

Appendix F Metering Plan

I. PURPOSE OF THIS GUIDELINE

The purpose of this Metering Plan guideline is to provide information to assist the Agency, its representative or Energy Analyst in the formulation of a Metering Plan that is to be incorporated in the Energy Analysis Report and the Energy Systems Performance Verification Plan.

Useful guidelines can be found in ASHRAE's *HVAC Applications Handbook*, 1995, Chapter 37, "Building Energy Monitoring" (updated in the 1999 version, Chapter 39), American Society of Heating, Refrigerating, and Air Conditioning Engineers, Atlanta, GA.

II. OBJECTIVE OF METERING END USES WITHIN THE BUILDING

The SEED rules (Appendix B) include a provision that the building will be monitored during 18 months of occupancy to make sure that the building is being operated according to the design. To reach that goal, it is necessary to monitor the *major* specific end uses within the building, and collect data that affect the end use such as the outside temperature.

The rules also state that in case significant differences between the monitored data and the modeling results are discovered during this period, the Agency needs to investigate to find the cause. This will result in either: 1) an adjustment can be made in either the model or the operation of the building, or 2) an explanation for the difference can be found that is acceptable to the Agency and the Department of Energy.

Furthermore, it is believed that metering will help manage the energy use of the building on a long term basis, assist in verifying utility billing, and offer the opportunity to select appropriate utility rate schedules if or when more choices in rates are being offered.

III. MONITORING AND DATA COLLECTION

1. Monitoring

The Agency, in consultation with the Energy Analyst, the Design Team, and the Department of Energy need to choose which end uses are to be monitored in the building. ***As a minimum***, the total electric and gas loads of the new or renovated facility need to be monitored separately from other (nearby) facilities. Monitoring water use is encouraged as well.

The Agency is encouraged to *separately* monitor, where practical, the major energy using equipment or systems. In general, heating, ventilating and air conditioning systems, electric motors, boiler and chiller loads, lighting, and where applicable, domestic water heating should be considered.

2. Data Collection

As a minimum, manually collected *monthly* data should be collected and reported. *Hourly* data are preferable for the end use analysis and the comparison to the modeling results. Generally acceptable data formats and analysis procedures will not only help facilitate the comparison to the modeling results, but they are also helpful in comparing the performance of different buildings. The Agency Contact is encouraged to contact his or her department's building operations personnel or the Department of Administrative Services (DAS) to find out what software package is being used by the various state agencies. (Note: As the result of a coordinated effort by many state agencies in the fall of 2001, a software package for monitoring energy use was selected that is powerful and flexible. Many agencies have chosen to use this software package).

3. Hardware

The department's building operations personnel or DAS can also be helpful in choosing suitable metering hardware. The software specifications provide guidance as to the hardware and data format(s) that are compatible with the software. Many buildings have an energy management system installed at the time of construction, which may be compatible with the software as well.

4. Personnel

It is extremely important to identify who is responsible for these long term monitoring activities and to provide adequate resources to do this work. Coordination with personnel who monitor and perform data analyses and quality control in other buildings within the agency will be helpful and save cost.

5. Process of identifying data monitoring points

In the process of determining what loads should be sub-metered, the Agency can make use of the following:

- The Energy Analyst's expertise and modeling results will indicate the major energy using loads.
- The Energy Analyst's expertise and modeling results will indicate which factors significantly affect the energy use. Such factors need to be included in the monitoring effort (e.g., boiler start time and heating load varies with outside air temperature).
- As outlined in more detail in Appendix E with *the Energy Systems Performance Verification Plan*, the Design Intent document provides the owner's vision for the planned facility and expectations for how it will be used and operated. It describes the assumptions used for sizing and selection of systems (i.e., operating conditions, and design conditions, weather data, interior environmental criteria,

and other pertinent design assumptions). This document is helpful in determining the absolute and relative size of the different loads and can, therefore, be used for the selection of monitoring points.

- During the verification process, all building systems are checked whether they perform interactively as intended and in accordance with the contract documents, the owner's objectives and operational needs.

III. MORE INFORMATION

More detailed guidelines can be found in ASHRAE's *HVAC Applications Handbook*, 1995, Chapter 37, "Building Energy Monitoring" (updated in the 1999 version, Chapter 39), American Society of Heating, Refrigerating, and Air Conditioning Engineers, Atlanta, GA.