

# Planning for the Next Generation of EPA ENERGY STAR Certification

Cindy Jacobs, EPA  
Joelle Michaels, EIA  
May 8, 2014

# Overview

---



- Background: ENERGY STAR Energy Performance Scores
- Process of Developing Scores and Data Needs
- CBECS Status and Timing (EIA)
- Updating ENERGY STAR Scores
- Opportunities for Input
- Questions

---

# BACKGROUND

# ENERGY STAR Score Objectives



- Reduce greenhouse gas emissions from energy use in buildings
  - Relies on actual, measured energy bill data
- Evaluate whole building energy use
  - Accounts for combined effects of for technology, operation, maintenance, and usage patterns
  - Recognizes that these factors all affect each other and the bottom line measured energy consumption
- Motivate organizations to develop a strategic approach to energy management
- Provide a comparative, national benchmark
  - To enable fair comparisons, adjusts for weather and certain business choices (e.g. hours of operation)
  - Ranks performance relative to existing buildings in the market
- Identify best performers in the market, like the ENERGY STAR on products, so consumers and businesses can make smart choices

# Energy Performance Score for Buildings




EPA Fuel Economy and DOT Environmental Comparisons

**25** combined city/hwy **MPG** city **30** highway

4.0 gallons of gasoline used every 100 miles

Annual Fuel Cost **\$1,680**

How This Vehicle Compares  
Among all vehicles and within midsize cars

Worst 10 25 50 75 100 Best

Environment  
Greenhouse Gases: 62 (100 g/mile, better is lower)  
Other Air Pollutants: 4 (100, better is lower)

Smartphone  
Scan this QR code  
Available for more information

Fuel Efficiency  
**MPG**

Is 25 MPG high or low for an automobile?

## Is 80 kBtu/SF/YR high or low for a building?

Statement of Energy Performance

**ENERGY STAR Score**

**STATEMENT OF ENERGY PERFORMANCE**  
Margrave High School  
Richmond, VA 23224  
For 12 Month Period Ending January 31, 2014

Client: Commonwealth of VA  
Contract Number: 1317-1001-0001  
Site Type: Public School  
Risk: 100  
Address: VA 23220  
City: VA 23220

Facility Type Use Summary	Area <sup>2</sup>	Number of Students	Number of FTEs	Condition Percent
Open Space	128	NA	NA	NA
Classroom	26,223	1,275	624	100

Site Energy Use Summary

Source (kBtu)	Consumption (kBtu)	Professional Verification
Electricity	5,085,851	Yes
Gas	100,000	Yes
Total Energy (kBtu)	5,185,851	Yes

Results

Energy Performance Rating (1-100): 54

Energy Intensity (kBtu/SF/yr): 17  
Score (0-100): 68.4

Subscores

Category	Score
CO <sub>2</sub> Emissions (kBtu)	6,791
CO <sub>2</sub> Intensity (lb/SF/yr)	366
Water (100 Gallons)	71

Energy Cost

Cost (\$/yr)	Intensity (\$/SF/yr)
\$214,655	\$8.12

Indoor Environmental Criteria\*

Criterion	Met
Indoor air pollutants	Yes
Asbestos	Yes
Lead	Yes
Radon	Yes
Water	Yes

Notes:  
1. The ENERGY STAR score is based on a 100-point scale of the Total Energy Intensity. Score of 50 is the national average score.  
2. The ENERGY STAR score is based on the 12-month period ending January 31, 2014.  
3. The ENERGY STAR score is based on the 12-month period ending January 31, 2014.  
4. The ENERGY STAR score is based on the 12-month period ending January 31, 2014.



