

WESTINGHOUSE ELECTRIC NUCLEAR ENGINEERING HEADQUARTERS

DANIEL AUGHENBAUGH — MECHANICAL OPTION



Daniel Aughenbaugh
Mechanical Option

Westinghouse Nuclear Engineering Headquarters

PRESENTATION OUTLINE



INTRODUCTION

EXISTING MECHANICAL SYSTEM

MY DESIGN ANALYSES

DEDICATED OUTDOOR AIR SYSTEM

GROUND SOURCE HEAT PUMP PLANT

CENTRAL PLANT

PLANT INITIAL COST

PLANT LIFECYCLE COST

ARCHITECTURAL STUDY- FAÇADE REDESIGN

CONCLUSIONS

Daniel Aughenbaugh
Mechanical Option

Westinghouse Nuclear Engineering Headquarters

FACILITY INFORMATION



LOCATION:

PITTSBURGH AREA

PROJECT COST:

\$240 MILLION

COMPLEX SIZE:

3 BUILDINGS (4-5 LOORS)

844,600 SF

OCCUPANCY TYPE:

OPEN OFFICE

DELIVERY METHOD:

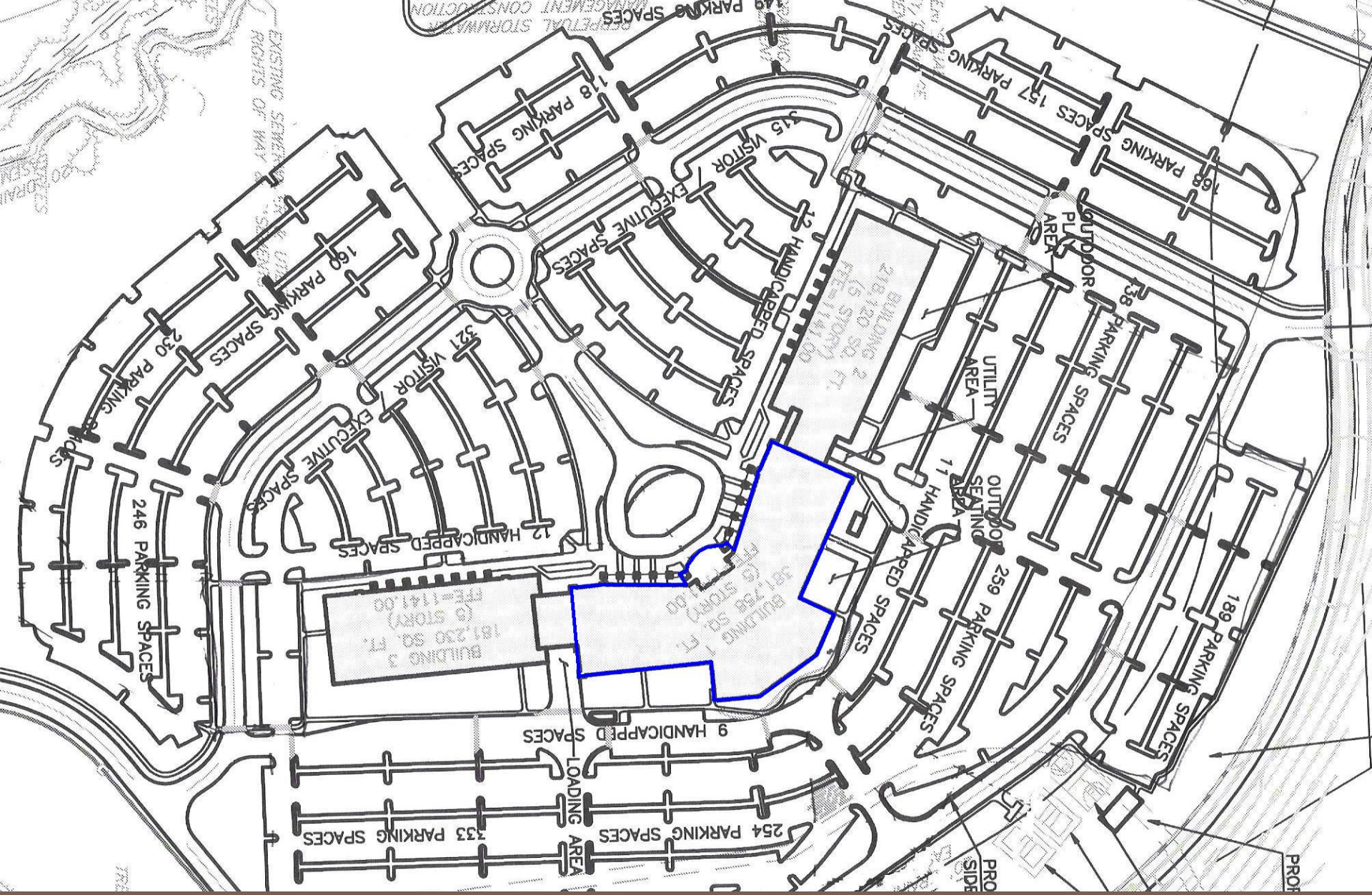
DESIGN-BID-BUILD
JOINT VENTURE

CONSTRUCTION PERIOD:

2/2008 - 5/2010

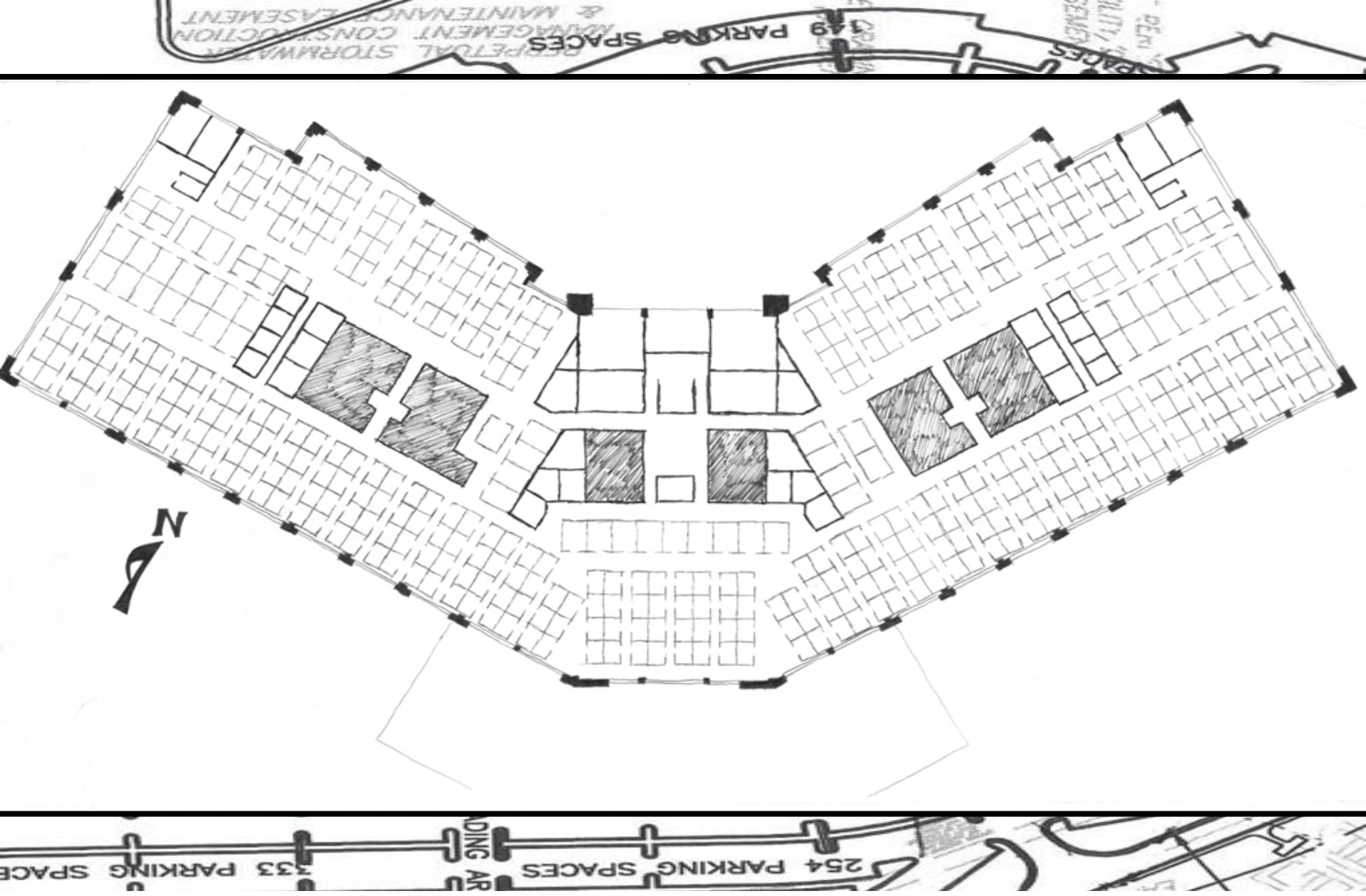
Introduction

Westinghouse Nuclear Engineering Headquarters



Introduction

Westinghouse Nuclear Engineering Headquarters



Introduction

Westinghouse Nuclear Engineering Headquarters

Facility Mechanical Information

Program is largely open office space with a Cafeteria, Data Center, and Fitness Center

