

**AGENDA**  
**TC 7.6 Building Energy Performance**  
**Monitoring and Energy Performance Subcommittee**  
 2019 ASHRAE Winter Meeting, Atlanta, GA  
 Monday, January 14, 2019, 2:15 – 4:15 pm

**Purpose:** TC 7.6 is concerned with the estimation, measurement, analysis, benchmarking, and management of whole building and building systems energy and water performance. This includes performance and resource management of new and existing buildings. This sub-committee implements this scope by monitoring the state of governmental policy, data, and tools addressing building energy and water performance (especially building benchmarking and energy auditing), and by developing ASHRAE programs and courses on these topics.

**1. Introductions**

**2. ASHRAE Standards and Guidelines**

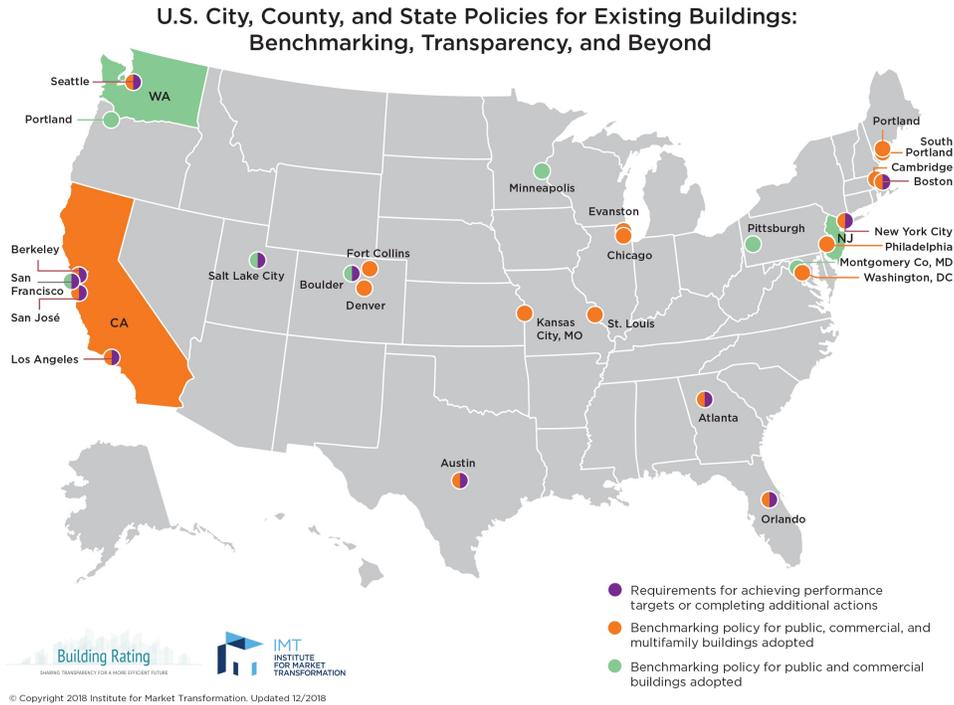
- a. **Standard 100-2015, Energy Efficiency in Existing Buildings** – In continuous maintenance; Updates on RTAR to update targets to 2012 CBECS
- b. **Standard 105-2014, Expressing and Comparing Building Energy Performance and Greenhouse Gas Emissions** – Update in progress; lots of discussions on source conversion factors.
- c. **Standard 211-2018, Standard for Commercial Building Energy Audits** – Published; Green Book being rewritten as Best Practices.
- d. **Guideline 14-2014, Measurement for Energy, Demand, and Water Savings** – Title Purpose and Scope updated; working on various updates.
- e. **ASHRAE Standard 189.1, Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings** – Updated version soon to be published.
- f. **AEDG, Achieving Zero Energy series** – Version for small to medium office buildings to be published soon.

