Next Century Capitol Campus

Predesign Report

Prepared for:
Washington State Office of Financial Management

By: Department of Enterprise Services
In cooperation with: UMC and MENG Analysis

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ACKNOWLEDGEMENTS

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Executive Summary

1. Executive Summary

Introduction and Background

The existing Washington State Capitol Campus steam plant, which provides heating for most of the Capitol Campus buildings, is obsolete, hazardous to repair, and performs poorly (roughly 34% efficient). Furthermore, the plant's location is vulnerable to extreme weather events, including earthquakes, flooding, and landslides.

Being aware of these problems, Department of Enterprise Services (DES) energy and maintenance staff and planners have worked to preemptively address these issues by reviewing alternative systems, technologies, and sites to replace this critical infrastructure before a catastrophic failure occurs. This project is referred to as the Next Century Capitol Campus (NC3) project. The NC3 project seeks to renew this critical infrastructure to serve the Campus through the mid-21st century and beyond.

Figure 1. *Steep Slope Adjacent to Central Plant*

Figure 2. *Aged Steam Distribution System*

Responsiveness to Legislation

Not only will this project provide heating, cooling, and emergency power to multiple Campus facilities, it is also directly responsive to RCW[1] 70.235.050 (greenhouse gas emission limits for state agencies), RCW 43.21M.040 (incorporation of climate adaptation plans of action by state agencies), Executive Order 18-01 (state efficiency and environmental performance), and Senate Bill 5116 (supporting Washington's clean energy economy and transitioning to a clean, affordable, and reliable energy future).

In response to a 2015-2017 capital budget proviso, DES utilized the Energy Savings Performance Contracting (ESPC) program and selected UMC, Inc. to evaluate system alternatives that would meet efficiency improvement and environmental impact reduction goals.

UMC performed detailed monitoring and analysis of the current system and produced an Investment Grade Audit (IGA) and Energy Services Proposal (ESP).

The preferred alternative is to install a centralized Combined Heat and Power (CHP) system adjacent to the OB2 building. A detailed analysis of possible sites is included in report section 3.5.

[1] Full text of the RCWs is included in the Appendix. The full text of Senate Bill 5116 can be found at the following location: https://app.leg.wa.gov/billsummary?BillNumber=5116&Initiative=false&Year=2019

Project Overview

The NC3 project will be responsible for the heating, cooling, and power distribution infrastructure necessary to serve the Washington State Capitol Campus building facilities through the mid-21st century and beyond, in support of the Capitol Campus Master Plan. The NC3 project has been under development for several years, culminating in this predesign report which summarizes the process and recommends the preferred alternative.

As a state cabinet agency, DES is directed by aforementioned RCW and Executive Order to consider all opportunities to reduce our carbon footprint, integrate Continuity of Operations (COOP) criteria, and reduce operating costs. After nearly 100 years of service, the existing Capital Campus energy infrastructure, particularly the steam heating system, is at its end of life and does not support the Capitol Campus Master Plan, specifically the development of new facilities and renovation of existing facilities on the campus.

The main equipment for the current heating and cooling system is located in the Powerhouse on Capitol Lake, below West Campus. Analysis of this site has revealed significant risks of continuing to use the facility. Natural disasters could disable the Powerhouse which would mean no heating or cooling for connected buildings, threatening the continuity of government operations in buildings on the Capitol Campus.

Analysis of the existing system has revealed a low overall operating efficiency of about 34% for the steam heating system. Though the carbon footprint of the Campus is at an all-time low, improving the system efficiency would lower the lifecycle cost of operations and set the Campus on a pathway to further reduce carbon emissions.

Project Objectives

Each heating and cooling system alternative and related technology was analyzed against three primary project criteria:

1) **Continuity** of government
2) **Cost**-effectiveness
3) **Carbon** footprint reduction

Secondary objectives of this project include:

4) Improving life safety of operating personnel
5) Allowing for future growth
6) Fuel flexibility and future technologies
7) Demonstrating the feasibility of technology at a campus scale
8) Emergency electrical power

Project Summary

This predesign report considers three system alternatives and examines technology that is available under each of these systems. High-level diagrams of energy transfer for each system (from utility to buildings) can be found in Appendix A.5.

The three system alternatives considered are:

1) **Business as Usual (BAU)**, which attempts to extend the life of and expand the existing steam and chilled water district energy system.
2) **Decentralized**, which would provide heating, cooling, and power independently for each building.
3) **Centralized**, which would provide heating, cooling, and power for each building from a new, central plant.

In addition to the variety of potential systems and technologies, the equipment for these alternatives may be housed at a number of different sites. For this project, the sites considered were:

1) The existing **Powerhouse (PH)** on the slope by Capitol Lake.
2) A building replacement at the **Archives Building (Arch)** site.
3) A new facility east of **Office Building 2 (OB2)** incorporating the existing 50 Level. (basement).

Figure 3 shows the responsiveness of each system to the agreed upon project criteria.

Responsive to Legislation	BAU	Dec.	Cent.
RCW 70.235.050	✗	✓	✓
RCW 43.21M.040	✗	✓	✓
Executive Order 18-01	✗	✓	✓
Senate Bill 5116	✗	✓	✓
Continuity			
Reduce Risk of Failure	✗	✓	✓
Future System Flexibility	✗	✗	✓
Cost			
Reduce Maintenance Cost	✗	✗	✓
Minimal Construction Cost	✓	✗	✗
Carbon			
Reduce Carbon Emissions	✗	✓	✓
Fuel Flexibility	✗	✗	✓
Satisfied Criteria	**1/10**	**6/10**	**9/10**
Rank	3	2	1

Figure 3. *System Selection Table*

Recommendation

The recommended alternative is a centralized system with hot water and chilled water distribution to multiple buildings (***Figure 5***), plus emergency power. The existing distribution system is shown in ***Figure 4***. A new central plant east of OB2 will house the primary heating and cooling equipment for the entire Capitol Campus. Maximum efficiency and flexibility will be ensured by use of a combined heat and power (CHP) system. The CHP system will be based on a reciprocating engine generator, thermal energy storage (TES), high-efficiency hot water boilers, and a chilled water plant with heat recovery. The engine generator, initially to be fueled by natural gas, will provide hot water for heating Campus buildings and up to 2.6 MW of electricity. Future fueling options include renewable alternative fuels such as biogas, digester gas, hydrogen, or landfill gas. An insulated TES system will provide hot (and/or chilled) water storage for use during morning warm-up and peak demand. Diversity of heating and cooling needs across the Campus will be met by the integrated thermal system. Electric power production will offset existing utility purchases and provide increased Campus resiliency in the event of utility source power interruptions. Electric power production also has the capability of being expanded in the future to provide emergency power to buildings and displace the use of backup emergency generators across Campus.

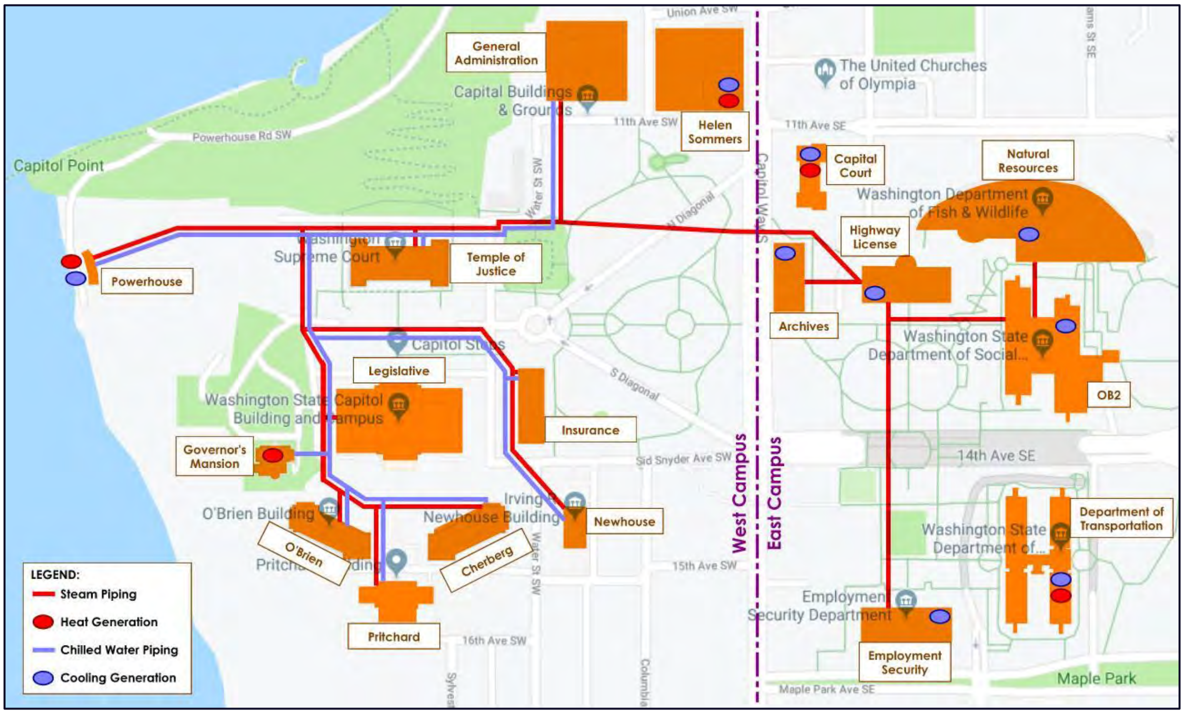

***Figure 4**: Distribution System Map (Business as Usual)*

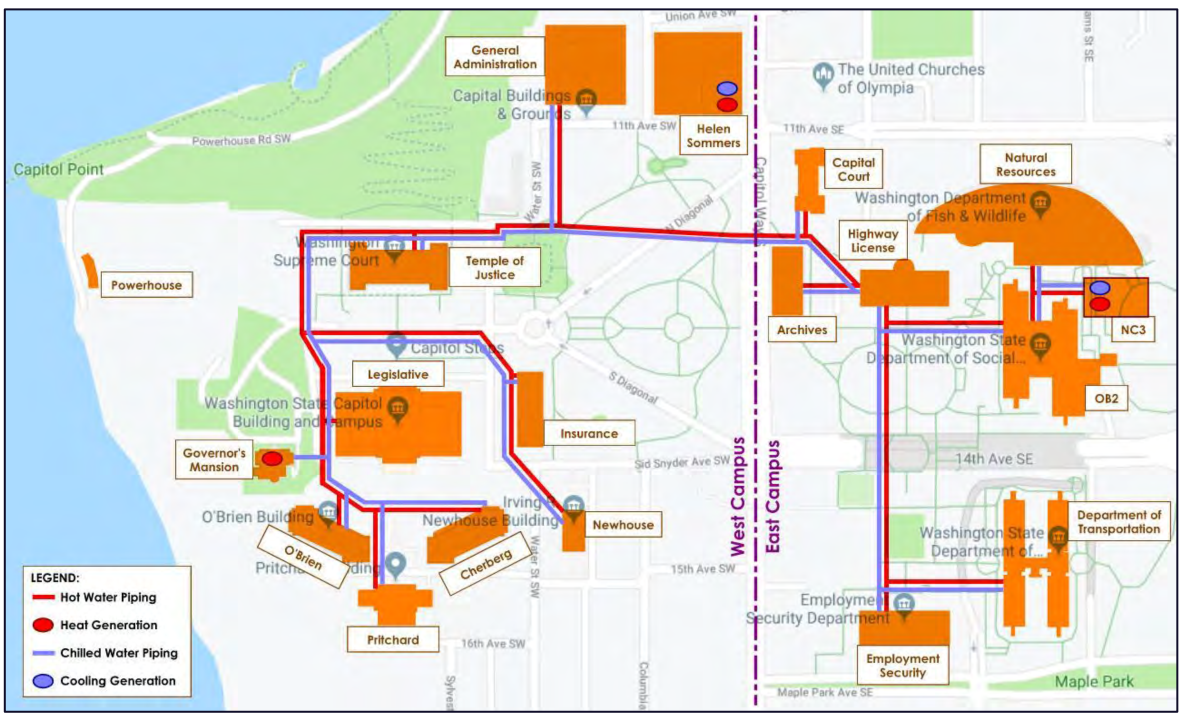

***Figure 5**: Distribution System Map (Centralized Alternative)*

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Problem Statement

2. Problem Statement

2.1 Project Objectives

The Capitol Campus is the seat of government of Washington State. It is home to the Supreme Court, the Legislature, the Governor, Statewide Elected Officials, and the headquarters of most executive branch agencies. Without functional heating, cooling, and electrical systems in the Campus buildings, it would be extremely challenging, if not impossible, for the government to function.

The Washington State Capitol Campus energy infrastructure, specifically the current steam plant for heating Capitol Campus buildings, is 100 years old, inefficient, and at its end of life. The NC3 project seeks to enhance this critical infrastructure to serve the Campus through the mid-21st century and beyond by addressing three primary objectives:

1. Ensure continuity of government
2. Enhance reliability and resiliency
3. Provide cost-effective and efficient system

DES is responsible for managing the Capital Campus and is committed to reaching the state's long-term carbon reduction goals. Greenhouse gas reduction targets for state agencies are established in RCW 70.235.050 and new energy efficiency requirements were established in SB 5116 and signed into law in May 2019. These initiatives will help Washington State navigate the path to clean energy. The state has a unique opportunity to provide leadership in energy innovation by using this project to showcase responsiveness to new environmental goals.

The basic need is a way to heat, cool, and power buildings on the Capitol Campus in order to maintain the continuity of government while considering a finite budget and new environmental goals. What is needed is an efficient system with a realistic operations and maintenance (O&M) strategy that allows for adaptability tor future technology and fuel sources.

2.2 Existing System

Currently, most buildings on the Capitol Campus are heated from boilers in the Powerhouse near Capitol Lake. The boilers burn natural gas to produce steam which is distributed to the buildings through a series of underground tunnels and utilidors. Two buildings use the steam directly for heating, but most buildings have steam-to-hot-water converters, producing heating and domestic hot water. Additionally, West Campus buildings are cooled by chilled water produced at the Powerhouse, while East Campus buildings have standalone chilled water equipment.

Furthermore, many mission-critical buildings have dedicated diesel-fueled standby generator power.

The existing steam and condensate piping is aging with increasing risk of failure, both as a whole and to individual buildings. Producing steam requires a relatively high-temperature energy source, such as a flame from natural gas or fuel oil, which limits the options for future upgrades. Emerging high-efficiency technologies such as renewable solar, all-electric heat pumps, and other low-temperature equipment cannot be incorporated into high-temperature systems like steam.

The existing chilled water systems are in better condition than the steam and condensate system, but are still aging, especially the chilled water distribution system piping serving West Campus which is over 40 years old. The piping is relatively brittle asbestos-concrete (Transite) underground piping that may fail during a major seismic event. The East Campus buildings are served by standalone chilled water systems with minimal redundancy and little or no opportunity for energy recovery to or from other buildings, and are due for replacement within the next 10 years.

Figure 6. *Aged Steam Distribution System*

Similar to chilled water for East Campus, nearly all buildings have standalone emergency power generation but with little or no redundancy and minimal opportunity upgrades. This requires diesel fuel storage for multiple generators.

The Department of General Administration (GA), the predecessor to DES, initiated studies by Moffatt & Nichol (2008) and Golder Associates (2009) to evaluate risks associated with continuing use of the Powerhouse which contains the major equipment for the existing system. These studies revealed significant risks to the Powerhouse from landslides or flooding that could disable the existing powerhouse for months, meaning no capacity for heating or cooling in most Campus facilities. ***Figure 7*** shows the risk of slope failure from the Golder Associates Report (2010), and the Powerhouse (westernmost) site is shown as a high-risk area.

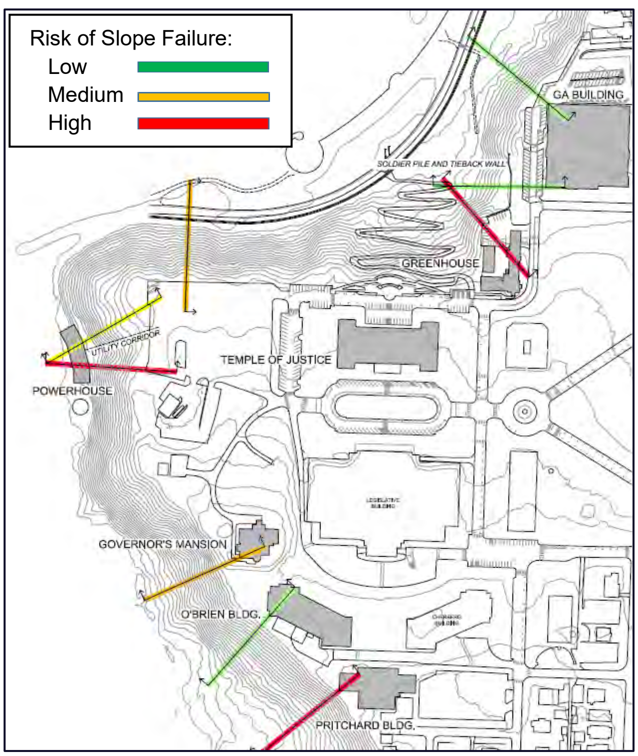


Figure 7*: Risk of Slope Failure / Landslides*

Cost-Effectiveness

The existing steam system is not cost-effective. An in-depth study developed jointly by UMC, Inc. and DES shows the current system has an unusually low efficiency of only 34%, which translates to wasted energy and high operations and maintenance (O&M) cost. Additionally, steam systems require specialized training to operate, and qualified technicians are becoming more difficult to hire and retain. The current system is increasingly costly to maintain and operate due to aged and obsolete equipment and old distribution piping. Additionally, low steam system efficiency leads to excessive consumption of natural gas. ***Figure 8*** shows a table of lifecycle cost for each system over the next 50 years and an approximate number of staff required to support its functionality.

	Cost	FTE
Business as Usual	$601 M	9
Decentralized - Gas	$597 M	9
Decentralized - Elec	$608 M	9
Centralized - Gas	$563 M	6
Centralized - Elec	$585 M	6

Figure 8*: ROM Cost and FTE per System*

Carbon Emissions

In response to RCW 70.235.050 which limits greenhouse gas emissions for state agencies, RCW 43.21M.040 which requires incorporation of adaptation plans of action by state agencies, and Executive Order 18-01 addressing state efficiency and environmental performance, DES is committed to reaching the state's carbon reduction goals. The Campus carbon footprint is measured in metric tons of carbon dioxide equivalent emissions (MT CO2e). ***Figure 9*** shows measured carbon emissions for the Campus and the targets established by RCW 70.235.050.

	Year	**MT CO2e**
Measured Campus Emissions	2005	30,775
Measured Campus Emissions	2010	34,980
Measured Campus Emissions	2015	27,282
Target (15% below 2005)	2020	26,158
Target (36% below 2005)	2035	19,696
Target (57.5% below 2005)	2050	13,079

Figure 9*: Campus Carbon Emissions and Targets*

Though the carbon emissions from utilities used on the Capitol Campus are at an all-time low, regular improvements and adaptations to new technologies are required to keep the Campus on the path toward carbon neutrality. The current steam system does not readily allow for further carbon footprint reduction because it can only be supported by ongoing consumption of fossil fuels.

Additional Objectives

In addition to the three primary project criteria, there are also several additional objectives that were incorporated while developing this project.

Life Safety: The existing steam tunnels have been declared as confined spaces by WA State Labor & Industries and now require special and costly entry procedures, which hamper O&M activities.

Fuel Flexibility: Steam systems require high-temperature heat sources, which are currently limited to fossil fuels including natural gas, fuel oil, or propane. These fuels lock the Campus into a high-carbon system when DES is striving to provide a pathway to a low-carbon future for the Campus.

Future Technologies: As a result of fuel limitations, steam technology restricts the system's ability to incorporate new high-performance technologies, such as heat pumps, solar thermal energy, low-temperature heat recovery, and other emerging energy technologies.

2.3 Project History

Existing System Efficiency

In 2004, GA contracted with McKinstry to analyze the steam system and propose opportunities to conserve energy. Among those measures discussed were:

- Distributed domestic hot water tanks to allow for Powerhouse boiler plant summer shutdown
- Steam conservation opportunities

Reports that followed the McKinstry study have referenced an efficiency of 68% which has not been substantiated. As part of UMC's two-year energy audit they modeled the system efficiency based on actual consumption data at the powerhouse. They then back checked McKinstry's data using the same technique, which then showed about a 34% annual efficiency. This is consistent with the analysis of data they collected in 2014 and 2015.

ESPC Process

In response to a 2015-2017 capital budget proviso, DES utilized the Energy Savings Performance Contracting (ESPC) program and selected UMC to evaluate alternatives that would meet efficiency improvement and environmental impact reduction goals in a cost-effective way. UMC performed detailed monitoring and analysis of the current system and produced an Investment Grade Audit (IGA) and Energy Services Proposal (ESP).

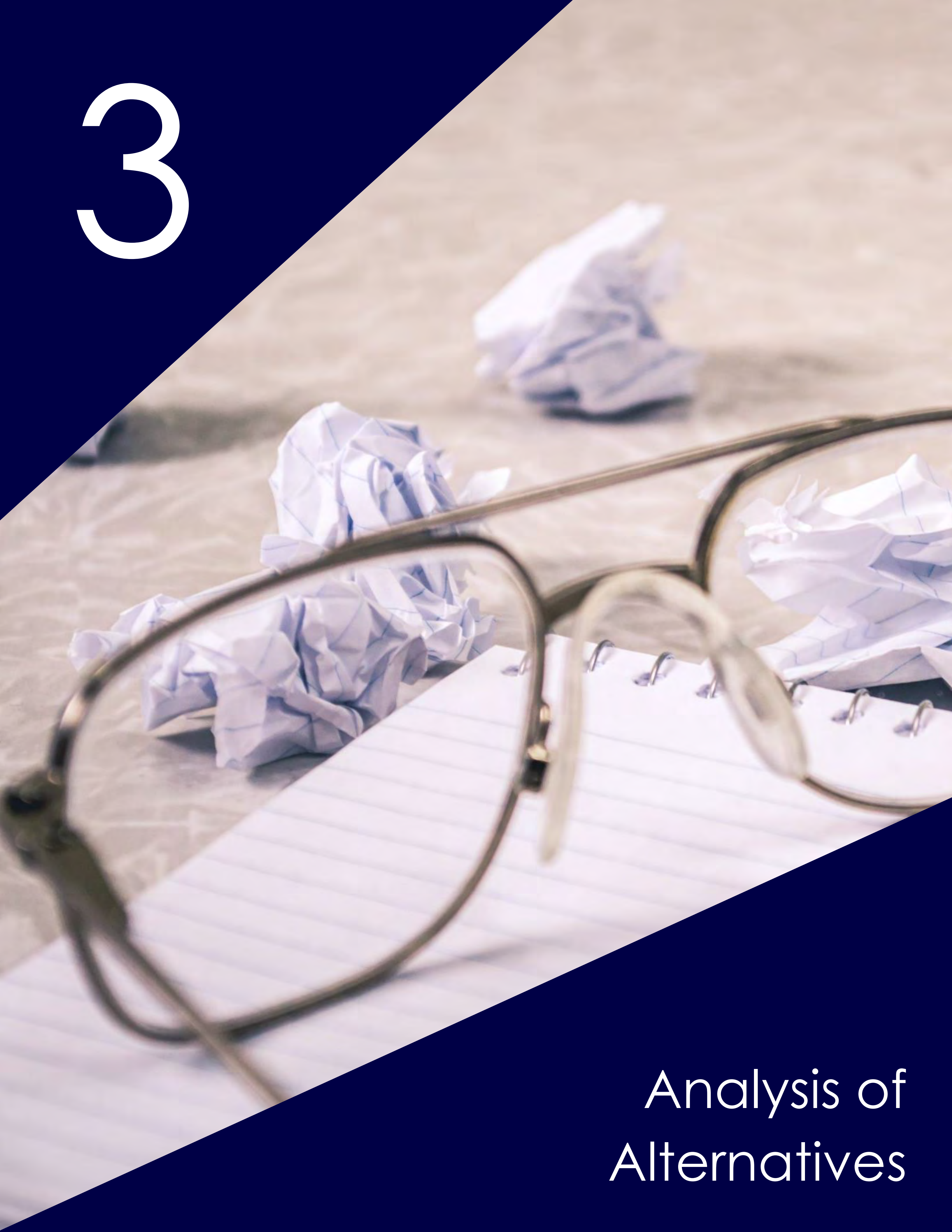
The IGA (published in December 2016) analyzed cost-effective energy efficiency improvements for the steam and chilled water systems. The audit is based on the existing system and required both instantaneous measurements and historical data logs of system performance. The IGA also compared system alternatives and the results showed that a centralized hot water system using CHP in conjunction with thermal storage could be more cost effective and efficient than the existing system. UMC also engaged outside entities as part of this study, reaching out to the WSU Energy Extension and DOE's Northwest CHP Technical Assistance Partnership (June 2015), which found support for use of a CHP system to meet the goals stated in the IGA.

The ESP (published in June 2017) expanded on analysis done in the IGA by providing more specific details on energy consumption, energy efficiency measures (EEMs), anticipated schedule, and verification of comfort conditions. Additionally, the ESP establishes guaranteed maximum construction cost, guaranteed minimum energy savings, and guaranteed equipment performance. The ESPC process includes measurement and verification to ensure those guarantees are being met.