Façade is approximately 40% glazing for all orientations

VAV system conditions the Office Spaces

CRAC Units condition the Data Center

Four Air Handling Units supply 293,600 CFM and 40% OA

Three 450 Ton Chillers and Cooling Towers

Electric Resistance Re-heat

Current Design

Westinghouse Nuclear Engineering Headquarters

Redesign Analyses



Redesign Analyses

Westinghouse Nuclear Engineering Headquarters

Redesign Analyses

1. Reduce Plant Loads with a Dedicated Outdoor Air System
2. Investigate a Hybrid Ground Source Heat Pump Plant
3. Investigate a Central Plant

Redesign Analyses



Energy Use

Initial Cost

Lifecycle Cost

Indoor Air Quality

Environmental Impact

Construction Impact

Operation and Maintenance

Dedicated Outdoor Air System

A photograph of a modern office interior. On the left, a large window provides a view of a cityscape and a tall, green tree. In the center, a wooden desk is set up with a chair. Behind the desk is a large wooden bookshelf filled with books and decorative items. The ceiling features recessed lighting.

DOAS

Westinghouse Nuclear Engineering Headquarters

Dedicated Outdoor Air System

1. Less Ventilation Air
2. Indoor Air Quality
3. Sensible and Latent Loads are decoupled

DOAS

Westinghouse Nuclear Engineering Headquarters

Plant Load Reduction

The background image shows a modern office interior. On the left, there is a large window with a view of a city and a balcony with a railing and a small tree. In the center and right, there is a wooden desk with a chair, a bookshelf filled with books, and a computer monitor. The ceiling has recessed lighting fixtures.

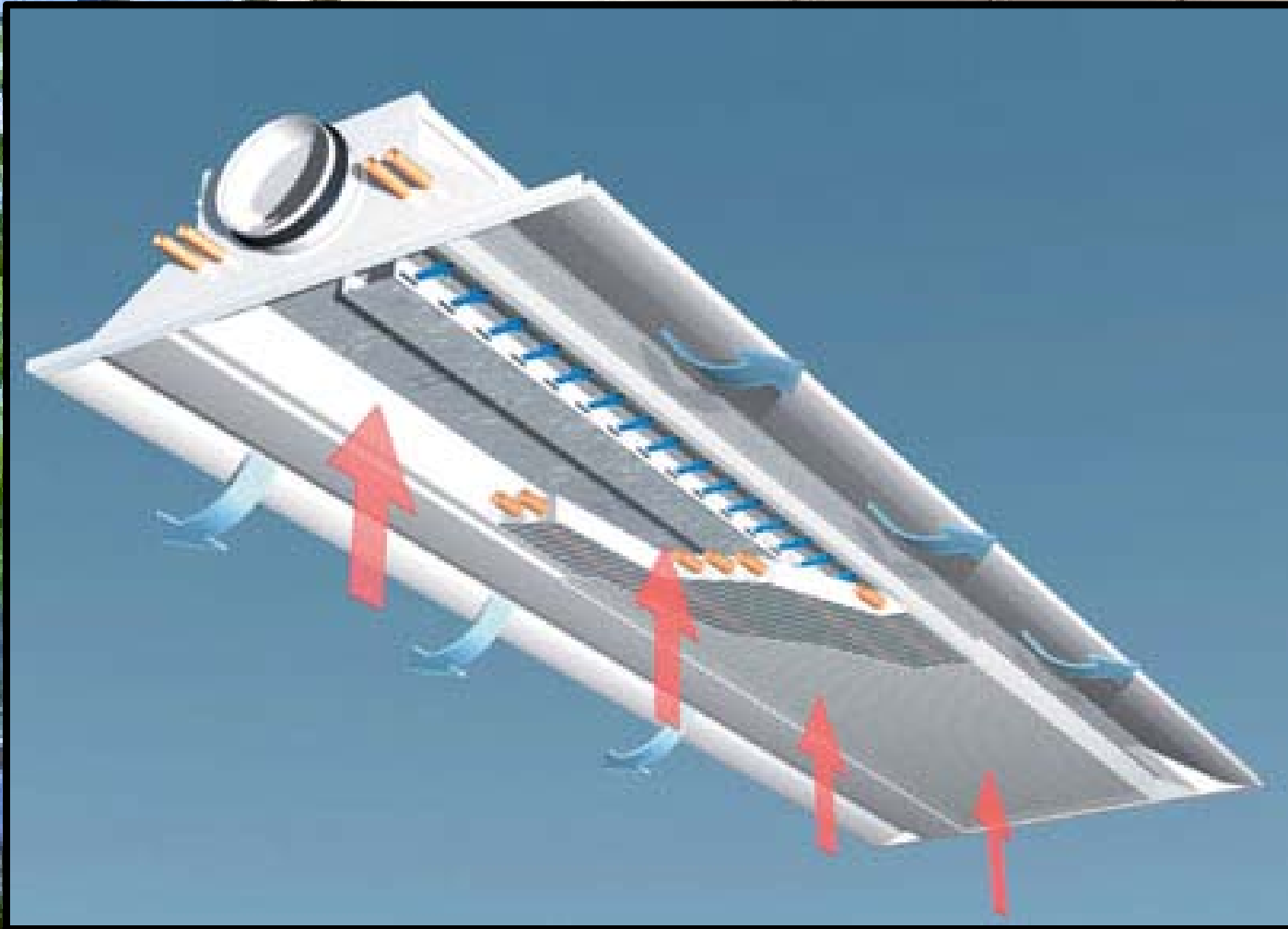
Proposed:

1. Active Chilled Beams (ACB)
2. DOAS Fan Powered Terminal Units (FPT)
3. ACBs to condition Core Office Areas, DOAS FPTs to condition Perimeter Office Areas

