THERMOLITE
WINDOW SYSTEMS

Supplemental Window Systems

The performance benefits of supplemental window systems in commercial building modernization applications

March 2013

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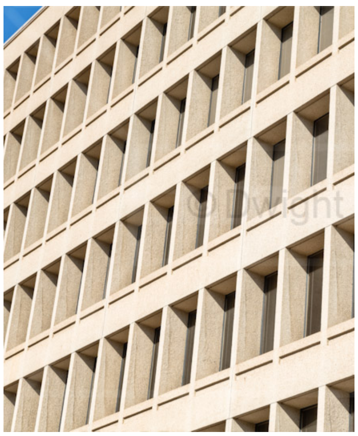
Introduction



Buildings account for about 40% of US energy consumption and windows can account for 58% of energy consumption in a building. Window technologies can therefore significantly reduce energy consumption, with a corresponding reduction in the environmental impact of CO^2 emissions.

In this white paper you will find an analysis of a supplemental window system and the energy effects on a 100,000 square foot office building located in Chicago, Illinois. Not only will you see this technology reduce ongoing costs of heating and cooling, this paper also illustrates the reduction of heating and cooling capacity needed, which will have an immediate impact at the beginning of a modernization project of an existing building renovation.

Multiple stakeholders require businesses to concentrate on environmental management and to promote common global goals in environmental issues. In construction, environmental stability requires sustainable use of materials, energy, water and land, product recyclability, durability, closed material loops and increased product lifecycle.

Many organizations have already taken a proactive approach to sustainablity to minimize their environmental impact. Building owners and managers, while motivated by environmental impact of using their building's energy more efficiently do have budget constraints. In most all cases owners are looking for the best place to spend their capital in order to maximize their return on investment in the technologies selected for modernization.

There are literally hundreds of options for an energy modernization project. One strategy that is often overlooked is sealing the building envelope and the effect of window air infiltration and thermal energy loss through the glass. In many cases, windows are often screened out of the short list of viable building options during the decision making process. The many positive attributes of supplemental windows are usually not fully considered:

- Low installation cost compared to other window options
- Reduces or eliminates air infiltration through older window openings
- Are made from sustainable aluminum and glass materials
- Reduces the heating and cooling demand load in the facility substantially
- Allows control of solar energy into the building in winter months
- Increases comfort of the occupants / reduces sound transmission
- Will last the lifetime of the building

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Modernization Process

The renovation of existing buildings involves a decision-making process with the goal of reducing energy consumption and total operating costs. This is the essence of any building modernization project. Every decision maker has his or her own style, product preferences and engineering beliefs, but at the end of the day, the decision must be rational and be as close to optimal as possible.

The objective function is then to:

Minimize Energy and Operation Costs: Cost1 + Cost 2 + Cost3… etc

Subject to the capital budget: Available $ for the project

A decision-making process, which focused on renovation strategies from thermal comfort and energy consumption perspective, appeared in World Academy of Science, Engineering and Technology 76 2011 by Hang Zin and Karsten Menzel both from the Department of Civil Engineering University College of Cork Ireland. The decision support model includes six sections including:

I. An initial survey of area conditions
II. Analysis of building performance
III. Consideration of all possible solutions
IV. Generation of feasible options
V. Evaluation of those options
VI. Selection of the best option

Their work depicts a very straight forward process in selecting modernization options. What is worth noting is that the process calls for the evaluation of ALL possible solutions which is difficult due to time constraints of the project manager. However, since windows play such a critical role in building performance, supplemental window systems should always be considered as the PRIMARY option since it optimizes the objective function criteria in the window category. They are always less expensive than new or replacement windows and outperform on energy efficiency.

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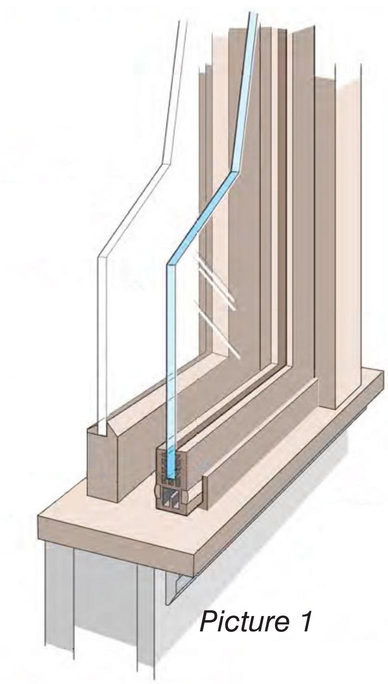
Supplemental Window Systems



Picture 1

Sometimes referred to as storm windows, supplemental window systems are actually quite different. Besides being made specific to each opening and installed to restrict air infiltration, supplemental window systems use high performing materials which has a superior effect on both energy performance and physical security enhancement.

3.1 Frame Performance

The basic premise of a supplemental window system is to reuse the existing glass and window frame and mount a new frame and glass lite behind this. Installation and materials cost is greatly reduced and the basic thermal performance of the original window is not only maintained but amplified. By placing a window behind the existing glass, an air gap is created and works in a similar fashion as insulated glass units (Picture 1). The supplemental frame is often times mounted on an area which is inside the existing frame. Not only will the air infiltration be prevented from leaking into the building but a thermal break is created between the original frame and the supplemental window frame. Convection rather than conduction becomes the main driver of thermal heat loss which is one of the reasons why supplemental window systems work.

Between glass blinds have further effect on the performance of the system. Not only do they keep radiant light energy from flowing through the window if the blinds are drawn, they also serve as a buffer which breaks up the air gap between the glass into two, further improving the thermal performance.

3.2 Glass Performance

The next most important factor of a supplemental window system is the selection of glass coating. Low emissivity (Low e) hard coats can be placed on either side of the glass which will reduce the flow of infrared energy through the glass. In warm months, this energy is bounced out of the building and in cooler months, near infrared radiant energy from the buildings heating system is directed inwards. Low e coatings are proven to increase the insulative attributes of the glass and should always be considered.

Solar heat gain films are another excellent option to place on the glass surface either as stand alone or used in tandem with low-e coatings. These films will reduce the intensity of light coming into the building and serve as a shade with minimal affect to the visible light spectrum.

3.3 Security Performance

The last important option of supplemental window systems deal with the security of the building. Bomb blast window frames and laminated or filmed glass are an excellent choice for historic buildings which may be located by a state or federal building. These systems can be quickly installed on the interior which will not alert either tenants or terrorists that the building is being “hardened” for blast mitigation.

Hurricane window systems can be installed in the exact same fashion which will prevent windows from breaking out completely and creating a positive air pressure inside the structure and placing the building roof at risk.

Other security window systems use ballistic glass and frame placed behind the original glass to guard against projectiles such as large caliber bullets and vandals breaking though the glass using metal tools such as crowbars and sledgehammers.

Lastly, signal defense film can be placed in the laminate material which will eliminate the amount of radio frequency leakage and guard against data theft from internal routers. Electrofied film is also specified by Homeland Security to guard against laser enabled eavesdropping. All of these security options will produce similar if not enhanced energy performance of the supplemental window system.

3.4 Energy and Sustainability Performance

Low installation cost compared to other window options: These systems are placed on the inside of the existing glass in a new frame which seals the glass from the inside of the building. They use a simple frame system to recycle the existing glass and incorporate it into a new window system. Typical installations are 50% less expensive than new glazing and are more energy efficient.

Reduces or eliminates air infiltration through older window openings: Undesired air coming into the building through leaky windows has a profound effect on the energy used to maintain temperature. It's similar to a bucket full of small holes leaking water. Rather than spending resources on new and efficient ways of putting water back into the bucket, it is reasonable to first start with plugging the holes in the most cost effective way before you start looking into better ways of filling the bucket when it runs low.

Are made from sustainable aluminum and glass materials: Aluminum is the most abundant and recyclable metal in the Earth's crust. Glass is made from silicon and low emissivity glass coatings use a thin layer of silver.

Reduces the heating and cooling demand load in the facility: Once the building envelope is sealed, only will the demand capacity selection of the heating and cooling system be optimized. Significant savings will be realized at the beginning of the modernization project by reducing the size of the heating/cooling systems.

Allows control of solar energy into the building in winter months: Between glass blinds can be opened and closed which will allow visible light into the building and creating heat gain. This is desirable in winter months in colder climates.

Increases comfort of the occupants / reduces sound transmission: Commercial buildings with older windows can create cold and hot spots in work areas. Supplemental window systems will reduce this and limit the amount of street noise to up to a STC 49.

Will last the lifetime of the building: Unlike all other equipment modernization options, supplemental window systems will last hundreds of years if properly maintained. They will not rust, fade or fail in any way.

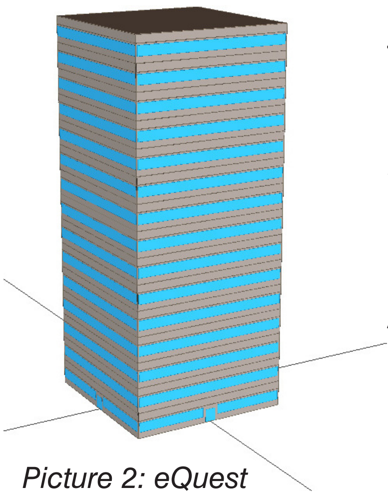
Computer Modeling

This model to be discussed has been prepared by using WINDOW 6.3 and eQuest simulation software. The subject building is a hypothetical commercial office building situated in Chicago Illinois but was then later modeled in 14 other metropolitan areas in the United States. This model contains the energy analysis of a BASELINE condition and of the SUPPLEMENTAL condition using two kinds of supplemental window systems (Security and Energy). The report is based on the information typical of a building of this size and window characteristics modeled using WINDOW 6.3 software and independent laboratory testing conducted on behalf of Thermolite Inc to calculate air infiltration effects. Actual data for specific modeling purposes should be provided by the architect and the design consultants involved in your particular project.

The purpose of this report is to present the theoretical performance of the SUPPLEMENTAL Model in comparison to a Baseline budget building based on the prescriptive requirements from Appendix G/ Performance Rating Method of ASHRAE/IESNA 90.1-2004. The results are structured as follows:

PROJECT DESCRIPTION
BASELINE MODEL
SUPPLEMENTAL MODEL

Appendix A: Model results of the BASELINE and SUPPLEMENTAL conditions describing energy use, utility cost and capacity requirements. Load profiles are available but not included in this white paper.



Picture 2: eQuest Building Sample

4.1 Project Description

The hypothetical facility of this case study is a commercial office building comprising 100,000 square feet and has a window to wall ratio is 40%. The building has a ground and fourteen above grade floors. A zoning plan was developed for each floor and entered into the simulation model. Each zone was assigned a set of properties including lighting power density, equipment power density, occupancy rate, etc. Each zone was also assigned physical properties of floor-to-floor height, material conductivity and fenestration area etc.

A Baseline Model as per the requirements has been considered without modeling any blinds or shades. The SUPPLEMENTAL model does NOT consider in-between-glass blinds with the Security Window System or the Energy Window System. Between-glass blinds improve the performance of the window system significantly by reducing solar heat gain in the summer and increasing it in the winter while at the same time decreasing U value.

The project has been modeled using the eQuest energy analysis software, an energy simulation engine developed by US Department of Energy (DOE). The eQuest energy modeling software allows for a graphical display of all the 3-dimensional geometry entered in the application to describe the building. As per the view shown (Picture 2), the building has been modeled in detail to improve the accuracy of analysis work. The project objective is to evaluate energy use and the energy efficiency performance of the building.

4.2 Baseline Model

Building Square Footage: 100,000
Floors: 15
Percent Glass: 40%
Glass Square Footage: 23,500
Floor Height: 12 ft
Cooling System: VAV w/ reheat
Cooling: Chilled water (COP 4.2) (44/85 evap/condenser standard delta T's)
Heating: Hot water (efficiency 80%)
Cooling Setpoint: 75
Heating Setpoint: 72
Building Shape: Square
Zones/floor: 5
Lighting loads: 1.3 w/sq ft
Plug Loads: .5 w/sq ft
Schedules: Default office schedules in eQuest

Rate Structure Information: (based on Illinois state average)
Gas: $ .88/therm
Electric: $ .08/kw-hr

The Baseline model is used to benchmark the SUPPLEMENTAL Model, as well as determine the LEED®CS points.

This model is based upon the SUPPLEMENTAL design, but the performance parameters listed below are defined to reflect the minimum efficiency levels that ASHRAE 90.1-2004 defines for various building components. The only variable between the Baseline Model and the SUPPLEMENTAL model is the fenestration type.

