Valerie Miller
Mechanical Option
Advisor: Dr. Freihaut
NASA Langley Research Center – Administration Office Building One (AOB1); Langley, VA
March 30, 2015

Presentation Outline

I. Introduction (1 slide)
II. Building background (2 slides)
    a. Building statistics
    b. Site/floor plans
    c. Mechanical systems overview
III. Thesis proposal (1 slide)
    a. Depth option chosen; justification
    b. Components of my analysis
    c. Breadth options and relations
IV. Mechanical depth
    a. Glass types, properties (1 slide)
    b. Location of PV glass (1 slide)
    c. Trace 700 results (2 slides)
        i. Equipment schedule
        ii. Geothermal load
        iii. Yearly energy consumption
    d. Cost analysis (2 slides)
        i. Construction cost
        ii. Operating cost
        iii. 20 year life-cycle and payback
V. Environmental breadth: life-cycle emissions of PV glass (2 slides)
    a. Electricity generated on-site
    b. Research methods to calculate energy of manufacturing
    c. CO_2 emissions over life-cycle; payback
VI. Conclusions/recommendation (1 slide)
    a. Reiterate payback results of depth and breadth
    b. Recommendation statement
VII. Acknowledgements (1 slide)
VIII. Appendices (as needed; not part of presentation)
    a. Lighting breadth
    b. Trace 700 result charts for all glass types analyzed
    c. Breakdown of costs: glass, equipment, utility rate
    d. Energy comparison chart of real building energy usage and Trace 700 model
    e. Environmental calculation equations
    f. Floor plans
    g. Pictures

Valerie Miller, BAE

Mechanical Option

Advisor: Dr. Freihaut

NASA Langley Research Center
Administration Office Building One (AOB1)

