The background of the slide is a grayscale photograph of an industrial facility. The top half shows large, white, curved pipes and structural beams. The bottom half shows a dense network of pipes, valves, and machinery. Labels like 'CHILLED WATER RETURN' and 'MEDIUM PRESSURE STEAM' are visible on the pipes. The overall scene is a complex industrial environment.

# DYNAMIC UTILITY MASTER PLANNING

Ben Dombrowski, PE  
Mechanical Engineer, Energy & Power Solutions

**JACOBS**<sup>®</sup>

# Why Master Plan?



**FUNDING**



**SUSTAINABILITY  
GOALS**



**OPERATIONS &  
MAINTENANCE**



**COMMUNICATION &  
REPORTING**



**RESILIENCY**



**TRANSITIONS**

# Why Do Master Plans Fail?



**NO PLAN**



**SEVERAL  
POTENTIAL PLANS**



**CHANGES  
TO PLAN**

# Why Do Master Plans Fail?

Changes or availability of  
**TECHNOLOGY**



**CHANGES  
TO PLAN**

# Why Do Master Plans Fail?

Changes or availability of  
**TECHNOLOGY**

Availability of  
**FUNDING**



**CHANGES  
TO PLAN**

# Why Do Master Plans Fail?

Changes or availability of  
**TECHNOLOGY**



Availability of  
**FUNDING**

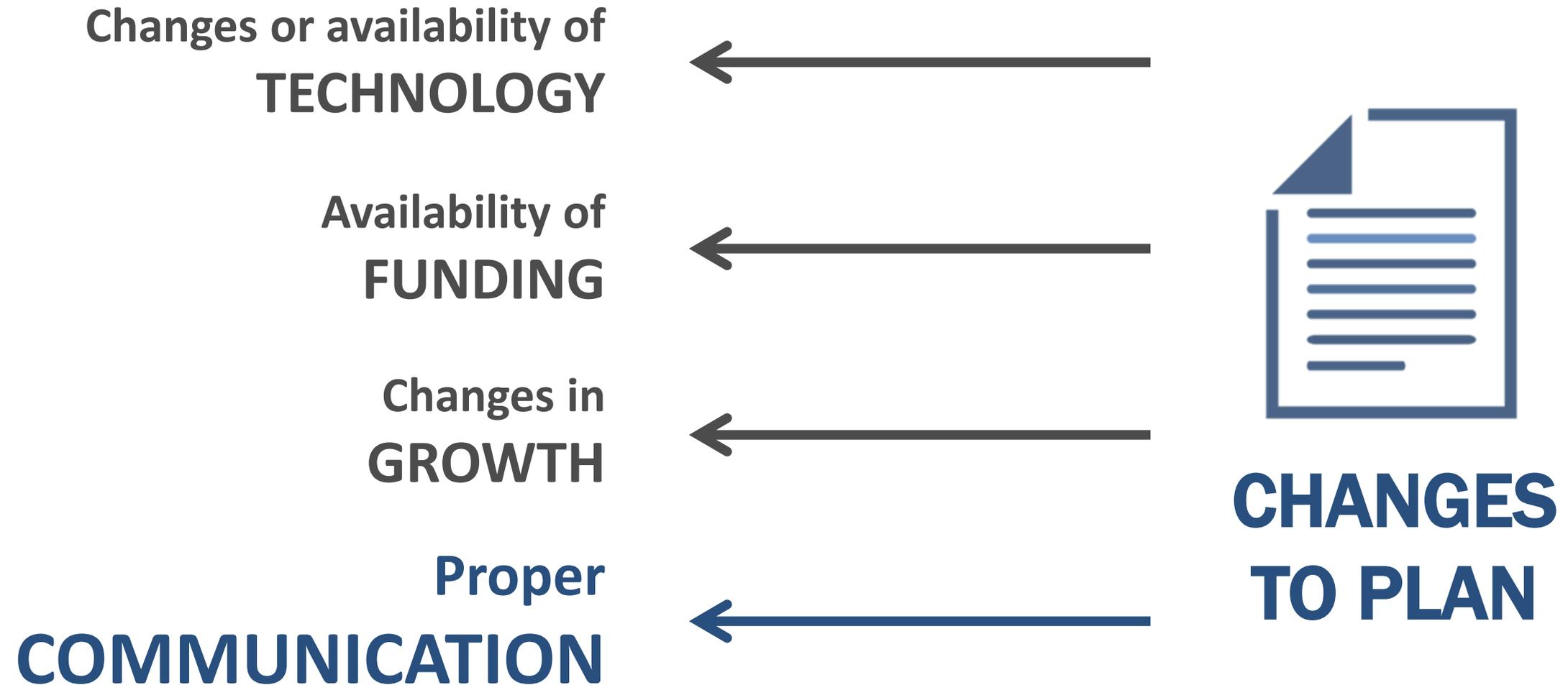


Changes in  
**GROWTH**



**CHANGES  
TO PLAN**

# Why Do Master Plans Fail?



How do we support  
currently required  
utilities while adapting  
to future changes?

