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62%+

The 2012 global average share of *non-green* building activity.

SLOW FLOW OF PROGRESS IN AEC INDUSTRY

Life Cycle Costs of a Facility

- 92%
- 2%
- 6%

- Salaries of Occupants
- Costs of O&M
- Original Design & Construction

50% - 80%

The percentage of high performance buildings with actual energy consumption found to exceed predicted consumption.

**Sources:**
LACK OF PERSONAL CONTROL, FRUSTRATION & IMPACT ON PERFORMANCE

Leaving lights on as a sign of protest & statement of personal control

New Mexico Elementary School
LINK BETWEEN ENERGY & OCC. EXPERIENCE

Comparison of EUI Ratios to Temperature Responses
KEY TAKEAWAYS

• Recognize that BEHAVIOR JUDGEMENTS are a matter of perspective
• Improve ALIGNMENT
• Account for PRODUCTIVITY/PERFORMANCE and HEALTH impacts
• Increase number of DECISION MAKERS and GROUP UNITY
Indi

vidual

Environment

Behavior (Including Decision Making)

Needs

Based on research spanning from:
Kurt Lewin, 1936 *Principles of Topological Psychology*
to
Elliott Sober & David Sloan Wilson, 1999
*Unto Others: The Evolution and Psychology of Unselfish Behavior*
BEHAVIOR JUDGEMENTS
Clothing Variability, Thermal Comfort & Energy Consumption
BEHAVIOR JUDGEMENTS

Based on research spanning from:
Kurt Lewin, 1936 *Principles of Topological Psychology*
Elliott Sober & David Sloan Wilson, 1999
*Unto Others: The Evolution and Psychology of Unselfish Behavior*
IMPROVE ALIGNMENT

EAM PROCESS: For Building & Occupant Alignment

**Evaluate**
- Background Data *(HR & Building)*
- Engage Bldg Population *(Interview, Observe, & Survey)*
- Facility Evaluation *(Space Measurements & FPTs; O&M Engagement)*

**Align**
- Physical *(Facility, O&M Modifications)*
- Social *(Behavior, Organization Policy Modifications)*

**Monitor**
- Metrics *(Energy and Water; Survey Results; Productivity and Health)*
- Evaluation Plan *(Frequency; Records and Engagement)*
- Address Issues

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IMPROVE ALIGNMENT
Deep key stakeholder engagement needed to assess varying wants/needs/values
New Mexico Elementary School

IMPROVE ALIGNMENT

Personal Control, Occupant Inertia & Ease of Blind Control Access
IMPROVE ALIGNMENT

New Mexico Elementary School

Technology’s perspective from a child
QUANTIFY PRODUCTIVITY/HEALTH IMPACTS

Direct Measure
- Field Setting
- Lab Setting

Direct Estimate
- Multivariate Regression Analysis
- Looking for Correlations
- Looking for Average Impacts

Quantified Productivity/Performance & Health Impacts

Indirect Estimate
- Using previous research informed by ethnography
- Wasted Time
- IEQ Impacts
Conrad Duberstein U.S. Courthouse and Post Office’s Energy Conservation Measure (ECM) Total Cost and Estimated Payback

Photo Rights: Cervin Robinson, Richard McElhiney Architects LLC

ECM Estimated Total Implementation Costs $9,167,000

ECM Estimated Annual Energy Savings $872,000

Simple Payback (Energy Only) 10.5 yrs

Simple Payback (Energy + Productivity) 2.1 yrs

ECM Estimated Annual Productivity Savings $3,570,000

QUANTIFY PRODUCTIVITY/HEALTH IMPACTS
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Evaluation of Design Daylighting Options Using Productivity Impacts

Option 1: Frit Glazing

Option 2: LightLouver + Blinds/Shades

3% - 6% increase in performance (math & reading tasks) over Option 1
INCREASE NUMBER OF DECISION MAKERS
As well as GROUP UNITY

Utility & Productivity Impacts

- 2011-2012 Utility Costs
- Estimated Annual Utility Savings
- Estimated Annual Productivity Improvement (Dollar Equivalent)

Kansas School District
INCREASE NUMBER OF DECISION MAKERS

As well as GROUP UNITY

Kansas School District: addressing elementary school space restrictions/lack of flexibility issues were estimated to:

• Eliminate **18,400 – 22,400 person-hours** per school-year of wasted teacher/staff time spent scheduling and coordinating use of space.

• Equates to approximately **2.16% - 2.63%** of the total labor hours annually “spent” by the elementary school teachers/staff.

• Translates to approximately **$722,970 – $883,630** worth of teacher/staff time.
INCREASE NUMBER OF DECISION MAKERS
As well as GROUP UNITY

72%
• Recognize that **BEHAVIOR JUDGEMENTS** are a matter of perspective

• Improve **ALIGNMENT**

• Account for **PRODUCTIVITY/PERFORMANCE** and **HEALTH** impacts

• Increase number of **DECISION MAKERS** and **GROUP UNITY**
