CBECS
Commercial Buildings Energy Consumption Survey

Assuring Sample Quality in the 2012 Commercial Buildings Energy Consumption Survey

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CBECS Overview

- **Sponsored by U.S. Department of Energy (DOE), Energy Information Administration (EIA)**

- **Mandated by DOE Organization Act of 1977**

- **Sole national estimates of the number, size, energy use and energy costs for U.S. commercial buildings**

- **Provides vital details on energy-related building characteristics, activities, technology trends**

- **Conducted every 3 to 5 years since 1979**

- **2012 data collection performed April - November, 2013**

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CBECS Quality Control Challenges

- **Unique unit of analysis (an entire building)**

- **Large variations in size, configuration, and uses**

- **Unfamiliar concepts for field interviewers**

- **Many "gray areas" and opportunities for error**

- **Sampling and screening procedures are unique, complex, time-consuming, and IMPORTANT**
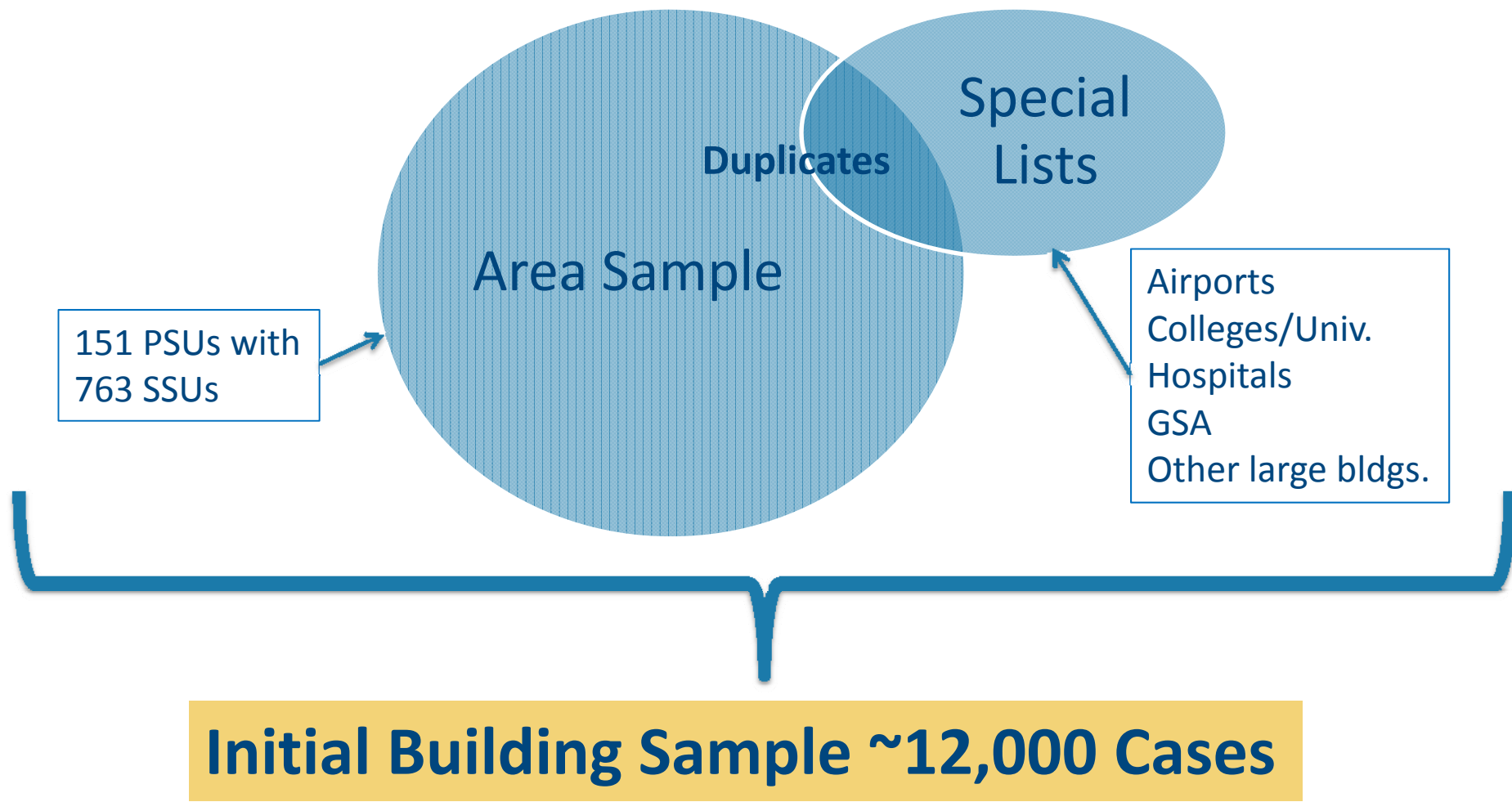
- **CBECS sampling QC must take all of this into account**

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CBECS Sampling Topics

1. CBECS Design Objectives

2. Multiple Buildings

3. Strip Shopping Center

4. Square Footage Edits

5. Conclusions and Future Research

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2. CBECS Design Objectives

Area Sample

Duplicates

Special Lists

151 PSUs with 763 SSUs

Airports
Colleges/Univ.
Hospitals
GSA
Other large bldgs.