**3. Governmental Policy**

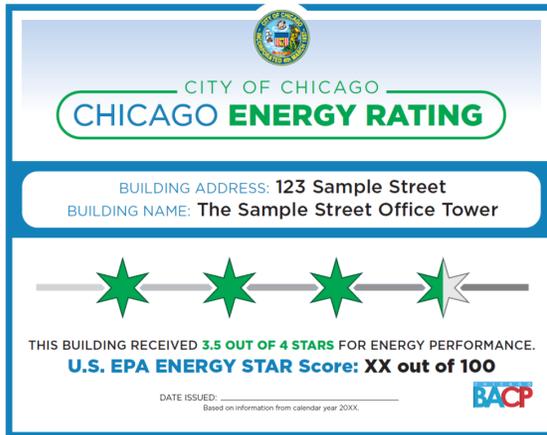
- a. Municipal
  - i. 25 cities/counties currently have mandatory benchmarking and disclosure policy.
    1. Policy comparison matrix: <https://www.buildingrating.org/graphic/us-commercial-building-policy-comparison-matrix> (excerpt below)

Legislation	Public Data Available	Policy Impact			Buildings Included	Policy Schedule		Compliance		Additional Elements	
		Released	Number of Bldgs	Square Footage		Energy Savings	Types & Sizes	Reporting to Gov't	Transparency	By # of Buildings	By % of Sq. Ft.
<a href="#">Atlanta</a>	-	2,900	402 million	-	Comm & MF ≥ 25K	Jun 1, 2017	(If Energy Star >55) Sept 2018	-	-	✓	Audits every 10 years
<a href="#">Austin</a>	-	2,800	113 million	-	Comm ≥ 10K MF ≥ 5 units	Jun 1, Annual	Time of transaction	-	-	-	Audits & mandatory upgrades for high energy use MF buildings
<a href="#">Berkeley</a>	-	257	13.7 million	-	Comm & MF ≥ 50K Comm & MF ≥ 25K	July 1, 2018 July 1, 2019	TBD TBD	-	-	✓	Periodic/time of sale energy reports for all buildings (timing based on size)
<a href="#">Boston</a>	Yes	1,600	250 million	-	Comm ≥ 35K MF ≥ 35K/35 units	May 15, Annual	Oct 1, Annual	-	84% (2014)	✓	Periodic energy assessments and/or actions
<a href="#">Boulder</a>	-	475	26 million	-	Comm ≥ 50K New Comm ≥ 10K Comm ≥ 30K Comm ≥ 20K	Aug 1, 2016 Aug 1, 2016 Jun 1, 2018 Jun 1, 2020	>Jun 1, 2019 >Jun 1, 2019 >Jun 1, 2021 >Jun 1, 2023	100% (2016)	100% (2016)	✓	Lighting upgrade; audits & RCx every 10 yrs (must invest in RCx measures w/ ≤2yr payback)
<a href="#">Cambridge</a>	Yes	1,100	78 million	-	Comm ≥ 50K MF ≥ 50 units	May 1, Annual	Sept 1, Annual	95% (2015)	93.5% (2014)	✓	-
<a href="#">Chicago</a>	Yes	3,500	900 million	10% (2010-15)	Comm ≥ 50K MF ≥ 50K	Jun 1, Annual	>Jun 1, Annual	84% (2014)	92% (2014)	-	Data verification by licensed professional 1 <sup>st</sup> year & every 3 years
<a href="#">Denver</a>	-	3,000	360 million	-	Comm & MF ≥ 25K	Jun 1, Annual	TBD	-	-	-	-
<a href="#">District of Columbia</a>	Yes	2,000	357 million	9% (2010-13)	Comm ≥ 50K MF ≥ 50K	Apr 1, Annual	>Apr 1, Annual	83% (2013)	-	✓	-

2. Map: <https://www.buildingrating.org/graphic/us-building-benchmarking-policy-landscape>



- ii. Washington DC city government passed “the strongest climate law ever passed by a U.S. city” in December. Noteworthy: introduces building energy performance standard (BEPS) which groups buildings by type and sets minimum energy efficiency standard no lower than median performance level for each building type. All existing buildings over 50,000 square feet will be required to reach minimum levels by 2026, with smaller buildings progressively phasing in: <https://www.imt.org/dc-adopts-nations-strongest-climate-law/>
- iii. New York City introduced landmark energy retrofit bill that sets mandatory carbon emissions limits for buildings >25,000 sf based on occupancy group. Noteworthy: fast timeline with emissions limits for 2022; expands LL87 RCx and audit requirements to buildings >25,000 sf: <https://www.urbangreencouncil.org/content/news/blueprint-bill>
- iv. Chicago is preparing to launch its Chicago Energy Rating System, required for buildings currently benchmarking (>50,000 sf). System awards rating from 1-4 stars based on Energy Star score if available, and relative to national median if score unavailable. Noteworthy: Similar to European EPCs, buildings are required to post placard in prominent location to make rating visible; extra star given for improvement in scores: <https://www.imt.org/chicago-launches-first-building-energy-rating-system-in-the-u-s/>



