Appendix A

The Facility Survey

The Need for Facility-Level Data

The CBECS is designed to measure consumption of individual fuels in individual commercial buildings. Data are collected on buildings' consumption of electricity, natural gas, fuel oil, and district heating and cooling. Each fuel is measured in terms of the amount consumed at, or delivered to, the building, rather than in terms of the primary fuels that may have been consumed at the earlier point of generation.

In this framework, district heat is an important fuel type. The total energy delivered in this form to commercial buildings is of the same magnitude as the total energy delivered from fuel oil. CBECS estimates of the amount of district heat provided to commercial buildings have been increasing since the first CBECS was conducted in 1979, largely as a result of improvements in coverage due to better understanding of this form of energy. In 1989, 13 percent of heated commercial floorspace was in buildings served by district steam or hot water. Six percent of air-conditioned commercial floorspace was cooled by district chilled water.[10]

For purposes of the CBECS, district heat is steam or hot water piped into a building from a central source that is located outside the building and serves more than one building. Similarly, district cooling is chilled water piped into a building from a central source that is located outside the building and serves more than one building. The central source may be a utility, or else a central physical plant that serves the entire multibuilding facility of which the building is a part. Typical examples of multibuilding facilities are university campuses and hospital complexes.

When district heating or cooling is provided by a utility or similar vendor, the amounts delivered are usually metered and billed, much as electricity, natural gas, or water service would be. Consumption for purchased district heating and cooling are relatively easy to obtain from billing records.

Of the commercial floorspace served by district heating and cooling, roughly three-quarters is served, not by a utility, but by a central physical plant on the same facility. Often in such cases, there is no metering of individual buildings' steam, hot water, or chilled water use. There may be metering records for a loop that serves several buildings, a record of total plant output only, or even no record of the overall output. In the latter case, the total facility inputs may be the only data available. For these reasons, it has been difficult for the CBECS to provide accurate estimates of total district heating and cooling consumption by commercial buildings.

Another difficulty with the CBECS district heating and cooling estimates has been reconciling the CBECS consumption totals, based on aggregating deliveries to individual buildings, with EIA's commercial-sector sales totals from energy suppliers. CBECS consumption totals can be compared with EIA commercial sales totals for electricity, natural gas, and fuel oil. However, EIA does not collect data on sales of steam, hot water, or chilled water to the commercial sector. Most of the energy consumed at the building level as cooling (via chilled water) or as heat (via steam or hot water) is reflected in sales of coal, natural gas, or fuel oil. Thus, accurate accounting of district heating consumption is needed to account for discrepancies between total sales and total building consumption of fossil fuels.

[10]Energy Information Administration, Office of Energy Markets and End Use, *Commercial Buildings Characteristics 1989*, DOE/EIA-0246(89) (Washington, DC, June 1991), Tables 79 and 80.

Generally, the primary fuels consumed on commercial facilities to generate district heating and cooling are excluded from the CBECS consumption totals. The primary fuel is typically excluded because the central plant that consumed the primary fuel is usually in a building classified as industrial, not commercial. Energy consumption in noncommercial buildings is explicitly outside the scope of the basic CBECS.

The CBECS designation of a building as commercial (in-scope) or noncommercial (out-of-scope) depends on the activity within the individual building, not the activity of the facility to which the building belongs. If the central physical plant occupies most of the building, the building is classified as industrial. Though awkward in relation to the central plant issues, the building classification scheme was developed for sound methodological reasons, and is fundamental to the design of the CBECS. The CBECS is a commercial *buildings* survey, and not a commercial *establishments* survey, because most energy consumption in the commercial sector is building related, that is, for space conditioning and lighting. To understand commercial energy consumption, it is therefore necessary to focus on characteristics of commercial buildings. In the field, CBECS interviewers devote a considerable amount of effort to defining building boundaries and determining whether the use of the building meets CBECS definitions of commercial activity.

The Facility Survey was added to the 1989 CBECS for two main reasons:

- To provide a better basis for imputing district heat consumption for sample buildings with no building-level metering. Previously, CBECS might have obtained building-specific records when available, total loop or system output when building records were not available, and total system input when output records were not available. It was hoped that collecting all types of information available from each site would provide a better basis for developing input-output relationships to be applied to cases where only limited information is available.

