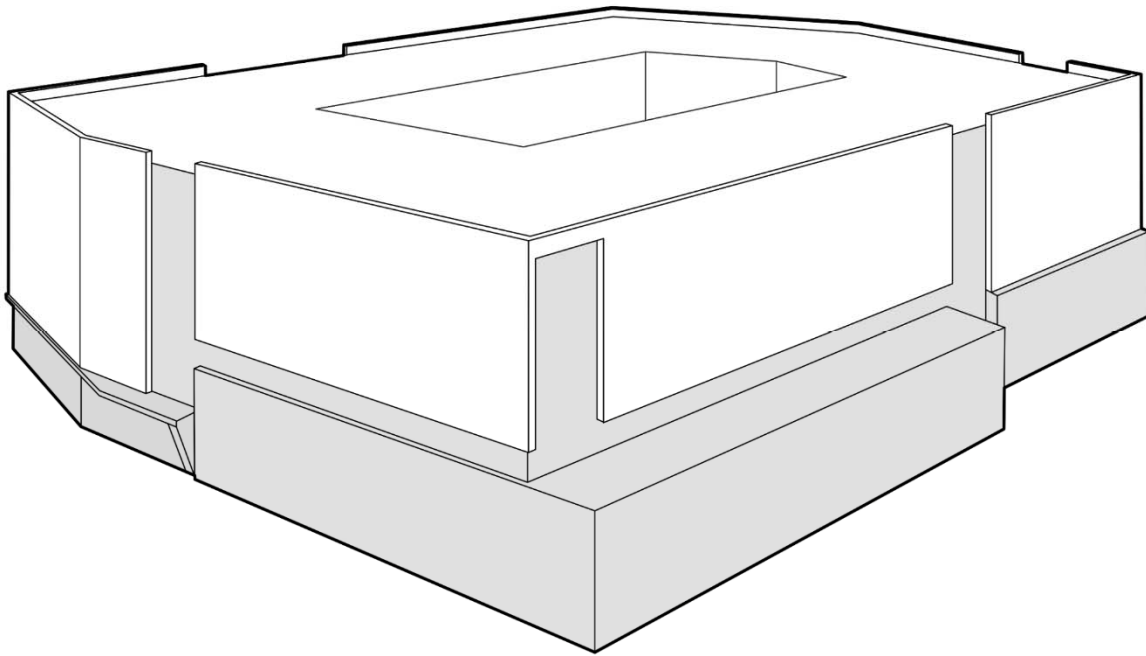




ENERGY MODEL REPORT
Arlington YMCA Redevelopment, Arlington, VA

July 25, 2022



Prepared by: Brian Stanfill, MaGrann Associates

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I. EXECUTIVE SUMMARY

This report presents the projected energy usage of various design scenarios of the Arlington YMCA Redevelopment project to be built in Arlington, VA. The building consists of 7 stories over parking and will contain 374 residential dwelling units. Lower floors include amenity spaces serving the dwelling units with dwelling units on all floors. The project will be pursuing LEED certification. The building is approximately 374,425 gross square feet.

The simulations for the project have been developed using eQuest v3.65 software. There were 2 iterations ran to analyze the projected energy consumption of multiple design strategies. A baseline model based on ASHRAE 90.1-2010 Appendix G was simulated as well so savings above that baseline could be assessed for LEED certification. The 2 iterations ran were as follows:

- **Base Case: Conventional style Air Source Heat Pumps serving dwelling units and common areas and standard electric storage water heaters in each dwelling unit.**
- **Iteration 1: VRF style Air Source Heat Pumps serving dwelling units and common areas and standard electric storage water heaters in each dwelling unit.**
- **Iteration 2: VRF style Air Source Heat Pumps for dwelling units and common areas and heat pump hot water heating system for domestic hot water**

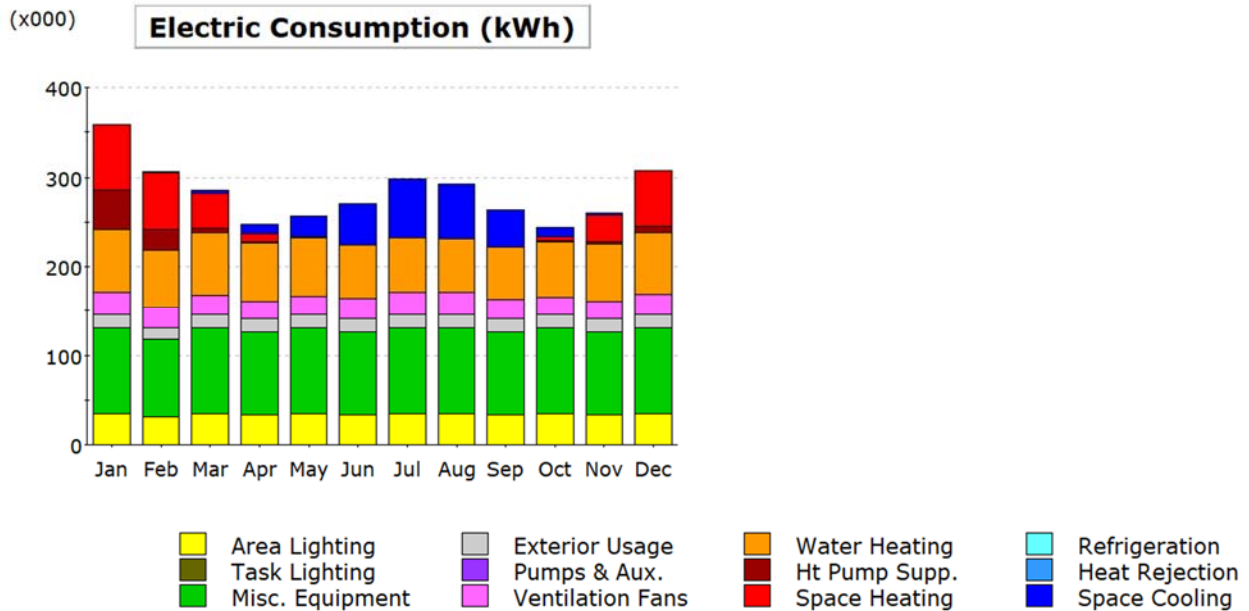
The modeling performed was done at schematic stage of the design. The results are expected to change throughout the design process as more clarity on design decisions are implemented and the model is updated. The results presented in this report are based on a simulation and may not reflect the actual performance of the building once it is built and operating.

II. RESULTS

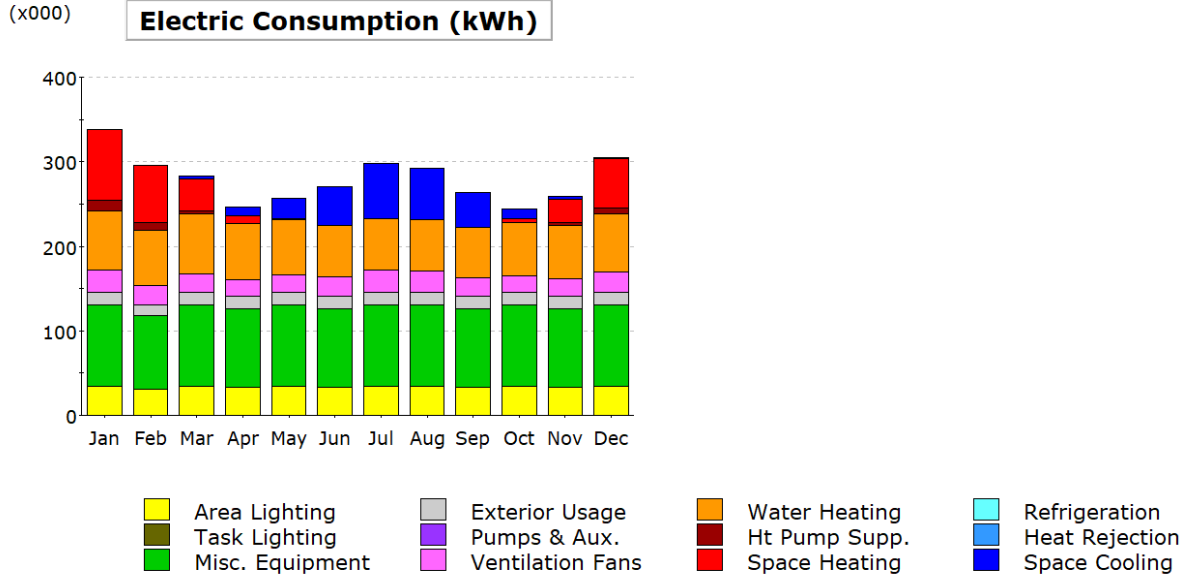
Energy Model Iteration	Projected Energy Usage From Model			
	Electricity	Total Site kBTU	kBtu/Sq Ft/yr	% Savings over 90.1-2010
n/a	3,389,453	11,564,814	30.89	21.3%
VRF Heat Pumps - Standard Electric DHW	3,317,683	11,319,934	30.23	23.0%
VRF Heat Pumps w/ Heat Pump DHW	3,263,625	11,135,489	29.74	24.3%

In addition to the results shown below, the Base Case results were entered into EPA's Portfolio Manager to produce an ENERGY STAR Score of 94 which would meet the designed to Earn ENERGY STAR threshold of 75 or higher. A copy of those results can be found at the end of this report.