Conclusion

In order for DES to meet its obligations to reduce its carbon footprint, reduce the costs of government operations, and maintain the Capitol Campus facilities to the highest standards, it is important to pursue innovative solutions that provide a pathway to a low-carbon future that has the best lifecycle cost and provides for flexibility in operations and future growth.

The NC3 project accomplishes all of these goals. In conjunction with planned upgrades to Campus buildings and future developments in renewable energy sources, this project would make the Capitol Campus a model leader in sustainable low-carbon operations.



3

Analysis of Alternatives

3. Analysis of Alternatives

The NC3 project stems from the heating and cooling needs of current and future buildings on the Capitol Campus. Project development focused on several factors including:

1) How do we improve resiliency of Campus infrastructure to ensure continuity of government operations during unforeseen circumstances?
2) What can we do to reduce operating costs and ensure we can maintain the Capitol Campus to a high standard?
3) What system and technologies provide the lowest carbon footprint today and in the future?

To answer these questions three system alternatives / operating strategies are analyzed:

- **Business as Usual** – Keep the central steam heating and separate chilled water systems
- **Decentralized** – Install updated heating and cooling equipment in each building
- **Centralized** – Build a new central plant that provides heating and cooling to campus buildings

Each system alternative has multiple technology options, which include various fuel sources. For the centralized alternative, site selection is an additional factor.

3.1 Business as Usual Scenario

The business as usual (BAU) system alternative (maintaining existing plant location and operations) requires ongoing reliance on the Powerhouse on the existing high-risk site at Capitol Lake and the aging and inefficient steam distribution system. Heating, cooling, and backup power would be provided as they are now, with no change.

Heating: The existing steam system is aging with increasing risk of failure, inefficient, and requires specialized technicians to maintain and operate equipment.

Cooling: The existing West Campus chilled water system has little capacity to support additional loads without future investment. East Campus facilities have standalone chilled water systems with little or no redundancy.

Power: The existing Campus standby power system is standalone, building-by-building, with little or no redundancy for most buildings, requiring substantial diesel fuel storage.

Although the BAU strategy maintains the current status quo, there are options for technological improvements. Examples of types of technologies that could be implemented under the BAU alternative are:

1) ***Minimum:*** Maintain both Powerhouse and individual building equipment at code minimum.
2) ***Optimal:*** Upgrade to high-efficiency equipment in the Powerhouse and individual buildings.
3) ***Future:*** Upgrade to high-efficiency equipment in the Powerhouse and individual buildings, and update the distribution system to decrease losses.

The BAU scenario maintains the status quo but does not support the primary project criteria of enhancing continuity, reducing cost, and limiting carbon. Analysis of the Powerhouse, which houses the primary equipment for the current system, has revealed significant risk of catastrophic failure and the facility cannot be relied upon to maintain functionality long-term.

The first costs for this alternative are comparatively low, but maintaining the 100-year-old system poses higher lifecycle costs and poses continued health and safety risks for maintenance staff. Lastly, as previously stated, steam is a high-temperature technology which relies on consumption of fossil fuels. This reliance restricts the Campus' ability to reduce its carbon footprint.

3.2 Decentralized System

The decentralized alternative is characterized by independent heating, cooling, and backup power systems installed at each building. This scenario would phase out the use of the Powerhouse in favor of standalone heating, cooling, and standby power in each Campus building. The Helen Sommers Building already has such a system in place, whereas all other major buildings are connected to the steam (and in some cases chilled water) distribution system and would require additional equipment.

This alternative avoids the risks associated with relying on the Powerhouse, but would greatly increase the amount of equipment requiring regular maintenance and capital renewal, including boilers, chillers, and pumps for each individual building.

Heating: Buildings with HVAC units that use hot water would replace their steam-to-hot-water converters with gas-fired boilers and add new natural gas service, and buildings with HVAC units that use steam would add low-pressure steam boilers or be converted to heating hot water.

Cooling: Buildings served by the district chilled water system (West Campus) would receive new individual chilled water equipment or be fitted with other refrigeration technology. East Campus buildings already use standalone chilled water systems and would require little or no additional work.

Power: The existing Campus standby power system is stand-alone, building-by-building, with little or no redundancy for most buildings, and would require little or no work.

Examples of types of technologies that could be implemented under the decentralized alternative are:

1) ***Minimum:*** Packaged rooftop units (RTUs) or four-pipe boiler, chiller, and forced-air variable air volume units (VAVs).
2) ***Optimal:*** Semi-integrated design, premium building insulation, high-efficiency VAVs, heat pumps, and 50% heat recovery ventilation.
3) ***Future:*** Zero-net energy/carbon, fully-integrated design, super-insulated, radiant heating/cooling, 90% heat recovery ventilation, and solar thermal/electric energy.

Decentralized systems inherently increase performance efficiency as housing equipment in the building it serves eliminates losses to the environment through distribution, minimizes pumping energy, and reduces the sources of potential leaks. Smaller decentralized heating equipment should eliminate the need for air emissions permitting associated with larger central plant equipment. However, the historic buildings on the Capitol Campus pose several challenges to implementing a decentralized approach (both gas-fired and all-electric), including:

- The small mechanical rooms would require expansion to accommodate the additional equipment which would encroach on usable tenant space
- New natural gas service would be required throughout Campus to support currently unserved buildings
- All buildings are designed for higher-temperature hot water (160°F-200°F) which heat pumps at building scale cannot achieve
- Electric boilers, though very low capitol cost, can produce high temperatures but have very high energy consumption costs
- It is unknown if the electrical service to each building can handle the increased loads heat pumps, electric boilers, or chillers would have at each building
- Distributed heating, ventilation and air-conditioning equipment increases the operation and maintenance costs and future capital renewal costs.

3.3 Centralized System

The current system (BAU) is an example of a centralized system where primary heating and cooling equipment is housed in one location, and energy is distributed to multiple buildings. For analysis of this alternative it is assumed that the primary equipment is housed in a new facility. By making this distinction, a centralized alternative avoids the previously discussed risks of continuing use of the Powerhouse.

The fundamental advantage of using a centralized system comes from consolidating equipment. Housing the major components like boilers and chillers in one facility creates a simpler system that is easier and more cost-effective to maintain. It also allows for the sharing of thermal energy among connected buildings and easy implementation of future advances in technologies and fuel sources on a campus scale.

Heating: A new central plant will house the primary heating equipment for the entire Capitol Campus.

Cooling: A new central plant will house the primary cooling equipment for the entire Capitol Campus.

Power: The emergency power system may remain as standalone, building-by-building, but some technologies (e.g. CHP) would mean some power could be provided by equipment in a new central plant.

Examples of types of technologies that could be implemented under the centralized alternative are:

1) ***Minimum:*** Four-pipe boiler and chiller with new hot and chilled water distribution system.
2) ***Optimal:*** Premium-efficiency four-pipe natural gas-fired CHP with integrated thermal energy storage (TES) and low-temperature heat recovery with a new hot and chilled water distribution system.
3) ***Future:*** Four-pipe distribution system with centralized thermal generation and TES. Incorporation of heat sources/sinks to effectively dispatch and meet campus loads. Fully-electrified or fully-renewable systems. Grid-integrated to take full advantage of balancing intermittent renewables and maximizing the value of installed equipment.

This alternative requires more design effort to ensure that the central plant fits into the vision of the Capitol Campus Master Plan. It has high initial cost, but also brings significant lifecycle cost savings and directly addresses all of the primary project criteria. A centralized system would provide ongoing flexibility for thermal production and backup power, while incorporating new renewable technologies.

3.4 System Selection Summary

Figure 10 shows how responsive each system is to the new legislation mentioned in the Executive Summary, as well as the other identified project criteria.

	BAU	Decentralized	Centralized
Responsive to RCW 70.235.050	No	Yes	Yes
Responsive to RCW 43.21M.040	No	Yes	Yes
Responsive to Executive Order 18-01	No	Yes	Yes
Responsive to Senate Bill 5116	No	Yes	Yes
Incresases continuity of governmentt	No	Yes	Yes
Provides cost-effective solution	No	No	Yes
Reduces carbon footprint	No	Possible	Yes
Improves lifesafety of operations staff	No	Yes	Yes
Allows for future growth	Yes	Yes	Yes
Provides future fuel flexibility	No	No	Yes
Demostrates the State's energy vision	No	No	Yes
Provides emergency electric power	Possible	Possible	Yes

Figure 10. *Criteria Responsiveness*

3.5 Site Alternatives

The BAU alternative relies on the existing Powerhouse site, and the decentralized alternative requires installing equipment at each building throughout the Campus. The centralized alternative is the only alternative that allows for consideration of new sites for the central plant.

In 2014 when the initial analysis for this project began, site analysis was an important piece of the process. A promising site alternative was determined to be the space east of OB2, incorporating the existing 50 Level (below-grade). Site of the previous Dept. of Information Services DATA Center.

In 2017, Schacht Aslani Architects and Mithun, Inc. performed a site analysis to identify future building opportunity sites which provided valuable background on a possible location for a new facility. All of the evaluated sites are part of the Capitol Campus and will not pose any acquisition issues.

In 2019, at the request of Capitol Campus Design Advisory Committee (CCDAC), DES and UMC evaluated the Archives site as a potential second location of a new central plant for the heating and cooling systems.

The criteria being used to compare these three site alternatives fell into five categories:

- **Space:** Available square footage and feasible configuration for major equipment.
- **Access:** Ease of access for construction, utilities, and operations and maintenance personnel.

- **Risk:** Ability to maintain the continuity of government by minimizing risk of system failure.
- **Distribution Efficiency:** Minimizing energy consumption and losses through distribution.
- **Aesthetics:** Compatibility with Campus architecture and minimizing obstruction to views.

Powerhouse Site (BAU Scenario)

There are several inherent risks that will have to be addressed if the Powerhouse site is to be maintained long-term. Given the critical nature of the facility for serving the heating and cooling needs of the majority of the Capitol Campus, it is important to address any potential risks that could affect its operation. Without remediation of the inherent risks at the Powerhouse site, extreme weather or seismic events could result in the long-term disabling of the plant, life safety risk to operating personnel, and disruptions to the continuity of government. For reference, ***Figure 11*** shows an aerial view of the Powerhouse.

***Figure 11**: Powerhouse Site*

Hillside Landslide Risks

The 2009 slope stability analysis conducted by Golder Associates concluded that there is a risk of two types of landslides at the hillside above the Powerhouse. A shallow slide has a high risk of occurring if the hillside is not remediated. A deep slide, though possible, is not likely, but any landslide in that area would result in extensive damage to buildings, Campus infrastructure, and large-scale loss of utility services.

As part of their 2009 report, Golder Associates provided recommendations with approximate cost estimates to address the stability risks on the hillside.

Hillside Remediation	Estimate
Instrumentation	$ 281,000
Soldier Pile Wall	$ 1,107,000
Reinforced Slope at Powerhouse	$ 3,672,000
Vegetation Management	$ 1,278,000
Park / Walk Path	$ 300,000
Subtotal	$ 6,638,000

Flooding

In 2008, GA commissioned a study by Moffatt & Nichol to develop an understanding of the different future management alternatives for Capitol Lake, and included an assessment of future risk from flooding. The study concluded that much of the park infrastructure around Capitol Lake is vulnerable to flooding. The Powerhouse is not subject to flooding itself, but the parking area around it is.

Moffatt & Nichol recommended an approximately 400-foot long perimeter dike structure to protect the parking lot and provide additional protection to the Powerhouse.

Flood Remediation	Estimate
Conceptual Design	$ 74,000
Final Design	$ 618,000
400-foot Dike w/ Permits	$ 1,815,000
Site Preparation and Fill	$ 687,000
Asphalt, Stripping, Landscaping	$ 1,186,000
Subtotal	$ 4,380,000

Seismic Upgrades and Concerns

The Powerhouse structure was seismically retrofitted in the 1980s. The structural frame that was installed is evident. This retrofit is now at least thirty years old and civil and structural codes have changed significantly in that time. By today’s standard, permitting authorities would likely require that the building, including the exterior exhaust stack, be in full compliance with current codes. DES classifies the Powerhouse as a critical facility and believes that permitting authorities would agree. This classification changes the seismic importance factor from a 1.0 (baseline) to a 1.5, which means failure could impair the continued operation of the facility.

Seismic Upgrades	Estimate
Design	$ 244,000
Structural Retrofit	$ 1,756,000
Subtotal	$ 2,000,000

Aboveground Storage Tank Removal

At the Powerhouse site there is an existing 30,000-gallon fuel oil aboveground storage tank. Leaks could contaminate Capitol Lake, the Deschutes River, and Puget Sound, and spread into the hillside.

The Department of Ecology does not require a formal site assessment for the demolition of a storage tank, but it is wise to investigate and document the baseline environmental conditions.

Aboveground Storage Tank Removal	Estimate
Geotechnical Support and Testing	$ 19,500
AST Demolition	$ 980,500
Subtotal	$ 1,000,000

Full costs for brown field remediation, ecological impacts, and addressing contaminated soils would require further study.

Erosion Control of the Slope

It has been observed over the past several years that the slope continues to erode where the flow of the Deschutes River meets the slope in front of the secondary containment system for the aboveground storage tank at the Powerhouse. Without remediation, erosion may undercut and remove support of the tank.

Constructing an erosion mitigation structure in Capitol Lake adjacent to the Powerhouse will require coordination and permitting from state, federal and tribal government agencies. The estimated timeline for obtaining the necessary permits to complete the work is upwards of nine months. Permitting costs and schedule will be dependent on the actual permits required for the project, but the following table demonstrates the approximate cost to remediate the erosion of the bank at the Powerhouse.

Slope Erosion Remediation	Estimate
Design	$ 125,000
Permitting Support	$ 40,000
Construction	$ 835,000
Subtotal	$ 1,000,000

Archives Site

The Archives site is positioned near the center of the Capitol Campus. The current occupants, Secretary of State Archives Division, are being relocated to a new facility in Tumwater when it is completed (scheduled for December 2022). The Archives site is an existing facility adjacent to other existing facilities, an arterial street (Capitol Way), and parking areas. There is some room for an extension on the east side, but space availability is a constraint at this site. Aerial and side views of the Archives site are shown in ***Figure 12.***

Figure 12*: Archives Site*

This site provides opportunity to reuse existing walls and slab-on-grade, and there is an existing stack conveniently located in the adjacent Highways and Licensing Building that could be repurposed for the new central plant. Being near the center of Campus, this site is in a slightly better position for the distribution system.

Selection of this site would impact the geometry of the new central plant, construction laydown areas are limited, and construction would require a moderate level of shutdowns on Capitol Way. This would restrict access to the Plaza Garage and parking near the Highways and Licensing Building. This site also provides difficult access to the Campus electrical feeders.

OB2 + 50 Level Site

The third site alternative for the new central plant is on East Campus adjacent to OB2 and incorporates the 50 Level (below-grade basement level). The central plant would be designed to blend with the surrounding Campus architecture. New landscaping could also be included to satisfy Capitol Campus Design Advisory Committee (CCDAC) requests.

There are several inherent advantages to this location:

- Close proximity to the existing Campus electrical substation and natural gas lines that will be required
- Provides access for distribution piping for centralization of all Campus district energy systems
- Eliminates the inherent risks currently associated with the existing Powerhouse location
- Allows for a more flexible building configuration compared to the other site alternatives
- Minimizes aesthetic impact, sightlines, and noise by using existing underground space

Diagrams for two possible configurations have been drafted for this site. Both configurations have an approximately 40,000-square-foot footprint and are two-story facilities. The bar configuration, ***Figure 13***, is narrow with a photovoltaic array to support the production of electricity featured on the roof. The cone configuration, ***Figure 14***, allows for a larger green roof area and features the cooling tower. The cone configuration is the alternative that is reflected in the cost estimates.

3.6 Site Selection Summary

The responsiveness of each of the sites in relation to the decision criteria was scored on a scale of 1 to 5, 5 being the best. The table of results is shown in ***Figure 15.***

Figure 13: *Schematic Drawing of Bar Configuration*

Figure 14: *Schematic Drawing of Cone Configuration*

	PH	Arch	OB2
Space	2	2	5
Accessibility	5	3	5
Risk	1	5	5
Distribution	3	5	4
Aesthetics	5	3	4
Total	**16**	**18**	**23**

Figure 15: *Site Selection Table*

3.7 Summary of Life Cycle Cost Model Results

The 2018 Washington State OFM Life Cycle Cost Model (LCCM) is very good at cost/benefit comparison, but is primarily focused on single-building projects that occur within a single construction period. In order to capture the complexity of the NC3 project, UMC used OFM

LCCA tool as a basis to develop a separate but similar tool to include:

- Modifications and additions required to incorporate future facilities
- Modifications and upgrades to existing facilities
- Anticipated system renewals
- Energy consumption comparison

Summaries of the LCCM costs and Schedule Estimates for both 30 years and 50 years are shown in ***Figures 16 and 17,*** respectively. For more information, refer to Appendix A.3 LCCM Details.

Results from the system selection (***Figure 10*** in Section 3.4), site selection (***Figure 15***), and LCCM results point to the preferred alternative of:

- **System:** Centralized
- **Technology:** CHP and TES using hot water
- **Fuel:** Natural Gas and Electricity
- **Site:** OB2 + 50 Level

The implementation of this project will provide the Capitol Campus with the most significant step forward in meeting the project goals that can realistically be executed at this point in time. It will also provide a path to meet the long-term goal of carbon neutrality.

Present Value (30-Year)	BAU	Decentralized		Centralized	
	Natural Gas	Natural Gas	All-Electric	Natural Gas	All-Electric
Capital Cost					
Capital Recovery - Debt Service (Loan 1)	$ -	$ 70,837,969	$ 78,701,939	$ 96,903,357	$ 96,591,319
Capital Recovery - Debt Service (Loan 2)	$ 18,163,857	$ 33,171,392	$ 36,853,864	$ 45,377,066	$ 45,230,948
Future Building Connections	$ 14,852,018	$ 17,580,018	$ 17,580,018	$ (999,086)	$ (999,086)
Subtotal - Capital Cost	**$ 33,015,875**	**$ 121,589,379**	**$ 133,135,821**	**$ 141,281,337**	**$ 140,823,181**
Fixed Operating Cost					
Major Overhaul	$ 8,160,530	$ -	$ -	$ 2,777,676	$ 2,777,676
Major Renewal	$ 41,041,512	$ 11,236,204	$ 10,627,727	$ 1,157,651	$ 1,157,651
Operating Labor	$ 50,054,532	$ 51,336,268	$ 51,336,268	$ 29,259,558	$ 29,259,558
Minor Repair	$ 30,198,258	$ 36,507,158	$ 36,507,158	$ 31,254,191	$ 21,688,831
Other Costs	$ -	$ 405,469	$ 405,469	$ 405,469	$ 405,469
Subtotal - Fixed Operating Cost	**$ 129,454,832**	**$ 99,485,099**	**$ 98,876,622**	**$ 64,854,545**	**$ 55,289,185**
Variable Operating Cost					
Gas	$ 28,486,572	$ 11,173,381	$ 1,566,529	$ 54,159,181	$ 1,566,529
Electricity	$ 140,287,913	$ 130,204,739	$ 143,874,087	$ 74,888,495	$ 156,927,912
Potable Water/Wastewater	$ 4,858,737	$ 4,626,319	$ 4,626,319	$ 4,651,701	$ 4,651,701
Carbon	$ 50,352,974	$ 41,209,673	$ 41,430,639	$ 41,291,230	$ 45,087,259
Chemicals	$ 5,311,611	$ 5,118,858	$ 5,763,449	$ 5,167,084	$ 5,167,084
Subtotal - Variable Cost	**$ 229,297,807**	**$ 192,332,970**	**$ 197,261,024**	**$ 180,157,691**	**$ 213,400,485**
Present Value Summary (30 Year Costs)					
Capital Recovery	$ 33,015,875	$ 121,589,379	$ 133,135,821	$ 141,281,337	$ 140,823,181
Fixed Operating Costs	$ 129,454,832	$ 99,485,099	$ 98,876,622	$ 64,854,545	$ 55,289,185
Variable Operating Costs	$ 229,297,807	$ 192,332,970	$ 197,261,024	$ 180,157,691	$ 213,400,485
Total Costs	**$ 391,768,514**	**$ 413,407,448**	**$ 429,273,467**	**$ 386,293,573**	**$ 409,512,851**
Net Present Value		$ (21,638,934)	$ (37,504,953)	$ 5,474,941	$ (17,744,337)
Schedule					
Start Date	10/7/2021	10/7/2021	10/7/2021	10/7/2021	10/7/2021
Midpoint Date	6/7/2023	6/7/2023	6/7/2023	6/7/2023	6/7/2023
Completion Date	2/4/2025	2/4/2025	2/4/2025	2/4/2025	2/4/2025

Figure 16*: 30-Year LCCM Results and Schedule Estimates*

Present Value (50-Year)	BAU	Decentralized		Centralized	
	Natural Gas	Natural Gas	All-Electric	Natural Gas	All-Electric
Capital Cost					
Capital Recovery - Debt Service (Loan 1)	$ -	$ 70,837,969	$ 78,701,939	$ 96,903,357	$ 96,591,319
Capital Recovery - Debt Service (Loan 2)	$ 18,163,857	$ 33,171,392	$ 36,853,864	$ 45,377,066	$ 45,230,948
Future Building Connections	$ 23,567,934	$ 24,676,125	$ 24,676,125	$ 20,683,270	$ 20,683,270
Subtotal - Capital Cost	**$ 41,731,790**	**$ 128,685,485**	**$ 140,231,928**	**$ 162,963,693**	**$ 162,505,536**
Fixed Operating Cost					
Major Overhaul	$ 15,654,077	$ -	$ -	$ 22,615,073	$ 22,615,073
Major Renewal	$ 78,599,325	$ 41,931,233	$ 40,148,733	$ 2,582,554	$ 2,582,554
Operating Labor	$ 89,989,141	$ 92,893,566	$ 92,893,566	$ 51,117,508	$ 51,117,508
Minor Repair	$ 53,928,568	$ 69,047,822	$ 69,047,822	$ 57,064,488	$ 38,517,013
Other Costs	$ -	$ 405,469	$ 405,469	$ 405,469	$ 405,469
Subtotal - Fixed Operating Cost	**$ 238,171,110**	**$ 204,278,091**	**$ 202,495,591**	**$ 133,785,093**	**$ 115,237,618**
Variable Operating Cost					
Gas	$ 46,746,613	$ 17,052,070	$ 1,566,529	$ 93,859,377	$ 1,566,529
Electricity	$ 189,851,676	$ 177,343,618	$ 194,621,036	$ 89,072,497	$ 215,920,507
Potable Water/Wastewater	$ 5,436,134	$ 5,202,507	$ 5,202,507	$ 5,243,836	$ 5,243,836
Carbon	$ 72,753,564	$ 58,824,239	$ 58,360,604	$ 58,775,434	$ 64,768,099
Chemicals	$ 5,979,748	$ 5,763,449	$ 5,763,449	$ 5,841,975	$ 5,841,975
Subtotal - Variable Cost	**$ 320,767,736**	**$ 264,185,882**	**$ 265,514,125**	**$ 252,793,119**	**$ 293,340,946**
Present Value Summary (50 Year Costs)					
Capital Recovery	$ 41,731,790	$ 128,685,485	$ 140,231,928	$ 162,963,693	$ 162,505,536
Fixed Operating Costs	$ 238,171,110	$ 204,278,091	$ 202,495,591	$ 133,785,093	$ 115,237,618
Variable Operating Costs	$ 320,767,736	$ 264,185,882	$ 265,514,125	$ 252,793,119	$ 293,340,946
Total Costs	**$ 600,670,636**	**$ 597,149,459**	**$ 608,241,643**	**$ 549,541,905**	**$ 571,084,100**
Net Present Value		$ 3,521,178	$ (7,571,007)	$ 51,128,731	$ 29,586,536
Schedule					
Start Date	10/7/2021	10/7/2021	10/7/2021	10/7/2021	10/7/2021
Midpoint Date	6/7/2023	6/7/2023	6/7/2023	6/7/2023	6/7/2023
Completion Date	2/4/2025	2/4/2025	2/4/2025	2/4/2025	2/4/2025

***Figure 17**: 50-Year LCCM Results and Schedule Estimates*

4

Detailed Analysis of Preferred Alternative

4. Detailed Analysis of Preferred Alternative

A centralized district energy system shows the most potential as the NC3 system. The core aspect of this system begins with the conversion from an inefficient, high-temperature steam distribution system to a lower-temperature heating hot water system. This initial step provides significant energy and operational savings while setting the stage and providing flexibility for the application of efficient thermal production technologies. The initial primary production source would be combined heat and power (CHP) coupled with thermal energy storage (TES). The transition would also include installing high-efficiency hot water boilers as a supplemental heating source for peak loads and backup. The CHP system would be designed and operated in a “heat load following” mode, to ensure maximum energy efficiency was achieved from the system.

The chilled water system would also be centralized, utilizing heat recovery chillers, high-efficiency centrifugal chillers, and potentially absorption/ adsorption cooling, which could be used to take advantage of additional waste heat. And, provide the ability to move thermal energy between buildings based on need. The proposed distribution system will be designed to handle future load growth over the next 50 years and beyond, as identified in coordination with the Campus master planning team during the development of this project.