# Eligible to Receive an ENERGY STAR Score



**Bank/Financial Institutions**



**Courthouses**



**Data Centers**



**Dormitories\***



**Hospitals**



**Hotels**



**Worship Facilities**



**K-12 Schools**



**Medical Offices\***



**Office Buildings**



**Retail Stores**



**Senior Care Communities**



**Supermarkets**



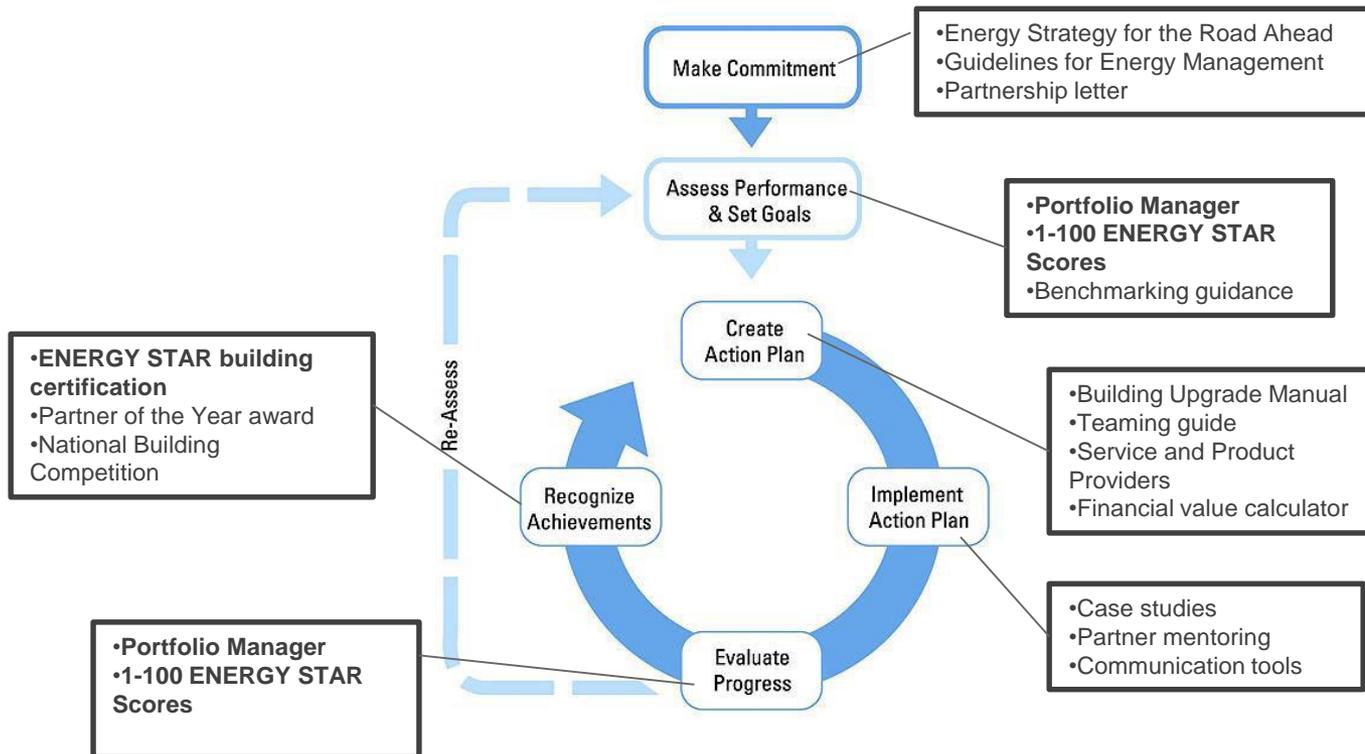
**Warehouses & Distribution Centers**



**Wastewater Treatment Plants\***

\*These building types are not eligible for ENERGY STAR certification.