DOAS

Westinghouse Nuclear Engineering Headquarters

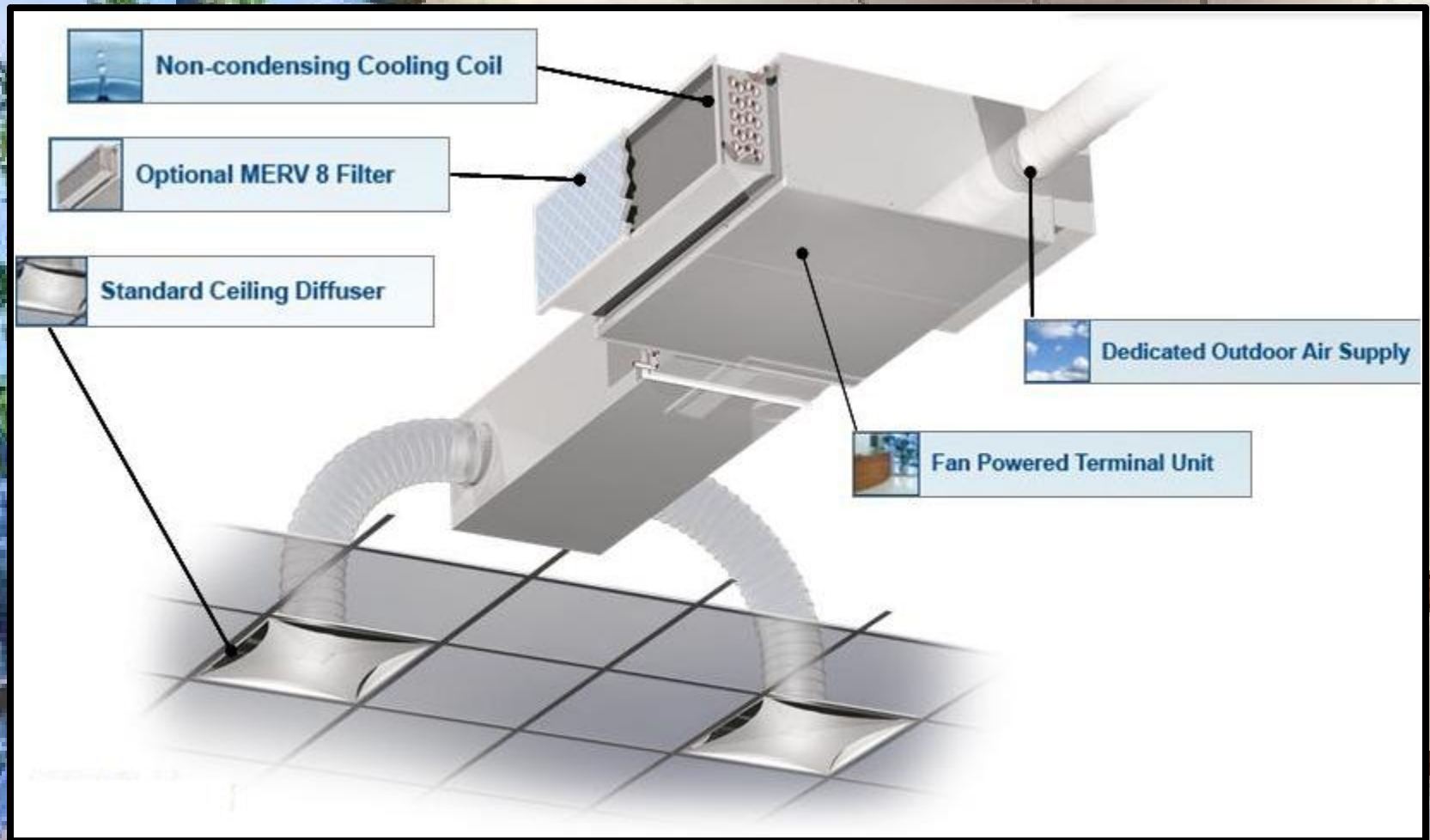
Active Chilled Beams



DOAS

Westinghouse Nuclear Engineering Headquarters

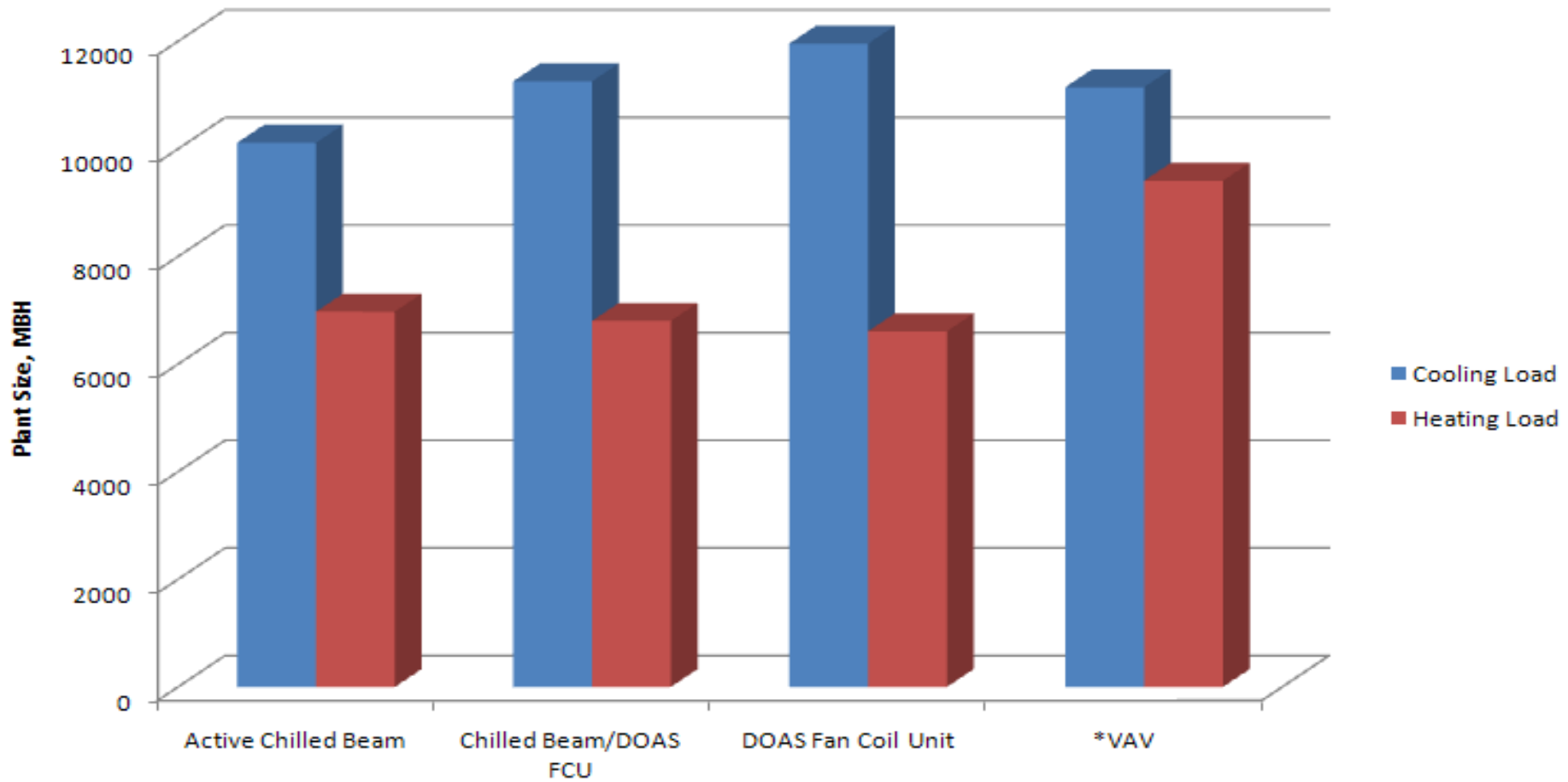
DOAS Fan Powered Terminal Units



DOAS

Westinghouse Nuclear Engineering Headquarters

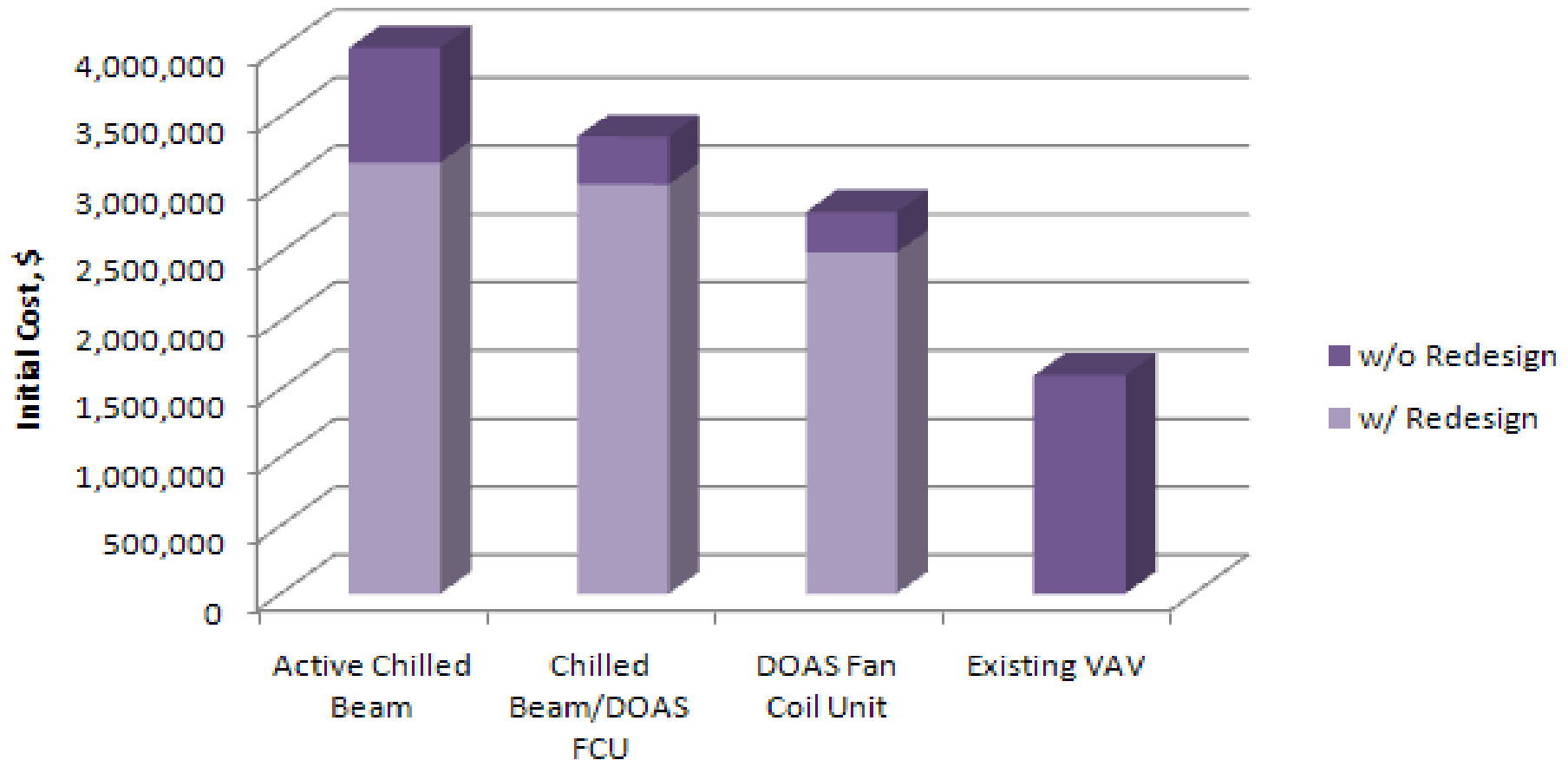
Plant Loading



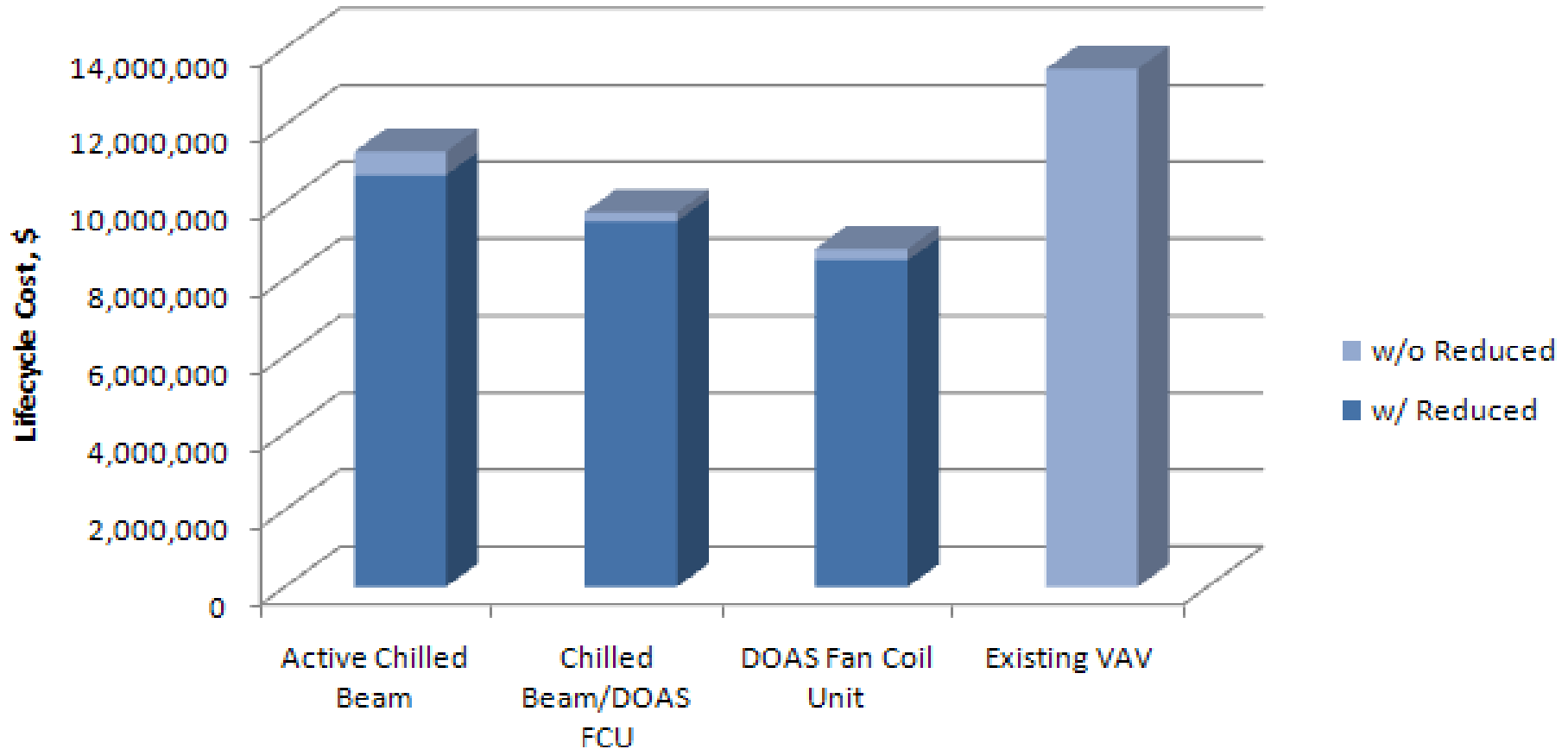
DOAS

Westinghouse Nuclear Engineering Headquarters

System Initial Cost



System Life Cycle Cost



DOAS