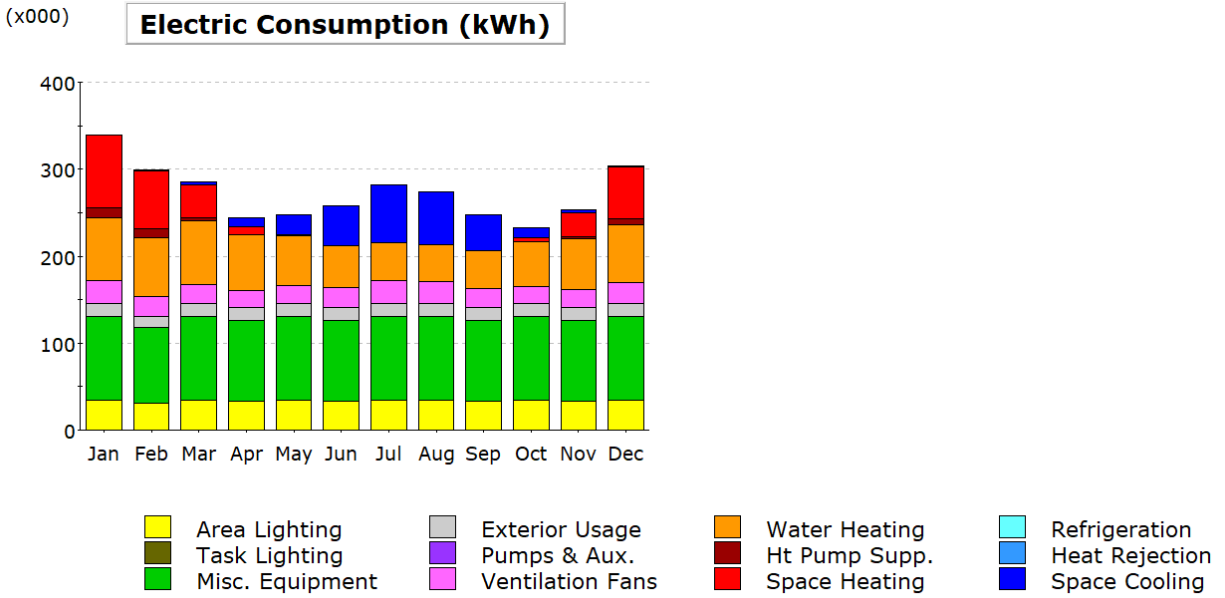
Base Case



VRF Heat Pumps – Standard Electric DHW



VRF Heat Pumps with Central Heat Pump Domestic Hot Water Heaters



III. MODELING SPECIFICATIONS

BASE CASE ENERGY MODEL ASSUMPTIONS

Input Summary	Proposed Case
Roof Insulation	R-30 rigid insulation on top of roofdeck, U-0.032
Above Grade Wall Insulation	2x6 metal studs with R-7.5 rigid on lower floors (U-0.060), 2x6 wood studs with R-7.5 rigid on upper floors (U-0.40)
Floor over Garage	R-30 insulation on underside of concrete floor, U-0.030
Swinging Doors	U=0.700
Residential Windows	U=0.32 SHGC= 0.32
Plumbing Fixtures	Showerheads: 1.75 gpm @ 80 psi Bathroom Faucets: 1.5 gpm @ 60 psi Kitchen Faucets: 1.50 gpm @ 60 psi
Residential Appliances	ENERGY STAR Appliances Refrigerator: 423 kWh/yr-unit Stove: Electric, 604 kWh/yr-unit Dishwasher: 164 kWh/yr-unit In-unit Washers: 81 kWh/yr-unit In-unit Dryers: Electric, 641.5 kWh/yr-unit)
Plug Loads	Residential: 0.5 W/Sf Corridors, Stairs and Restrooms: 0.2 W/Sf Other Public and Common Areas: 0.5 W/Sf
Domestic Hot Water	0.93 UEF electric storage water heaters
Lighting LPD (Space by Space method)	20% reduction of values by space shown in ASHRAE 90.1-2010
Ventilation	Energy Recovery Ventilators
Temperature Setpoints	Cooling: 75° F Heating: 72° F
In-Unit Heating/Cooling System	Conventional Air Source Heat Pumps, 15 SEER, 8.5 hspf
Common Heating/Cooling System	Conventional Air Source Heat Pumps, 15 SEER, 8.5 hspf
Stairwell Heating System	Electric Resistance Space Heaters
Mechanical Rooms	Electric Resistance Space Heaters

ITERATION 1

In-Unit Heating/Cooling System	VRF Air Source Heat Pumps, 12 SEER, 4.3 COP
Common Heating/Cooling System	VRF Air Source Heat Pumps, 12 SEER, 4.3 COP

ITERATION 2

Domestic Hot Water	Air Source Heat Pump Hot Water Heaters, UEF = 2.70
--------------------	---

IV. STATEMENT OF DESIGN ENERGY DESIGN INTENT



ENERGY STAR[®] Statement of Energy Design Intent (SEDI)¹

Arlington YMCA Redevelopment

LEARN MORE AT
energystar.gov

94

Primary Property Type: Multifamily Housing
Gross Floor Area (ft²): 374,425
Estimated Date of Certification of Occupancy: _____

Date Generated: July 25, 2022

ENERGY STAR[®]
Design Score²

1. This form is required when applying for Designed to Earn the ENERGY STAR recognition. It was generated from ENERGY STAR Portfolio Manager.

2. The ENERGY STAR 1 – 100 Score is based on total annual Source Energy. To be eligible for Designed to Earn the ENERGY STAR recognition you must score at least 75.

Property & Contact Information for Design Project

Property Address Arlington YMCA Redevelopment 3400 13th Street Arlington, Virginia 22201	Project Architect _____ , (____)____-____ _____	Owner Contact _____ , (____)____-____ _____
Property ID: 20971111	Architect Of Record _____ _____ , (____)____-____ _____	Property Owner _____ , (____)____-____ _____

Estimated Design Energy

Fuel Type	Usage	Energy Rate (\$/Unit)
Electric - Grid	3,317,683 kWh (thousand Watt-hours)	Not Provided

Estimated Design Use Details

★ This Use Detail is used to calculate the 1-100 ENERGY STAR Score.

Parking		Multifamily Housing	
★ Partially Enclosed Parking Garage Size	108,020 Sq. Ft.	Number of Laundry Hookups in Common Area(s)	0
★ Open Parking Lot Size	0 Sq. Ft.	Percent That Can Be Cooled	All of it - 100%
★ Completely Enclosed Parking Garage	0 Sq. Ft.	Common Entrance	Yes
★ Supplemental Heating	No	Resident Population Type	No specific resident population
		★ Number of Residential Living Units in a Low-rise Building (1-4 stories)	0
		★ Total Number of Residential Living Units	374
		Number of Laundry Hookups in All Units	374
		★ Number of Bedrooms	479
		★ Number of Residential Living Units in a Mid-rise Building (5-9 stories)	374
		Percent That Can Be Heated	All of it - 100%
		★ Gross Floor Area	374,425 Sq. Ft.
		★ Number of Residential Living Units in a High-rise Building (10 or more stories)	0
		Government Subsidized Housing	No

Design Energy and Emission Results

Metric	Design Project	Median Property	Estimated Savings
ENERGY STAR Score (1-100)	94	50	N/A
Energy Reduction (from Median)(%)	-33.1	0	N/A
Source Energy Use Intensity (kBtu/ft ² /yr)	84	126	42
Site Energy Use Intensity (kBtu/ft ² /yr)	30	45	15
Source Energy Use (kBtu/yr)	31,695,817	47,378,722	15,682,905
Site Energy Use (kBtu/yr)	11,319,934	16,920,974	5,601,040
Energy Costs (\$)	250,153	373,927	123,774
Total GHG Emissions (Metric Tons CO ₂ e)	1,022	1,527	505

Designed to Earn the ENERGY STAR: Application Checklist

This section is only required if you are using this document to apply for Designed to Earn the ENERGY STAR. All design projects that achieve an EPA energy performance score of 75 or higher are eligible for this certification.

- 1) Does your [property type](#) match the function or use of a property that's eligibility to receive an ENERGY STAR design score? Yes No/Not Sure

If you are not sure your project is eligible for an ENERGY STAR design score, please describe the property's major functions or use:

- 2) Is the design project at least 95% complete with construction documents? Yes No

If no, please explain:

- 3) Is the property currently unoccupied and not yet generating energy bills? Yes No

- 4) Do energy calculations account for the whole building intended operations and all energy sources? Yes No

- 5) Is the Architect of Record (AOR) applying for ENERGY STAR partnership? Yes No

- 6) Was the design record created in the owner's Portfolio Manager account? Yes No

- 7) Are you seeking other qualifications for this design project? Yes No

If so, please select all that apply:

- AIA 2030 Commitment
- Architecture 2030 Challenge
- Federal, State or Local Disclosure Ordinance
- Green Globes
- LEED
- Other, please indicate: _____

Professional Verification

I _____ (Name) verify that the above information is true and correct to the best of my knowledge.

Signature: _____ Date: _____

Verifying Professional

,
(____)____ - _____



**Verifying Professional Stamp
(if applicable)**

Note: When applying for the ENERGY STAR Designed to Earn, the signature of the Verifying Professional must match the stamp.

I agree to adhere to the ENERGY STAR Identity Guidelines when using the Designed to Earn the ENERGY STAR recognition graphic in association with this project.

