Evidence-based Design

Drivers and Data for Design Teams

BECC Conference
Sacramento, CA
November 16, 2010

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Program Director

nbi new buildings institute

new buildings institute

- Non-profit, think tank on commercial building energy efficiency
- Formed in December 1997
- Funding
  - Sponsors: includes SCE, PG&E, NGrid, NYSERDA, CEC, SMUD, NEEA
  - Major Grants: EPA, EF, Doris Duke, Kresge
  - Contracts: USGBC, CEC PIER, DOE, EPA
  - Staff in Vancouver, Seattle, and White Salmon, Washington

Evidence-based Design and Operations
is a California Energy Commission
Public Interest Energy Research (PIER) project

PUBLIC INTEREST ENERGY RESEARCH
"Research Powers the Future"

Common Interests

Do design firms want to create buildings of beauty that meet the clients program AND are energy and environmentally responsible?

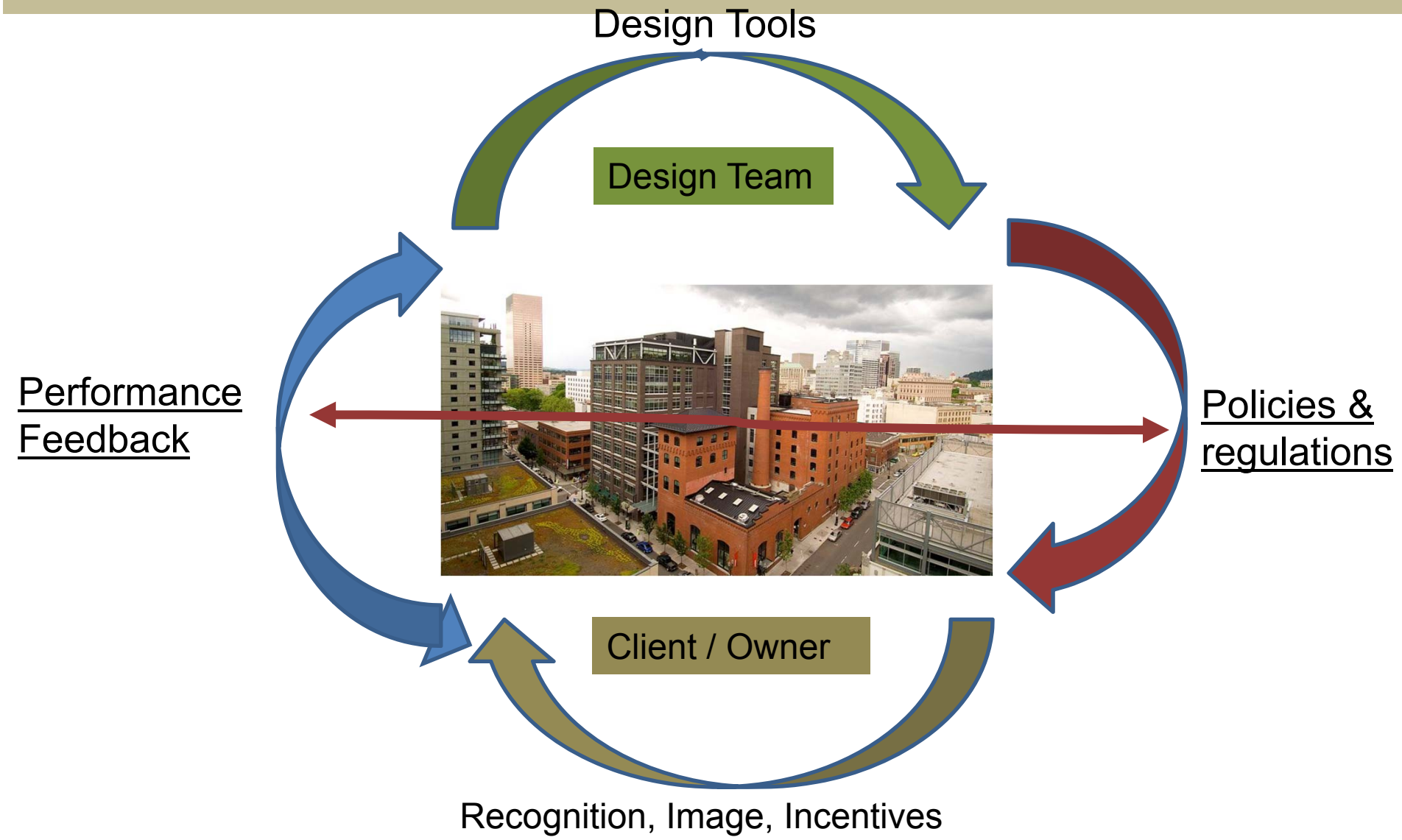
Yes

No

California Advisors on Measured Performance (CAMP)

