

What Makes a Building Energy Efficient?

Joshua Lehman

With the support of:

Steven Winter Associates, Inc.

New York City Department of Housing Preservation and Development

Dunn Development Corp.

C&C Affordable Management LLC

L&M Builders LLC

The Phipps Houses Group

Outline

- Background
- Description of Study
- Results
- Case Study
- Analysis
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Carbon Emissions

- IPCC:
 - 3 Gigatons from on-site combustion
 - 5.6 Gigatons from off-site electricity production
- Residential buildings in the US:
 - 20% of US carbon emissions
 - 4.4% of worldwide carbon emissions



Questions

- What causes the differences in energy efficiencies between buildings?
- How can we make buildings more efficient?



Problems are simple

Buildings are complex

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- National Performance Path
 - HERS Rating
- National Prescriptive Path
 - Builder Option Package

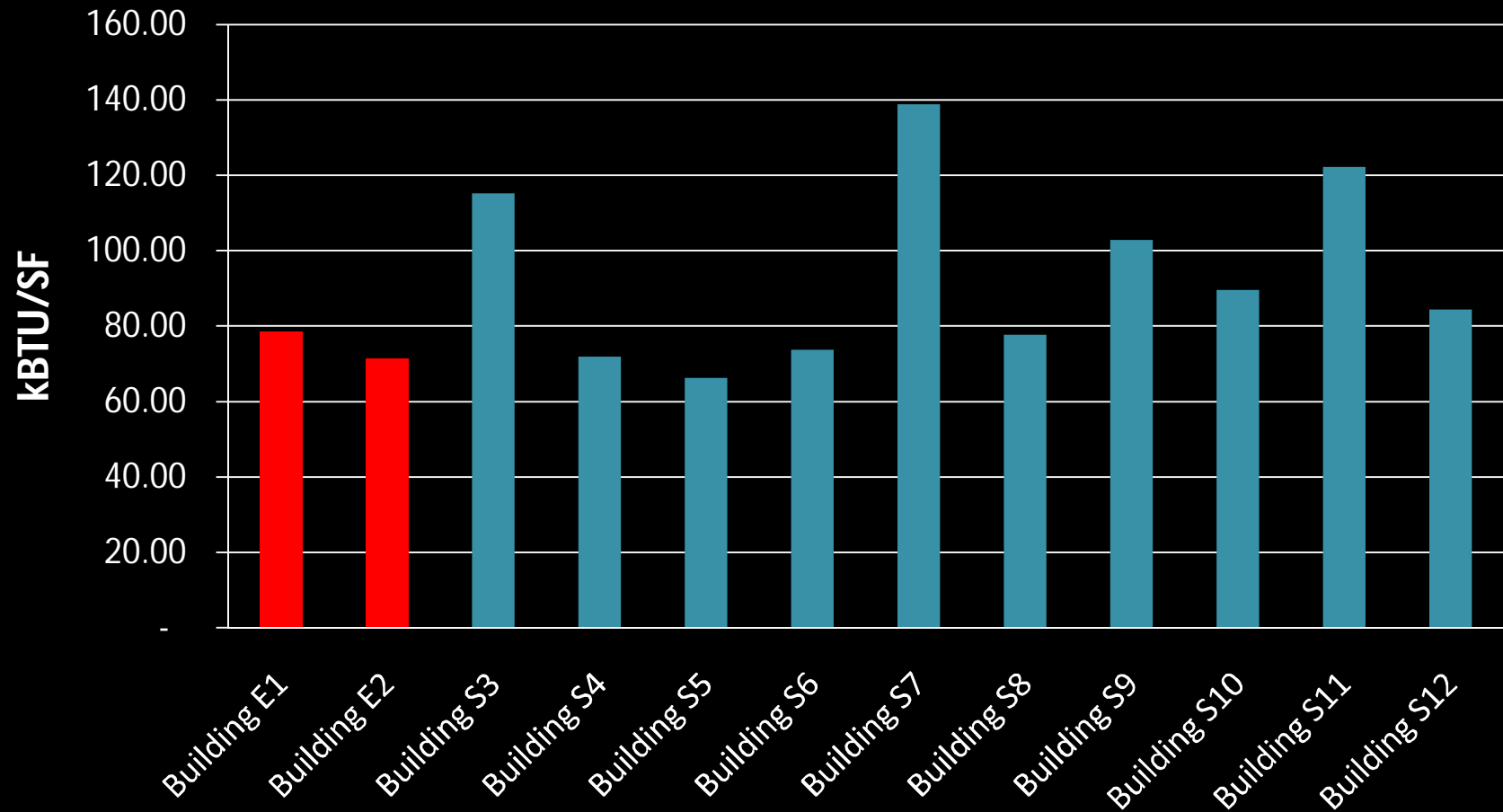
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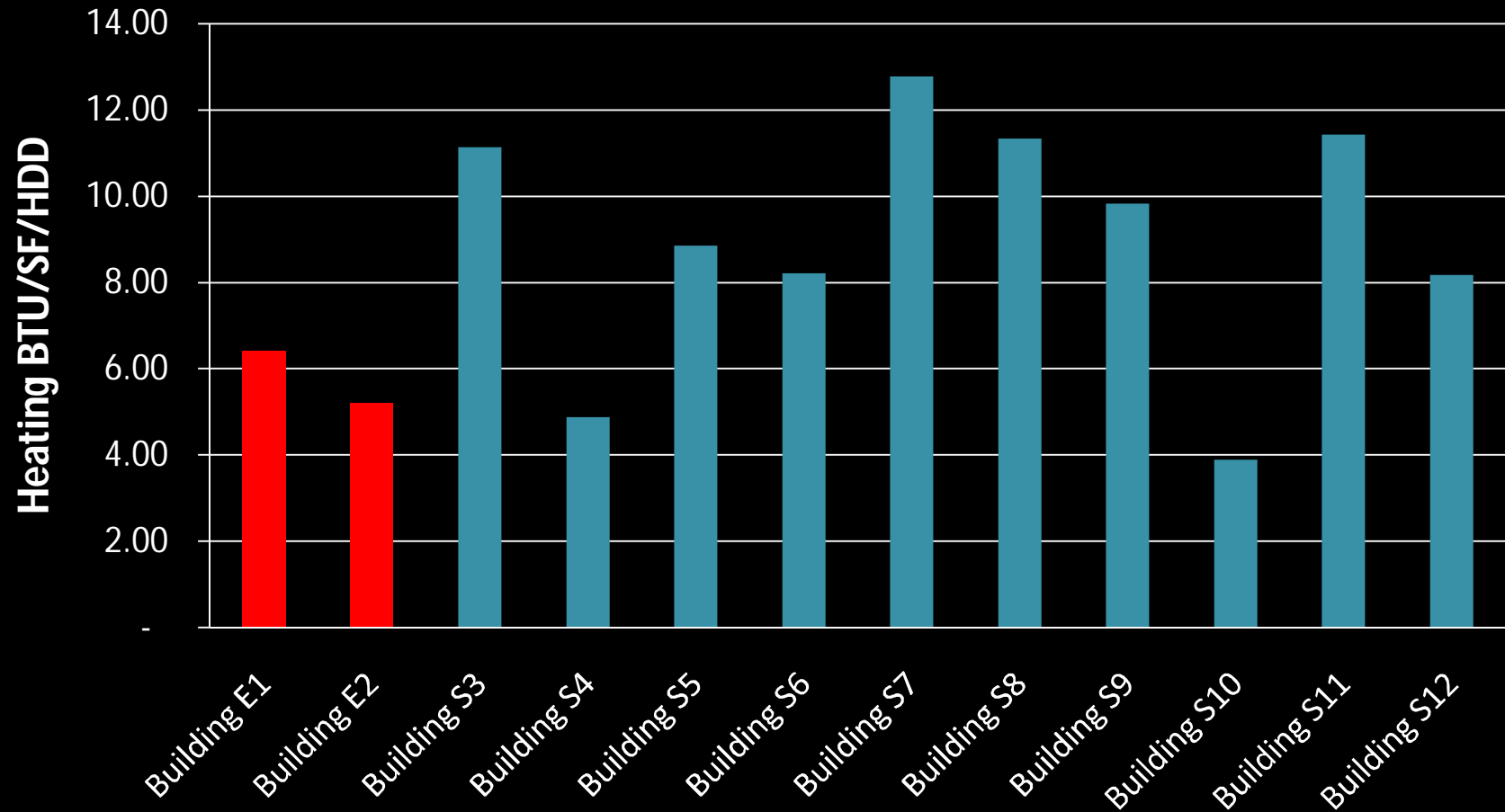
Building Energy

