

Survey Data vs. Energy Audits: Comparing Two Forms of Data Collection in the Commercial Buildings Energy Consumption Survey



*International Energy Program Evaluation Conference
August 12, 2015 | Long Beach, CA*

*Bill McNary
Office of Consumption and Efficiency Statistics*



U.S. Energy Information Administration

Independent Statistics & Analysis | www.eia.gov

Commercial Buildings Energy Consumption Survey (CBECS) Overview

- CBECS is the only source of national-level data on the characteristics and energy use of commercial buildings in the United States
- CBECS data are used for:
 - policy planning,
 - building code development,
 - forecasting energy consumption,
 - critical input to the Environmental Protection Agency's Energy Star models
- Data collection
 - Trained survey interviewers using a computerized questionnaire
 - Usage records from energy providers
- 2012 data for 6,720 buildings

Energy Assessment (EA) Overview

- National Research Council recommendations on how to improve consumption surveys – test feasibility of using energy auditors in tandem with, or instead of, trained interviewers
- EIA's research goals
 - Learn process of integrating audits into CBECS,
 - evaluate CBECS data quality,
 - improve the CBECS survey process
- 203 buildings, across all five climate zones, variety of building sizes and activities
- Trained auditors and a standardized paper checklist

EA Checklist

CBECs: Energy Assessment Checklist		Confidential Building Reference No: <u>Office 24</u>					Date: <u>6/4/13</u>		Source		By: <u>Bob L.</u>	
Units		1	2	3	4	5	I	O	D	Additional Notes / Ref.		
5A	HVAC: Principal Heating & Cooling Equipment											
①	Building Block ID / Tag											
●	Principal HVAC Type											
	▲ Options	1. Roof Top Unit	2. PTACs	3. Heat Pumps	4. Chiller-Boiler	5. Other - Specify						
①	Year Installed (Existing System)											
①	Last Renovation (Key Major Upgrades)											
①	Renovation Summary											
	▲ Tips	Obtain which items were upgraded and / or renovated since original install and cross reference with head-end devices, distribution systems and terminal unit categories. New controls, new energy saving devices, distribution loop upgrades, new equipment or equipment conversions, disabled existing equipment due to other issues, etc. are common and important changes than need to be collected.										
●	Heating & Cooling Distribution Medium											
	▲ Options	1. Air+Water+Steam	2. Air + Water	3. All Air System	4. All Water	5. All Steam						

Research Goals

- Quantitative and qualitative data differences between
 - Trained interviewers and
 - Energy auditors
- Advantages and disadvantages of each method
- Determine whether an energy assessment is a feasible or logical addition to CBECS data collection

Energy Assessment Data

- 203 completed energy assessments
- 13 energy assessors completed between 2 and 40 assessments, average of 15 EAs per assessor
- Average of 3.2 hours on-site

Results



*Bill McNary, Long Beach, CA
August 12, 2015*

Square Footage

CBECS

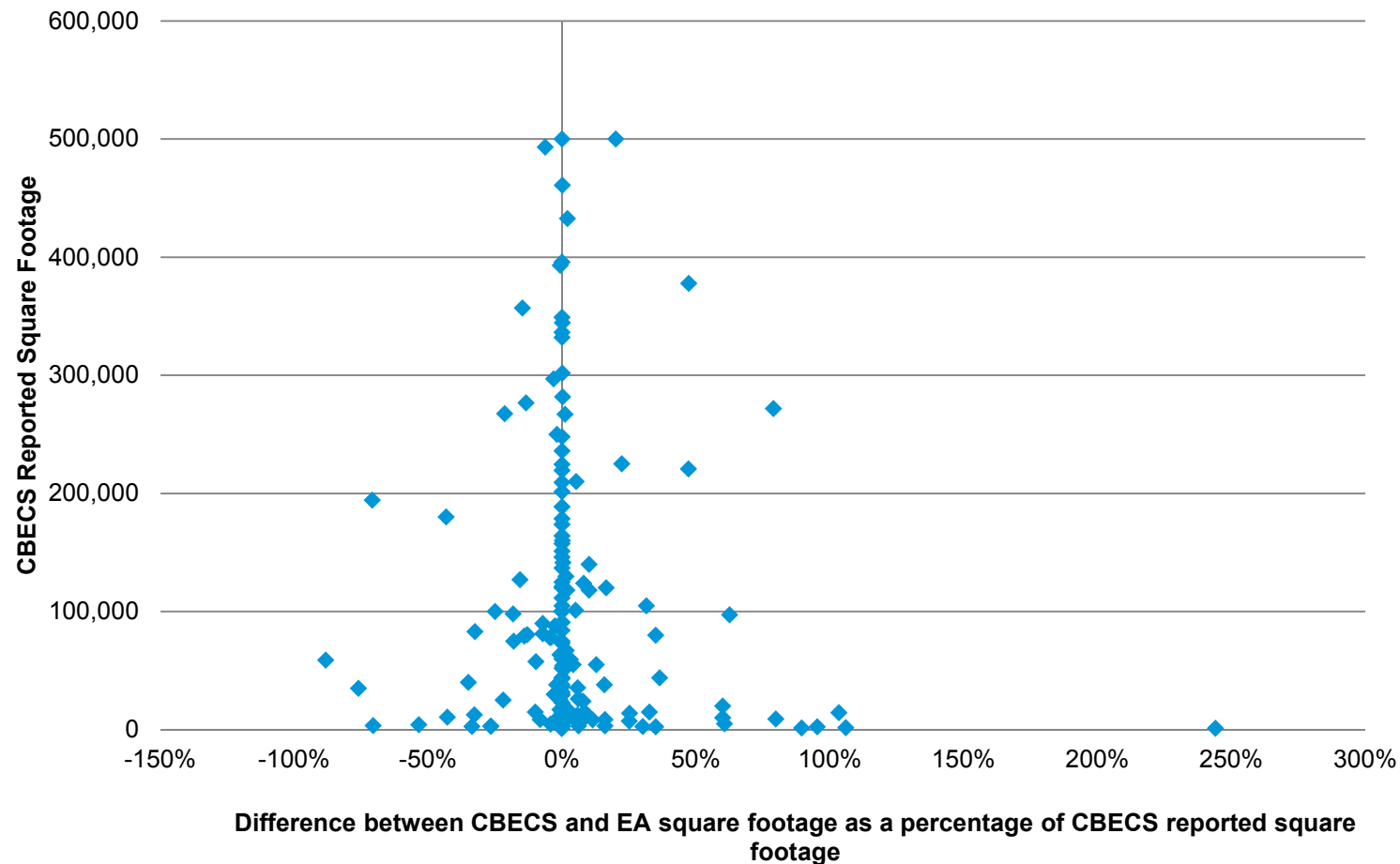
- Respondents asked for exact square footage
- Two follow-up questions:
Does this include parking?
Does this include all common areas?
- If the respondent cannot report an exact square footage, categories provided