Architect of Record Acknowledgement

As the Architect of Record representative, I confirm that the information on this SEDI is true and accurate to the best of my knowledge. It is our best estimate for all energy use of specified systems and processes but does not guarantee the operational performance of this building. Instead, this project has been specified to achieve Designed to Earn the ENERGY STAR recognition in an effort to assist the Owner/Developer in meeting their operational performance goal for the building to earn ENERGY STAR certification.

Signature: _____

Date: _____

Building Owner/Developer Acknowledgement

As the Building Owner/Developer representative, I concur that this project be nominated for Designed to Earn the ENERGY STAR recognition. Our organization understands the importance of measuring actual energy use in Portfolio Manager after receiving the Certificate of Occupancy to verify that this property is performing as intended. We understand that once the building earns an ENERGY STAR score of 75 or higher, it may be eligible for ENERGY STAR certification.

Signature: _____

Date: _____



LEED v4 for BD+C: New Construction and Major Renovation

Project Checklist

Project Name: Arlington YMCA
Date: 11-Apr-22

Y L LL N

Y	L	LL	N	Credit	Integrative Process	1
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9	5	1	1	Location and Transportation	16	
				Credit	LEED for Neighborhood Development Location	16
1				Credit	Sensitive Land Protection	1
1			1	Credit	High Priority Site	2
2	3			Credit	Surrounding Density and Diverse Uses	5
4	1			Credit	Access to Quality Transit	5
	1			Credit	Bicycle Facilities	1
1				Credit	Reduced Parking Footprint	1
		1		Credit	Green Vehicles	1

1	4	3	2	Sustainable Sites	10	
Y				Prereq	Construction Activity Pollution Prevention	Required
	1			Credit	Site Assessment	1
			2	Credit	Site Development - Protect or Restore Habitat	2
	1			Credit	Open Space	1
	2	1		Credit	Rainwater Management	3
1		1		Credit	Heat Island Reduction	2
		1		Credit	Light Pollution Reduction	1

3	0	8	0	Water Efficiency	11	
Y				Prereq	Outdoor Water Use Reduction	Required
Y				Prereq	Indoor Water Use Reduction	Required
Y				Prereq	Building-Level Water Metering	Required
1		1		Credit	Outdoor Water Use Reduction	2
2		4		Credit	Indoor Water Use Reduction	6
		2		Credit	Cooling Tower Water Use	2
		1		Credit	Water Metering	1

5	11	15	2	Energy and Atmosphere	33	
Y				Prereq	Fundamental Commissioning and Verification	Required
Y				Prereq	Minimum Energy Performance	Required
Y				Prereq	Building-Level Energy Metering	Required
Y				Prereq	Fundamental Refrigerant Management	Required
	3	3		Credit	Enhanced Commissioning	6
5	5	8		Credit	Optimize Energy Performance	18
		1		Credit	Advanced Energy Metering	1
			2	Credit	Demand Response	2
	3	2		Credit	Renewable Energy	5
		1		Credit	Enhanced Refrigerant Management	1

3	1	7	2	Materials and Resources	13	
Y				Prereq	Storage and Collection of Recyclables	Required
Y				Prereq	Construction and Demolition Waste Management Planning	Required
		3	2	Credit	Building Life-Cycle Impact Reduction	5
1		1		Credit	Building Product Disclosure and Optimization - Environmental Product Declarations	2
		2		Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
1		1		Credit	Building Product Disclosure and Optimization - Material Ingredients	2
1	1			Credit	Construction and Demolition Waste Management	2

4	2	10	0	Indoor Environmental Quality	16	
Y				Prereq	Minimum Indoor Air Quality Performance	Required
Y				Prereq	Environmental Tobacco Smoke Control	Required
1	1			Credit	Enhanced Indoor Air Quality Strategies	2
2		1		Credit	Low-Emitting Materials	3
1				Credit	Construction Indoor Air Quality Management Plan	1
		2		Credit	Indoor Air Quality Assessment	2
		1		Credit	Thermal Comfort	1
	1	1		Credit	Interior Lighting	2
		3		Credit	Daylight	3
		1		Credit	Quality Views	1
		1		Credit	Acoustic Performance	1

2	1	3	0	Innovation	6	
1	1	3		Credit	Innovation	5
1				Credit	LEED Accredited Professional	1

2	1	1	0	Regional Priority	4	
	1			Credit	Regional Priority: † Optimize Energy Performance (10)	1
1				Credit	Regional Priority: † Access to Quality Transit (4)	1
1				Credit	Regional Priority: † Reduced Parking Footprint (1)	1
		1		Credit	Regional Priority: † Green Vehicles (1)	1

29	25	49	7	TOTALS	Possible Points: 110
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Certified: 40 to 49 points, Silver: 50 to 59 points, Gold: 60 to 79 points, Platinum: 80 to 110

54 Points Silver Level Targeted



LEED BD+C: Homes and Multifamily v4 Workbook

Step 1.

Ensure this project is registered in LEED Online.

Step 2.

Enable macros

Note: This workbook is for use with Excel for Mac 2011 and Excel 2007 or later.

Step 3.

Unit of measure

Step 4.

Project rating system

Project type

Market Classification

Total homes in submittal

Construction type

Subdivision/Development Name

Project team leader name

Project team leader organization name

Builder (if different than team leader org)

Project team leader Email address

Provider Organization name

Green rater

Green rater

Energy Rater

Provider QAD

Mid-construction visit date(s)

ex: 1/1/2015, 2/27/2015

Date final visit completed

ex: 3/31/2016

Step 5.

The following information must be consistent with project details in LEED Online:

Individual Project Information

Project ID #	
Project name	Arlington YMCA
Project address	3422 13th St N, Arlington, VA 22201
City	Arlington
State	VA
Country	USA
Zip Code	22201

Building type	Multifamily midrise
Number of stories	7
Number of bedrooms	483
Conditioned floor area (sq ft)	352260
Gross floor area (sq ft)	352260

Additional Resources

- Resources & Tools section of the Homes Guide to Certification (<http://www.usgbc.org/cert-guide/homes#tools>)
- Credit Library (<http://www.usgbc.org/credits>)

Arlington YMCA Scorecard

Location: 3422 13th St N, Arlington, VA 22201, Arlington, VA 22201, USA

Note: The information on this tab is READ-ONLY. To edit this information, see the Credit Category tabs.



Integrative Process		Preliminary	Y	1 of 2	V	2	Verified	0
---------------------	--	-------------	---	--------	---	---	----------	---

IPc	Integrative Process			1 of 2		2		
-----	---------------------	--	--	--------	--	---	--	--



Location and Transportation		Preliminary	Y	15 of 15	V	0	Verified	0
-----------------------------	--	-------------	---	----------	---	---	----------	---

LTP	Floodplain Avoidance			Required				Not Verified
-----	----------------------	--	--	----------	--	--	--	--------------

Performance Path

LTC	LEED for Neighborhood Development			0 of 15		0		
-----	-----------------------------------	--	--	---------	--	---	--	--

Prescriptive Path

LTC	Site Selection			8 of 8		0		
-----	----------------	--	--	--------	--	---	--	--

LTC	Compact Development			3 of 3		0		
-----	---------------------	--	--	--------	--	---	--	--

LTC	Community Resources			2 of 2		0		
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LTC	Access to Transit			2 of 2		0		
-----	-------------------	--	--	--------	--	---	--	--



Sustainable Sites		Preliminary	Y	3 of 7	V	3	Verified	0
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SSp	Construction Activity Pollution Prevention			Required				Not Verified
-----	--	--	--	----------	--	--	--	--------------

SSp	No Invasive Plants			Required				Not Verified
-----	--------------------	--	--	----------	--	--	--	--------------

SSc	Heat Island Reduction			1 of 2		1		
-----	-----------------------	--	--	--------	--	---	--	--

SSc	Rainwater Management			0 of 3		2		
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SSc	Nontoxic Pest Control			2 of 2		0		
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Water Efficiency		Preliminary	Y	6 of 12	V	2	Verified	0
------------------	--	-------------	---	---------	---	---	----------	---

WEP	Water Metering			Required				Not Verified
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Performance Path

WEC	Total Water Use			0 of 12		2		
-----	-----------------	--	--	---------	--	---	--	--

Prescriptive Path

WEC	Indoor Water Use			5 of 6		0		
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WEC	Outdoor Water Use			1 of 4		3		
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Energy and Atmosphere		Preliminary	Y	26.5 of 37	V	3	Verified	23.5
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EAp	Minimum Energy Performance			Required				Not Verified
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EAp	Energy Metering			Required				Not Verified
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EAp	Education of the Homeowner, Tenant or Building Manager			Required				Not Verified
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EAc	Annual Energy Use			23.5 of 30		0		23.5
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EAc	Efficient Hot Water Distribution System			2 of 5		3		
-----	---	--	--	--------	--	---	--	--

EAc	Advanced Utility Tracking			1 of 2		0		
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Materials and Resources		Preliminary	Y	2.5 of 9	V	3.5	Verified	0
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MRp	Certified Tropical Wood			Required				Not Verified
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MRp	Durability Management			Required				Not Verified
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MRC	Durability Management Verification			1 of 1		0		
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MRC	Environmentally Preferable Products			0.5 of 5		2.5		
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MRC	Construction Waste Management			1 of 3		1		
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Indoor Environmental Quality		Preliminary	Y	8.5 of 18	V	2	Verified	0
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EQp	Ventilation			Required				Not Verified
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EQp	Combustion Venting			Required				Not Verified
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EQp	Garage Pollutant Protection			Required				Not Verified
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EQp	Radon-Resistant Construction	Required			Not Verified
EQp	Air Filtering	Required			Not Verified
EQp	Environmental Tobacco Smoke	Required			Not Verified
EQp	Compartmentalization	Required			Not Verified
EQc	Enhanced Ventilation	1 of 3		0	
EQc	Contaminant Control	0.5 of 2		0	
EQc	Balancing of Heating and Cooling Distribution Systems	2 of 3		0	
EQc	Enhanced Compartmentalization	0 of 3		0	
EQc	Combustion Venting	1 of 2		1	
EQc	Enhanced Garage Pollutant Protection	0 of 1		1	
EQc	Low-Emitting Products	3 of 3		0	
EQc	No Environmental Tobacco Smoke	1 of 1		0	