- Raw energy
 - British Thermal Units (BTUs)
- Normalization
 - Square Feet (SF)
 - Heating Degree Days (HDD)

Full Year Energy Use



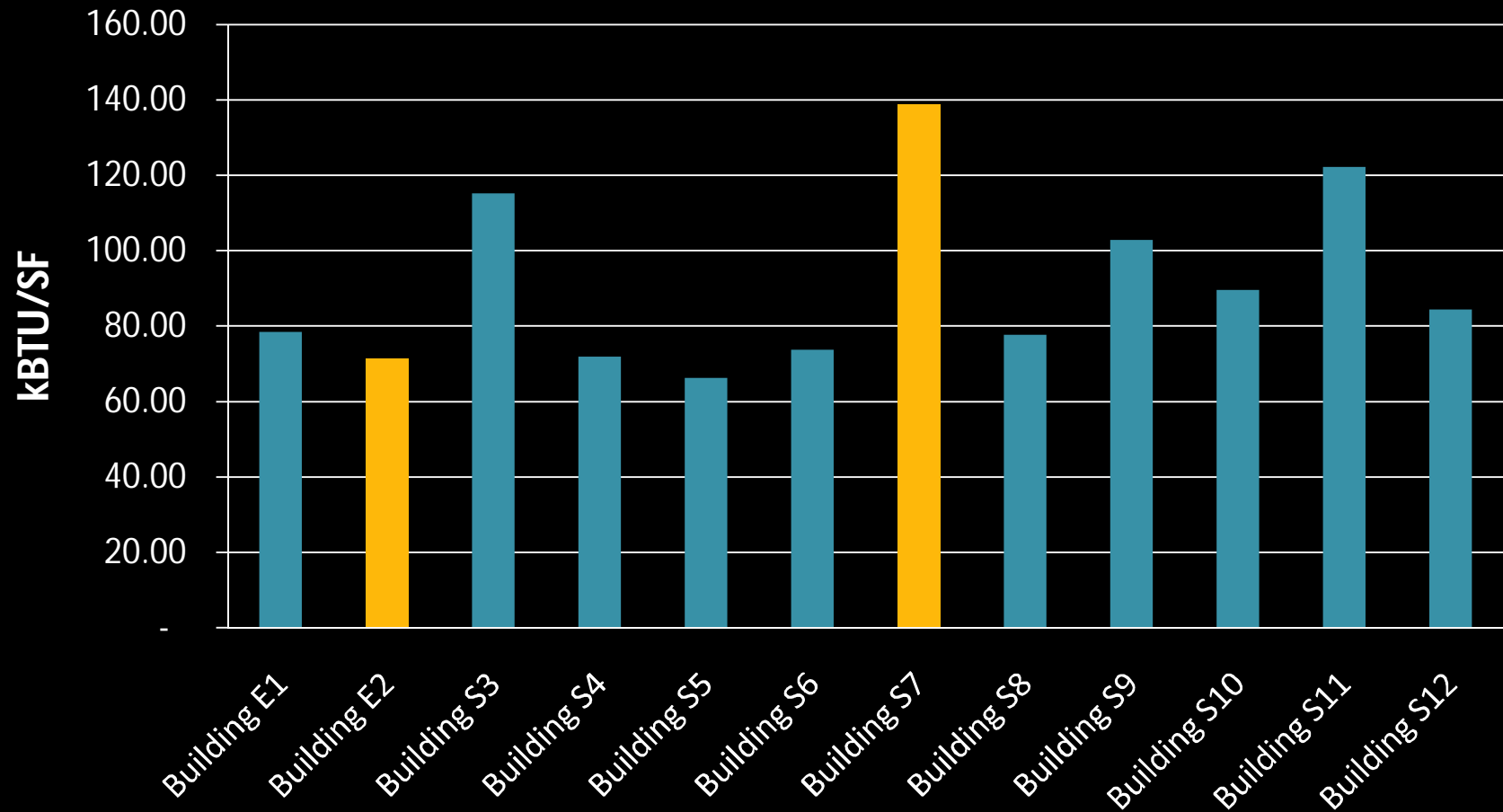
Heating Fuel Use

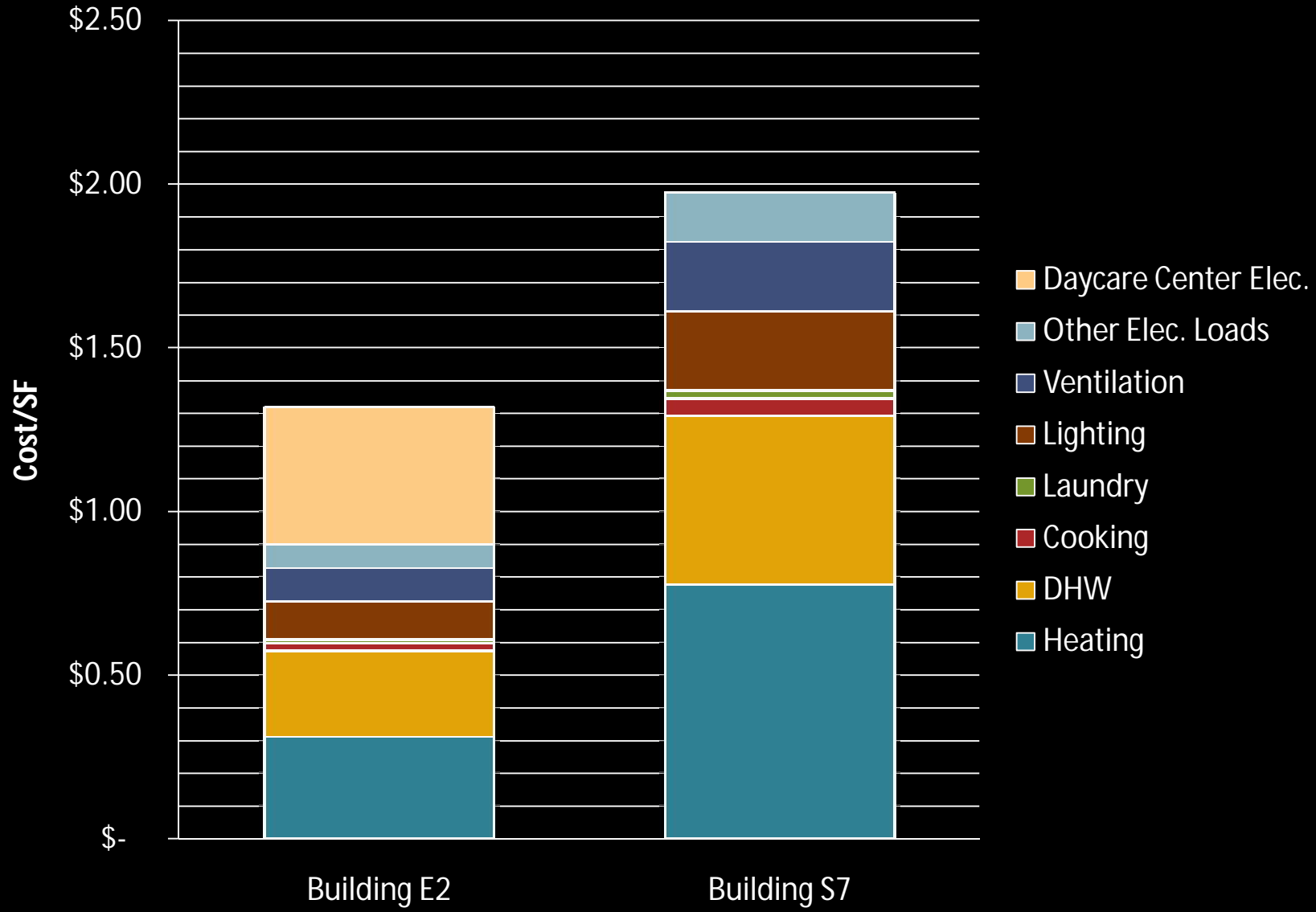


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Full Year Energy Use





Driving Forces

- HVAC Design and Distribution Systems
- Thermal Envelope
- Domestic Hot Water
- Lighting
- Occupant Behavior

