Daylight Harvesting: A Cost Benefit Analysis of Daylight Harvesting at UC Davis

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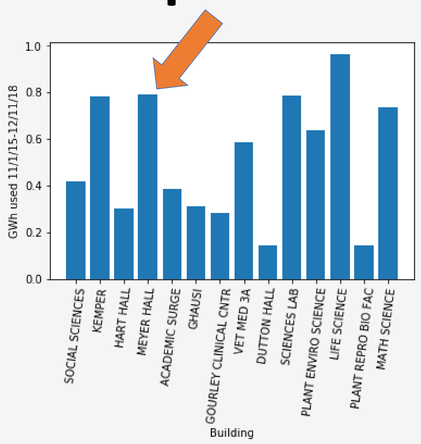
Background and Scope

- Daylight infrastructure already installed, but inactive
- Redundant lighting around our campus
- Meyer Hall used a proxy for existing buildings
- Collect daylight data
- Controls test run
- Modeled cost savings



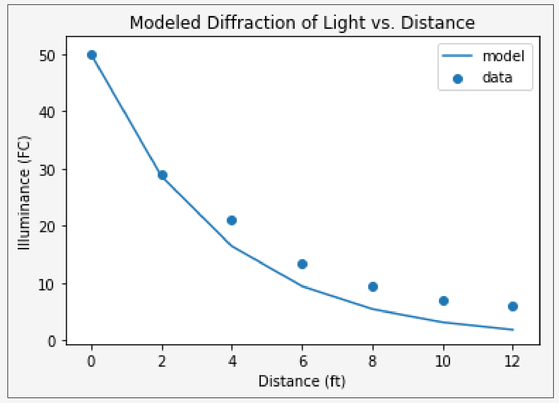
Methodology

- Data loggers used to measure illuminance (lum/ft^2)
  - 8 locations observed, covering cardinal directions
- Daylighting controls test run
  - Optimized parameters based on standards
  - Collected data to validate test
- Savings model
  - Modeled diffusion of light into room
  - Modeled daylighting
  - Estimated savings

Conclusions

- In general, daylight harvesting is worth it if...
  - Large solar potential, rooms with windows, large rooms
- Recommendations for ECO
  - Re-calibrate daylight sensors
  - Use different control mode
- Energy savings for closed loop ~18% (Delvaeye et. al 2016)
- Proper configuration is key for optimal performance

Results



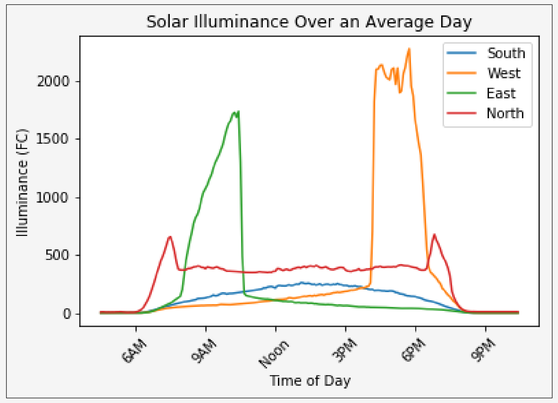


Table 1: Summary of Main Findings

Finding	Small Room	Large Room
Cost without daylighting ($/year)	16.8	163
Average Cost Savings with daylighting ($/year)	1.02-2.41	17.11-33.05
Average Cost Savings (%)	6-14	10-20
Payback time (years)	35-83	2.6-4.97

Table 2: Sensitivity analysis for small room using daylighting

Direction	Base Savings ($/year)	Weather Sensitivity (%) (0.50/+0.20)	Usage Sensitivity (%) (24 hrs/Peak)	Electricity Cost Sensitivity (%) (.25/+0.25)	Illuminance Sensitivity (%) (-0.5/+0.25)
North	1.98	-50/+25	-55/+0.01	-25/+25	-0/+0
South	1.02	-50/+25	-49/+27	-25/+25	-0/+0
East	1.85	-50/+25	-43/+186	-25/+25	-1/+0
West	2.41	-50/+25	-65/+327	-25/+25	-16/+0

Table 3: Sensitivity analysis for large room using daylighting

Direction	Base Savings ($/year)	Weather Sensitivity (%) (-0.50/+0.20)	Usage Sensitivity (%) (24 hrs/Peak)	Electricity Cost Sensitivity (%) (.25/+0.25)	Illuminance Sensitivity (%) (-0.5/+0.25)
North	33.05	-50/+20	-57/+9	-25/+25	-0.5/+0
South	17.11	-50/+20	-47/+24	-25/+25	-0/+0
East	17.38	-28/+11	-48/+146	-25/+25	15/+14
West	18.06	-21/+8	-55/+267	-25/+25	11/+11

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