

Energy Innovations in Urban Development at the Building Scale

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achieving a sustainable energy future
St Louis University
April 14, 2016

imagine | accelerate | perform | sustain

INTEGRAL

Revolutionary Engineering





building types

statistical analysis

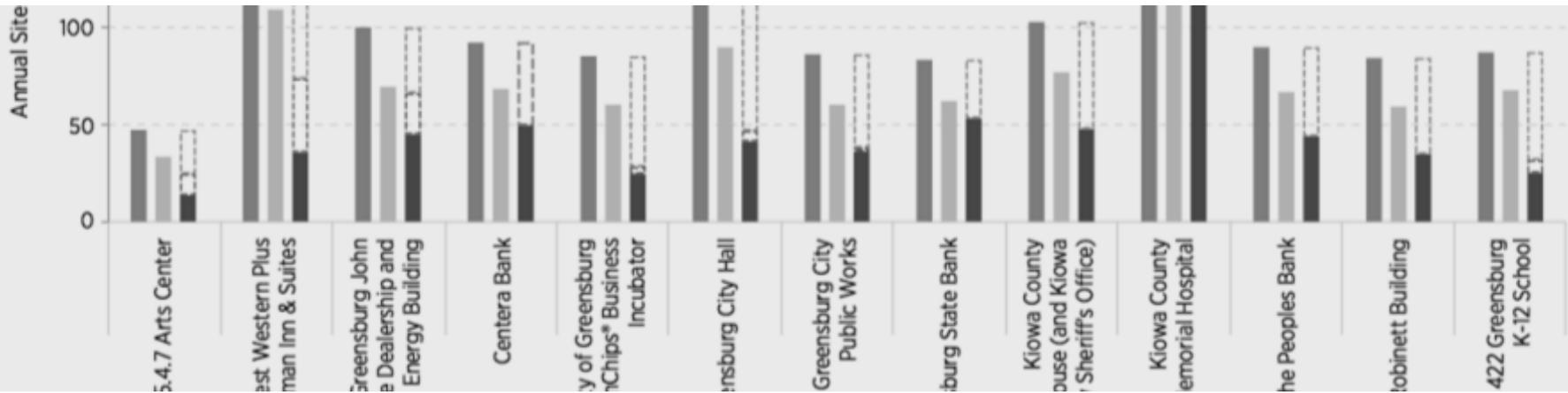


- community centers (learning/visitor)
- k-12 schools
- office buildings – low-rise
- wet labs