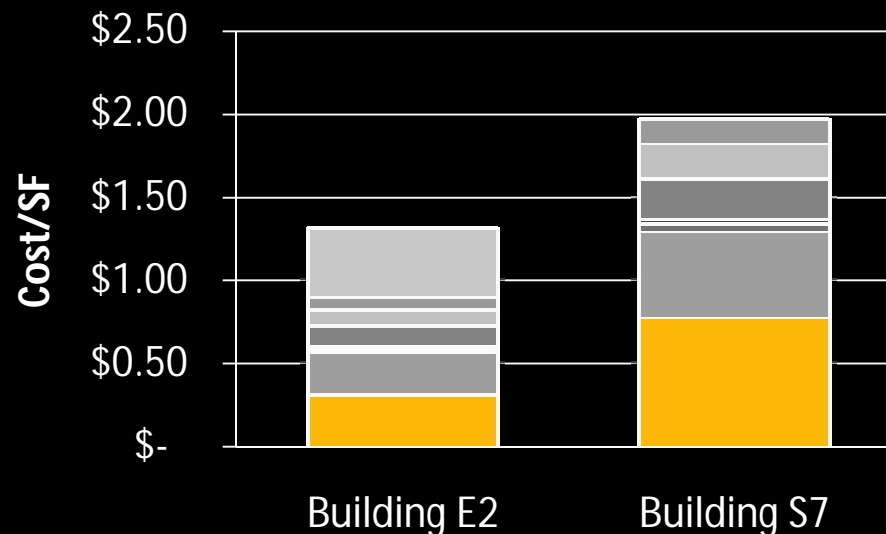
HVAC Design and Distribution

Building E2

- 2 boilers: 87% efficiency
- Zoned by unit

Building S7

- 8 boilers: 82% efficiency
- Single automated control
 - Outdoor temperature



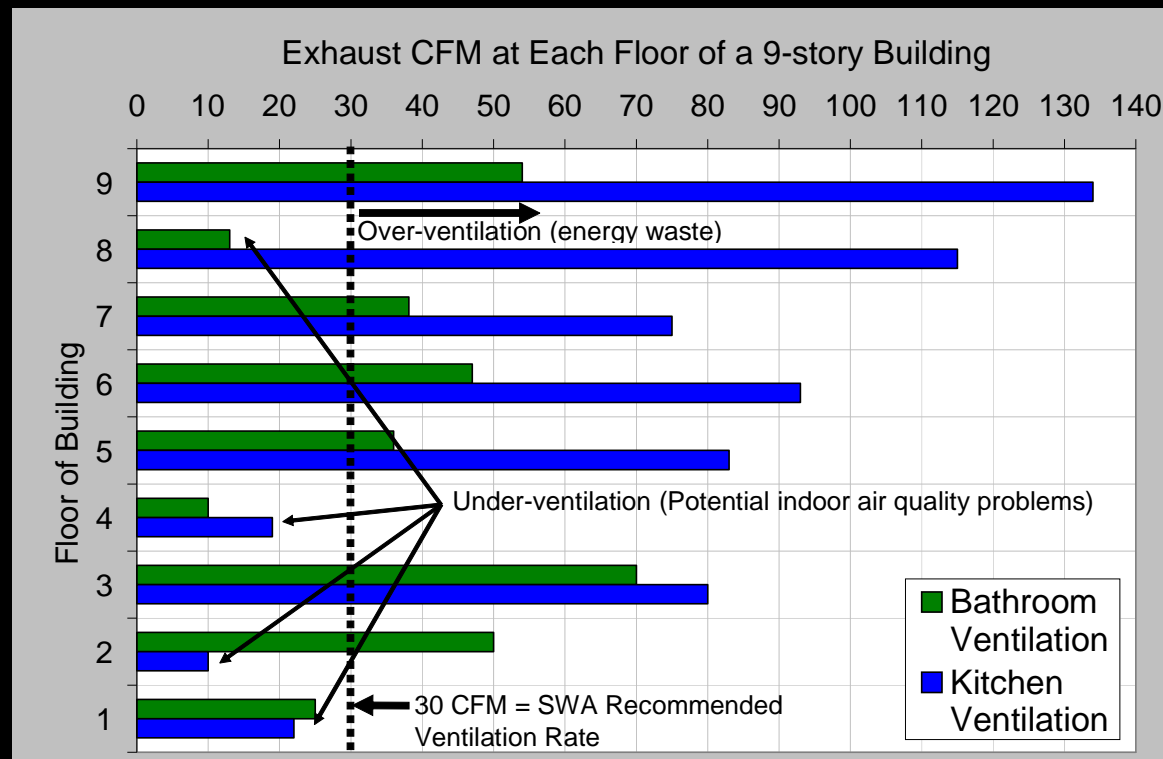
HVAC Design and Distribution

Building E2

- Roof fans on timers
