TEAM LAS VEGAS

PRESENTS

Sinatra LIVING

JURY NARRATIVES

08.10.17

UNIVERSITY OF NEVADA LAS VEGAS

U.S. Department of Energy Solar Decathlon 2017

Jury Deliverables

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FOREWARD

Life begins when you start living passionately.

We designed a home that helps you live passionately by embracing every moment, simplifying your life, and giving you freedom.Sinatra Living is an energy-efficient and health-conscious home for active aging citizens of Las Vegas and beyond.

U.S. Department of Energy Solar Decathlon 2017—Team Las Vegas
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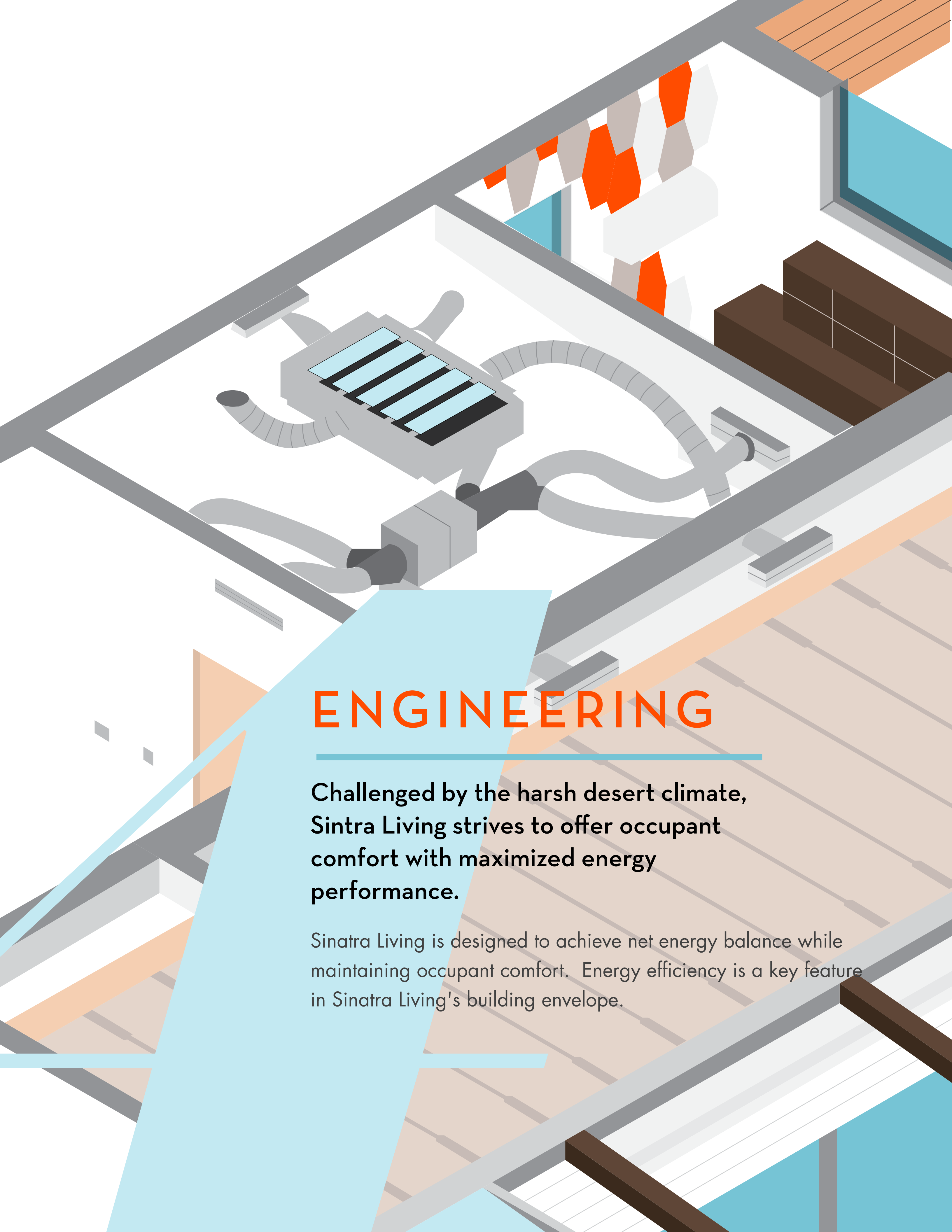


ENGINEERING

Challenged by the harsh desert climate, Sintra Living strives to offer occupant comfort with maximized energy performance.