# The ENERGY STAR Score Supports Strategic Energy Management



# Analysis: Buildings Benchmarking Consistently Saved Energy and Reduced GHG Emissions

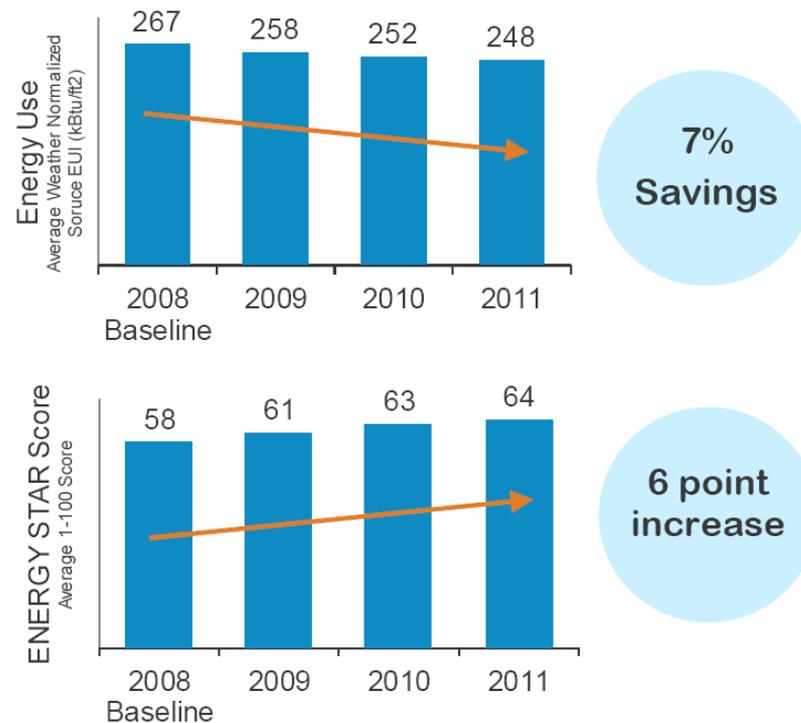


Analysis showed 7% average energy savings and 6 point ENERGY STAR score increase among Portfolio Manager buildings

Average 2.4% energy savings per year

Results in GHG reductions of over 6%

## Energy Savings in Portfolio Manager



---

# PROCESS OF DEVELOPING SCORES AND DATA NEEDS

# Process of Developing ENERGY STAR Score



- Obtain and analyze national survey data
  - Develop regression models to predict energy use for specific property types based on business operations
  - Create 1-100 score
    - Scores are based on the distribution of energy performance across commercial buildings
    - Compares actual energy use with predicted energy use
    - One point on the ENERGY STAR scale represents one percentile of buildings
- Buildings that perform in the 75th percentile or better can earn ENERGY STAR certification

# ENERGY STAR Score Data Source Requirements



- Sample must, at a minimum:
  - Be random and nationally representative
    - Diverse in size
    - Diverse in geography
    - Diverse in ownership/management
    - Sufficiently large to be representative of population
  - Include measured whole building energy use data for all fuel types
  - Include data on numerous characteristics
- Data should be updated periodically to reflect market changes
- **CBECS meets all requirements**

# ENERGY STAR Score Data Sources



Space Type	Release Date	Source of Data	Collection Date(s)
Data Center	2010	EPA Survey	2008/2009
Hospital	2001	Industry Survey	1997
	2011	Industry Survey	2008
Hotel	2002	Industry Survey	1999
	2009	CBECS	2003
K-12 School	2000	CBECS	1995
	2004	CBECS	1999
	2009	CBECS	2003
Medical Office*	2004	CBECS	1999
Office, Bank/Financial and Courthouse	1999	CBECS	1995
	2004	CBECS	1999
	2007	CBECS	2003
Residence Hall/Dormitory*	2004	CBECS	1999
Retail Store	2007	CBECS	2003
Senior Care Community	2011	Industry Survey	2008/2009
Supermarket	2001	CBECS	1992 & 1995
	2008	CBECS	1999 & 2003
Warehouse	2004	CBECS	1999
	2009	CBECS	2003
Wastewater Treatment Plant*	2007	Industry Survey	2004
Worship Facility	2009	CBECS	2003

EIA

# STATUS AND TIMING OF CBECS

# Update on the 2012 Commercial Buildings Energy Consumption Survey (CBECS)



# CBECS

# CBECS provides essential, unique information

- The CBECS is the only national-level source of data on the *characteristics* and *energy use* of commercial buildings
- Mandated by Congress, it has been conducted every 3 to 5 years since 1979
- The 2012 CBECS data collection is in the final stage
  - Final sample of over 6,700 buildings, the largest CBECS ever
- Energy Star currently uses the 2003 CBECS data

