



The Oregon State University Kelley Engineering Center

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Glumac

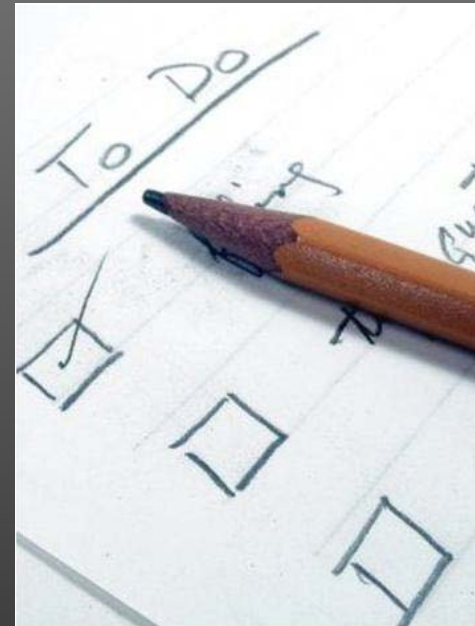
August, 2010

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Proceedings of the 17th Symposium for
Improving Building Systems
in Hot and Humid Climates
Austin Texas
August 24-25, 2010

Agenda

1	About Kelley
2	Design Process
3	Project Features
4	Building Performance
5	Q&A



About Kelley

- Oregon State University, Corvallis, Oregon
- First LEED® Gold certified academic engineering building in the U.S.
- Four-story, 155,000 sf
- Completed in 2004
- Project Cost of \$45 million
- Architect: Yost Grube Hall
- Contractor: Skanska Construction



Design Process

- Energy model to meet Oregon State Energy Efficiency Design (SEED) guidelines
- Computational Fluid Dynamics (CFD) modeling
- LEED benchmarking
- Design for LEED Gold

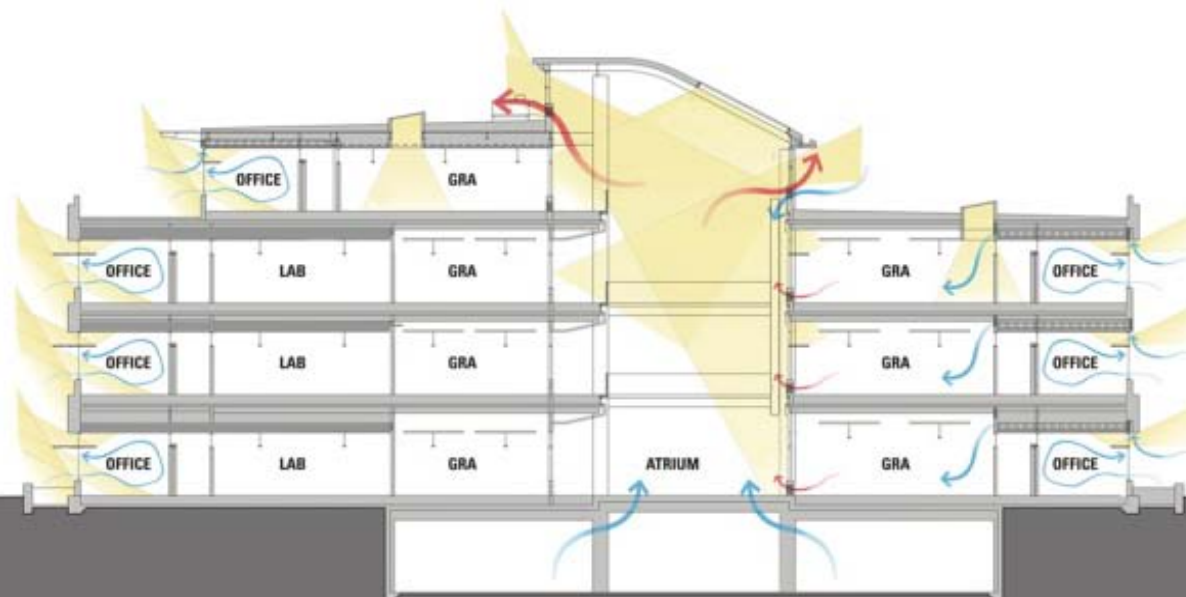


Project Features: Spatial Relations

- Interconnecting spaces
 - Enclosed GRA spaces
 - Private perimeter offices
 - Interior engineering and computer labs
- Atrium
- Open sky bridges and stairwells
- Café
- Open study areas