**CHICAGO ENERGY RATING SYSTEM (WITH HALF-STARS)**

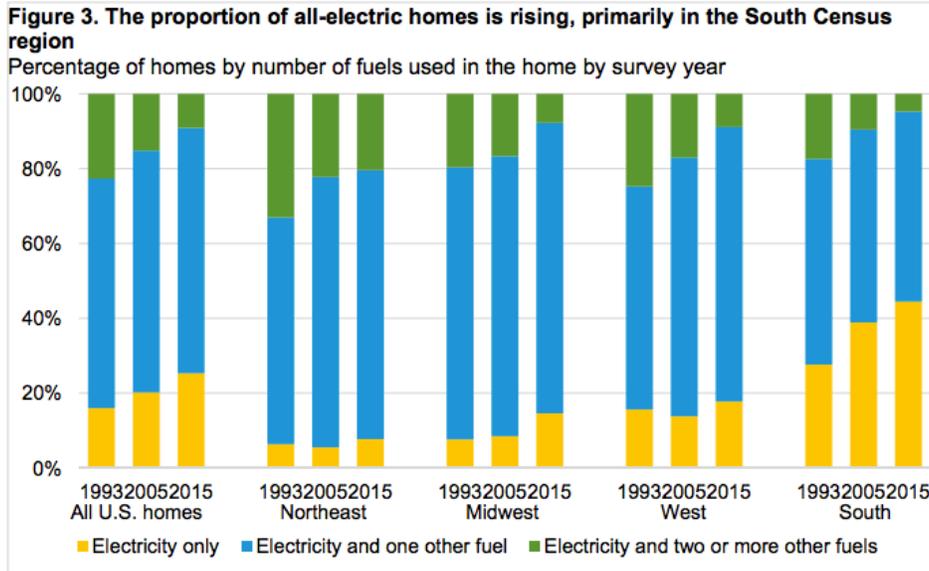
- ★ ★ ★ ★ • **4 Stars:** Score of 81-100 or score of 61-80 and 10 point improvement in the past 2 years\*
- ★ ★ ★ ★ • **3.5 Stars:** Score of 71-80
- ★ ★ ★ ★ • **3 Stars:** Score of 61-70 or score of 41-60 and 10 point improvement in past 2 years
- ★ ★ ★ ★ • **2.5 Stars:** Score of 51-60
- ★ ★ ★ ★ • **2 Stars:** Score of 41-50 or score of 11-40 and 10 point improvement in past 2 years
- ★ ★ ★ ★ • **1.5 Stars:** Score of 31-40
- ★ ★ ★ ★ • **1 Star:** Score of 1-30
- ★ ★ ★ ★ • **0 Star:** Did not submit required benchmarking information

\*Note: Any building with ENERGY STAR certification also receives four stars.

- v. Bloomberg American Cities Climate Challenge has provided two-year funding to 25 cities to meet or beat carbon emissions goals around buildings and transportation. Noteworthy: wide geographic range; ACEEE and IMT partners: <https://www.bloomberg.org/program/environment/climatechallenge>
- b. State
  - i. 3 states (CA, WA, NJ) currently with mandatory benchmarking policies, per IMT policy comparison matrix: <https://www.buildingrating.org/graphic/us-commercial-building-policy-comparison-matrix>
- c. U.S. Federal
  - i. Updates?
- d. International
  - i. New International Partnership for Energy Efficiency Cooperation (IPEEC) Buildings Energy Efficiency Task Group report looking at different definitions of Zero Energy Buildings around the world. Noteworthy: Emerging trend to use zero carbon instead of zero energy as the metric; majority of activity around “nearly zero” or “zero ready” buildings as opposed to true ZEBs: <https://ipeec.org/en/newsroom/15-new-report-on-zero-energy-building-definitions-and-policy-activity-beet-7-.html>