88
high-performance
buildings

approach

statistical analysis



normalize data

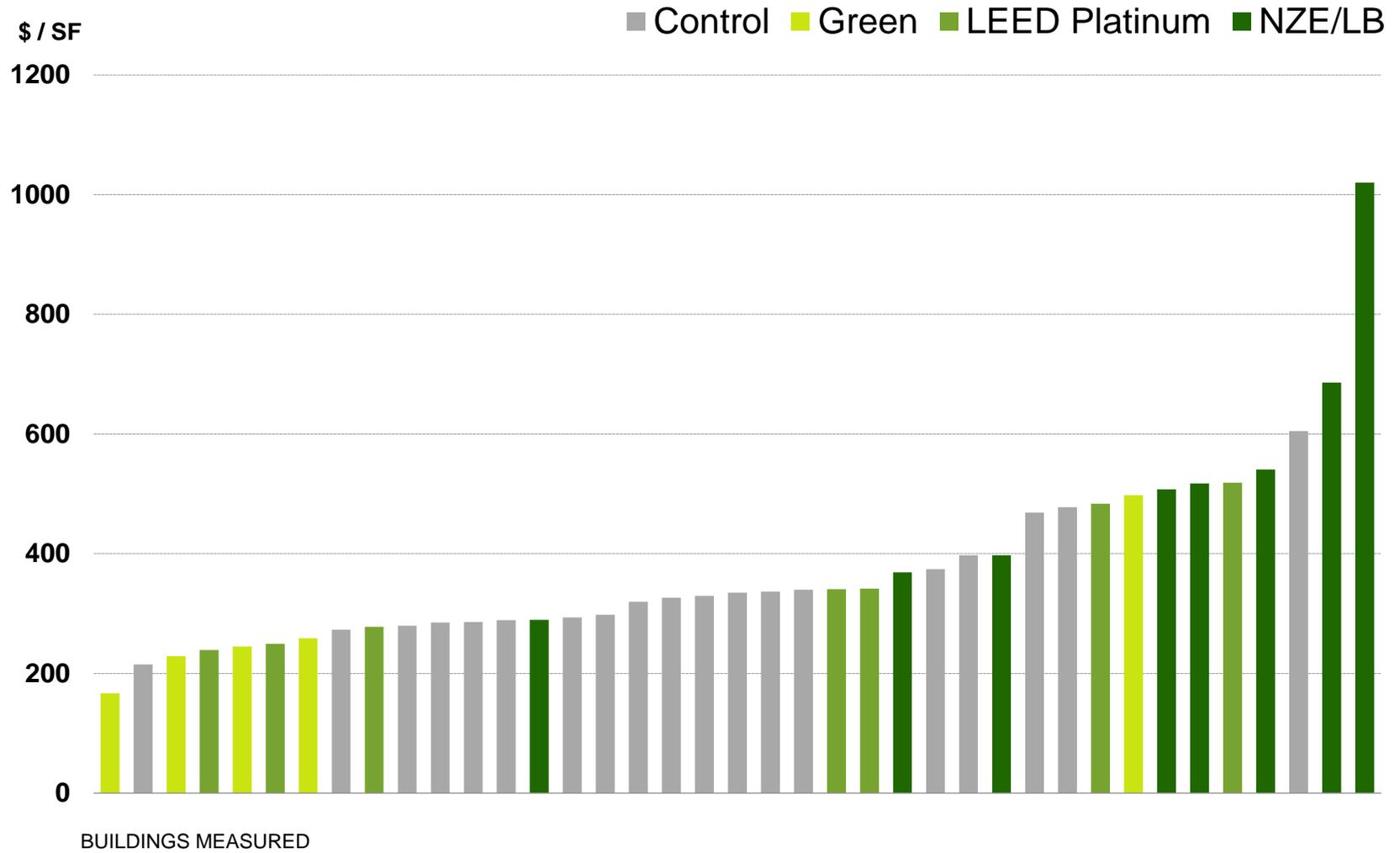
- common location
- common time

establish comparison baseline

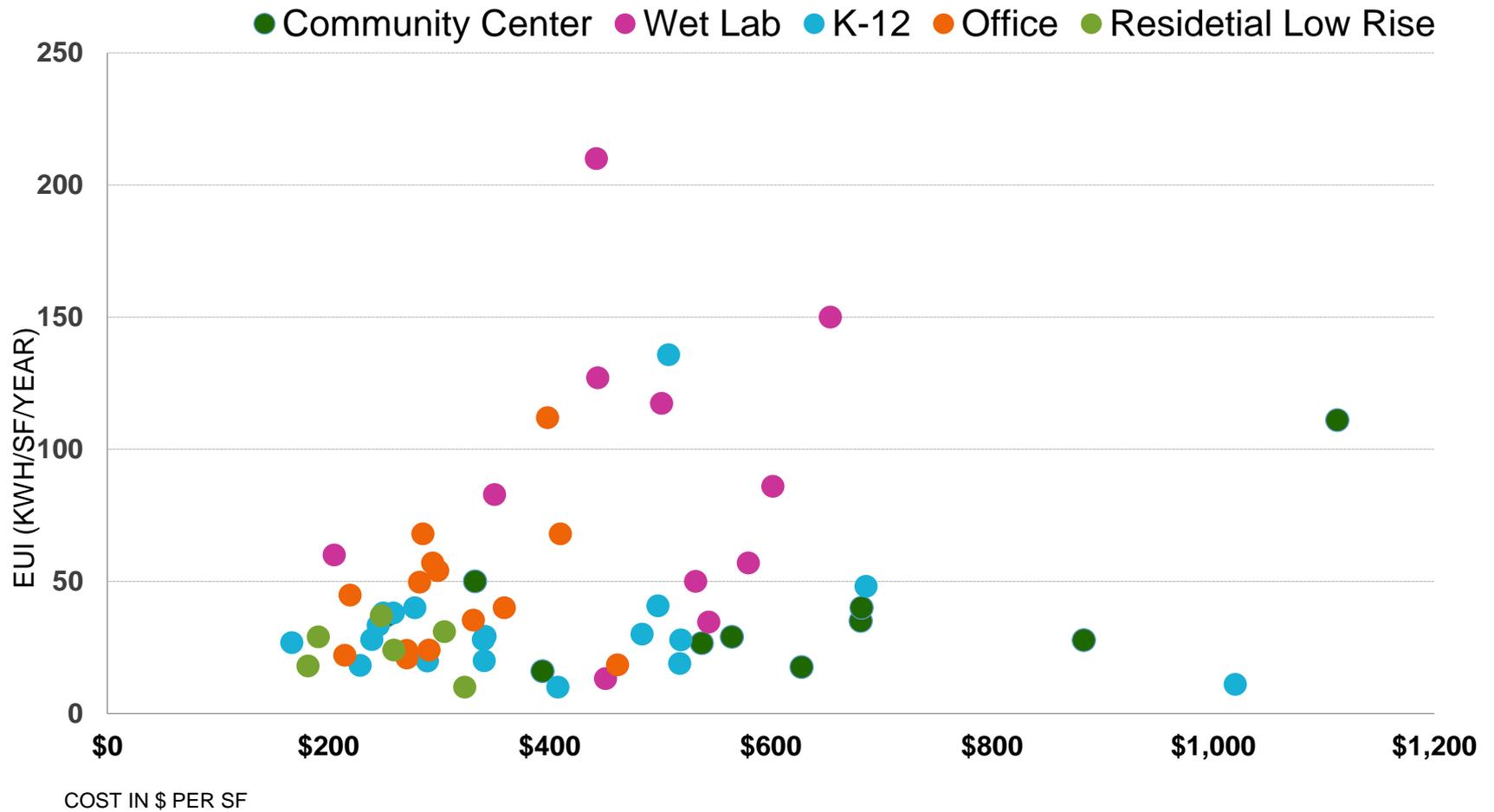
- the project's original budget
- the project itself, without the green elements
- similar projects

K-12

statistical analysis

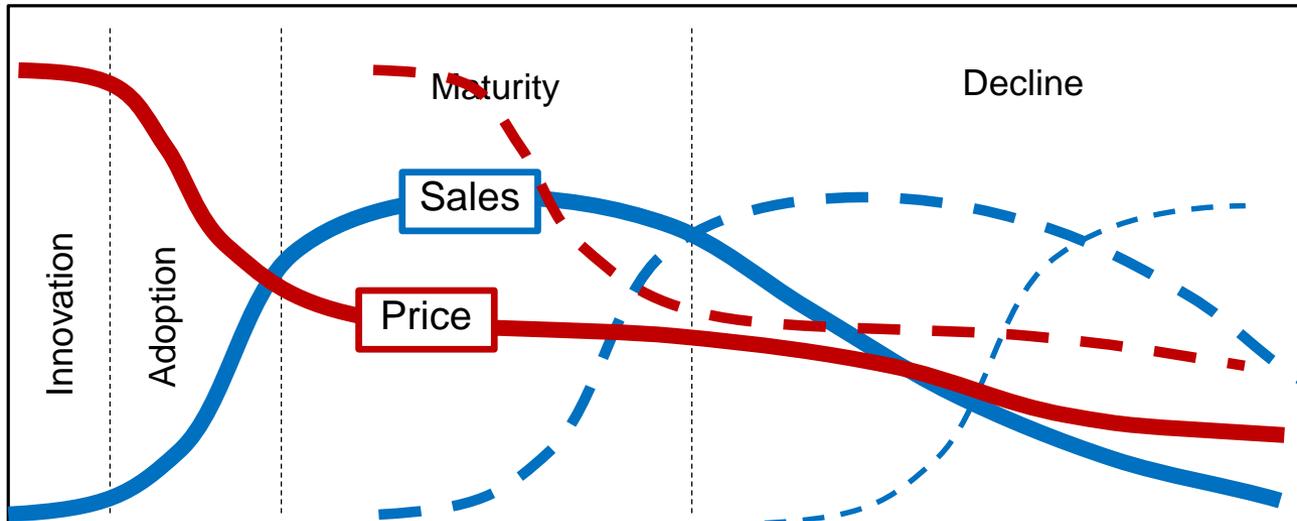


EUI to cost



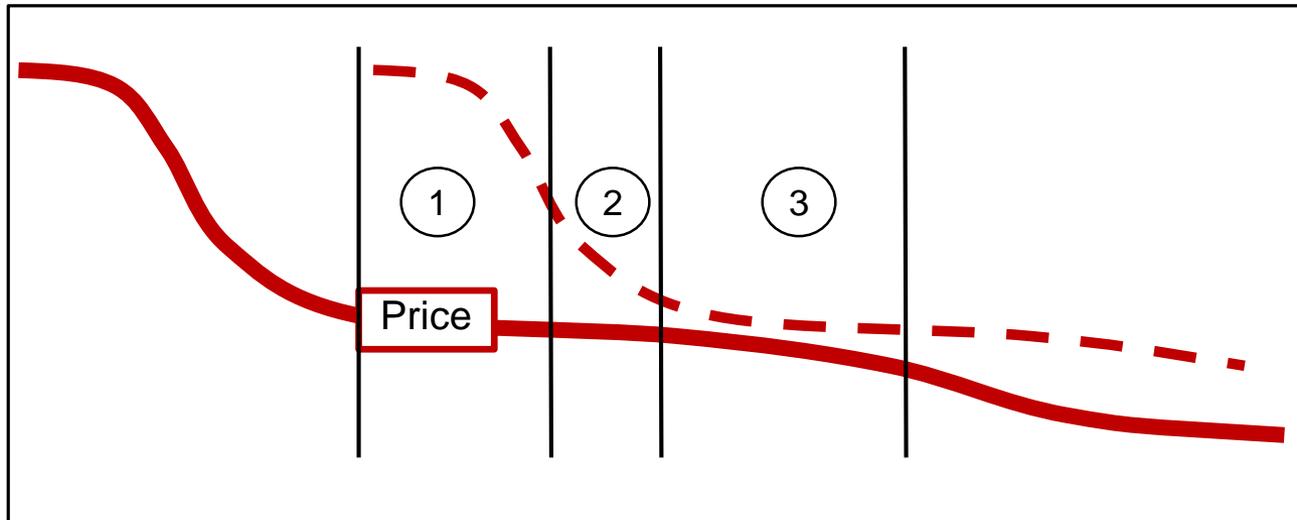
cost of learning curve

statistical analysis



cost of learning curve

statistical analysis

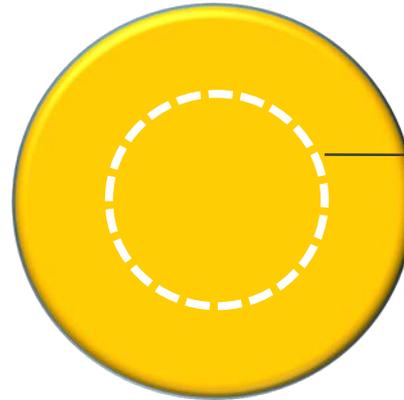
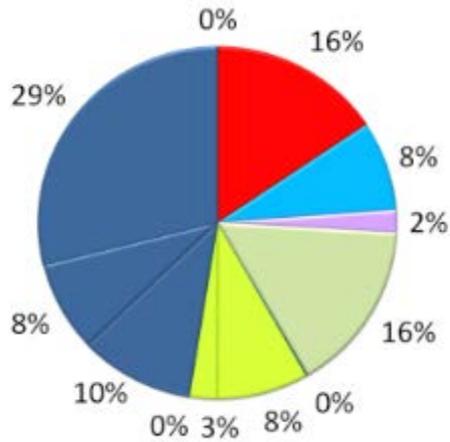




