estimate Power Usage Effectiveness (PUE), for all remaining data centers over 100 kW that they are planning to keep open."

[17] In general, energy-intensive buildings have higher than typical energy loads beyond standard building ventilation and thermal comfort operations, including uses such as computing, manufacturing, process loads, and increased ventilation requirements.

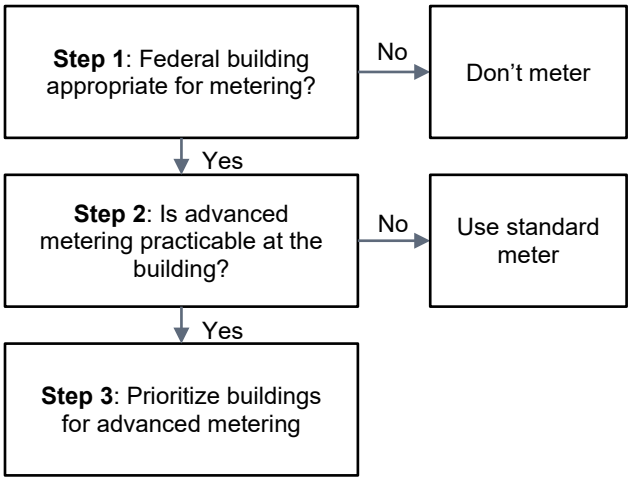
[18] In general, water-intensive buildings have high water use beyond standard operations, including high occupancy density, long operating hours, and/or water-intensive end-use equipment such as irrigation, cooling towers, and commercial kitchen equipment.

4. All onsite water sources, including surface and wells, that supply water to the installation (campus);
5. Main distribution lines, to effectively identify system losses—prioritize the largest distribution lines first;
6. Remainder of buildings, largest first.

Once all buildings that are part of a covered facility have been ranked, repeat the previous step for buildings in group (B) using the same prioritization of building types listed in the previous step.

Summary Flow Chart for Metering Determination Process

The figure below summarizes the steps of the Metering Determination Process described in this section.



III. Agency Metering Plan

As directed by Section 1002 of the Energy Act of 2020, each agency must submit a Metering Plan to DOE not later than 180 days after the issuance of this updated Metering Guidance. It is recommended, though not statutorily required, that each agency's Plan cover the five year period from 2022 to 2026. The Plan must demonstrate that the agency is complying with statutory requirements related to metering.

Minimum Required Information

For each agency, the Metering Plans shall include:

- Anticipated milestones and timeline.
- Estimated amount of funding and personnel required to implement the Plan.
- Description of how the agency will designate personnel primarily responsible for achieving the requirements.
- Description of the agency's approach to the energy and water metering determination process and summary results (agencies are not required to provide a prioritized list of buildings and locations).[19]
- Description of the agency's method for evaluating the practicability of advanced metering, including how and when advanced meter life-cycle costs could prohibit the accomplishment of agency mission and project objectives, if applicable.[20]
- Description of the agency's plan to assess the information security requirements that apply to its advanced metering infrastructure (AMI) system, and if applicable, its plan to obtain an authorization to operate (ATO) the AMI system (see Cybersecurity section in the Appendix).
- Description of how meter data are currently incorporated into energy and water tracking systems and, where applicable, benchmarking systems.
- Description of implementation barriers and how they are being addressed.
- Concurrence signatures from the Agency National Energy Manager/Metering Program Manager.

Agencies shall submit their updated Metering Plans to the FEMP Metering Program Manager. Agencies may submit Plans for sub-agencies as well, at the agency's discretion.

[19] Agencies may share their prioritized lists with FEMP, but should not submit any documentation that includes classified, confidential, or sensitive information, or information that could expose identifying information on sensitive buildings. The prioritized list of buildings and locations should be maintained internally and updated as necessary.
[20] Agencies may simply refer to Section II in this Metering Guidance if they have no special considerations beyond the criteria outlined in Step 2.

Appendix: Recommended Elements of an Effective Metering Plan

The purpose of the Metering Plan is to provide a framework for agencies to identify the key decisions, equipment, and personnel necessary to implement and maintain a successful metering program. Beyond the minimum required information described above, it is recommended that each agency include or reference documentation in the following areas to produce a complete and effective Metering Plan:

- Metering implementation
- Cybersecurity
- Data management and analysis
- Program performance

These planning documents are described in more detail in the following subsections. It is recognized that many of the plan elements described here may already be documented in other existing agency plans or records, such as an EnMS or a risk management strategy. In cases where existing agency documents satisfy the recommendations described below, they may be incorporated by reference.