A & E firm advisors to PIER and related measured performance projects

Design team as Advocates for Energy Efficiency




Policies & Regulations

Rating & Disclosure Mandates

	Enacted	Building types	Disclosure	Also required
California	**2007**	Nonresidential	Point of Transaction: Buyers, lessees and lenders	Utility assistance
Austin, TX	**2008**	Nonresidential + multifamily	Point of Transaction: Buyers + public display for multifamily	Energy audits + some retrofits for multifamily
District of Columbia	**2008**	Nonresidential	Annual to public web site	Disclosure of energy use estimations for new buildings
Washington State	**2009**	Nonresidential	Point of Transaction: Buyers, lessees and lenders	Utility assistance; minimum ratings for state leases
New York City	**2009**	Nonresidential + multifamily	Annual to public web site	Energy audits & retro commissioning
Seattle	**2010**	Nonresidential + multifamily	Annual to city + Point of Transaction: Buyers, lessees , lenders + current tenants	Utility assistance
Others	**Pending**			

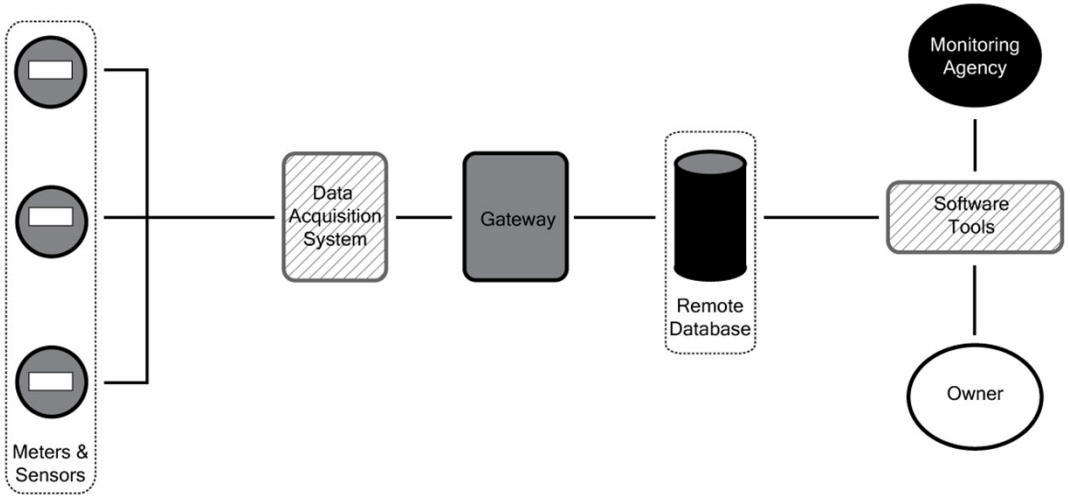
Source: Institute for Market Transformation

Ratings & Labels

Benchmark first then: Label @ design and @ operations

Levels of Metering

- Whole building metering
- Tenant space sub-metering
- Load-type isolation (Design for Meterability)
  - HVAC
  - Lighting
  - Building Operations (elevators, automatic doors, etc.)
  - Miscellaneous (plug and process loads)
- Metering of on-site renewables
- All connected to a data acquisition system



Process diagram for data collection from meters to software tools

Proposal for the International Green Code Council (IgCC)

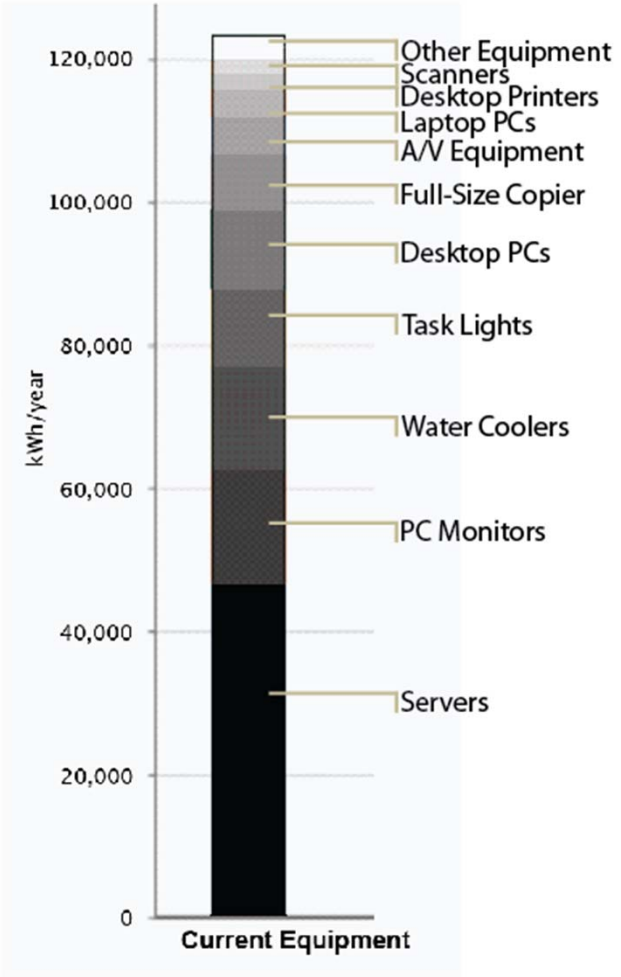
An outcome-based energy code

- Would be based on achieving actual post-retrofit ***performance outcomes*** rather than applying prescriptive codes
- Would leverage current efforts toward annual ***disclosure and benchmarking*** of performance of all buildings

Probable Pilots: Seattle, Vancouver B.C.

an outcome-based code is worth exploring

- Can include typical “unregulated” loads
- Puts appropriate pressure on operations and Cx to assure that equipment works and is properly controlled
- Credits good daylighting design and natural ventilation – difficult now
- Breaks policy silos by becoming a reference point for multiple entities
- Narrows the gap between design and actual performance – puts pressure on design teams (or design build) to optimize the solution set.