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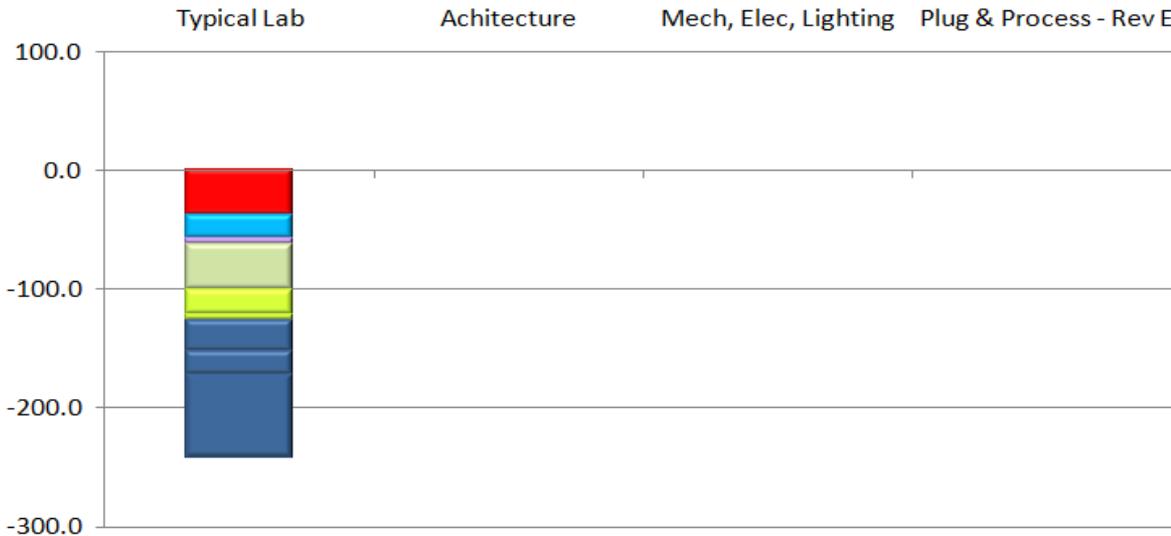
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achieving net-zero



Area Available = "Energy Budget"

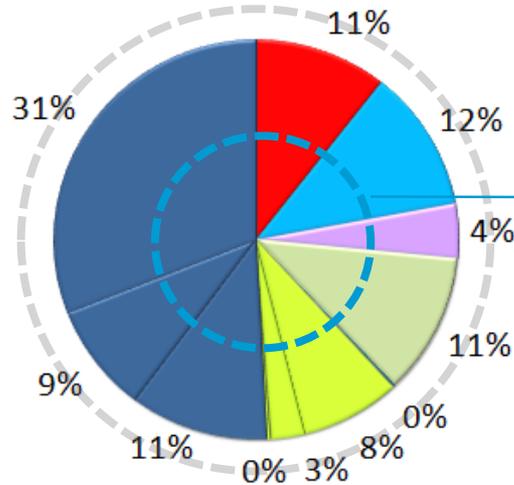
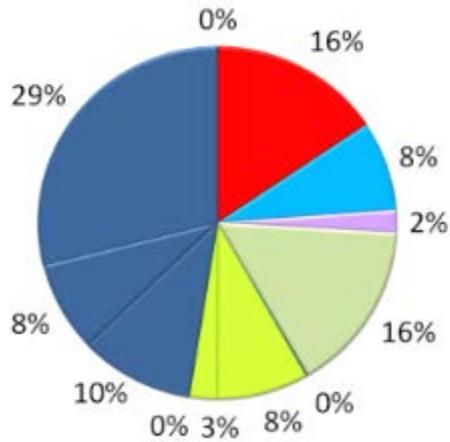
PV Output Required =
4x Roof Area Available



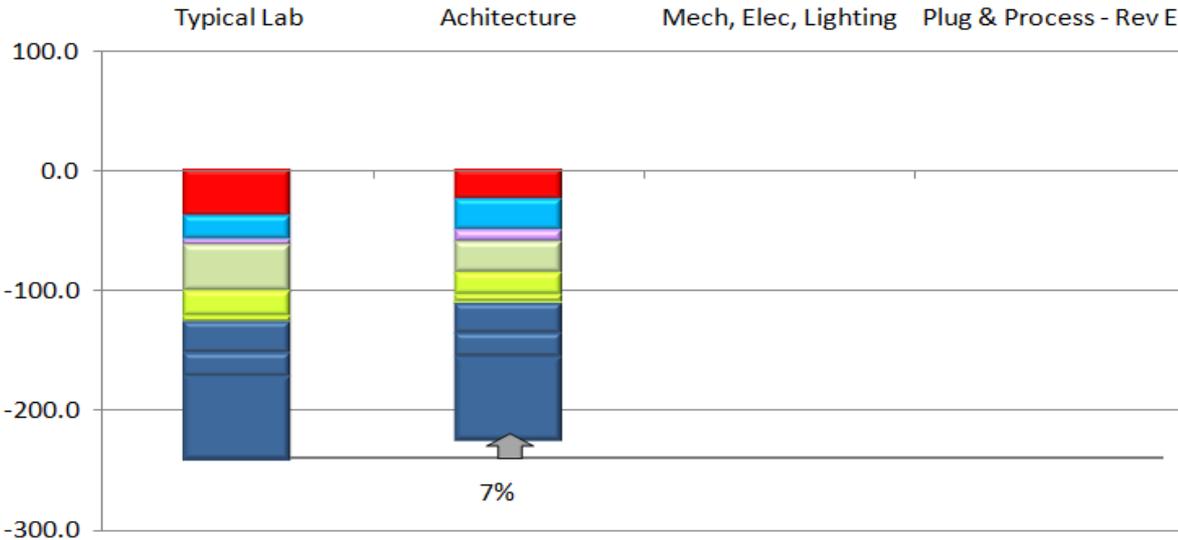
- Heating
- Cooling
- Pumps
- Fans
- DHW
- Lighting
- Exterior Lighting
- Vehicles
- Office Plug Loads
- Lab Plug Loads
- Freezers
- PV Output

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orientation, massing and envelope



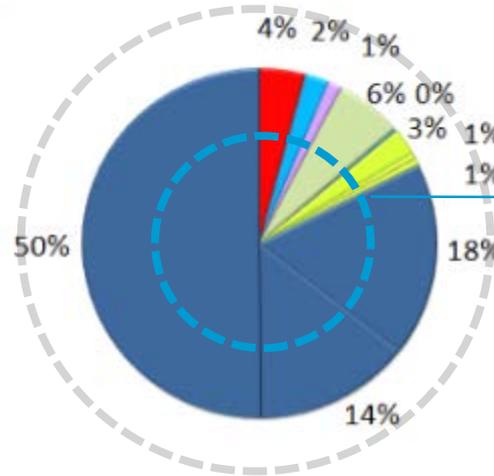
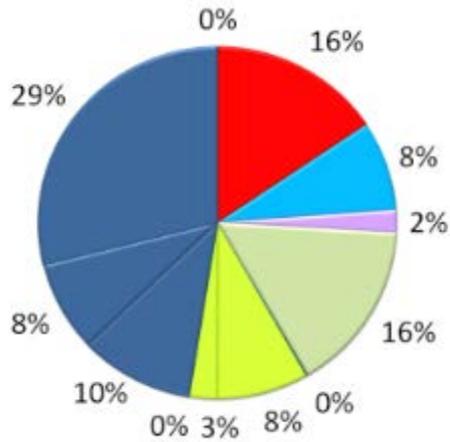
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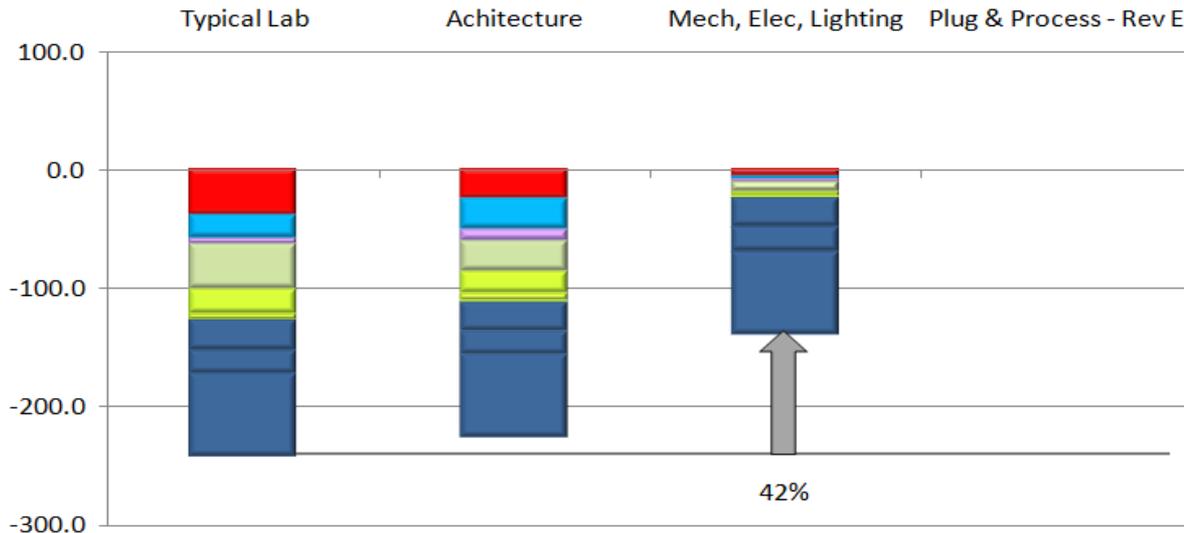
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MEP, lighting