Note: It is recommended, **but not required**, that agencies incorporate the elements outlined below into their Metering Plans.

Metering Determination Process

The agency's Metering Plan should include documentation of the method that was used to determine buildings appropriate for metering. The Metering Plan should include the following elements to properly document the determination process (as described in Section II):

- Agency's approach to the energy and water metering verification and identification.
- Agency's method for evaluating the practicability of advanced metering, including how and when advanced meter life-cycle costs could prohibit the accomplishment of agency mission and project objectives, if applicable.[21]
- Agency's approach to prioritizing buildings for advanced energy and water meters.[22]
- Results of the determination process with summary statistics on future implementation of energy and water metering (separate statistics should be provided for energy and water meters):
    - Number of buildings determined to be appropriate for metering (results of Step 1),
    - Number of buildings determined to be practicable for advanced metering (results of Step 2),
    - Number of buildings determined to not be practicable for advanced metering.

[21] Agencies may simply refer to Section II in this Metering Guidance if they have no special considerations beyond the criteria outlined in Step 2.
[22] Agencies may share their prioritized lists with FEMP, but should not submit any documentation that includes classified, confidential, or sensitive information, or information that could expose identifying information on sensitive buildings. The prioritized list of buildings and locations should be maintained internally and updated as necessary.

Metering Implementation

The agency's Metering Plan should include or reference the processes by which advanced meters for electricity, gas, steam, and water will be selected, procured, installed, commissioned, and authorized to operate. The Plan should consider resources required and prioritize metering implementation efforts for appropriate Federal buildings over the planning period covered in the Metering Plan.

Meter Selection and Procurement Process

Each agency should select advanced meters and related equipment that best fit the specific system design for each building. Designing and implementing an effective procurement process that ensures reliable delivery of all essential materials and services is critical to developing a successful and sustainable metering program. The agency's Metering Plan should include or reference documentation on the following advanced meter selection and procurement elements:

- **Equipment specifications:** Document the process by which specifications for the advanced meters for each specific utility (electricity, gas, steam, and water), data acquisition and data management systems, communications systems, and associated hardware (such as piping and wiring) will be developed. These specifications should clearly lay out the requirements for acquiring data, storing data locally, and transmitting data over a communications network. When developing specifications, agencies should consider relevant industry standards (e.g., IEEE, ANSI, AGA).

- **Procurement plan:** Define a process by which advanced meters, associated hardware, services, and internal support will be procured. Ensure that there is a mechanism to clearly communicate metering needs to applicable internal stakeholders. Develop a contracting strategy and language that sets terms and conditions to define the vendor selection process, delivery of goods and services, and payment process. Identify specific roles and responsibilities for the advanced meter procurement team. Integrate the principles of information and communications technology supply chain risk management to ensure the integrity and security of procured metering products and services (see National Institute of Standards and Technology (NIST) Special Publication 800-161).

Installation and Commissioning

Each agency should document a plan for the proper installation and commissioning of advanced meters and related equipment. Ensure that all parties involved in this process including agency personnel and contractors have expertise in the specific meter types (electricity, gas, steam, and water). The agency's Metering Plan should include or reference documentation on the following elements:

- **Building survey:** Document the procedure for assessing a building's specific metering needs. The procedure should ensure that all information required to design the metering assembly and communications system (e.g., service voltage/size, water supply line diameter) is collected during the survey. Survey results produced by a third-party contractor should be reviewed and approved by an agency representative, ensuring that the proposed metering equipment and installation plan is sound.

- **Metering equipment and communications systems engineering design:** Establish a design process and identify personnel who will participate in the metering design and approval, thus ensuring that the design is appropriate before the installation phase.

- **Field installation, commissioning, and testing:** Document the process by which the contractor will be selected (ensuring expertise in the specific utility), and execute the equipment installation, commissioning, and testing. The metering and communications equipment should perform within tolerances that are defined during the design process.

- **System acceptance:** Document the mechanism for system acceptance that will apply for each metering installation. All participating parties should be represented. An agency representative should ensure that the advanced meter is functioning properly once it has been installed, commissioned, and authorized to operate.

Cybersecurity

The agency's Metering Plan should include or reference documentation for plans to ensure the security of its AMI system. Cybersecurity is vital to ensure that meters are connected securely to the AMI communications network and do not open vulnerable pathways to other building networks and operations. This part of the Metering Guidance provides an overview of the Risk Management Framework (RMF), the process by which agencies authorize the operation of their information systems, as well as the Framework for Improving Critical Infrastructure Cybersecurity.