Sinatra Living is designed to achieve net energy balance while maintaining occupant comfort. Energy efficiency is a key feature in Sinatra Living's building envelope.

DESIGN APPROACH

Location & Considerations

Nevada and Las Vegas in particular have a unique set of environmental conditions. Temperature, precipitation, and irradiance need special consideration during energy analysis and building design. The average annual temperature in Las Vegas is 69.3 ˚F . Temperatures range from an average low of 56.6 ˚F to an average high of 80 ˚F . At an average of 4.17 inches of rain/year, Las Vegas receives most of it's precipitation over an average 21 days. The rest of the year, Las Vegas experiences plenty of irradiance, approx. 3,817hr of sunshine. Las Vegas is within zone 1, of the solar insolation map for the United States. The city receives 5.3 kWh/m2 in solar irradiance/day, leading the nation in solar energy potential. These environmental conditions guide Sinatra Living's design towards net energy balance.

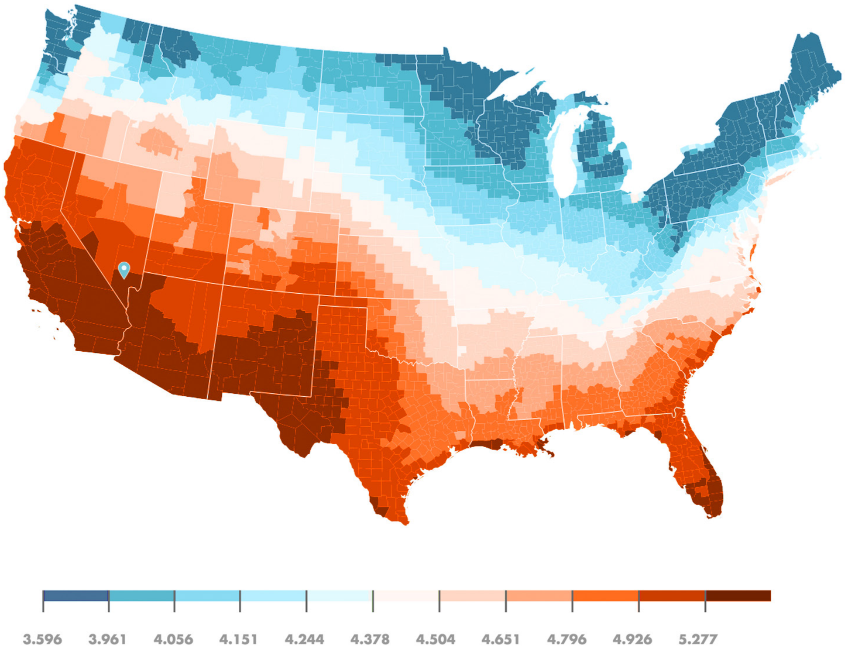
Energy Model: Approach and Tools

Sinatra Living is designed to operate in the harsh desert climate of Las Vegas. To design around Las Vegas' unique environment, Sinatra Living has gone through rigorous energy modeling and equipment sizing tools to maximize performance and reduce electrical loads while maintaining occupant comfort.

Furthermore, the competition site in Denver, Co is also taken into consideration when selecting building materials, mechanical systems and electrical system. Where appropriate, energy modeling for both Las Vegas, and Denver, Co will be used in the Energy Modeling Appendix. The team utilized the following programs to guide in the design of Sinatra Living's building envelope as well as mechanical /electrical systems.