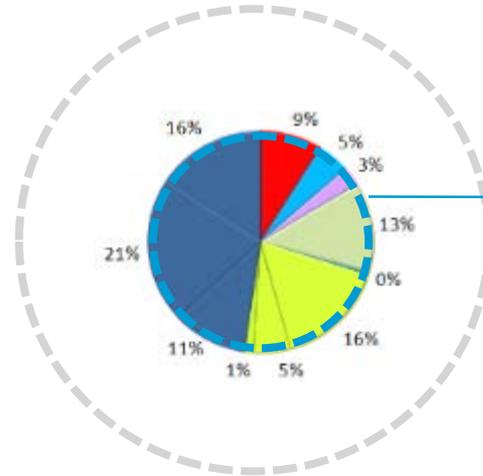
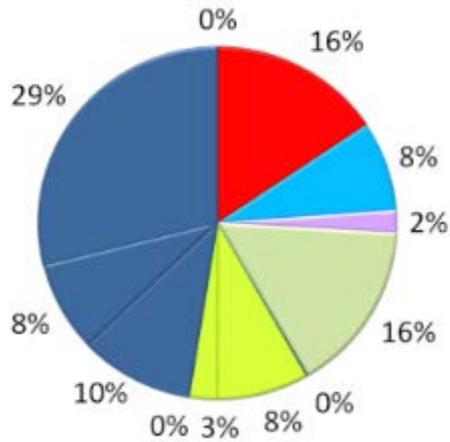
“Energy Budget”



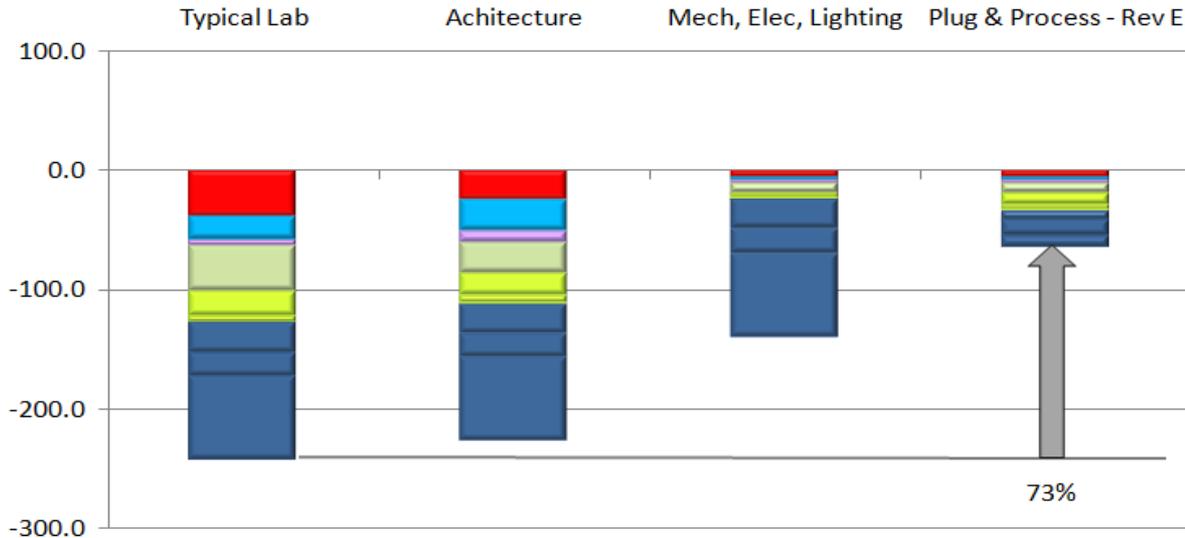
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optimize plug load/equipment



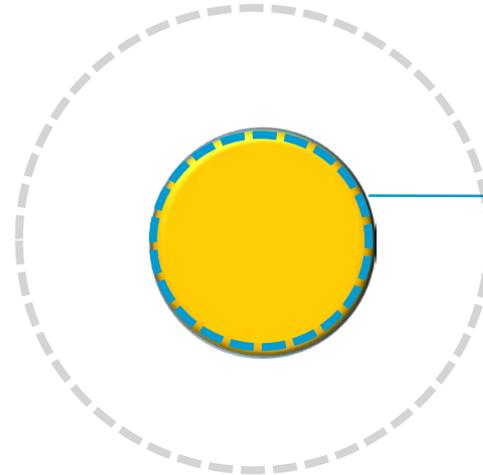
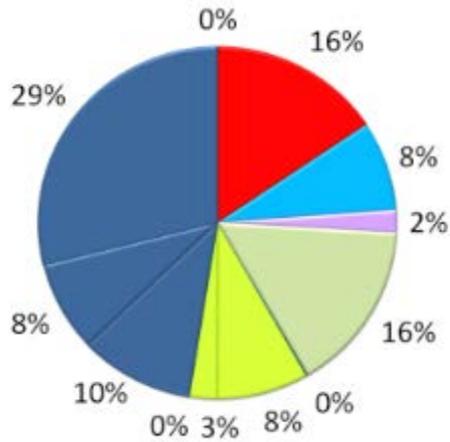
“Energy Budget”