It is recommended that agencies visit the FEMP website to learn more about energy and cybersecurity integration. The website hosts a variety of tools and resources for learning more and implementing the frameworks discussed below.[23]

Risk Management Framework

The Federal Information Security Modernization Act of 2014 (FISMA) requires agencies to implement a program to assure the agency-wide security of information and information systems, including agency-owned assets as well as those provided or managed by another agency or contractor. An AMI system comprises a portfolio of advanced meters and related assets that collect, process, store, maintain, use, share, disseminate, and dispose of information. Therefore, an AMI system could meet the definition of a Federal information system, and if so, the agency would be required to demonstrate compliance with information security requirements. As required in Section III, agencies shall document plans to assess the information security requirements that apply to their AMI systems and whether an ATO is required.

At the direction of FISMA, NIST created the RMF, a process by which agencies can assure the security of information and information systems and authorize the operation of those systems at an acceptable level of risk to agency operations and assets, individuals, other organizations, and the Nation.[24] The RMF is a seven-step process to guide individuals responsible for mission processes in the development of a cybersecurity program. The steps of the RMF are provided below.

- **Step 0:** Prepare to develop a cybersecurity plan by identifying organizational priorities for managing risks to security and privacy.
- **Step 1:** Categorize the system based on the impact of loss of the information the system stores, processes, and transmits.
- **Step 2:** Select an initial set of security controls based on the impact analysis.
- **Step 3:** Implement the security controls and document the implementation.
- **Step 4:** Assess the security controls to determine the effectiveness with respect to satisfying the security and privacy requirements.

[23] FEMP resources for Energy and Cybersecurity Integration are available at: https://www.energy.gov/eere/femp/energy-and-cybersecurity-integration
[24] Note that depending on meter ownership, different standards may apply. For example, meters installed at Department of Defense (DOD) buildings through Energy Savings Performance Contracts or Utility Energy Service Contracts are government-owned and must follow the RMF process; however, meters installed by Utilities Privatization system owners at DOD buildings follow a separate standard and must achieve Cybersecurity Maturity Model Certification.

- **Step 5:** Authorize the system for operation based on the determination of the risk the system poses to all stakeholders.
- **Step 6:** Monitor the continued effectiveness of the controls at an interval conducive to meeting the organization's risk tolerance.

Further detail is provided in NIST Special Publication 800-37 Rev. 2, *Risk Management Framework for Information Systems and Organizations: A System Life Cycle Approach for Security and Privacy*, and associated publications.

Note that the Department of Homeland Security (DHS) administers the implementation of information security policies for non-national security Federal Executive Branch systems, including providing technical assistance and deploying technologies to such systems.[25]

Framework for Improving Critical Infrastructure Cybersecurity

Executive Order (EO) 13800, signed May 11, 2017, provides broad cybersecurity guidelines for all Federal owners and operators of critical infrastructure to use NIST's Framework for Improving Critical Infrastructure Cybersecurity, or Cybersecurity Framework (CSF), to manage cybersecurity risk. The EO recognizes the increasing interconnectedness of Federal information and information systems, and requires agency heads to ensure appropriate risk management for the agency's enterprise and for the Executive Branch as a whole.

In addition, the CSF provides a common language to address cybersecurity risk inside and across organizations, which can improve communications, awareness, and understanding between and among information technology (IT), planning, and operating units, as well as senior executives of organizations. CSF and RMF are complementary processes. The cybersecurity controls in the RMF can be mapped to the CSF. Per EO 13800, Federal agencies are encouraged to leverage CSF to evaluate cybersecurity risks to critical systems, including AMI. Results of the CSF evaluation may be incorporated into the agency's Metering Plan by reference.

The NIST CSF follows a seven-step process for developing and implementing a cybersecurity program:

- **Step 1:** Prioritize and scope the organization's mission objectives and priorities. Select an implementation tier that aligns with the organization's risk tolerances.
- **Step 2:** Orient the cybersecurity program to align mission-critical systems and assets with known threats and vulnerabilities.
- **Step 3:** Create a current profile by using the Framework to assess the organization's security posture.
- **Step 4:** Conduct a risk assessment to understand the likelihood and impacts of security events on the organization.
- **Step 5:** Create a target profile that defines the organization's desired security outcomes. These outcomes may be expressed as implementation tiers. The target profile is organization specific and the implementation tiers can differ between CSF core functions.
- **Step 6:** Determine, analyze, and prioritize gaps between the organization's current and target profiles.

