

ENERGY AUDITS AND ENERGY USE INTENSITY (EUI) ACCORDING TO ASHRAE Standard 100-2018

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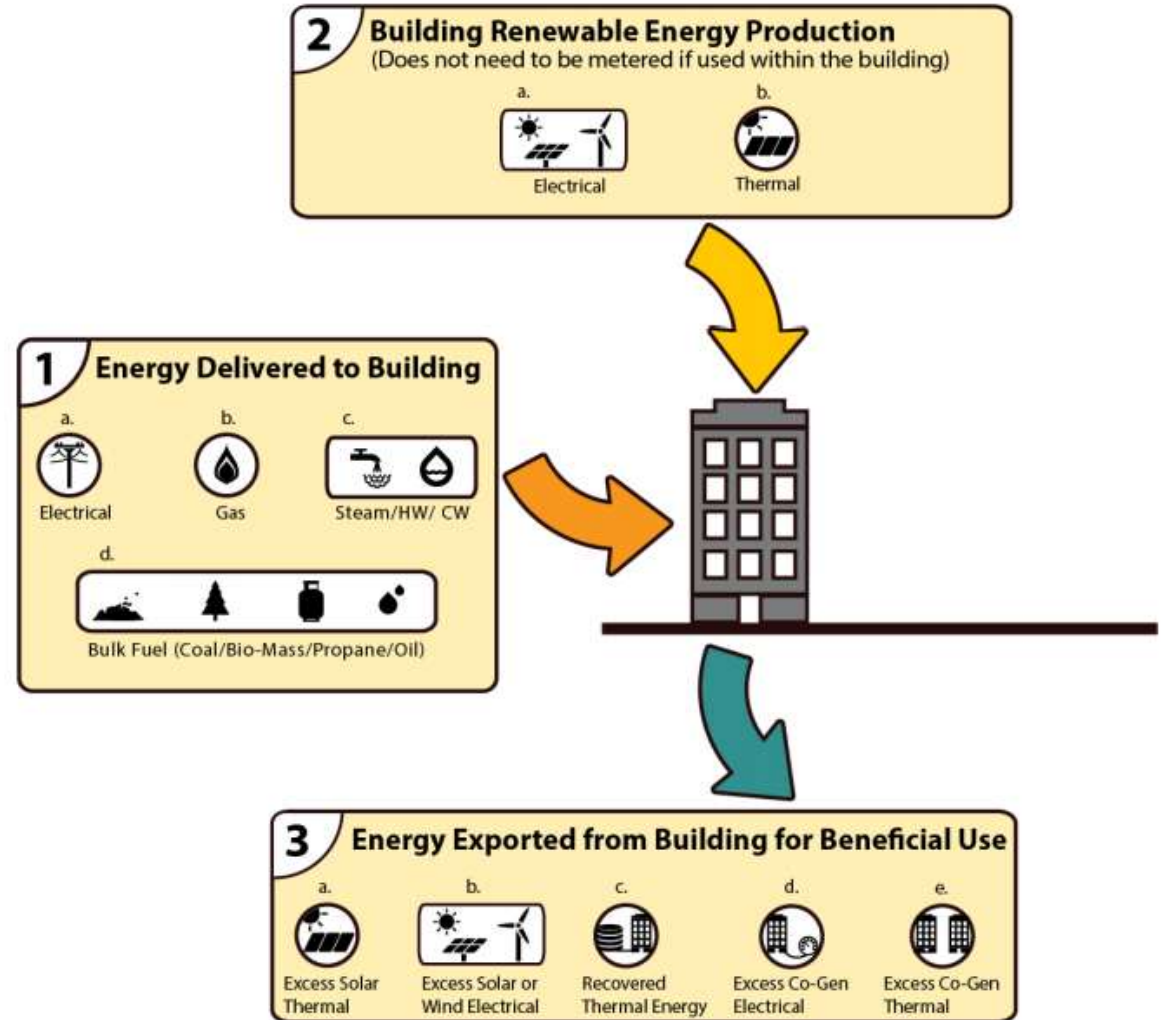