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on-site photovoltaics

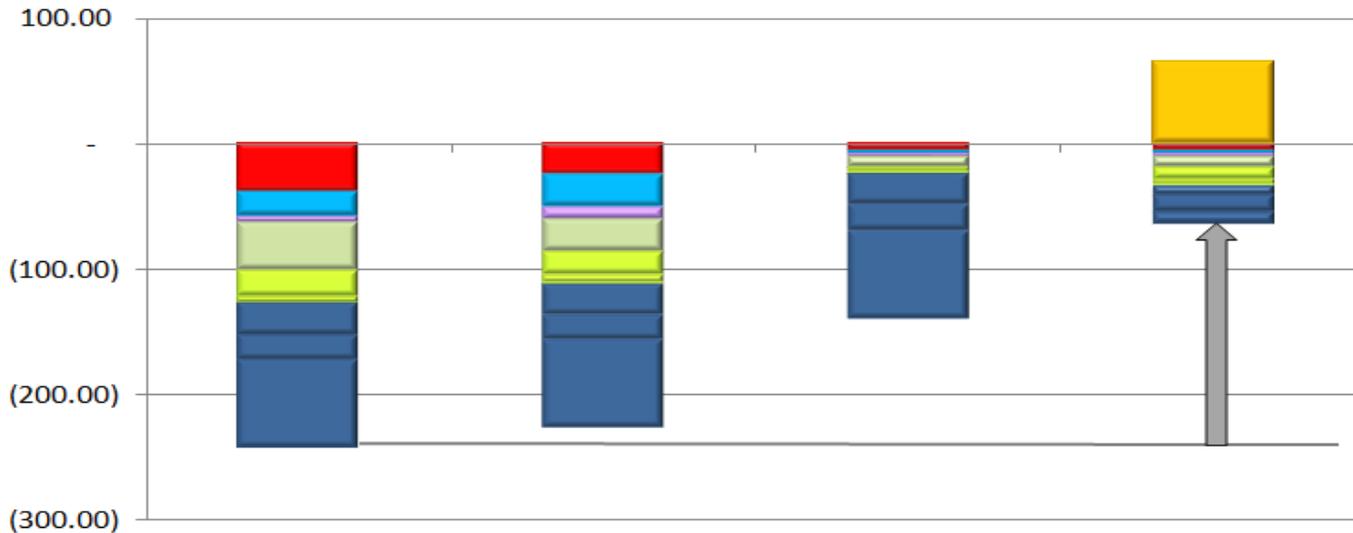


Typical Lab

Achitecture

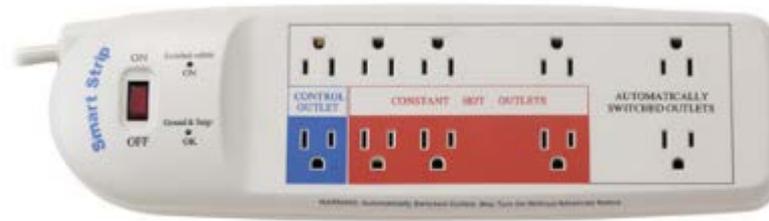
Mech, Elec, Lighting

Plug & Process - Rev E



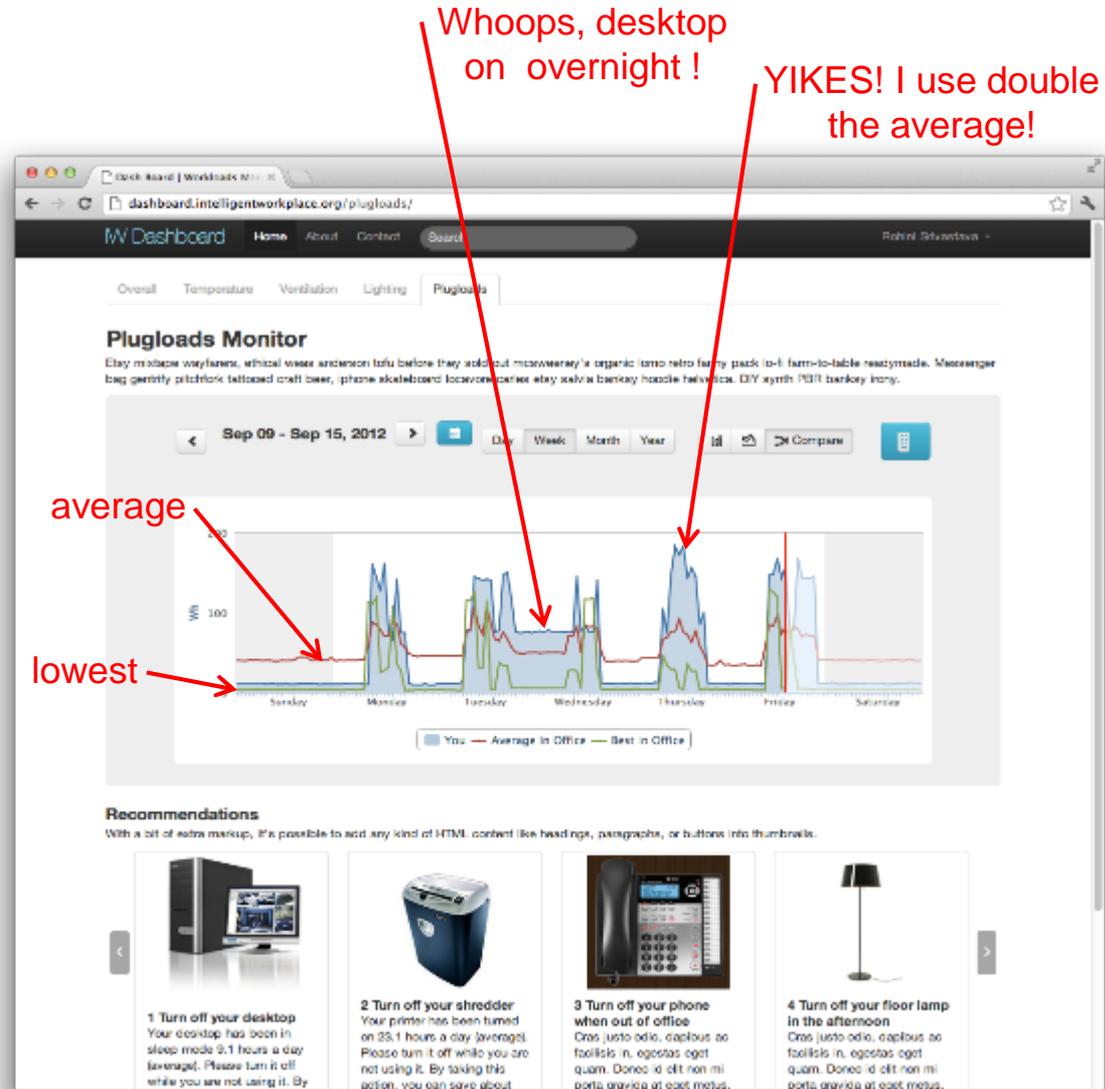
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PLUG LOAD MANAGEMENT