Westinghouse Nuclear Engineering Headquarters

Hybrid Ground Source Heat Pump Plant



Hybrid GSHP

Westinghouse Nuclear Engineering Headquarters

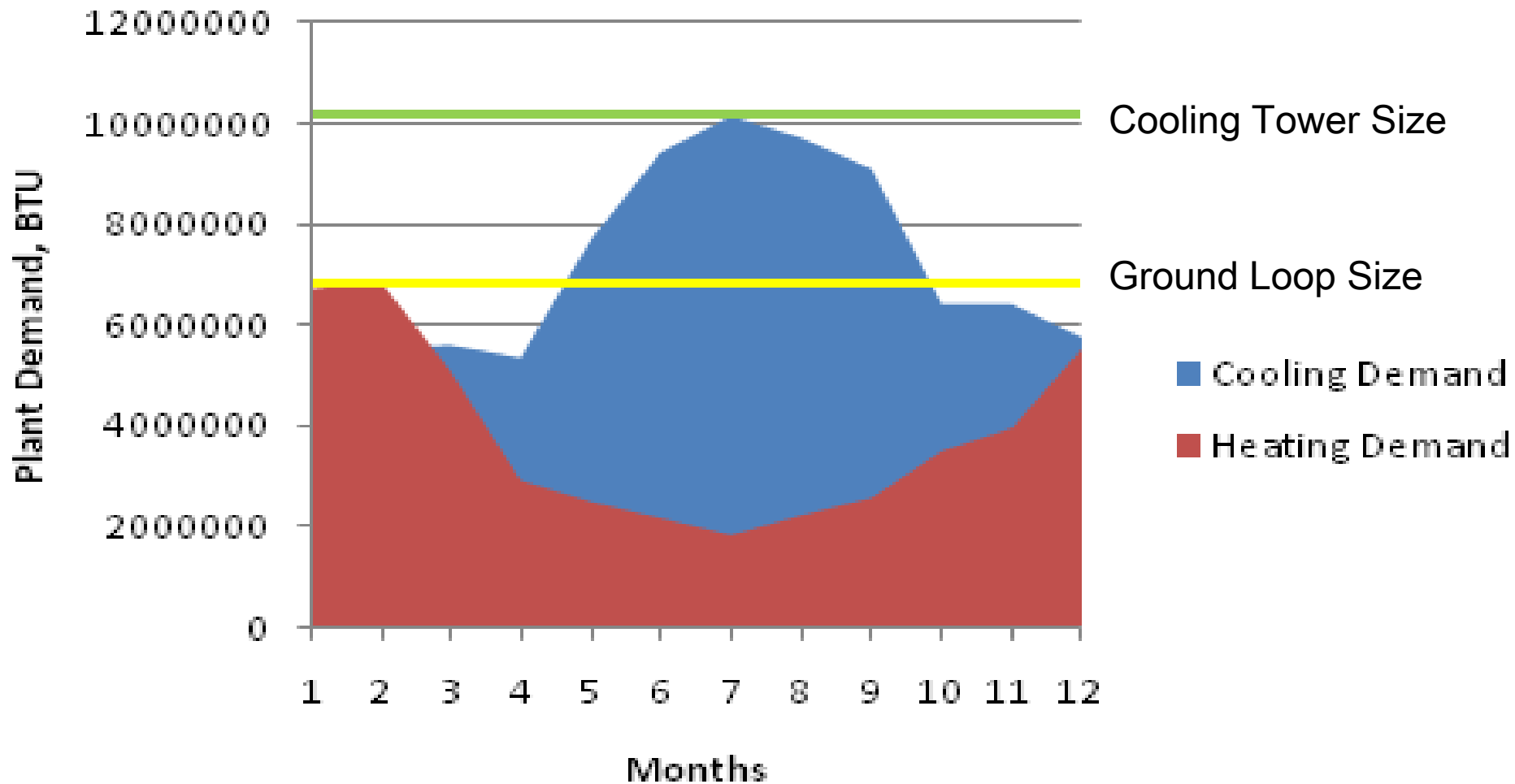
Hybrid GSHP Plant Schematic



Hybrid GSHP

Westinghouse Nuclear Engineering Headquarters

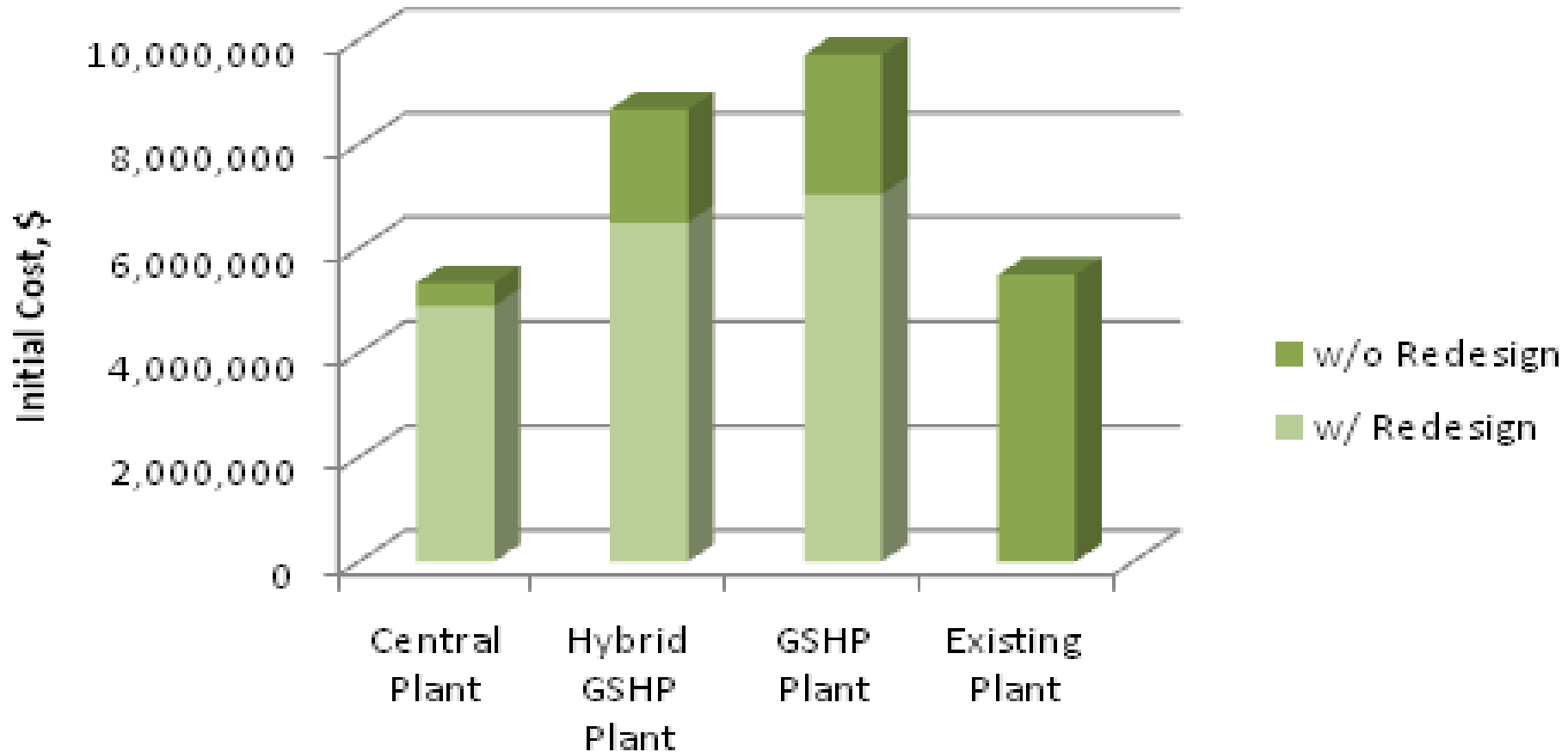
Hybrid GSHP Sizing



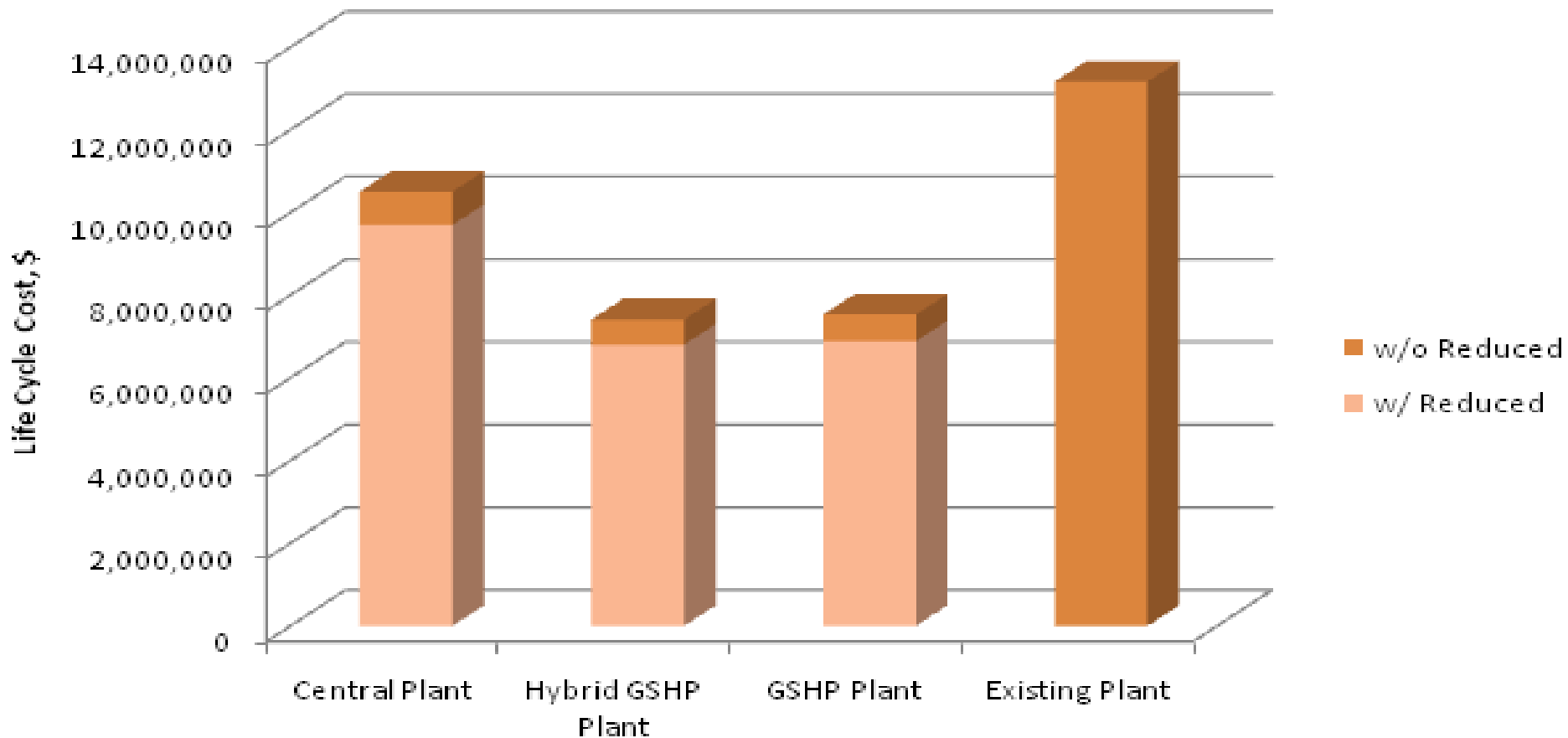
Hybrid GSHP

Westinghouse Nuclear Engineering Headquarters

Plant Initial Cost



Plant Lifecycle Cost



Architectural Study- Façade Redesign

A detailed architectural rendering of a modern multi-story building, identified as the Westinghouse Nuclear Engineering Headquarters. The image is set at dusk or night, with the building's interior lights glowing through large glass windows and doors. The facade features a combination of dark brickwork and light-colored panels. Several prominent vertical brick columns are illuminated from within, creating a warm glow. A large, cantilevered entrance canopy is visible in the center. The sky is a deep blue, suggesting twilight.