[25] See the DHS Cybersecurity & Infrastructure Security Agency page on securing Federal networks for more information: https://www.cisa.gov/securing-federal-networks

- **Step 7:** Implement an action plan that addresses the gaps. The organization's risk assessment should inform the action plan.

Further detail is provided in the NIST white paper, *Framework for Improving Critical Infrastructure Cybersecurity, version 1.1*.

Data Management and Analysis

The agency's Metering Plan should include or reference documentation on the process by which energy and water meter data will be collected, managed, and analyzed. Robust, well-organized meter data enables a host of analytic capabilities for building owners and operators, from basic energy and water benchmarking and forecasting to detailed fault detection, condition-based monitoring, and system optimization. It is common for AMI to comprise a wide array of systems, often sourced from multiple vendors and employing a variety of communication protocols, which can lead to challenges in accessing and utilizing the data. Therefore, a comprehensive plan for data management and analysis is vital for the success of an agency's metering program. This part of the Metering Guidance defines energy and water data management and analysis elements that should be documented or referenced in the agency's Metering Plan.

Data Management

Each agency should have a data management plan to document its system for collecting, storing, and securing energy and water meter data. Documentation of the data management system should include the following:

- **Overview of the data management system:** Document the components of the system, the communication pathways and protocols between components, and the boundaries of agency control over the network. (Cross-reference with the network diagram described in the Operations and Maintenance subsection below.) Describe whether the system is owned and maintained by the agency, or if the agency contracts with a FedRAMP-authorized cloud service provider.[26]

- **Data storage and backup processes:** Document the points in the system where energy and water data are stored (e.g., at the meter, gateway servers, central database), the type of data being stored, the backup processes in place to ensure redundancy of data storage, the frequency of data backup, and the period of time for which data are retained.

- **Data administration and user access:** Document the roles of agency personnel in the administration of data at all levels, as well as the rules for determining various levels of user access to data. (Cross-reference with the roles and responsibilities described below under Program Performance.)

- **Data security:** The secure transmission, storage, and access of meter data should be assured through the agency's authorization to operate the AMI system, if applicable. (See the previous subsection on Cybersecurity.)

- **Federal energy and water tracking systems:** Document the Federal energy tracking systems available to Federal facility/building managers (e.g., ENERGY STAR Portfolio Manager®) and how meter data will be incorporated into those energy tracking systems.

- **Planned upgrades to the data management system:** document any major planned system upgrades.

[26] FedRAMP is a government-wide program that provides a standardized approach to security assessment, authorization, and continuous monitoring for cloud products and services. FedRAMP is mandatory for Federal Agency cloud deployments and service models at the low, moderate, and high risk impact levels. Information on FedRAMP is available at: https://www.fedramp.gov

Data Analysis

Each agency should document its framework for analyzing energy and water meter data to support decisions on building O&M and optimization, energy and water evaluations, and capital planning. Documentation of the meter data analysis system should include the following:

- **Identification of personnel who will analyze the meter data:** Document the roles and responsibilities of personnel involved in meter data analysis. (Cross-reference with the roles and responsibilities described below under Program Performance.)
- **Delegation of analysis by role:** Document the level of aggregation at which personnel will analyze data according to their role. For example, facility/building managers should review trends for the building(s) they directly oversee, while regional energy managers should review summaries of energy and water performance across their regional portfolio of buildings.
- **Meter data-driven decisions:** Document the ways that meter data will be used to inform decisions. For example, anomalies in building-level trends can alert facility/building managers about necessary scheduling and maintenance; aggregated portfolio-level benchmarking data can aid in prioritizing buildings for evaluations and capital improvements.
- **Mapping functionality to desired analytical capabilities:** Document the functionality provided by the agency's current energy management information system (EMIS) and/or other meter data analytics tools to determine if the current system meets the agency's needs. If the current system does not offer sufficient functionality, include any recommendations regarding enhancement of the existing system or replacement with third-party software.

Program Performance

The agency's Metering Plan should include or reference documentation of plans to assure ongoing program performance. Maintaining an effective metering program requires proper maintenance and having the right expertise and leadership support. This part of the Metering Guidance defines elements that should be included or referenced in the Metering Plan to track the performance and ensure the ongoing success of the metering program.