PLUG LOAD CONTROL :: USER INVOLVEMENT

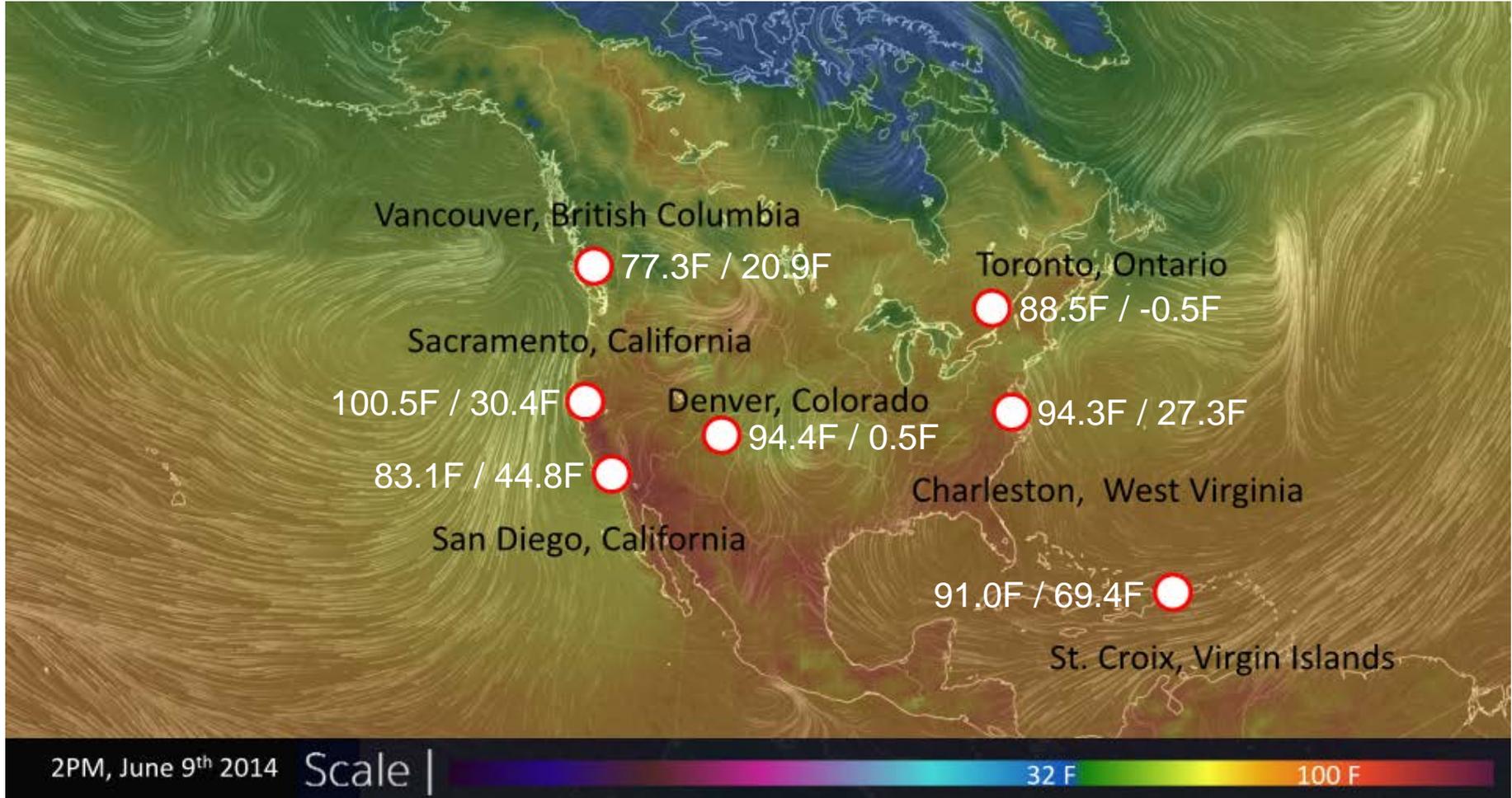
THE PASSIVE BUILDING
REQUIRES AND ACTIVE
OCCUPANT



Courtesy: Vivian Loftness
Carnegie Mellon University



Design High and Low Temperatures



Mild. Dry.

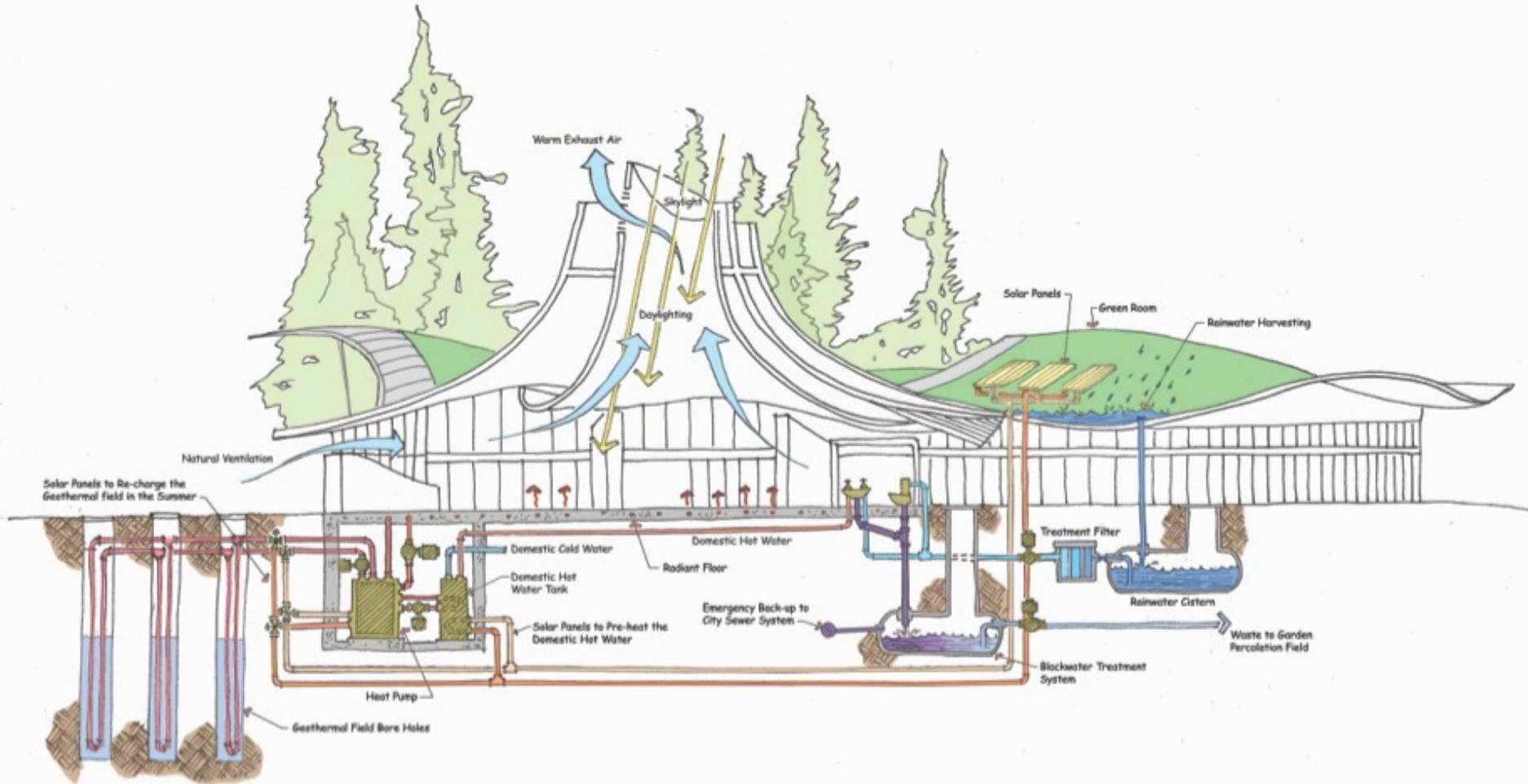
Van Dusen Visitors Center – Vancouver, BC



Passive



Natural Ventilation



Natural Ventilation



Hot. Cold. Dry.

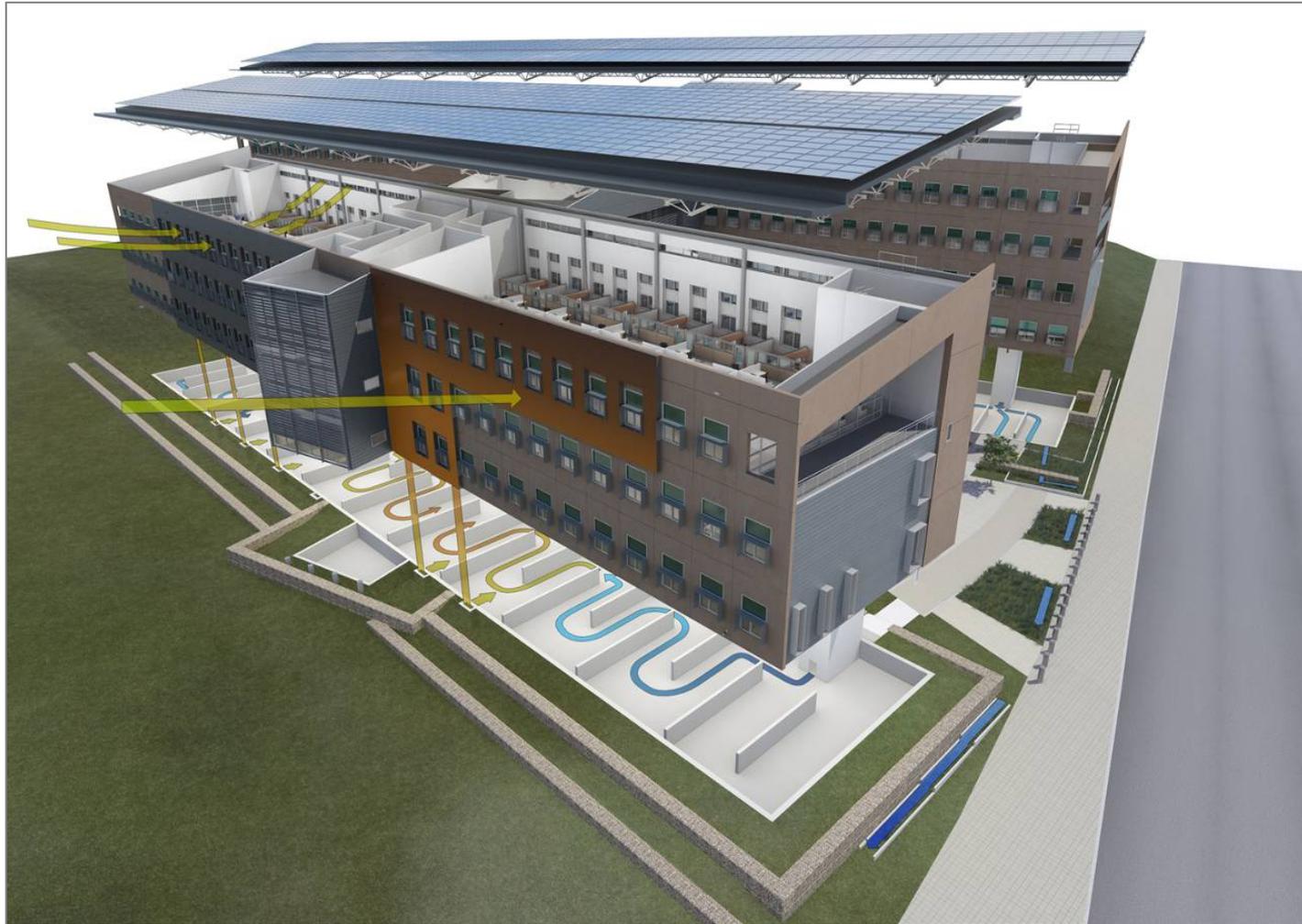
NREL Research Support Facility – Golden, CO