Initial Building Sample ~12,000 Cases

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What is a Commercial Building?

1. <u>Structure:</u> **Enclosed with walls that extend from the foundation to the roof**

2. <u>Size:</u> **Larger than 1,000 square feet**

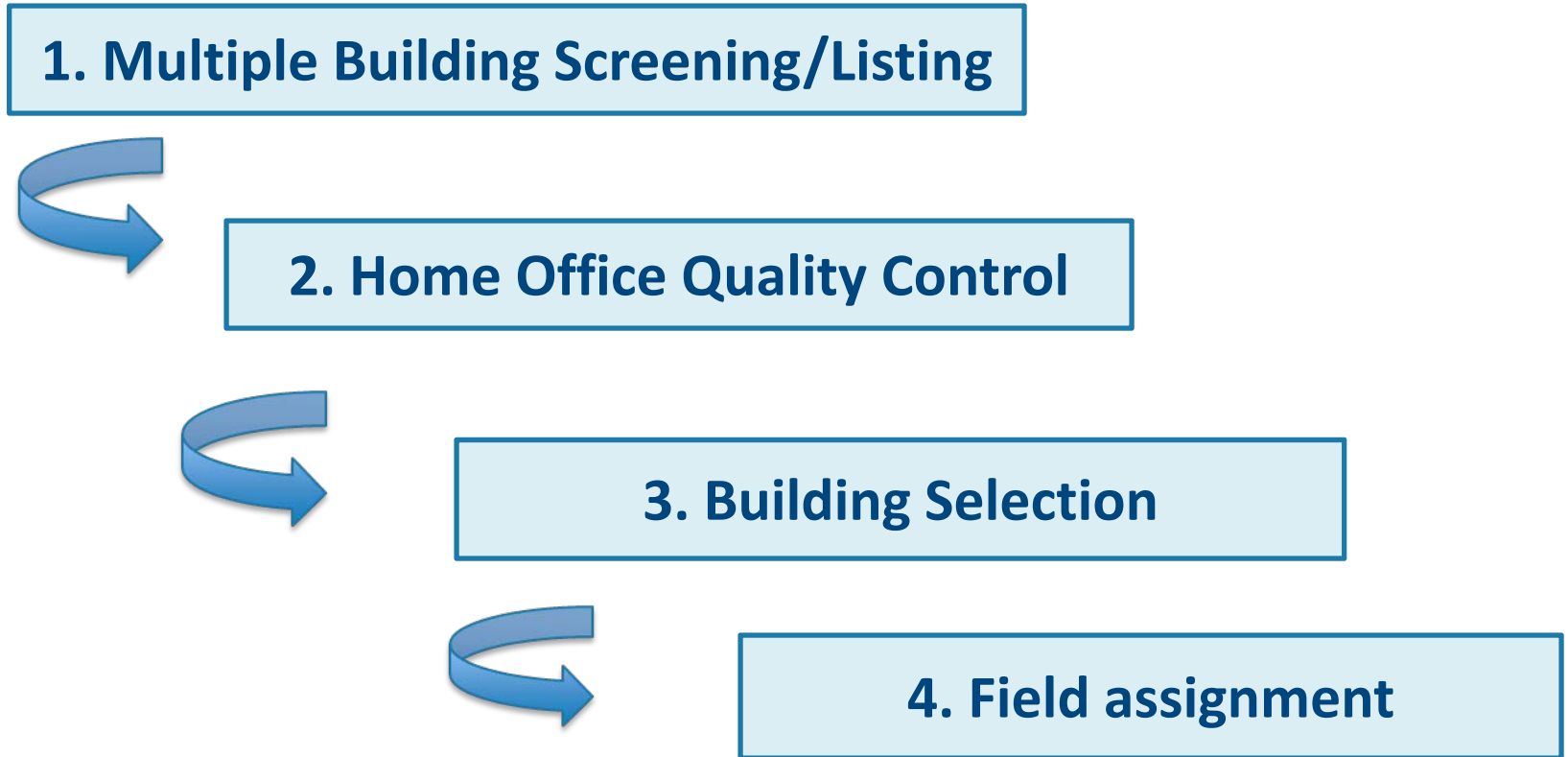3. <u>Activity:</u> **Used primarily for commercial activities**