4.1 Facility Requirements

In response to the predesign criteria to describe the basic space requirements, the criteria were adapted to fit this project. The new central plant for the primary NC3 equipment is anticipated to be a two-story building about 40,000 square feet. The size is driven by the energy load of Campus buildings and this space will primarily house equipment; human occupancy is expected to be minimal. International Building Code occupancy classifications may include business, factory, storage, and utility.

Anticipated central plant equipment for the CHP plant would include boilers, chillers, pumps, storage tanks, and a cogeneration system. The design is not yet complete and this concept specifically allows for future expansion, so the exact number and sizes of equipment are not yet selected.

Aside from equipment in central plant, steam distribution piping in the tunnels and utilidors will be replaced with hot water piping. Prefabricated energy transfer stations will be installed in mechanical rooms of all connected buildings.

Figure 18 shows the anticipated heating and cooling loads, as well as square footage and average electric power consumption. These values drive the system and facility size. It can be seen that both the BAU (Powerhouse) and centralized CHP alternatives can satisfy the anticipated heating load, but the Powerhouse does not have the capacity to serve the Campus cooling load nor will it provide electric power.

		Anticipated Annual Loads		
		Heating	Cooling	Electric
Facility	SF	(MMBtu/h)	(Tons)	(avg MW)
Archives Bldg	51,500	1.11	70	0.246
Cherberg	100,377	6.35	275	0.201
Employment Security	93,200	3.76	240	0.150
GA Bldg.	283,865	2.29	600	0.568
Highway-License	193,900	6.22	320	0.311
Insurance	65,502	2.66	100	0.131
Legislative	235,500	11.78	650	0.471
Natural Resources (MUA)	387,558	3.88	700	0.672
Newhouse	25,084	0.52	0	0.050
OB-2	379,204	15.65	900	0.532
O'Brien	100,700	9.33	250	0.103
Pritchard (Library)	55,485	2.99	95	0.049
Temple of Justice	85,900	2.56	120	0.059
Capital Court	40,948	1.63	96	0.082
Future Expansion - 1 (Newhouse site)	200,000	6.06	400	0.400
Transportation	206,100	6.00	500	0.565
Future Expansion - 2	225,000	6.82	450	0.450
Future Expansion - 3	200,000	6.06	400	0.400
Governor's Mansion	21,400	3.22	35	0.043
Helen Sommers Building	225,000	6.51	300	0.450
Jefferson Building - Office / Retail	240,594	7.29	480	0.481
Jefferson Building - Datacenter	132,503	0.00	2000	0.265
Future Expansion - 4	200,000	6.06	400	0.400
Total	3,749,320	119	9,381	7.08
Diversity Factor		0.88	0.80	
Diversified Peak		**75**	**5,028**	**14.16**
BAU Capacity		**145**	**8,691**	**15.0**
Centralized NC3 Plant Capacity		**90**	**6,000**	**2.6**

Figure 18: *Anticipated Load Table*

Stormwater Requirements

The new central plant will create new impervious surface on a portion of the sloping field on the east side of OB2. Stormwater collection and conveyance will be provided to existing City of Olympia stormwater infrastructure. No onsite stormwater management is anticipated, but this must be confirmed during final design. Onsite stormwater management may be problematic at this relatively small site. Furthermore, there may be some opportunity for rainwater harvesting as a sustainability feature.

Easements and Setback Requirements

Depending the final design and site selection, easements and setbacks may be required. When the design is further developed, easement and setback requirements should be investigated.

Information Technology Requirements

The NC3 central plant energy management and control system (EMCS) will network all NC3-connected buildings to the new central plant for continuous central monitoring and control. Enabling the central plant to run automatically at its most efficient. This will also include utility grade sub-metering of connected buildings.
Plant personnel will monitor for safety.

4.2 Significant Components

Combined Heat and Power

CHP, also known as cogeneration, was identified as the technology with the most potential for addressing the primary project criteria of the NC3 project. Most conventional power plants produce waste heat as a byproduct of generating electricity, then discharge this valuable heat resource to the atmosphere. Standard power plants effectively use just 40% of the fuel they burn to produce electricity. The rest of the energy is released as waste heat. CHP offers the opportunity to generate electricity locally and capture the waste heat to serve buildings.

Another significant source of heat loss is the distribution system. Every district energy system loses energy through distribution, but heat loss is proportional to the difference in temperature, so transitioning from steam to hot water (a lower-temperature medium) will inherently reduce those losses. Addressing those two sources of energy loss would contribute to a major jump in efficiency from the verified 34% to around 85%.

The primary power source options for CHP systems are reciprocating engines and turbines. Both systems have been proven throughout the country and the world in thousands of cogeneration plants. They are both fairly easy to install, can operate efficiently on a variety of fuels, and first costs per kW are relatively low. Neither technology is necessarily superior to the other as each has attributes that make it more suitable for specific applications.

Natural gas reciprocating engines are generally more fuel-efficient than turbines in pure electric power applications. They have lower initial cost per kW in smaller projects (less than 5 MW) and are more tolerant of high altitudes and high ambient temperatures. They operate on low-pressure fuel (up to 5 psi) which eliminates the costs to install and operate a gas compressor system.

While the utilization of utility-provided natural gas is the most common application, engines readily accept many alternative fuels, such as biogas, digester gas, landfill gas, and even specialized fuels like coke gas and coal mine methane. These engines have multiple recoverable heat sources including exhaust, jacket water, aftercooler, and oil cooler. These recovered heat resources can be used to produce hot water.

Natural gas turbines, the other primary power source for CHP systems, produce fewer emissions than reciprocating engines and have a high heat-to-power ratio. They are best suited for loads above 5 MW that require high-temperature exhaust. Since the NC3 load is anticipated to be up to 2.6 MW and a low-temperature system, cost estimates are based on a CHP natural gas reciprocating engine.

CHP is also a technology heavily backed by the US Department of Energy (DOE). The DOE has CHP technical assistance partnerships (CHP TAPS) throughout the country, providing free evaluation and assistance in development of CHP projects. The DOE lists many benefits for the end use of a

CHP system and the broader regional/national benefits of CHP systems.

Thermal Energy Storage

Hot water thermal energy storage (TES) is a means to collect and productively use waste heat from equipment like CHP reciprocating engines and heat recovery chillers. This utilization of thermal storage will work to improve the overall operating efficiency of the heating system by decoupling the generation and distribution of thermal energy. Energy is stored to support the heating demand during both low-load periods (e.g. nighttime and weekend hours) and peak periods (e.g. mid-day in winter). Low-load periods can use the stored energy instead of actively running equipment to support the load, and peak periods can utilize both stored energy and the full capacity of the CHP equipment to provide heat. This allows the system design to incorporate CHP equipment with a lower installed capacity which reduces the first capital cost as well as operating in the most efficient manner, reducing operating expenses. Similarly, TES can be used for chilled water system applications and may be incorporated in the NC3 final design.

Visual Mitigation

Appropriate steps will be taken to minimize any perceived adverse visual impact by consulting with CCDAC. For example, the bar configuration (***Figure 13*** in Section 3.5) has tanks hidden in trees and landscaping to the south of the lot and the cone configuration (***Figure 14***) has tanks inside on the north end of the central plant.

4.3 Distributed Generation

CHP coupled with TES creates a “smart grid”-compatible facility capable of working cooperatively with the local utility in modes of operation that benefit both the Capitol Campus and the utility. An example is afternoon CHP operation in the late summer and fall when hydroelectric resources can be limited, and storing the waste heat in the TES tanks. This type of operation would help the local utility especially as Washington eliminates coal-generated power and contemplates dam removal on the Snake and Columbia Rivers.

CHP with TES also makes a campus and utility more resilient against utility source power interruptions from transmission lines and central power production facility outages (wildfires, flooding, earthquake, terrorist, etc.).

4.4 Master Plan and Policy Coordination

This project supports the:

- **Governor's Results Washington**
  - Efficient, effective, and accountable government
    - 1.1 Increase customer satisfaction
    - 2.2 Reduce the cost of energy at state-owned facilities
- **DES Strategic Framework and Business Plan**
  - Vision - Enable government to best serve the people of Washington.
    - Deliver exceptional services
    - Reduce the overall cost of government operations
    - Set a standard for continuous improvement
- **2006 Master Plan for the Capitol of the State of Washington**:
  - Principle 2 – Provide facilities that support state agencies’ effective and efficient delivery of public services
  - Principle 3 – Facility projects employ the highest standards of environmental protection
  - Principle 4 – Preserve historical properties
  - Principle 5 – Quality designs at the Capitol Campus
  - Principle 6 – Use high-performance standards for major building rehabilitations
  - Principle 7 – Protect citizen’s investment in state facilities, responsibility for state facilities rests equitably on those who benefit
- **DES Leadership Model – Big 3 Initiatives:**
  - Improve Customer Satisfaction
  - Team Member Satisfaction
  - Financial Health
- **DES Capital Plan priorities for excellence in stewardship, safety, and sustainability.**

The project also helps DES achieve the carbon and energy reduction goals set by Executive Orders 18-

01 and 13-04, RCW 70.235.050, and RCW 43.21M.040.

4.5 Laws and Regulations

Federal, state, and local codes or regulations are applicable to the use and operation of the facility. All work installed under this project will meet the requirements of the following codes:

- International Building Code and appendices thereto pertaining to building accessibility, not including the adoption of the incorporated electrical codes, plumbing codes, fire codes, or property maintenance codes other than specifically referenced subjects or sections of the International Fire Code, but including the incorporated International Residential Code, International Mechanical Code, International Fuel Gas Code, and International Energy Conservation Code.
- IAPMO/ANSI UMC-1 Uniform Mechanical Code
- IAPMO/ANSI UPC-1 Uniform Plumbing Code
- ASME/ANSI A17.1 Safety Code for Elevators and Escalators
- ICBO Uniform Code for Building Conservation
- NFPA 13, Fire Sprinkler Systems
- NFPA 70, National Electrical Code (NEC)
- NFPA 72, Fire Alarm Systems
- Washington State Energy Code (WSEC)
- Revised Code of Washington (RCW)
- Washington Administrative Code (WAC)
- Washington State Ventilation and Indoor Air Quality Code
- Olympic Region Clean Air Agency (ORCAA) requirements
- All applicable City of Olympia codes

High-performance public buildings (Chapter 39.35D RCW)

The three primary objectives of this project (cost, continuity, and carbon) are driven by the need to increase the performance of the Campus heating system. This project is intended to be performed through the Energy Savings Performance Contracting (ESPC) program within DES, and that process includes ongoing measurement and verification.

Greenhouse gas emissions reduction policy (RCW 70.235.070)

DES is committed to reaching carbon reduction goals. Responding to RCW 70.235.070 is one of the primary objectives of this project. Though carbon emissions are at an all-time low at the Capitol Campus, NC3 will put the Campus on the path to carbon neutrality by allowing for easy implementation of future low-carbon technologies and lower cost alternatives for Campus building renewals. New legislation has shortened the timeline for electric utilities to be carbon neutral by 2030 and carbon-free by 2045; NC3 allows for regular analysis of the best available technologies to continually decrease emissions on the Campus.

State efficiency and environmental performance (Executive Order 18-01)

Environmental performance is a primary objective of this project, and efficiency plays a significant role in cost and carbon reduction. Analysis of the existing system shows an overall efficiency of around 34%; the NC3 is designed to raise that figure significantly by reducing distribution losses and installing individual units that use fuel more effectively and take advantage of otherwise wasted energy.

Archeological and cultural resources (Executive Order 05-05 and Section 106 of the National Historic Preservation Act of 1966)

The Department of Archaeology and Historic Preservation (DAHP) has been contacted and DES is committed to working with DAHP should the preferred site be identified to impact any cultural resources.

Americans with Disabilities Act (ADA) implementation (Executive Order 96-04)

Any facilities constructed for this project will be built in compliance with the requirements of the Americans with Disabilities Act.

Compliance with planning under Chapter 36.70A RCW, as required by RCW 43.88.0301

Capital budget instructions—Additional information—Staff support from office of community development.

(1) The office of financial management must include in its capital budget instructions, beginning with its instructions for the 2003-2005 capital budget, a request for "yes" or "no" answers for the following additional informational questions from capital budget applicants for all proposed major capital construction projects valued over five million dollars and required to complete a predesign:
   (a) For proposed capital projects identified in this subsection that are located in or serving city or county planning under RCW 36.70A.040: **NO**
   (b) For proposed capital projects identified in this subsection that are requesting state funding: **YES**
      (i) Whether there was regional coordination during project development; **YES**
      (ii) Whether local and additional funds were leveraged; **NO**
      (iii) Whether environmental outcomes and the reduction of adverse environmental impacts were examined. **YES**

Incorporation of adaptation plans of action by state agencies (RCW 43.21M.040)

State agencies shall strive to incorporate adaptation plans of action as priority activities when planning or designing agency policies and programs. Agencies shall consider the integrated climate change response strategy when designing, planning, and funding infrastructure projects, and incorporating natural resource adaptation actions and alternative energy sources when designing and planning infrastructure projects.

4.6 Problems for Further Study

Carbon Emission Rate of Electricity

Although CHP would burn more natural gas than the current system, life cycle modeling for this report shows an overall reduction in carbon emissions due to the production of electricity locally instead of relying on the electric utility. This is due to the use of marginal electricity emission rates as published in OFM's life cycle modeling tool. The carbon dioxide equivalent emission rate of electricity (MT CO2e / kWh) from utilities changes depending on the utility's energy sources. Typically, Washington's electricity is generated from several sources including hydroelectric, natural gas, and coal. Depending on how much of each fuel a utility uses, the carbon emission rate will fluctuate. Analysis for this report applied a constant emission rate based on data from 2009 - 2011. New legislation expedites the goal of electric utilities being carbon neutral by 2030 (and carbon-free by 2045), so the emission rate is projected to decrease over time.

Figure 19 shows two options of modeling the emission rate; the constant model (blue) used for this report and the dynamic model (orange) which assumes the emission rate declines steadily to meet the goal of electric utilities being carbon neutral by 2030. ***Figure 20*** uses the emission rates from ***Figure 19*** to show the total carbon emissions per year. The constant emission factor model shows CHP (darker lines) producing fewer emissions than BAU (lighter lines), while the

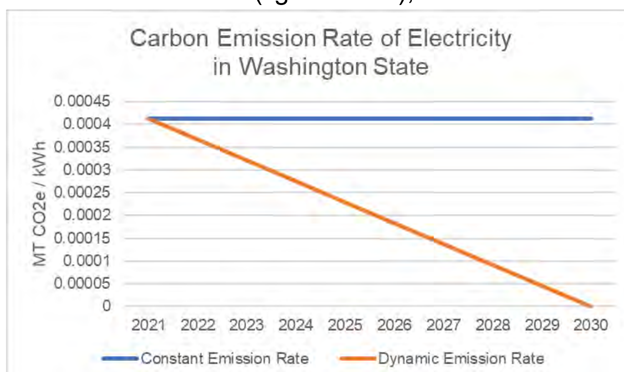


***Figure 19**: Projected Carbon Emission Rates*

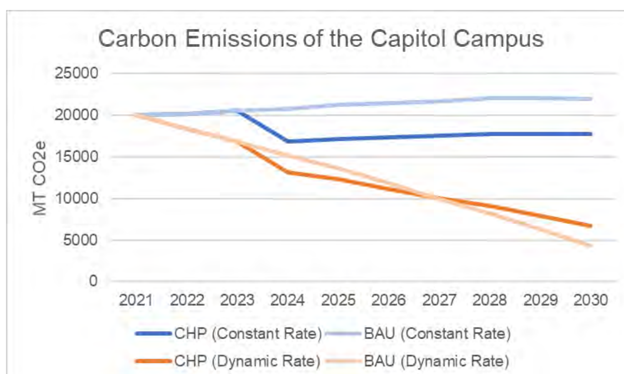


***Figure 20**: Constant vs. Dynamic Model*

dynamic emission factor model shows CHP producing fewer emissions only from 2023 to 2027, the plant would reduce emissions on day one of operation. Looking back at ***Figure 19***, the turning point occurs when the emission rate is approximately .00014 MT CO2e / kWh.

NC3 is intended to accommodate future technologies as more efficient or more green equipment comes to market. Initial conversations between DES and LOTT Clean Water Alliance show interest in producing renewable gas from the wastewater treatment facility. This could be available within the expected life of the CHP unit. There are also other large entities, such as Port of Seattle, publishing requests for proposals of renewable natural gas (RNG) on long-term contracts from outside entities. In addition to RNG there are also several emerging technologies such as renewable hydrogen and pyrolysis oil (bio-oil) that could become feasible for implementation.

Additionally, the CHP unit could be replaced at its end of life with another low-carbon technology to continue to reduce the Campus' carbon footprint.

Harmonize with Capitol Campus Master Plan

Future collaboration will be required to ensure that this project and the plan are consistent with each other. NC3 currently supports future flexibility for Capitol Campus development.

4.7 Commissioning

UMC will provide the initial start-up and commissioning of the system to ensure that it operates per the proposed criteria. Systems must be operated per the proposed criteria to ensure energy cost savings are realized. The commissioning report will be provided to the DES within 90 days of completion of the project. Performance of the system is guaranteed under the ESPC program with ongoing measurement and verification used to validate the performance and uphold the performance guarantee. DES recommends a 10-year M&V plan.

4.8 Future Expansion

As a centralized system, all current and future Capitol Campus facilities are expected to be connected to the new central plant. New facilities (each roughly 200,000 square feet) are anticipated to be constructed and connected to the centralized system in 2020, 2025, 2035, and 2045.

In addition to the anticipated load growth from future facilities, there is the potential for ongoing load reduction at existing facilities due to demand-side conservation efforts. This potential concurrent load reduction could free up capacity. It is anticipated that this available capacity could create opportunities to further expand the overall district energy system for service to a growing facility base. Any future expansion would serve to increase the system's financial and carbon benefits.

4.9 Delivery Method and Project Management

The preferred project delivery method is through the Energy Savings Performance Contracting (ESPC) program within the DES, as authorized in Chapter 39.35C RCW.

ESPC is a methodology for identifying, implementing, and financing energy and utility efficiency projects. ESPC is authorized under RCW 39.35A.030 for public sector agencies, including state agencies. DES is directed in RCW 39.35C.010 to assist state agencies in implementing conservation projects by providing technical and analytical support, including procurement of performance based contracting services. Under ESPC, agencies work with an ESCO to identify, develop, and implement projects that save utility costs, reduce maintenance expense, and reduce greenhouse gas emissions. DES provides an assigned project manager for each client agency and project to assist with ESCO selection, project analysis and development, contract management, financing guidance, project quality assurance, and measurement and verification of energy savings.

Over the last two decades, DES has periodically evaluated the Capitol Campus steam system, seeking to improve its efficiency, reliability, and provide for future needs on the Capitol Campus.

In the 2013-2015 Capital Budget, DES received combined funding to replace two 40-year-old chillers, investigate ways to reduce the energy consumption of the steam system, and address steam system safety issues through an Energy Savings Performance Contracting (ESPC) project.

A total of five Energy Services Companies (ESCOs) from the DES-maintained list of pre-qualified companies were asked to participate in a walkthrough examination of the Capitol Campus central plant and steam distribution system. Oral interviews were then conducted where each firm provided a review of their findings and what their proposed solution might look like.

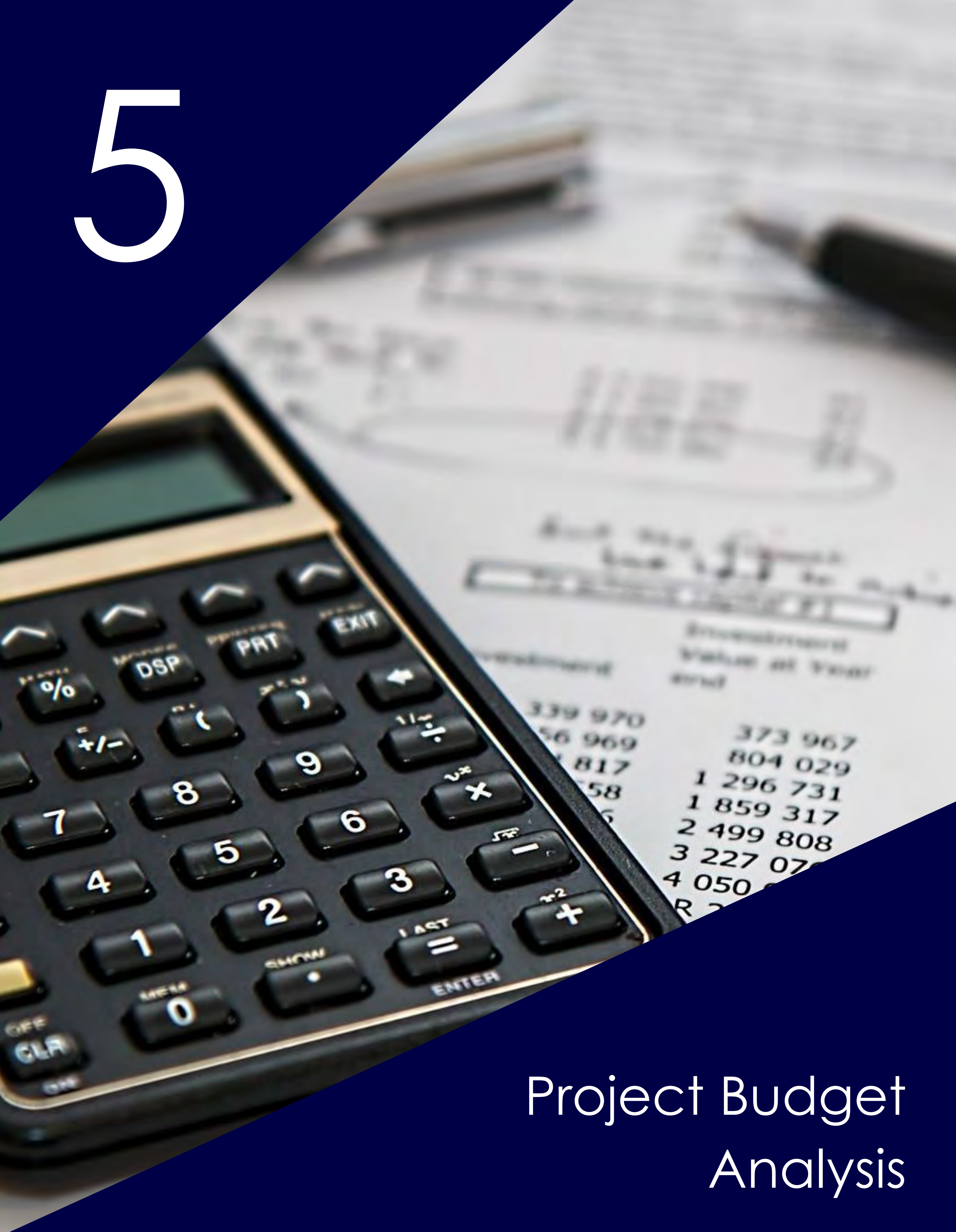
UMC, Inc. was selected because of their attention to detail and their experience with large complex projects involving heating and cooling plants, especially in a campus setting. As an ESPC project, value engineering and constructability review are not required from separate entities or through a bidding process.

4.10 Schedule

The project will be designed and constructed over two biennia, and the project schedule can be found on the following page. There are no anticipated delays to the project (covering delays due to permitting, local government ordinances, or neighborhood issues). All of the site alternatives are owned by the state, are already part of the Capitol Campus, and are well-known by DES and UMC. Additionally, local jurisdiction will be contacted in the design phase of the project and stakeholder meetings are part of the process over 2019 and 2020.