Innovation		Preliminary	Y	4 of 6	V	1	Verified	0
INp	Preliminary Rating	Required						Not Verified
INc	Innovation	4 of 5				1		
INc	LEED Accredited Professional	0 of 1				0		



Regional Priority		Preliminary	Y	3 of 4	V	1	Verified	0
RPC	Regional Priority	3 of 4				1		

Point Floors

The project earned at least 8 points total in Location and Transportation and Energy and Atmosphere	<input type="text" value="Yes"/>
The project earned at least 3 points in Water Efficiency	<input type="text" value="No"/>
The project earned at least 3 points in Indoor Environmental Quality	<input type="text" value="No"/>

Total	Preliminary	Y	69.5 of 110	V	17.5	Verified	23.5
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Certification Thresholds Certified: 40-49, Silver: 50-59, Gold: 60-79, Platinum: 80-110

Preliminary Energy Analysis Report

ARLINGTON YMCA
3422 13th St N, Arlington, VA, 22201
March 25, 2022



SETTY

Mechanical ♦ Electrical ♦ Plumbing ♦ Fire Protection ♦ Energy ♦ Sustainable Design
Project Management ♦ Construction Management ♦ Consultant Design Engineers

Setty & Associates, Ltd.
3040 Williams Drive, Suite 600
Fairfax, VA 22031
SAPX196031.00

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I. INTRODUCTION

1. Purpose and Scope

The Arlington YMCA building will be located at 3422 13th St N, Arlington, VA, 22201. The building is intended to be 246,518 GSF with a green building sustainability target of 0.35 FAR.

The design of the project is currently at the Schematic Development stage. The energy simulation for the project was performed using the eQuest 3.65 software, with build version 7175 & DOE2 version 2.3.

The project team proposes three mechanical system options to provide heating, cooling, and ventilation to the YMCA facility.

The three (3) systems deemed appropriate for the facility are listed as follows:

- 1. Option 1 - Geothermal System – Central Station Air System approach**
- 2. Option 2 - Geothermal System – Distributed Air System approach**
- 3. Option 3 - Air Cooled System – Central or Distributed approach**

For the purpose of this study, Option-1 has not been considered for this study as the ductwork distribution involved with Option-1 would impact the height of the building in a detrimental way.

The proposed design systems are detailed for the remaining option 2 & option 3 under section 5 of this report.

The primary purpose of this report is to quantify the potential energy usage of the building. The energy consumption will change as more building design parameters are identified. The energy model however is only a simulation tool to predict energy performance. Should the operation or the systems differ from the model, the results of the actual building will vary.

The proposed facility is anticipated to consist of a combination of administrative and recreational spaces which includes a Tennis Center, Natatorium with Lap and Recreational Pool, Pickleball Courts, and a Wellness Center, in addition to miscellaneous Studio and Support spaces. The facility will also include three-story below-grade parking levels.

2. Summary of Findings

The below table 2-1 contains the annual energy use index and energy consumption per year and the following figures contain a summary of projected monthly energy consumption.

System	EUI - kBtu/ft ² -yr	MBtu/yr	Total Charge (\$)
Option - 2	25.7	6,325.2	159,383
Option - 3	31.5	7,768.2	195,743

Table 2-1: Energy Use Intensity, Energy Consumption and Energy Cost per year

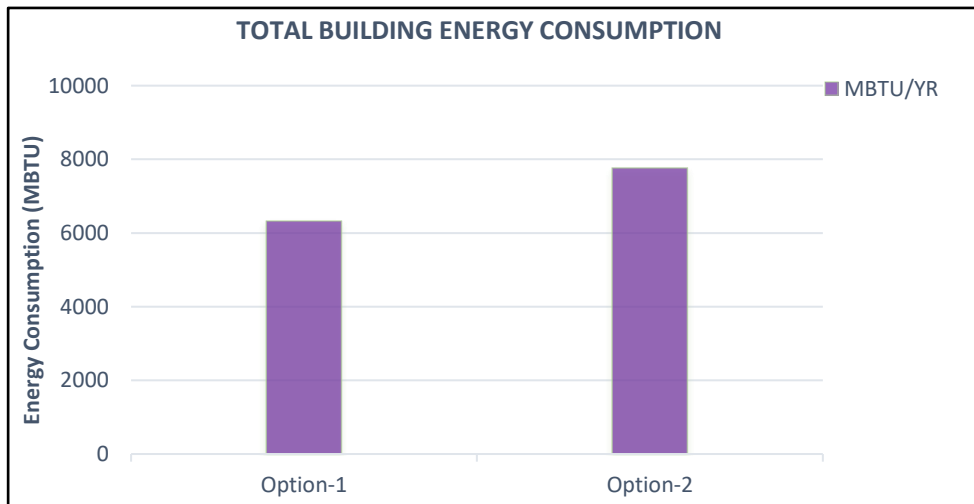


Figure 2 - 1: Total Building Energy Consumption

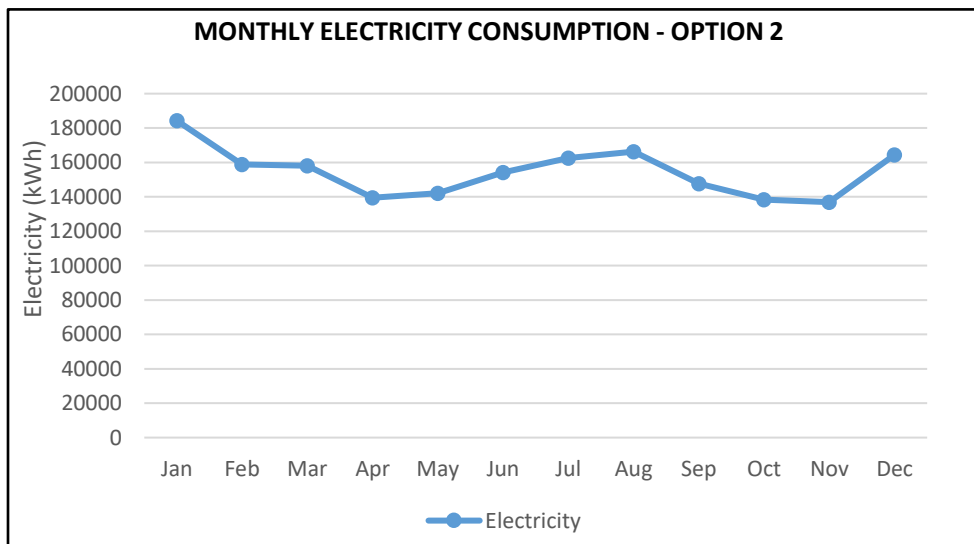


Figure 2 - 2: Monthly Electricity Consumption - Option 2

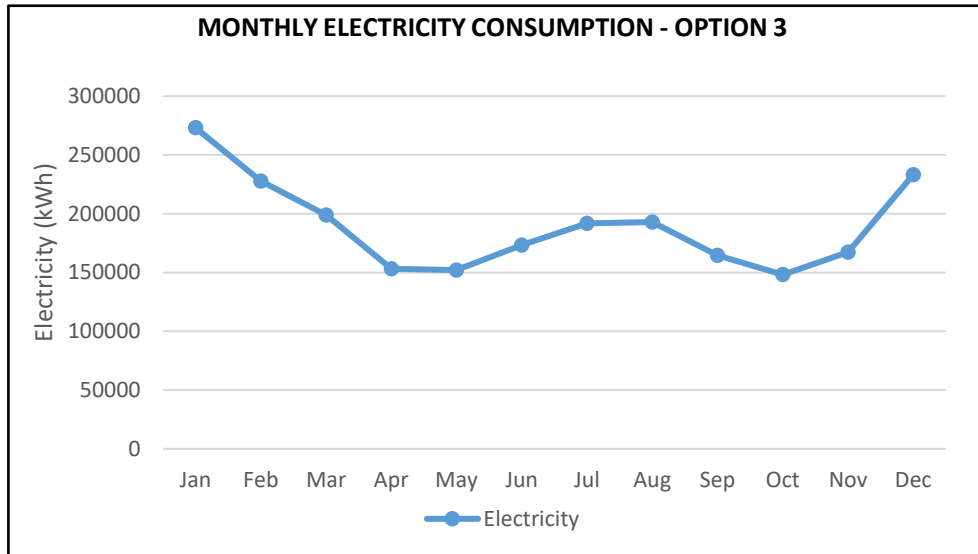


Figure 2 - 3: Monthly Electricity Consumption - Option 3

II. APPROACH

1. Strategy

The process of identifying energy efficiency and conservation measures relies on the following strategy. This strategy can be applied to optimize and fully capitalize on the associated usage.

Minimize Building Loads - Improve the building envelope, reduce lighting power densities and usage, reduce equipment power densities and usage, and reduce water-consumption flow rates.

Improve System Effectiveness – Improve HVAC system design, increase motor efficiencies, incorporate energy recovery technologies, and utilize applicable controls strategies.