# Going Beyond Today

**Complete real time option analysis based on current conditions**

# Going Beyond Today

Complete real time option analysis based on current conditions

**Incorporate and evaluate new technology & goals**

# Going Beyond Today

Complete real time option analysis based on current conditions

Incorporate and evaluate new technology & goals

**Identifies utility requirements for supporting future projects**

# Key Inputs & Outputs

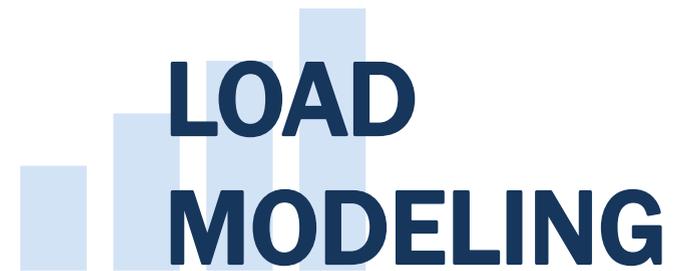
**Capital cost**

**Utility cost and  
consumption**

**Operations and  
maintenance cost**

**Goal compliance**

# Dynamic Planning Toolkit



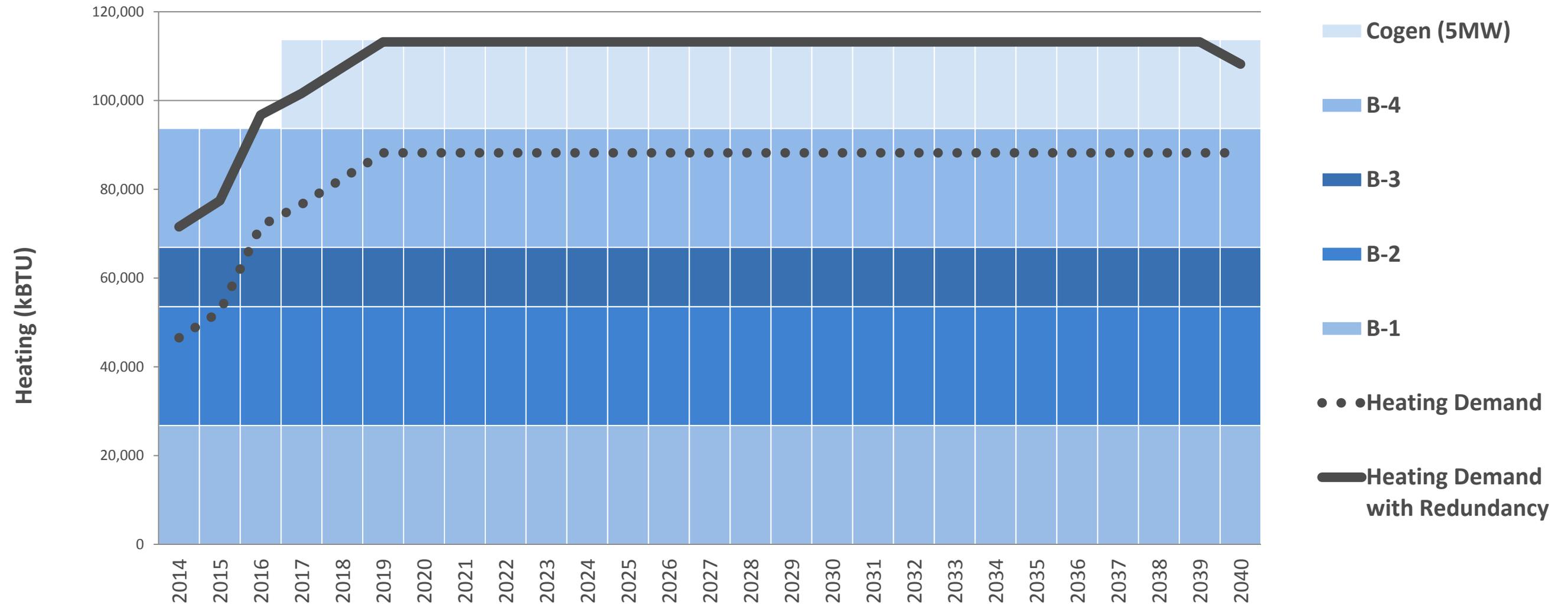


# Load Modeling

Boilers Located in CEP				Buildings on CEP Steam System			
Boiler	MBtuh	Date Installed	Life				
CEP#1	23,433	2009	40	<input type="checkbox"/>	Armour Academic Facility	<input checked="" type="checkbox"/>	Central Energy Plant (CEP)
CEP#2	23,433	2009	40	<input checked="" type="checkbox"/>	Atrium Building	<input checked="" type="checkbox"/>	Orthopedic Ambulatory Building
CEP#3	23,433	2009	40	<input type="checkbox"/>	Chiller Plant (PPP)	<input checked="" type="checkbox"/>	East Tower
CEP#4	13,390	2009	40	<input type="checkbox"/>	Cohn Research	<input checked="" type="checkbox"/>	AACC
CEP#5	70,000	2015	40	<input type="checkbox"/>	Jelke	<input checked="" type="checkbox"/>	Central HUB
CEP#6	70,000	2020	40	<input type="checkbox"/>	Johnston R. Bowman	<input type="checkbox"/>	New Research Building
				<input type="checkbox"/>	Kellogg Pavilion	<input checked="" type="checkbox"/>	Atrium Expansion
				<input type="checkbox"/>	Pavilion	<input checked="" type="checkbox"/>	Tunnel
				<input type="checkbox"/>	Professional Bldg. 1		
				<input type="checkbox"/>	Professional Bldg. 2		
				<input type="checkbox"/>	Professional Bldg. 3		