Task Name	Duration	Start	Finish
CAPITOL CAMPUS - PROJECT DEVELOPMENT SCHEDULE	1458 days	08/28/20	03/31/26
Funding and Contract	306 days	08/28/20	10/29/21
DES Submit to Legislature	33 days	08/28/20	10/13/20
Legislature Budget Preparation	126 days	10/14/20	04/07/21
Legislature Session - Funding	124 days	04/08/21	09/28/21
Receive Notice to Proceed	0 days	09/28/21	09/28/21
Sign Contract	1 month	09/29/21	10/26/21
Preconstruction	380 days	10/27/21	04/11/23
Design Development	2 months	10/27/21	12/21/21
Schematic Design	2 months	12/22/21	02/15/22
60% CD Design Documents	2 months	10/27/21	12/21/21
90% CD Design Documents	3 months	12/22/21	03/15/22
Document Review Process	2 months	03/16/22	05/10/22
Analyze and Recommend Critical Scopes	1 month	05/11/22	06/07/22
Permits - City and Local Agencies	4 months	05/11/22	08/30/22
Federal and Local Utilities Rebate Process	6 months	10/27/21	04/12/22
Construction Documents - 100% CD	2 months	08/31/22	10/25/22
Internal Final Cost Budget Review	15 days	10/26/22	11/15/22
Submittals	2 months	10/26/22	12/20/22
Early Bid Packages and Procurement of Long-Leadtime Items	6 months	10/26/22	04/11/23
Construction	595 days	10/26/22	02/04/25
Early Bid Packages and Procurement of Long-Leadtime Items	8 months	10/26/22	06/06/23
Site Civil Work	1.5 months	10/26/22	12/06/22
New Central Plant	400 days	12/07/22	06/18/24
Foundations	1.5 months	12/07/22	01/17/23
Steel Erection	1.5 months	01/18/23	02/28/23
Concrete	2 months	03/01/23	04/25/23
Roofing	1.5 months	04/26/23	06/06/23
Exteriors	2 months	06/07/23	08/01/23
Storefront and Windows	1 month	08/02/23	08/29/23
Carpentry	1.5 months	08/30/23	10/10/23
Finishes	2.5 months	10/11/23	12/19/23
Elevators	0.5 months	12/20/23	01/02/24
Plumbing	4 months	01/03/24	04/23/24
Mechanical	6 months	01/03/24	06/18/24
Electrical	5 days	01/03/24	01/09/24
PSE Connections	1 week	01/03/24	01/09/24
Controls	3 months	01/03/24	03/26/24
Clean-Up	2 weeks	01/03/24	01/16/24
District Piping Systems	240 days	12/07/22	11/07/23
UG Utilities and Trench Piping Systems	12 months	12/07/22	11/07/23
Building Energy Transfer Station (ETS) Connections	10 months	11/08/23	08/13/24
Building Heating Hot Water System Conversions	10 months	11/08/23	08/13/24
Startup and Commissioning	4 months	08/14/24	12/03/24
Substantial Completion	30 days	12/04/24	01/14/25
Final Fire Marshall Inspections	1 week	12/04/24	12/10/24
Punch lists	30 days	12/04/24	01/14/25
UMC Internal	2 weeks	12/04/24	12/17/24
Architect/Engineer	2 weeks	12/18/24	12/31/24
DES/Owner	2 weeks	01/01/25	01/14/25
DES Final ESPC Checklist/Inspection	1 week	01/15/25	01/21/25
Owner Occupancy	2 weeks	01/22/25	02/04/25
Project Completion	0 days	02/04/25	02/04/25
Measurement and Verification	3 months	02/05/25	04/29/25
Continuous Commissioning	12 months	04/30/25	03/31/26

5



Project Budget Analysis

5. Project Budget Analysis

5.1 Cost Estimates

30- and 50-year lifecycle cost models (LCCMs) were completed for this project and a complete discussion of the 50-year LCCM can be found in the separate Energy Services Proposal (ESP) and Investment Grade Audit (IGA) documents. The LCCM for the preferred alternative was developed in 2016 as a guaranteed maximum price and formed the basis of the ESP. The other alternatives are rough order of magnitude estimates (targeting < 25% error) and are meant to provide equivalency to compare alternatives during the development process. Estimates are based on similar recent projects by UMC. See Appendix A.3 for the LCCMs and Appendix A.4 for the Uniformat Level II cost estimate and C-100 form.

The LCCMs developed by UMC employ a "total cost of ownership" approach. This method of cost analysis encompasses all costs likely to be incurred over the entire 30- and 50-year term for each alternative considered. These expenditures included capital construction costs (owner equity and debt service), fixed variable costs (equipment overhaul, system renewal, operating labor, minor repairs), and variable operating costs (energy and utility costs). Additional consideration was given to near future costs such as the social cost of carbon. It should be noted that this analysis is focused on a comparison of the potential savings that could be documented based on the budget items identified by DES. These projected costs are not intended to identify all costs associated with the heating and cooling systems outside of the identified scope or for individual building level operation costs beyond those identified at the energy transfer station connection to the district energy distribution system. Unidentified costs that currently exist as part of the BAU alternative are assumed to continue following the implementation of the proposed project, however, the differential cost savings will remain the same.

All costs shown in the LCCMs are 30- and 50-year present value cumulative costs. Similarly, the net present value is a 30- and 50-year cumulative cost and is calculated by subtracting the 30- and 50-year total cost of each alternative from the 30- and 50-year total cost of BAU.

Separate from this LCCM, a simplified cash flow analysis has been performed to illustrate the funding of this project and payback of potential treasury loans. The costs shown in this analysis include the estimated variable cost savings (energy and utility) and fixed cost savings (operating, renewal, and minor repairs) as shown in the LCCM, but excludes the overall complexity of the LCCM to give a simpler view of the ongoing cashflow.

Construction Contingency

Construction contingency is defined as follows: latent conditions contingency, Owner-directed contingency, design contingency, scheduling contingency, and re-commissioning contingency. As approved by the Owner, UMC is authorized to utilize this contingency for items necessary to complete the original intended scope of this project. This can be done following review and approval by the Owner and DES.

1) **Latent conditions contingency** is an allowance provided within the contract on the assumption that latent or unknown conditions do exist related to existing systems, facilities or the facility sites. The discovery of these latent conditions could not have been reasonably known prior to construction. Furthermore, the Owner has disclosed all adverse conditions that are known or could be reasonably known prior to construction. These conditions may include, but are not limited to: defects, malfunctions, or obsolescence in systems being modified or in supporting systems; systems and conditions required to be upgraded to meet current or new building or safety codes; defective structures; discovery of hazardous materials including asbestos; buried utilities or underground obstructions; etc. Such conditions when uncovered shall be dealt with in the course of the project and the project responses to the unknown conditions shall be treated as change orders.

2) **Owner-directed contingency** is an allowance to accommodate adjustments to scope directed by the Owner through change orders as outlined below:

a) Change orders for Owner-directed Changes requiring price adjustments, if any, shall be funded from the construction contingency allowance; but only when additional funds are available following the completion of the primary scope of work identified in this document. The Owner may contribute additional funds for additions or changes to the scope if available.
b) In addition, such changes may delay the contract schedule or contiguous tasks or both. UMC shall be entitled to equitable adjustments to the schedule. Such schedule adjustments and the resultant price of such adjustments shall be included in the change order.

3) **Design contingency allowance** is used to provide small project adjustments to contract costs due to minor errors, happenstance or minor circumstances outside of the control of UMC. These contingency funds are separate from all other contingency funds and are accessible solely by change order as approved by Owner.

4) **Scheduling contingency** accounts for:
   a) Increased mobilization cost associated with implementing the project in two separate phases.
   b) Potential increases in the cost of labor and materials for the measures that will be implemented in subsequent years.

Major Assumptions

The estimate reflects anticipated construction costs and total project costs for a centralized system, with a new central plant located at the preferred site east of OB2, incorporating CHP technology and thermal storage. Major renewals for the system include replacement of a chiller at year 21 and replacement of the CHP equipment at year 28. In reality, CHP replacement will be determined as new technology enters the market and as Washington approaches its goal of 100% carbon-free electric utilities in 2045. For comparison, the BAU estimate includes replacement of a boiler at year 2, a chiller at year 5, the chilled water distribution piping years 1-5, and steam/condensate piping at years 2-16.

The estimate is based on information developed by UMC. The estimate is for the sole use of providing design, construction, and project budgets based on available programming documentation. The estimate is not to be used for comparison to actual bids received at any time. An updated estimate based on fully-developed construction documents will have to be prepared for any comparison of future bids.

5.2 Proposal Funding

The original IGA/ESP completed in 2017 suggested a financing pathway with a mix of capital appropriation and loans reflected in the 50-year LCCA model. DES directed the 30-year LCCA to assume the project would be financed through 100% loans.

Baseline – Traditional State Finance

Washington State Agencies, like DES, are the sole owner/operators of thermal energy utility assets located on campuses, serving hundreds of buildings, across the state. Agencies rely on the capital budget to support the renewal and growth and an operating budget to fund utility and maintenance costs of these thermal utility assets.

Investments in energy efficiency are often delivered through the state ESPC program; utilizing utility rebates and grants along with capital funds and public debt (leveraged with energy savings) to help reduce operating costs. However, operating savings alone cannot fund all of the infrastructure upgrades that would economically and environmentally benefit the state.

Thermal utility infrastructure and equipment renewal is typically not funded when it is needed. Causing these systems to be operated to failure before being replaced, sometimes on an emergency basis. This funding condition results in poor performance and hampers the ability of agencies to meet their agency mission and achieve the statutory requirements to reduce carbon and lower the cost of operations. It is crucial to fund improvements and renewal of utility infrastructure before these critically important systems reach the point of failure.

Alternative Financing Options

Capital to modernize energy infrastructure is challenging to raise when its use is outside the core mission of the property owner, competes with other priorities, is spent for emergency repairs, and changes in each budget cycle.

A modern alternative is to finance district energy renewal and growth as a self-sustaining thermal energy utility. This new entity, referred to as the “Capitol District Energy Company,” would exist to provide resilient, sustainable, and competitive thermal energy to connected customers.

This Capitol District Energy Company would represent a new district energy company that sells thermal energy as a utility service to connected customers in the framework of a long-term Energy Purchase Agreement. The state of Washington would potentially be the initial equity owner and anchor customer.

As an alternative financing strategy, UMC is willing to propose a Development Agreement to start the Capitol District Energy Company to facilitate financing and successful long-term operations as a thermal utility.

For structure, one option would be to form this company as a customer-owned cooperative with the State of Washington being the initial equity owner. All thermal generation assets would be contributed as equity to the company. Heat Purchase Agreements (HPA) would be signed and an Operating Agreement would be executed with the state.

The closest local example of this structure is the LOTT Alliance which is effectively a not-for-profit customer-owned utility providing wastewater and wholesale reclaimed water services. Once in the structure of a utility with revenue and cash flow, the Capitol District Energy Company could easily raise capital for modernization, renewal, and growth.

Rates for thermal energy service in the HPA would provide the path to independently financing the building and district energy utility as separate assets. Key elements of rates that are very well understood in the district energy sector are as follows:

Term – district energy contracts are long-term, generally 20 years or longer when used as the foundation for a major renewal or investment in a new system.

Contract capacity – the heating and cooling capacity associated with each connected building designed to reserve the firm capacity needed in a peak hour of a peak day.

Capacity rate – fixed monthly fee per unit heating and unit cooling Contract Capacity that is intended to cover fixed cost of operation and capital recovery and to build limited reserve for maintenance and renewal.

Consumption rate – variable monthly fee per unit metered heating and cooling consumption of variable costs such as fuel, electricity, carbon emissions, potable water, wastewater, and purple water. This rate can be escalated with inflation or designed as a pure pass-through with surplus returned at year end.

Connection rate – a one-time rate charged upon connection (sometimes optional). The connection rate can also be spread over time or applied to provide capital to building customer to help fund investments over a longer period.

The Capitol District Energy Company could lease space in a new central plant building owned and operated by the State of Washington. If state funding for the building is not available, then the state could consider funding the design and construction of the building with a pre-paid space lease over the term of the HPA. In this structure, there would be a monthly connection rate ($/ft^2) in the HPA charged to the state based on the total connected space.

With this financing alternative, all district energy utility capital and operating costs would be managed by the Capitol District Energy Company. As the developer, UMC would propose to help shape the utility business and secure additional funding as needed to proceed with design and construction of utility assets and ensure efficient, reliable, future operation that is fully funded and not subject to two-year budget cycles.

UMC would work directly with the state to establish key performance indicators for the HPA tied to long-term operation including resource efficiency, carbon emissions, reliability, and resilience, consistent with state goals.

Once in the utility structure, the Capitol District Energy Company would be positioned to finance and modernize district energy systems and to grow to serve additional state facilities as required. It would also have the opportunity to improve productivity and reduce overall operating costs by serving other facilities within the Olympia region. The state could use public, private, or a combination of public/private funding for the development of this utility.

5.3 Operations and Maintenance

During the development of the detailed LCCM, UMC worked closely with DES to identify and document the ongoing costs associated with the continued operation of the existing system. The anticipated operating labor requirements for each alternative are shown in ***Figure 21*** below.

	Heating FTE	Cooling FTE
Business as Usual	7	2
Decentralized	6	3
Centralized	4	2

Figure 21*: Projected Staffing Requirements*

BAU is a centralized system. The reason for the reduction in FTEs from the BAU to NC3 is that automation of the plant plays a key role. In BAU the plant continues to require 24/7 staffing. Staffing levels can be reduced in the NC3 plant through automation. And NC3 plant staff taking on a more active repair role than just monitoring.

Figure 22 shows anticipated costs over the first five biennia. Note that no major renewals or replacements are expected in this timeframe.

5.4 Equipment

The scope of the proposed project includes all equipment required to operate the proposed plant.

	PV	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Capital Cost											
Capital Recovery - Debt Service (Loan 1)	$ 55,164,760	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476
Capital Recovery - Debt Service (Loan 2)	$ 33,305,525	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552
Future Building Connections	$ 2,490,843	$ -	$ -	$ -	$ 1,733,957	$ -	$ -	$ 756,887	$ -	$ -	$ -
Subtotal - Capital Cost	**$ 90,961,128**	**$ 8,847,028**	**$ 8,847,028**	**$ 8,847,028**	**$ 10,580,985**	**$ 8,847,028**	**$ 8,847,028**	**$ 9,603,915**	**$ 8,847,028**	**$ 8,847,028**	**$ 8,847,028**
Fixed Operating Cost	$ -										
Major Overhaul/Replacement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Major Renewal	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Operating Labor	$ 9,949,523	$ 973,445	$ 1,002,745	$ 956,426	$ 907,075	$ 934,378	$ 969,790	$ 998,981	$ 1,037,357	$ 1,068,581	$ 1,100,746
Minor Repair	$ 7,406,574	$ 516,811	$ 532,367	$ 704,987	$ 726,541	$ 748,410	$ 775,808	$ 799,160	$ 841,901	$ 867,242	$ 893,346
Other Costs (M&V)	$ 315,000	$ -	$ -	$ -	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000
Subtotal - Fixed Operating Cost	**$ 17,671,097**	**$ 1,490,256**	**$ 1,535,113**	**$ 1,661,414**	**$ 1,678,616**	**$ 1,727,788**	**$ 1,790,598**	**$ 1,843,140**	**$ 1,924,258**	**$ 1,980,823**	**$ 2,039,092**
Variable Operating Cost	$ -										
Gas	$ 9,924,702	$ 506,296	$ 513,270	$ 569,836	$ 878,240	$ 1,008,031	$ 1,154,613	$ 1,192,950	$ 1,296,787	$ 1,383,642	$ 1,421,037
Electricity Purchased	$ 32,287,632	$ 3,669,926	$ 3,736,478	$ 3,858,151	$ 2,629,065	$ 2,664,979	$ 2,831,173	$ 3,029,561	$ 3,149,994	$ 3,309,441	$ 3,408,866
Potable Water/Wastewater	$ 2,118,348	$ 167,080	$ 176,497	$ 189,375	$ 198,845	$ 212,073	$ 221,543	$ 231,013	$ 240,641	$ 240,641	$ 240,641
Carbon	$ 14,469,152	$ 1,483,837	$ 1,516,016	$ 1,573,383	$ 1,305,508	$ 1,347,174	$ 1,381,486	$ 1,416,222	$ 1,454,899	$ 1,475,106	$ 1,515,520
Chemicals	$ 2,345,208	$ 185,110	$ 195,426	$ 209,704	$ 220,121	$ 234,823	$ 245,240	$ 255,658	$ 266,376	$ 266,376	$ 266,376
Subtotal - Variable Cost	**$ 61,145,042**	**$ 6,012,249**	**$ 6,137,687**	**$ 6,400,448**	**$ 5,231,778**	**$ 5,467,080**	**$ 5,834,055**	**$ 6,125,402**	**$ 6,408,697**	**$ 6,675,205**	**$ 6,852,440**
Total Cost	**$ 169,777,268**	**$ 16,349,533**	**$ 16,519,828**	**$ 16,908,891**	**$ 17,491,379**	**$ 16,041,896**	**$ 16,471,682**	**$ 17,572,458**	**$ 17,179,983**	**$ 17,503,057**	**$ 17,738,560**

Figure 22*: Five Biennia of Capital and Operating Costs*

A

Appendix

A. Appendix

A.1 Predesign Checklist

A predesign should include the content detailed here. OFM will approve limited scope predesigns on a case-by-case basis.

- **Executive summary**
- **Problem statement, opportunity or program requirement**
  - ☑ Identify the problem, opportunity or program requirement that the project addresses and how it will be accomplished.
  - ☑ Identify and explain the statutory or other requirements that drive the project's operational programs and how these affect the need for space, location or physical accommodations. Include anticipated caseload projections (growth or decline) and assumptions, if applicable.
  - ☑ Explain the connection between the agency's mission, goals and objectives; statutory requirements; and the problem, opportunity or program requirements.
  - ☑ Describe in general terms what is needed to solve the problem.
  - ☑ Include any relevant history of the project, including previous predesigns or budget funding requests that did not go forward to design or construction.
- **Analysis of alternatives (including the preferred alternative)**
  - ☑ Describe all alternatives that were considered, including the preferred alternative. Include:
    - ☑ A no action alternative.
    - ☑ Advantages and disadvantages of each alternative. Please include a high-level summary table with your analysis that compares the alternatives, including the anticipated cost for each alternative.
    - ☑ Cost estimates for each alternative:
      - ☑ Provide enough information so decision makers have a general understanding of the costs.
      - ☑ Complete OFM's Life Cycle Cost Model (RCW 39.35B.050).
    - ☑ Schedule estimates for each alternative. Estimate the start, midpoint and completion dates.
- **Detailed analysis of preferred alternative**
  - ☑ Nature of space – how much of the proposed space will be used for what purpose (i.e., office, lab, conference, classroom, etc.)
  - ☑ Occupancy numbers.
  - ☑ Basic configuration of the building, including square footage and the number of floors.
  - ☑ Space needs assessment. Identify the guidelines used.
  - ☑ Site analysis:

- ☑ Identify site studies that are completed or under way.
- ☑ Location
- ☑ Building footprint and its relationship to adjacent facilities and site features. Provide aerial view, sketches of the building site and basic floorplans.
- ☑ Stormwater requirements.
- ☑ Ownership of the site and any acquisition issues.
- ☑ Easements and setback requirements.
- ☑ Potential issues with the surrounding neighborhood, during construction and ongoing.
- ☑ Utility extension or relocation issues.
- ☑ Potential environmental impacts.
- ☑ Parking and access issues, including improvements required by local ordinances, local road impacts and parking demand.
- ☑ Impact on surroundings and existing development with construction lay-down areas and construction phasing.

☑ Consistency with applicable long-term plans (such as the Thurston County and Capitol campus master plans and agency or area master plans) as required by RCW 43.88.110.

☑ Consistency with other laws and regulations:

- ☑ High-performance public buildings (Chapter 39.35D RCW).
- ☑ State efficiency and environmental performance, if applicable (Executive Order 18-01).
- ☑ Greenhouse gas emissions reduction policy (RCW 70.235.070).
- ☑ Archeological and cultural resources (Executive Order 05-05 and Section 106 of the National Historic Preservation Act of 1966).
- ☑ Americans with Disabilities Act (ADA) implementation (Executive Order 96-04).
- ☑ Compliance with planning under Chapter 36.70A RCW, as required by RCW 43.88.0301.
- ☑ Information required by RCW 43.88.0301(1).
- ☑ Other codes or regulations.

☑ Identify problems that require further study. Evaluate identified problems to establish probable costs and risk.

☑ Identify significant or distinguishable components, including major equipment and ADA requirements in excess of existing code.

☑ Identify planned technology infrastructure and other related IT investments that affect the building plans.

☑ Describe planned commissioning to ensure systems function as designed.

☑ Describe any future phases or other facilities that will affect this project.

☑ Identify and justify the proposed project delivery method. For GC/CM, link to the requirements in RCW 39.10.340.

☑ Describe how the project will be managed within the agency.

☑ Schedule.

- ☑ Provide a high-level milestone schedule for the project, including key dates for budget approval, design, bid, acquisition, construction, equipment installation, testing, occupancy and full operation.
- ☑ Incorporate value-engineering analysis and constructability review into the project schedule, as required by RCW 43.88.110(5)(c).

- ☑ Describe factors that may delay the project schedule.
- ☑ Describe the permitting or local government ordinances or neighborhood issues (such as location or parking compatibility) that could affect the schedule.
- ☑ Identify when the local jurisdiction will be contacted and whether community stakeholder meetings are a part of the process.

❖ **Project budget analysis for the preferred alternative**

- ☑ Cost estimate.
  - ☑ Major assumptions used in preparing the cost estimate.
  - ☑ Summary table of Uniformat Level II cost estimates.
  - ☑ The C-100.
- ☑ Proposed funding.
  - ☑ Identify the fund sources and expected receipt of the funds.
  - ☑ If alternatively financed, such as through a COP, provide the projected debt service and fund source. Include the assumptions used for calculating finance terms and interest rates.
- ☑ Facility operations and maintenance requirements.
  - ☑ Define the anticipated impact of the proposed project on the operating budget for the agency or institution. Include maintenance and operating assumptions (including FTEs).
  - ☑ Show five biennia of capital and operating costs from the time of occupancy, including an estimate of building repair, replacement and maintenance.
- ☑ Clarify whether furniture, fixtures and equipment are included in the project budget. If not included, explain why.

❖ **Predesign appendices**

- ☑ Completed Life Cycle Cost Model.
- ☑ A letter from DAHP.

A.2 DAHP Letter

The Department of Archaeology and Historic Preservation (DAHP) has been contacted and DES is committed to working with DAHP should the preferred site be identified to impact any cultural resources. Confirmation from DAHP after they have conducted their review may be inserted here upon completion.

A.3 LCCM Details

Business as Usual (1 of 3)

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	0	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Gas (MMbtu/yr)		70,358	69,026	72,516	72,516	77,266	77,266	77,266	81,231	81,231	81,231	81,231	81,231	81,231	81,231
Electricity (kWh/yr)		39,548,309	40,021,814	40,665,181	41,140,309	41,638,346	42,105,804	42,573,262	43,045,551	43,045,551	42,864,239	42,465,354	42,465,354	42,323,528	42,323,528
Carbon MTCO2e		20,025	20,149	20,599	20,795	21,252	21,445	21,638	22,043	22,043	21,968	21,804	21,804	21,745	21,745
Carbon MTCO2e - Heating & Cooling		7,596	7,708	8,192	8,387	8,890	9,082	9,275	9,718	9,718	9,643	9,479	9,479	9,420	9,420
Capital Expense	$ 15,892,386														
Owner Equity	$ -														
Debt Finance	$ 15,892,386														
Campus Heating Economics	PV	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Capital Cost															
Owner Equity (Construction Capital)	$ -														
Capital Recovery - Debt Service (Loan 1)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Capital Recovery - Debt Service (Loan 2)	$ 18,163,857	$ 1,333,177	$ 1,333,177	$ 1,333,177	$ 1,333,177	$ 1,333,177	$ 1,333,177	$ 1,333,177	$ 1,333,177	$ 1,333,177	$ 1,333,177	$ 1,333,177	$ 1,333,177	$ 1,333,177	$ 1,333,177
Future Building Connections	$ 23,567,934	$ -	$ -	$ -	$ 3,265,243	$ -	$ -	$ 3,784,433	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal - Capital Cost	**$ 41,731,790**	**$ 1,333,177**	**$ 1,333,177**	**$ 1,333,177**	**$ 4,598,421**	**$ 1,333,177**	**$ 1,333,177**	**$ 5,117,610**	**$ 1,333,177**	**$ 1,333,177**	**$ 1,333,177**	**$ 1,333,177**	**$ 1,333,177**	**$ 1,333,177**	**$ 1,333,177**
Fixed Operating Cost															
Major Overhaul/Replacement	$ 15,654,077	$ -	$ 1,963,046	$ -	$ -	$ 1,867,337	$ -	$ 1,875,602	$ -	$ -	$ -	$ -	$ 2,637,164	$ -	$ -
Major Renewal	$ 78,599,325	$ 2,294,033	$ 3,841,204	$ 3,203,541	$ 3,254,930	$ 3,352,903	$ 1,713,078	$ 5,850,598	$ 2,913,299	$ 3,586,039	$ 4,981,356	$ 2,013,441	$ 4,367,914	$ 2,043,840	$ 3,710,506
Operating Labor	$ 89,989,141	$ 1,081,605	$ 1,114,161	$ 1,162,701	$ 1,197,698	$ 1,233,749	$ 1,285,460	$ 1,324,152	$ 1,396,742	$ 1,438,784	$ 1,482,091	$ 1,545,157	$ 1,591,667	$ 1,639,576	$ 1,688,927
Minor Repair	$ 53,928,568	$ 649,272	$ 668,815	$ 718,481	$ 740,107	$ 762,384	$ 794,057	$ 817,959	$ 852,621	$ 878,285	$ 904,721	$ 936,429	$ 964,615	$ 993,650	$ 1,023,559
Other Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Subtotal - Fixed Operating Cost	**$ 238,171,110**	**$ 4,024,910**	**$ 7,587,226**	**$ 5,084,722**	**$ 5,192,735**	**$ 7,216,373**	**$ 3,792,594**	**$ 9,868,310**	**$ 5,162,663**	**$ 5,903,108**	**$ 7,368,169**	**$ 4,495,027**	**$ 9,561,360**	**$ 4,677,066**	**$ 6,422,992**
Variable Operating Cost															
Gas	$ 46,746,613	$ 506,296	$ 513,270	$ 569,836	$ 591,405	$ 662,757	$ 759,131	$ 784,337	$ 837,842	$ 893,958	$ 918,119	$ 968,000	$ 999,955	$ 1,027,233	$ 1,051,394
Electricity	$ 189,851,676	$ 3,669,926	$ 3,736,478	$ 3,858,151	$ 4,005,463	$ 4,198,646	$ 4,435,048	$ 4,719,503	$ 5,054,883	$ 5,310,752	$ 5,447,262	$ 5,590,238	$ 5,758,518	$ 5,986,525	$ 6,233,042
Potable Water/Wastewater	$ 5,436,134	$ 151,740	$ 161,891	$ 171,361	$ 180,832	$ 193,570	$ 203,040	$ 216,079	$ 225,549	$ 235,019	$ 244,489	$ 244,489	$ 244,489	$ 244,489	$ 244,489
Carbon	$ 72,753,564	$ 1,483,837	$ 1,516,016	$ 1,573,383	$ 1,612,036	$ 1,671,719	$ 1,711,310	$ 1,751,340	$ 1,809,261	$ 1,834,390	$ 1,878,262	$ 1,889,073	$ 1,913,929	$ 1,933,591	$ 1,958,381
Chemicals	$ 5,979,748	$ 166,914	$ 178,080	$ 188,498	$ 198,915	$ 212,927	$ 223,344	$ 237,687	$ 248,104	$ 258,521	$ 268,938	$ 268,938	$ 268,938	$ 268,938	$ 268,938
Subtotal - Variable Cost	**$ 320,767,736**	**$ 5,978,713**	**$ 6,105,736**	**$ 6,361,229**	**$ 6,588,650**	**$ 6,939,619**	**$ 7,331,874**	**$ 7,708,945**	**$ 8,175,639**	**$ 8,532,640**	**$ 8,757,070**	**$ 8,960,737**	**$ 9,185,829**	**$ 9,460,777**	**$ 9,756,244**
Total Cost	**$ 600,670,636**	**$ 11,336,801**	**$ 15,026,140**	**$ 12,779,129**	**$ 16,379,805**	**$ 15,489,170**	**$ 12,457,646**	**$ 22,694,866**	**$ 14,671,479**	**$ 15,768,925**	**$ 17,458,416**	**$ 14,788,942**	**$ 20,080,366**	**$ 15,471,020**	**$ 17,512,414**