2. Energy Modeling

All project energy modeling is performed using eQuest 3.65 software, with build version 7175 & DOE2 version 2.3, a program that simulates the hourly energy consumption and demand loads for the project. The eQuest model for this building consists of 4 components: Building envelope, Interior loads, Water-side HVAC & Air-side HVAC.

To develop a building model, the floor plans, floor heights, and window configurations are coded into the computer program. The simulation uses hourly weather data to estimate the energy consumption of the building for each hour of the year.

3. Modeling Design Parameters

The building & system models are subject to change as further project definition becomes available during next phases in project as additional system design information is developed.

ENVELOPE VALUES						
ABBRV.	Material	R-value	U-value	SHGC	Visible Transmittance	
BR1	Masonry	24.3	0.04115226	-	-	
FC	GFRC	23.76	0.04208754	-	-	
MP	Metal Panel	23.26	0.04299226	-	-	
KW	Kal wall	8	0.125	-	-	
CW	Curtain Wall	-	0.33	0.29	0.58	
Below Grade Wall	Concrete + 3" Insulation Outboard	9	0.11	-	-	
Roof	-	30	0.33	-	-	

Table 3-1: Envelope Values

Climate Data	Arlington YMCA	
Location	Arlington, VA	
ASHRAE Climate Zone	4A	
Latitude	38.9° N	
Longitude	77.0° W	
Heating Degree Days (base 65 °F)	3901	
Cooling Degree Days (base 65 °F)	1587	
Heating Design Temp	17.9 °F	
Cooling Design Dry-bulb	94.7 °F	
Cooling Design Wet-bulb	75.5 °F	
Heating & Cooling Setpoints	Heating	Cooling
	70°F	75°F

Table 3-2: Energy Model Inputs

	Option - 2	Option - 3
Column Title		
First Cost	High	Average
Efficiency and Operations Savings	High	Average
Equipment Required	Geothermal Well Geothermal Loop RTU DOAS WSHP FCU	Cooling Tower Condenser Loop RTU DOAS WSHP FCU
Human Comfort	High	High
Humidity Control	Yes	Yes
Ventilation Control	High	High
Sustainability Benefits	High	Average
Maintenance/Operational Effort	Medium	Medium

Table 3-3: Mechanical System Option Comparison Matrix

4. Description

The following figures represent 3-D images of the building model in eQuest. The building model includes thermal characteristics of the building's envelope components.

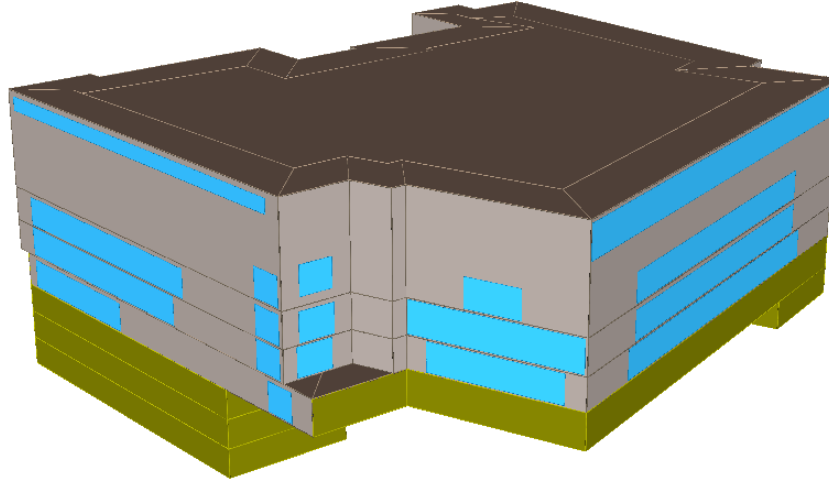


Figure 4 - 1: Model Rendering

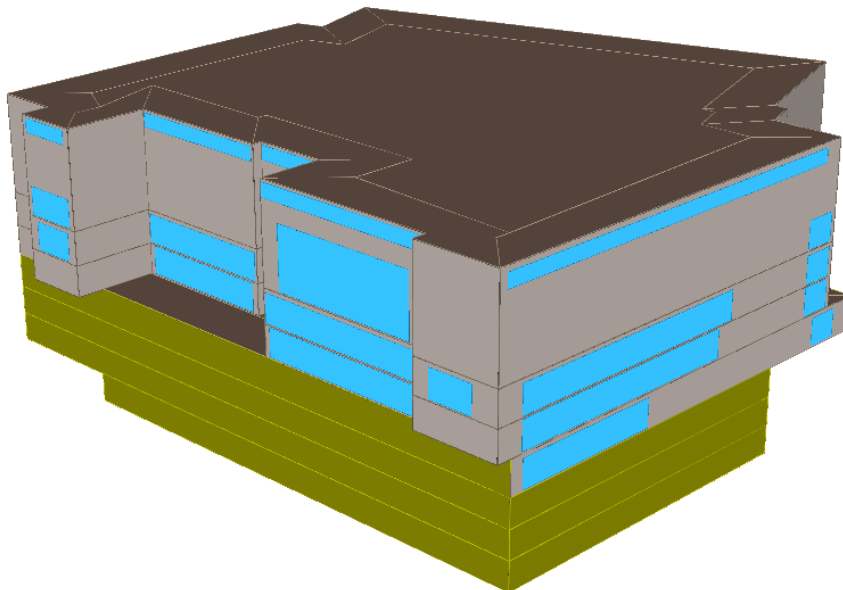


Figure 4 - 2: Model Rendering

5. Mechanical System Model Analysis

5.1 Option - 2: Geothermal System – Distributed Air System Components:

1. Geothermal System
2. Roof Top Unit (Heat Pump)
3. Distributed WSHP with DOAS (Dedicated Outdoor Air System)

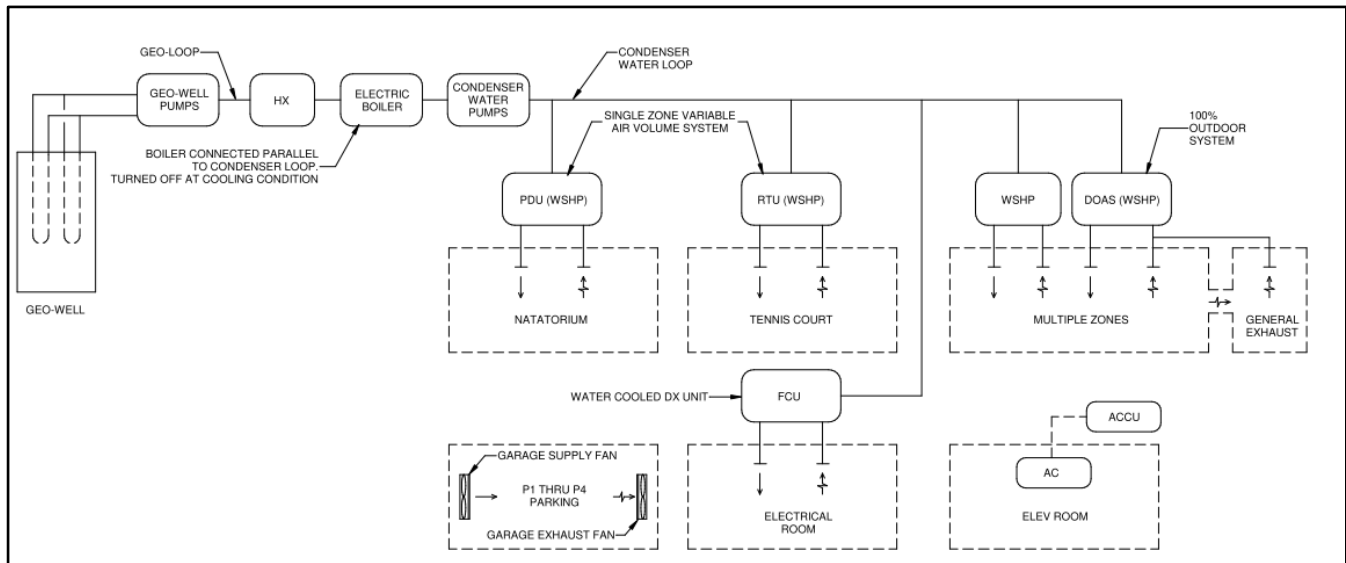


Figure 5.1 - 1: Schematic Diagram for Option 2

The proposed geothermal wellfield will require approximately eighty (80) borewells with a depth of 400 feet each. The wellfield will support the whole YMCA facility except for the natatorium. The hybrid system would be composed of distribution and circulation pumps, heat exchangers, and electric boilers.

The two-pipe, closed-loop, geothermal water system would provide condenser water to the building systems water source heat pumps composed of primary air-handling equipment located on the roof and the indoor central station air handler. The hot water provided by the boilers will be used to maintain loop temperature and can also be expanded to provide hot water to heating coils in the air handling equipment to reduce the load from electric heating coils.

A. General Facility Ventilation:

One (1) 25,000 CFM, 100% Dedicated Outside Air System (DOAS) located on the rooftop will supply filtered and dehumidified outside air to the building. The water source heat pump unit will be connected to the geothermal loop. Ventilation air will be provided to each zone directly from the DOAS via VAV terminal units allowing precise control of airflow, humidity, and pressurization at each zone.