Project Features: Natural Ventilation



SOUTH SIDE

NORTH SIDE

MECHANICAL
ECONOMIZER
CYCLE NIGHT
TIME ZONE

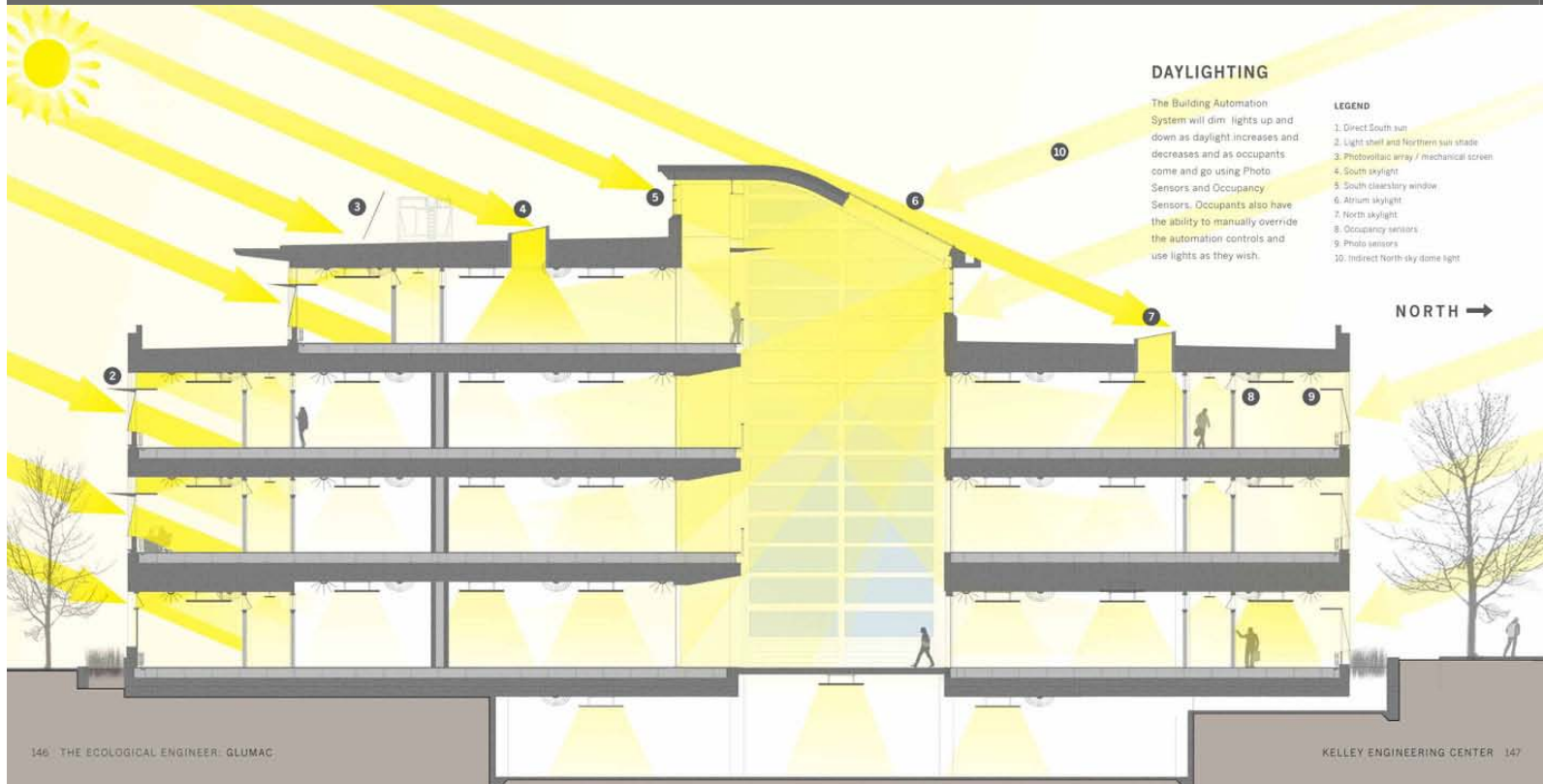
MECHANICALLY CONDITIONED ZONE

NATURAL VENTILATION NIGHT TIME FLUSH ZONE

MECHANICAL
ECONOMIZER
CYCLE NIGHT
TIME ZONE

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Project Features: Daylighting



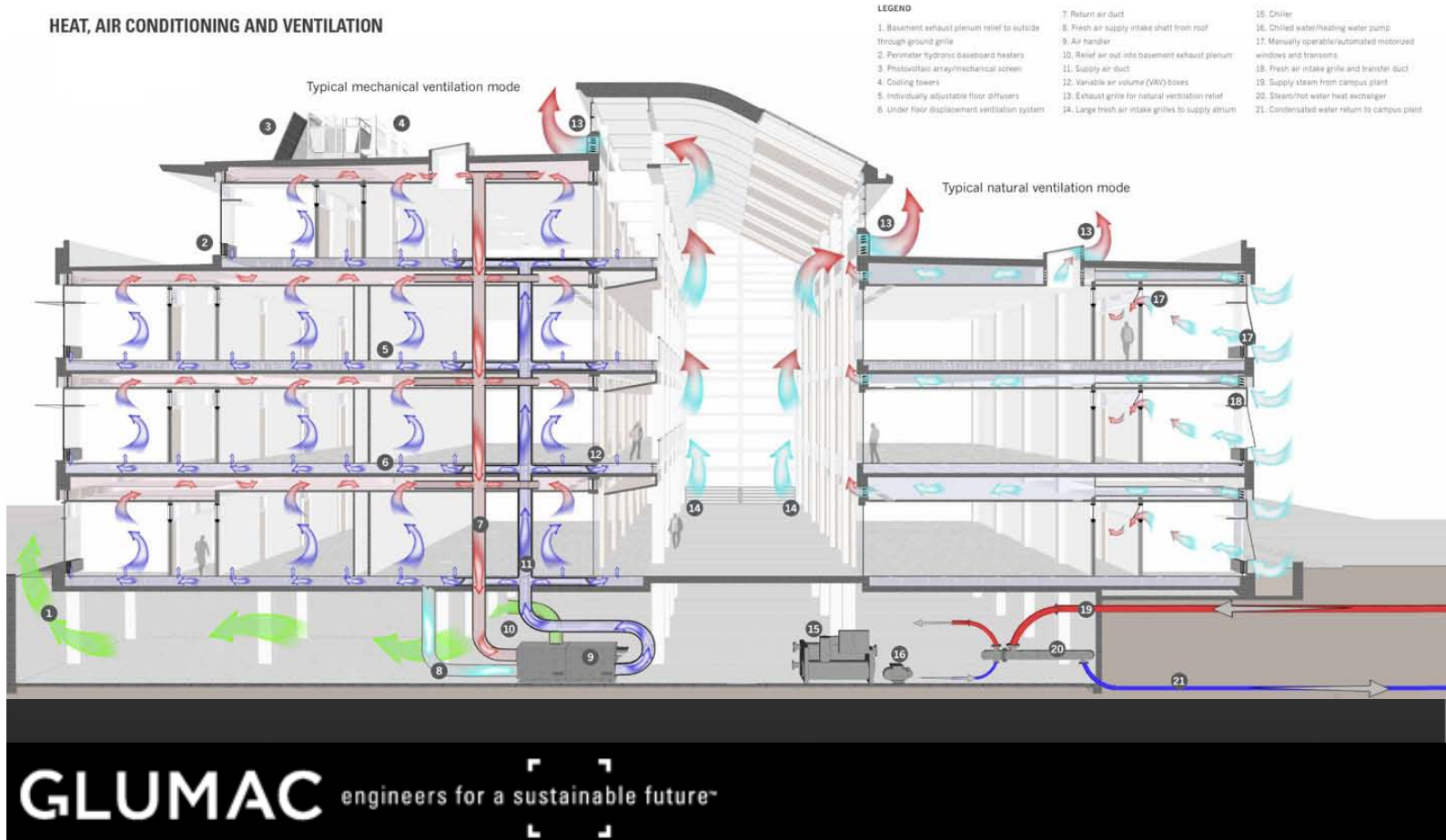
Project Features: Atrium

- Four-stories
- Stack-driven chimney for natural ventilation
- Motorized windows and dampers
 - Manual and controlled operation
- Daylight Harvesting