Feedback on
Key Performance Indicators

Glazing performance – building orientation – cooling efficiency – infiltration – operating hours – climate – weather – occupant density – heating efficiency – duct design – fan size – window area – HVAC control sophistication – building mass – interior shading – occupant habits – data centers – kitchen equipment – lighting power density – filter condition – wall color – lighting controls - furniture configuration – exterior vegetation - operable window use – insolation- glazing orientation – wall insulation – ventilation rate - exposed interior surface characteristics - domestic hot water use – number of computers – copiers and printers – elevators – exterior lighting - occupant gender ratio – elevation – photovoltaics - development density – register location – cooling distribution system – roof insulation – building manager training – cool roof – building surface to volume ratio – building use type – janitorial services – metering strategies – commissioning – structural system – acoustic treatment – slab edge detailing – night setback temperature – ground water temperature – humidity – occupant dress code – lamp replacement strategy – roof slope – daylight controls – sensor calibration – corporate culture – lease terms – utility meter characteristics – parking garage ventilation – HVAC system capacity – number of separate tenants – retail space – age of equipment – ceiling height – heating fuel – transformer capacity – window mullion pattern – terms of maintenance contract – wall thickness – building height – lighting fixture layout – overhangs – thermostat location – exit lighting – private offices – refrigerators – solar hot water – utility meter – load diversity

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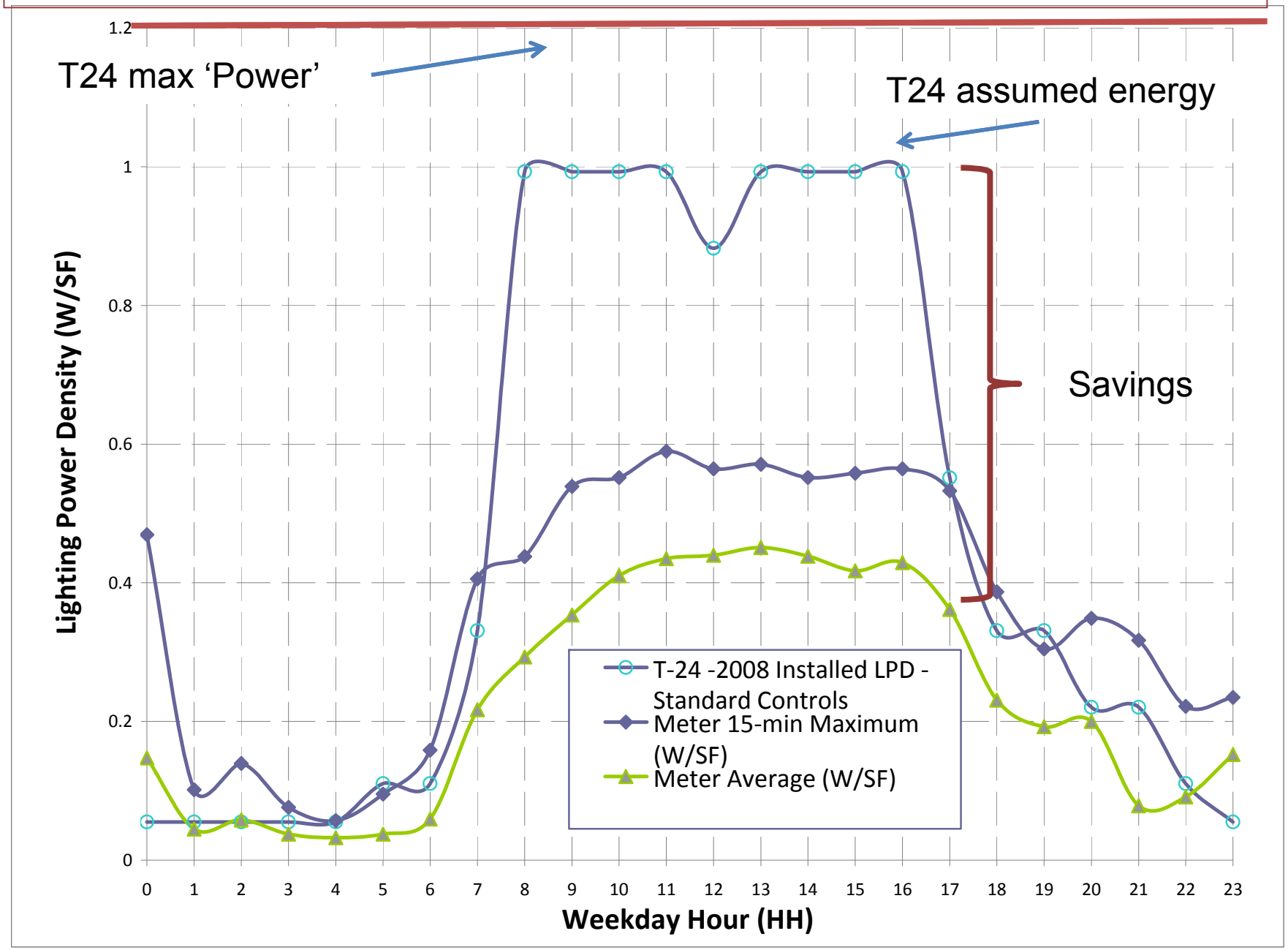
What do we measure?