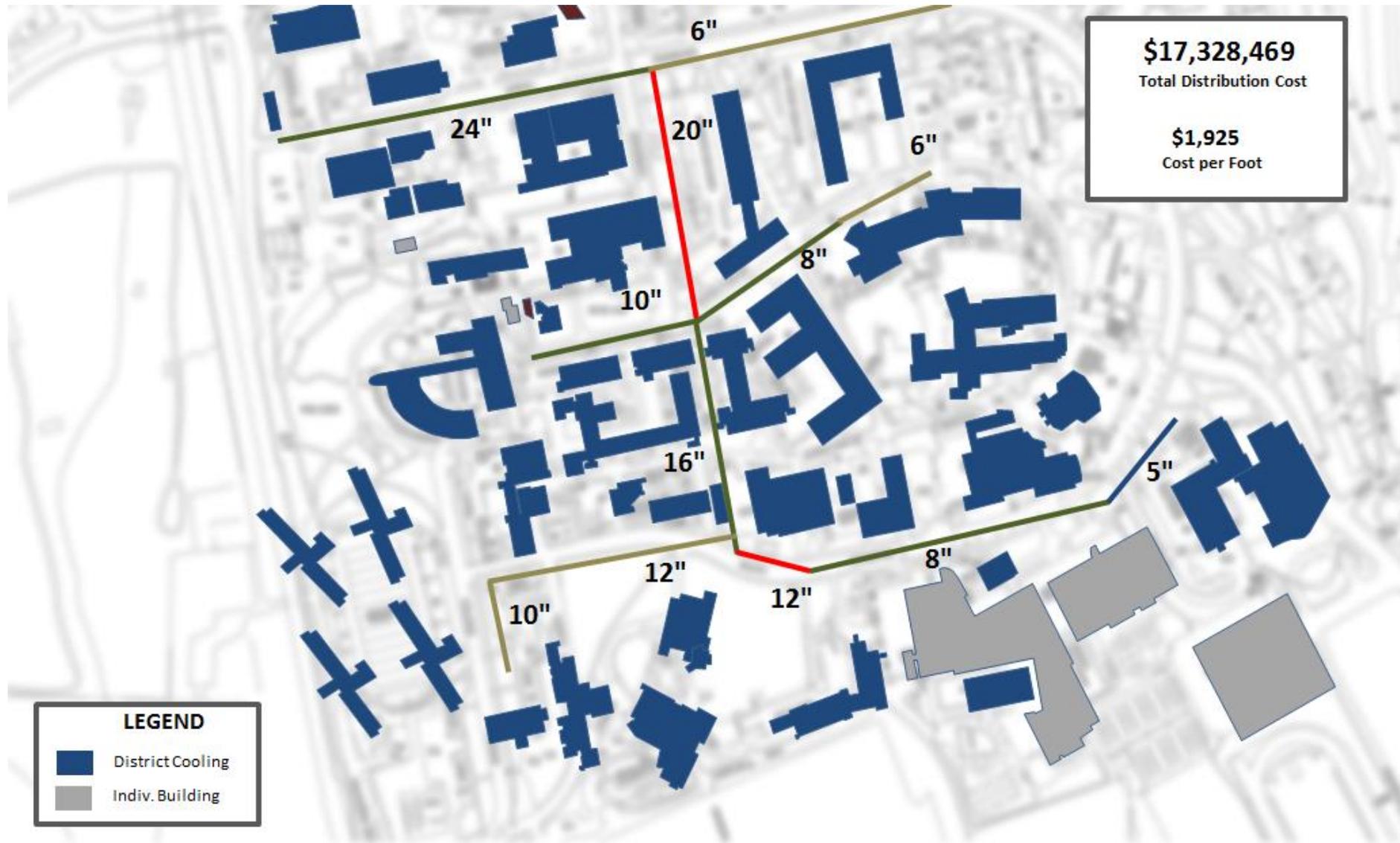
**Rush University Medical Center**  
Central Energy Plant

# Load Modeling



University of Massachusetts – Boston  
 Central Energy Producing Facility, Heating & Load Capacity