- To provide a basis for estimating primary fuel consumption by central plants in noncommercial buildings on commercial facilities. This would help to reconcile discrepancies between CBECS consumption totals and EIA's commercial-sector sales totals. The data collection was designed for a size-based network estimator of facility consumption totals.[11]

Because central plant outputs include chilled water and electricity as well as steam and hot water, any sound analysis of input-output relationships will need to account for chilled water and electricity generated or cogenerated onsite. It was therefore anticipated that this analysis effort would result in improved estimates not only for district heating consumption, but also for chilled water consumption and for electricity generation and cogeneration. However, the improved estimates for chilled water and electricity were secondary, not primary, purposes of the Facility Survey. The amounts of district chilled water and electricity produced are smaller in magnitude than district heat, and good data have been more difficult to obtain.

Identifying and Surveying Facilities

The facilities were sampled via the 1989 CBECS buildings sample.[12] During the interview at the building, the respondent was asked if the building was part of a multibuilding facility or complex. If the building was part of such a facility, the respondent was then asked if the facility had a central physical plant that produced district heating, district cooling, or electricity.

[11]Miriam L. Goldberg, "An Adjunct Facilities Survey for a Complex Buildings Survey," *Proceedings of the Section on Survey Research Methods of the American Statistical Association,* (1989).

[12]Energy Information Administration, Office of Energy Markets and End Use, *Commercial Buildings Characteristics 1989*, DOE/EIA-0246(89) (Washington, DC, June 1991), Appendix A.

The definition used for a multibuilding facility was purposefully made broad. A multibuilding facility was defined as "two or more buildings on the same site owned or operated by a single organization, business, or individual." The scope of the Facility Survey was restricted to facilities with central physical plants that produced district heating, district cooling, or electricity. If steam, hot water, or chilled water was piped in from one building to another (such as a boiler in a main hospital building supplied steam to an annex) then the building providing the steam, hot water, or chilled water was considered the central plant.

The Facility Form (Form EIA-871B) was then sent to all central physical plants so identified. The Facility Form (Appendix F) asked for the following:

- the principal activity of the facility;
- the number of buildings on the facility and their total square footage;
- whether the facility was designated a qualifying facility under the Public Utilities Regulatory Act of 1978 (PURPA);
- verification that there was a central physical plant;
- whether the plant had a cogeneration system and, if so, the total nameplate capacity and whether the system was interconnected with an electric utility;
- information on plant inputs (fuels, amount consumed, and expenditures);
- information on outputs from the plant to the district system (output fuels, yearly plant output, number and floorspace of buildings served).

Facility Survey cases were identified when respondents to the Building Questionnaire indicated that the building was both part of a facility and had a central physical plant. Forms were mailed in January 1990 with the rest of the Energy Suppliers Survey forms. Half of the returns were received within 2 months of the original request. A second mailing and reminder letters resulted in a limited number of additional responses. Telephone prompting, begun in late August, was much more effective at converting nonresponses. During these calls, survey staff members were able to answer questions and to encourage respondents to return their survey questionnaires even if they were unable to provide all of the requested data. The survey close-out date was November 10, 1990.

A total of 393 survey forms were mailed to managers of central physical plants identified on the Building Questionnaire. However, 24 of these responded that there was no central physical plant and an additional 8 reported that there was only one building on the facility. The overall response rate for the facility form was 68 percent (Table A1). This rate is based on all responses from eligible facilities, including those containing data (complete or partial) and those indicating they did not have a central plant. Nonrespondents included those who refused to answer the questionnaire (6 cases), those who indicated they would not respond because they do not maintain the necessary records to provide the requested information (3 cases), those that had not provided any information by survey closeout date (113 cases), and two "problem" cases which could not be classified. A total of 136 of the 385 eligible facilities (35 percent) responded with complete data that passed the critical item edit. Another 125 facilities provided some information, but what they provided was missing critical data needed for a response to be complete.

The problem of nonresponse, and its implications for the quality of the Facility Survey data, is discussed more fully in Appendix B, "Data Quality."

Table A1. Facility Form Responses by Disposition

Survey Disposition	Total Forms	Percent
	112	28
A. Complete, Usable Data		
B. Complete, No Central Plant	24	6
C. Partially Complete	125	32
D. Nonresponse	124	32
E. Not a Facility	8	2
F. Total Cases (sum of A through E)	393	100
G. Some Facility Data Present (A+B+C)	261	--
H. Response Rate (G/F-E)	--	68

-- = Data not applicable.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871B, "Facility Form" of the 1989 Commercial Buildings Energy Consumption Survey.