INSOLATION MAP - United States

Avg. daily sunlight, 1979-2011 (measured in kilowatt hours of solar radiation per square meter) *SOURCE: North America Land Data Assimilation System (NLDAS) Daily Sunlight (Insolation) years 1979-2011 on CDC WONDER Online Database, released 2012. Published July 13, 2015*



ENERGY MODELING

Tools

BEopt (Building Energy Optimization) - Whole Building Energy Modeling Software

- Utilized to model the building envelope, orientation, and glazing.
- Provided heating and cooling load requirements
- Provided building electrical consumption breakdown
- Provided material and labor cost for application comparison

AutoDesk Flow

- Utilized to model natural ventilation through the home
- Assisted in the placement of openings to promote cross ventilation

Therm : two-dimensional heat-transfer modeling tool

- Utilized to model possible building thermal bridges and how to mitigate them
- Thermal bridge between the home and metal frame
- Performance of Windows
- Performance of walls

ACCA Manual J

- Room by room heating/cooling load calculations
- Guided in the selection of an appropriate heating/cooling system
- Room by room fresh air supply requirement
- Guided in the selection of an appropriate fresh air supply and recirculation system that includes a HEPA/Carbon Filter.

Mitsubishi Electric HVAC Sizing Software

- Utilized to size mechanical equipment based off of the following
- Heating/Cooling loads from energy modeling
- Refrigerant Line Distance

Uponor Advanced Design Suite

- Utilized to size hydronic radiant heating system
- Pipe length
- Heating Zone
- Water Temperature

SAM (System Advisory Model)

- Utilized to size Solar Thermal Systems for the following
- Hot water demand for domestic hot water
- Hot water demand for radiant heating
- Utilized to size Solar Photovoltaic (PV) System to meet the home's electrical loads.
- Utilized to model Battery operation with several utility structures, including the U.S Department of Energy Solar Decathlon Energy Balance & Value Contest.

Energy Analysis and Results Discussion

Energy modeling from BeOpt and Therm guided the building envelope design. Utilizing Beopt's ability to include financial variables, all building envelope materials were selected to provide maximum comfort and energy reduction, while ensuring the best return on investment (ROI). Materials such as framing members (2x6 or 2x8) (wood or metal framing), insulation material and depth, as well as window panes were all selected with efficiency and ROI in mind.

BUILDING ENVELOPE

Overview

Advanced framing techniques were used to reduce material and cost, while increasing insulation space. The home includes a zip sheathing system designed for installation speed and ease. The continuous air barrier provided by the taped seams in between the sheathing protect against air leakage. An integrated water-resistive barrier helps protect against water intrusion while still allowing the panels to properly dry. Finally the sheathing is designed to meet structural 1 rating requirements. A 1″ layer of closed cell spray foam insulation is used as the first layer of insulation in the interior. It provides significant thermal resistance and rigidity to the framing. The remaining cavity is then filled with open cell spray foam, providing added thermal resistance while remaining cost effective.

Floor: 38.91

THICKNESS (IN) x [QUANTITY]	MATERIAL	THERMAL RESISTANCE (R VALUE)
1 1/8″	Subfloor	1.41
1″	Closed Cell Spray Foam	6
9″	Open Cell Spray Foam	3.5 x 9 = 31.5

Wall: 29.25

THICKNESS (IN) x [QUANTITY]	MATERIAL	THERMAL RESISTANCE (R VALUE)
1/4″	Fiber Cement (Equitone)	.5
1″	Air Space	1
1 1/2″	Zip R-Sheathing	6
1″	Closed Cell Foam	6
4.5″	Open Cell Spray Foam	15.75
5/8″	Gypsum Board	.5

Roof: 50.56

THICKNESS (IN) x [QUANTITY]	MATERIAL	THERMAL RESISTANCE (R VALUE)
1″	Closed Cell	6
10 7/8″	Cellulose	38.06

Window

WINDOW TYPE	FRAME	THERMAL RESISTANCE (R VALUE, FRAME + GLASS)
Double Pane	Aluminum w/ thermal break	4

MECHANICAL

Induction

Sinatra Living's mechanical systems provide redundancy, cost-reduction and ease of maintenance. It's designed with a fully integrated heating, ventilation, and air conditioning system. Phase change material system provides heating and cooling energy reduction. HEPA and carbon filters treat fresh and return air. Sinatra Living will also include a modular mechanical pod for solar thermal applications. The mechanical pod will supply the home's radiant heating and hot water supply. These systems are designed around the home's extensive energy models and their results.