Daylight + Natural Ventilation



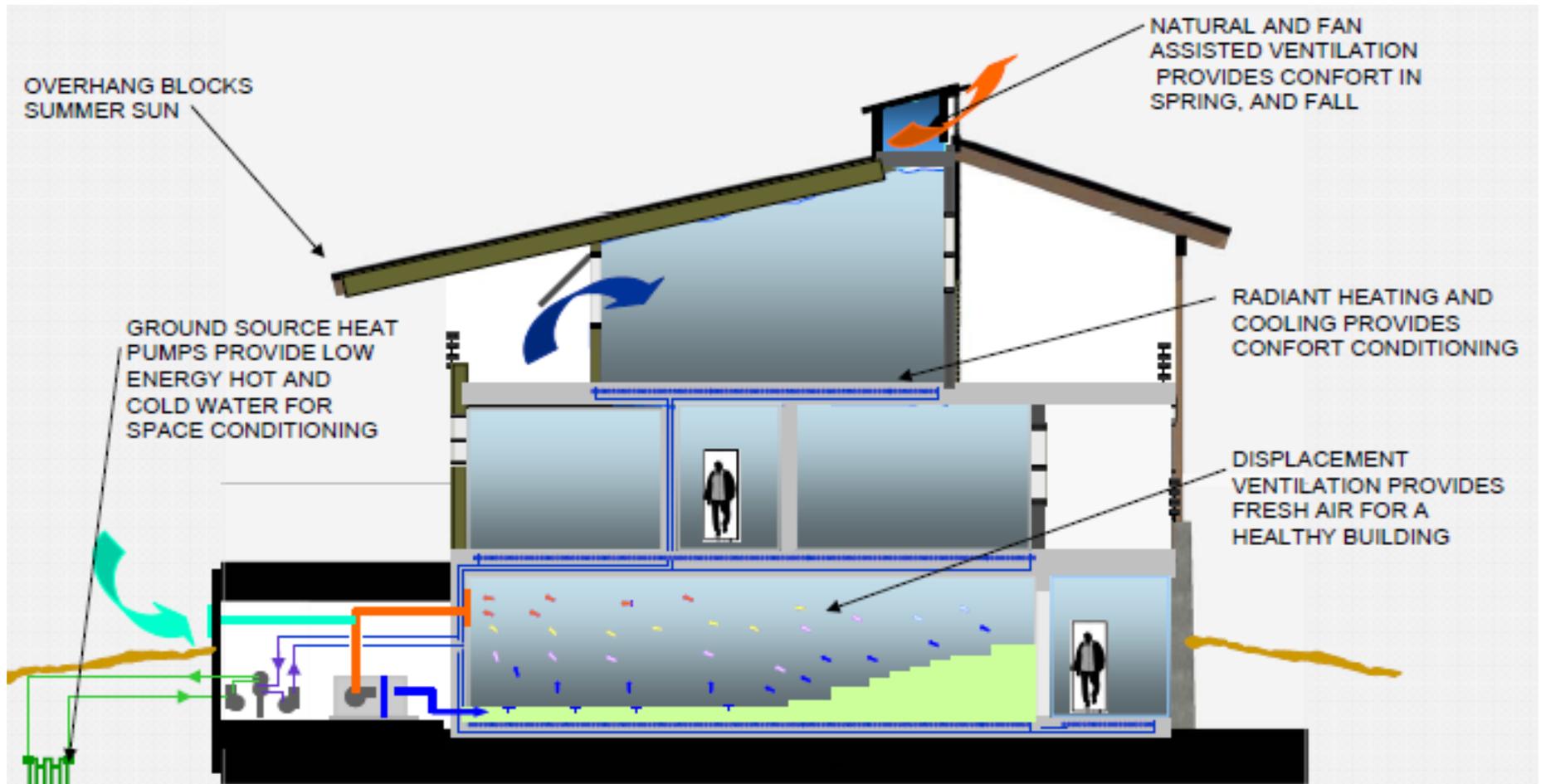
Capture + Storage Energy



Thermal Mass



The Summit, Boy Scouts of America, West Virginia



1

LOW ENERGY HEATING AND COOLING

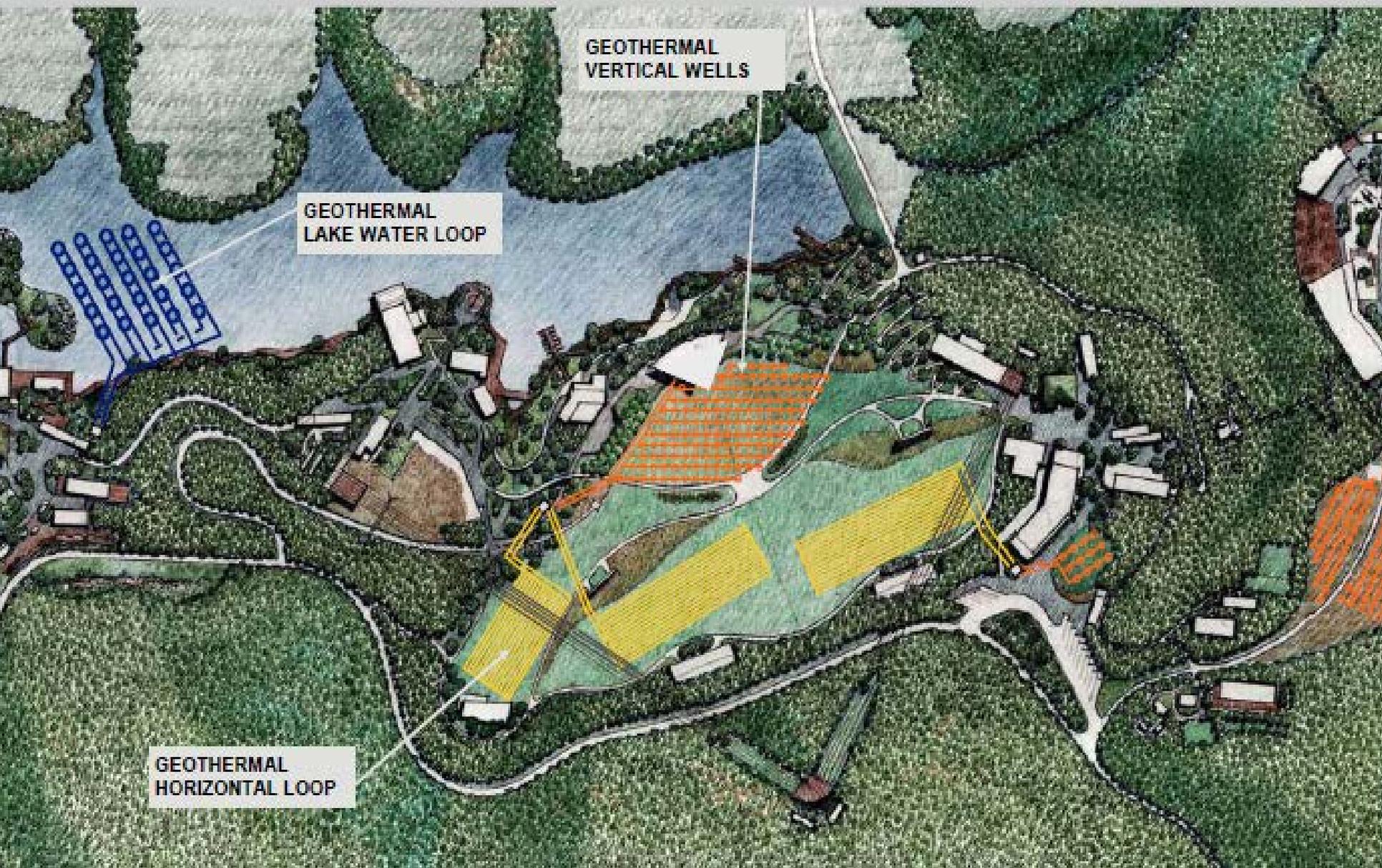
NO SCALE

the **Summit**
BECHTEL RESERVE