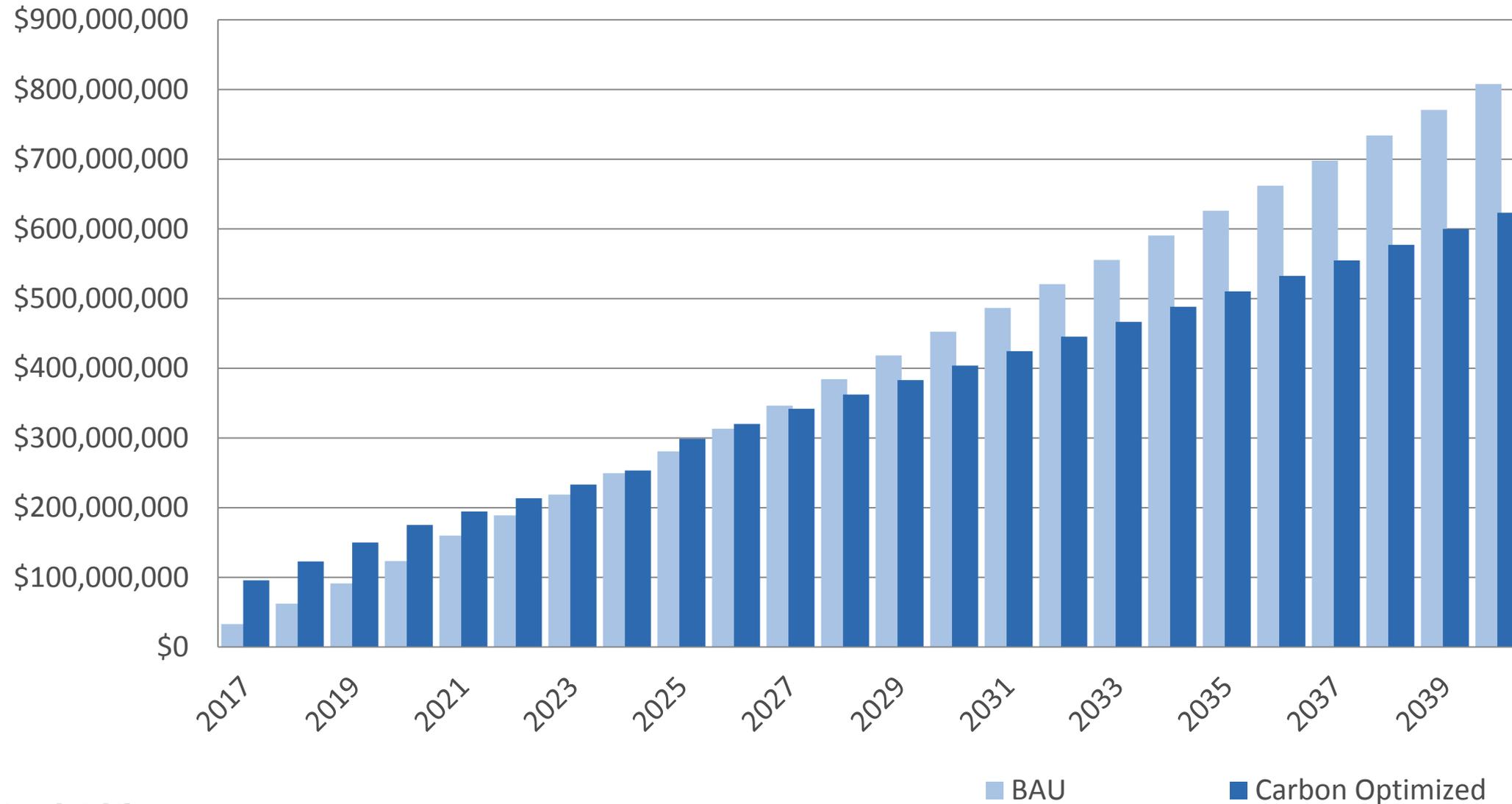
# Distribution Planning



Confidential Client  
Chilled Water Distribution



# Life Cycle Cost Analysis



Life Cycle Cost Savings  
**\$6,015,334**

Projected Cost Reduction  
**26%**

Average Annual Utility Savings  
**Electrical: 0 kWh**  
**Nat. Gas: 110,161 mmBTU**  
**Water: 0 kGal**