Business as Usual (2 of 3)

15	16	17	18	19	20	21	22	23
2035	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**
73,068	73,068	73,068	73,068	73,068	82,616	82,616	87,351	87,351
42,374,085	42,374,085	42,374,085	42,374,085	42,374,085	42,385,718	42,385,718	33,867,966	33,845,458
21,333	21,333	21,333	21,333	21,333	21,844	21,844	18,588	18,579
9,053	9,053	9,053	9,053	9,053	9,656	9,656	6,444	6,435
2035	2036	2037	2038	2039	2040	2041	2042	2043
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 1,333,177	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ 5,094,556	$ -	$ -	$ -	$ -
$ 1,333,177	**$ -**	**$ -**	**$ -**	**$ 5,094,556**	**$ -**	**$ -**	**$ -**	**$ -**
$ -	$ -	$ -	$ -	$ -	$ -	$ 1,957,296	$ -	$ 47,472
$ 2,168,731	$ 2,234,009	$ 61,256	$ 383,717	$ 79,053	$ 2,669,192	$ -	$ 2,836,136	$ 357,701
$ 1,739,764	$ 1,792,130	$ 1,846,074	$ 1,920,915	$ 1,978,735	$ 2,038,295	$ 2,099,647	$ 2,162,847	$ 2,277,707
$ 1,054,368	$ 1,086,105	$ 1,118,797	$ 1,159,663	$ 1,194,568	$ 1,230,525	$ 1,267,564	$ 1,305,717	$ 1,366,468
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 4,962,862	**$ 5,112,245**	**$ 3,026,127**	**$ 3,464,295**	**$ 3,252,357**	**$ 5,938,011**	**$ 5,324,507**	**$ 6,304,700**	**$ 4,049,349**
$ 969,568	$ 989,338	$ 1,009,108	$ 1,028,878	$ 1,048,648	$ 1,208,041	$ 1,230,395	$ 1,324,534	$ 1,348,168
$ 6,480,061	$ 6,480,061	$ 6,480,061	$ 6,480,061	$ 6,480,061	$ 6,481,840	$ 6,481,840	$ 5,179,262	$ 5,175,820
$ 243,211	$ 243,211	$ 246,383	$ 246,383	$ 246,383	$ 246,383	$ 246,383	$ 246,383	$ 246,383
$ 1,945,525	$ 1,969,844	$ 2,018,482	$ 2,042,801	$ 2,067,120	$ 2,141,632	$ 2,166,535	$ 1,864,742	$ 1,884,992
$ 267,532	$ 267,532	$ 271,021	$ 271,021	$ 271,021	$ 271,021	$ 271,021	$ 271,021	$ 271,021
$ 9,905,896	**$ 9,949,985**	**$ 10,025,054**	**$ 10,069,143**	**$ 10,113,232**	**$ 10,348,917**	**$ 10,396,173**	**$ 8,885,941**	**$ 8,926,383**
$ 16,201,936	$ 15,062,230	$ 13,051,181	$ 13,533,438	$ 18,460,145	$ 16,286,928	$ 15,720,680	$ 15,190,641	$ 12,975,732

24	25	26	27	28	29	30	31	32
2044	**2045**	**2046**	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**
87,351	92,881	92,881	92,881	92,881	92,881	92,881	92,881	92,881
33,845,458	33,963,102	33,963,102	33,963,102	33,963,102	33,963,102	33,769,722	33,769,722	33,769,722
18,579	18,921	18,921	18,921	18,921	18,921	18,841	18,841	18,841
6,435	6,830	6,830	6,830	6,830	6,830	6,750	6,750	6,750
2044	2045	2046	2047	2048	2049	2050	2051	2052
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 5,908,854	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 5,908,854	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
$ -	$ -	$ -	$ -	$ 854,573	$ -	$ -	$ 4,037,261	$ -
$ 2,054,529	$ 1,763	$ 1,816	$ 231,264	$ 1,943,150	$ 18,651,631	$ 293,338	$ 169,264	$ 147,236
$ 2,346,266	$ 2,463,241	$ 2,537,384	$ 2,613,759	$ 2,745,521	$ 2,828,161	$ 2,913,289	$ 3,000,979	$ 3,091,309
$ 1,407,599	$ 1,477,716	$ 1,522,195	$ 1,568,013	$ 1,631,469	$ 1,680,576	$ 1,731,161	$ 1,783,269	$ 1,836,946
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 5,808,394	**$ 3,942,719**	**$ 4,061,395**	**$ 4,413,037**	**$ 7,174,713**	**$ 23,160,369**	**$ 4,937,789**	**$ 8,990,774**	**$ 5,075,491**
$ 1,371,803	$ 1,483,795	$ 1,508,925	$ 1,534,056	$ 1,559,187	$ 1,584,318	$ 1,609,449	$ 1,634,580	$ 1,659,711
$ 5,175,820	$ 5,193,811	$ 5,193,811	$ 5,193,811	$ 5,193,811	$ 5,193,811	$ 5,164,238	$ 5,164,238	$ 5,164,238
$ 60,115	$ 60,115	$ 60,115	$ 63,287	$ 63,287	$ 63,287	$ 63,287	$ 63,287	$ 63,287
$ 1,906,171	$ 1,984,424	$ 2,005,993	$ 2,027,563	$ 2,049,133	$ 2,070,703	$ 2,083,466	$ 2,104,945	$ 2,126,424
$ 66,127	$ 66,127	$ 66,127	$ 69,616	$ 69,616	$ 69,616	$ 69,616	$ 69,616	$ 69,616
$ 8,580,036	**$ 8,788,271**	**$ 8,834,971**	**$ 8,888,333**	**$ 8,935,034**	**$ 8,981,735**	**$ 8,990,056**	**$ 9,036,666**	**$ 9,083,276**
$ 20,297,285	$ 12,730,990	$ 12,896,367	$ 13,301,370	$ 16,109,746	$ 32,142,103	$ 13,927,844	$ 18,027,440	$ 14,158,766

Business as Usual (3 of 3)

33	34	35	36	37	38	39	40	41
2053	2054	2055	2056	2057	2058	2059	2060	2061
92,881	92,881	92,881	92,881	92,881	92,881	92,881	92,881	92,881
33,769,722	33,769,722	33,769,722	33,769,722	33,769,722	33,769,722	33,769,722	33,769,722	33,769,722
18,841	18,841	18,841	18,841	18,841	18,841	18,841	18,841	18,841
6,750	6,750	6,750	6,750	6,750	6,750	6,750	6,750	6,750
2053	2054	2055	2056	2057	2058	2059	2060	2061
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ 4,235,160	$ -	$ -	$ 4,629,222	$ -	$ -	$ -
$ -	**$ -**	**$ 4,235,160**	**$ -**	**$ -**	**$ 4,629,222**	**$ -**	**$ -**	**$ -**
$ -	$ -	$ -	$ -	$ -	$ 5,706,287	$ -	$ -	$ -
$ 7,293,380	$ 2,433,953	$ 3,537,770	$ 6,578,858	$ 299,597	$ 2,971,466	$ 5,197,223	$ 3,456,772	$ 2,834
$ 3,184,357	$ 3,280,206	$ 3,378,940	$ 3,480,646	$ 3,585,414	$ 3,693,335	$ 3,804,504	$ 3,919,020	$ 4,036,982
$ 1,892,238	$ 1,949,194	$ 2,007,865	$ 2,068,302	$ 2,130,558	$ 2,194,687	$ 2,260,747	$ 2,328,796	$ 2,398,893
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 12,369,974	**$ 7,663,353**	**$ 8,924,575**	**$ 12,127,806**	**$ 6,015,568**	**$ 14,565,776**	**$ 11,262,475**	**$ 9,704,588**	**$ 6,438,708**
$ 1,684,842	$ 1,709,973	$ 1,735,104	$ 1,760,235	$ 1,785,366	$ 1,810,497	$ 1,835,628	$ 1,860,759	$ 1,885,889
$ 5,164,238	$ 5,164,238	$ 5,164,238	$ 5,164,238	$ 5,164,238	$ 5,164,238	$ 5,164,238	$ 5,164,238	$ 5,164,238
$ 63,287	$ 63,287	$ 63,287	$ 63,287	$ 63,287	$ 63,287	$ 63,287	$ 63,287	$ 63,287
$ 2,147,903	$ 2,169,382	$ 2,190,861	$ 2,212,340	$ 2,233,819	$ 2,255,298	$ 2,276,777	$ 2,298,256	$ 2,319,735
$ 69,616	$ 69,616	$ 69,616	$ 69,616	$ 69,616	$ 69,616	$ 69,616	$ 69,616	$ 69,616
$ 9,129,886	**$ 9,176,496**	**$ 9,223,106**	**$ 9,269,715**	**$ 9,316,325**	**$ 9,362,935**	**$ 9,409,545**	**$ 9,456,155**	**$ 9,502,765**
$ 21,499,860	$ 16,839,848	$ 22,382,841	$ 21,397,522	$ 15,331,894	$ 28,557,933	$ 20,672,020	$ 19,160,743	$ 15,941,474

42	43	44	45	46	47	48	49	50
2062	2063	2064	2065	2066	2067	2068	2069	2070
92,881	92,881	92,881	92,881	92,881	92,881	92,881	92,881	92,881
33,769,722	33,769,722	33,769,722	33,769,722	33,769,722	33,769,722	33,769,722	33,769,722	33,769,722
18,841	18,841	18,841	18,841	18,841	18,841	18,841	18,841	18,841
6,750	6,750	6,750	6,750	6,750	6,750	6,750	6,750	6,750
2062	2063	2064	2065	2066	2067	2068	2069	2070
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,607,857
$ -	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 6,607,857**
$ -	$ 5,449,679	$ -	$ -	$ -	$ 4,231,755	$ 6,227,329	$ -	$ (17,193,437)
$ 3,310,962	$ 411,634	$ 221,230	$ 265,871	$ 6,005,652	$ 173,300	$ 3,890,005	$ 6,158,181	$ (37,874,503)
$ 4,158,495	$ 4,283,666	$ 4,412,604	$ 4,545,424	$ 4,682,241	$ 4,823,177	$ 4,968,354	$ 5,117,902	$ 5,271,950
$ 2,471,099	$ 2,545,479	$ 2,622,098	$ 2,701,024	$ 2,782,324	$ 2,866,072	$ 2,952,341	$ 3,041,207	$ 3,132,747
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 9,940,557	**$ 12,690,459**	**$ 7,255,933**	**$ 7,512,318**	**$ 13,470,218**	**$ 12,094,304**	**$ 18,038,030**	**$ 14,317,289**	**$ (46,663,242)**
$ 1,911,020	$ 1,936,151	$ 1,961,282	$ 1,986,413	$ 2,011,544	$ 2,036,675	$ 2,061,806	$ 2,086,937	$ 2,112,068
$ 5,164,238	$ 5,164,238	$ 5,164,238	$ 5,164,238	$ 5,164,238	$ 5,164,238	$ 5,164,238	$ 5,164,238	$ 5,164,238
$ 63,287	$ 63,287	$ 63,287	$ 63,287	$ 63,287	$ 63,287	$ 63,287	$ 63,287	$ 63,287
$ 2,341,214	$ 2,362,693	$ 2,384,172	$ 2,405,651	$ 2,427,130	$ 2,448,609	$ 2,470,088	$ 2,491,567	$ 2,513,046
$ 69,616	$ 69,616	$ 69,616	$ 69,616	$ 69,616	$ 69,616	$ 69,616	$ 69,616	$ 69,616
$ 9,549,375	**$ 9,595,985**	**$ 9,642,595**	**$ 9,689,205**	**$ 9,735,815**	**$ 9,782,425**	**$ 9,829,035**	**$ 9,875,645**	**$ 9,922,255**
$ 19,489,932	$ 22,286,444	$ 16,898,528	$ 17,201,523	$ 23,206,033	$ 21,876,729	$ 27,867,065	$ 24,192,934	$ (30,133,130)

Decentralized Natural Gas (1 of 3)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		2021	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**
Gas (MMbtu/yr)		70,358	69,026	72,516	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903
Net Electricity Purchased (kWh/yr)		39,548,309	40,021,814	40,665,181	37,498,042	37,822,296	38,137,656	38,453,016	38,676,585	38,676,585	38,676,585	38,676,585	38,676,585	38,676,585	38,676,585
Carbon MTCO2e		20,025	20,149	20,599	17,032	17,165	17,295	17,425	17,517	17,517	17,517	17,517	17,517	17,517	17,517
Capital Expense	$ 87,069,487														
Owner Equity	$ -														
Debt Finance	$ 87,069,487														
Campus Heating Economics		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Capital Cost	**PV**														
Owner Equity (Construction Capital)	$ -														
Capital Recovery - Debt Service (Loan 1)	$ 70,837,969	$ 4,032,636	$ 4,032,636	$ 4,032,636	$ 4,032,636	$ 4,032,636	$ 4,032,636	$ 4,032,636	$ 4,032,636	$ 4,032,636	$ 4,032,636	$ 4,032,636	$ 4,032,636	$ 4,032,636	$ 4,032,636
Capital Recovery - Debt Service (Loan 2)	$ 33,171,392	$ 2,434,689	$ 2,434,689	$ 2,434,689	$ 2,434,689	$ 2,434,689	$ 2,434,689	$ 2,434,689	$ 2,434,689	$ 2,434,689	$ 2,434,689	$ 2,434,689	$ 2,434,689	$ 2,434,689	$ 2,434,689
Future Building Connections	$ 24,676,125	$0	$0	$0	$1,733,957	$0	$0	$756,887	$0	$0	$0	$0	$0	$0	$1,514,647
Subtotal - Capital Cost	**$ 128,685,485**	**$ 6,467,325**	**$ 6,467,325**	**$ 6,467,325**	**$ 8,201,282**	**$ 6,467,325**	**$ 6,467,325**	**$ 7,224,212**	**$ 6,467,325**	**$ 6,467,325**	**$ 6,467,325**	**$ 6,467,325**	**$ 6,467,325**	**$ 6,467,325**	**$ 7,981,972**
Fixed Operating Cost															
Major Overhaul/Replacement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Major Renewal	$ 41,931,233	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,803,557	$ -	$ 1,632,392	$ 3,026,749	$ -	$ 1,141,938	$ -	$ -
Operating Labor	$ 92,893,566	$ 973,445	$ 1,002,745	$ 963,050	$ 1,186,373	$ 1,222,083	$ 1,302,593	$ 1,341,801	$ 1,432,031	$ 1,475,135	$ 1,519,536	$ 1,620,639	$ 1,669,420	$ 1,719,670	$ 1,771,432
Minor Repair	$ 69,047,822	$ 482,375	$ 496,895	$ 542,005	$ 791,177	$ 814,991	$ 885,395	$ 912,045	$ 992,508	$ 1,022,383	$ 1,053,156	$ 1,093,645	$ 1,126,563	$ 1,160,473	$ 1,195,403
Other Costs (M&V)	$ 405,469	$ -	$ -	$ -	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ -
Subtotal - Fixed Operating Cost	**$ 204,278,091**	**$ 1,455,820**	**$ 1,499,640**	**$ 1,505,054**	**$ 2,022,550**	**$ 2,082,074**	**$ 2,232,988**	**$ 5,102,403**	**$ 2,469,539**	**$ 4,174,910**	**$ 5,644,442**	**$ 2,759,284**	**$ 3,982,922**	**$ 2,925,143**	**$ 2,966,835**
Variable Operating Cost	$ -														
Gas	$ 17,052,070	$ 506,296	$ 513,270	$ 569,836	$ 243,869	$ 256,493	$ 293,791	$ 303,546	$ 308,423	$ 329,080	$ 337,974	$ 356,336	$ 368,099	$ 378,141	$ 387,035
Electricity Purchased	$ 177,343,618	$ 3,669,926	$ 3,736,478	$ 3,858,151	$ 3,650,848	$ 3,813,850	$ 4,017,079	$ 4,262,749	$ 4,541,831	$ 4,771,731	$ 4,915,087	$ 5,091,475	$ 5,244,742	$ 5,470,677	$ 5,695,952
Potable Water/Wastewater	$ 5,202,507	$ 166,831	$ 176,301	$ 189,040	$ 198,510	$ 211,548	$ 221,019	$ 230,489	$ 239,959	$ 239,959	$ 239,959	$ 239,959	$ 239,959	$ 239,959	$ 239,959
Carbon	$ 58,824,239	$ 1,483,837	$ 1,516,016	$ 1,573,383	$ 1,320,292	$ 1,350,212	$ 1,380,145	$ 1,410,374	$ 1,437,796	$ 1,457,765	$ 1,497,704	$ 1,517,673	$ 1,537,643	$ 1,557,612	$ 1,577,581
Chemicals	$ 5,763,449	$ 184,638	$ 195,055	$ 209,068	$ 219,485	$ 233,827	$ 244,244	$ 254,661	$ 265,079	$ 265,079	$ 265,079	$ 265,079	$ 265,079	$ 265,079	$ 265,079
Subtotal - Variable Cost	**$ 264,185,882**	**$ 6,011,528**	**$ 6,137,121**	**$ 6,399,478**	**$ 5,633,004**	**$ 5,865,931**	**$ 6,156,277**	**$ 6,461,818**	**$ 6,793,087**	**$ 7,063,613**	**$ 7,255,802**	**$ 7,470,522**	**$ 7,655,521**	**$ 7,911,467**	**$ 8,165,605**
Total Cost	**$ 597,149,459**	**$ 13,934,673**	**$ 14,104,086**	**$ 14,371,857**	**$ 15,856,836**	**$ 14,415,331**	**$ 14,856,590**	**$ 18,788,433**	**$ 15,729,951**	**$ 17,705,848**	**$ 19,367,569**	**$ 16,697,131**	**$ 18,105,768**	**$ 17,303,935**	**$ 19,114,413**

Decentralized Natural Gas (2 of 3)

15	16	17	18	19	20	21	22	23
2035	**2036**	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**	**2043**
29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903
38,673,353	38,673,353	38,673,353	38,673,353	38,673,353	38,452,333	38,452,333	32,139,954	32,139,954
17,516	17,516	17,516	17,516	17,516	17,425	17,425	14,825	14,825
2035	2036	2037	2038	2039	2040	2041	2042	2043
$ 4,032,636	$ 4,032,636	$ 4,032,636	$ 4,032,636	$ 4,032,636	$ 4,032,636	$ -	$ -	$ -
$ 2,434,689	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$0	$0	$0	$0	$7,369,539	$0	$3,877,309	$0	$0
$ 6,467,325	**$ 4,032,636**	**$ 4,032,636**	**$ 4,032,636**	**$ 11,402,175**	**$ 4,032,636**	**$ 3,877,309**	**$ -**	**$ -**
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,440,150	$ -
$ 1,824,752	$ 1,879,677	$ 1,936,256	$ 1,994,537	$ 2,054,572	$ 2,116,415	$ 2,180,119	$ 2,245,741	$ 2,387,165
$ 1,231,385	$ 1,268,449	$ 1,306,630	$ 1,399,886	$ 1,442,023	$ 1,485,428	$ 1,530,139	$ 1,576,196	$ 1,717,700
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 3,056,137	**$ 3,148,127**	**$ 3,242,885**	**$ 3,394,423**	**$ 3,496,595**	**$ 3,601,843**	**$ 3,710,258**	**$ 5,262,087**	**$ 4,104,865**
$ 396,790	$ 404,880	$ 412,971	$ 421,062	$ 429,153	$ 437,243	$ 445,334	$ 453,425	$ 461,516
$ 5,914,126	$ 5,914,126	$ 5,914,126	$ 5,914,126	$ 5,914,126	$ 5,880,327	$ 5,880,327	$ 4,915,006	$ 4,915,006
$ 243,131	$ 243,131	$ 243,131	$ 243,131	$ 243,131	$ 243,131	$ 243,131	$ 56,863	$ 56,863
$ 1,597,429	$ 1,617,397	$ 1,657,333	$ 1,677,301	$ 1,697,269	$ 1,708,312	$ 1,728,176	$ 1,487,237	$ 1,504,137
$ 268,567	$ 268,567	$ 268,567	$ 268,567	$ 268,567	$ 268,567	$ 268,567	$ 63,673	$ 63,673
$ 8,420,043	**$ 8,448,102**	**$ 8,496,128**	**$ 8,524,187**	**$ 8,552,245**	**$ 8,537,580**	**$ 8,565,535**	**$ 6,976,204**	**$ 7,001,195**
$ 17,943,505	**$ 15,628,864**	**$ 15,771,649**	**$ 15,951,246**	**$ 23,451,016**	**$ 16,172,059**	**$ 16,153,103**	**$ 12,238,291**	**$ 11,106,060**

24	25	26	27	28	29	30	31	32
2044	**2045**	**2046**	**2047**	**2048**	**2049**	**2050**	**2051**	**2052**
29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903
32,139,954	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554
14,825	14,816	14,816	14,816	14,816	14,816	14,816	14,816	14,816
2044	2045	2046	2047	2048	2049	2050	2051	2052
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$7,314,754	$0	$0	$0	$0	$0	$0	$0	$0
$ 7,314,754	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 12,076,476	$ -	$ -	$ -	$ -	$ 18,492,115	$ -	$ -	$ -
$ 2,459,018	$ 2,539,332	$ 2,615,766	$ 2,694,501	$ 2,857,082	$ 2,943,080	$ 3,031,667	$ 3,122,920	$ 3,216,920
$ 1,769,403	$ 1,968,544	$ 2,027,797	$ 2,088,834	$ 2,237,184	$ 2,304,524	$ 2,373,890	$ 2,445,344	$ 2,518,949
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 16,304,897	**$ 4,507,876**	**$ 4,643,563**	**$ 4,783,335**	**$ 5,094,266**	**$ 23,739,718**	**$ 5,405,557**	**$ 5,568,264**	**$ 5,735,869**
$ 469,606	$ 477,697	$ 485,788	$ 493,878	$ 501,969	$ 510,060	$ 518,151	$ 526,241	$ 534,332
$ 4,915,006	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580
$ 56,863	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035
$ 1,521,038	$ 1,553,871	$ 1,570,761	$ 1,587,651	$ 1,604,541	$ 1,621,430	$ 1,638,320	$ 1,655,210	$ 1,672,100
$ 63,673	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162
$ 7,026,186	**$ 7,070,345**	**$ 7,095,326**	**$ 7,120,307**	**$ 7,145,287**	**$ 7,170,268**	**$ 7,195,249**	**$ 7,220,229**	**$ 7,245,210**
$ 30,645,837	**$ 11,578,222**	**$ 11,738,889**	**$ 11,903,641**	**$ 12,239,554**	**$ 30,909,986**	**$ 12,600,805**	**$ 12,788,493**	**$ 12,981,078**

Decentralized Natural Gas (3 of 3)