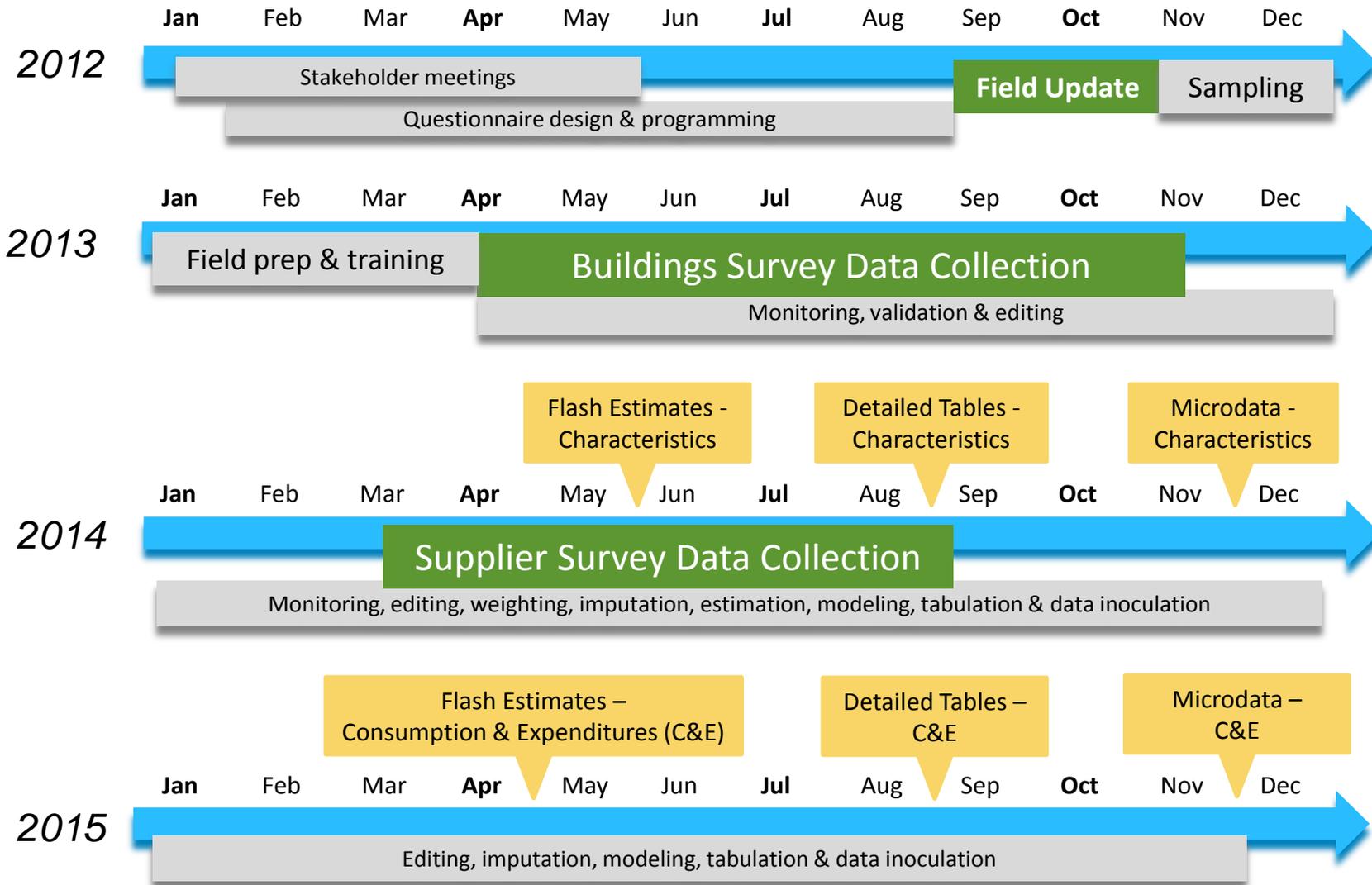
# CBECS uses a two-phase interviewing process

- Phase I: Buildings survey
  - In-person or telephone interview conducted by a trained interviewer
  - Computer-assisted survey instrument (since 1995)
  - Voluntary
  - Approximately 30-45 minutes in length
  - 2012 field period was ~ 8 months long
- Phase II: Energy suppliers survey
  - Follow-up with energy suppliers for about half of the building cases
  - Historically a mail survey; 2012 CBECS is mainly internet data collection
  - Mandatory
  - 2012 field period began in early March 2014, planned for ~ 5 months

# CBECS is different from other studies and databases

CBECS	Typical non-CBECS study or database
Every building has a <u>known</u> chance to be included and every selected building is contacted; results generalize to <u>entire</u> building population	Buildings are usually limited by type or geography and respondents opt-in; results only generalize to those buildings
Sample covers entire country with planned targets for precision	Because sample is not representative, precision is not estimable
Response rate is very high	Non-participants answers would likely change results
Standardized instrument, interviewer training; rigorous, reproducible statistical processes throughout program	Methods of collection, response quality, and review vary

# A CBECS cycle demands many years of work



# CBECS home page provides status updates

[www.eia.gov/consumption/commercial](http://www.eia.gov/consumption/commercial)