Building Envelope Constants:
- Exterior wall construction
- Roof construction
- Window to gross wall ratio: 40%
- Shading Devices: None
- Lighting Equipment
- An Average lighting power density
- An Average power density
- Elevator load
- Variable air volume (VAV) with reheat
- Heating: Electric Resistance
- Water cooled centrifugal chillers
- Primary Pumps
- Secondary Pumps
- Condenser Pumps

Building Envelope Variables: Fenestration Type
Baseline: ¼ Monolithic Glass
U-Value : 1.03 Btu/hr. sq. feetı F
SHGC: 0.82

SUPPLEMENTAL ***Security*** Window System: ¼ Monolithic glass plus 5/16 laminated low-e coating, aluminum frame, no blinds.
U-Value : .37 Btu/hr. sq. feetı F
SHGC: 0.52

SUPPLEMENTAL ***Energy*** Window System: : ¼ Monolithic glass plus 1" insulated glass low-e coating and argon filled, aluminum frame, no blinds.
U-Value : .14 Btu/hr. sq. feetı F
SHGC: .43

Please note there are no blinds and if there were, the SHGC number would be 2 to 3 times less. Furthermore, no allowance in this simulation has been made for opening or closing the blinds during the summer or winder months which could improve the performance of the SUPPLEMENTAL models.

4.3 Supplemental Model Results

SUPPLEMENTAL case assumptions and data are based on parameters commonly found in architectural drawings, HVAC floor plans, and technical specifications of buildings of this type. All other design and operating assumptions are based on experience and industry standards.

The SUPPLEMENTAL case considers two configurations- Security (Thermolite-1) and Energy (Thermolite – 2). These systems are placed behind the existing ¼ monolithic glass window which is the BASELINE. A Security Window design consists of an internal frame with 5/16 inch laminated glass while the Energy Window design uses a 1-inch insulated glass unit in an internal frame. Both window systems have low – e coatings in this example.

Annual energy cost of the BASELINE condition is $228,523. The SUPPLEMENTAL model indicates a savings of $57,191 with the Security Window System and $66,207 with the ENERGY WINDOW. This represents a 25% to 29% savings respectively.

On the demand side, electric peak in the BASELINE model is 739 kW and the two SUPPLEMENTAL conditions reduce electric peak to 517 kW for the Security Window and 492 kW for the Energy Window representing a 30% to 33% reduction. Gas usage is modeled to be 739 Mbtu in the BASELINE. The SUPPLEMENTAL Security and Energy Window System reduces this by 47% to 70%.

4.4 Return on Investment

Energy savings are calculated using $.08 per kwh for the city of Chicago, which is actually 10% below the delivered rate as of June 2012. As these rates move up or down, the return on investment will change accordingly. The model does not incorporate any price change do to peak reduction nor does it quantify first year savings in the reduction of size of heating and cooling capital equipment. This model does not incorporate the use of between glass blinds.

Cost and performance of supplemental window systems depend on the manufacturer and the city it is installed. In some cases, installation costs will equal the cost of the window system so simplicity is very important.

In this particular example, there is 23,500 square feet of glass on the entire building. If the building manager assumes a cost of $20/square foot, the entire project would run $470,000. Return on investment in this example is therefore calculated to be 8.2 years
using a basic supplemental window system with savings realized on a reduction in monthly gas and electric bills alone. Utility prices in this model were held constant over the payback period.

If the building is part of a larger modernization project, there would be significant capital savings due to capacity reduction in heating and cooling systems as stated before. In some cases, this reduction will be greater than the entire cost of the supplemental window project. Reduction in peak load could also have a significant effect on overall $/kwh pricing. Cites with high utility costs and hot and cold seasons are modeled to be the best candidates for supplemental window systems from return on investment. Other cities showing similar energy model results using supplemental window systems are New York City, Boston and Washington DC.

When the modernization process fully considers the wide ranging effect of supplemental window systems, the relatively low cost to install and essentially zero maintenance cost for the life of the building, this type of window product could be the best choice available.

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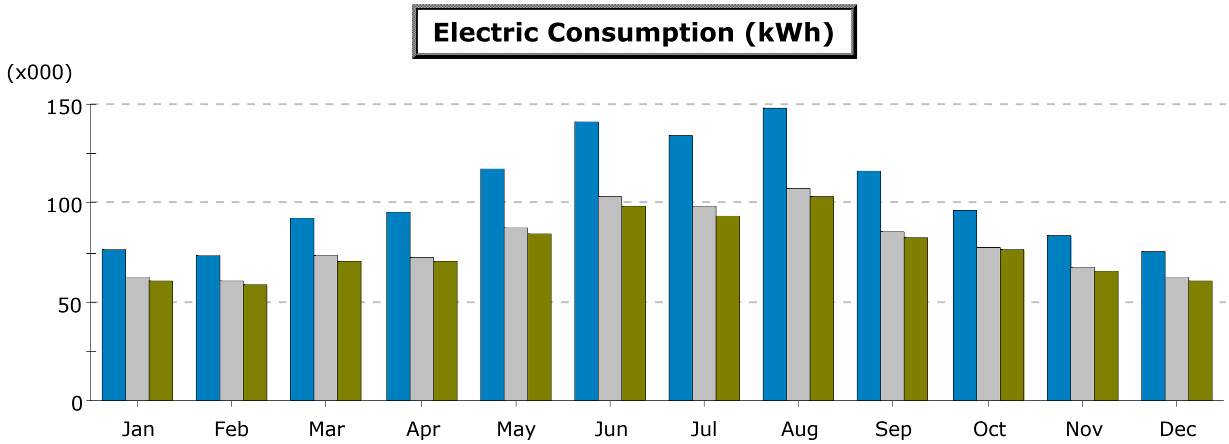
Summary:

- Supplemental window systems are modeled to reduce energy consumption in a 100,000 square foot building with existing ¼ monolithic glass by 23% to 30%.
- Supplemental window systems are modeled to reduce the peak loads by over 30%.
- Supplemental window systems work best in cold climates with high local energy costs but also perform in well temperate climates.
- Return on investment of these systems is modeled to be approximately 8 years on pure monthly energy savings alone.
- Heating and cooling capacity requirements need to be recalculated with supplemental window systems and will effect the return on investment.
- Supplemental window systems should always be considered in modernization projects when exterior windows are structurally and cosmetically sound.

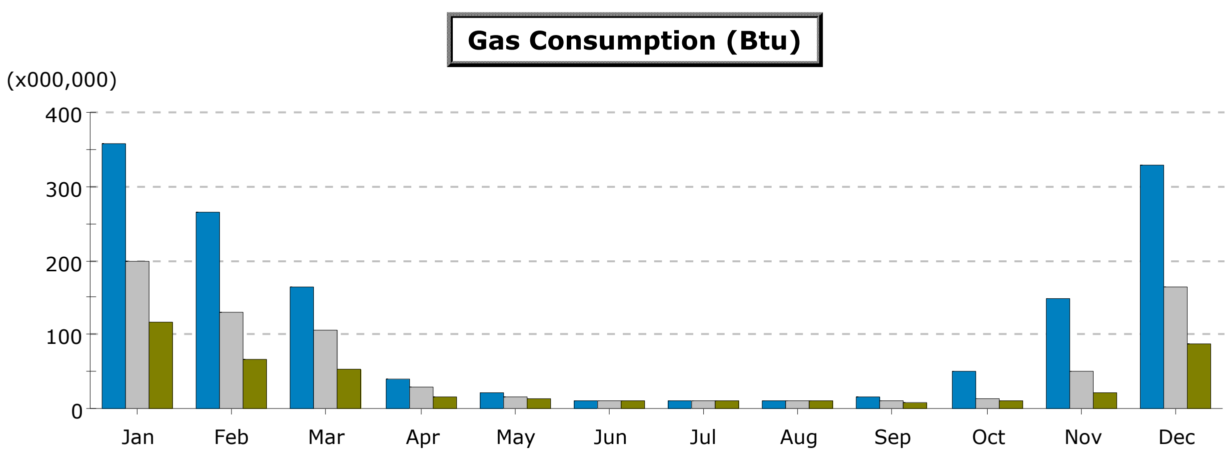
Appendices

Appendix A: Electric & Gas Consumption Comparison



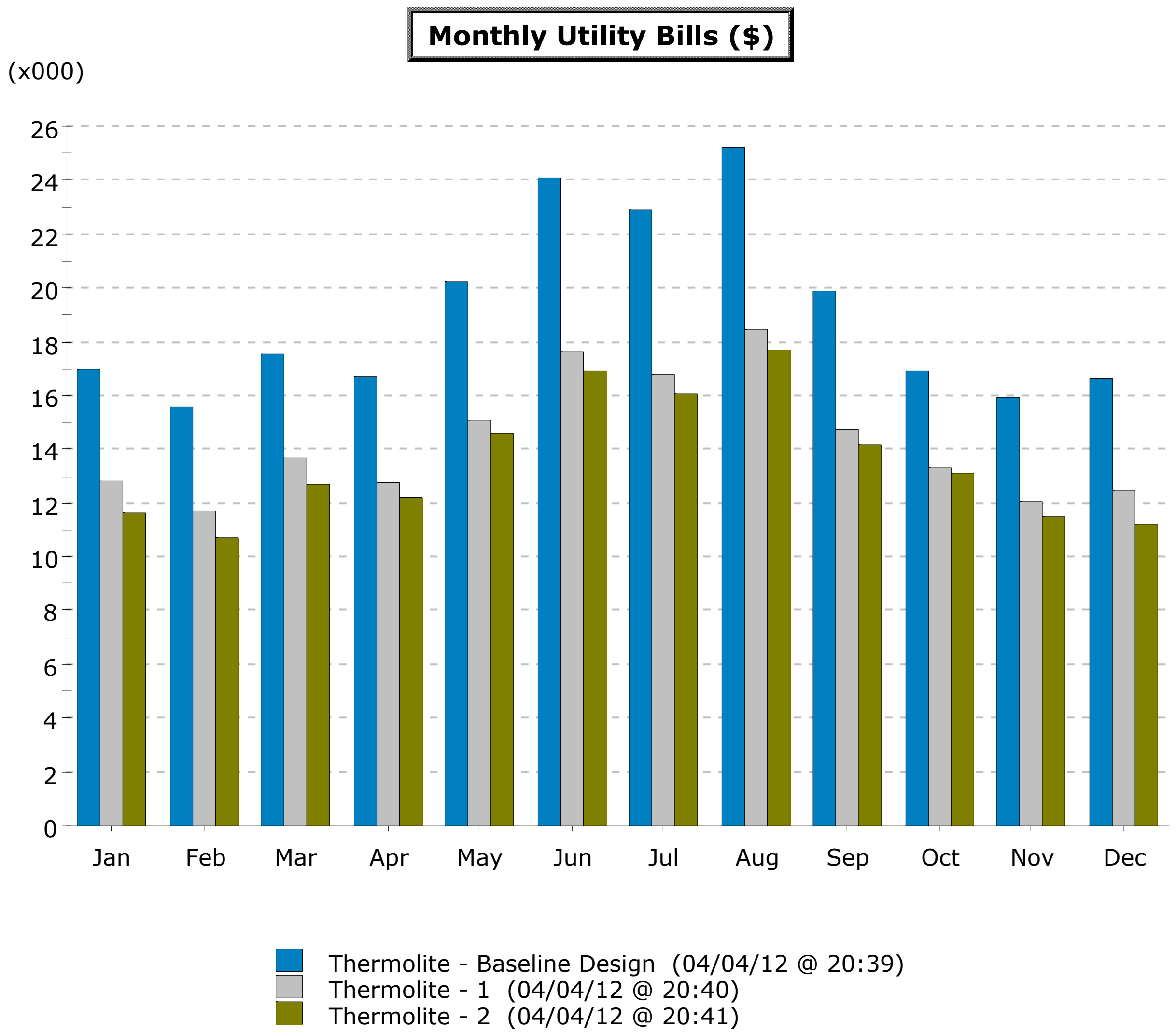
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	76.2	73.8	92.2	95.6	117.4	141.2	134.0	147.6	115.9	96.0	83.9	75.9	1,249.8
Run 2.	62.4	60.1	73.3	72.9	87.7	103.1	98.0	107.7	85.8	77.3	67.5	62.2	958.1
Run 3.	60.5	58.4	71.0	70.6	84.9	98.8	93.8	103.4	82.8	76.4	66.0	60.3	926.9
Run 4.													
Run 5.													