	CONNECTED LOAD	LIGHTING POWER DENSITY
Old System	1,564 W	1.04 W/SF
New System	2,076 W	1.32 W/SF

CA T24 code (2005) with controls allowance = 1.37

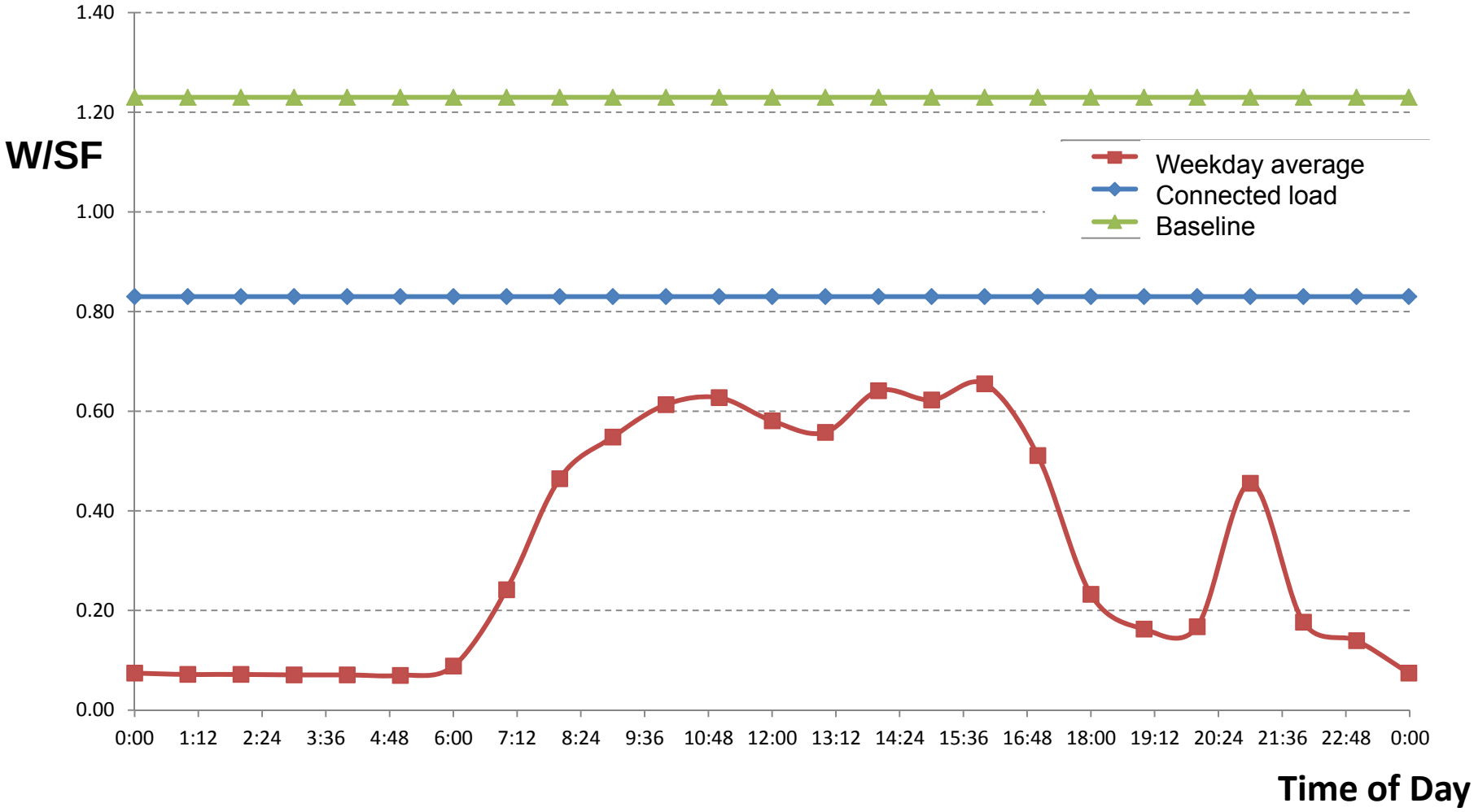
Office of the Future
Pilot Project

Landmark System Performance