Performance Reporting

As described in Section I, Federal agencies are required to report to FEMP annually the status of advanced meter installation in the Annual Energy Management Data Report for electric, natural gas, steam, and water meters. In addition, it is recommended that agencies document the status of their advanced meters at regular intervals to measure program performance as well as to identify meters requiring maintenance, repair, or replacement.

Operations and Maintenance (O&M)

Although advanced meters and associated hardware can be expected to offer reliable operation and require less periodic maintenance compared to other building systems, a metering program will not operate smoothly and consistently without human intervention. Therefore, agencies should plan accordingly when considering staffing and budgetary needs to meet the O&M requirements of their specific metering programs. O&M plans should include the following elements:

- **AMI network diagram:** Develop a detailed network diagram for the agency's AMI system, and update it when configuration changes occur. The diagram will assist network administrators in diagnosing anomalies, such as non-reporting meters.

- **Equipment inventory:** Document the complete inventory of advanced meters, networking equipment, and internet protocol (IP) addresses.
- **Meter performance monitoring:** Design a process for monitoring advanced meters' reporting status and a diagnostic checklist for identifying the root cause of interruptions in communication. Document the status of advanced meters at regular intervals.
- **Preventive maintenance and ongoing commissioning:** Develop plans to proactively identify and correct issues such as advanced meters and associated hardware that have not been properly commissioned, are not reading data correctly, or have data communication problems on an ongoing basis.
- **Responsive maintenance and troubleshooting:** Develop plans to respond to issues such as malfunctioning hardware, communications outages, power outages, uncoordinated IT security actions such as software security patches resulting in equipment incompatibilities, and personnel communication issues.

Trained Personnel Roles and Responsibilities

Staffing resources needed to install, maintain, and operate a metering system, as well as analyze the metered data, are critical to a successful metering program. Personnel need to be appropriately trained on the requirements for each specific meter type (electricity, gas, steam, and water) and afforded the necessary time to operate and maintain the metering equipment and AMI in order to gain the benefits of the metering system. Therefore, agencies should define the necessary personnel and required training to ensure metering systems can be operated and maintained appropriately. Agencies should scale the number of required personnel relative to the size of their program.

Each agency should include the following trained personnel in the Metering Plan, which defines the roles and responsibilities for properly installing and operating metering systems required to gather and use the metering information to track and reduce energy and water use:

- **Agency National Energy Manager/Metering Program Manager:** Individual within an agency with overall jurisdiction and responsibility for metering program execution.
- **Authorizing official:** A senior agency official or executive within an agency with the authority to formally assume responsibility for operating an information system at an acceptable level of risk to agency operations and assets, individuals, other organizations, and the Nation. The authorizing official is responsible for granting the authorization to operate an information system.
- **Program managers:** Staff who are responsible for the overall management of the metering program and will coordinate within their areas and estimate budgetary needs.
- **Project managers:** Staff who track installation and commissioning efforts, draft statements of work, coordinate with contracting offices, direct field personnel, and track budgets.
- **Procurement specialists:** Staff who understand the agency's procurement protocols and who will coordinate procurement procedures such as requests for proposals.
- **Contracting officers/representatives:** Staff who are authorized to perform contract administration functions and who ensure contractors meet Federal performance requirements.
- **Program support personnel:** Staff who handle general logistics and supply chain management.

- **Engineers and network architects:** Staff who design metering systems, ancillaries, and network architectures to meet specific metering and communication requirements.
- **IT security professionals:** Staff responsible for implementing policies and measures to prevent unauthorized access to AMI resources.
- **Network administrators:** Staff who are responsible for network health and troubleshooting.
- **Data analysts:** Staff who analyze energy and water data and interpret analysis results for energy and water managers.
- **Federal facility managers:** Building maintenance specialists and property administrators who conduct building operations and maintenance activities, coordinate facility programs and projects, and supervise building personnel.
- **Energy and water managers:** Staff who work with data analysts to develop energy and water savings measures and manage data reporting requirements.
- **Field technicians:** Staff who troubleshoot and repair advanced meters and associated hardware for the specific meter type.
- **Skilled craft laborers:** Contract or government personnel, such as pipe fitters and electricians, who perform skilled labor for installation and O&M.

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42 U.S.C. § 8253–Energy Management Requirements: Metering of Energy Use.

42 U.S.C. § 8258–Reports: Reports to Secretary.

44 U.S.C. § 3502–Definitions.

10 CFR Part 433–Energy efficiency standards for the design and construction of new Federal commercial and multi-family high-rise residential buildings.

10 CFR Part 436–Federal energy management and planning programs.

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