33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070
29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903	29,903
32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554	32,117,554
14,816	14,816	14,816	14,816	14,816	14,816	14,816	14,816	14,816	14,816	14,816	14,816	14,816	14,816	14,816	14,816	14,816	14,816
2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$0	$0	$3,811,644	$0	$0	$1,234,459	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,929,428
$ -	**$ -**	**$ 3,811,644**	**$ -**	**$ -**	**$ 1,234,459**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 7,929,428**
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,061,408	$ 2,466,844	$ 5,505,708	$ 6,543,957	$ -	$ 2,468,918	$ 4,450,657	$ -	$ -	$ -	$ -	$ -	$ 18,713,498	$ -	$ -	$ 3,113,665	$ 5,987,121	$ (39,299,971)
$ 3,313,749	$ 3,413,493	$ 3,516,239	$ 3,622,078	$ 3,731,102	$ 3,843,409	$ 3,959,095	$ 4,078,264	$ 4,201,020	$ 4,327,470	$ 4,457,727	$ 4,591,905	$ 4,730,121	$ 4,872,498	$ 5,019,160	$ 5,170,237	$ 5,325,861	$ 5,486,169
$ 2,594,769	$ 2,672,872	$ 2,753,325	$ 2,836,200	$ 2,921,570	$ 3,009,509	$ 3,100,095	$ 3,193,408	$ 3,289,530	$ 3,388,545	$ 3,490,540	$ 3,595,605	$ 3,703,833	$ 3,815,318	$ 3,930,159	$ 4,048,457	$ 4,170,315	$ 4,295,842
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 11,969,926	**$ 8,553,208**	**$ 11,775,272**	**$ 13,002,235**	**$ 6,652,672**	**$ 9,321,836**	**$ 11,509,848**	**$ 7,271,672**	**$ 7,490,549**	**$ 7,716,015**	**$ 7,948,267**	**$ 8,187,510**	**$ 27,147,452**	**$ 8,687,816**	**$ 8,949,319**	**$ 12,332,358**	**$ 15,483,297**	**$ (29,517,960)**
$ 542,423	$ 550,513	$ 558,604	$ 566,695	$ 574,786	$ 582,876	$ 590,967	$ 599,058	$ 607,149	$ 615,239	$ 623,330	$ 631,421	$ 639,511	$ 647,602	$ 655,693	$ 663,784	$ 671,874	$ 679,965
$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580	$ 4,911,580
$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035
$ 1,688,990	$ 1,705,880	$ 1,722,770	$ 1,739,660	$ 1,756,550	$ 1,773,440	$ 1,790,329	$ 1,807,219	$ 1,824,109	$ 1,840,999	$ 1,857,889	$ 1,874,779	$ 1,891,669	$ 1,908,559	$ 1,925,449	$ 1,942,339	$ 1,959,229	$ 1,976,118
$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162
$ 7,270,190	**$ 7,295,171**	**$ 7,320,152**	**$ 7,345,132**	**$ 7,370,113**	**$ 7,395,094**	**$ 7,420,074**	**$ 7,445,055**	**$ 7,470,035**	**$ 7,495,016**	**$ 7,519,997**	**$ 7,544,977**	**$ 7,569,958**	**$ 7,594,939**	**$ 7,619,919**	**$ 7,644,900**	**$ 7,669,880**	**$ 7,694,861**
$ 19,240,116	$ 15,848,380	$ 22,907,068	$ 20,347,368	$ 14,022,785	$ 17,951,388	$ 18,929,922	$ 14,716,727	$ 14,960,585	$ 15,211,031	$ 15,468,264	$ 15,732,487	$ 34,717,410	$ 16,282,754	$ 16,569,238	$ 19,977,258	$ 23,153,177	$ (13,893,671)

Decentralized All-Electric (1 of 3)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Gas (MMbtu/yr)		70,358	69,026	72,516	0	0	0	0	0	0	0	0	0	0	0
Net Electricity Purchased (kWh/yr)		39,548,309	40,021,814	40,665,181	42,215,145	42,674,013	43,123,987	43,573,961	43,932,144	43,932,144	43,932,144	43,932,144	43,932,144	43,932,144	43,932,144
Carbon MTCO2e		20,025	20,149	20,599	17,386	17,575	17,760	17,946	18,093	18,093	18,093	18,093	18,093	18,093	18,093
Capital Expense	$ 96,735,375														
Owner Equity	$ -														
Debt Finance	$ 96,735,375														
Campus Heating Economics		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Capital Cost	PV														
Owner Equity (Construction Capital)	$ -														
Capital Recovery - Debt Service (Loan 1)	$ 78,701,939	$ 4,480,313	$ 4,480,313	$ 4,480,313	$ 4,480,313	$ 4,480,313	$ 4,480,313	$ 4,480,313	$ 4,480,313	$ 4,480,313	$ 4,480,313	$ 4,480,313	$ 4,480,313	$ 4,480,313	$ 4,480,313
Capital Recovery - Debt Service (Loan 2)	$ 36,853,864	$ 2,704,973	$ 2,704,973	$ 2,704,973	$ 2,704,973	$ 2,704,973	$ 2,704,973	$ 2,704,973	$ 2,704,973	$ 2,704,973	$ 2,704,973	$ 2,704,973	$ 2,704,973	$ 2,704,973	$ 2,704,973
Future Building Connections	$ 24,676,125	$0	$0	$0	$1,733,957	$0	$0	$756,887	$0	$0	$0	$0	$0	$0	$1,514,647
Subtotal - Capital Cost	**$ 140,231,928**	**$ 7,185,286**	**$ 7,185,286**	**$ 7,185,286**	**$ 8,919,242**	**$ 7,185,286**	**$ 7,185,286**	**$ 7,942,172**	**$ 7,185,286**	**$ 7,185,286**	**$ 7,185,286**	**$ 7,185,286**	**$ 7,185,286**	**$ 7,185,286**	**$ 8,699,933**
Fixed Operating Cost															
Major Overhaul/Replacement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Major Renewal	$ 40,148,733	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,803,557	$ -	$ 1,632,392	$ 3,026,749	$ -	$ 1,141,938	$ -	$ -
Operating Labor	$ 92,893,566	$ 973,445	$ 1,002,745	$ 963,050	$ 1,186,373	$ 1,222,083	$ 1,302,593	$ 1,341,801	$ 1,432,031	$ 1,475,135	$ 1,519,536	$ 1,620,639	$ 1,669,420	$ 1,719,670	$ 1,771,432
Minor Repair	$ 69,047,822	$ 482,375	$ 496,895	$ 542,005	$ 791,177	$ 814,991	$ 885,395	$ 912,045	$ 992,508	$ 1,022,383	$ 1,053,156	$ 1,093,645	$ 1,126,563	$ 1,160,473	$ 1,195,403
Other Costs (M&V)	$ 405,469	$ -	$ -	$ -	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ -
Subtotal - Fixed Operating Cost	**$ 202,495,591**	**$ 1,455,820**	**$ 1,499,640**	**$ 1,505,054**	**$ 2,022,550**	**$ 2,082,074**	**$ 2,232,988**	**$ 5,102,403**	**$ 2,469,539**	**$ 4,174,910**	**$ 5,644,442**	**$ 2,759,284**	**$ 3,982,922**	**$ 2,925,143**	**$ 2,966,835**
Variable Operating Cost	$ -														
Gas	$ 1,566,529	$ 506,296	$ 513,270	$ 569,836	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Electricity Purchased	$ 194,621,036	$ 3,669,926	$ 3,736,478	$ 3,858,151	$ 4,110,110	$ 4,303,078	$ 4,542,294	$ 4,830,436	$ 5,158,997	$ 5,420,136	$ 5,582,973	$ 5,783,329	$ 5,957,422	$ 6,214,059	$ 6,469,945
Potable Water/Wastewater	$ 5,202,507	$ 166,831	$ 176,301	$ 189,040	$ 198,510	$ 211,548	$ 221,019	$ 230,489	$ 239,959	$ 239,959	$ 239,959	$ 239,959	$ 239,959	$ 239,959	$ 239,959
Carbon	$ 58,360,604	$ 1,483,837	$ 1,516,016	$ 1,573,383	$ 1,347,768	$ 1,382,454	$ 1,417,278	$ 1,452,524	$ 1,485,091	$ 1,505,717	$ 1,546,969	$ 1,567,596	$ 1,588,222	$ 1,608,848	$ 1,629,474
Chemicals	$ 5,763,449	$ 184,638	$ 195,055	$ 209,068	$ 219,485	$ 233,827	$ 244,244	$ 254,661	$ 265,079	$ 265,079	$ 265,079	$ 265,079	$ 265,079	$ 265,079	$ 265,079
Subtotal - Variable Cost	**$ 265,514,125**	**$ 6,011,528**	**$ 6,137,121**	**$ 6,399,478**	**$ 5,875,873**	**$ 6,130,907**	**$ 6,424,835**	**$ 6,768,111**	**$ 7,149,125**	**$ 7,430,890**	**$ 7,634,979**	**$ 7,855,962**	**$ 8,050,681**	**$ 8,327,944**	**$ 8,604,457**
Total Cost	$ 608,241,643	$ 14,652,634	$ 14,822,046	$ 15,089,818	$ 16,817,666	$ 15,398,267	$ 15,843,108	$ 19,812,687	$ 16,803,949	$ 18,791,086	$ 20,464,707	$ 17,800,532	$ 19,218,889	$ 18,438,373	$ 20,271,225

Decentralized All-Electric (2 of 3)

15	16	17	18	19	20	21	22	23
2035	2036	2037	2038	2039	2040	2041	2042	2043
0	0	0	0	0	0	0	0	0
43,928,912	43,928,912	43,928,912	43,928,912	43,928,912	43,657,170	43,657,170	34,598,272	34,598,272
18,092	18,092	18,092	18,092	18,092	17,980	17,980	14,249	14,249
2035	2036	2037	2038	2039	2040	2041	2042	2043
$ 4,480,313	$ 4,480,313	$ 4,480,313	$ 4,480,313	$ 4,480,313	$ 4,480,313	$ -	$ -	$ -
$ 2,704,973	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$0	$0	$0	$0	$7,369,539	$0	$3,877,309	$0	$0
$ 7,185,286	**$ 4,480,313**	**$ 4,480,313**	**$ 4,480,313**	**$ 11,849,852**	**$ 4,480,313**	**$ 3,877,309**	**$ -**	**$ -**
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,440,150	$ -
$ 1,824,752	$ 1,879,677	$ 1,936,256	$ 1,994,537	$ 2,054,572	$ 2,116,415	$ 2,180,119	$ 2,245,741	$ 2,387,165
$ 1,231,385	$ 1,268,449	$ 1,306,630	$ 1,399,886	$ 1,442,023	$ 1,485,428	$ 1,530,139	$ 1,576,196	$ 1,717,700
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 3,056,137	**$ 3,148,127**	**$ 3,242,885**	**$ 3,394,423**	**$ 3,496,595**	**$ 3,601,843**	**$ 3,710,258**	**$ 5,262,087**	**$ 4,104,865**
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,717,833	$ 6,717,833	$ 6,717,833	$ 6,717,833	$ 6,717,833	$ 6,676,277	$ 6,676,277	$ 5,290,944	$ 5,290,944
$ 243,131	$ 243,131	$ 243,131	$ 243,131	$ 243,131	$ 243,131	$ 243,131	$ 56,863	$ 56,863
$ 1,649,979	$ 1,670,604	$ 1,711,854	$ 1,732,478	$ 1,753,103	$ 1,762,756	$ 1,783,253	$ 1,429,470	$ 1,445,714
$ 268,567	$ 268,567	$ 268,567	$ 268,567	$ 268,567	$ 268,567	$ 268,567	$ 63,673	$ 63,673
$ 8,879,510	**$ 8,900,135**	**$ 8,941,385**	**$ 8,962,009**	**$ 8,982,634**	**$ 8,950,731**	**$ 8,971,228**	**$ 6,840,951**	**$ 6,857,195**
$ 19,120,933	$ 16,528,575	$ 16,664,583	$ 16,836,746	$ 24,329,081	$ 17,032,886	$ 16,558,796	$ 12,103,039	$ 10,962,060

24	25	26	27	28	29	30	31	32
2044	2045	2046	2047	2048	2049	2050	2051	2052
0	0	0	0	0	0	0	0	0
34,598,272	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873
14,249	14,240	14,240	14,240	14,240	14,240	14,240	14,240	14,240
2044	2045	2046	2047	2048	2049	2050	2051	2052
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$7,314,754	$0	$0	$0	$0	$0	$0	$0	$0
$ 7,314,754	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 10,446,447	$ -	$ -	$ -	$ -	$ 18,492,115	$ -	$ -	$ -
$ 2,459,018	$ 2,539,332	$ 2,615,766	$ 2,694,501	$ 2,857,082	$ 2,943,080	$ 3,031,667	$ 3,122,920	$ 3,216,920
$ 1,769,403	$ 1,968,544	$ 2,027,797	$ 2,088,834	$ 2,237,184	$ 2,304,524	$ 2,373,890	$ 2,445,344	$ 2,518,949
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 14,674,868	**$ 4,507,876**	**$ 4,643,563**	**$ 4,783,335**	**$ 5,094,266**	**$ 23,739,718**	**$ 5,405,557**	**$ 5,568,264**	**$ 5,735,869**
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 5,290,944	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519
$ 56,863	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035
$ 1,461,958	$ 1,493,479	$ 1,509,712	$ 1,525,946	$ 1,542,179	$ 1,558,413	$ 1,574,646	$ 1,590,879	$ 1,607,113
$ 63,673	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162
$ 6,873,439	**$ 6,908,195**	**$ 6,924,428**	**$ 6,940,662**	**$ 6,956,895**	**$ 6,973,129**	**$ 6,989,362**	**$ 7,005,596**	**$ 7,021,829**
$ 28,863,062	$ 11,416,071	$ 11,567,992	$ 11,723,996	$ 12,051,161	$ 30,712,847	$ 12,394,919	$ 12,573,859	$ 12,757,698

Decentralized All-Electric (3 of 3)

33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
2053	**2054**	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**	**2061**	**2062**	**2063**	**2064**	**2065**	**2066**	**2067**	**2068**	**2069**	**2070**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873	34,575,873
14,240	14,240	14,240	14,240	14,240	14,240	14,240	14,240	14,240	14,240	14,240	14,240	14,240	14,240	14,240	14,240	14,240	14,240
2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$0	$0	$3,811,644	$0	$0	$1,234,459	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$7,929,428
$ -	**$ -**	**$ 3,811,644**	**$ -**	**$ -**	**$ 1,234,459**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 7,929,428**
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,061,408	$ 2,466,844	$ 5,505,708	$ 6,543,957	$ -	$ 2,468,918	$ 4,450,657	$ -	$ -	$ -	$ -	$ -	$ 15,674,976	$ -	$ -	$ 3,113,665	$ 5,987,121	$ (37,235,157)
$ 3,313,749	$ 3,413,493	$ 3,516,239	$ 3,622,078	$ 3,731,102	$ 3,843,409	$ 3,959,095	$ 4,078,264	$ 4,201,020	$ 4,327,470	$ 4,457,727	$ 4,591,905	$ 4,730,121	$ 4,872,498	$ 5,019,160	$ 5,170,237	$ 5,325,861	$ 5,486,169
$ 2,594,769	$ 2,672,872	$ 2,753,325	$ 2,836,200	$ 2,921,570	$ 3,009,509	$ 3,100,095	$ 3,193,408	$ 3,289,530	$ 3,388,545	$ 3,490,540	$ 3,595,605	$ 3,703,833	$ 3,815,318	$ 3,930,159	$ 4,048,457	$ 4,170,315	$ 4,295,842
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 11,969,926	**$ 8,553,208**	**$ 11,775,272**	**$ 13,002,235**	**$ 6,652,672**	**$ 9,321,836**	**$ 11,509,848**	**$ 7,271,672**	**$ 7,490,549**	**$ 7,716,015**	**$ 7,948,267**	**$ 8,187,510**	**$ 24,108,930**	**$ 8,687,816**	**$ 8,949,319**	**$ 12,332,358**	**$ 15,483,297**	**$ (27,453,146)**
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519	$ 5,287,519
$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035	$ 60,035
$ 1,623,346	$ 1,639,580	$ 1,655,813	$ 1,672,047	$ 1,688,280	$ 1,704,514	$ 1,720,747	$ 1,736,981	$ 1,753,214	$ 1,769,448	$ 1,785,681	$ 1,801,915	$ 1,818,148	$ 1,834,381	$ 1,850,615	$ 1,866,848	$ 1,883,082	$ 1,899,315
$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162	$ 67,162
$ 7,038,063	**$ 7,054,296**	**$ 7,070,530**	**$ 7,086,763**	**$ 7,102,996**	**$ 7,119,230**	**$ 7,135,463**	**$ 7,151,697**	**$ 7,167,930**	**$ 7,184,164**	**$ 7,200,397**	**$ 7,216,631**	**$ 7,232,864**	**$ 7,249,098**	**$ 7,265,331**	**$ 7,281,565**	**$ 7,297,798**	**$ 7,314,031**
$ 19,007,988	$ 15,607,505	$ 22,657,445	$ 20,088,998	$ 13,755,669	$ 17,675,525	$ 18,645,311	$ 14,423,369	$ 14,658,480	$ 14,900,179	$ 15,148,664	$ 15,404,140	$ 31,341,794	$ 15,936,913	$ 16,214,650	$ 19,613,923	$ 22,781,095	$ (12,209,686)

Centralized Natural Gas (1 of 3)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		2021	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**
Gas (MMbtu/yr)		70,358	69,026	72,516	107,687	117,518	117,518	117,518	125,727	125,727	125,727	125,727	125,727	125,727	125,727
Net Electricity Purchased (kWh/yr)		39,548,309	40,021,814	40,665,181	27,003,257	26,428,836	26,878,810	27,328,784	26,824,201	26,824,201	26,824,201	26,824,201	26,824,201	26,824,201	26,824,201
Carbon MTCO2e		20,025	20,149	20,599	16,841	17,127	17,312	17,497	17,725	17,725	17,725	17,725	17,725	17,725	17,725
Carbon MTCO2e - Heating & Cooling		7,456	7,570	8,049	4,433	4,764	4,949	5,135	5,401	5,401	5,401	5,401	5,401	5,401	5,401
Capital Expense	$ 119,107,390														
Owner Equity	$ -														
Debt Finance	$ 119,107,390														
Campus Heating Economics		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Capital Cost	**PV**														
Owner Equity (Construction Capital)	$ -														
Capital Recovery - Debt Service (Loan 1)	$ 96,903,357	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476
Capital Recovery - Debt Service (Loan 2)	$ 45,377,066	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552	$ 3,330,552
Future Building Connections	$ 20,683,270	$0	$0	$0	$1,733,957	$0	$0	$756,887	$0	$0	$0	$0	$0	$0	$1,514,647
Subtotal - Capital Cost	**$ 162,963,693**	**$ 8,847,028**	**$ 8,847,028**	**$ 8,847,028**	**$ 10,580,985**	**$ 8,847,028**	**$ 8,847,028**	**$ 9,603,915**	**$ 8,847,028**	**$ 8,847,028**	**$ 8,847,028**	**$ 8,847,028**	**$ 8,847,028**	**$ 8,847,028**	**$ 10,361,675**
Fixed Operating Cost															
Major Overhaul/Replacement	$ 22,615,073	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Major Renewal	$ 2,582,554	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Operating Labor	$ 64,754,295	$ 973,445	$ 1,002,745	$ 956,426	$ 907,075	$ 934,378	$ 969,790	$ 998,981	$ 1,037,357	$ 1,068,581	$ 1,100,746	$ 1,143,106	$ 1,177,513	$ 1,212,956	$ 1,249,466
Minor Repair	$ 57,064,488	$ 516,811	$ 532,367	$ 704,987	$ 726,541	$ 748,410	$ 775,808	$ 799,160	$ 841,901	$ 867,242	$ 893,346	$ 921,802	$ 949,548	$ 978,130	$ 1,007,571
Other Costs (M&V)	$ 405,469	$ -	$ -	$ -	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ -
Subtotal - Fixed Operating Cost	**$ 147,421,880**	**$ 1,490,256**	**$ 1,535,113**	**$ 1,661,414**	**$ 1,678,616**	**$ 1,727,788**	**$ 1,790,598**	**$ 1,843,140**	**$ 1,924,258**	**$ 1,980,823**	**$ 2,039,092**	**$ 2,109,908**	**$ 2,172,061**	**$ 2,236,086**	**$ 2,257,038**
Variable Operating Cost	$ -														
Gas	$ 93,859,377	$ 506,296	$ 513,270	$ 569,836	$ 878,240	$ 1,008,031	$ 1,154,613	$ 1,192,950	$ 1,296,787	$ 1,383,642	$ 1,421,037	$ 1,498,241	$ 1,547,700	$ 1,589,921	$ 1,627,317
Electricity Purchased	$ 89,072,497	$ 3,669,926	$ 3,736,478	$ 3,858,151	$ 2,629,065	$ 2,664,979	$ 2,831,173	$ 3,029,561	$ 3,149,994	$ 3,309,441	$ 3,408,866	$ 3,531,200	$ 3,637,498	$ 3,794,196	$ 3,950,436
Potable Water/Wastewater	$ 5,243,836	$ 167,080	$ 176,497	$ 189,375	$ 198,845	$ 212,073	$ 221,543	$ 231,013	$ 240,641	$ 240,641	$ 240,641	$ 240,641	$ 240,641	$ 240,641	$ 240,641
Carbon	$ 58,775,434	$ 1,483,837	$ 1,516,016	$ 1,573,383	$ 1,305,508	$ 1,347,174	$ 1,381,486	$ 1,416,222	$ 1,454,899	$ 1,475,106	$ 1,515,520	$ 1,535,727	$ 1,555,934	$ 1,576,141	$ 1,596,348
Chemicals	$ 5,841,975	$ 185,110	$ 195,426	$ 209,704	$ 220,121	$ 234,823	$ 245,240	$ 255,658	$ 266,376	$ 266,376	$ 266,376	$ 266,376	$ 266,376	$ 266,376	$ 266,376
Subtotal - Variable Cost	**$ 252,793,119**	**$ 6,012,249**	**$ 6,137,687**	**$ 6,400,448**	**$ 5,231,778**	**$ 5,467,080**	**$ 5,834,055**	**$ 6,125,402**	**$ 6,408,697**	**$ 6,675,205**	**$ 6,852,440**	**$ 7,072,185**	**$ 7,248,149**	**$ 7,467,275**	**$ 7,681,117**
Total Cost	$ 563,178,692	$ 16,349,533	$ 16,519,828	$ 16,908,891	$ 17,491,379	$ 16,041,896	$ 16,471,682	$ 17,572,458	$ 17,179,983	$ 17,503,057	$ 17,738,560	$ 18,029,122	$ 18,267,239	$ 18,550,389	$ 20,299,830

Centralized Natural Gas (2 of 3)

15	16	17	18	19	20	21	22	23
2035	2036	2037	2038	2039	2040	2041	2042	2043
153,646	153,646	153,646	153,646	153,646	173,957	173,957	185,598	185,598
23,327,870	23,327,870	23,327,870	23,327,870	23,327,870	20,978,699	20,978,699	10,889,837	10,889,837
17,768	17,768	17,768	17,768	17,768	17,880	17,880	14,343	14,343
5,488	5,488	5,488	5,488	5,488	5,691	5,691	2,199	2,199
2035	2036	2037	2038	2039	2040	2041	2042	2043
$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ 5,516,476	$ -	$ -	$ -
$ 3,330,552	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$0	$0	$0	$0	$7,369,539	$0	$3,877,309	$0	$0
$ 8,847,028	**$ 5,516,476**	**$ 5,516,476**	**$ 5,516,476**	**$ 12,886,015**	**$ 5,516,476**	**$ 3,877,309**	**$ -**	**$ -**
$ -	$ -	$ -	$ -	$ -	$ -	$ 3,262,159	$ -	$ -
$ -	$ -	$ -	$ 153,487	$ 158,107	$ 162,866	$ 167,768	$ 172,818	$ 5,934
$ 1,287,075	$ 1,325,816	$ 1,365,723	$ 1,406,832	$ 1,449,177	$ 1,492,797	$ 1,537,731	$ 1,584,016	$ 1,644,000
$ 1,095,648	$ 1,128,627	$ 1,162,599	$ 1,202,626	$ 1,238,825	$ 1,321,026	$ 1,360,789	$ 1,425,377	$ 1,479,071
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 2,382,724	**$ 2,454,443**	**$ 2,528,322**	**$ 2,762,945**	**$ 2,846,110**	**$ 2,976,690**	**$ 6,328,448**	**$ 3,182,211**	**$ 3,129,005**
$ 2,038,792	$ 2,080,364	$ 2,121,936	$ 2,163,508	$ 2,205,080	$ 2,543,647	$ 2,590,714	$ 2,814,298	$ 2,864,515
$ 3,567,417	$ 3,567,417	$ 3,567,417	$ 3,567,417	$ 3,567,417	$ 3,208,169	$ 3,208,169	$ 1,665,329	$ 1,665,329
$ 244,001	$ 244,001	$ 244,001	$ 244,001	$ 244,001	$ 244,382	$ 244,382	$ 58,304	$ 58,304
$ 1,620,470	$ 1,640,726	$ 1,681,238	$ 1,701,494	$ 1,721,749	$ 1,752,920	$ 1,773,303	$ 1,438,880	$ 1,455,231
$ 270,221	$ 270,221	$ 270,221	$ 270,221	$ 270,221	$ 270,946	$ 270,946	$ 66,411	$ 66,411
$ 7,740,901	**$ 7,802,729**	**$ 7,884,813**	**$ 7,946,640**	**$ 8,008,468**	**$ 8,020,065**	**$ 8,087,515**	**$ 6,043,223**	**$ 6,109,791**
$ 18,970,653	**$ 15,773,648**	**$ 15,929,611**	**$ 16,226,061**	**$ 23,740,593**	**$ 16,513,230**	**$ 18,293,272**	**$ 9,225,434**	**$ 9,238,796**