Energy Assessments

- Assessors were told to obtain an exact square footage, from respondent, observation, or documentation
- No follow-up questions
- No category options

Agreement on Square Footage

Percentage difference between CBECS and EA square footage by CBECS square footage for buildings under 500,000 square feet



Building Activity (PBA)

CBECS

- Show Card listing 18 activities
- Respondent indicates
 - one activity >75% floorspace, or
 - up to three activities and their % of floorspace
- Subcategory options based on main activity
 - CBECS PBA mapped on selected subcategory

Energy Assessments

Checklist provided spaces for assessor to record:

- Up to five activities selected from 19 options
- Percent of floorspace served by each activity
- Subcategory for each activity was on last page of check list.

Most Building Activities Match

CBECS and EA PBA
matched in 77% of cases

Of the 47 non-matching
cases:

- EA was correct in 18 cases
- CBECS correct in 23 cases
- 6 cases were unclear or neither seemed correct

EA PBA	Matches CBECS PBA	Does NOT match CBECS PBA	Total cases	Match rate
Nonrefrigerated warehouse	7	0	7	100%
Lodging	9	1	10	90%
Inpatient health care	12	2	14	86%
Public assembly	22	5	27	82%
Education	32	8	40	80%
Service	8	2	10	80%
Food service	7	2	9	78%
Office	37	11	48	77%
Retail (other than mall)	7	3	10	70%
Outpatient health care	6	6	12	50%
Nursing	3	0	3	100%
Religious worship	2	0	2	100%
Food sales	1	0	1	100%
Laboratory	1	0	1	100%
Refrigerated warehouse	1	0	1	100%
Public order and safety	1	4	5	80%
Vacant	0	3	3	0%
Total for all buildings	156	47	203	78%

Results: Fuels

CBECS

- First fuel question asks which of nine different fuels are “used for any purpose”
- End-use questions include the list of selected fuels, plus an additional category for any other energy source

Energy Assessments

- No overall question on fuels used for any purpose
- Assessment initially collects supplier name for the five most-used fuels, out of 15 possible fuel options
- Equipment sections include the same list of 15 fuels

Agreement on Major Fuels, Differences on Minor Fuels

- The assessments collected fewer cases for each fuel
- Results closer for major fuels (electricity and natural gas)
- Fuel oil had the lowest match rate

Fuel	CBECS	Energy Assess.	Buildings where both CBECS and EA confirm use
Electricity	203	196	196
Natural Gas	141	135	126
Fuel Oil, Diesel, or Kerosene	75	32	29
Bottled Gas (LPG or Propane)	10	8	4
District Steam	25	15	15
District Hot Water	9	1	1
District Chilled Water	17	7	7
Wood	1	0	0
Solar	5	11	3

N=203 total buildings

Conclusions

- Square footage and PBA
 - errors were evenly distributed between the CBECS and the EAs
- CBECS interviewers were better at capturing all fuels used in the building,
 - due to structure of computerized instrument
- Unlikely that EAs would replace CBECS in the future due to time and cost constraints