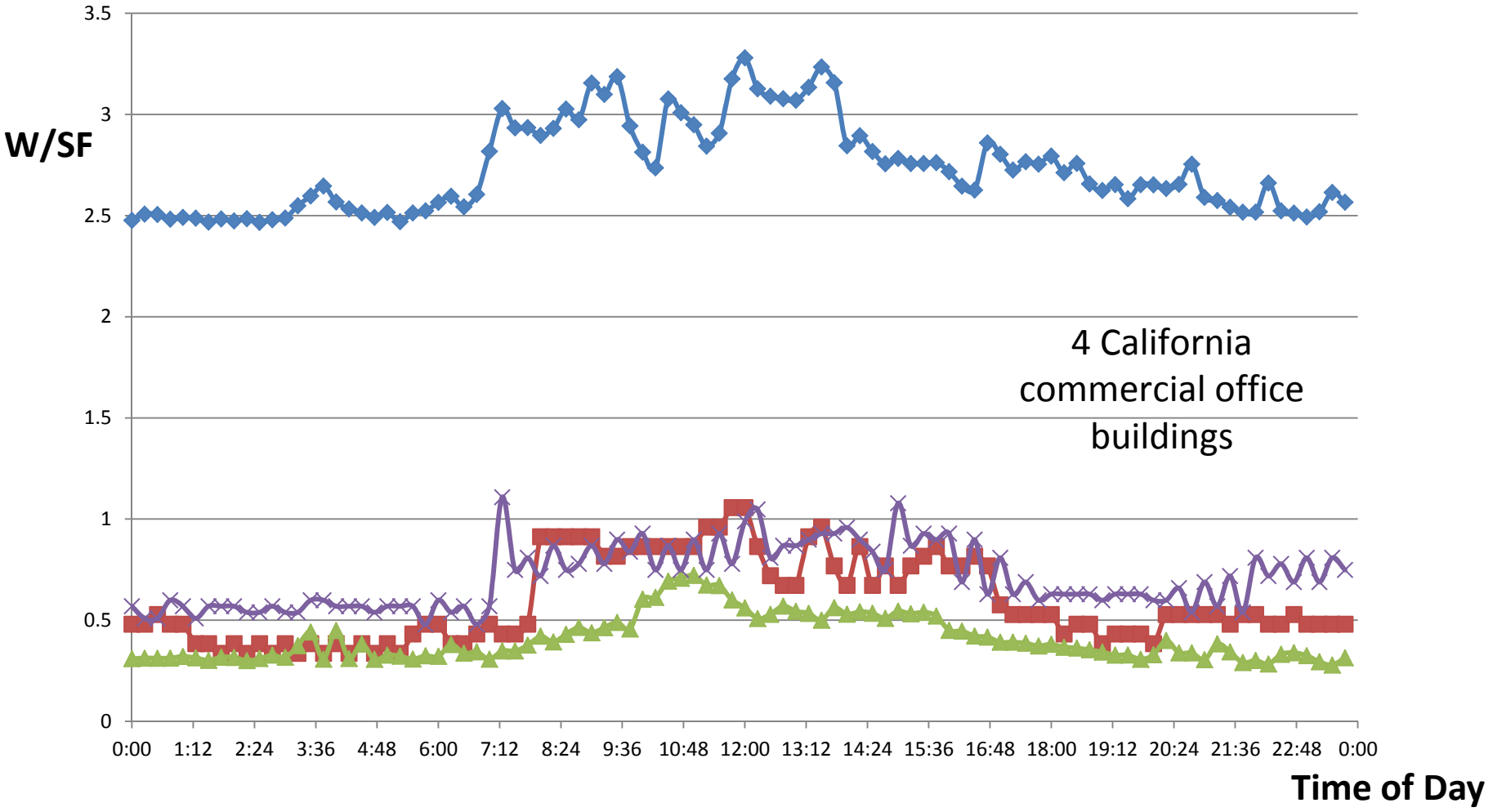
San Francisco Office

Lumenergi - Workstation Specific Lighting



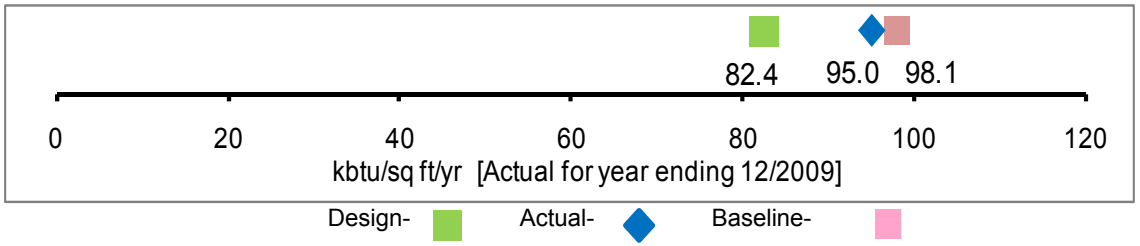
Plug Loads

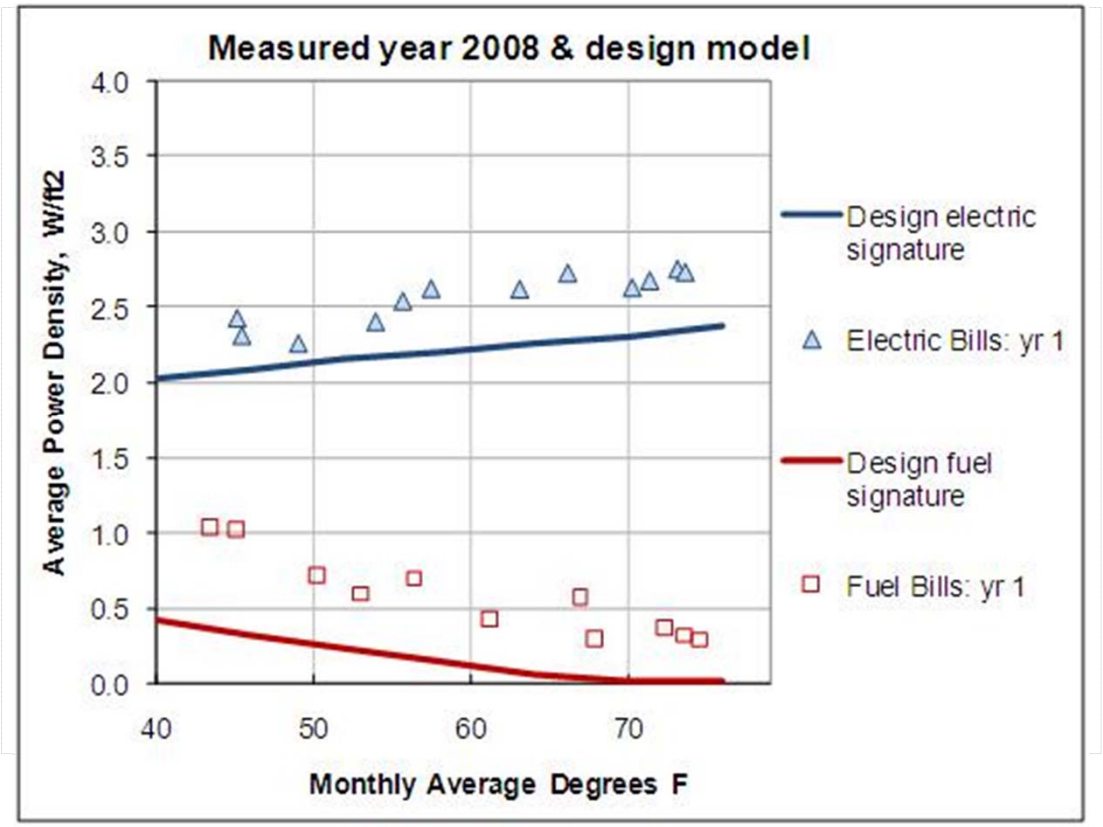
Plug Load Existing Condition