B. General Facility Heating and Cooling:

The heating and cooling of the general YMCA facility will be met by the incremental wall, floor, or ceiling-mounted water source heat pump fan coil units (FCUs) connected into the geothermal loop. Outside air will be supplied directly to the zones from the rooftop DOAS ductwork distribution.

C. Tennis Facility: RTU:

The Tennis Court area of the YMCA facility will be served by one (1) single-zone variable air volume water source heat pump rooftop unit (RTU) located on the adjacent roof. The RTU includes an electric heating coil, MERV-8 pre-filters, MERV-13 final filters, energy-recovery devices, supply fans, and return fans.

D. YMCA Natatorium Systems:

The Natatorium will be served by one (1) dedicated pool dehumidification unit (PDU) located in the pool mechanical room. PDU will be fluid cooled and can be connected to the building condenser water loop, or to a remote air-cooled dry cooler which can be located on the roof. The pool dehumidification unit will include an electric heating coil, heat recovery run-around coil, and hot water pool heat recovery.

Building Energy Consumption	Lights	Misc Eqp.	Heating	Cooling	Heat Rejection	Pumps & Aux	Vent Fans	DHW	EXT Usage
Option – 2	2,080	331.5	710	613.4	0	1,398	981.9	180.3	29.8

Table 5.1 - 1: Energy Consumption by End-Use (MBtu)

The following figure illustrates project's energy end-use percentages for the building for option-2.

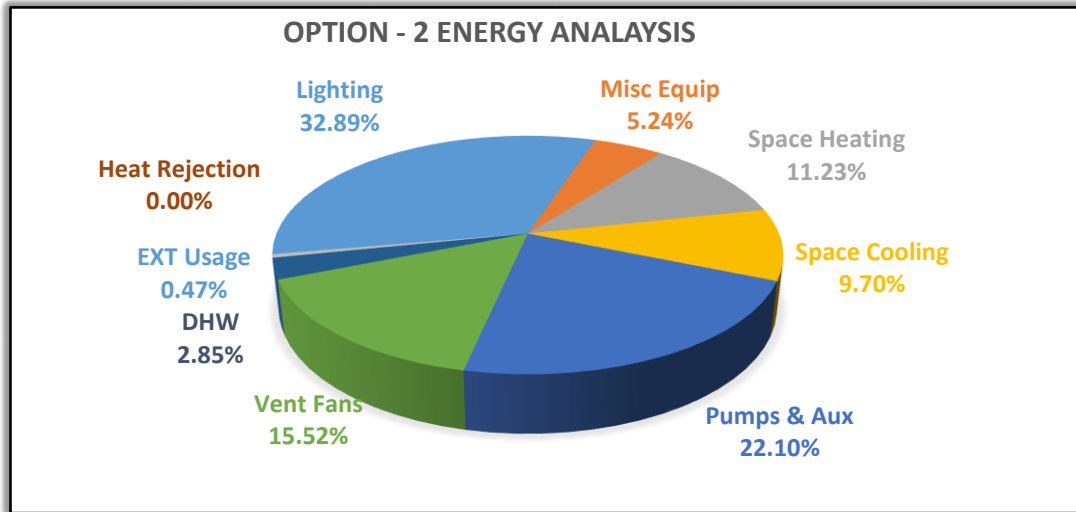


Figure 5.1 - 2: Energy End-Use Option - 2

5.2 Option - 3: Air Cooled System – Central or Distributed Components:

1. Cooling Tower
2. Roof Top Unit (Heat Pump)
3. WSHP with DOAS (Dedicated Outdoor Air System)

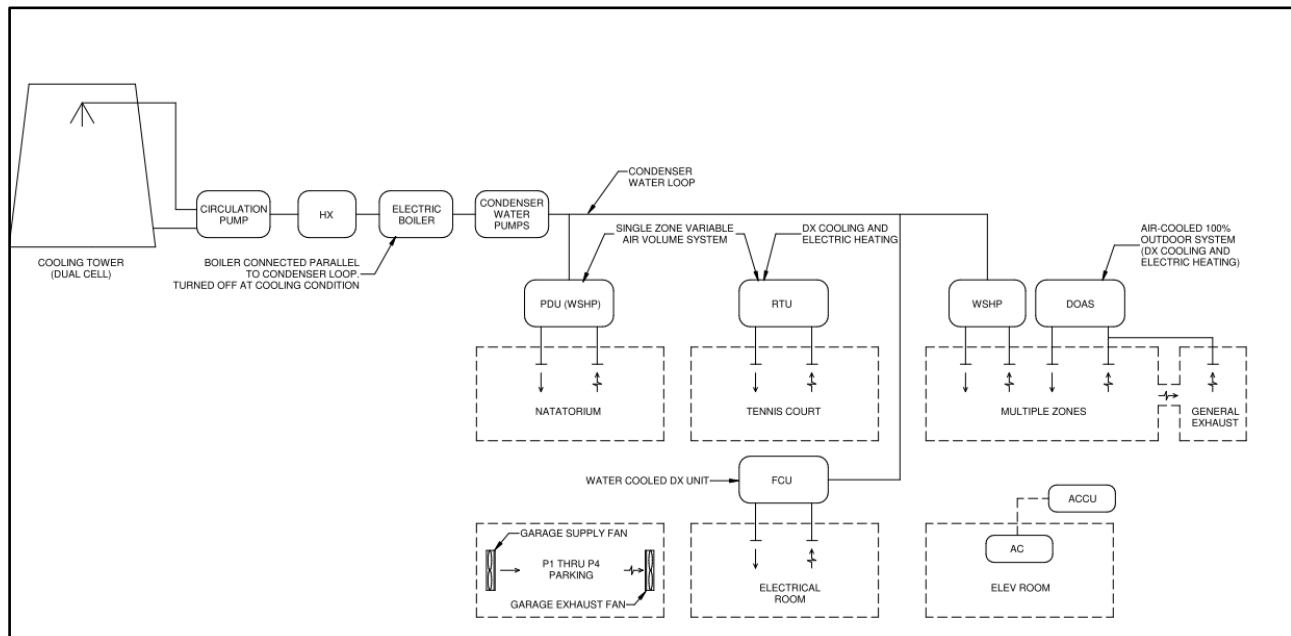


Figure 5.2 - 1: Schematic Diagram for Option 3

One (1) induced draft cooling tower, dual cell each sized to match 50% of the building supplemental cooling load. The tower shall be located on the roof of the building. The tower shall be sized for 78°F ambient wet bulb temperature, a condenser water supply temperature of 83°F, and a 10°F condenser water temperature difference (3 GPM per ton).

A. General Facility Ventilation:

One (1) 25,000 CFM packaged 100% Dedicated Outside Air System (DOAS) with DX cooling and Electric Heating located on the rooftop will supply filtered and dehumidified outside air to the building.

DX cooling coil, electric pre-heat coil, MERV 8 pre-filters and high-efficiency MERV 13 filters, fan wall type fan array for the supply fan and exhaust fan sections, fan piezometer air measuring devices, pre-conditioning energy recovery wheel(s), and an electric heating section.

B. General Facility Heating and Cooling:

The heating and cooling of the general YMCA facility will be met by the incremental wall, floor, or ceiling-mounted water source heat pump fan coil units (FCUs) connected into the condenser water loop. Outside air will be supplied directly to the zones from the rooftop DOAS ductwork distribution.

C. Tennis Facility: RTU:

The Tennis Court area of the YMCA facility will be served by one (1) single-zone packaged variable air-volume rooftop unit (RTU) located on the adjacent roof. The RTU will include a DX cooling coil, electric heating coil, MERV-8 pre-filters, MERV-13 final filters, energy recovery devices, supply fans, and return fans.

D. YMCA Natatorium Systems

The Natatorium will be served by one (1) dedicated pool dehumidification unit (PDU) located in the pool mechanical room. PDU will be fluid cooled and can be connected to the building condenser water loop, or to a remote air-cooled dry cooler which can be located on the roof. This unit will be provided with a fluid-cooled cooling coil, electric heating coil, heat recovery run-around coil, and hot water pool heat recovery.

Building Energy Consumption	Lights	Misc Eqp.	Heating	Cooling	Heat Rejection	Pumps & Aux	Vent Fans	DHW	EXT Usage
Option - 3	2,080	331.5	2,077	1,134	10.8	933.8	990.3	180.3	29.8

Table 5.2-1: Energy Consumption by End-Use (MBtu)

The following figure illustrates project's energy end-use percentages for the building for option 3.