1. Thermolite - Baseline Design (04/04/12 @ 20:39)
2. Thermolite - 1 (04/04/12 @ 20:40)
3. Thermolite - 2 (04/04/12 @ 20:41)

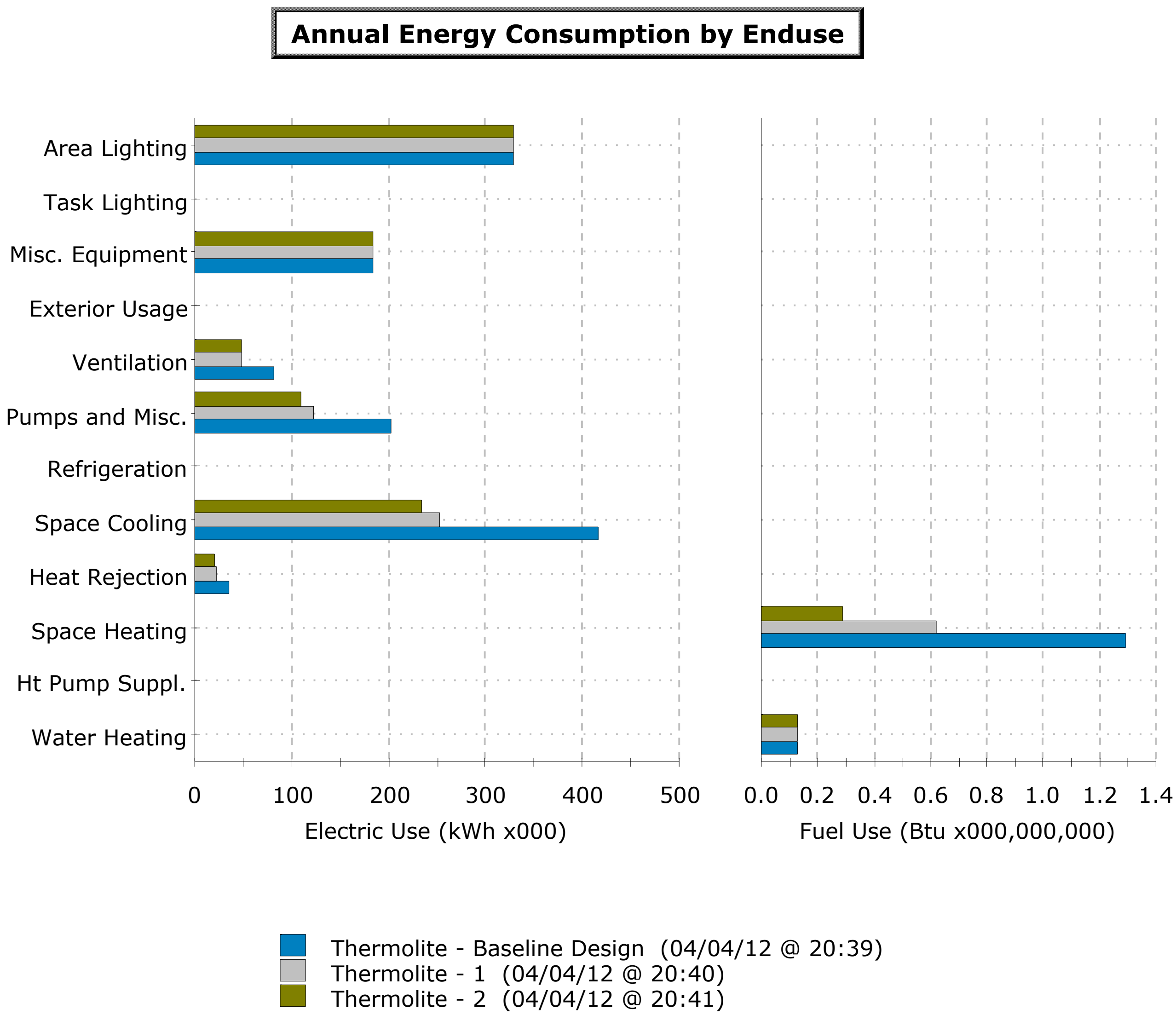


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Run 1.	357.6	265.8	164.4	39.3	20.3	10.9	9.8	9.9	16.6	51.2	147.8	328.0	1,421.5
Run 2.	198.6	131.1	104.9	28.4	15.1	10.9	9.3	10.0	10.6	14.5	50.0	164.4	747.9
Run 3.	116.7	66.3	53.1	15.2	12.2	10.9	9.3	10.0	8.7	9.7	20.1	87.2	419.6
Run 4.													
Run 5.													

Appendix B: Monthly Utility Bill Comparison

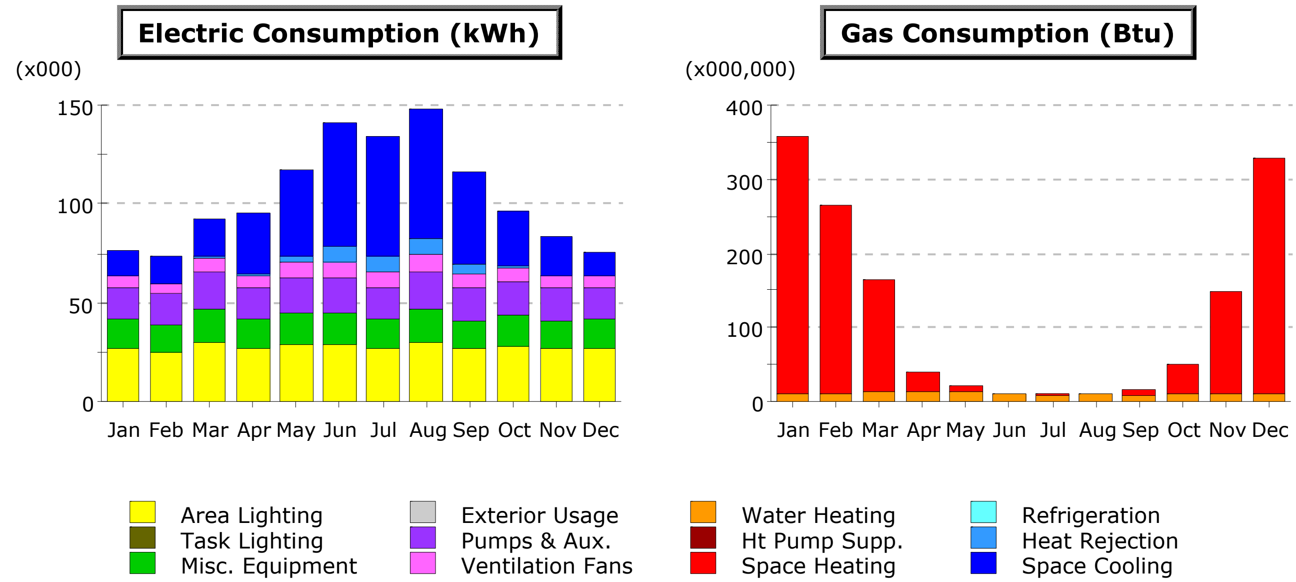


Appendix C: Annual Energy Consumption Comparison



Appendix D: Monthly Energy Consumption Breakdown: Baseline

Project/Run: Thermolite - Baseline Design | Run Date/Time: 04/04/12 @ 20:39



Electric Consumption (kWh x000)

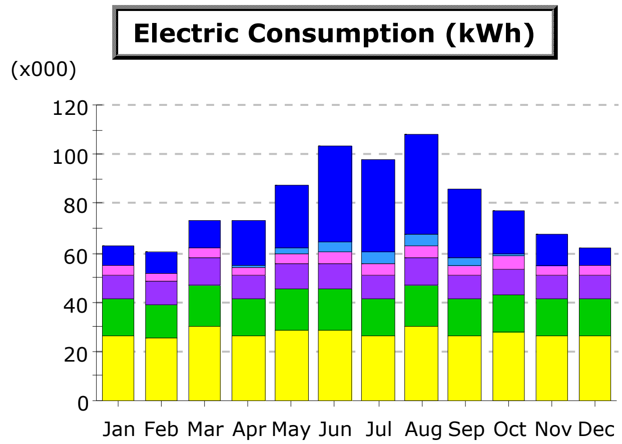
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	12.8	13.9	19.2	30.6	43.7	63.0	60.5	65.4	46.6	27.6	20.3	12.7	416.3
Heat Reject.	0.0	0.1	0.3	1.6	3.5	7.3	7.8	8.1	4.7	1.2	0.5	-	35.1
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	5.8	5.2	7.1	6.0	7.2	8.0	8.1	8.5	7.2	6.9	5.6	5.6	81.4
Pumps & Aux.	16.2	15.4	18.7	16.2	17.8	17.8	16.2	18.7	16.2	17.0	16.2	16.2	202.8
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	14.9	14.0	16.8	14.8	16.1	16.1	14.9	16.8	14.8	15.5	14.8	14.9	184.5
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	26.5	25.1	30.2	26.4	29.0	28.9	26.5	30.2	26.4	27.7	26.4	26.5	329.7
Total	76.2	73.8	92.2	95.6	117.4	141.2	134.0	147.6	115.9	96.0	83.9	75.9	1,249.8

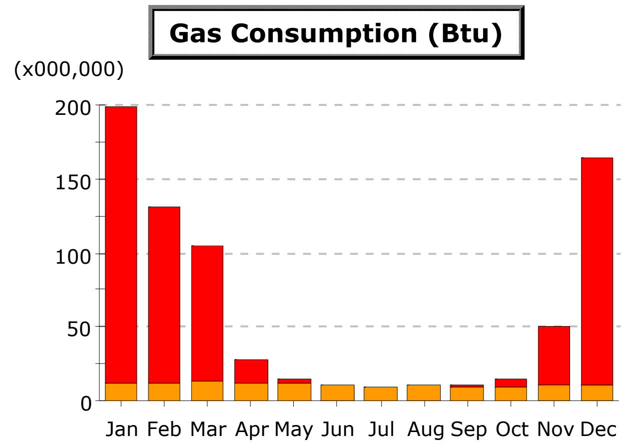
Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	345.7	254.2	150.5	27.4	8.3	-	0.5	-	7.9	41.6	137.8	316.9	1,290.9
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	11.9	11.6	13.9	11.9	12.0	10.9	9.2	9.9	8.7	9.6	10.0	11.0	130.7
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	357.6	265.8	164.4	39.3	20.3	10.9	9.8	9.9	16.6	51.2	147.8	328.0	1,421.5

Appendix E: Monthly Energy Consumption Breakdown: Supplemental I

Project/Run: Thermolite - 1 Run Date/Time: 04/04/12 @ 20:40





Electric Consumption (kWh x000)

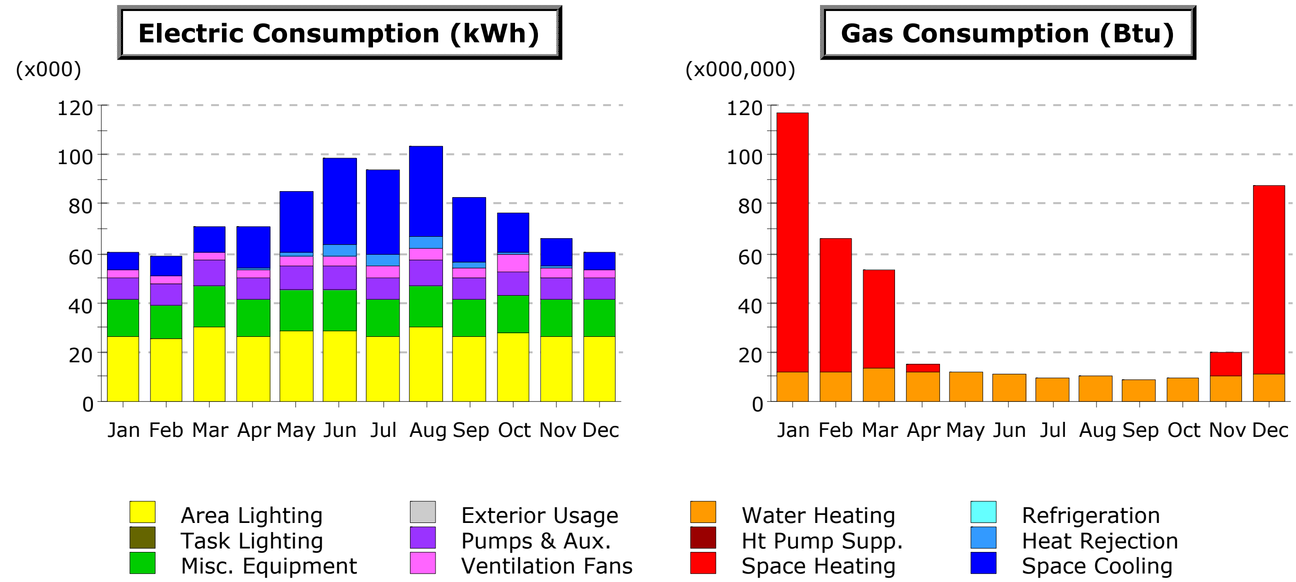
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	7.65	8.36	11.24	17.86	25.93	38.38	37.33	39.92	28.12	17.44	12.41	7.60	252.24
Heat Reject.	0.00	0.07	0.16	0.88	2.08	4.47	4.83	4.98	2.85	0.81	0.37	-	21.51
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	3.65	3.30	3.68	3.17	3.85	4.51	4.68	4.62	3.86	5.50	3.72	3.50	48.05
Pumps & Aux.	9.77	9.28	11.24	9.77	10.75	10.75	9.77	11.24	9.77	10.26	9.77	9.77	122.14
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	14.91	14.04	16.76	14.83	16.14	16.05	14.91	16.76	14.82	15.53	14.82	14.91	184.48
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	26.45	25.07	30.22	26.42	28.97	28.92	26.46	30.22	26.41	27.71	26.41	26.45	329.71
Total	62.44	60.12	73.30	72.93	87.73	103.07	97.99	107.74	85.82	77.27	67.49	62.23	958.12