Project Features: HVAC

HEAT, AIR CONDITIONING AND VENTILATION

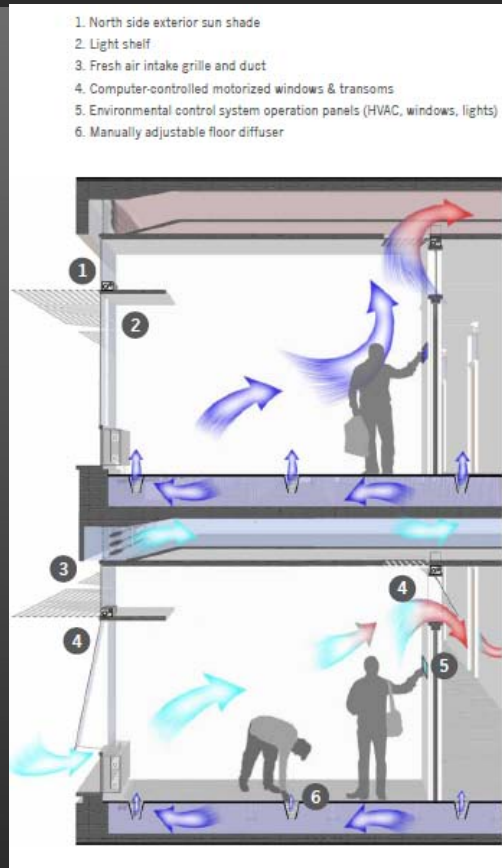


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Project Features: HVAC

Mechanical Ventilation

Natural Ventilation



Project Features: Private Offices

- Along the perimeter
- Occupant controls
- Natural ventilation
- Operable windows
- Interior light shelves
- Raised access floor air diffusers
- Room thermostats
- Simultaneous heating and cooling



Project Features: Rainwater Reclamation



RAINWATER RECLAMATION

LEGEND

1. Toilets and urinals flushed with harvested water
2. Roof top water collection with roof drains
3. Down spout
4. Rain water discharge into vegetative filter
5. Filtered water into collection 3 - 5,000-gallon tanks
6. Ultraviolet filtration system
7. Pumps supply harvested water to toilets and urinals
8. Back water discharged to sewer

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Project Features: Solar Technology

- 2,400-watt photovoltaic array
- Doubles as the cooling tower screenwall
- Evacuated tube solar hot water collector system
- Provides domestic hot water at 70% utilization efficiency