24	25	26	27	28	29	30	31	32
2044	2045	2046	2047	2048	2049	2050	2051	2052
185,598	201,939	201,939	201,939	201,939	201,939	201,939	201,939	201,939
10,889,837	9,664,114	9,664,114	9,664,114	9,664,114	9,664,114	9,664,114	9,664,114	9,664,114
14,343	14,706	14,706	14,706	14,706	14,706	14,706	14,706	14,706
2,199	2,615	2,615	2,615	2,615	2,615	2,615	2,615	2,615
2044	2045	2046	2047	2048	2049	2050	2051	2052
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$7,314,754	$0	$0	$0	$0	$0	$0	$0	$0
$ 7,314,754	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
$ -	$ -	$ -	$ -	$ 7,731,304	$ -	$ -	$ -	$ -
$ 1,301,986	$ 6,297	$ 6,486	$ 102,447	$ -	$ -	$ 104,677	$ -	$ -
$ 1,693,484	$ 1,745,508	$ 1,798,047	$ 1,852,169	$ 1,921,498	$ 1,979,335	$ 2,038,913	$ 2,100,285	$ 2,163,503
$ 1,523,591	$ 1,615,114	$ 1,663,729	$ 1,713,807	$ 1,774,469	$ 1,827,880	$ 1,882,900	$ 1,939,575	$ 1,997,956
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 4,519,061	**$ 3,366,918**	**$ 3,468,263**	**$ 3,668,423**	**$ 11,427,271**	**$ 3,807,216**	**$ 4,026,490**	**$ 4,039,859**	**$ 4,161,459**
$ 2,914,733	$ 3,226,002	$ 3,280,641	$ 3,335,279	$ 3,389,918	$ 3,444,557	$ 3,499,195	$ 3,553,834	$ 3,608,472
$ 1,665,329	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885
$ 58,304	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697
$ 1,471,582	$ 1,542,371	$ 1,559,136	$ 1,575,901	$ 1,592,666	$ 1,609,431	$ 1,626,196	$ 1,642,960	$ 1,659,725
$ 66,411	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320
$ 6,176,359	**$ 6,378,275**	**$ 6,449,678**	**$ 6,521,082**	**$ 6,592,485**	**$ 6,663,889**	**$ 6,735,292**	**$ 6,806,696**	**$ 6,878,099**
$ 18,010,174	**$ 9,745,193**	**$ 9,917,941**	**$ 10,189,505**	**$ 18,019,756**	**$ 10,471,105**	**$ 10,761,782**	**$ 10,846,555**	**$ 11,039,559**

Centralized Natural Gas (3 of 3)

33	34	35	36	37	38	39	40	41
2053	2054	2055	2056	2057	2058	2059	2060	2061
201,939	201,939	201,939	201,939	201,939	201,939	201,939	201,939	201,939
9,664,114	9,664,114	9,664,114	9,664,114	9,664,114	9,664,114	9,664,114	9,664,114	9,664,114
14,706	14,706	14,706	14,706	14,706	14,706	14,706	14,706	14,706
2,615	2,615	2,615	2,615	2,615	2,615	2,615	2,615	2,615
2053	2054	2055	2056	2057	2058	2059	2060	2061
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$0	$0	$3,811,644	$0	$0	$1,234,459	$0	$0	$0
$ -	**$ -**	**$ 3,811,644**	**$ -**	**$ -**	**$ 1,234,459**	**$ -**	**$ -**	**$ -**
$ -	$ 30,835,549	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ 548,188	$ -	$ -	$ -	$ 277,753	$ 286,114	$ 294,726	$ 303,597
$ 2,228,625	$ 2,295,706	$ 2,364,807	$ 2,435,988	$ 2,509,311	$ 2,584,841	$ 2,662,645	$ 2,742,790	$ 2,825,348
$ 2,058,095	$ 2,120,043	$ 2,183,856	$ 2,249,591	$ 2,317,303	$ 2,387,054	$ 2,458,904	$ 2,532,917	$ 2,609,158
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 4,286,719	**$ 35,799,486**	**$ 4,548,663**	**$ 4,685,578**	**$ 4,826,614**	**$ 5,249,649**	**$ 5,407,663**	**$ 5,570,434**	**$ 5,738,104**
$ 3,663,111	$ 3,717,750	$ 3,772,388	$ 3,827,027	$ 3,881,665	$ 3,936,304	$ 3,990,943	$ 4,045,581	$ 4,100,220
$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885
$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697
$ 1,676,490	$ 1,693,255	$ 1,710,020	$ 1,726,785	$ 1,743,550	$ 1,760,315	$ 1,777,080	$ 1,793,845	$ 1,810,609
$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320
$ 6,949,503	**$ 7,020,906**	**$ 7,092,310**	**$ 7,163,713**	**$ 7,235,117**	**$ 7,306,520**	**$ 7,377,924**	**$ 7,449,327**	**$ 7,520,731**
$ 11,236,222	$ 42,820,392	$ 15,452,617	$ 11,849,292	$ 12,061,731	$ 13,790,628	$ 12,785,587	$ 13,019,761	$ 13,258,835

42	43	44	45	46	47	48	49	50
2062	2063	2064	2065	2066	2067	2068	2069	2070
201,939	201,939	201,939	201,939	201,939	201,939	201,939	201,939	201,939
9,664,114	9,664,114	9,664,114	9,664,114	9,664,114	9,664,114	9,664,114	9,664,114	9,664,114
14,706	14,706	14,706	14,706	14,706	14,706	14,706	14,706	14,706
2,615	2,615	2,615	2,615	2,615	2,615	2,615	2,615	2,615
2062	2063	2064	2065	2066	2067	2068	2069	2070
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$0	$0	$0	$0	$0	$0	$0	$0	$0
$ -	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
$ -	$ 9,664,456	$ -	$ -	$ -	$ 22,166,335	$ -	$ -	$ (42,860,345)
$ 590,722	$ -	$ 136,425	$ 2,415,625	$ -	$ 149,119	$ 190,971	$ 12,830	$ (4,087,700)
$ 2,910,391	$ 2,997,994	$ 3,088,234	$ 3,181,190	$ 3,276,944	$ 3,375,580	$ 3,477,184	$ 3,581,848	$ 3,689,661
$ 2,687,694	$ 2,768,593	$ 2,851,928	$ 2,937,771	$ 3,026,198	$ 3,117,287	$ 3,211,117	$ 3,307,772	$ 3,407,336
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,188,807	**$ 15,431,044**	**$ 6,076,587**	**$ 8,534,586**	**$ 6,303,142**	**$ 28,808,320**	**$ 6,879,273**	**$ 6,902,449**	**$ (39,851,048)**
$ 4,154,858	$ 4,209,497	$ 4,264,135	$ 4,318,774	$ 4,373,413	$ 4,428,051	$ 4,482,690	$ 4,537,328	$ 4,591,967
$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885	$ 1,477,885
$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697
$ 1,827,374	$ 1,844,139	$ 1,860,904	$ 1,877,669	$ 1,894,434	$ 1,911,199	$ 1,927,964	$ 1,944,729	$ 1,961,494
$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320
$ 7,592,134	**$ 7,663,538**	**$ 7,734,941**	**$ 7,806,345**	**$ 7,877,748**	**$ 7,949,152**	**$ 8,020,555**	**$ 8,091,959**	**$ 8,163,362**
$ 13,780,942	$ 23,094,582	$ 13,811,529	$ 16,340,931	$ 14,180,890	$ 36,757,472	$ 14,899,828	$ 14,994,408	$ (31,687,685)

Centralized All-Electric (1 of 3)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14
		2021	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**
Gas (MMbtu/yr)		70,358	69,026	72,516	0	0	0	0	0	0	0	0	0	0	0
Net Electricity Purchased (kWh/yr)		39,548,309	40,021,814	40,665,181	43,989,062	44,997,330	45,447,304	45,897,278	46,714,195	46,714,195	46,714,195	46,714,195	46,714,195	46,714,195	46,714,195
Carbon MTCO2e		20,025	20,149	20,599	18,117	18,532	18,717	18,903	19,239	19,239	19,239	19,239	19,239	19,239	19,239
Capital Expense	$ 118,723,853														
Owner Equity	$ -														
Debt Finance	$ 118,723,853														
Campus Heating Economics		2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Capital Cost	**PV**														
Owner Equity (Construction Capital)	$ -														
Capital Recovery - Debt Service (Loan 1)	$ 96,591,319	$ 5,498,712	$ 5,498,712	$ 5,498,712	$ 5,498,712	$ 5,498,712	$ 5,498,712	$ 5,498,712	$ 5,498,712	$ 5,498,712	$ 5,498,712	$ 5,498,712	$ 5,498,712	$ 5,498,712	$ 5,498,712
Capital Recovery - Debt Service (Loan 2)	$ 45,230,948	$ 3,319,828	$ 3,319,828	$ 3,319,828	$ 3,319,828	$ 3,319,828	$ 3,319,828	$ 3,319,828	$ 3,319,828	$ 3,319,828	$ 3,319,828	$ 3,319,828	$ 3,319,828	$ 3,319,828	$ 3,319,828
Future Building Connections	$ 20,683,270	$0	$0	$0	$1,733,957	$0	$0	$756,887	$0	$0	$0	$0	$0	$0	$1,514,647
Subtotal - Capital Cost	**$ 162,505,536**	**$ 8,818,540**	**$ 8,818,540**	**$ 8,818,540**	**$ 10,552,497**	**$ 8,818,540**	**$ 8,818,540**	**$ 9,575,427**	**$ 8,818,540**	**$ 8,818,540**	**$ 8,818,540**	**$ 8,818,540**	**$ 8,818,540**	**$ 8,818,540**	**$ 10,333,187**
Fixed Operating Cost															
Major Overhaul/Replacement	$ 22,615,073	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Major Renewal	$ 2,582,554	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Operating Labor	$ 64,754,295	$ 973,445	$ 1,002,745	$ 956,426	$ 907,075	$ 934,378	$ 969,790	$ 998,981	$ 1,037,357	$ 1,068,581	$ 1,100,746	$ 1,143,106	$ 1,177,513	$ 1,212,956	$ 1,249,466
Minor Repair	$ 38,517,013	$ 496,209	$ 511,145	$ 555,648	$ 534,732	$ 550,828	$ 572,279	$ 589,504	$ 612,868	$ 631,315	$ 650,317	$ 671,458	$ 691,669	$ 712,489	$ 733,934
Other Costs (M&V)	$ 405,469	$ -	$ -	$ -	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ 45,000	$ -
Subtotal - Fixed Operating Cost	**$ 128,874,405**	**$ 1,469,654**	**$ 1,513,891**	**$ 1,512,074**	**$ 1,486,807**	**$ 1,530,206**	**$ 1,587,069**	**$ 1,633,485**	**$ 1,695,225**	**$ 1,744,896**	**$ 1,796,063**	**$ 1,859,564**	**$ 1,914,182**	**$ 1,970,445**	**$ 1,983,401**
Variable Operating Cost	$ -														
Gas	$ 1,566,529	$ 506,296	$ 513,270	$ 569,836	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Electricity Purchased	$ 215,920,507	$ 3,669,926	$ 3,736,478	$ 3,858,151	$ 4,282,820	$ 4,537,352	$ 4,787,011	$ 5,087,990	$ 5,485,696	$ 5,763,372	$ 5,936,521	$ 6,149,565	$ 6,334,682	$ 6,607,571	$ 6,879,661
Potable Water/Wastewater	$ 5,243,836	$ 167,080	$ 176,497	$ 189,375	$ 198,845	$ 212,073	$ 221,543	$ 231,013	$ 240,641	$ 240,641	$ 240,641	$ 240,641	$ 240,641	$ 240,641	$ 240,641
Carbon	$ 64,768,099	$ 1,483,837	$ 1,516,016	$ 1,573,383	$ 1,404,403	$ 1,457,719	$ 1,493,634	$ 1,529,971	$ 1,579,136	$ 1,601,068	$ 1,644,933	$ 1,666,865	$ 1,688,798	$ 1,710,730	$ 1,732,663
Chemicals	$ 5,841,975	$ 185,110	$ 195,426	$ 209,704	$ 220,121	$ 234,823	$ 245,240	$ 255,658	$ 266,376	$ 266,376	$ 266,376	$ 266,376	$ 266,376	$ 266,376	$ 266,376
Subtotal - Variable Cost	**$ 293,340,946**	**$ 6,012,249**	**$ 6,137,687**	**$ 6,400,448**	**$ 6,106,189**	**$ 6,441,967**	**$ 6,747,429**	**$ 7,104,632**	**$ 7,571,849**	**$ 7,871,457**	**$ 8,088,470**	**$ 8,323,447**	**$ 8,530,497**	**$ 8,825,318**	**$ 9,119,341**
Total Cost	$ 584,720,887	$ 16,300,443	$ 16,470,118	$ 16,731,062	$ 18,145,493	$ 16,790,713	$ 17,153,038	$ 18,313,544	$ 18,085,613	$ 18,434,894	$ 18,703,074	$ 19,001,552	$ 19,263,220	$ 19,614,303	$ 21,435,929

Centralized All-Electric (2 of 3)

15	16	17	18	19	20	21	22	23
2035	2036	2037	2038	2039	2040	2041	2042	2043
0	0	0	0	0	0	0	0	0
47,254,979	47,254,979	47,254,979	47,254,979	47,254,979	48,087,809	48,087,809	39,576,544	39,576,544
19,462	19,462	19,462	19,462	19,462	19,805	19,805	16,299	16,299
2035	2036	2037	2038	2039	2040	2041	2042	2043
$ 5,498,712	$ 5,498,712	$ 5,498,712	$ 5,498,712	$ 5,498,712	$ 5,498,712	$ -	$ -	$ -
$ 3,319,828	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$0	$0	$0	$0	$7,369,539	$0	$3,877,309	$0	$0
$ 8,818,540	**$ 5,498,712**	**$ 5,498,712**	**$ 5,498,712**	**$ 12,868,251**	**$ 5,498,712**	**$ 3,877,309**	**$ -**	**$ -**
$ -	$ -	$ -	$ -	$ -	$ -	$ 3,262,159	$ -	$ -
$ -	$ -	$ -	$ 153,487	$ 158,107	$ 162,866	$ 167,768	$ 172,818	$ 5,934
$ 1,287,075	$ 1,325,816	$ 1,365,723	$ 1,406,832	$ 1,449,177	$ 1,492,797	$ 1,537,731	$ 1,584,016	$ 1,644,000
$ 756,026	$ 778,782	$ 802,224	$ 831,404	$ 856,429	$ 882,207	$ 908,762	$ 936,116	$ 975,083
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 2,043,101	**$ 2,104,598**	**$ 2,167,947**	**$ 2,391,722**	**$ 2,463,713**	**$ 2,537,871**	**$ 5,876,420**	**$ 2,692,950**	**$ 2,625,017**
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 7,226,472	$ 7,226,472	$ 7,226,472	$ 7,226,472	$ 7,226,472	$ 7,353,833	$ 7,353,833	$ 6,052,247	$ 6,052,247
$ 244,001	$ 244,001	$ 244,001	$ 244,001	$ 244,001	$ 244,382	$ 244,382	$ 58,304	$ 58,304
$ 1,774,907	$ 1,797,093	$ 1,841,466	$ 1,863,652	$ 1,885,839	$ 1,941,652	$ 1,964,230	$ 1,635,154	$ 1,653,735
$ 270,221	$ 270,221	$ 270,221	$ 270,221	$ 270,221	$ 270,946	$ 270,946	$ 66,411	$ 66,411
$ 9,515,602	**$ 9,537,788**	**$ 9,582,161**	**$ 9,604,347**	**$ 9,626,533**	**$ 9,810,813**	**$ 9,833,391**	**$ 7,812,116**	**$ 7,830,697**
$ 20,377,243	**$ 17,141,099**	**$ 17,248,820**	**$ 17,494,782**	**$ 24,958,498**	**$ 17,847,397**	**$ 19,587,120**	**$ 10,505,065**	**$ 10,455,714**

24	25	26	27	28	29	30	31	32
2044	2045	2046	2047	2048	2049	2050	2051	2052
0	0	0	0	0	0	0	0	0
39,576,544	40,193,953	40,193,953	40,193,953	40,193,953	40,193,953	40,193,953	40,193,953	40,193,953
16,299	16,554	16,554	16,554	16,554	16,554	16,554	16,554	16,554
2044	2045	2046	2047	2048	2049	2050	2051	2052
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$7,314,754	$0	$0	$0	$0	$0	$0	$0	$0
$ 7,314,754	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
$ -	$ -	$ -	$ -	$ 7,731,304	$ -	$ -	$ -	$ -
$ 1,301,986	$ 6,297	$ 6,486	$ 102,447	$ -	$ -	$ 104,677	$ -	$ -
$ 1,693,484	$ 1,745,508	$ 1,798,047	$ 1,852,169	$ 1,921,498	$ 1,979,335	$ 2,038,913	$ 2,100,285	$ 2,163,503
$ 1,004,433	$ 1,050,157	$ 1,081,766	$ 1,114,327	$ 1,156,945	$ 1,191,769	$ 1,227,641	$ 1,264,593	$ 1,302,657
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 3,999,903	**$ 2,801,961**	**$ 2,886,300**	**$ 3,068,943**	**$ 10,809,747**	**$ 3,171,104**	**$ 3,371,231**	**$ 3,364,877**	**$ 3,466,160**
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,052,247	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664
$ 58,304	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697
$ 1,672,316	$ 1,736,147	$ 1,755,019	$ 1,773,890	$ 1,792,761	$ 1,811,632	$ 1,830,503	$ 1,849,374	$ 1,868,246
$ 66,411	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320
$ 7,849,278	**$ 8,014,828**	**$ 8,033,699**	**$ 8,052,570**	**$ 8,071,441**	**$ 8,090,312**	**$ 8,109,184**	**$ 8,128,055**	**$ 8,146,926**
$ 19,163,935	**$ 10,816,788**	**$ 10,919,999**	**$ 11,121,514**	**$ 18,881,188**	**$ 11,261,416**	**$ 11,480,414**	**$ 11,492,932**	**$ 11,613,086**

Centralized All-Electric (3 of 3)

33	34	35	36	37	38	39	40	41
2053	**2054**	**2055**	**2056**	**2057**	**2058**	**2059**	**2060**	**2061**
0	0	0	0	0	0	0	0	0
40,193,953	40,193,953	40,193,953	40,193,953	40,193,953	40,193,953	40,193,953	40,193,953	40,193,953
16,554	16,554	16,554	16,554	16,554	16,554	16,554	16,554	16,554
2053	2054	2055	2056	2057	2058	2059	2060	2061
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$0	$0	$3,811,644	$0	$0	$1,234,459	$0	$0	$0
$ -	**$ -**	**$ 3,811,644**	**$ -**	**$ -**	**$ 1,234,459**	**$ -**	**$ -**	**$ -**
$ -	$ 30,835,549	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ 548,188	$ -	$ -	$ -	$ 277,753	$ 286,114	$ 294,726	$ 303,597
$ 2,228,625	$ 2,295,706	$ 2,364,807	$ 2,435,988	$ 2,509,311	$ 2,584,841	$ 2,662,645	$ 2,742,790	$ 2,825,348
$ 1,341,867	$ 1,382,257	$ 1,423,863	$ 1,466,721	$ 1,510,870	$ 1,556,347	$ 1,603,193	$ 1,651,449	$ 1,701,158
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 3,570,492	**$ 35,061,700**	**$ 3,788,670**	**$ 3,902,709**	**$ 4,020,181**	**$ 4,418,941**	**$ 4,551,952**	**$ 4,688,965**	**$ 4,830,103**
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664
$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697
$ 1,887,117	$ 1,905,988	$ 1,924,859	$ 1,943,730	$ 1,962,601	$ 1,981,473	$ 2,000,344	$ 2,019,215	$ 2,038,086
$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320
$ 8,165,797	**$ 8,184,668**	**$ 8,203,539**	**$ 8,222,411**	**$ 8,241,282**	**$ 8,260,153**	**$ 8,279,024**	**$ 8,297,895**	**$ 8,316,766**
$ 11,736,289	**$ 43,246,368**	**$ 15,803,854**	**$ 12,125,120**	**$ 12,261,462**	**$ 13,913,553**	**$ 12,830,976**	**$ 12,986,861**	**$ 13,146,870**

42	43	44	45	46	47	48	49	50
2062	**2063**	**2064**	**2065**	**2066**	**2067**	**2068**	**2069**	**2070**
0	0	0	0	0	0	0	0	0
40,193,953	40,193,953	40,193,953	40,193,953	40,193,953	40,193,953	40,193,953	40,193,953	40,193,953
16,554	16,554	16,554	16,554	16,554	16,554	16,554	16,554	16,554
2062	2063	2064	2065	2066	2067	2068	2069	2070
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$0	$0	$0	$0	$0	$0	$0	$0	$0
$ -	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
$ -	$ 9,664,456	$ -	$ -	$ -	$ 22,166,335	$ -	$ -	$ (42,860,345)
$ 590,722	$ -	$ 136,425	$ 2,415,625	$ -	$ 149,119	$ 190,971	$ 12,830	$ (4,087,700)
$ 2,910,391	$ 2,997,994	$ 3,088,234	$ 3,181,190	$ 3,276,944	$ 3,375,580	$ 3,477,184	$ 3,581,848	$ 3,689,661
$ 1,752,363	$ 1,805,109	$ 1,859,443	$ 1,915,412	$ 1,973,066	$ 2,032,455	$ 2,093,632	$ 2,156,650	$ 2,221,565
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 5,253,476	**$ 14,467,559**	**$ 5,084,102**	**$ 7,512,227**	**$ 5,250,009**	**$ 27,723,488**	**$ 5,761,788**	**$ 5,751,327**	**$ (41,036,818)**
$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664	$ 6,146,664
$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697	$ 61,697
$ 2,056,957	$ 2,075,828	$ 2,094,700	$ 2,113,571	$ 2,132,442	$ 2,151,313	$ 2,170,184	$ 2,189,055	$ 2,207,927
$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320	$ 70,320
$ 8,335,638	**$ 8,354,509**	**$ 8,373,380**	**$ 8,392,251**	**$ 8,411,122**	**$ 8,429,993**	**$ 8,448,865**	**$ 8,467,736**	**$ 8,486,607**
$ 13,589,114	**$ 22,822,068**	**$ 13,457,482**	**$ 15,904,478**	**$ 13,661,131**	**$ 36,153,482**	**$ 14,210,652**	**$ 14,219,063**	**$ (32,550,211)**

A.4 Uniformat Level II Summary and C-100

Level 1 Major Group Elements	Level 2 Group Elements	Qty	Unit	Cost	Notes
	A10 Foundations	25692	gsf	$2,446,718	
A Substructure					
	B10 Super Structure	31842	gsf	$3,370,759	
B Shell	B20 Exterior Enclosure	13873	vsf	$1,661,917	
	B30 Roofing	25692	gsf	$2,348,737	
	C10 Interior Construction	31842	gsf	$2,367,900	
C Interiors					
	D10 Conveying	31842	gsf	$308,556	
D Services					
	D20 Plumbing & D30 HVAC			$13,195,470	Production Plant Heating Systems
	D20 Plumbing & D30 HVAC			$12,397,000	Production Plant CHW Systems
	D20 Plumbing & D30 HVAC			$1,265,725	Production Plant Control Systems
	D20 Plumbing & D30 HVAC			$2,821,040	Production Plant Building HVAC Services
	D20 Plumbing & D30 HVAC			$2,404,892	Modification to "In Building" Systems (Temple of Justice, Pritchard, Emp Sec, Newhouse, GA, Archives)
	D20 Plumbing & D30 HVAC			$3,385,938	ETS HW Connections to "In Building Systems
	D20 Plumbing & D30 HVAC			$1,729,000	ETS CHW Connections to "In Building Systems
	D40 Fire Protection	31842	gsf	$185,585	
	D50 Electrical			$3,440,605	Production Plant Electrical Systems
	E10 Equipment & E20 Furnishings	31842	gsf	$194,724	
E Equipment & Furnishings					
F Special Construction & Demolition	F20 Selective Building Demolition	31842	gsf	$1,545,523	New Building Demolition
	F20 Selective Building Demolition			$75,558	Existing OB2 basement area
	F20 Selective Building Demolition			$762,489	Steam Distribution System
	F20 Selective Building Demolition			$100,000	Fuel Tank Removal
	F20 Selective Building Demolition			$350,000	Powerhouse - Cut/Cap/Make Safe
	G10 Site Preparation			$8,000,000	Site Civil - Trenching for Tunnel/Utilidor/Direct Bury
G Building Sitework	G10 Site Preparation	88600	gsf	$3,410,179	New Building Sitework
	G30 Site Mechanical Utilities			$738,750	PSE Natural Gas Service
	G30 Site Mechanical Utilities			$4,000,085	HW Distribution Piping
	G30 Site Mechanical Utilities			$3,968,800	CHW Distribution Piping
	G40 Site Electrical Utilities			$197,000	PSE Electrical Service Upgrades
	G40 Site Electrical Utilities			$45,000	PSE Development of Interconnection Fees
	G90 Other Site Construction	31842	gsf	$2,787,289	Building Site Management
	G90 Other Site Construction	31842	gsf	$1,416,943	Temporary Site Services
	G90 Other Site Construction	4.6%		$4,145,906	Project Construction Management
	G90 Other Site Construction			$1,261,022	DES Project Management
	G90 Other Site Construction	0.8%		$693,575	Construction Bond
	G90 Other Site Construction			$60,000	M&V Year 1
	Z 50 Design Allowance			$3,100,000	Design: Arch/Civil/Structural/Env/Landscape/Acoustic/Wind/Envelope
Z Additional Costs	Z 50 Design Allowance			$275,000	Design: Geotech & Survey
	Z 50 Design Allowance	5.9%		$4,970,879	Design: Mechanical/Electrical
	Z60 Overhead & Profit	9.9%		$8,373,648	Overhead
	Z60 Overhead & Profit	5.8%		$4,905,773	Profit
	Construction Contingency	8.5%		$7,161,435	
	Estimate Tax	8.8%		$9,457,972	
Subtotal				**$125,327,390**	
Inflation Projection	Z70 Inflation Allowance	0.03	/yr	$136,948,623	(Original Estimate from 2016 - escalated to 2019)