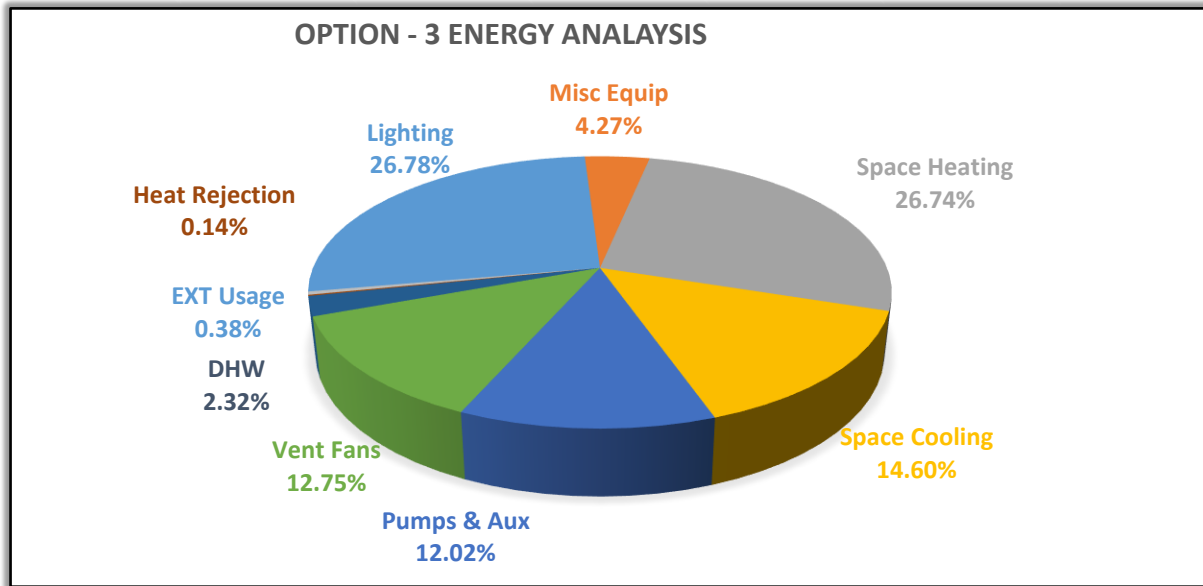


Figure 5.2 - 2 : Energy End-Use Option - 3

6. Building Energy Performance Summary

The model however is only a simulation tool to predict energy performance. Should the operation or the systems differ from the model; the results of the actual building will vary.

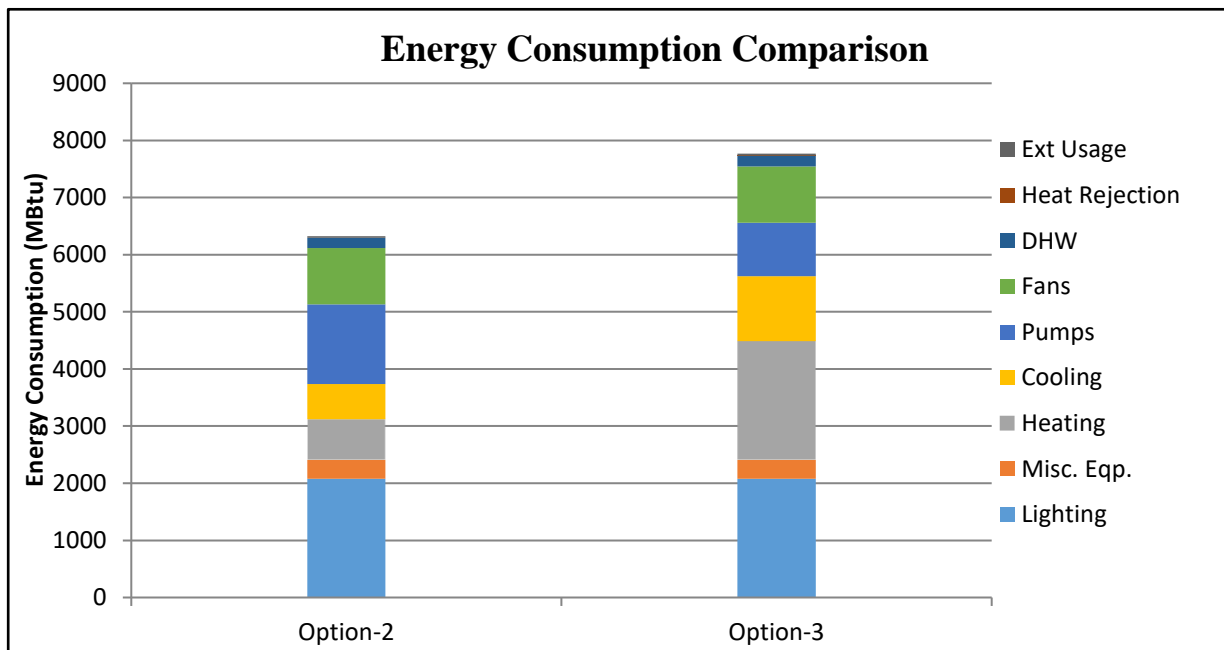


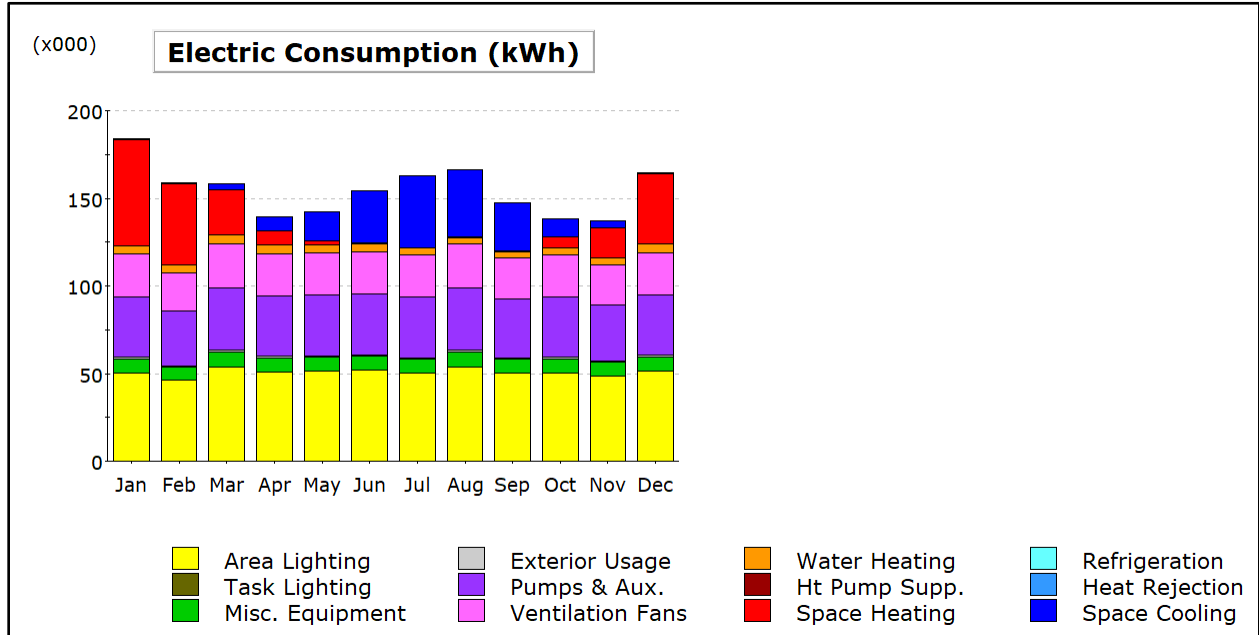
Figure 6 - 1: Energy consumption Comparison

ARLINGTON YMCA													DOE-2.3-50h	3/24/2022	12:01:53	BDL RUN	1
REPORT- BEPS Building Energy Performance													WEATHER FILE- WASHINGTON, DC				
	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL				
EM1 ELECTRICITY																	
MBTU	2080.0	0.0	331.5	710.0	613.4	0.0	1398.0	981.9	0.0	0.0	180.3	29.8	6325.2				
FM1 NATURAL-GAS																	
MBTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
MBTU	2080.0	0.0	331.5	710.0	613.4	0.0	1398.0	981.9	0.0	0.0	180.3	29.8	6325.2				
TOTAL SITE ENERGY				6325.20 MBTU			25.7 KBTU/SQFT-YR GROSS-AREA			25.7 KBTU/SQFT-YR NET-AREA							
TOTAL SOURCE ENERGY				18975.60 MBTU			77.0 KBTU/SQFT-YR GROSS-AREA			77.0 KBTU/SQFT-YR NET-AREA							
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 1.42																	
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00																	
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 27																	
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 54																	
NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.																	