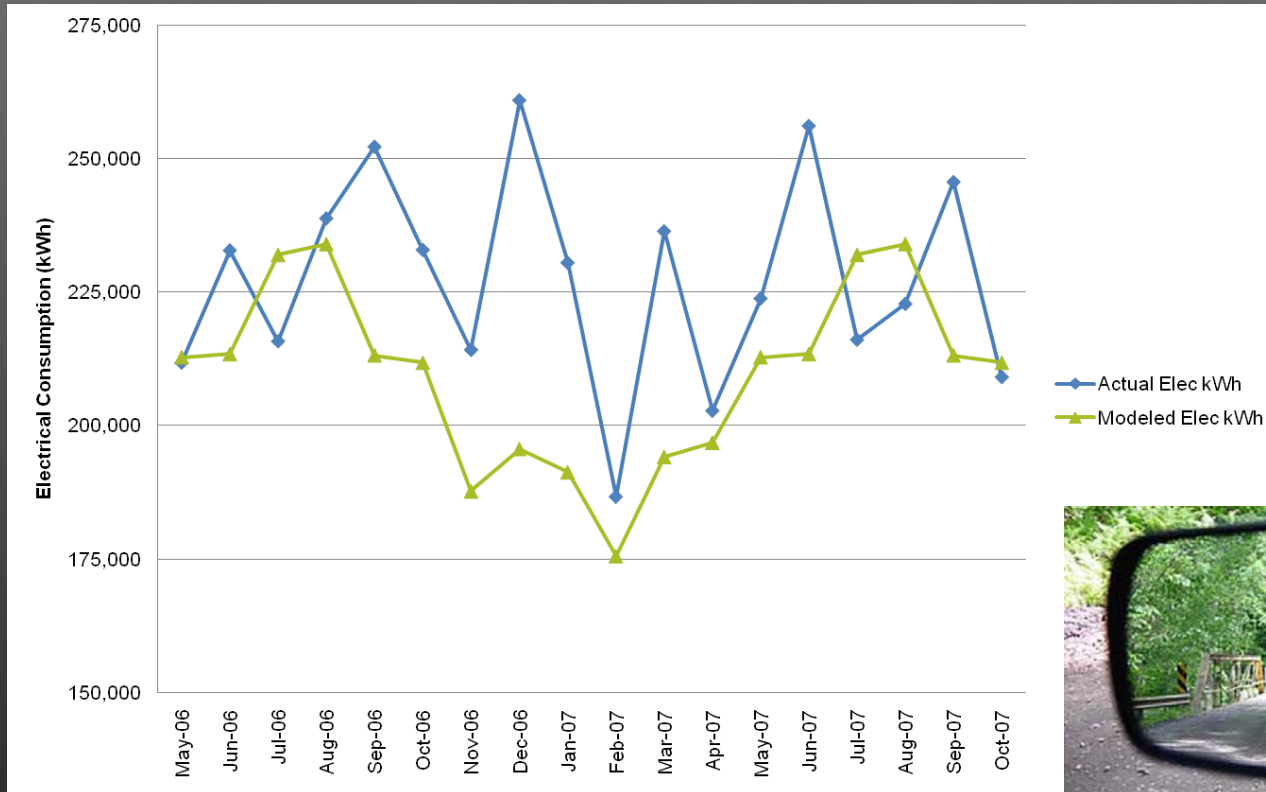


Building Performance

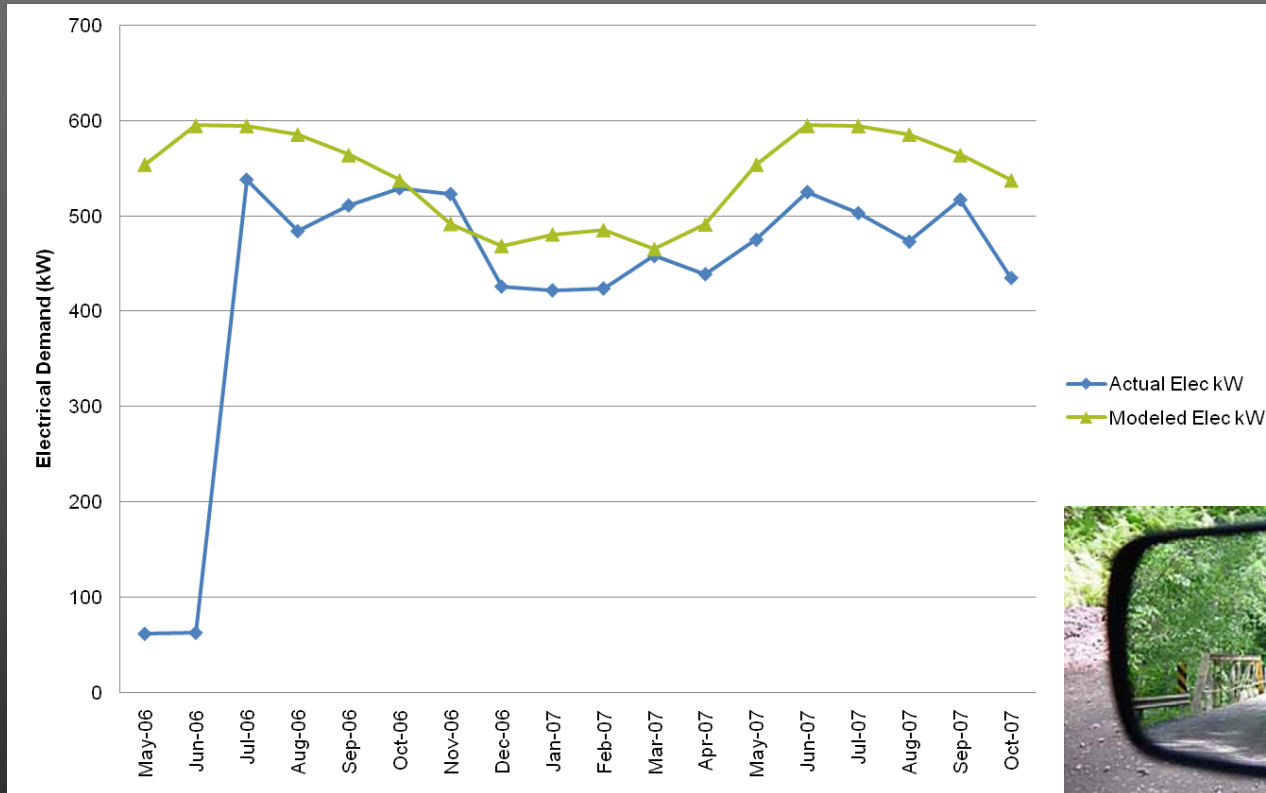
- Longer building operating hours than anticipated
- Reduced server room equipment loads
- Reduced plug loads
- Building warm-up not optimized
- New energy models
- Retro-commissioning



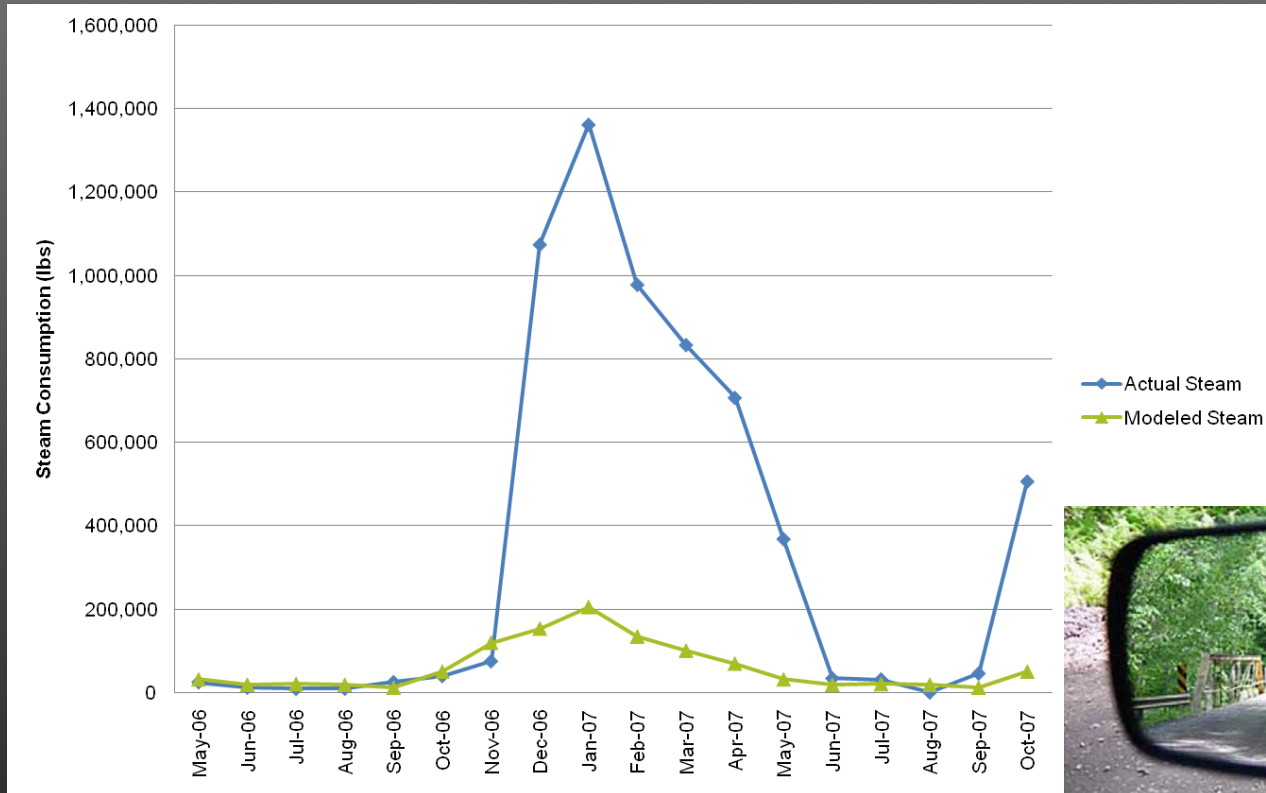
Looking Backwards – Electrical Consumption