State of Washington

AGENCY / INSTITUTION PROJECT COST SUMMARY

Agency	Department of Enterprise Services
Project Name	Next Century Capitol Campus - Phase 1
OFM Project Number	30000808

Contact Information	
Name	Ron Major
Phone Number	360-239-4134
Email	ron.major@des.wa.gov

Statistics			
Gross Square Feet	15,000	MACC per Square Foot	$0
Usable Square Feet	13,500	Escalated MACC per Square Foot	$0
Space Efficiency	90.0%	A/E Fee Class	A
Construction Type	Heating and power plan	A/E Fee Percentage	17.40%
Remodel	Yes	Projected Life of Asset (Years)	50
Additional Project Details			
Alternative Public Works Project	No	Art Requirement Applies	Yes
Inflation Rate	3.12%	Higher Ed Institution	No
Sales Tax Rate %	8.80%	Location Used for Tax Rate	Olympia
Contingency Rate	10%		
Base Month	May-16		
Project Administered By	DES		

Schedule			
Predesign Start	March-14	Predesign End	June-17
Design Start	September-27	Design End	September-29
Construction Start	September-29	Construction End	December-32
Construction Duration	39 Months		

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Project Cost Estimate

Total Project	$14,218,594	Total Project Escalated	$21,172,815
		Rounded Escalated Total	$21,173,000

State of Washington
AGENCY / INSTITUTION PROJECT COST SUMMARY

Agency	Department of Enterprise Services
Project Name	Next Century Capitol Campus - Phase 1
OFM Project Number	30000808

Cost Estimate Summary

Acquisition			
Acquisition Subtotal	**$0**	**Acquisition Subtotal Escalated**	**$0**

Consultant Services			
Predesign Services	$0		
A/E Basic Design Services	$7,300,000		
Extra Services	$3,688,916		
Other Services	$0		
Design Services Contingency	$3,229,678		
Consultant Services Subtotal	**$14,218,594**	**Consultant Services Subtotal Escalated**	**$21,172,815**

Construction			
Construction Contingencies	$0	Construction Contingencies Escalated	$0
Maximum Allowable Construction Cost (MACC)	$0	Maximum Allowable Construction Cost (MACC) Escalated	$0
Sales Tax	$0	Sales Tax Escalated	$0
Construction Subtotal	**$0**	**Construction Subtotal Escalated**	**$0**

Equipment			
Equipment	$0		
Sales Tax	$0		
Non-Taxable Items	$0		
Equipment Subtotal	**$0**	**Equipment Subtotal Escalated**	**$0**

Artwork			
Artwork Subtotal	**$0**	**Artwork Subtotal Escalated**	**$0**

Agency Project Administration			
Agency Project Administration Subtotal	$0		
DES Additional Services Subtotal	$0		
Other Project Admin Costs	$0		
Project Administration Subtotal	**$0**	**Project Administation Subtotal Escalated**	**$0**

Other Costs			
Other Costs Subtotal	**$0**	**Other Costs Subtotal Escalated**	**$0**

Project Cost Estimate

Total Project	**$14,218,594**	Total Project Escalated	**$21,172,815**
		Rounded Escalated Total	**$21,173,000**

State of Washington

AGENCY / INSTITUTION PROJECT COST SUMMARY

Agency	Department of Enterprise Services
Project Name	Next Century Capitol Campus - Phase 2
OFM Project Number	30000808

Contact Information	
Name	Ron Major
Phone Number	360-239-4134
Email	ron.major@des.wa.gov

Statistics			
Gross Square Feet	15,000	MACC per Square Foot	$2,806
Usable Square Feet	13,500	Escalated MACC per Square Foot	$4,308
Space Efficiency	90.0%	A/E Fee Class	A
Construction Type	Heating and power plan	A/E Fee Percentage	10.32%
Remodel	Yes	Projected Life of Asset (Years)	50
Additional Project Details			
Alternative Public Works Project	No	Art Requirement Applies	Yes
Inflation Rate	3.12%	Higher Ed Institution	No
Sales Tax Rate %	8.80%	Location Used for Tax Rate	Olympia
Contingency Rate	10%		
Base Month	May-16		
Project Administered By	DES		

Schedule			
Predesign Start	March-14	Predesign End	June-17
Design Start	September-27	Design End	September-29
Construction Start	September-29	Construction End	June-31
Construction Duration	21 Months		

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Project Cost Estimate			
Total Project	$54,936,832	Total Project Escalated	$84,246,885
		Rounded Escalated Total	$84,247,000

STATE OF WASHINGTON

AGENCY / INSTITUTION PROJECT COST SUMMARY

Agency	Department of Enterprise Services
Project Name	Next Century Capitol Campus - Phase 2
OFM Project Number	30000808

Cost Estimate Summary

Acquisition			
Acquisition Subtotal	**$0**	**Acquisition Subtotal Escalated**	**$0**

Consultant Services			
Predesign Services	$0		
A/E Basic Design Services	$0		
Extra Services	$0		
Other Services	$1,481,005		
Design Services Contingency	$1,213,494		
Consultant Services Subtotal	**$2,694,499**	**Consultant Services Subtotal Escalated**	**$4,170,545**

Construction			
Construction Contingencies	$4,208,453	Construction Contingencies Escalated	$6,513,844
Maximum Allowable Construction Cost (MACC)	$42,084,533	Maximum Allowable Construction Cost (MACC) Escalated	$64,614,944
Sales Tax	$4,073,783	Sales Tax Escalated	$6,259,334
Construction Subtotal	**$50,366,768**	**Construction Subtotal Escalated**	**$77,388,122**

Equipment			
Equipment	$0		
Sales Tax	$0		
Non-Taxable Items	$0		
Equipment Subtotal	**$0**	**Equipment Subtotal Escalated**	**$0**

Artwork			
Artwork Subtotal	**$323,075**	**Artwork Subtotal Escalated**	**$323,075**

Agency Project Administration			
Agency Project Administration Subtotal	$0		
DES Additional Services Subtotal	$0		
Other Project Admin Costs	$0		
Project Administration Subtotal	**$630,500**	**Project Administation Subtotal Escalated**	**$975,888**

Other Costs			
Other Costs Subtotal	**$921,990**	**Other Costs Subtotal Escalated**	**$1,389,255**

Project Cost Estimate			
Total Project	**$54,936,832**	Total Project Escalated	**$84,246,885**
		Rounded Escalated Total	**$84,247,000**

State of Washington

AGENCY / INSTITUTION PROJECT COST SUMMARY

Agency	Department of Enterprise Services
Project Name	Next Century Capitol Campus - Phase 3
OFM Project Number	30000808

Contact Information	
Name	Ron Major
Phone Number	360-239-4134
Email	ron.major@des.wa.gov

Statistics			
Gross Square Feet	15,000	MACC per Square Foot	$2,806
Usable Square Feet	13,500	Escalated MACC per Square Foot	$4,541
Space Efficiency	90.0%	A/E Fee Class	A
Construction Type	Heating and power plan	A/E Fee Percentage	10.32%
Remodel	Yes	Projected Life of Asset (Years)	50
Additional Project Details			
Alternative Public Works Project	No	Art Requirement Applies	Yes
Inflation Rate	3.12%	Higher Ed Institution	No
Sales Tax Rate %	8.80%	Location Used for Tax Rate	Olympia
Contingency Rate	10%		
Base Month	May-16		
Project Administered By	DES		

Schedule			
Predesign Start	March-14	Predesign End	June-17
Design Start	September-27	Design End	September-29
Construction Start	July-31	Construction End	December-32
Construction Duration	17 Months		

Green cells must be filled in by user

Project Cost Estimate			
Total Project	$56,215,330	Total Project Escalated	$90,056,864
		Rounded Escalated Total	$90,057,000

State of Washington
AGENCY / INSTITUTION PROJECT COST SUMMARY

Agency	Department of Enterprise Services
Project Name	Next Century Capitol Campus - Phase 3
OFM Project Number	30000808

Cost Estimate Summary

Acquisition			
Acquisition Subtotal	**$0**	**Acquisition Subtotal Escalated**	**$0**

Consultant Services			
Predesign Services	$0		
A/E Basic Design Services	$0		
Extra Services	$0		
Other Services	$1,481,005		
Design Services Contingency	$1,213,494		
Consultant Services Subtotal	**$2,694,499**	**Consultant Services Subtotal Escalated**	**$4,389,877**

Construction			
Construction Contingencies	$4,208,453	Construction Contingencies Escalated	$6,856,413
Maximum Allowable Construction Cost (MACC)	$42,084,533	Maximum Allowable Construction Cost (MACC) Escalated	$68,114,681
Sales Tax	$4,073,783	Sales Tax Escalated	$6,597,457
Construction Subtotal	**$50,366,768**	**Construction Subtotal Escalated**	**$81,568,551**

Equipment			
Equipment	$0		
Sales Tax	$0		
Non-Taxable Items	$0		
Equipment Subtotal	**$0**	**Equipment Subtotal Escalated**	**$0**

Artwork			
Artwork Subtotal	**$1,601,573**	**Artwork Subtotal Escalated**	**$1,601,573**

Agency Project Administration			
Agency Project Administration Subtotal	$0		
DES Additional Services Subtotal	$0		
Other Project Admin Costs	$0		
Project Administration Subtotal	**$630,500**	**Project Administation Subtotal Escalated**	**$1,027,211**

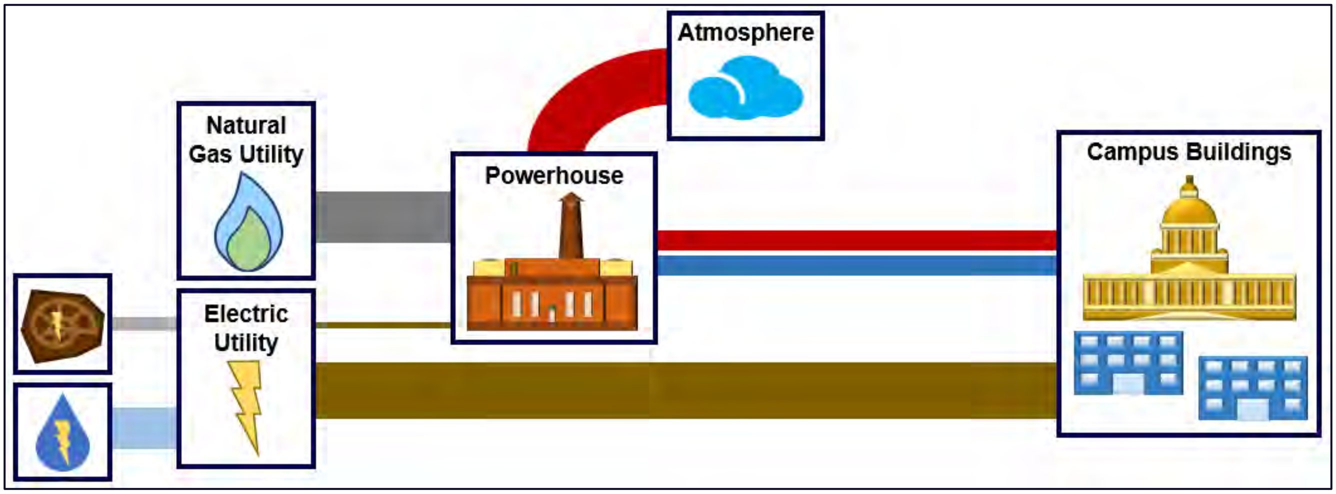
Other Costs			
Other Costs Subtotal	**$921,990**	**Other Costs Subtotal Escalated**	**$1,469,652**

Project Cost Estimate			
Total Project	**$56,215,330**	Total Project Escalated	**$90,056,864**
		Rounded Escalated Total	**$90,057,000**

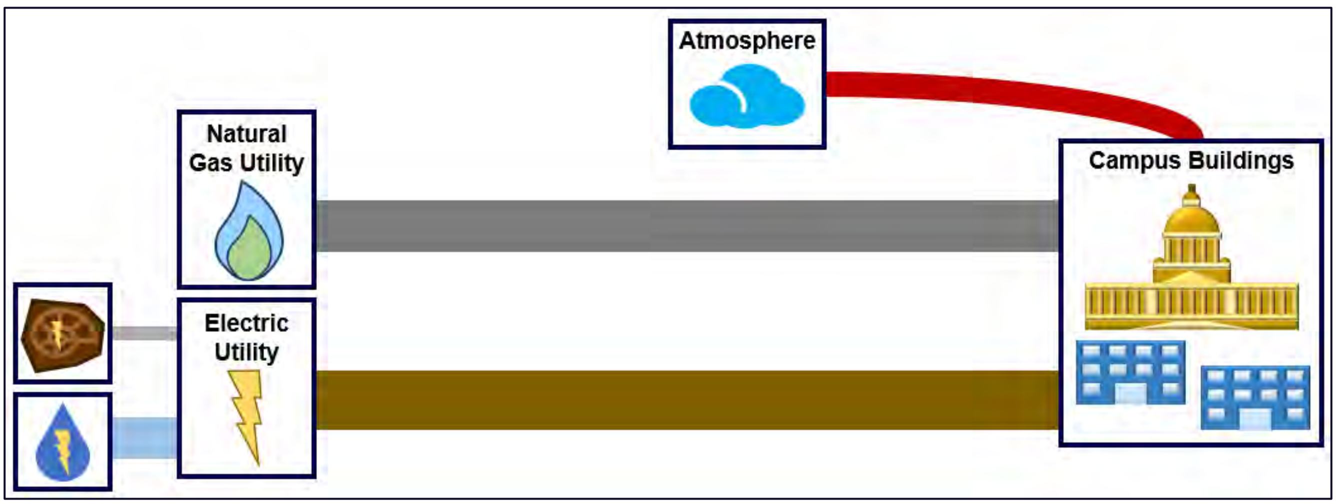
A.5 High-Level Alternative Diagrams

Heating	Cooling	Electric	Natural Gas / Non-Renewables	Renewable Energy

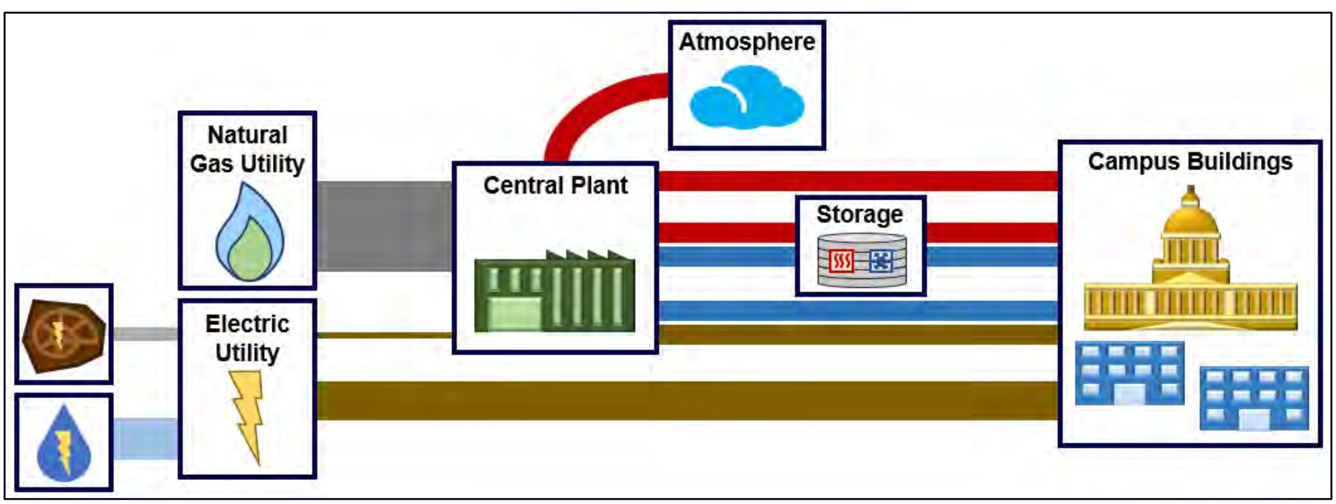
Business-as-Usual



Decentralized



Centralized



A.6 Legislation

RCW 39.35C.070

Development of cogeneration projects.
(1) Consistent with the region's need to develop cost-effective, high efficiency electric energy resources, the state shall investigate and, if appropriate, pursue development of cost-effective opportunities for cogeneration in existing or new state facilities.
(2) To assist state agencies in identifying, evaluating, and developing potential cogeneration projects at their facilities, the department shall notify state agencies of their responsibilities under this chapter; apprise them of opportunities to develop and finance such projects; and provide technical and analytical support. The department shall recover costs for such assistance through written agreements, including reimbursement from third parties participating in such projects, for any costs and expenses incurred in providing such assistance.
(3)(a) The department shall identify priorities for cogeneration projects at state facilities, and, where such projects are initially deemed desirable by the department and the appropriate state agency, the department shall notify the local utility serving the state facility of its intent to conduct a feasibility study at such facility. The department shall consult with the local utility and provide the local utility an opportunity to participate in the development of the feasibility study for the state facility it serves.
(b) If the local utility has an interest in participating in the feasibility study, it shall notify the department and the state agency whose facility or facilities it serves within sixty days of receipt of notification pursuant to (a) of this subsection as to the nature and scope of its desired participation. The department, state agency, and local utility shall negotiate the responsibilities, if any, of each in conducting the feasibility study, and these responsibilities shall be specified in a written agreement.
(c) If a local utility identifies a potential cogeneration project at a state facility for which it intends to conduct a feasibility study, it shall notify the department and the appropriate state agency. The department, state agency, and local utility shall negotiate the responsibilities, if any, of each in conducting the feasibility study, and these responsibilities shall be specified in a written agreement. Nothing in this section shall preclude a local utility from conducting an independent assessment of a potential cogeneration project at a state facility.
(d) Agreements written pursuant to (a) and (b) of this subsection shall include a provision for the recovery of costs incurred by a local utility in performing a feasibility study in the event such utility does not participate in the development of the cogeneration project. If the local utility does participate in the cogeneration project through energy purchase, project development or ownership, recovery of the utility's costs may be deferred or provided for through negotiation on agreements for energy purchase, project development or ownership.
(e) If the local utility declines participation in the feasibility study, the department and the state agency may receive and solicit proposals to conduct the feasibility study from other parties. Participation of these other parties shall also be secured and defined by a written agreement which may include the provision for reimbursement of costs incurred in the formulation of the feasibility study.
(4) The feasibility study shall include consideration of regional and local utility needs for power, the consistency of the proposed cogeneration project with the state energy strategy, the cost and certainty of fuel supplies, the value of electricity produced, the capability of the state agency to own and/or operate such facilities, the capability of utilities or third parties to own and/or operate such facilities, requirements for and costs of standby sources of power, costs associated with interconnection with the local electric utility's transmission system, the capability of the local electric utility to wheel electricity generated by the facility, costs associated with obtaining wheeling services, potential financial risks and losses to the state and/or state agency, measures to mitigate the financial risk to the state and/or state agency, and benefits to the state and to the state agency from a range of design configurations, ownership, and operation options.
(5) Based upon the findings of the feasibility study, the department and the state agency shall determine whether a cogeneration project will be cost-effective and whether development of a cogeneration project should be pursued. This determination shall be made in consultation with the local utility or, if the local utility had not participated in the development of the feasibility study, with any third party that may have participated in the development of the feasibility study.

(a) Recognizing the local utility's expertise, knowledge, and ownership and operation of the local utility systems, the department and the state agency shall have the authority to negotiate directly with the local utility for the purpose of entering into a sole source contract to develop, own, and/or operate the cogeneration facility. The contract may also include provisions for the purchase of electricity or thermal energy from the cogeneration facility, the acquisition of a fuel source, and any financial considerations which may accrue to the state from ownership and/or operation of the cogeneration facility by the local utility.
(b) The department may enter into contracts through competitive negotiation under this subsection for the development, ownership, and/or operation of a cogeneration facility. In determining an acceptable bid, the department and the state agency may consider such factors as technical knowledge, experience, management, staff, or schedule, as may be necessary to achieve economical construction or operation of the project. The selection of a developer or operator of a cogeneration facility shall be made in accordance with procedures for competitive bidding under chapter 43.19 RCW.
(c) The department shall comply with the requirements of chapter 39.80 RCW when contracting for architectural or engineering services.
(6)(a) The state may own and/or operate a cogeneration project at a state facility. However, unless the cogeneration project is determined to be cost-effective, based on the findings of the feasibility study, the department and state agency shall not pursue development of the project as a state-owned facility. If the project is found to be cost-effective, and the department and the state agency agree development of the cogeneration project should be pursued as a state-owned and/or operated facility, the department shall assist the state agency in the preparation of a finance and development plan for the cogeneration project. Any such plan shall fully account for and specify all costs to the state for developing and/or operating the cogeneration facility.
(b) It is the general intent of this chapter that cogeneration projects developed and owned by the state will be sized to the projected thermal energy load of the state facility over the useful life of the project. The principal purpose and use of such projects is to supply thermal energy to a state facility and not primarily to develop generating capacity for the sale of electricity. For state-owned projects with electricity production in excess of projected thermal requirements, the department shall seek and obtain legislative appropriation and approval for development. Nothing in chapter 201, Laws of 1991 shall be construed to authorize any state agency to sell electricity or thermal energy on a retail basis.
(7) When a cogeneration facility will be developed, owned, and/or operated by a state agency or third party other than the local serving utility, the department and the state agency shall negotiate a written agreement with the local utility. Elements of such an agreement shall include provisions to ensure system safety, provisions to ensure reliability of any interconnected operations equipment necessary for parallel operation and switching equipment capable of isolating the generation facility, the provision of and reimbursement for standby services, if required, and the provision of and reimbursement for wheeling electricity, if the provision of such has been agreed to by the local utility.
(8) The state may develop and own a thermal energy distribution system associated with a cogeneration project for the principal purpose of distributing thermal energy at the state facility. If thermal energy is to be sold outside the state facility, the state may only sell the thermal energy to a utility.

RCW 70.235.050

Greenhouse gas emission limits for state agencies—Timeline—Reports—Strategy—Point of accountability employee for energy and climate change initiatives.
(1) All state agencies shall meet the statewide greenhouse gas emission limits established in RCW 70.235.020 to achieve the following, using the estimates and strategy established in subsections (2) and (3) of this section:
(a) By July 1, 2020, reduce emissions by fifteen percent from 2005 emission levels;
(b) By 2035, reduce emissions to thirty-six percent below 2005 levels; and
(c) By 2050, reduce emissions to the greater reduction of fifty-seven and one-half percent below 2005 levels, or seventy percent below the expected state government emissions that year.

(2)(a) By June 30, 2010, all state agencies shall report estimates of emissions for 2005 to the department, including 2009 levels of emissions, and projected emissions through 2035.
(b) State agencies required to report under RCW 70.94.151 must estimate emissions from methodologies recommended by the department and must be based on actual operation of those agencies. Agencies not required to report under RCW 70.94.151 shall derive emissions estimates using an emissions calculator provided by the department.
(3) By June 30, 2011, each state agency shall submit to the department a strategy to meet the requirements in subsection (1) of this section. The strategy must address employee travel activities, teleconferencing alternatives, and include existing and proposed actions, a timeline for reductions, and recommendations for budgetary and other incentives to reduce emissions, especially from employee business travel.
(4) By October 1st of each even-numbered year beginning in 2012, each state agency shall report to the department the actions taken to meet the emission reduction targets under the strategy for the preceding fiscal biennium. The department may authorize the department of enterprise services to report on behalf of any state agency having fewer than five hundred full-time equivalent employees at any time during the reporting period. The department shall cooperate with the department of enterprise services and the department of commerce to develop consolidated reporting methodologies that incorporate emission reduction actions taken across all or substantially all state agencies.
(5) All state agencies shall cooperate in providing information to the department, the department of enterprise services, and the department of commerce for the purposes of this section.
(6) The governor shall designate a person as the single point of accountability for all energy and climate change initiatives within state agencies. This position must be funded from current full-time equivalent allocations without increasing budgets or staffing levels. If duties must be shifted within an agency, they must be shifted among current full-time equivalent allocations. All agencies, councils, or work groups with energy or climate change initiatives shall coordinate with this designee.

RCW 43.21M.040

Incorporation of adaptation plans of action by state agencies.

State agencies shall strive to incorporate adaptation plans of action as priority activities when planning or designing agency policies and programs. Agencies shall consider: The integrated climate change response strategy when designing, planning, and funding infrastructure projects; and incorporating natural resource adaptation actions and alternative energy sources when designing and planning infrastructure projects.

A.7 References

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