Architecture

Westinghouse Nuclear Engineering Headquarters



North View



South View

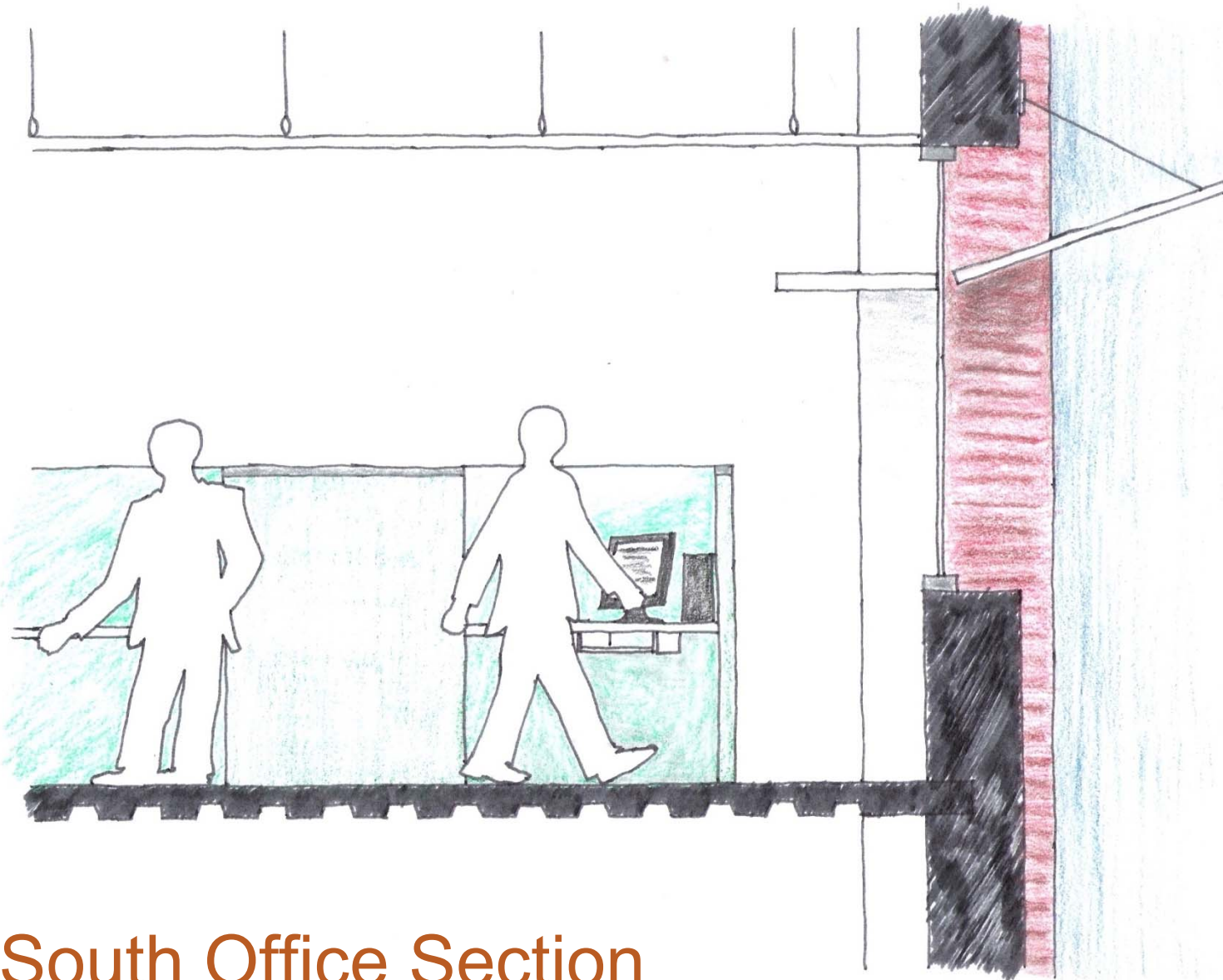
Architecture

Westinghouse Nuclear Engineering Headquarters



Architecture

Westinghouse Nuclear Engineering Headquarters



South Office Section

Architecture

Westinghouse Nuclear Engineering Headquarters



North Office Redesign

Architecture

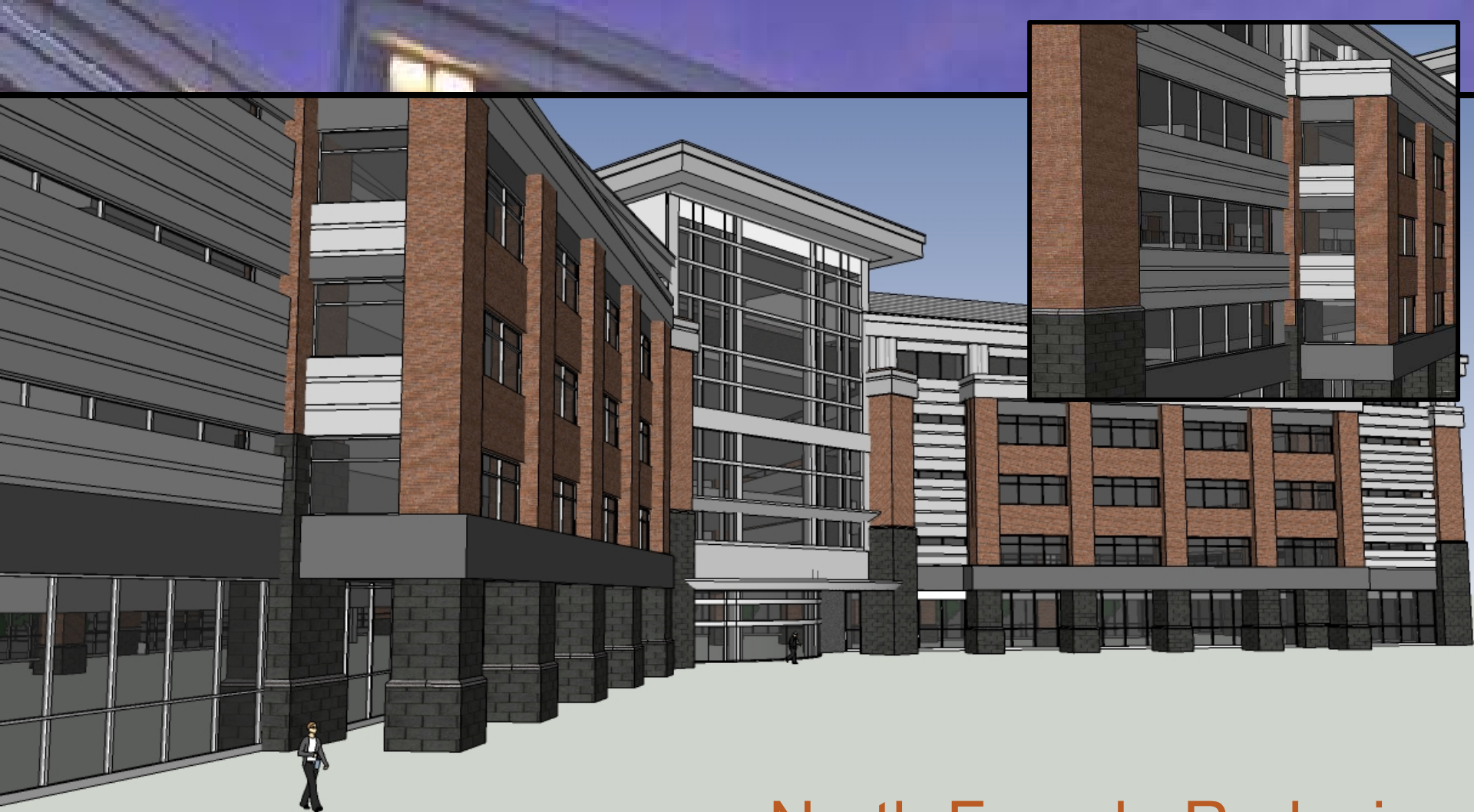
Westinghouse Nuclear Engineering Headquarters