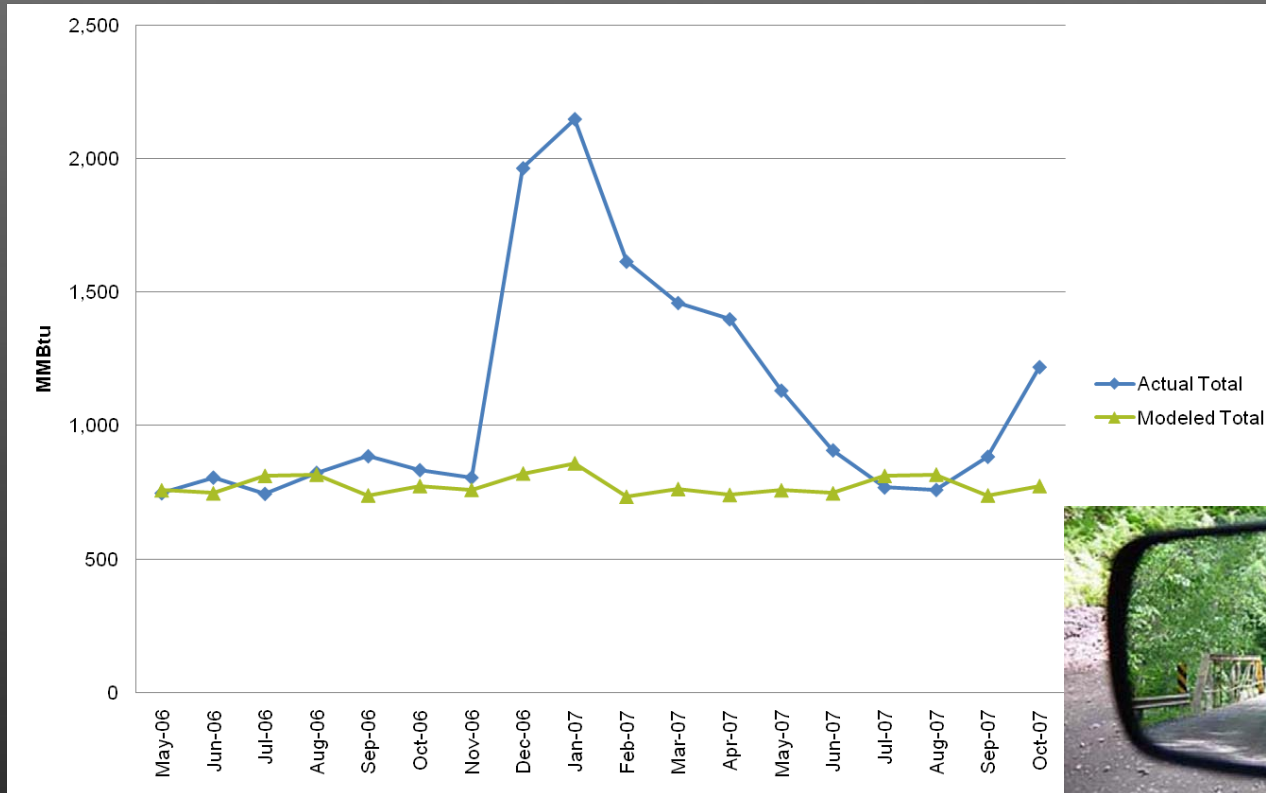
Looking Backwards – Electrical Demand



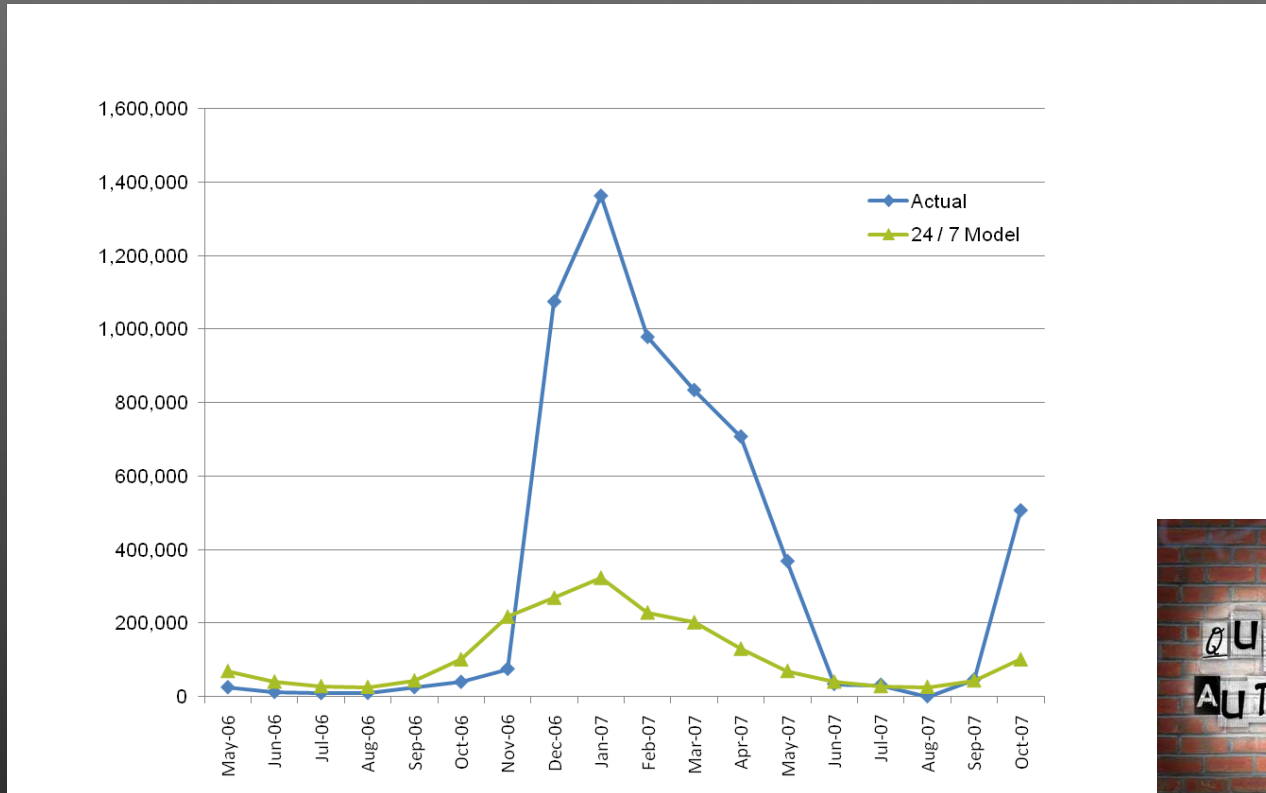
Looking Backwards – Steam