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	186.83	119.48	91.05	16.49	3.10	-	-	-	1.85	4.91	39.99	153.45	617.17
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	11.81	11.57	13.89	11.96	12.02	10.95	9.29	9.96	8.74	9.60	9.98	10.97	130.74
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	198.65	131.05	104.94	28.44	15.13	10.95	9.29	9.96	10.59	14.51	49.98	164.42	747.90

Appendix F: Monthly Energy Consumption Breakdown: Supplemental II

Project/Run: Thermolite - 2 Run Date/Time: 04/04/12 @ 20:41



Electric Consumption (kWh x000)

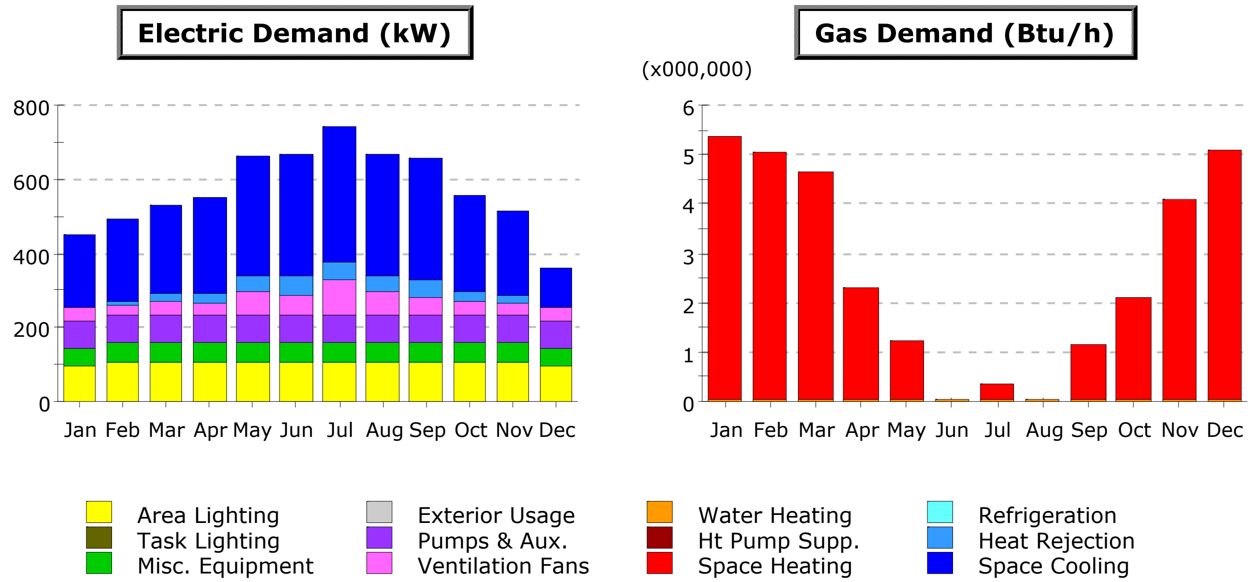
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	6.89	7.60	10.23	16.53	24.10	35.51	34.59	37.02	26.15	16.34	11.53	6.84	233.35
Heat Reject.	0.00	0.07	0.15	0.86	1.99	4.16	4.48	4.64	2.69	0.80	0.38	-	20.24
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	3.40	3.29	3.52	3.19	4.00	4.45	4.60	4.62	3.98	6.73	4.11	3.27	49.17
Pumps & Aux.	8.80	8.36	10.12	8.80	9.68	9.68	8.80	10.12	8.80	9.24	8.80	8.80	109.97
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	14.91	14.04	16.76	14.83	16.14	16.05	14.91	16.76	14.82	15.53	14.82	14.91	184.48
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	26.45	25.07	30.22	26.42	28.97	28.92	26.46	30.22	26.41	27.71	26.41	26.45	329.71
Total	60.45	58.43	71.00	70.63	84.88	98.77	93.84	103.39	82.85	76.36	66.04	60.27	926.92

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	104.90	54.80	39.28	3.26	0.22	-	-	-	-	0.15	10.18	76.24	289.03
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	11.78	11.54	13.87	11.94	12.02	10.95	9.30	9.96	8.73	9.59	9.96	10.94	130.56
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	116.68	66.34	53.15	15.21	12.23	10.95	9.30	9.96	8.73	9.74	20.14	87.18	419.59

Appendix G: Monthly Peak Demand: Baseline

Project/Run: Thermolite - Baseline Design | Run Date/Time: 04/04/12 @ 20:39



Electric Demand (kW)

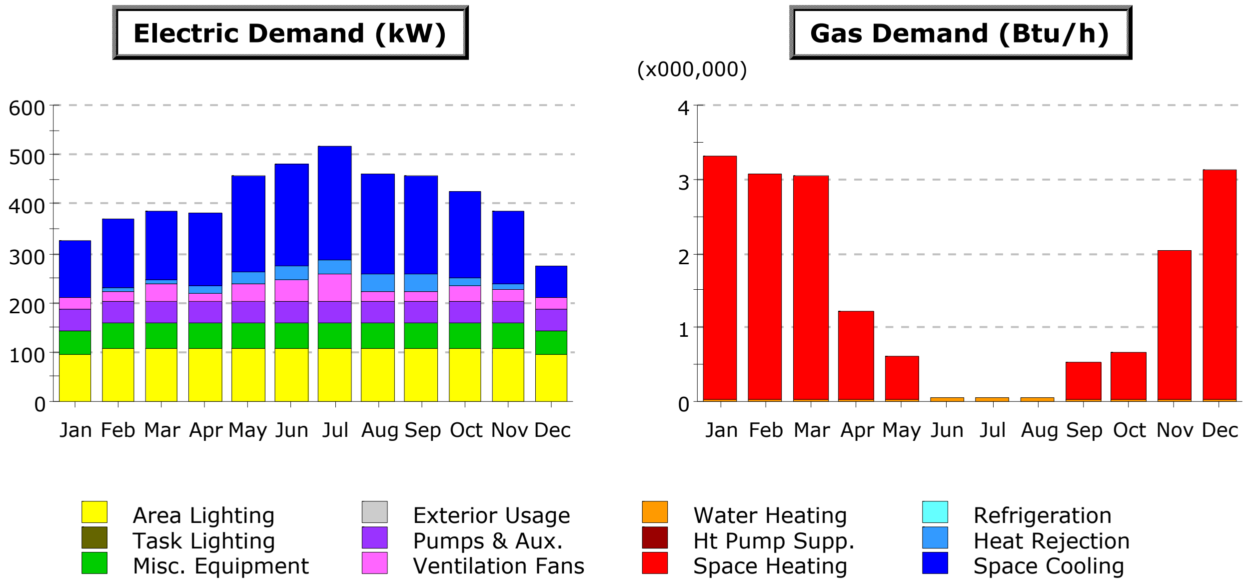
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	194.0	221.4	241.9	259.5	321.0	333.6	362.0	329.5	327.0	260.5	229.9	102.9	3,183.2
Heat Reject.	0.7	12.3	20.6	26.3	42.4	49.7	48.1	45.5	48.9	25.2	17.7	-	337.3
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	40.1	26.2	35.9	33.0	64.8	53.4	96.3	60.9	48.3	35.7	32.6	40.1	567.1
Pumps & Aux.	73.7	73.7	73.7	73.7	73.7	73.7	73.7	73.7	73.7	73.7	73.7	73.7	885.0
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	45.7	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.2	45.7	604.5
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	96.1	108.4	108.4	108.4	108.4	108.4	108.4	108.4	108.4	108.4	108.4	96.1	1,275.8
Total	450.3	493.3	531.9	552.3	661.6	670.1	739.8	669.3	657.6	554.8	513.4	358.5	6,852.9

Gas Demand (Btu/h x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	5.32	5.03	4.62	2.28	1.22	-	0.31	-	1.14	2.09	4.07	5.08	31.15
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.03	0.03	0.03	0.03	0.03	0.05	0.02	0.04	0.02	0.02	0.03	0.03	0.37
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	5.35	5.06	4.65	2.31	1.24	0.05	0.34	0.04	1.17	2.11	4.10	5.11	31.52

Appendix H: Monthly Peak Demand: Supplemental I

Project/Run: Thermolite - 1 Run Date/Time: 04/04/12 @ 20:40



Electric Demand (kW)

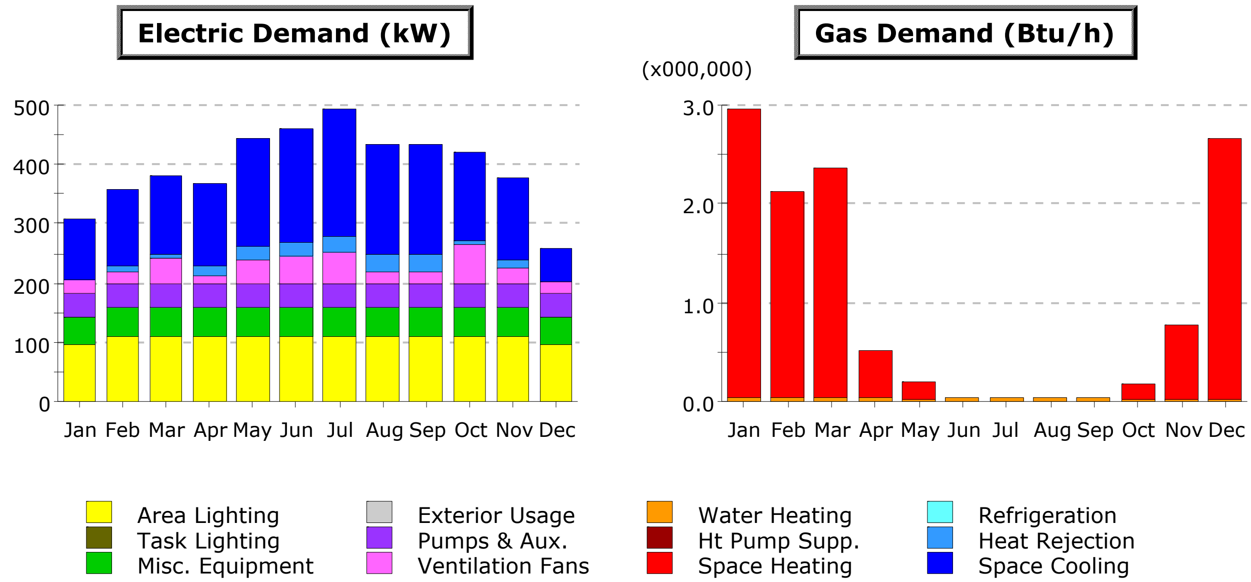
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	116.1	138.8	138.8	148.3	193.0	205.0	229.9	202.2	201.1	172.3	147.4	61.5	1,954.5
Heat Reject.	0.4	8.3	8.0	16.4	25.4	27.8	30.4	32.7	32.6	18.8	11.8	-	212.7
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	24.6	17.9	33.3	14.2	34.5	43.5	52.9	20.2	19.9	28.8	23.0	24.6	337.4
Pumps & Aux.	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	533.0
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	45.7	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	45.7	604.6
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	96.1	108.4	108.4	108.4	108.4	108.4	108.4	108.4	108.4	108.4	108.4	96.1	1,275.8
Total	327.3	369.1	384.2	383.0	457.0	480.4	517.3	459.2	457.8	424.0	386.2	272.4	4,917.9

Gas Demand (Btu/h x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	3.27	3.04	3.01	1.18	0.59	-	-	-	0.50	0.63	2.03	3.10	17.34
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.03	0.03	0.03	0.03	0.03	0.05	0.04	0.04	0.02	0.02	0.03	0.03	0.39
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	3.30	3.07	3.05	1.21	0.62	0.05	0.04	0.04	0.52	0.66	2.05	3.12	17.73

Appendix I: Monthly Peak Demand: Supplemental II

Project/Run: Thermolite - 2 | Run Date/Time: 04/04/12 @ 20:41



Electric Demand (kW)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	104.5	130.5	131.9	137.9	183.1	192.0	213.7	186.7	184.9	146.2	139.0	55.4	1,805.8
Heat Reject.	0.4	8.2	8.1	15.5	23.8	25.7	27.8	30.1	29.9	9.4	11.5	-	190.4
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	-	-	-	-	-	-	-	-	-	-	-	-	-
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	22.1	19.3	40.8	13.5	37.4	44.3	51.0	18.6	17.9	63.7	25.9	19.9	374.4
Pumps & Aux.	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	479.9
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	45.7	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	51.3	45.7	604.6
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	96.1	108.4	108.4	108.4	108.4	108.4	108.4	108.4	108.4	108.4	108.4	96.1	1,275.8
Total	308.7	357.7	380.5	366.5	444.0	461.6	492.3	435.1	432.3	419.0	376.1	257.1	4,730.8

Gas Demand (Btu/h x000,000)