## Projected schedule of 2012 CBECS data releases

Building characteristics (BC) preliminary estimates	June 2014
BC detailed tables	September 2014
BC public use microdata	November 2014
Consumption & expenditures (C&E) preliminary estimates	Spring 2015
C&E detailed tables	Fall 2015
C&E public use microdata	Winter 2015

# For more information:

CBECS home page | [www.eia.gov/consumption/commercial](http://www.eia.gov/consumption/commercial)

Joelle Michaels, CBECS Survey Manager | [joelle.michaels@eia.gov](mailto:joelle.michaels@eia.gov)

Tom Leckey, Director, Office of Energy Consumption and  
Efficiency Statistics | [thomas.leckey@eia.gov](mailto:thomas.leckey@eia.gov)

---

---

# UPDATING ENERGY STAR SCORES

# Process of Developing ENERGY STAR Score



- Obtain and analyze national survey data
- **Develop regression models to predict energy use for specific property types based on business operations**
- Create 1-100 score
  - Scores are based on the distribution of energy performance across commercial buildings
  - Compares actual energy use with predicted energy use
  - One point on the ENERGY STAR scale represents one percentile of buildings
- Buildings that perform in the 75th percentile or better can earn ENERGY STAR certification

# Steps to Developing Regression Models



- Review and Filter Data
- Normalize for Business Activity
  - Run numerous regression analyses to correlate energy use to business activity
  - Identify best model

✓ Characteristics Included	✗ Characteristics Excluded
<ul style="list-style-type: none"><li>✓ Describe how a building operates</li><li>✓ Explain physical conditions and parameters</li><li>✓ Are determined by the business activity and needs</li></ul> <p><i>Examples: Hours, Workers, Floor Area, Computers, Weather</i></p>	<ul style="list-style-type: none"><li>✗ Describe why a building performs a certain way</li><li>✗ Specify technologies used</li><li>✗ Reflect market conditions that may motivate behavior but are not related to thermodynamic performance</li></ul> <p><i>Examples: Lighting Technology, Window Type, Energy Price</i></p>

# Process of Developing ENERGY STAR Score



- Obtain and analyze national survey data
- Develop regression models to predict energy use for specific property types based on business operations
- **Create 1-100 score**
  - Scores are based on the distribution of energy performance across commercial buildings
  - Compares actual energy use with predicted energy use
  - One point on the ENERGY STAR scale represents one percentile of buildings
- Buildings that perform in the 75th percentile or better can earn ENERGY STAR certification

# ENERGY STAR Score Interpretation and Application



✓ The Score Does	✗ The Score Does Not
<ul style="list-style-type: none"><li>✓ Evaluate actual metered energy use</li><li>✓ Normalize for business activity (hours, workers, climate)</li><li>✓ Compare buildings to the national population</li><li>✓ Indicate the level of energy performance</li></ul>	<ul style="list-style-type: none"><li>✗ Sum the energy use of each piece of equipment</li><li>✗ Credit specific technologies</li><li>✗ Compare buildings with others in Portfolio Manager</li><li>✗ Explain why a building performs well or poorly</li></ul>

# New Data Could Impact Scores



- Changes in the way that certain business activities affect whole building energy use
  - E.g., Has the relationship between worker density and energy use changed?
- New or different activities correlated with energy use
  - E.g., Is a business activity that was not captured in previous surveys a significant contributor to energy use?
- Overall building energy efficiency has changed
  - Buildings may be more, or less, energy efficient than in previous surveys

# Next Steps



- Host series of information webinars
  - Today: Setting the Stage
  - Fall 2014
  - Spring 2015
  - Additional webinars TBD
- Solicit input
  - Ideas on overall process
  - Insight from specific sectors
  - Stay tuned for details about opportunities for input
- Begin analysis as soon as data is available
  - 1-2 property types at a time
  - Specific order TBD

# Resources Available on [energystar.gov](https://energystar.gov)



- Portfolio Manager Technical Reference Series
  - ENERGY STAR Score
  - Green Power
  - Greenhouse Gas Emissions
  - Source Energy
  - Climate and Weather
  - Thermal Conversion Factors
  - US National Energy Intensity
- Technical Descriptions of ENERGY STAR score development for each property type
- Help Desk
- Extensive FAQs



---

**QUESTIONS?**