Langley, VA

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Building background

Thesis proposal

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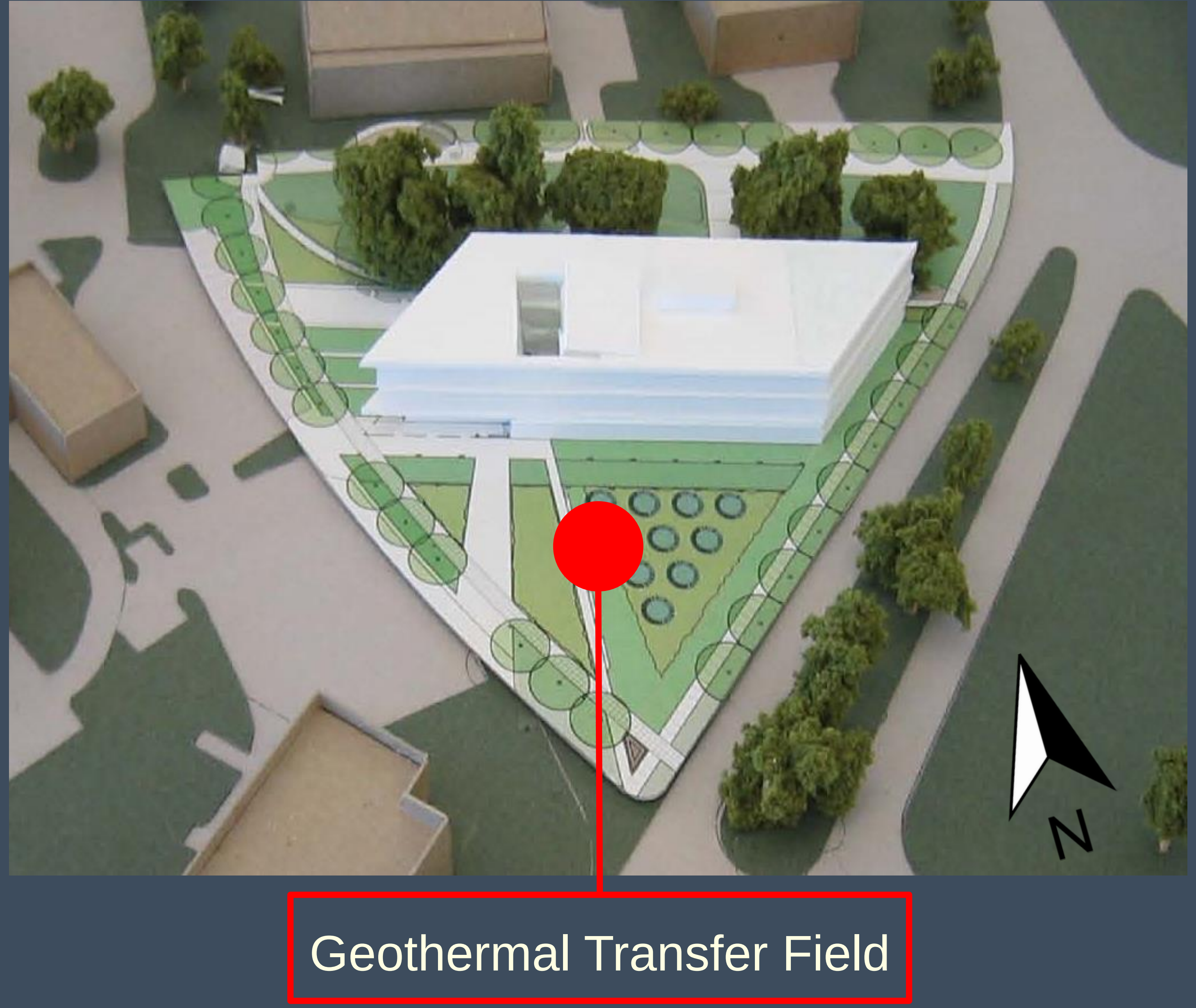
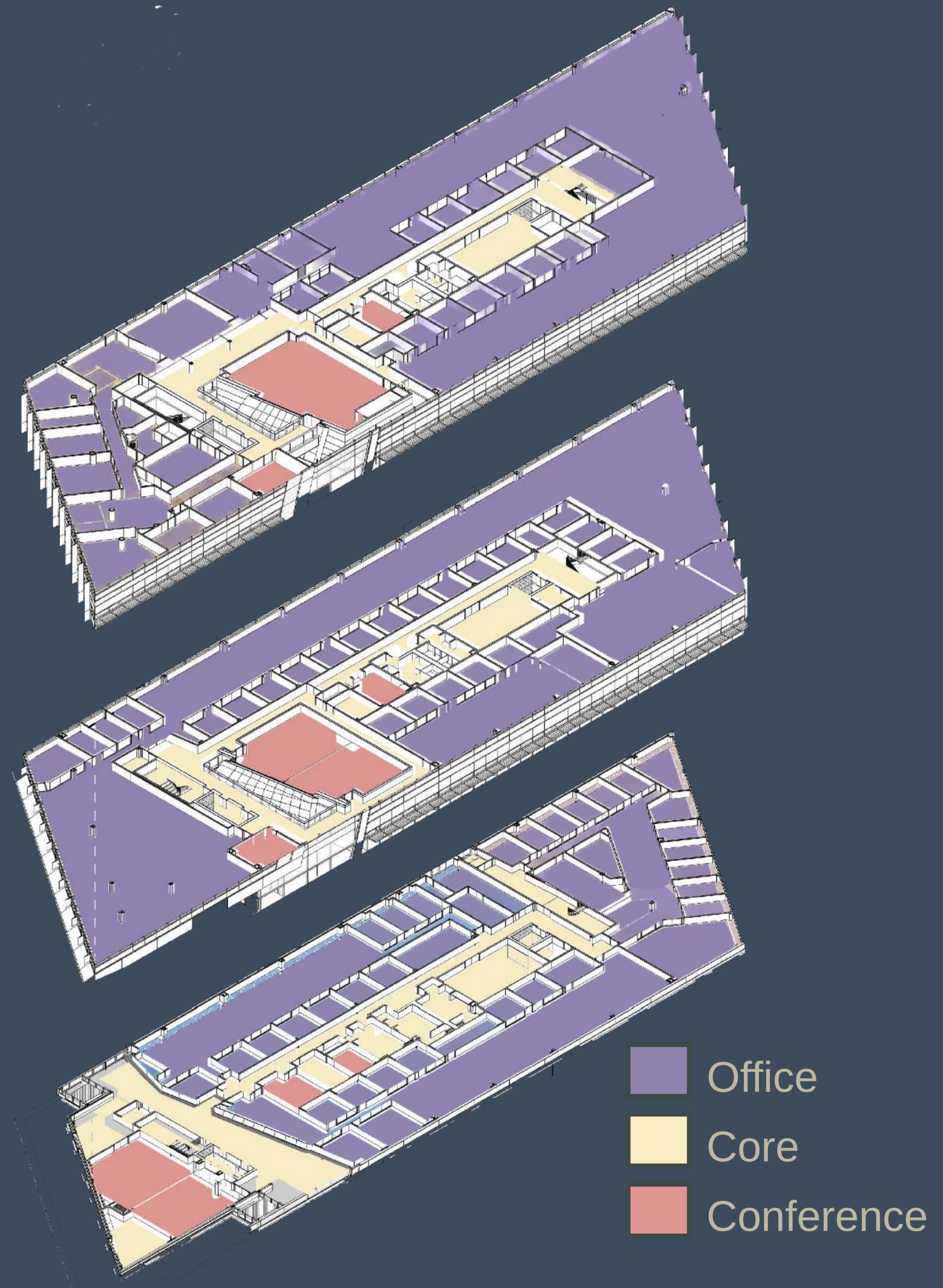
Recommendation