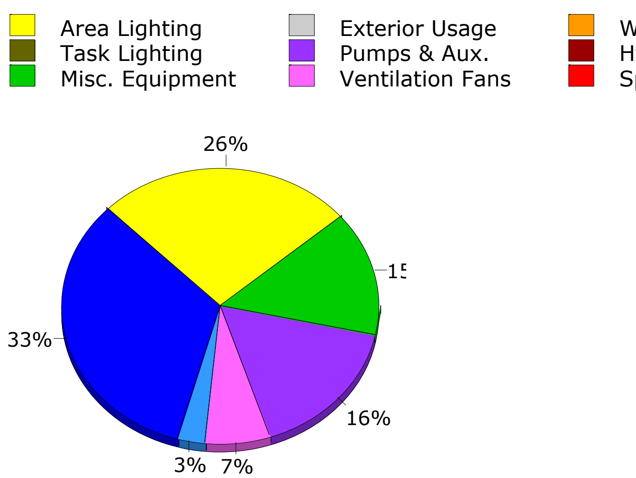
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	2.93	2.09	2.32	0.48	0.17	-	-	-	-	0.15	0.74	2.63	11.51
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	0.03	0.03	0.03	0.03	0.03	0.05	0.04	0.04	0.04	0.02	0.03	0.03	0.41
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	2.96	2.12	2.36	0.51	0.19	0.05	0.04	0.04	0.04	0.17	0.77	2.65	11.91

Appendix J: Annual Energy Consumption: Baseline

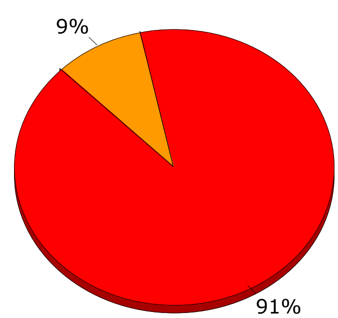
Project/Run: Thermolite - Baseline Design | Run Date/Time: 04/04/12 @ 20:39

Annual Energy Consumption by Enduse

	Electricity kWh (x000)	Natural Gas MBtu	Steam Btu	Chilled Water Btu
Space Cool	416.3	-	-	-
Heat Reject.	35.1	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	1,290.9	-	-
HP Supp.	-	-	-	-
Hot Water	-	130.7	-	-
Vent. Fans	81.4	-	-	-
Pumps & Aux.	202.8	-	-	-
Ext. Usage	-	-	-	-
Misc. Equip.	184.5	-	-	-
Task Lights	-	-	-	-
Area Lights	329.7	-	-	-
Total	1,249.8	1,421.5	-	-



Electricity



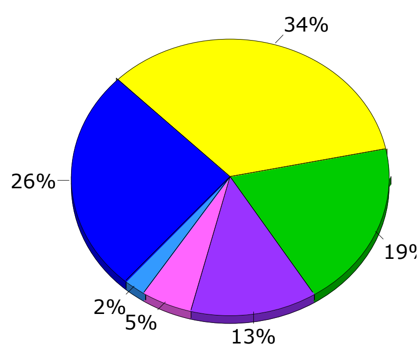
Natural Gas

Appendix K: Annual Energy Consumption: Supplemental I

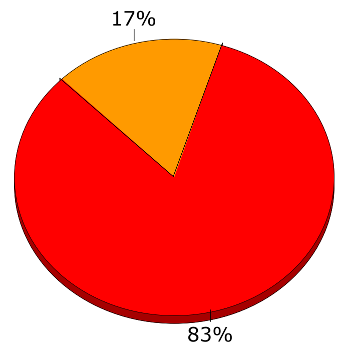
Project/Run: Thermolite - 1 | Run Date/Time: 04/04/12 @ 20:40

Annual Energy Consumption by Enduse

	Electricity kWh (x000)	Natural Gas MBtu	Steam Btu	Chilled Water Btu
Space Cool	252.24	-	-	-
Heat Reject.	21.51	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	617.17	-	-
HP Supp.	-	-	-	-
Hot Water	-	130.74	-	-
Vent. Fans	48.05	-	-	-
Pumps & Aux.	122.14	-	-	-
Ext. Usage	-	-	-	-
Misc. Equip.	184.48	-	-	-
Task Lights	-	-	-	-
Area Lights	329.71	-	-	-
Total	958.12	747.90	-	-



Electricity



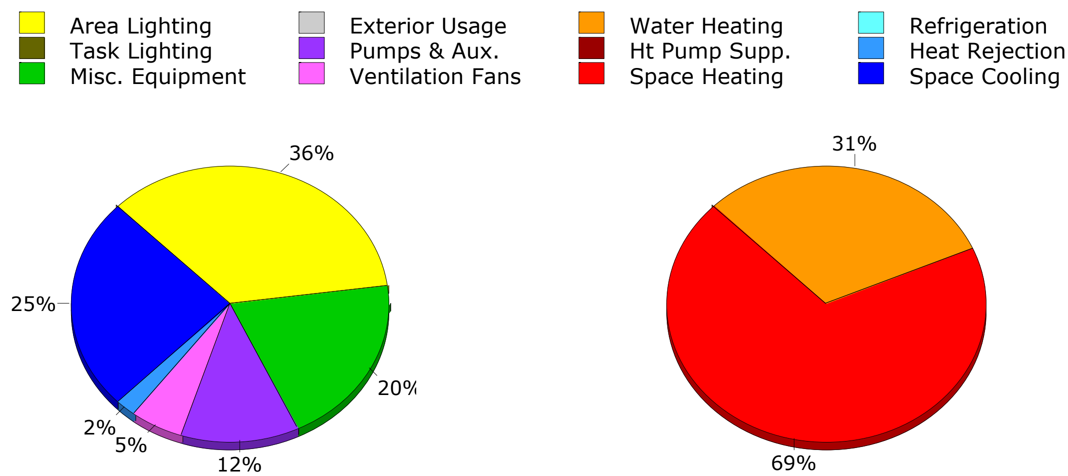
Natural Gas

Appendix L: Annual Energy Consumption: Supplemental II

Project/Run: Thermolite - 2 | Run Date/Time: 04/04/12 @ 20:41

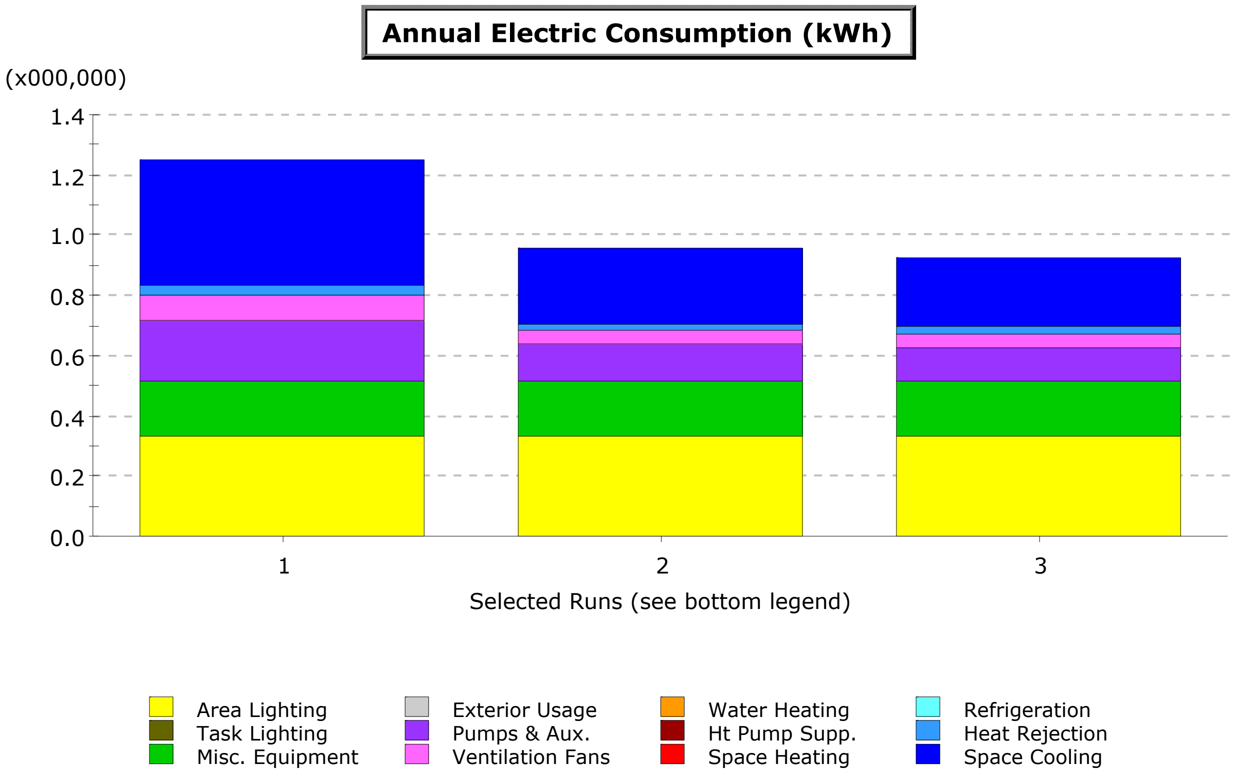
Annual Energy Consumption by Enduse

	Electricity kWh (x000)	Natural Gas MBtu	Steam Btu	Chilled Water Btu
Space Cool	233.35	-	-	-
Heat Reject.	20.24	-	-	-
Refrigeration	-	-	-	-
Space Heat	-	289.03	-	-
HP Supp.	-	-	-	-
Hot Water	-	130.56	-	-
Vent. Fans	49.17	-	-	-
Pumps & Aux.	109.97	-	-	-
Ext. Usage	-	-	-	-
Misc. Equip.	184.48	-	-	-
Task Lights	-	-	-	-
Area Lights	329.71	-	-	-
Total	926.92	419.59	-	-



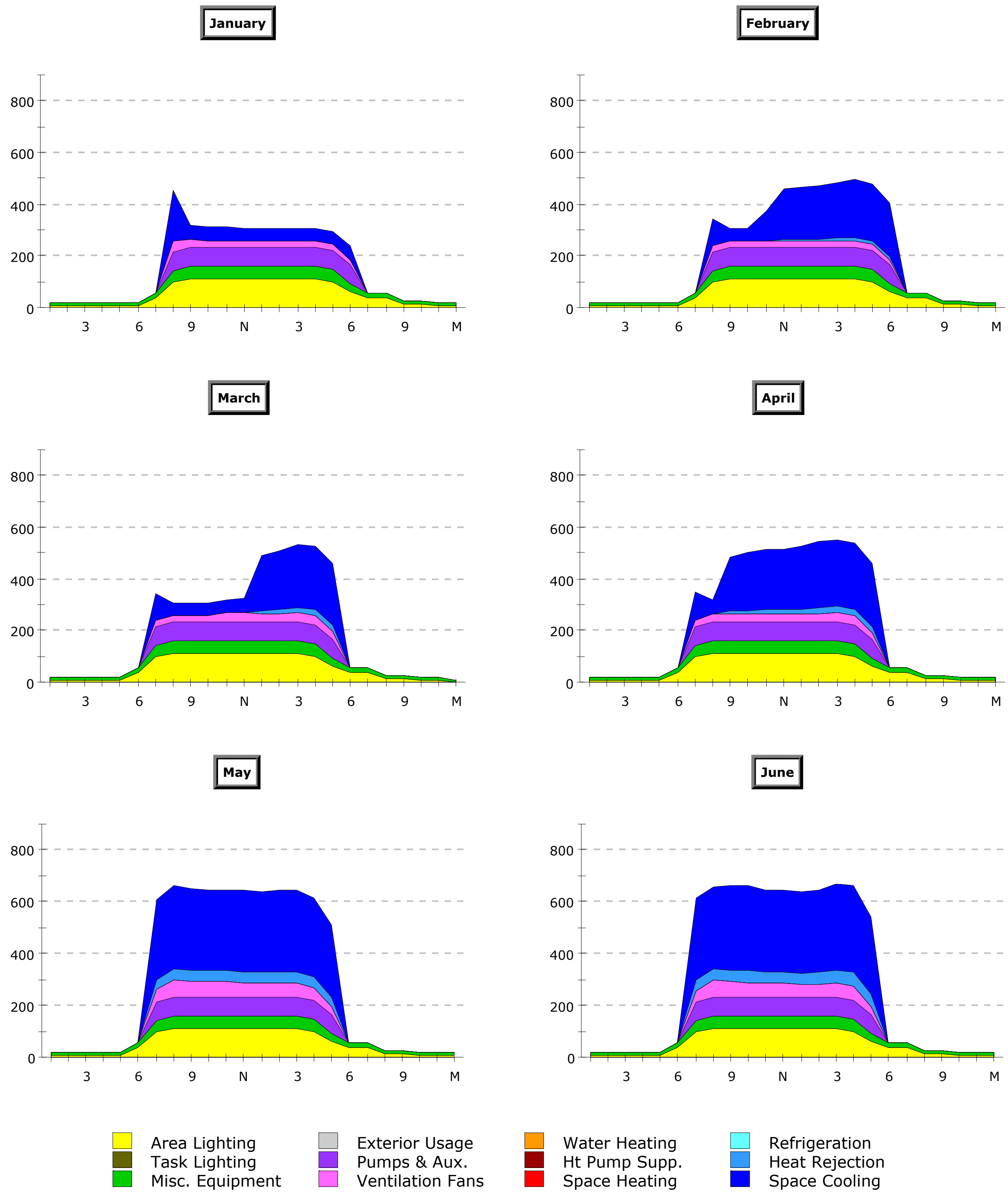
Electricity **Natural Gas**

Appendix M: Annual Energy Consumption Comparison



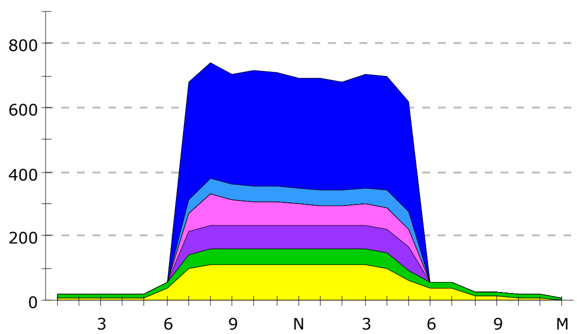
1. Thermolite - Baseline Design (04/04/12 @ 20:39)
2. Thermolite - 1 (04/04/12 @ 20:40)
3. Thermolite - 2 (04/04/12 @ 20:41)