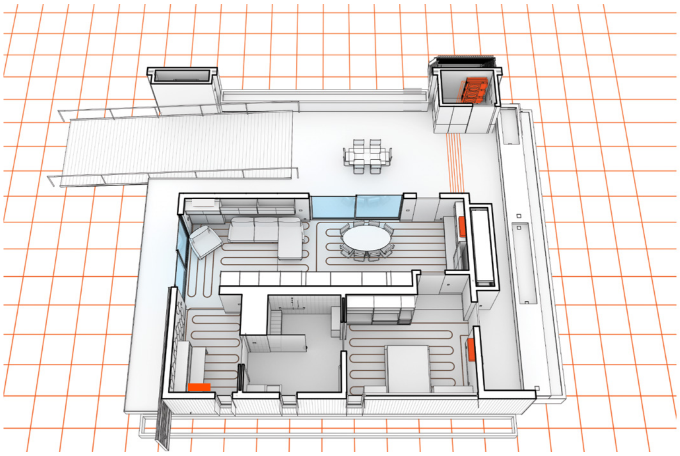
Energy Efficient Heat Pumps

A single SEER 33.5 and two SEER 22.5 ductless heat pump units will supply heating, cooling and dehumidification to the home. In milder weather conditions, each unit will have enough capacity to provide air-conditioning to their respective zones. As a result, the system will operate more efficiently and provide added reliability. This can also allow occupants to move to an unaffected zone when a unit is in maintenance. For cooling the units will operate in the cooling mode. The heat pumps use direct expansion (DX) refrigeration to cool. Thus, the indoor coils operate at temperatures below the dew point temperature. This allows the units to operate in a dehumidification mode for managing latent loads . When the room temperature is within the comfort zone, but the humidity is high, heat pumps will operate in a low speed cooling mode to remove humidity as condensate. Radiant heating systems can then be used as reheat to maintain the comfort zone. These separate systems will operate through the home automation system for integrated controls.

The heat pump indoor units are equipped with large particle air filters, Anti-Allergy Enzyme Filters, and deodorizing filters to help maintain air quality. All three sets of filters are designed to be hand washed and reused for serviceability. The units are sized to meet the home's year round heating/cooling loads, the three unit system allows for easy handling of temperature asymmetries during the fall and monsoon seasons, while quickly mitigating temperature stratifications during peak hours in the summer. For further information, modeling and calculations See Appendix Energy Modeling: HVAC Sizing

Hydronic Radiant Heating

Hydronic radiant floor heating is used as a heating source for the building. Solar thermal collectors on the Mechanical Pod provide heat to a solar thermal tank. An isolated loop in the solar thermal tank will provide hot water to the hydronic radiant heating system. Hot water will feed through a temperature controlled mixing valve. The mixing valve will be set for the desired radiant heating temperature. If the solar thermal tank temperature is insufficient to supply the radiant heating system, energy efficient heat pumps will provide heating to the home. Heat pumps can also be used when solar thermal components are under maintenance. For further information, modeling and calculations See Appendix Energy Modeling : Radiant Heating



PCM & HEPA FILTRATION UNIT

Fresh Air Intake

Sinatra's Living's tight building envelope minimizes air exchanges through the home. Although this has a thermal benefit, maximizing the quality of air in the home is key for any resident. Sinatra Living utilizes ASHRAE 62.2 guidelines, to provide occupants with good indoor air quality. Operable windows are available in all living spaces to provide clean air to occupants. A mechanical system is utilized to reduce the introduction of allergens and/or pollutants as well as mitigate heating and cooling loads. This makeup air and filtration system to supplement the home's heating and cooling system. This system uses a phase change material for year-round heating and cooling load reduction. The system is combined with a HEPA and carbon filter unit, to treat both fresh and return air supplied to the home.