- Balanced ventilation

Building S7

- Roof fans run 24/7
- Unbalanced



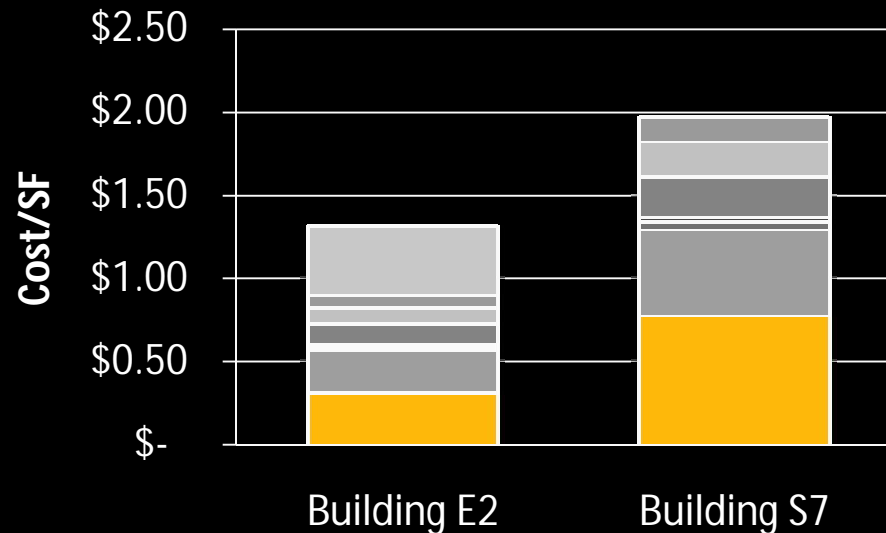
Thermal Envelope

Building E2

- Compressible fiberglass insulation
- Advanced commissioning
- Triple-pane windows
 - AC unit optional

Building S7

- Prefabricated panels
- No commissioning
- Double-pane windows
 - AC unit optional