Appendix N: Monthly Electric Peak Day Load Profiles: Baseline (1 of 2)

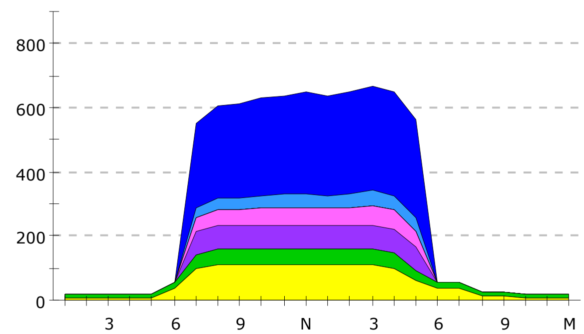


Appendix N: Monthly Electric Peak Day Load Profiles: Baseline, (2 of 2)

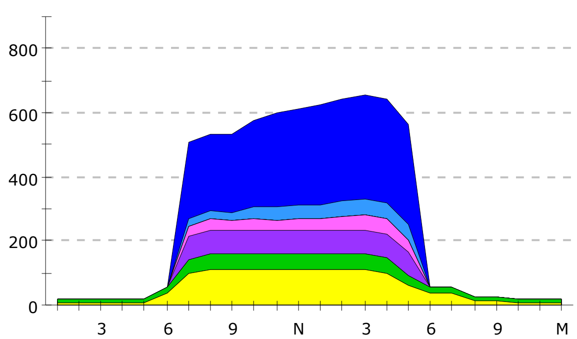
July



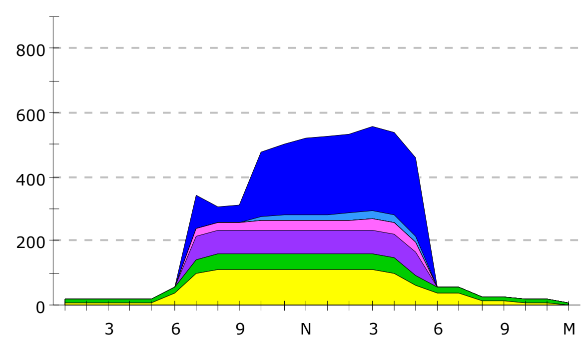
August



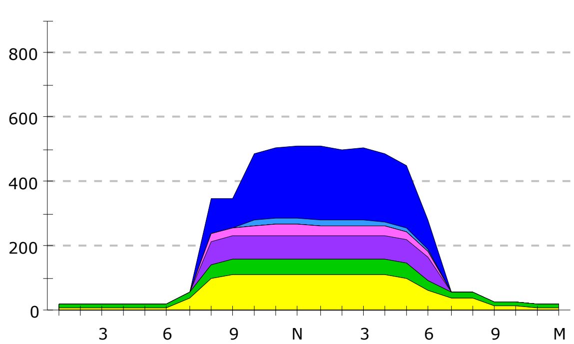
September



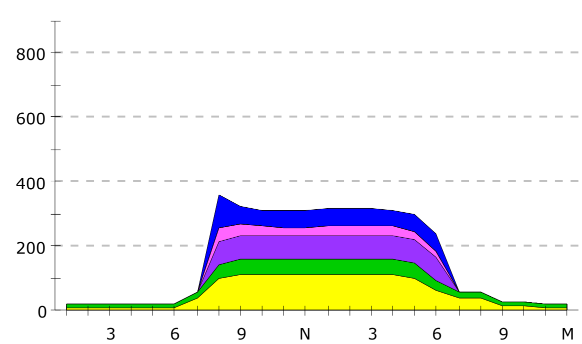
October



November

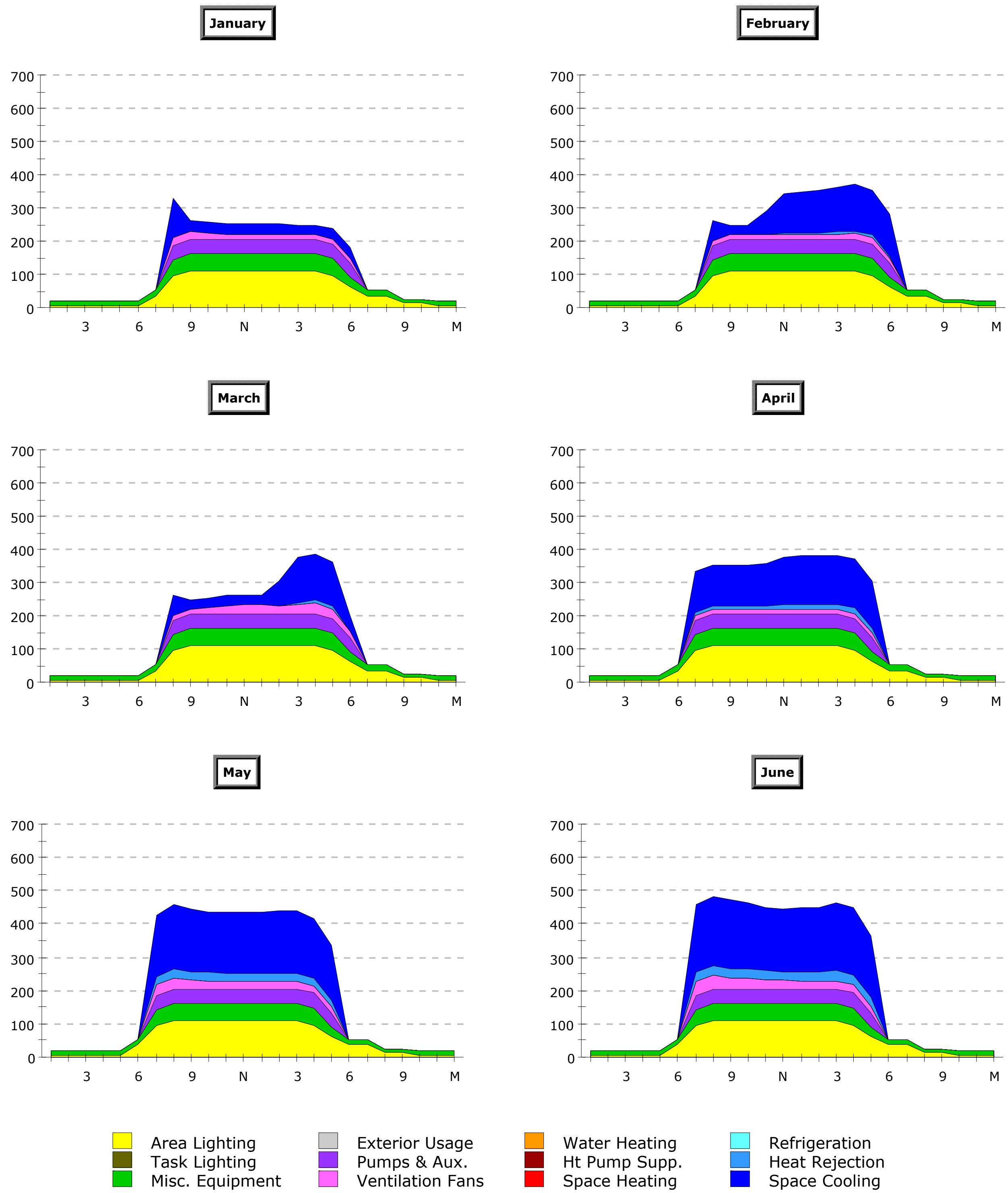


December

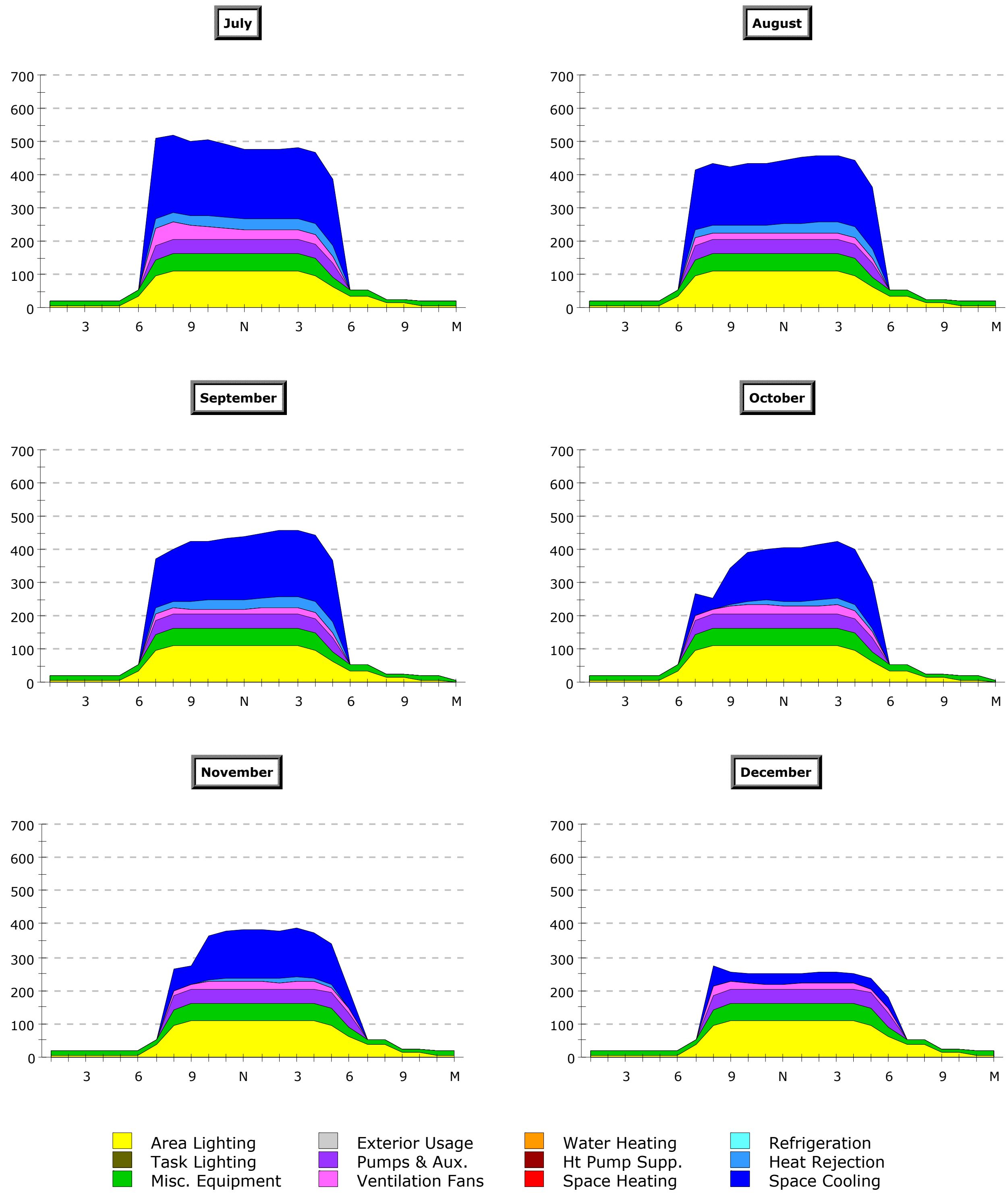


Area Lighting
Task Lighting
Misc. Equipment
Exterior Usage
Pumps & Aux.
Ventilation Fans
Water Heating
Ht Pump Supp.
Space Heating
Refrigeration
Heat Rejection
Space Cooling