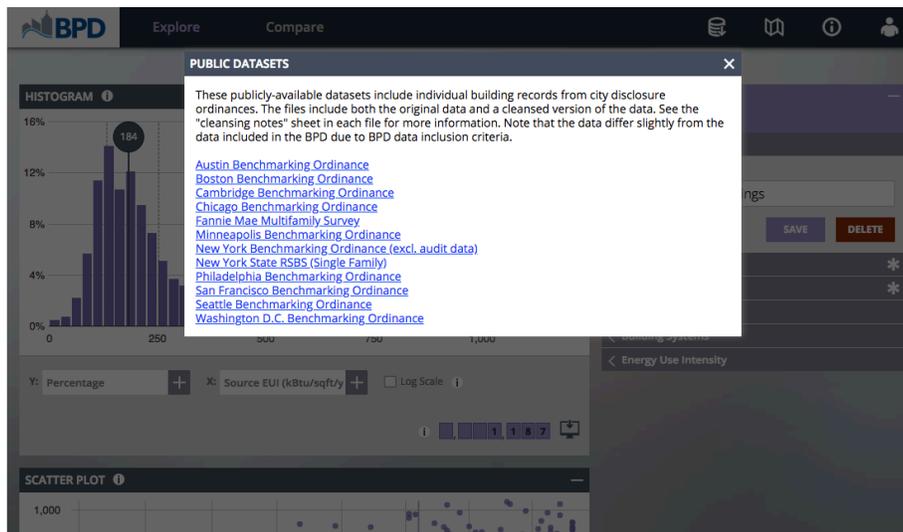
**4. Data and Databases**

- a. CBECS
  - i. 2018 CBECS questionnaire has been finalized. Noteworthy changes compared to 2012 CBECS: added whether solar for electricity or thermal; updated HVAC system options (including VRF); added whether “smart” thermostat; removed utility purchasing; added electric vehicle charging stations; added data center PUE and characteristics; removed water consumption; removed green building certification; added tenant billing and metering: [https://www.eia.gov/consumption/commercial/pdf/questionnaire\\_cbecs.pdf](https://www.eia.gov/consumption/commercial/pdf/questionnaire_cbecs.pdf)
- b. RECS
  - i. Highlights from 2015 RECS in report, “What’s new in how we use energy at home.” Noteworthy: the proportion of all-electric homes is rising, especially in the South census region: [https://www.eia.gov/consumption/residential/reports/2015/overview/pdf/whatsnew\\_home\\_energy\\_use.pdf](https://www.eia.gov/consumption/residential/reports/2015/overview/pdf/whatsnew_home_energy_use.pdf)



Source: U.S. Energy Information Administration, [2015 Residential Energy Consumption Survey](https://www.eia.gov/consumption/residential/)

- ii. Additional highlights from 2015 RECS in two webinars. Noteworthy: 2015 RECS end use models followed an engineering approach (i.e., used “U-A calculations for heat conduction”), whereas end-use estimates from 1980 to 2009 relied on statistical approach:   
[https://www.eia.gov/consumption/residential/webinar\\_slides/highlights\\_from\\_the\\_2015\\_RECS.pdf](https://www.eia.gov/consumption/residential/webinar_slides/highlights_from_the_2015_RECS.pdf)
- c. DOE Building Performance Database (BPD)
  - i. More than 1 million buildings now in BPD; 12 datasets with individual building records currently available for download: <https://bpd.lbl.gov>