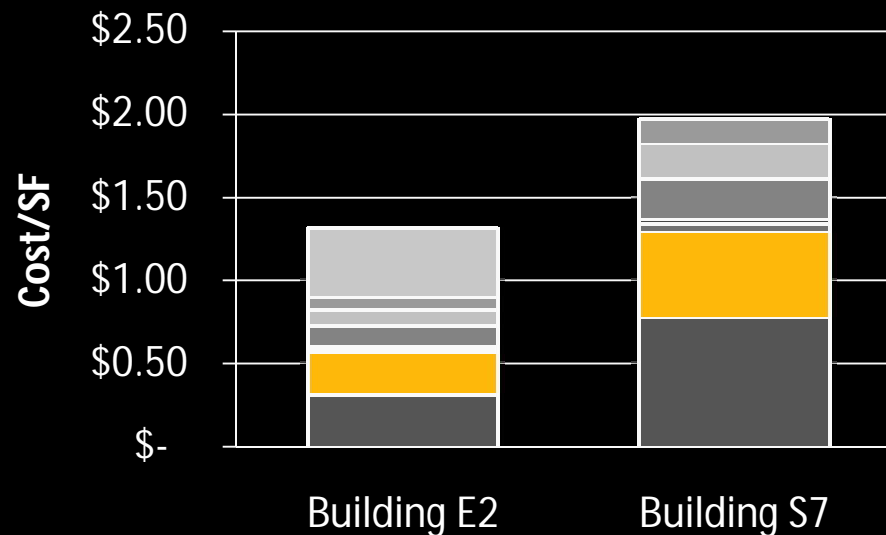
Domestic Hot Water

Building E2

- 87% Efficient boiler
- Low-flow fixtures in showers and sinks

Building S7

- 82% Efficient boiler
- Pipe insulation added after construction
- Replaced kitchen sinks



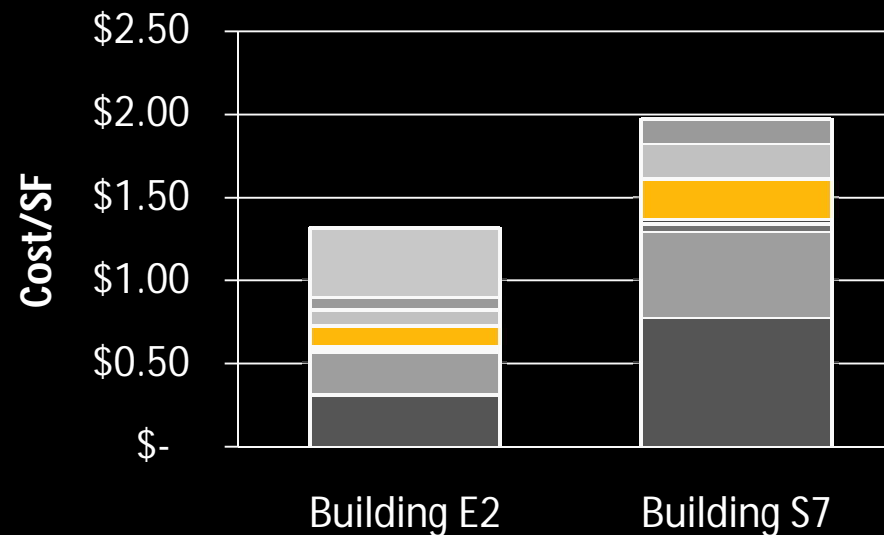
Lighting

Building E2

- Hallway lighting on timers
- Stairwell lighting is bi-level

Building S7

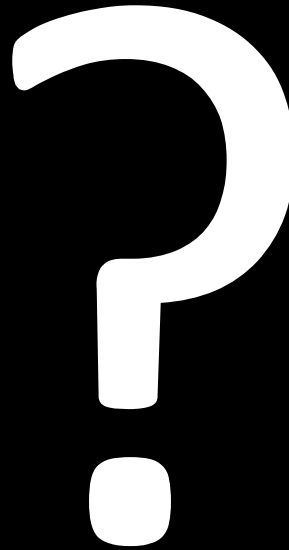
- Exterior and interior lighting on 24/7