Comparing Models to Actual Easier with Energy Signature

- Compare EUIs
- Compare Signatures





Primary Performance Areas as seen by *First View* tool

Design & construction:

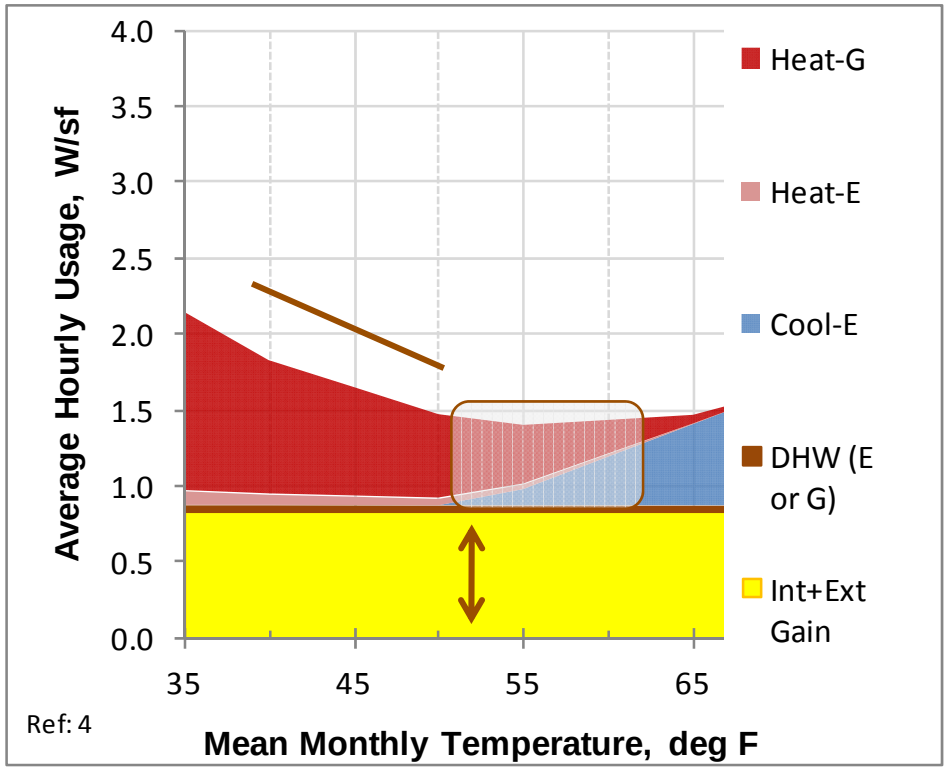
- –Signature slopes ↔ Shell, HVAC

Tenants / Occupants:

- Schedule & plug loads ↔ Internal gains

Operations:

- Controls-related issues ↔ Model interactions and relationships



First View

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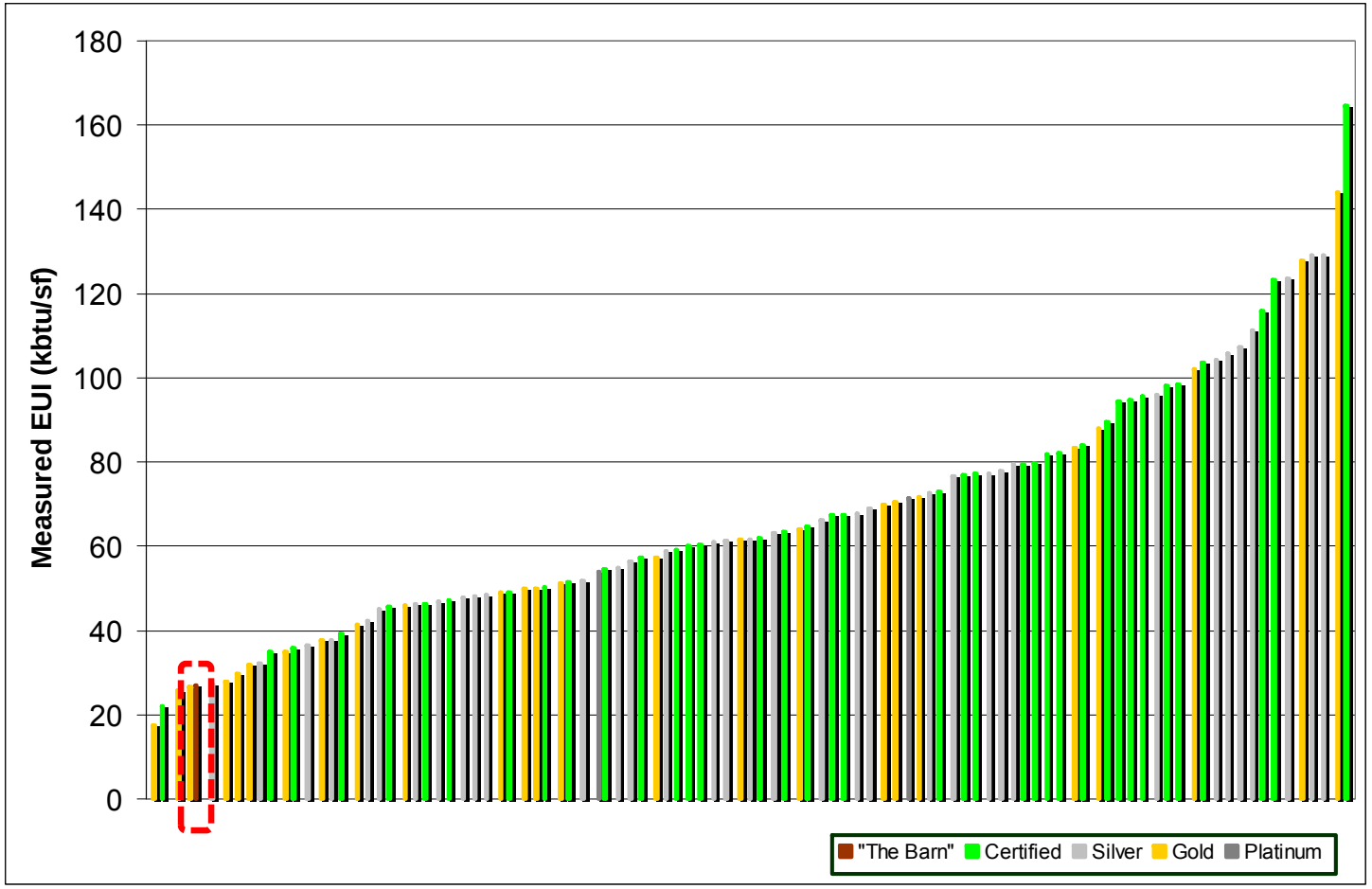
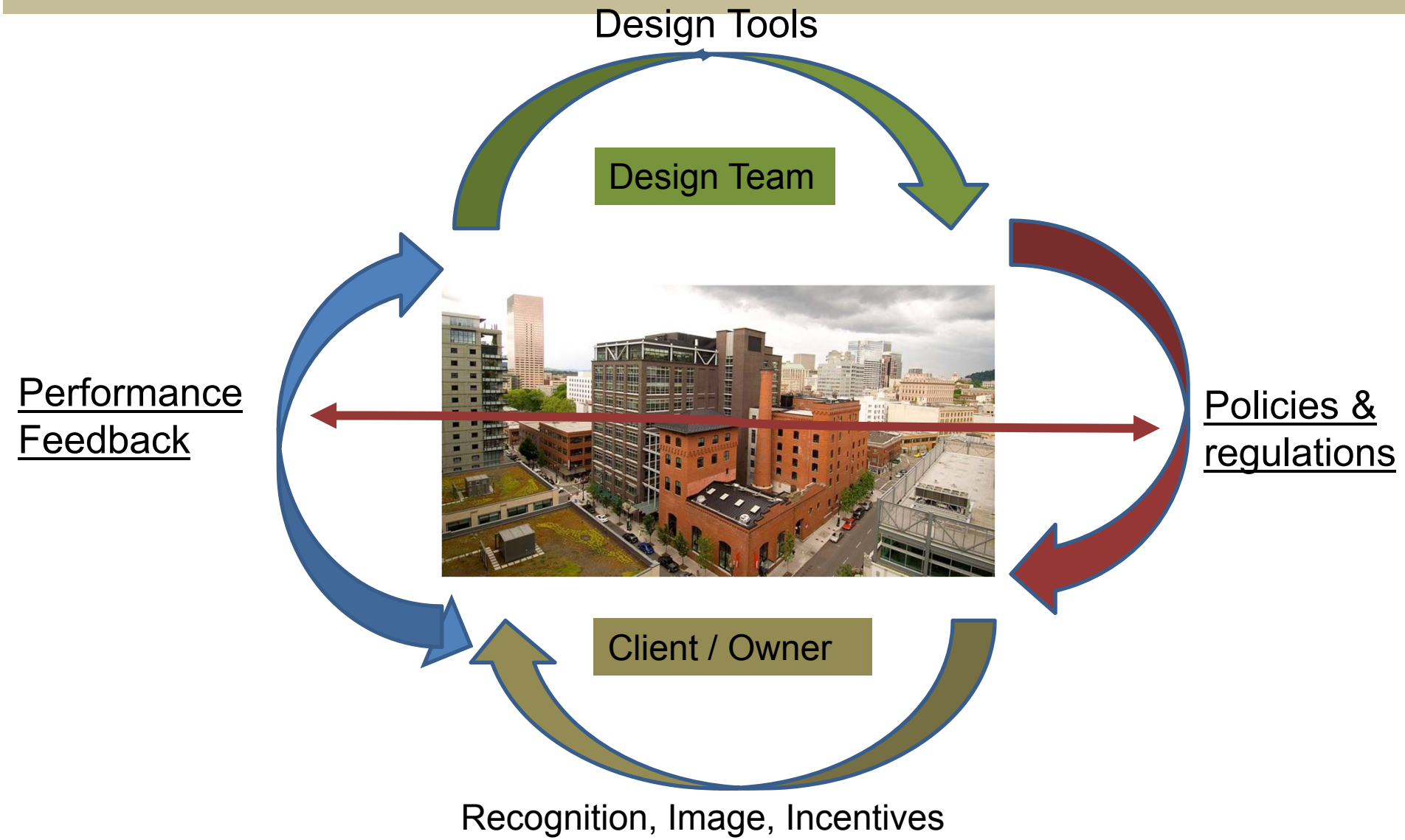
Relative vs. Absolute energy