Phase Change Material

Phase Change Material (PCM) is a substance with a high heat of fusion. By melting and solidifying at certain temperatures, it is capable of storing and releasing large amounts of energy. PCM is used in the home's active fresh-air plenum. Thus, reducing air conditioning required to heat or cool incoming fresh air. The system which has been in testing for two years at UNLV uses a commercially available PCM. The PCM is made from an encapsulated eutectic salt, which is contained in foil packets that are approved for installation in the air plenum. The packets are designed to be maintenance free and can continue operating with building for the duration of it's life. This PCM is designed to "freeze" below "thaw" above 78 ° F . When installed in the fresh air plenum, PCM will melt in the higher ambient temperatures and absorb heat from the incoming air. During cooler evening hours, the absorbed heat is rejected to the ambient, or used to heat the inside spaces. When the home is operating in the heating mode the PCM will absorb rejected heat. This can be used during cooler hours to also heat the home. The PCM enclosure separates supply and exhaust air streams to provide clean air while conditioning the PCM for further use. The PCM quantity is calculated using ASHRAE 62.2 standards, desired change in temperature, sensible heat constant, and desired time of operation. This can then be adjusted to the heat capacity of an individual PCM packet to identify required quantities. See Appendix Energy Modeling: Phase Change Material

The University of Nevada, Las Vegas has conducted studies on PCM in the active fresh air plenum. These studies have shown that PCM in the active fresh air plenum, can reduce heating and cooling loads by up to 50%.

Indoor Air Filtration

The home's air filtration system treats return air and conditioned fresh air through the PCM plenum. The filtration system includes a pre-filter, carbon filter and 99.99% at 0.3 micron HEPA filter. The combination of filters will help reduce odors, allergens and small particles.

Building Exhaust

Exhaust systems will remove sensible and latent loads at their origin and improve air quality. This will include an efficient bathroom exhaust to remove humidity from showering. An exhaust system in the laundry room and a kitchen exhaust hood will remove heat and odor from cooking. The bathroom and laundry exhaust will "freeze" or "thaw" the PCM, depending on the heating/cooling mode. The exhaust stream will be separated from the supply. Providing only heat transfer to the PCM through convection.

MECHANICAL POD

Mechanical Pod

Sinatra Living features a mechanical pod designed to meet the home's hot water demand, while complementing its architectural form. Solar thermal is at the core of the mechanical pod, it features a combined 3.8kW (13 MBTU) pair of solar thermal evacuated tube collectors. Evacuated tube collectors were chosen over flat plate due to their increased performance throughout the year and reduced chance of dissipating heat and freezing over during winter nights. It's designed to provide domestic hot water and radiant heating. An optimized collector slope allows for year long solar exposure. Furthermore, a plug & play design makes it an integratable feature for any home. The modular design allows for separation between living space, mechanical systems and maintenance.