Occupant Behavior

Building E2

Building S7



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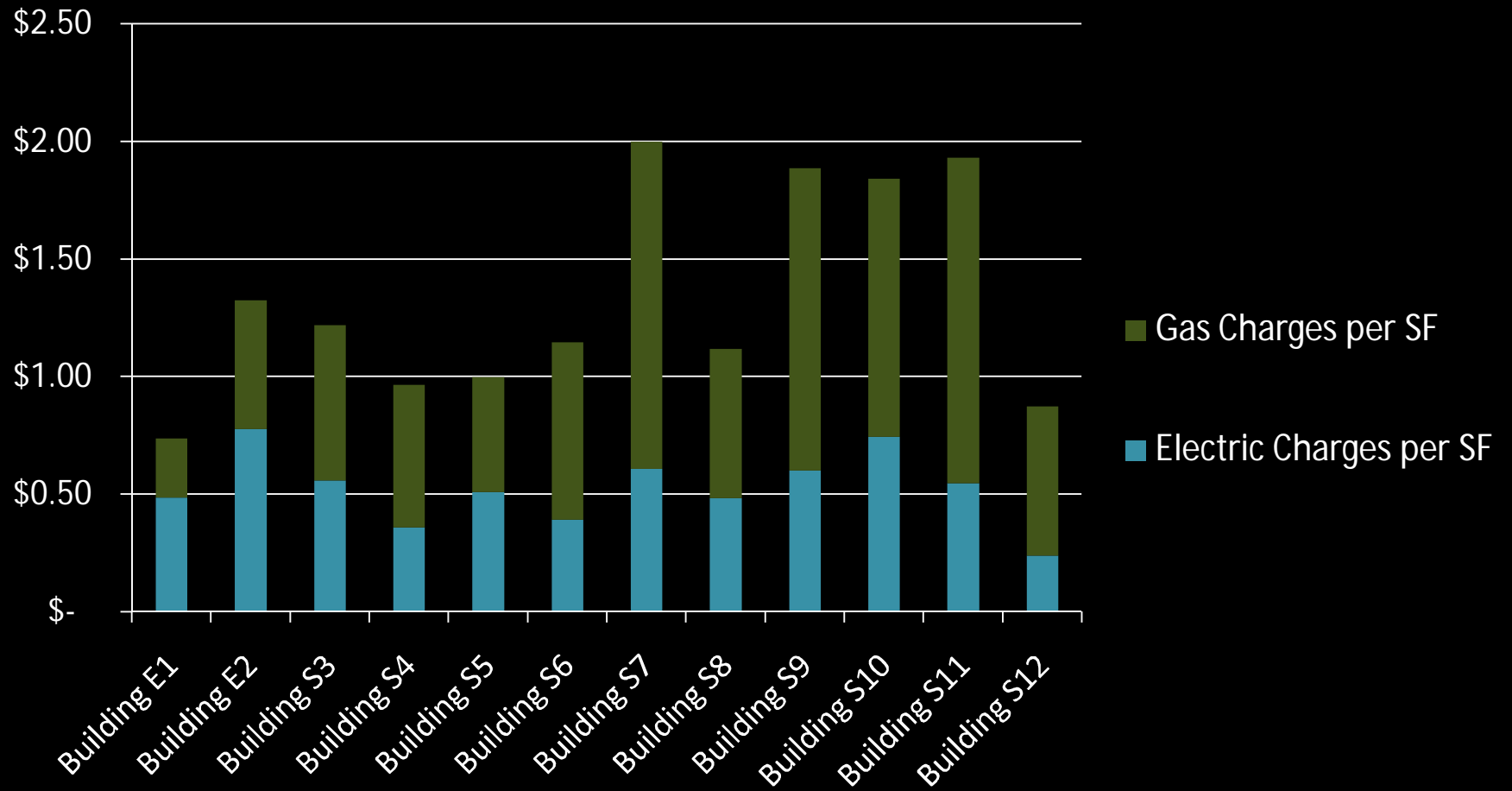
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- Controls the Range of Variables
- On-site Verification
- **Produces Efficient Buildings**

-

- Reliance on Energy Model and Design Case
- Gifford Argument

Operating Costs



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1. What can we accomplish by setting energy efficiency criteria?
2. How can we more accurately predict energy use?
3. What is the direction of future studies?

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END