Figure 6 - 2: Building Energy Performance Summary Option -2

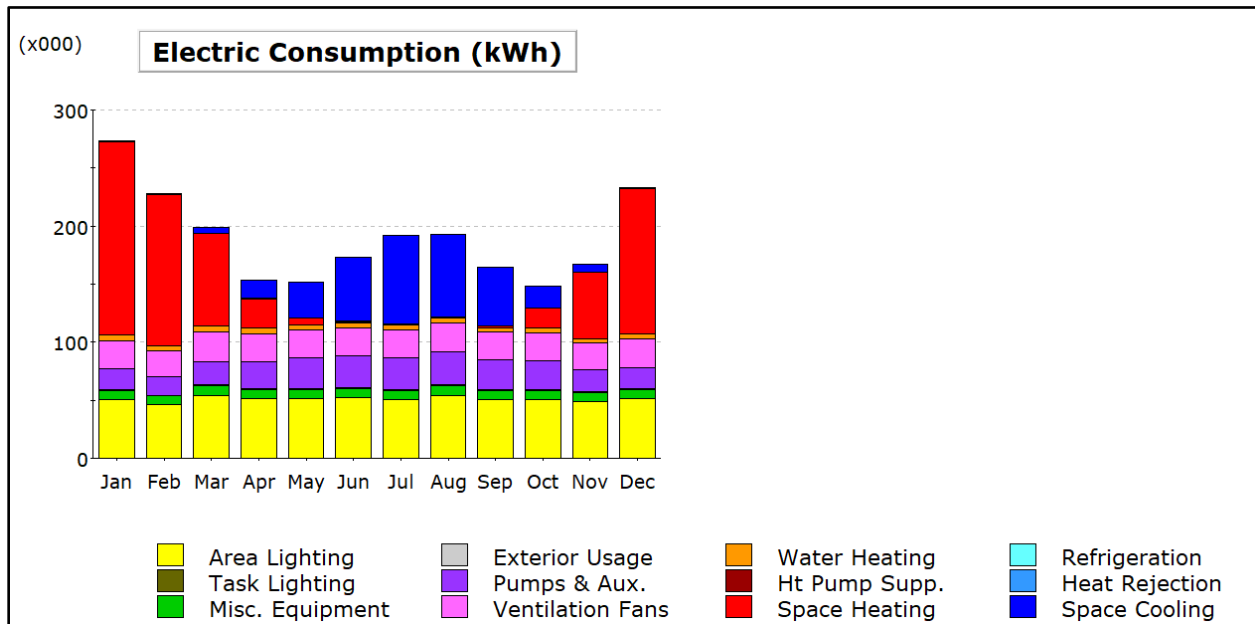
ARLINGTON YMCA													DOE-2.3-50h	3/24/2022	12:01:50	BDL RUN	1
REPORT- BEPS Building Energy Performance													WEATHER FILE- WASHINGTON, DC				
	LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL				
EM1 ELECTRICITY																	
MBTU	2080.0	0.0	331.5	2077.0	1134.0	10.8	933.8	990.3	0.0	0.0	180.3	29.8	7768.2				
FM1 NATURAL-GAS																	
MBTU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
MBTU	2080.0	0.0	331.5	2077.0	1134.0	10.8	933.8	990.3	0.0	0.0	180.3	29.8	7768.2				
TOTAL SITE ENERGY				7768.18 MBTU			31.5 KBTU/SQFT-YR GROSS-AREA			31.5 KBTU/SQFT-YR NET-AREA							
TOTAL SOURCE ENERGY				23304.60 MBTU			94.5 KBTU/SQFT-YR GROSS-AREA			94.5 KBTU/SQFT-YR NET-AREA							
PERCENT OF HOURS ANY SYSTEM ZONE OUTSIDE OF THROTTLING RANGE = 1.04																	
PERCENT OF HOURS ANY PLANT LOAD NOT SATISFIED = 0.00																	
HOURS ANY ZONE ABOVE COOLING THROTTLING RANGE = 0																	
HOURS ANY ZONE BELOW HEATING THROTTLING RANGE = 59																	
NOTE: ENERGY IS APPORTIONED HOURLY TO ALL END-USE CATEGORIES.																	

Figure 6 - 3: Building Energy Performance Summary Option -3



Electric Consumption (kWh x000)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.7	0.6	3.1	8.2	16.2	29.8	40.9	38.4	27.4	10.2	3.6	0.7	179.7
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	60.6	46.2	25.7	7.7	2.4	0.6	0.1	0.2	0.8	6.4	17.3	40.0	208.0
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	5.0	4.7	5.4	5.1	4.6	4.3	3.9	3.8	3.6	3.8	4.0	4.7	52.8
Vent. Fans	24.2	21.8	25.1	24.2	24.2	24.2	24.2	25.1	23.4	24.2	22.6	24.2	287.7
Pumps & Aux.	34.5	31.1	35.7	34.5	34.5	34.5	34.5	35.7	33.4	34.5	32.2	34.5	409.6
Ext. Usage	0.9	0.8	0.8	0.7	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.9	8.7
Misc. Equip.	8.1	7.4	8.5	8.1	8.2	8.2	8.1	8.5	8.0	8.1	7.8	8.2	97.1
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	50.3	46.3	54.0	51.0	51.3	52.0	50.3	54.0	50.3	50.3	48.5	51.3	609.5
Total	184.3	158.8	158.2	139.5	142.1	154.1	162.6	166.3	147.6	138.4	136.9	164.5	1,853.3

Figure 6 - 4: Energy use per month Option -2



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.8	0.8	5.3	15.4	31.0	55.3	76.2	71.2	50.2	18.8	6.6	0.7	332.3
Heat Reject.	0.0	0.0	0.0	0.1	0.2	0.5	0.8	0.7	0.5	0.2	0.0	0.0	3.2
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	166.0	129.8	79.4	25.1	5.6	0.9	0.2	0.4	1.5	17.0	57.4	125.3	608.6
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	5.0	4.7	5.4	5.1	4.6	4.3	3.9	3.8	3.6	3.8	4.0	4.7	52.8
Vent. Fans	24.5	22.0	25.3	24.5	24.5	24.5	24.5	25.3	23.6	24.5	22.8	24.5	290.2
Pumps & Aux.	17.6	16.0	20.2	23.1	26.1	27.1	27.4	28.2	26.2	24.7	19.1	17.7	273.6
Ext. Usage	0.9	0.8	0.8	0.7	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.9	8.7
Misc. Equip.	8.1	7.4	8.5	8.1	8.2	8.2	8.1	8.5	8.0	8.1	7.8	8.2	97.1
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	50.3	46.3	54.0	51.0	51.3	52.0	50.3	54.0	50.3	50.3	48.5	51.3	609.5
Total	273.1	227.8	198.9	153.0	152.1	173.4	191.9	192.8	164.6	148.1	167.2	233.3	2,276.1

Figure 6 - 5: Energy use per month Option -3

7. Conclusion:

By comparing the building performance and the energy usage between option 2 & option 3, option 2 exceeds option 3. However, it must be noted that these savings come at a higher first cost associated with option 2.

End of Report

Arlington YMCA Scorecard

Location: 3422 13th St N, Arlington, VA 22201, Arlington, VA 22201, USA

Note: The information on this tab is READ-ONLY. To edit this information, see the Credit Category tabs.



Integrative Process		Preliminary	Y	1 of 2	M	2	Verified	0
IPc	Integrative Process			1 of 2		2		



Location and Transportation		Preliminary	Y	15 of 15	M	0	Verified	0
LTp	Floodplain Avoidance			Required				Not Verified
<i>Performance Path</i>								
LTc	LEED for Neighborhood Development			0 of 15		0		
<i>Prescriptive Path</i>								
LTc	Site Selection			8 of 8		0		
LTc	Compact Development			3 of 3		0		
LTc	Community Resources			2 of 2		0		
LTc	Access to Transit			2 of 2		0		



Sustainable Sites		Preliminary	Y	3 of 7	M	3	Verified	0
SSp	Construction Activity Pollution Prevention			Required				Not Verified
SSp	No Invasive Plants			Required				Not Verified
SSc	Heat Island Reduction			1 of 2		1		
SSc	Rainwater Management			0 of 3		2		
SSc	Nontoxic Pest Control			2 of 2		0		



Water Efficiency		Preliminary	Y	6 of 12	M	2	Verified	0
WEp	Water Metering			Required				Not Verified
<i>Performance Path</i>								
WEc	Total Water Use			0 of 12		2		
<i>Prescriptive Path</i>								
WEc	Indoor Water Use			5 of 6		0		
WEc	Outdoor Water Use			1 of 4		3		



Energy and Atmosphere		Preliminary	Y	26.5 of 37	M	3	Verified	23.5
EAp	Minimum Energy Performance			Required				Not Verified
EAp	Energy Metering			Required				Not Verified
EAp	Education of the Homeowner, Tenant or Building Manager			Required				Not Verified
EAc	Annual Energy Use			23.5 of 30		0		23.5
EAc	Efficient Hot Water Distribution System			2 of 5		3		
EAc	Advanced Utility Tracking			1 of 2		0		



Materials and Resources		Preliminary	Y	2.5 of 9	M	3.5	Verified	0
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MRp	Certified Tropical Wood	Required					Not Verified	
MRp	Durability Management	Required					Not Verified	
MRC	Durability Management Verification	1 of 1		0				
MRC	Environmentally Preferable Products	0.5 of 5		2.5				
MRC	Construction Waste Management	1 of 3		1				



Indoor Environmental Quality		Preliminary	Y	8.5 of 18	M	2	Verified	0
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EQp	Ventilation	Required					Not Verified	
EQp	Combustion Venting	Required					Not Verified	
EQp	Garage Pollutant Protection	Required					Not Verified	
EQp	Radon-Resistant Construction	Required					Not Verified	
EQp	Air Filtering	Required					Not Verified	
EQp	Environmental Tobacco Smoke	Required					Not Verified	
EQp	Compartmentalization	Required					Not Verified	
EQc	Enhanced Ventilation	1 of 3		0				
EQc	Contaminant Control	0.5 of 2		0				
EQc	Balancing of Heating and Cooling Distribution Systems	2 of 3		0				
EQc	Enhanced Compartmentalization	0 of 3		0				
EQc	Combustion Venting	1 of 2		1				
EQc	Enhanced Garage Pollutant Protection	0 of 1		1				
EQc	Low-Emitting Products	3 of 3		0				
EQc	No Environmental Tobacco Smoke	1 of 1		0				



Innovation		Preliminary	Y	4 of 6	M	1	Verified	0
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INp	Preliminary Rating	Required					Not Verified	
INc	Innovation	4 of 5		1				
INc	LEED Accredited Professional	0 of 1		0				



Regional Priority		Preliminary	Y	3 of 4	M	1	Verified	0
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RPC	Regional Priority	3 of 4		1				
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Point Floors	
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The project earned at least 8 points total in Location and Transportation and Energy and Atmosphere	<input type="text" value="Yes"/>
The project earned at least 3 points in Water Efficiency	<input type="text" value="No"/>
The project earned at least 3 points in Indoor Environmental Quality	<input type="text" value="No"/>

Total		Preliminary	Y	69.5 of 110	M	17.5	Verified	23.5
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Certification Thresholds Certified: 40-49, Silver: 50-59, Gold: 60-79, Platinum: 80-110