All-in-One Solution

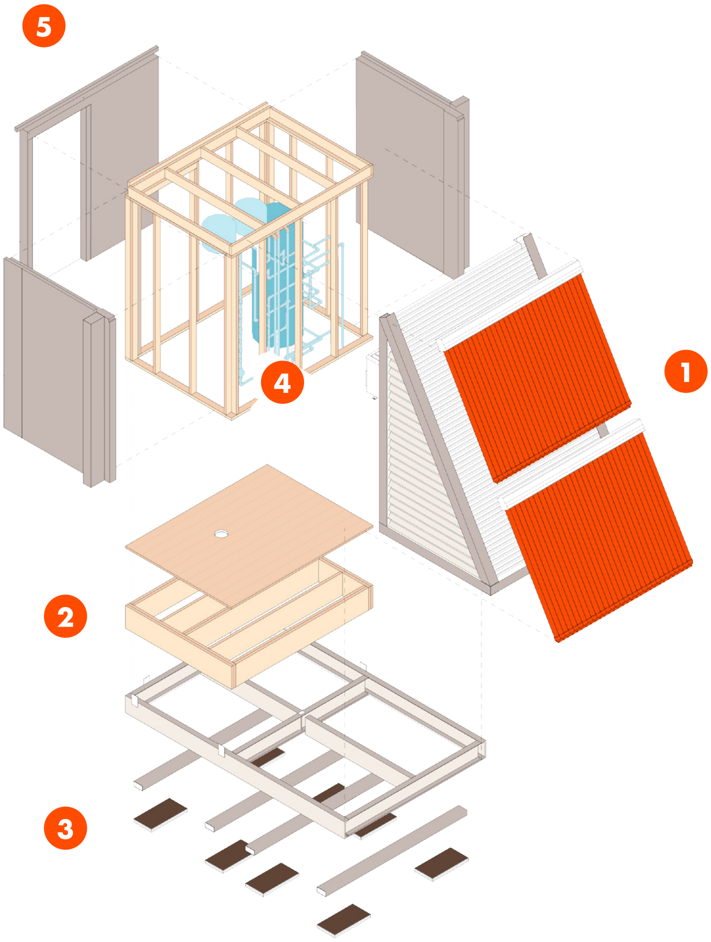
The Mechanical Pod provides simplified integration. All the components within the pod will be pre-assembled and plumbed in the structure. As a result, the pod will have hassle free shipping and commissioning. The exterior of the building supports the required solar thermal collectors. The interior will house the solar thermal tank, pumps, and necessary plumbing components. The unit will also have a self contained electrical panel and controls. These electrical components can plug into the home for power and control.

Optimized Yearlong Performance

The Mechanical Pod provides simplified integration. All the components within the pod will be pre-assembled and plumbed in the structure. As a result, the pod will have hassle free shipping and commissioning. The exterior of the building supports the required solar thermal collectors. The interior will house the solar thermal tank, pumps, and necessary plumbing components. The unit will also have a self contained electrical panel and controls. These electrical components can plug into the home for power and control.

1 Solar Thermal Evacuated Tubes	**3** Steel Framing
2 Mech Pod Subfloor	**4** Hot Water Tanks
	5 Exterior Walls

AXON - Mech Pod



ELECTRICAL

Introduction

Sinatra Living's electrical systems provide energy-reduction, smart energy production and backup power. It features energy efficient appliances to reduce the home's electrical load. The home's smart inverter and battery will operate on a time-of-use utility schedule. This will reduce electricity costs by shifting peak electrical loads to the evening. The inverter and battery will also provide backup power to the home.

Reduced Energy Consumption

Energy efficiency is a key feature in Sinatra Living's building envelope. Energy modeling utilizing location, orientation and typical weather guide the building envelope's design. Reduced heating and cooling loads are a result of energy efficient envelope decisions. Energy STAR appliances reduce remaining electrical loads. While an eco mode conserves building energy consumption.

Lighting

Sinatra Living features energy efficient lighting solutions to adequately meet the lighting needs of residents. Lighting requirements were modeled to meet luminous flux (LUX) per sq-ft within the interior space. This also takes into consideration workspace/ task locations. Lighting controls are then applied to work seamlessly with the home automation system. Dimming controls are integrated with daylighting sensor to maximize lighting while providing energy savings. For further information, modeling and calculations See Appendix Energy Modeling : Lighting.

Energy Production and Storage - PV

Sinatra Living utilizes a 6.9kW DC (6.8kW AC), 24 Module Monocrystalline PV array. The system is sized to meet the home's appliance, lighting and mechanical loads. Las Vegas experiences harsh summers with high cooling loads. The home's PV system is optimized to meet summer cooling loads which attribute to costly electrical loads during peak hours of the day. To optimize the performance during this peak, the modules are mounted at a low inclination angle to increase the energy production during summer peak load periods. For further information, modeling and calculations See Appendix Energy Modeling : PV Analysis.

The PV system will also use DC Power Optimizers for Maximum Power Point Tracking (MPPT). The system will mitigate power loss effects from module mismatch, shading, soiling and uneven aging of modules. This will allow the system to perform better than traditional systems that are at the mercy of string members. Module isolation also provides safety for installers and first responders through an automatic shutdown feature. Finally, optimizers allow for both module-level, string-level, and system wide performance monitoring. This can be used to reduce maintenance time and cost while increasing system uptime.

