TARGETING 100!

AN INTERDISCIPLINARY STUDY OF ENERGY REDUCTION IN HOSPITALS

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INITIATION OF NATIONAL RESEARCH | WORKSHOPS | ANALYSIS + SUMMARY | WORKSHOPS & TOOL DEVELOPMENT | TOOL

LESSONS LEARNED | BRCM PILOT STUDY | PROJECT PROPOSAL | NEW YORK PROPOSAL | PHOENIX PROPOSAL | PILOT HOSPITAL ANALYSIS | LOS ANGELES PROPOSAL | PHOENIX PROPOSAL | HOUSTON PROPOSAL | NATIONAL REVIEW MEETING

2010 | 2011 | 2012

Division of Technical Resources

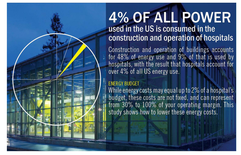
Office of Research Facilities

The National Institutes of Health

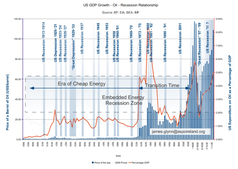
The formulae $\frac{dE_{bldg}}{dt}=\sum_i\left(\frac{dE_i}{dt}\right)_{HVAC}+\sum_i\left(\frac{dE_i}{dt}\right)_{Light}+\sum_i\left(\frac{dE_i}{dt}\right)_{Plug}+\sum_i\left(\frac{dE_i}{dt}\right)_{Process}$ *for building* $\frac{dE_{bldg}}{dt}=\sum_i\left(\frac{dE_i}{dt}\right)_{HVAC}+\sum_i\left(\frac{dE_i}{dt}\right)_{Light}+\sum_i\left(\frac{dE_i}{dt}\right)_{Plug}+\sum_i\left(\frac{dE_i}{dt}\right)_{Process}$ *state of the art* $\frac{dE_{bldg}}{dt}=\sum_i\left(\frac{dE_i}{dt}\right)_{HVAC}+\sum_i\left(\frac{dE_i}{dt}\right)_{Light}+\sum_i\left(\frac{dE_i}{dt}\right)_{Plug}+\sum_i\left(\frac{dE_i}{dt}\right)_{Process}$ *biomedical research facilities.*

WHY

ENERGY FOOTPRINT OF HOSPITALS

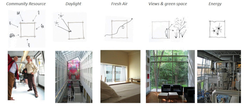


UTILITY PRICE VOLATILITY



ACTUAL HOSPITAL ENERGY USE

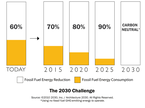
BENEFITS OF HIGH-PERFORMANCE HOSPITALS



MAJOR CONCEPTS

6 BIGGEST CITIES IN MOST DIVERSE CLIMATE REGIONS

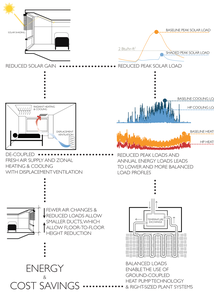
2 PRINCIPAL STUDY GOALS



Meet Energy Reduction Goals

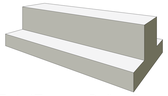
Determine First Cost and Operational Costs

INTEGRATED STRATEGIES & LOAD REDUCTION

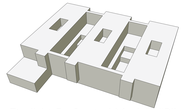


CONCEPTUAL FRAMEWORK

ARCHITECTURAL SCHEMES



Typical Tower on Podium Base - "A"
- Program – 225 beds, 477,000 SF
- Window to wall ratios – 30%



Daylight Perforated Model - "B"
- Program – 225 beds, 477,000 SF
- Window to wall ratios – 30%
- Facade area double that of Scheme A to achieve daylight

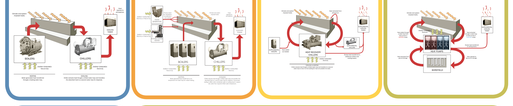
Baseline | High Performance

ENERGY OPTIONS

1 | 2 | 3 | 4

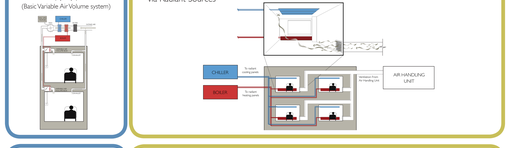
PLANT

- 1: Conventional Plant System
- 2: High Efficiency Distributed Heat Generation Plant
- 3: Enhanced Heat Recovery Chiller Plant
- 4: Ground Coupled Heat Pump Plant



BUILDING MECHANICAL

- 1: VAV (Basic Variable Air Volume system)
- 2–4: De-Coupled Ventilation and Zonal Heating and Cooling via Radiant Sources

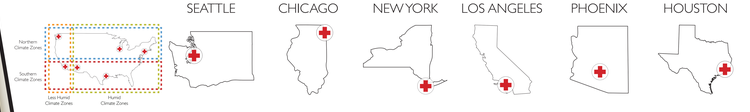


ARCHITECTURE

- Minimum Code Performance (ASHRAE 90.1-2010)
- High Performance Envelope
  - Balance heat loss and radiant comfort with thermal performance
  - Minimize peak loads for cooling performance and increased thermal comfort
  - Solar Control
  - Daylighting
  - Increase interior environmental quality and decrease electric lighting loads

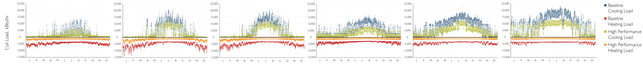
PRELIMINARY OUTCOMES

STUDY LOCATIONS, PROCESS AND OUTCOMES

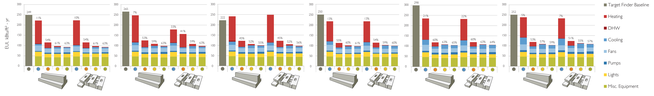


Peer Review Group Meetings

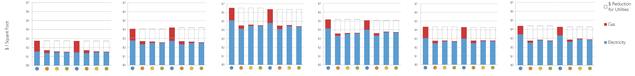
Annual Heating & Cooling Load Profile High Performance & Baseline



EUI Results Schemes A & B



Energy Cost Per Square Foot Schemes A & B



Cost Comparison Scheme A1 vs. A4

IMPLICATIONS FOR DESIGN

CONCLUSIONS

- SETTING PERFORMANCE-BASED GOALS EARLY, TRACKING PROGRESS TOWARD GOALS, AND BENCHMARKING/EVALUATION ARE CRITICAL STEPS TO MEETING HIGH PERFORMANCE GOALS
- INTEGRATED TEAMS ENABLE EFFICIENT INTEGRATED SYSTEMS
- LOAD REDUCTION STRATEGIES FOR ARCHITECTURE AND BUILDING MECHANICAL SYSTEMS LEAD TO SMALLER SYSTEM SIZING
- PARTNERING WITH OPERATIONAL TEAMS, EDUCATING STAFF, AND ESTABLISHING A CULTURE AROUND RESOURCE CONSERVATION WILL MEANINGFULLY IMPACT CONSISTENT PERFORMANCE

NEXT STEPS

THE HOSPITAL OF THE FUTURE

UNIVERSITY of WASHINGTON | COLLEGE OF BUILT ENVIRONMENTS | INTEGRATED DESIGN LAB

U.S. DEPARTMENT of ENERGY | neea | SOLARC | tbd consultants | nbbj

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