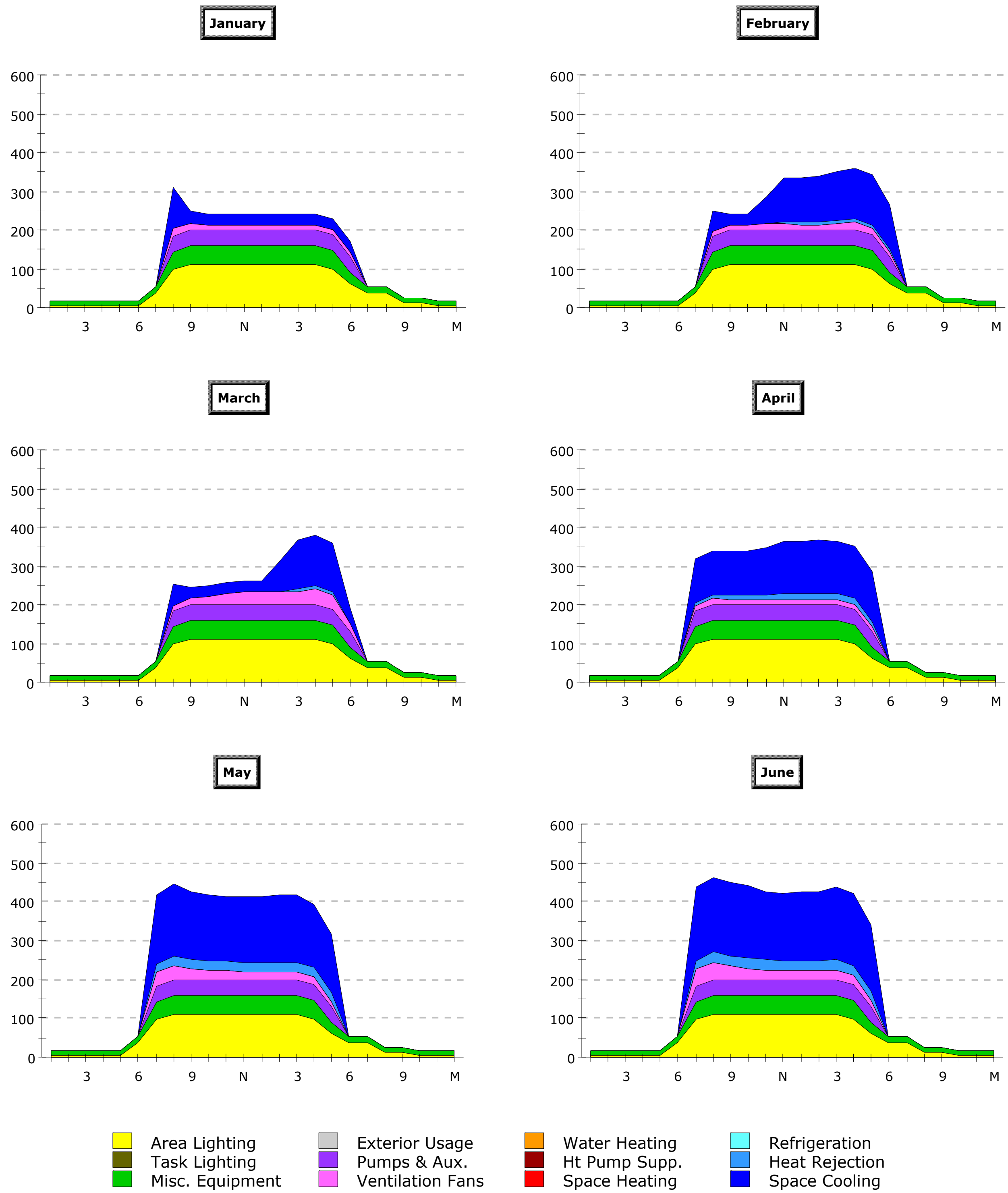
Appendix O: Monthly Electric Peak Day Load Profiles: Supplemental I (1 of 2)



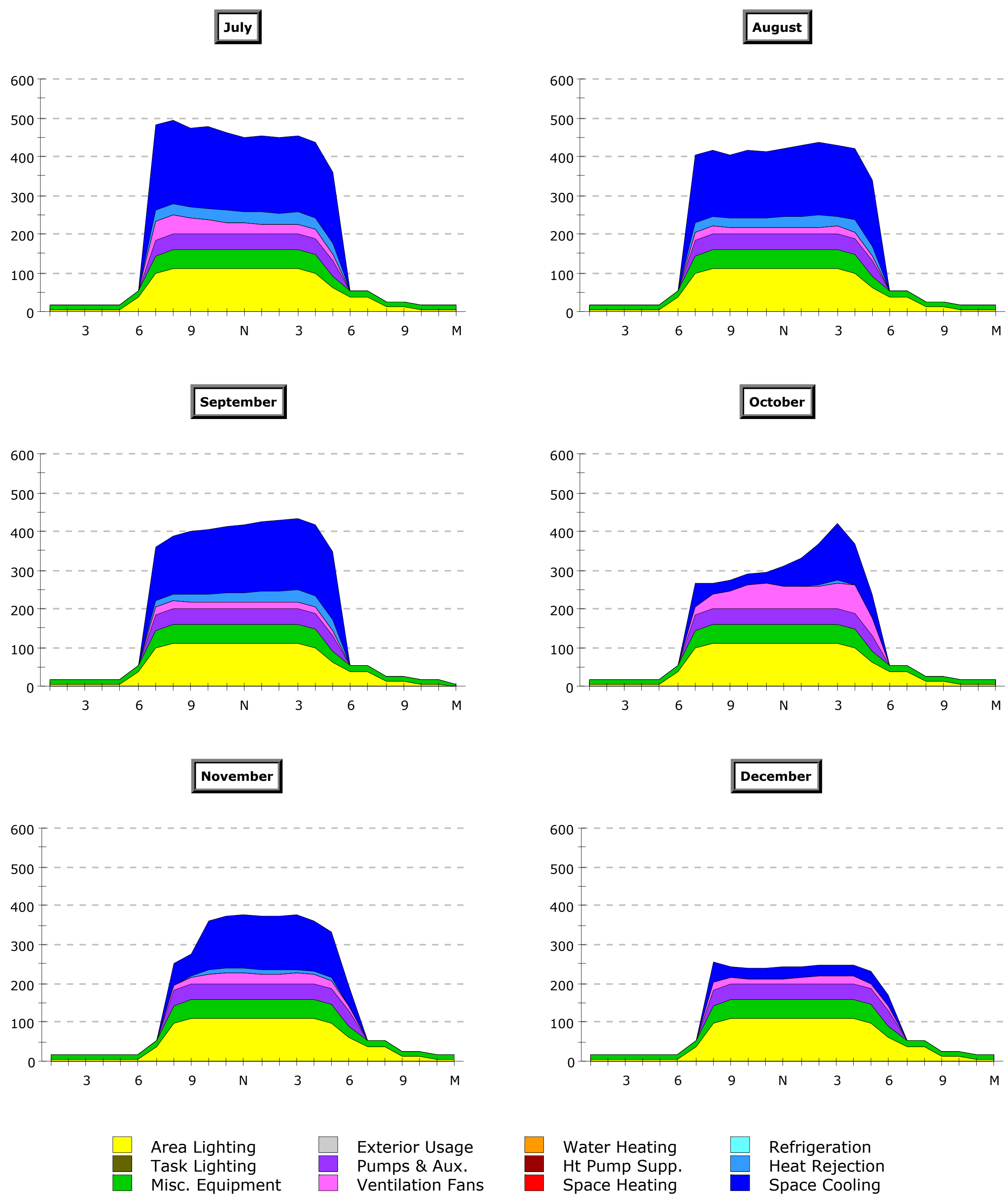
Appendix O: Monthly Electric Peak Day Load Profiles: Supplemental I (2 of 2)



Appendix P: Monthly Electric Peak Day Load Profiles: Supplemental II (1 of 2)



Appendix P: Monthly Electric Peak Day Load Profiles: Supplemental II (2 of 2)



Project: Thermolite | Run Date/Time: 04/04/12 @ 20:41

Annual Electric Energy by Enduse (pg 1 of 4)

Annual Energy USE (kWh)

		Ambient Lights	Task Lights	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Dom Ht Wtr	Exterior Usage	Total
0	Base Design	329,706	0	184,477	0	416,259	35,133	202,802	81,389	0	0	1,249,765
1	0+SafetySeries	329,706	0	184,477	0	252,240	21,511	122,144	48,047	0	0	958,123
2	0+Energy Series	329,706	0	184,477	0	233,351	20,237	109,971	49,173	0	0	926,914

Incremental SAVINGS (MWh) **(values are relative to previous measure (% savings are relative to base case use), negative entries indicate increased use)**

		Ambient Lights	Task Lights	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Dom Ht Wtr	Exterior Usage	Total
1	0+SafetySeries	0.00 (0%)	--	0.00 (0%)	--	164.02 (39%)	13.62 (39%)	80.66 (40%)	33.34 (41%)	--	--	291.64 (23%)
2	0+Energy Series	0.00 (0%)	--	0.00 (0%)	--	182.91 (44%)	14.90 (42%)	92.83 (46%)	32.22 (40%)	--	--	322.85 (26%)

Cumulative SAVINGS (MWh) **(values (and % savings) are relative to the Base Case, negative entries indicate increased use)**

		Ambient Lights	Task Lights	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Dom Ht Wtr	Exterior Usage	Total
1	0+SafetySeries	0.00 (0%)	--	0.00 (0%)	--	164.02 (39%)	13.62 (39%)	80.66 (40%)	33.34 (41%)	--	--	291.64 (23%)
2	0+Energy Series	0.00 (0%)	--	0.00 (0%)	--	182.91 (44%)	14.90 (42%)	92.83 (46%)	32.22 (40%)	--	--	322.85 (26%)

Annual Electric Coincident Peak Demand by Enduse (pg 2 of 4)

		Ambient Lights	Task Lights	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Dom Ht Wtr	Exterior Usage	Total
Annual Energy Coincident Demand (kW)												
0	Base Design	108.4	0.0	51.3	0.0	362.0	48.1	73.7	96.3	0.0	0.0	739.8
1	0+SafetySeries	108.4	0.0	51.3	0.0	229.9	30.4	44.4	52.9	0.0	0.0	517.3
2	0+Energy Series	108.4	0.0	51.3	0.0	213.7	27.8	40.0	51.0	0.0	0.0	492.3

Incremental SAVINGS (kW) **(values are relative to previous measure (% savings are relative to base case demand), negative entries indicate increased demand)**

		Ambient Lights	Task Lights	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Dom Ht Wtr	Exterior Usage	Total
1	0+SafetySeries	0.00 (0%)	--	0.00 (0%)	--	132.03 (36%)	17.70 (37%)	29.33 (40%)	43.43 (45%)	--	--	222.49 (30%)
2	0+Energy Series	0.00 (0%)	--	0.00 (0%)	--	148.23 (41%)	20.21 (42%)	33.76 (46%)	45.31 (47%)	--	--	247.51 (33%)

Cumulative SAVINGS (kW) **(values (and % savings) are relative to the Base Case, negative entries indicate increased demand)**

		Ambient Lights	Task Lights	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Dom Ht Wtr	Exterior Usage	Total
1	0+SafetySeries	0.00 (0%)	--	0.00 (0%)	--	132.03 (36%)	17.70 (37%)	29.33 (40%)	43.43 (45%)	--	--	222.49 (30%)
2	0+Energy Series	0.00 (0%)	--	0.00 (0%)	--	148.23 (41%)	20.21 (42%)	33.76 (46%)	45.31 (47%)	--	--	247.51 (33%)

Appendix Q: Annual Energy Enduse Summary (3 of 4)

Annual Electric Non-Coincident Peak Demand by Enduse (pg 3 of 4)

Annual Energy Non-Coincident Demand (kW)

		Ambient Lights	Task Lights	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Dom Ht Wtr	Exterior Usage	Total
0	Base Design	108.4	0.0	51.3	0.0	381.0	58.6	73.7	96.3	0.0	0.0	739.8
1	0+SafetySeries	108.4	0.0	51.3	0.0	241.2	36.0	44.4	61.4	0.0	0.0	517.3
2	0+Energy Series	108.4	0.0	51.3	0.0	223.1	33.0	40.0	72.1	0.0	0.0	492.3

Incremental SAVINGS (kW) **(values are relative to previous measure (% savings are relative to base case demand), negative entries indicate increased demand)**

		Ambient Lights	Task Lights	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Dom Ht Wtr	Exterior Usage	Total
1	0+SafetySeries	0.00 (0%)	--	0.00 (0%)	--	139.72 (37%)	22.61 (39%)	29.33 (40%)	34.95 (36%)	--	--	222.49 (30%)
2	0+Energy Series	0.00 (0%)	--	0.00 (0%)	--	157.89 (41%)	25.62 (44%)	33.76 (46%)	24.18 (25%)	--	--	247.51 (33%)

Cumulative SAVINGS (kW) **(values (and % savings) are relative to the Base Case, negative entries indicate increased demand)**

		Ambient Lights	Task Lights	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Dom Ht Wtr	Exterior Usage	Total
1	0+SafetySeries	0.00 (0%)	--	0.00 (0%)	--	139.72 (37%)	22.61 (39%)	29.33 (40%)	34.95 (36%)	--	--	222.49 (30%)
2	0+Energy Series	0.00 (0%)	--	0.00 (0%)	--	157.89 (41%)	25.62 (44%)	33.76 (46%)	24.18 (25%)	--	--	247.51 (33%)