Confidential Client  
Utility Master Plan



# Sustainability Tracker



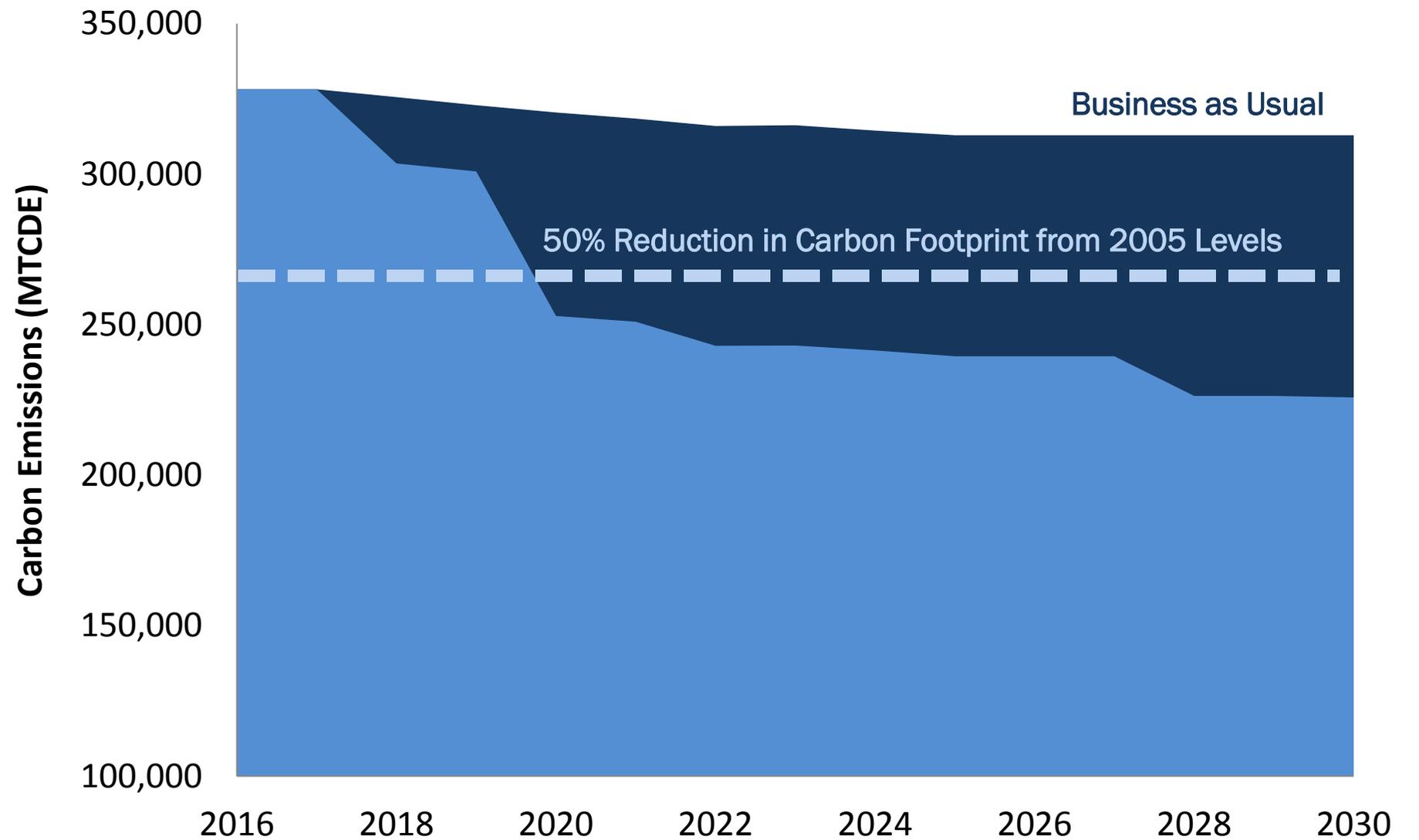
Energy Reduction  
**14%**



Greenhouse Gas Reduction  
**14%**



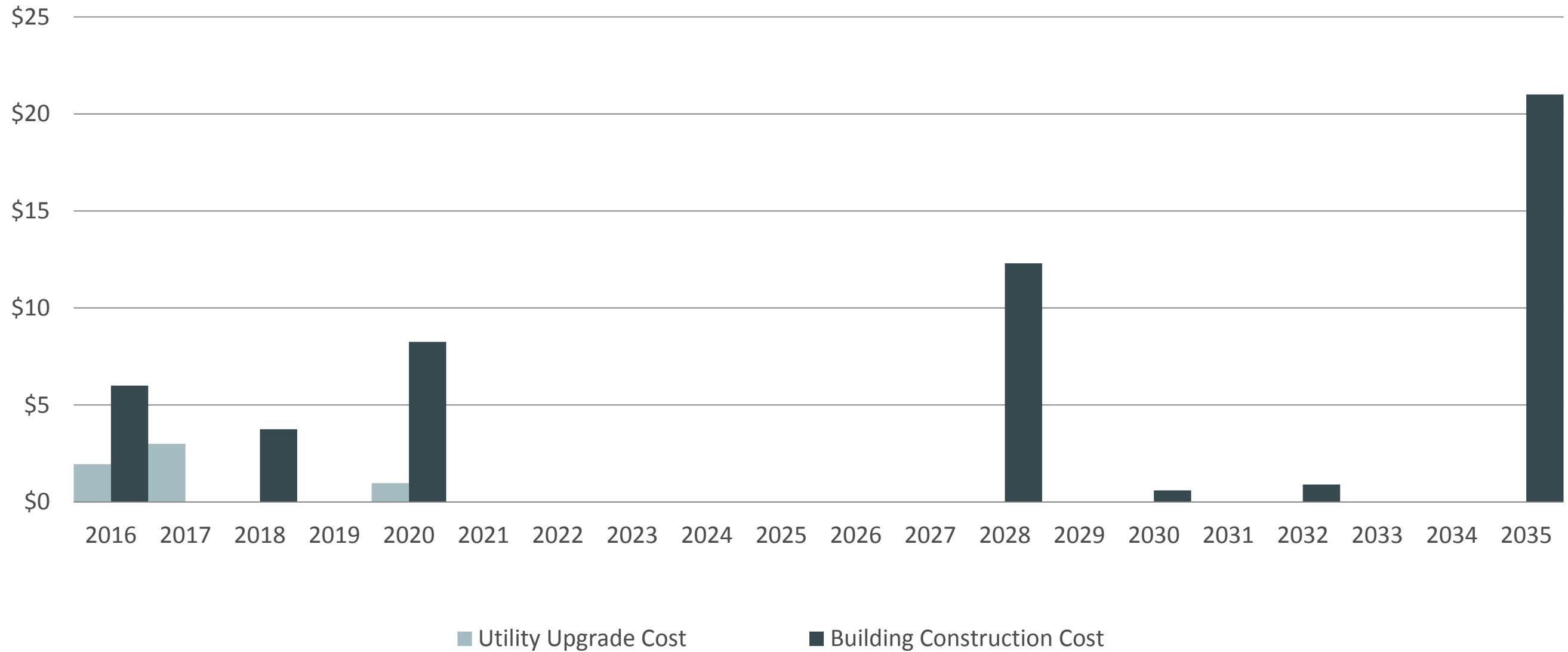
Water Conservation  
**0%**



# ✓ Option Analysis

<b>District energy</b>	<b>vs</b>	<b>Decentralized</b>
<b>Minimum capacity</b>	<b>vs</b>	<b>Redundancy</b>
<b>BAU</b>	<b>vs</b>	<b>Annual goal compliance</b>
<b>BAU</b>	<b>vs</b>	<b>Optimized infrastructure</b>

# \$ Capital Planning



# Summary

**Flexibility over the entire lifetime of the utility master plan**

# Summary

Flexibility over the entire lifetime of the utility master plan

**Collaborative effort and vision between stakeholders**

# Summary

Flexibility over the entire lifetime of the utility master plan

Collaborative effort and vision between stakeholders

**Robust plan providing long term savings and definitive answers**

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