Acknowledgement

- Owner: NASA & U.S. General Services Administration
- Location: Langley, VA
- 79,000 ft^2
- 3 stories + penthouse
- LEED Platinum rating
- Cost: $26 million
- Ribbon cutting: June 17, 2011





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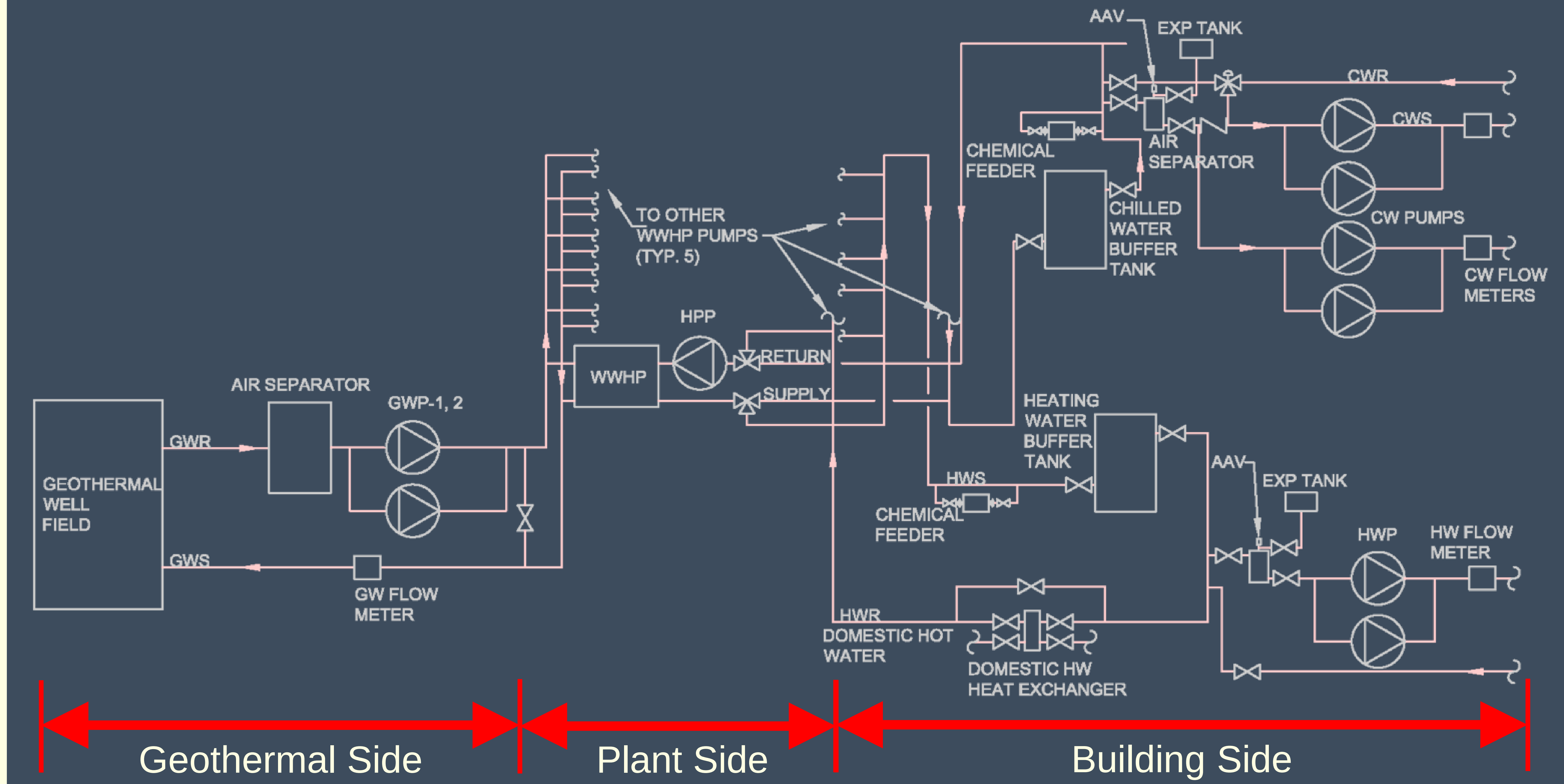


Penthouse:

AHU-5: Conference 205 and 305

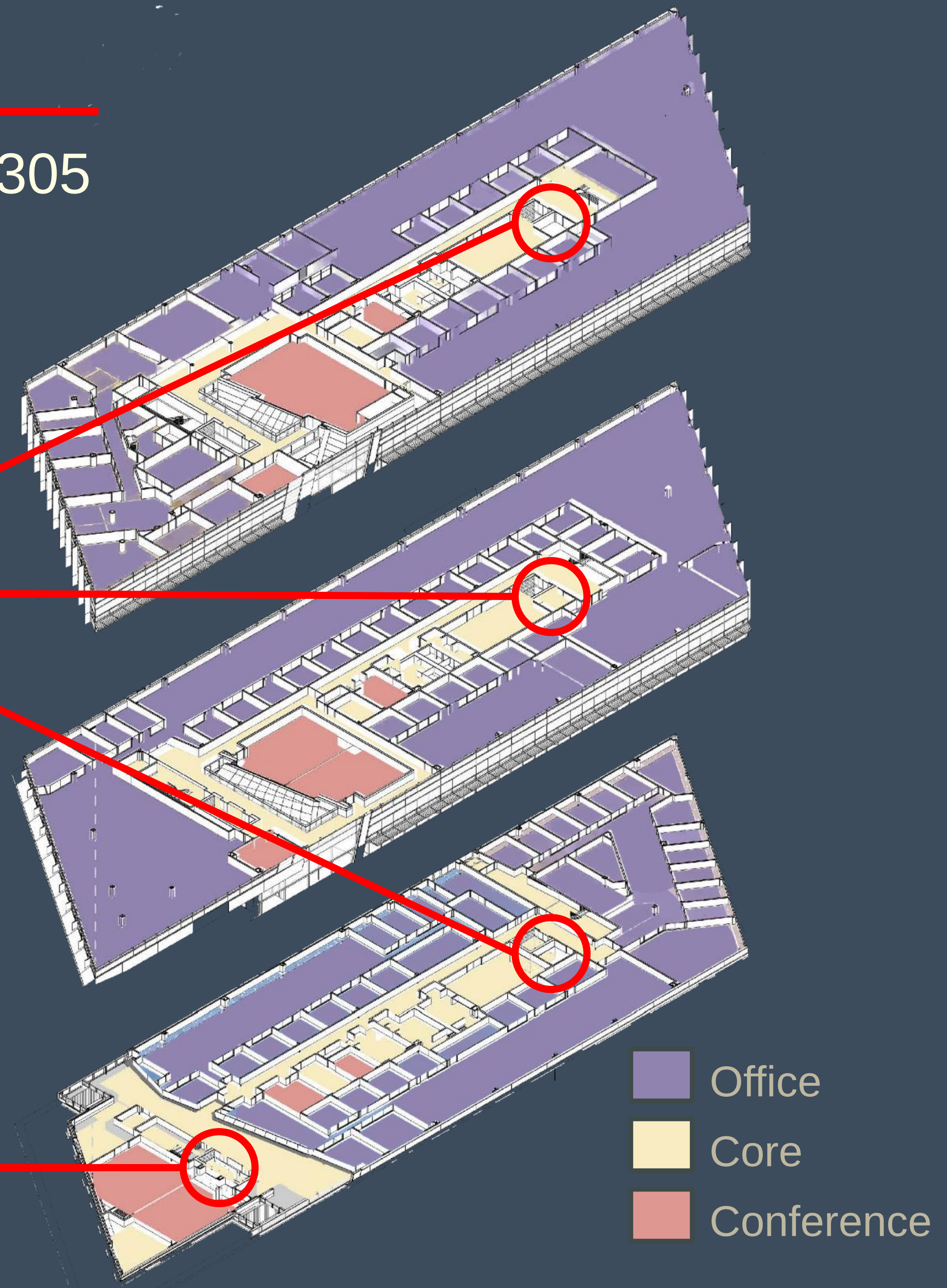
DOAS unit: AHU-1, 2, 3, 5

AHU-1, 2, 3

UFAD floors 1, 2, 3

AHU-4

Conference 105A, B



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Breadth Topic:
Life-cycle Emissions of PV Glass

Onyx Solar:

Low-E Photovoltaic

Transparent Glass

- Manufactured in Spain
- Thin film amorphous silicon (a-Si)
- Etched for desired Visible Light Transmittance (VLT)
- 3,575 ft^2 total glass area, 2,500 ft^2 PV area
- Peak power: 2.972 W/ft^2 = 7,440 W
- 1,450 kWh/year generated
- $111.65/year saved

Research Method 1

E. Alsema, 1998

Area method

- 11.15 kWh/ft^2
- 39,861 kWh

Research Method 2

Environmental Science and Technology, 2013

Power output method

- 4.5 kWh/W
- 33,480 kWh

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Breadth Topic:

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Site CO_2 emission factor:	1.64 lb/kWh	
Spain CO_2 emission factor:	0.756 lb/kWh	
	Research method 1	Research method 2
kWh/year generated on-site by glass:	1,451	
Pounds of CO_2/year saved from on-site generation:	2,380	
Total power (kWh) required for manufacturing:	39,861	33,480
Pounds CO_2 emitted in manufacturing:	30,131	25,308
CO_2 payback (years):	12.7	10.6