Project: Thermolite Run Date/Time: 04/04/12 @ 20:41

Annual Fuel Energy by Enduse (pg 4 of 4)

Annual Energy USE (MBtu)	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Ht Pump Supp	Dom Ht Wtr	Exterior Usage	Total
0 Base Design	0.0	1,290.9	0.0	0.0	0.0	0.0	0.0	130.7	0.0	1,421.5
1 0+SafetySeries	0.0	617.2	0.0	0.0	0.0	0.0	0.0	130.7	0.0	747.9
2 0+Energy Series	0.0	289.0	0.0	0.0	0.0	0.0	0.0	130.6	0.0	419.6

Incremental SAVINGS (MBtu) **(values are relative to previous measure (% savings are relative to base case use), negative entries indicate increased use)**

	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Ht Pump Supp	Dom Ht Wtr	Exterior Usage	Total
1 0+SafetySeries	--	673.72 (52%)	--	--	--	--	--	-0.07 (-0%)	--	673.64 (47%)
2 0+Energy Series	--	1,001.86 (78%)	--	--	--	--	--	0.10 (0%)	--	1,001.96 (70%)

Cumulative SAVINGS (MBtu) **(values (and % savings) are relative to the Base Case, negative entries indicate increased use)**

	Misc Equip	Space Heating	Space Cooling	Heat Reject	Pumps & Aux	Vent Fans	Ht Pump Supp	Dom Ht Wtr	Exterior Usage	Total
1 0+SafetySeries	--	673.72 (52%)	--	--	--	--	--	-0.07 (-0%)	--	673.64 (47%)
2 0+Energy Series	--	1,001.86 (78%)	--	--	--	--	--	0.10 (0%)	--	1,001.96 (70%)

Project: Thermolite | Run Date/Time: 04/04/12 @ 20:41

Annual Energy and Demand (pg 1 of 2)

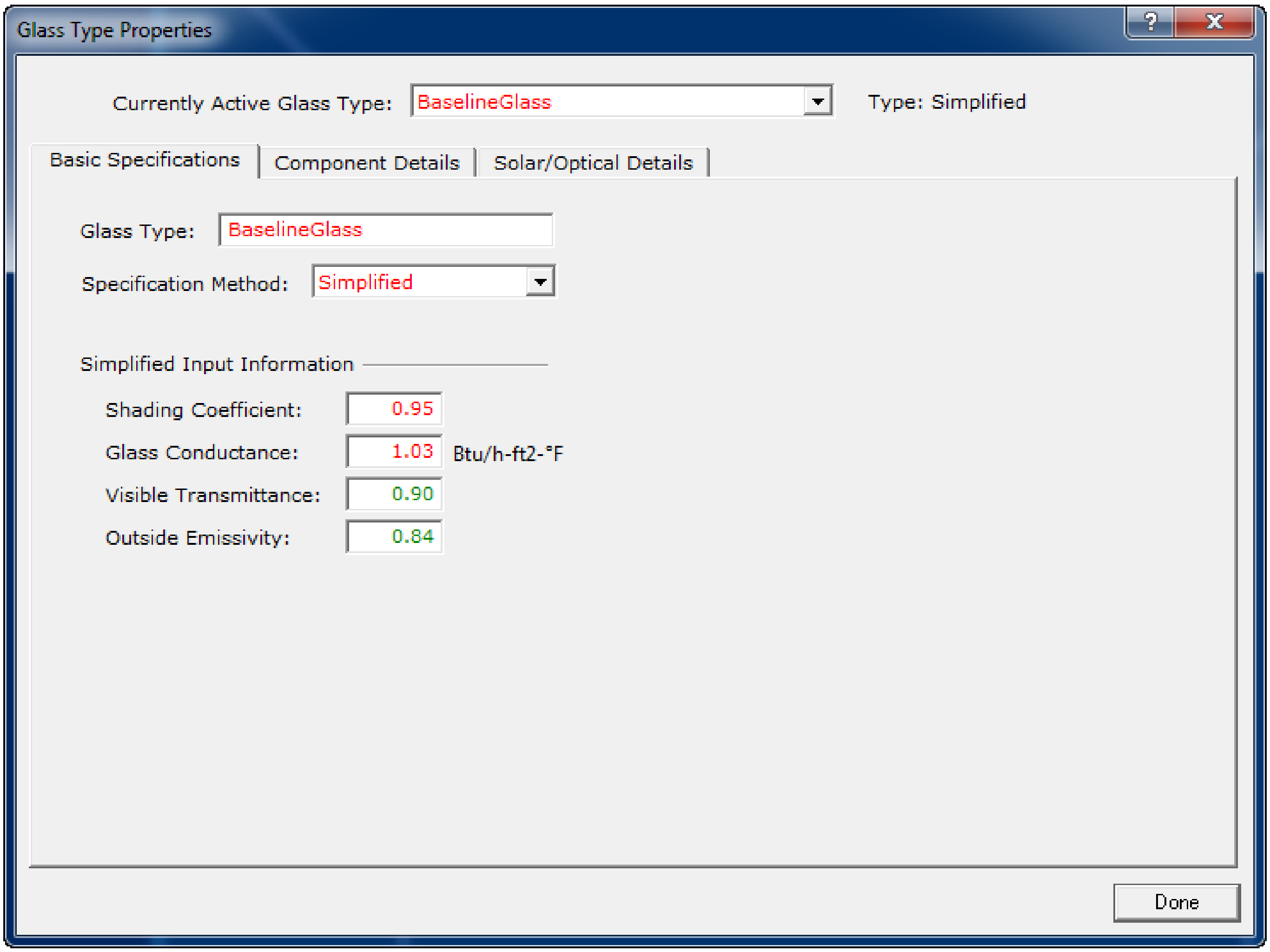
		Ann. Source Energy		Annual Site Energy		Lighting	HVAC Energy			Peak	
		Total Mbtu	EUI kBtu/sf/yr	Elect kWh	Nat Gas Therms	Electric kWh	Electric kWh	Nat Gas Therms	Total Mbtu	Elect kW	Cooling Tons
Annual Energy USE or DEMAND											
0	Base Design	14,218	142.18	1,249,765	14,215	329,706	735,583	12,909	3,801	740	396
1	0+SafetySeries	10,558	105.58	958,123	7,479	329,706	443,941	6,172	2,132	517	256
2	0+Energy Series	9,910	99.10	926,914	4,196	329,706	412,732	2,890	1,698	492	240
Incremental SAVINGS	**(values are relative to previous measure (% savings are relative to base case use), negative entries indicate increased use)**										
1	0+SafetySeries	3,660	36.60 (26%)	291,642 (23%)	6,736 (47%)	0 (0%)	291,642 (40%)	6,737 (52%)	1,669 (44%)	222 (30%)	140 (35%)
2	0+Energy Series	4,308	43.08 (30%)	322,850 (26%)	10,020 (70%)	0 (0%)	322,851 (44%)	10,019 (78%)	2,104 (55%)	248 (33%)	156 (39%)
Cumulative SAVINGS	**(values (and % savings) are relative to the Base Case, negative entries indicate increased use)**										
1	0+SafetySeries	3,660	36.60 (26%)	291,642 (23%)	6,736 (47%)	0 (0%)	291,642 (40%)	6,737 (52%)	1,669 (44%)	222 (30%)	140 (35%)
2	0+Energy Series	4,308	43.08 (30%)	322,850 (26%)	10,020 (70%)	0 (0%)	322,851 (44%)	10,019 (78%)	2,104 (55%)	248 (33%)	156 (39%)

Appendix R: Annual Building Summary (2 of 2)

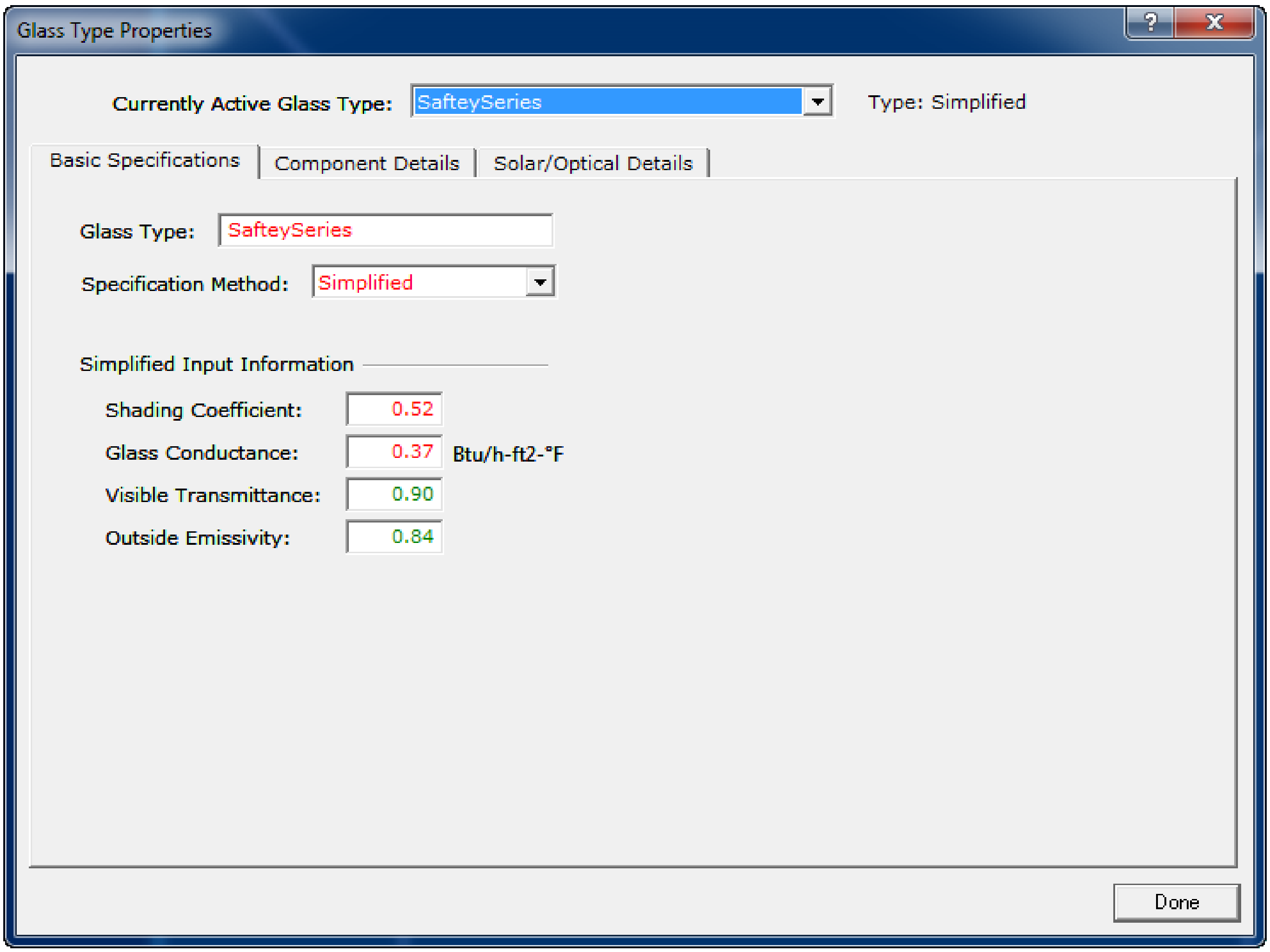
Annual Costs (pg 2 of 2)

		Annual Utility Cost					Incentives		LCC
		Electric kWh($)	Electric kW($)	Electric Total($)	Nat Gas Total($)	Total ($)	Owner ($)	Design Team ($)	Total (PV$)
Annual COST									
0	Base Design	$ 212,460	--	$ 212,460	$ 16,063	$ 228,523			$ 1,411,686
1	0+SafetySeries	$ 162,881	--	$ 162,881	$ 8,451	$ 171,332			$ 1,054,924
2	0+Energy Series	$ 157,575	--	$ 157,575	$ 4,741	$ 162,316			$ 996,259
Incremental SAVINGS	**(values are relative to previous measure (% savings are relative to base case cost), negative entries indicate increased cost)**								
1	0+SafetySeries	$ 49,579	--	$ 49,579	$ 7,612	$ 57,191			$ 356,761
2	0+Energy Series	$ 54,885	--	$ 54,885	$ 11,322	$ 66,207			$ 58,665
Cumulative SAVINGS	**(values (and % savings) are relative to the Base Case, negative entries indicate increased cost)**								
1	0+SafetySeries	$ 49,579	--	$ 49,579	$ 7,612	$ 57,191			$ 356,761
2	0+Energy Series	$ 54,885	--	$ 54,885	$ 11,322	$ 66,207			$ 415,427

Appendix S: Settings Used for Baseline Model



Appendix T: Settings Used for Supplemental I Model



Appendix U: Settings Used for Supplemental II Model