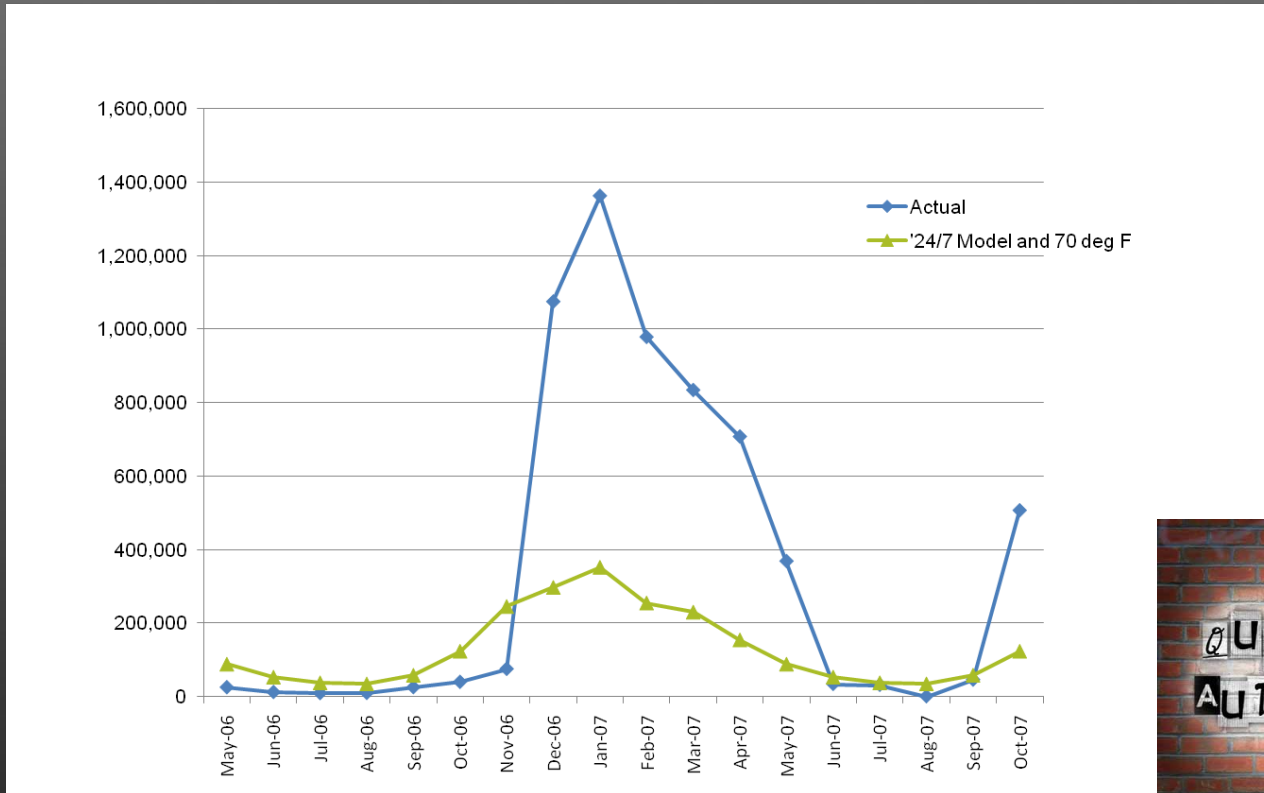
Looking Backwards – Total Energy



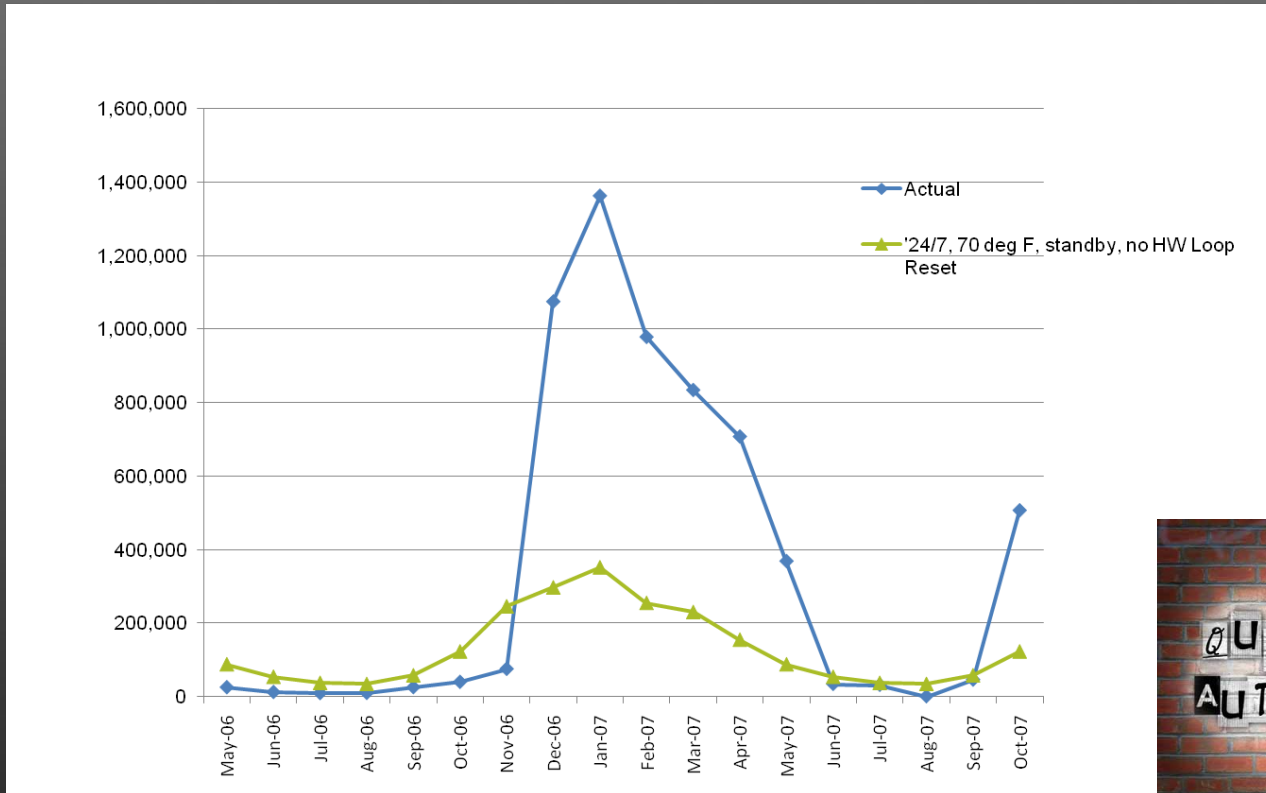