North Conference Redesign

Architecture

Westinghouse Nuclear Engineering Headquarters

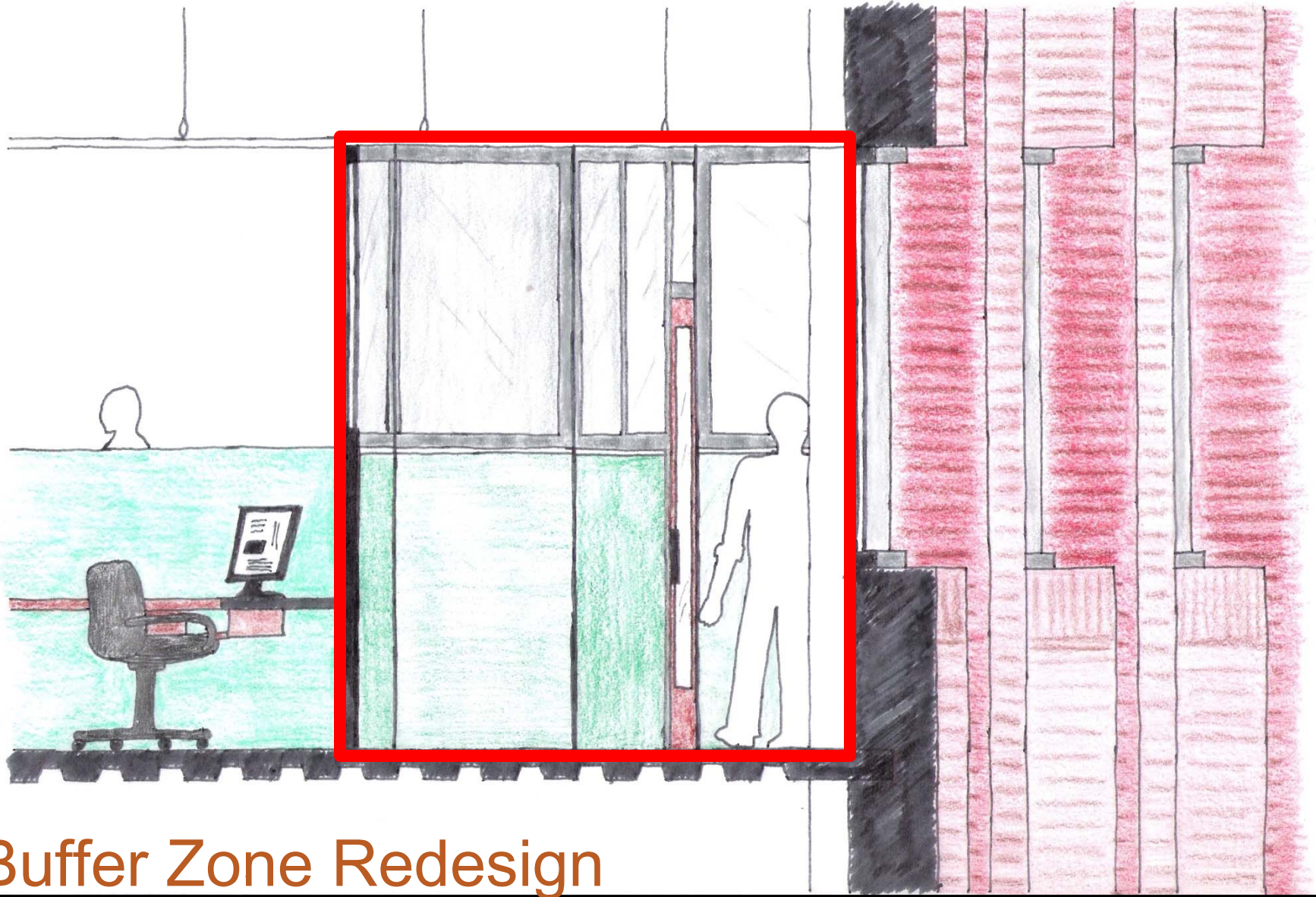


North Façade Redesign



Architecture

Westinghouse Nuclear Engineering Headquarters

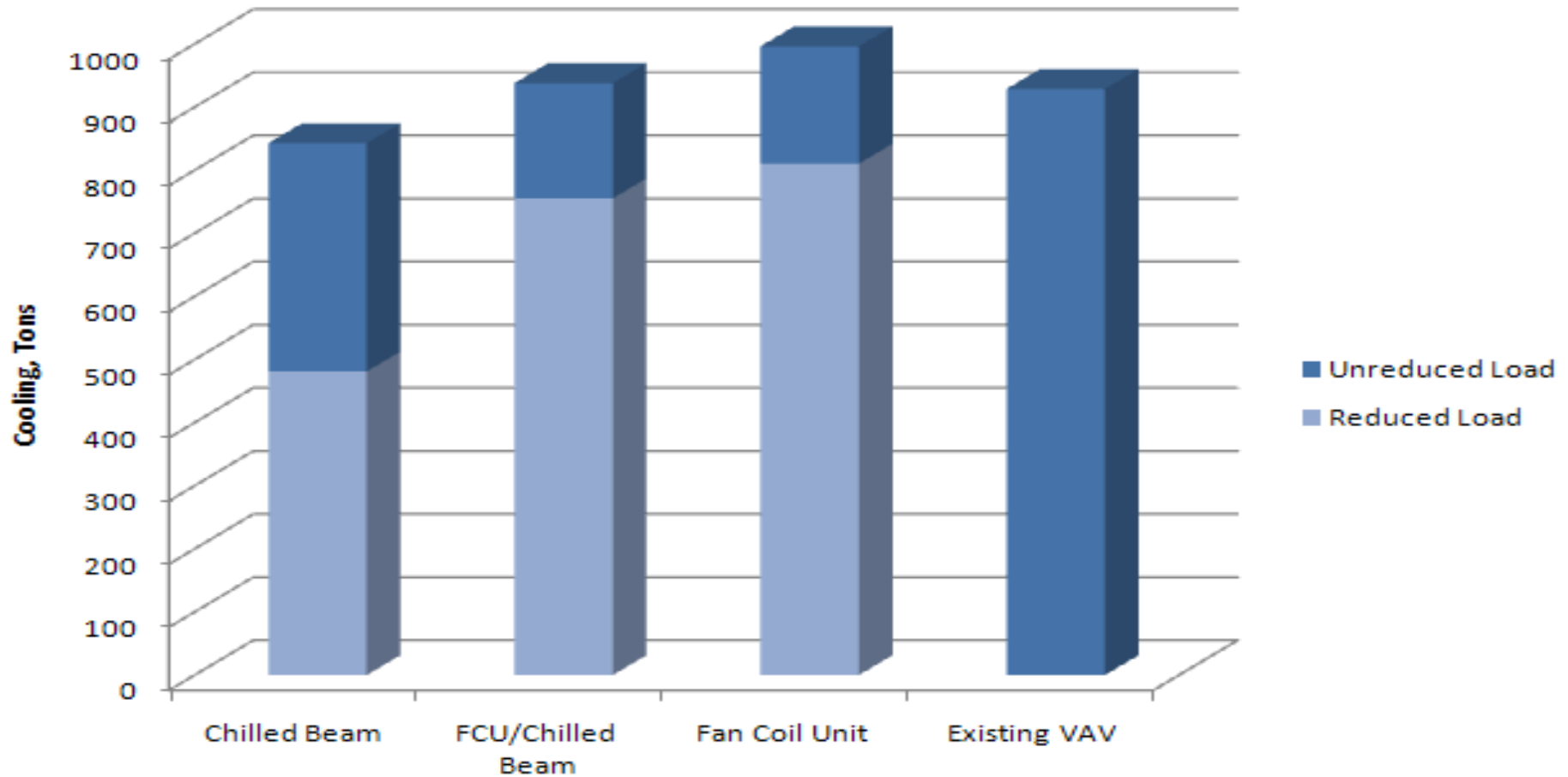


Buffer Zone Redesign

Architecture

Westinghouse Nuclear Engineering Headquarters

Plant Impact



Architecture

Westinghouse Nuclear Engineering Headquarters

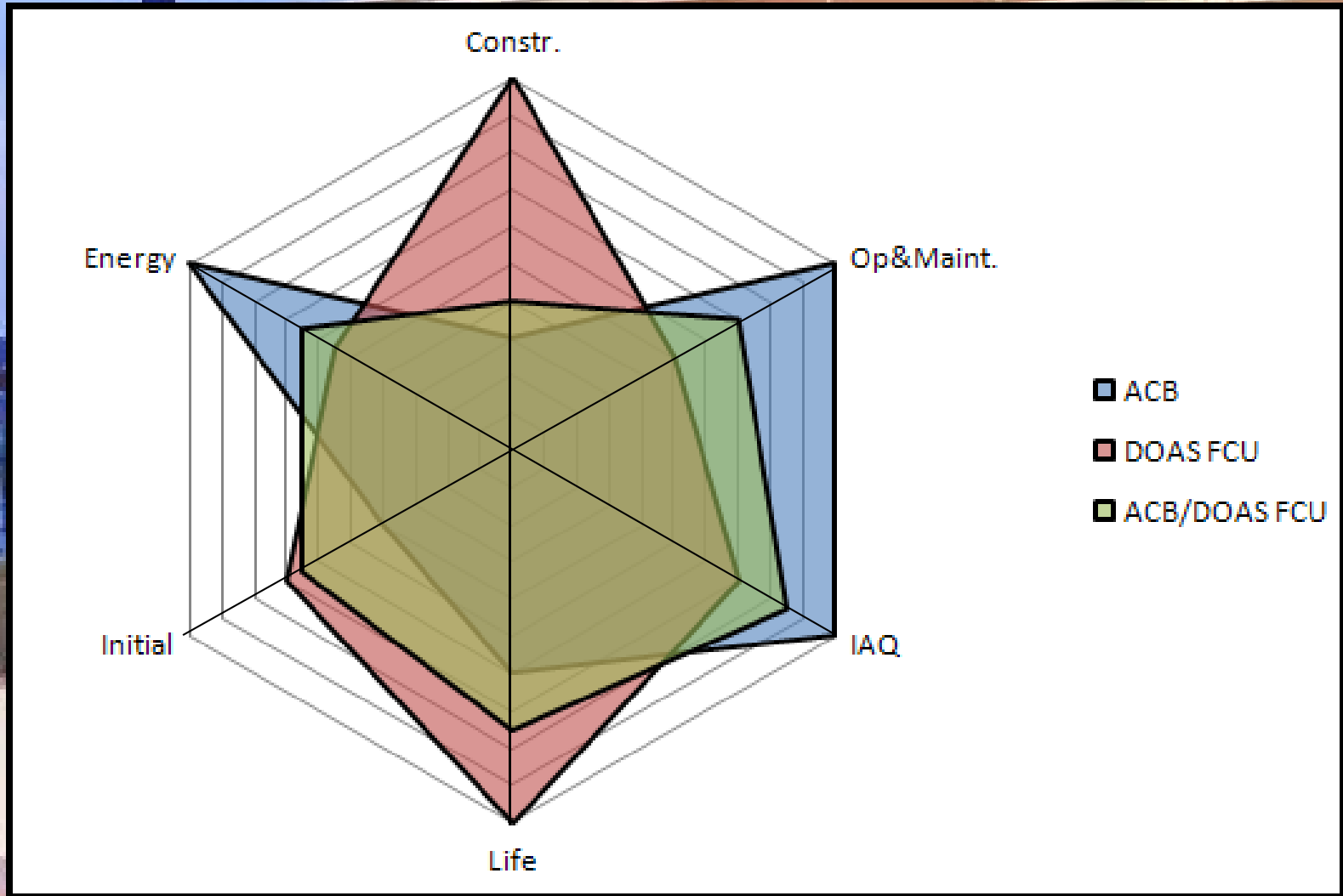
Conclusions

A photograph of a modern conference room. In the foreground, a long, light-colored conference table is surrounded by several grey office chairs. In the background, a large whiteboard is mounted on a red wall. To the left, a large window offers a view of a city at dusk, with buildings and hills visible under a blue sky. The room is lit by overhead fluorescent lights.

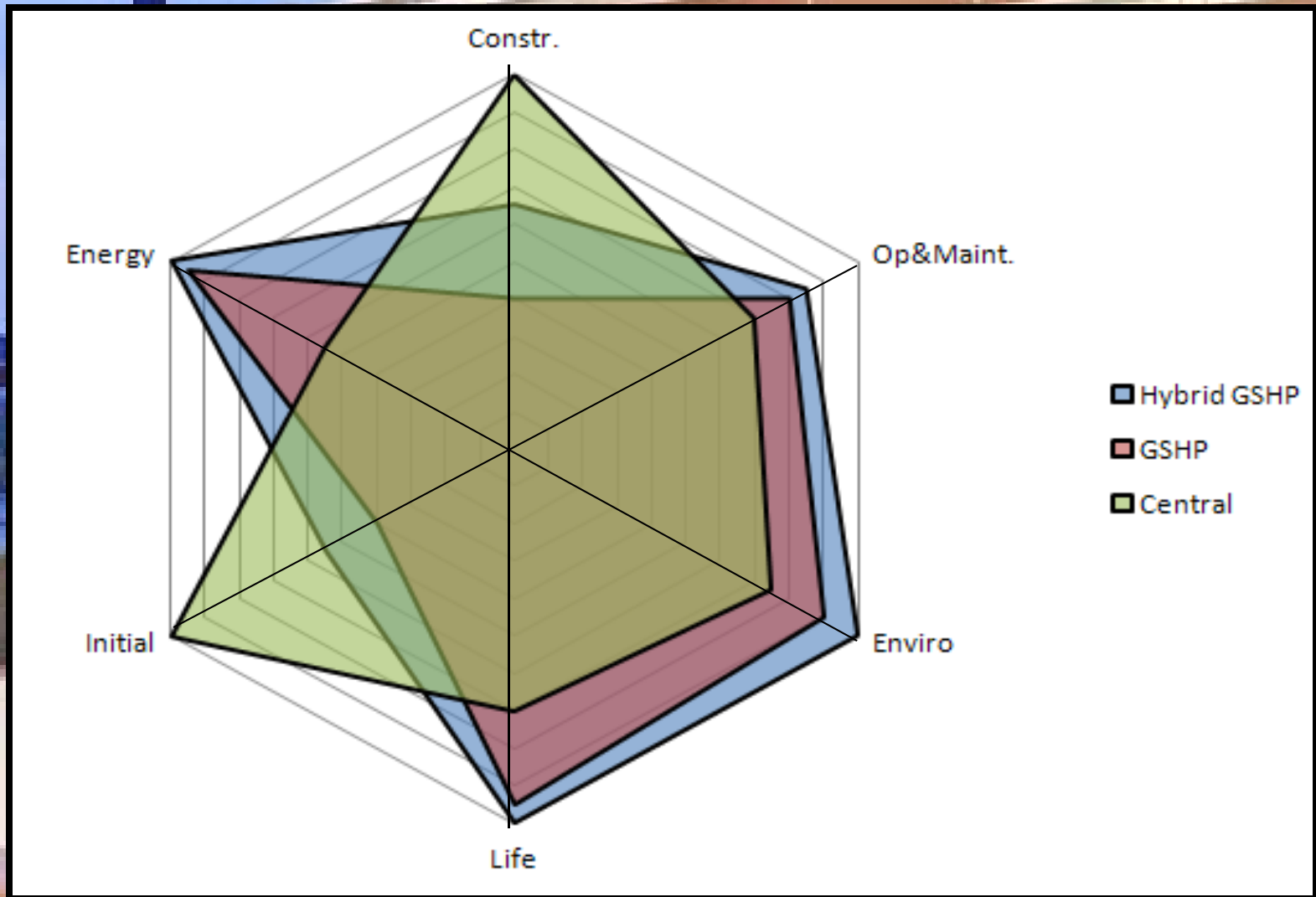
Conclusions

Westinghouse Nuclear Engineering Headquarters

Conclusions: Air Systems



Conclusions: Mechanical Plant



Conclusions

Westinghouse Nuclear Engineering Headquarters

Conclusions

A photograph of a modern conference room. In the foreground, a long, light-colored conference table is surrounded by several grey office chairs. The room has large windows on the left side, offering a view of a cityscape. On the right wall, there is a whiteboard and a red wall. The ceiling features recessed lighting fixtures.

The best alternate Air System for the Westinghouse Headquarters is a Dedicated Outdoor Air System coupled with an all DOAS Fan Powered Terminal configuration to condition the office space.

The best alternate Plant for the Westinghouse Headquarters is a Hybrid Ground Source Heat Pump Plant.

Thank You...

Professor Bahnfleth

Professor Freihaut

Professor Holland

Bob Hennessey, Turner Construction

Ernie Tillman, LLI Engineering

Joel R. Bernard, IKM Inc.

Special Thanks to all my friends and family for their support!

Conclusions

Westinghouse Nuclear Engineering Headquarters



Questions ?

Daniel Aughenbaugh
Mechanical Option

Westinghouse Nuclear Engineering Headquarters