2. Multiple Buildings

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Multiple Building Procedures

1. **Multiple Building Screening/Listing**

2. **Home Office Quality Control**

3. **Building Selection**

4. **Field assignment**

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Multiple Building QC Checks

- **Check that:**

  - **Listed structures are in-scope for CBECS**

  - **Listed buildings are not sample duplicates**

  - **Activity and size categories are appropriate**

- **Review online resources when available to supplement existing records**

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Multiple Buildings QC Pass Rate

Result	Count	Percent of received
Passed QC (Final)	188	44.8
Failed QC (Final)	232	55.2
Total Received	420	100.0

3. Strip Shopping Centers

- **Strip shopping centers are special types of buildings that require specific procedures in CBECS**

- **Usually no single respondent with adequate knowledge of the entire building to complete the CBECS interview**

- **Diverse types of tenants (general use) and corresponding variety in energy consumption (intensity)**

- **Growing number of building types share some characteristics of strip shopping centers, without the diversity of use**

- **Often difficult for interviewers to classify correctly**

Strip Shopping Center?

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Strip Shopping Center?

Characteristics of Strip Shopping Centers

- **Usually built as a unit**

- **Structures about the same age**

- **Usually set back from the street**

- **Primarily occupied by retail establishments**

- **Parking areas in front**

- **Usually has a name (e.g., "New Town Shopping Center")**

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Interviewer Role

- **Located the sampled building**

- **Assessed the situation: is this building a strip shopping center?**

- **Completed a screener form:**

  - **Listed all the establishments**

  - **Paced off the distance across the front of each establishment**

  - **Determined the primary activity (e.g., retail store)**

- **Scanned the screener form using laptop and transmitted to Home Office for review**

Home Office Role

Reviewed each form transmitted

- **Does the building meet the CBECS definition of a strip shopping center?**

- **Used online tools such as strip shopping center web site when available (maps occasionally)**

- **Used Google, WhitePages.com, Google Earth Pro, Bing and others**

- **Interviewers revisited the site in-person as needed**

- **For each establishment, checked number of paces: was this reasonable, and consistent with its general use?**

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Strip Shopping Center QC Results

Result	Count	Percent of Received
Passed QC (final)	**421**	**75.0**
Failed QC (final)		
Not a Strip Shopping Center	**138**	**24.5**
Other problem	**3**	**0.5**
Total Received	**562**	**100.0**

Sampling Staff Role

Checks for subsampling of establishments

- **Total establishments: 3 to 20**

- **General use code provided**

- **Number of paces: from 5 to 100**
  - **Proxy for the total square footage of the establishment**
  - **New procedure adopted in 2012**

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Subsampling Establishments

- **Establishments were subsampled using a probability proportional to size (PPS) sampling method**

- **New cases generated for establishment interviews, and a short interview about the entire building**

- **This is the only type of building where establishment interviews were conducted**

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Quality Impact on CBECS Estimates

- **If the establishment activity was not correctly identified or the number of paces was in error, then a misclassification would result**

- **The sampling rate would not be optimal**

- **The precision of the estimates derived for the strip shopping centers would be reduced**

4. Square Footage Edits

- **Was the interview potentially conducted in a wrong building?**

- **Was the interview conducted for an entire campus, not just the sampled building(s)?**

- **Was the interview conducted in a portion of the sampled building?**

- **Was the interviewed building duplicated in the sampling frame?**

Square Footage Edits (cont.)

- **Weekly checks run on buildings reported as complete, out-of-scope, terminated during interview**

- **Square Footage critical edit checks**
  - **Frame size**
  - **Interview size**

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Square Footage Edit - Example

Interview information:

Interview Size Class: 2   (10,001 - 25,000 Sq. Ft.)

Frame information:

Frame Size Class: 6   (200,001-500,000 Sq. Ft.)

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Checking Square Footage Online

- **Find the interviewed building**

- **Estimate perimeter of the roof**

- **Check number of floors**

- **Calculate the square footage**

- **Determine whether frame size or interview size is correct**

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Possible Findings and Decisions

- **If the interviewed building was located**

    - **Correct building: interview (or frame) size confirmed**

    - **Incorrect building: closed out as wrong building**

- **The listing turned out to be a campus**

    - **Interviewer should have listed all buildings and submitted to Home Office for subsampling**

    - **Home office completes listing and performs subsampling**

5. Conclusions and Future Research

- **CBECS unit of analysis and complex sampling goals continue to require major investment in QC process**

- **While time-consuming, reduction of survey error means QC procedures pay off in better quality estimates**

- **Consider expanded interviewer training on building concepts with more real-world exercises**

- **Continue to assess and refine uses of online mapping and imaging resources for listing, screening**

- **Investigate the use of new mobile devices and GPS tools to move some edit checks to the field in real time**

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Thank you!