ANSI/ASHRAE/IES Standard 100-2018
(Supersedes ANSI/ASHRAE/IES Standard 100-2015)
Includes ANSI/ASHRAE/IES addenda listed in Annex N

Energy Efficiency in Existing Buildings

Ref. ASHRAE Std. 100-2018

- SUPPLIED ENERGY FLOW INTO AND OUT OF BUILDINGS
- MOST EXISTING BUILDINGS ONLY HAVE ENERGY SUPPLIED LISTED IN BOX 1



Net energy concept.

TO DETERMINE ENERGY USE BY BUILDINGS

- Total all energy that flows into the building in any form for an entire year. Use the BTU (British Thermal Units) format.
- Electric is converted to BTU's.
- Fossil fuels such as gas, propane, coal and oil are converted to BTUs using the amount used and the heating value of the fuel.
- The net flow of energy into a building for the entire year is divided by the gross square footage to get the annual ENERGY USE INTENSITY FACTOR (EUI)

Target EUI's from ASHRAE Std. 100-2018

- Building EUI's vary from 0 BTU/sq.ft./yr. for very efficient zero energy buildings to well over 150,000 BTU/sq.ft./yr. with poor energy efficiency
- New to ASHRAE Std. 100-2018 version are target EUI's for various types of existing buildings based on the climate zone
- Example EUI from Std 100-2018, Table 7.2a for Climate Zone 5a
 - Office Buildings – 48
 - Laboratories – 209
 - Churches- 27
 - Schools – 37 to 57
 - Colleges- 78

These are not High Performance EUI Targets. They are averages based on existing buildings using census data.

Comparison to ASHRAE Target EUI's

- After calculating a buildings EUI, compare it to the target value listed in the standard. Called benchmarking.
- If it is above the target EUI value, find out why the energy usage is high.
- High EUI's could result from poor insulation, envelope infiltration, inefficient HVAC equipment, poor control systems, high lighting and plug loads, etc.
- Energy auditors can help determine the source(s) of high energy use and provide cost effective options to get to the target. Energy modeling or digital twins of the building helps zero in on the most cost-effective improvements.





ENERGY AUDITING of BUILDINGS

- Energy auditors are specialized HVAC professional engineers with the skills and tools required to look at all aspects of a building's operation and energy use.
 - ASHRAE Level 1 audits are usually one time evaluation of the building.
 - ASHRAE Level 2 audits are in depth and look at every aspect of energy use. They provide Energy Efficiency Measures (EEM) that could bring the EUI down to the target level.
 - ASHRAE Level 3 is investment grade and general used in guaranteed savings contracts.
- Some EEM's are simple and may only require a change in behavior of the occupants or building controls (e.g., turning off the lights)
- Many require financial investment with a payback period. (e.g. adding insulation to the roof, LED lights, upgrading HVAC equipment and controls, new windows.)



Tools of the Energy Auditor

- Some of these measurement tools are also good for the building owner/operator to have and use.
- Smart phone apps are appearing for some measurements.
- Prices are coming down.



Temperature/Humidity

- Accurate thermometer and hygrometer to check air temperature and humidity (RH, Dewpoint) levels. Some will have data logging capability to record data over a time period.



Light Meters

Light Meter to check lighting levels. Usually measured in footcandles

Smart phone apps are also available for light measurements



Air Flow

- Velometer to measure air flow from grills and through ductwork. Velocity at points in a cross-section are used to get an average velocity, which is then multiplied by the flow area to get cfm





Infrared Thermometer

IR Cameras can measure surface temperatures, find envelope leaks, hot electrical wires.

Some can take visual camera pictures

Pictures may be downloaded to a computer for further study.

Air Quality Sensors

- These meters are targeted at chemicals in the air. Carbon dioxide meter measures CO₂ in rooms. VOC, Ions, CO, NO, etc. can be measured.