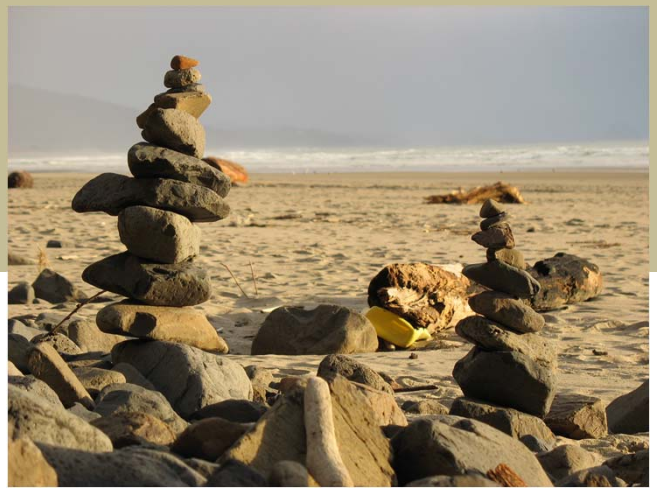
NBI Study of the measured performance of 100 LEED buildings.

Design team as Advocates for Energy Efficiency



Snapshot Summary: Designers need

- Receptive owners / clients
  - Policies
    - Disclosure, Labeling, Codes, Metering
  - Incentives & Promotion
- Evidence on performance
  - Feedback on their buildings
  - Comparative data



Thank you

Questions?

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