Looking Backwards – Occupancy Schedules



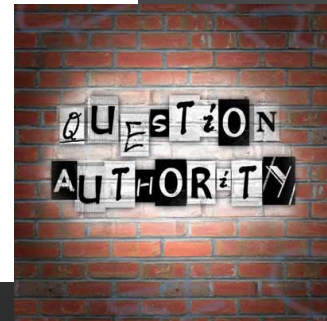
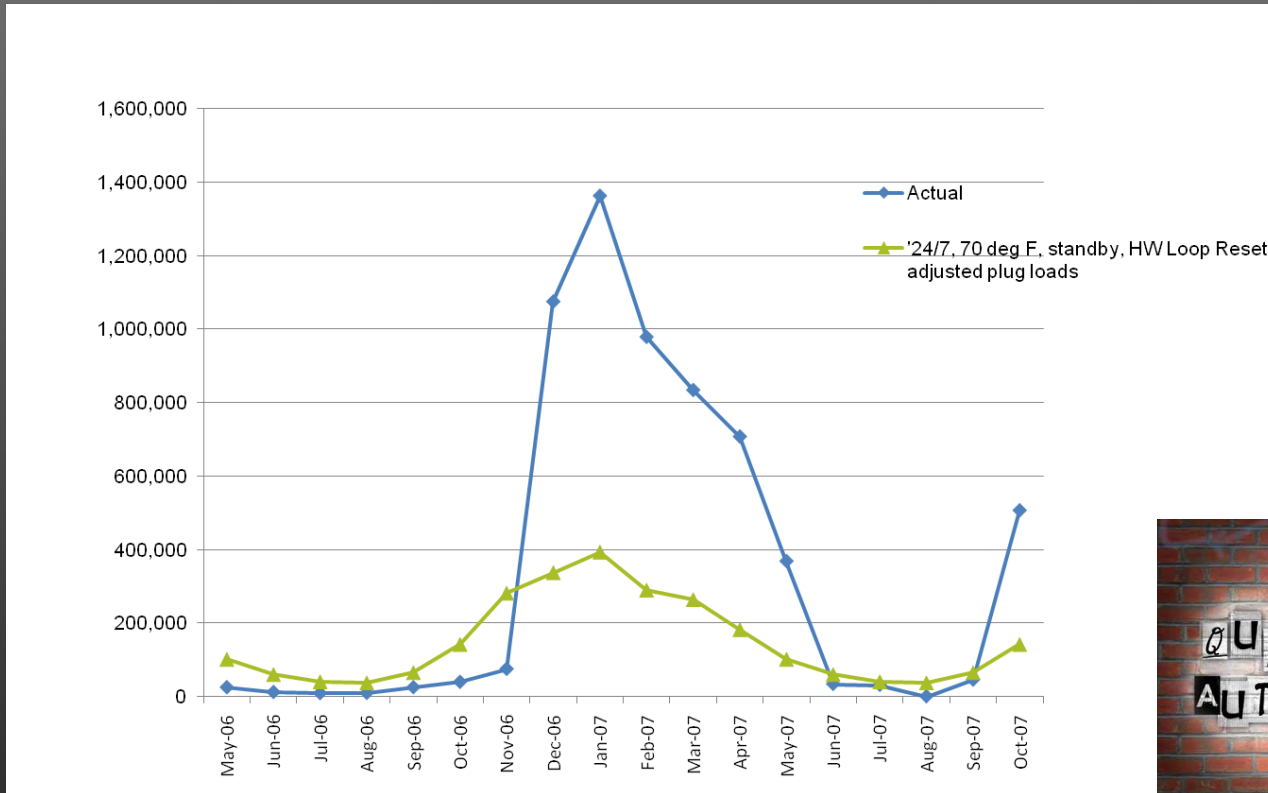
Looking Backwards – Heating Setpoint



