# ASHRAE Standard 100-2015: Implications for District Energy

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# Purpose of Presentation

- ANSI/ASHRAE/IES Standard 100-2015 (Energy Efficiency in Existing Buildings)
  - Significant revision of the 2006 version
  - Intended to be a code-enforceable standard for adoption by local authorities
- IDEA is seeking revision of the standard under ASHRAE's "continuous maintenance" process
- This presentation discusses and illustrates the potential impacts of the standard on district energy

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# Structure of the Standard

- Sets a single upper limit on ***site*** energy use (kBtu/sq ft/year) for each of 48 commercial and institutional building types and 5 residential building types in 17 climate zones.
- Energy use calculation includes all fuel, steam, hot water, chilled water and electricity crossing the building site boundary, net of energy exported from the building (including excess production of electricity and thermal energy).
- All energy consumption is converted to common units (Btu).

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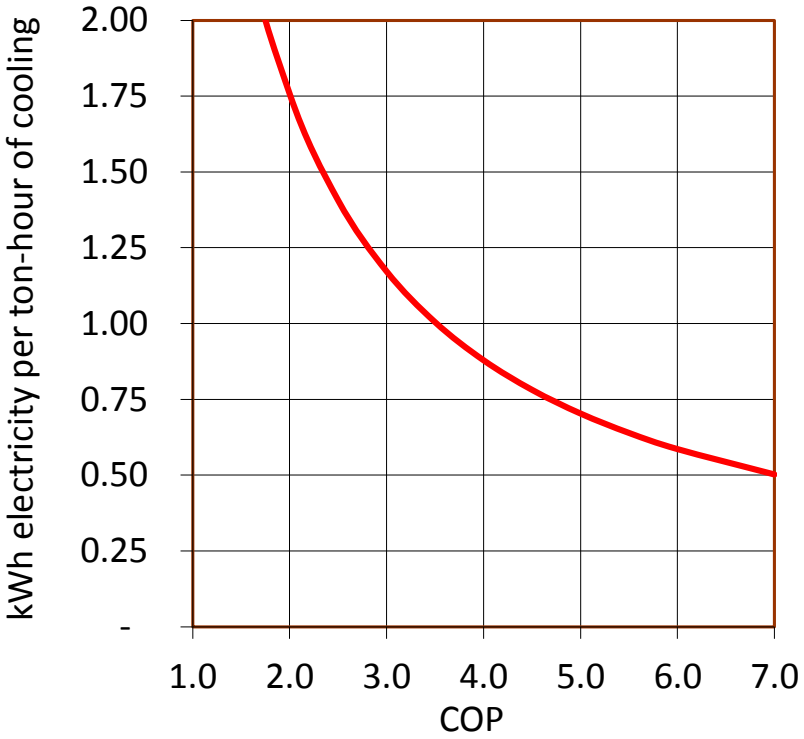
# Implications for District Energy

- Standard is beneficial for district heating, because a Btu of steam is counted the same as a Btu of natural gas.
- However, the standard is egregiously harmful for district cooling.
- Buildings using district cooling will in most cases not be able to meet the standard.
- Chilled water crossing the site boundary far exceeds the electricity that would cross the site boundary if the building had its own chillers.

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# Example Calculation

- Equad J building at Princeton University uses electricity, steam and chilled water from the campus utility system.
- Princeton is a leader in energy-efficient design practices in its campus utility system and its buildings.
- However, Equad J would not be compliant with the Standard.

| | |
|---|---|
| **Site energy consumption (kBtu/yr)** | |
| Chilled water | 16,966,152 |
| Steam | 2,608,463 |
| Electricity | 5,472,900 |
| Total | 25,047,515 |
| **Building size (square feet)** | 75,929 |
| **Standard 100 performance standard (Btu/square foot/year)** | |
| As building exists (with district cooling) | 330,000 |
| If building had in-building chillers * | 162,000 |
| **Applicable Standard 100 targets (Btu/square foot/year) **** | 209,000 |

* Assumes total chiller system (including chillers, cooling towers, pumps) COP of 4.0

** ANSI/ASHRAE/IES Standard 100-2015, Table 7.2 for Laboratory, Climate Zone 5A

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# Changes to the Standard Are Essential

- Adoption of the proposed standard as code-enforceable would create pressure for buildings to get off district cooling and install their own chillers, despite superior total energy performance by district cooling systems and absolutely zero change in end-use energy consumption.
- The standard must be changed to prevent unintended but very severe consequences for district cooling.
- More than 3 billion square feet of commercial building space are served by district cooling in North America.
- District cooling is growing dramatically throughout the world, including Europe, Asia and the Middle East.

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# What's the Solution?

- In using site energy, Standard 100 contrasts with the direction of building energy ratings and codes in the U.S. and worldwide. For example:
  - ASHRAE's own building energy quotient (bEQ) initiative uses source energy.
  - The International Green Construction Code calculates energy usage with the zero energy performance index, which uses source energy.
  - The Environmental Protection Agency's Portfolio Manager scores buildings based on source energy, not site energy.
  - European codes are based on source energy (Energy Performance of Buildings Directive, CEN Standard EN 15603).
- Short of a wholesale shift to source energy, an easy fix is to require that chilled water must be converted at an appropriate rate, e.g., 3,000 Btu/ton-hr. This is equivalent to a system COP of 4 (0.88 kW/ton).

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# Thanks for your attention!


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