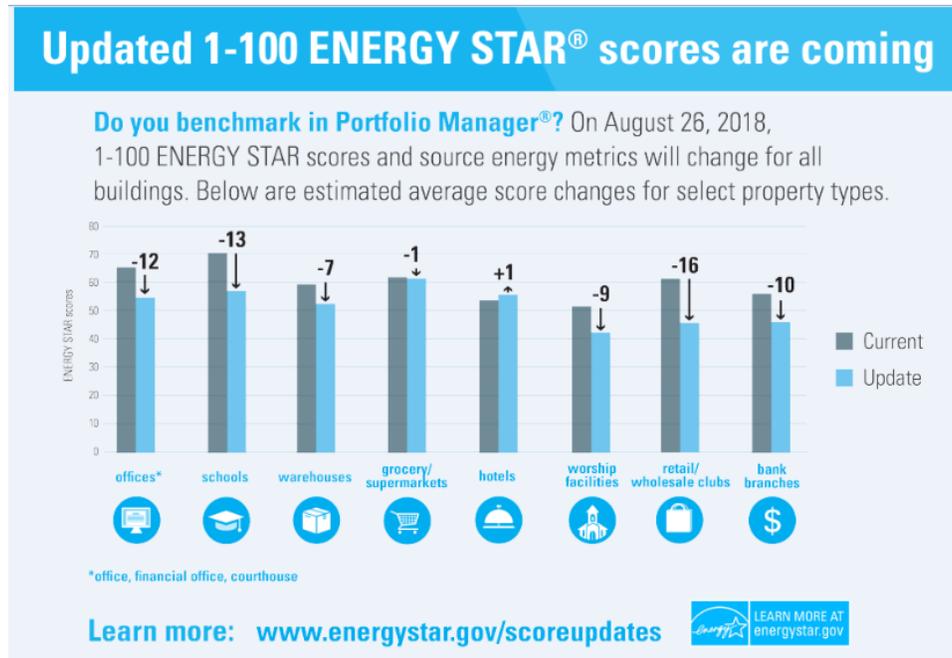


- d. Municipal Benchmarking Data
  - i. 15 cities with data publicly available online and/or data visualization sites:   
<https://www.buildingrating.org/graphic/us-benchmarking-data-and-data-visualization-links>

## 5. Benchmarking Tools

### a. Energy Star

- i. Energy Star models for many property types were updated in August 2018 based on 2012 CBECS data. Noteworthy: average scores dropped for almost all building types (attributed to improvements in building stock from 2003 to 2012); site-to-source conversion factor for electricity updated from 3.1 to 2.8 to reflect improvements in electric grid's efficiency (affects all property types, not just updated models). FAQs: <https://portfoliomanager.zendesk.com/hc/en-us/sections/115000041352-2018-Score-Updates>



- b. Building EQ
  - i. Updates?

## 6. Research Findings

- a. Scofield, John H., and Jillian Doane. “Energy Performance of LEED-Certified Buildings from 2015 Chicago Benchmarking Data.” *Energy and Buildings* 174 (2018): 402–13. <https://doi.org/10.1016/j.enbuild.2018.06.019>.
  - i. Used data from Chicago benchmarking ordinance to determine whether LEED-certified buildings have better energy performance than non-certified buildings
  - ii. For offices, K-12 schools, and multifamily housing, LEED-certified use no less source energy, but use roughly 10% less site energy; one reason for this: LEED-buildings use comparatively more electricity.
- b. Lewis, Katie, Michaels, Joelle, and Grace Deng. “Comparison of Energy Data for Green-Certified and Non-Certified buildings in the 2012 Commercial Buildings Energy Consumption Survey (CBECS).” In *ACEEE Summer Study on Energy Efficiency in Buildings*, 2018. <https://aceee.org/conferences/2018/ssb>
  - i. Used externally validated data from 2012 CBECS question about Energy Star and LEED certification to determine whether certified green buildings use less energy; looked at office buildings only.

- ii. Using three different statistical methods, certified green buildings were shown to have lower energy use than non-certified buildings.

## 7. Discussion of Subcommittee Activities

## 8. ASHRAE Sessions of Interest

Sunday, January 13, 9:45 AM – 10:45 AM Seminar 8  
**Sustainable Building Operation via ASHRAE Standard 189.1 and Lessons Learned**

Sunday, January 13, 11:00 AM – 12:30 PM Workshop 2  
**Turning to Old Buildings: Optimizing and Upgrading Our Existing Building Stock**

Monday, January 14, 11:00 AM – 12:00 PM Seminar 35  
**NetZero: Understanding, Reducing, and Mitigating Uncertainty in the Design Phase**

Tuesday, January 15, 9:45 AM - 10:45 AM Seminar 53  
**The New Chapter 36 of the HVAC Applications Handbook: Energy and Water Use and Management**

Wednesday, January 16, 8:00 AM – 9:30 AM Seminar 61  
**Building Data Exchange Formats: Sharing Building Data with Ease**

Wednesday, January 16, 8:00 AM – 9:30 AM Conference Paper Session 16  
**Building Performance with Respect to Energy Efficiency**

Wednesday, January 16, 9:45 AM – 10:45 AM Seminar 66  
**How ASHRAE Standard 100 can be Applied to Atlanta's Building Energy and Water Efficiency Ordinance**

Wednesday, January 16, 11:00 AM – 12:30 PM Seminar 71  
**How to Ensure that Your Building Control Improvements Actually Last**