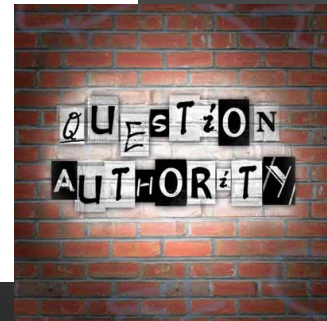
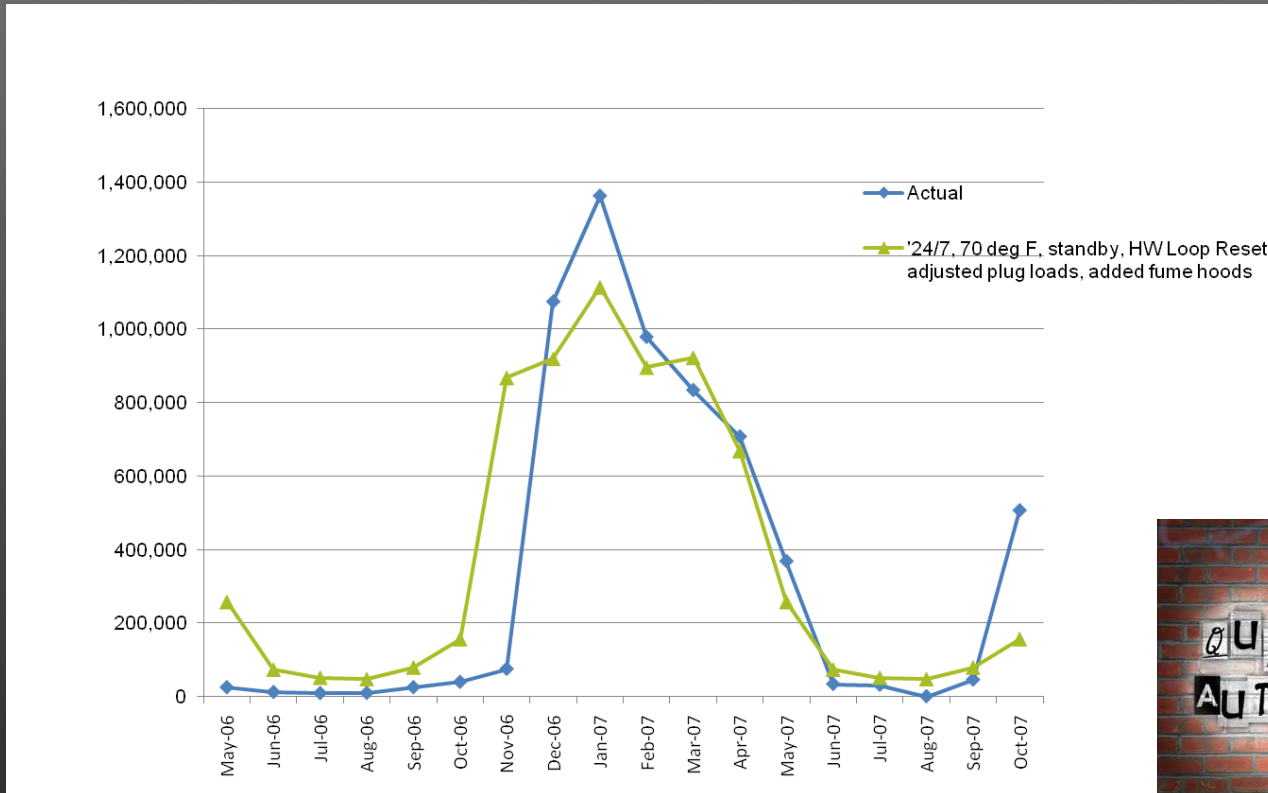
Looking Backwards – Delete HW Loop Reset



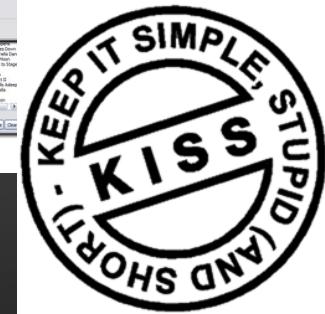
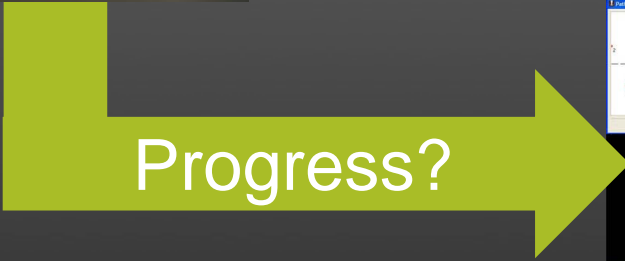
Looking Backwards – Adjust Plug Loads



Looking Backwards – Add Fume Hoods



Keep it Simple – Lighting Controls



This isn't your father's Oldsmobile

Buildings are “non-traditional”

- Natural ventilation = higher temps in summer and lower temps in winter
- Day lit buildings may have greater variation in illuminance levels
- For greatest energy savings direct occupant control may diminish

Q & A