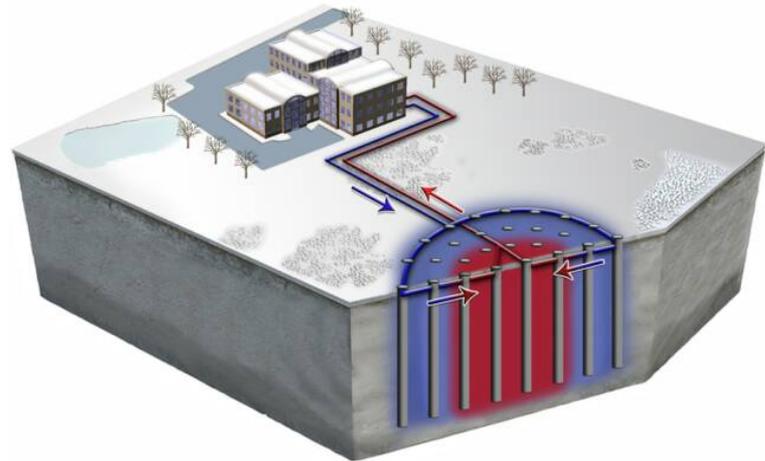
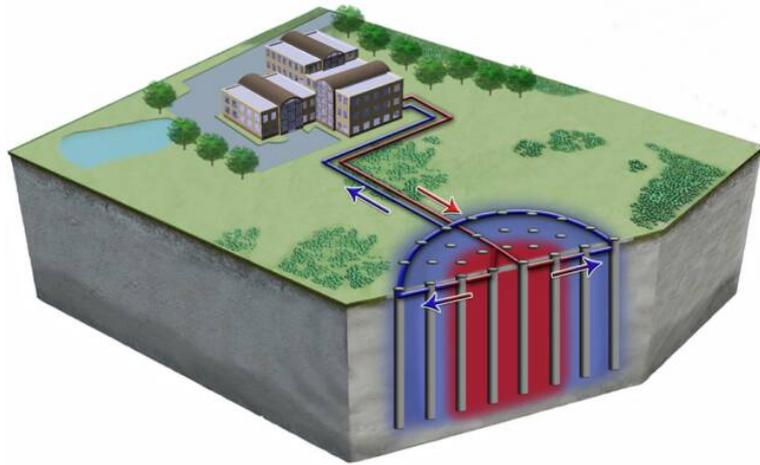


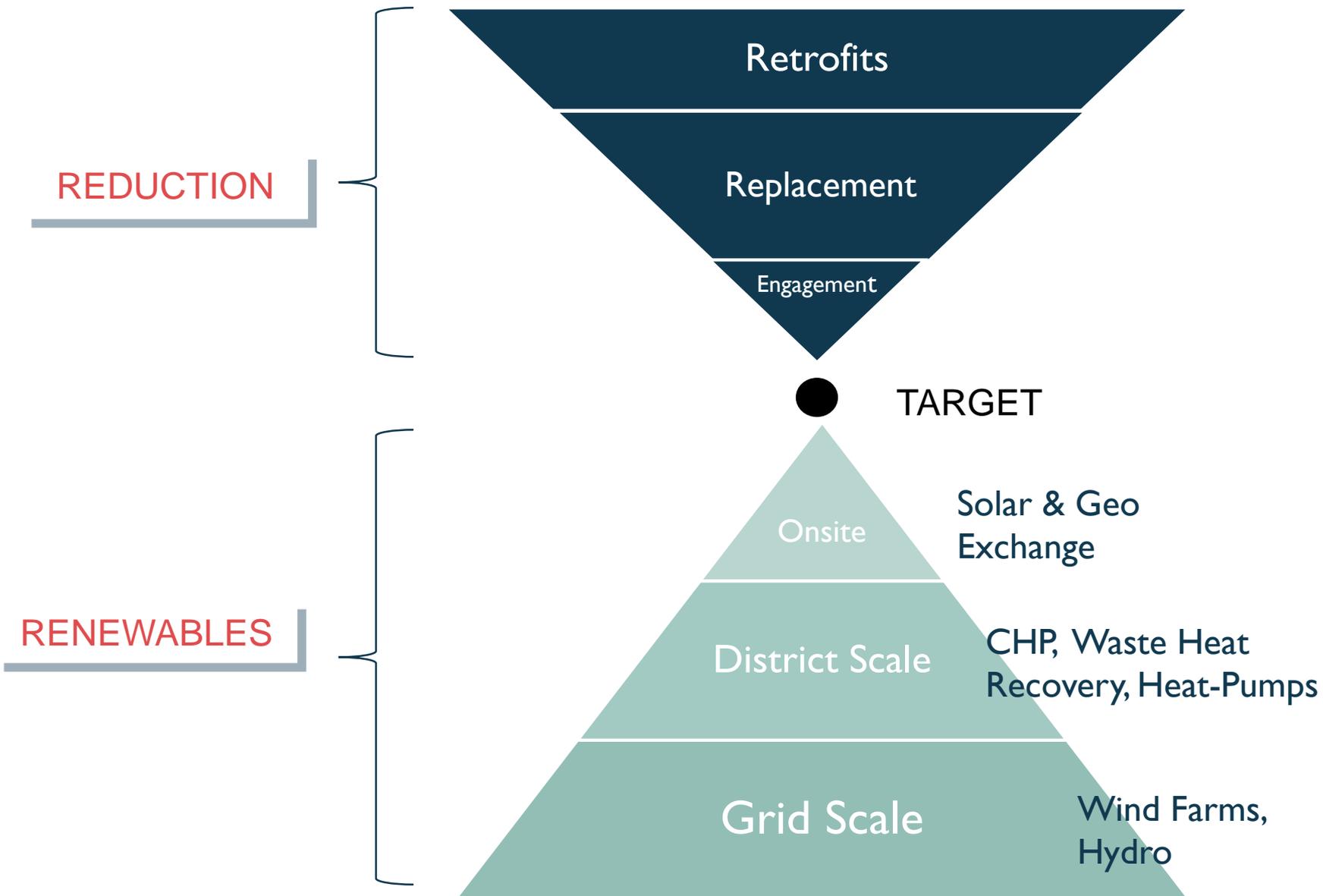


Geothermal



THINKING BEYOND THE BUILDING





Key Actions:

1. Retrofits to Existing Buildings
2. Net Zero New Construction
3. Energy Supply
4. Local Carbon Fund
5. Engagement & Capacity Building