Laser distance measuring

- For building dimensions, areas, and volumes.



Combination Realtime Indoor IAQ Instruments



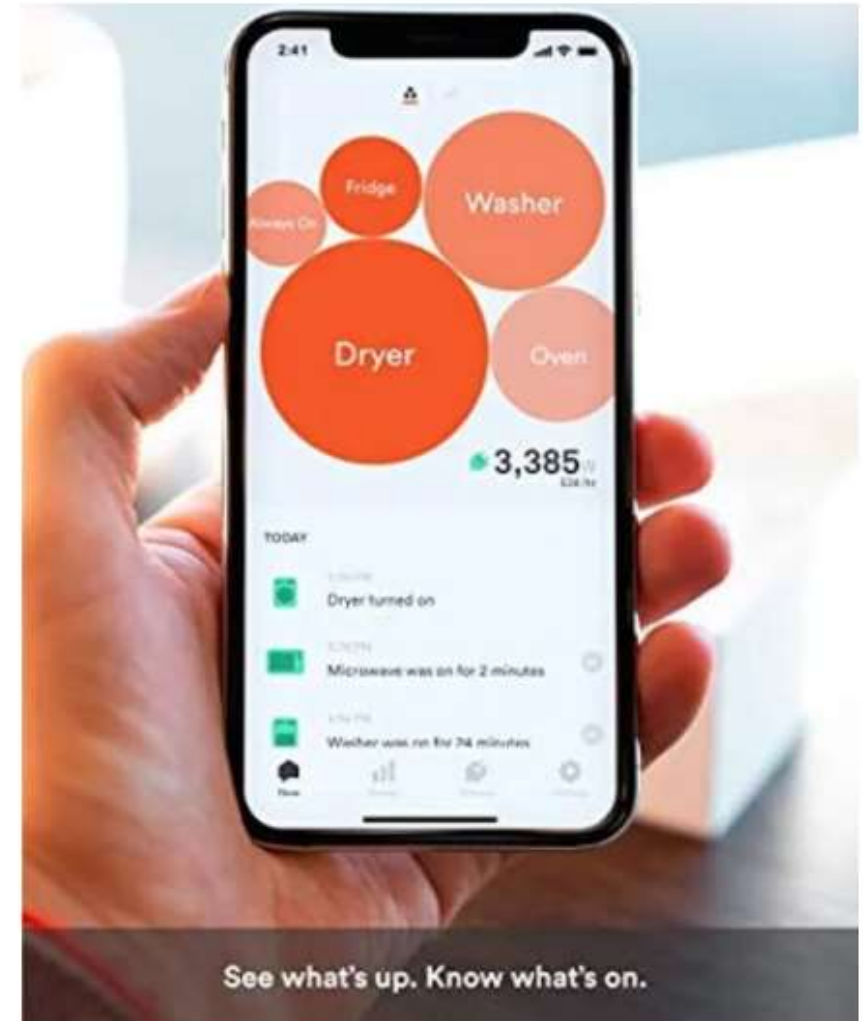
<\$380 USD

- New low cost instruments are now available that measure and display temperature, relative humidity, dewpoint, CO₂, CO, Volatile Organic Compounds, CO, Dust Particulate levels (PM_{2.5}) and NO₂ levels in a room.
- Readings are hourly or longer time period.
- Can be accessed thru the internet.

Real Time Energy Measuring Instruments

Circuit breaker panel mounted current sensor measures power draw, time on/off and inrush to identify items in the electric panel

Instant or time based reports over the internet allow for real time remote monitoring and evaluation.





Summary

- Auditors and building operators have measurement instrumentation options.
 - Trend is towards real time, remote, access to the data.
 - Prices are coming down. You pay more for really accurate lab grade measurements. Are they needed?
 - Knowing your building's spot or real time IEQ and energy usage is key to continued high performance. Like OnStar is for a car.
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Let's go to Lunch

- Follow me.