Smart Inverter

Sinatra Living features a programmable smart inverter. The inverter can be programmed to provide solar power to the home's loads, off-load to the grid, or store into the home's battery system. The inverter is connected to the home's automation system and can adjust operations to fit the home's needs.

ELECTRICAL SYSTEMS

Battery Systems

Sinatra Living utilizes a 13.2 kWH battery that is AC coupled. The battery system is designed to store power from the home's PV system or utility grid, depending on the operation. The battery will be used to provide peak shaving by storing excess power from the PV system or grid during off peak (low cost) hours. The battery can then discharge during peak (expensive) utility hours. This will allow the home to gain the full value of its PV system while mitigating high utility costs. For further information, modeling and calculations See Appendix Energy Modeling : Battery Analysis.

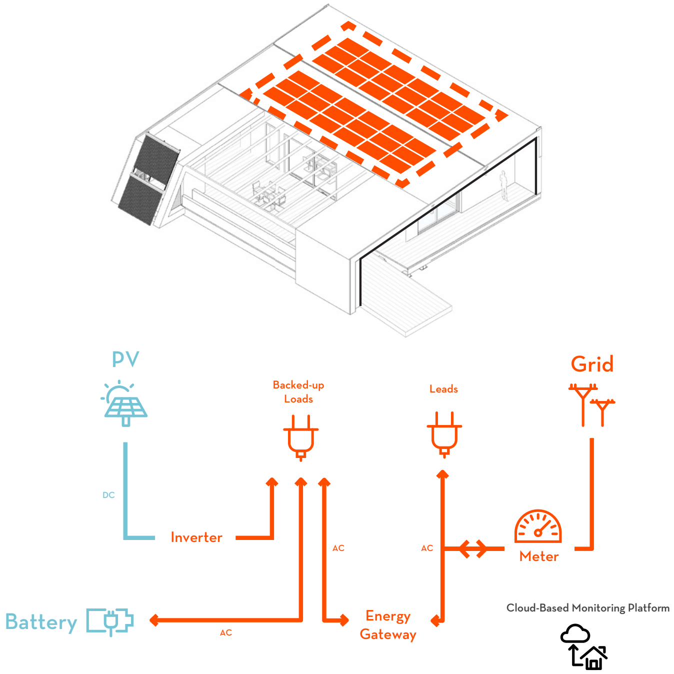
Back-Up Gateway

Sinatra Living utilizes an energy gateway to control the flow of power from the grid and/or PV system to the home's battery. This unit is set to monitor current from both solar and grid and select the optimal source based on the home's operation. The energy gateway also serves as a backup system. The unit can detect grid outages and respond accordingly. Most traditional PV systems will stop generating power when there is a loss in grid power as per UL 1741. The energy gateway allows the home to disconnect from the grid power and maintain the home's operations. This is sustained by powering only critical loads through solar and stored battery energy. These critical loads reside on an isolated sub-panel and include circuits for the refrigerator, HVAC, partial lighting and electrical outlet that would be used for medical and/or communications purposes. Reducing electrical loads on the home during outages will increase the battery's ability to sustain power to the home when solar is not available.

Load Prediction and Control

Sinatra Living features an instrumentation suite that allows for monitoring of the interior and exterior environment. Using these sensors, the home is able to predict cooling and heating spikes before they occur. This allows the home to control and ramp mechanical systems to maintain thermal comfort. To avoid the cost of inrush current during peak hours, the home can begin discharging the battery to meet the load.

ENERGY PRODUCTION



PLUMBING

Introduction

Sinatra Living's plumbing systems are designed to be maintenance free, with low degradation over time. PEX piping is used to supply domestic hot and cold water due to its lower cost, flexibility, and simplicity of installation over conventional copper piping. All hot water piping will is insulated. Low flow fixtures are installed to reduce domestic water consumption by 64%. 48 Gallons/day vs 78 Gallons/day for a regular home in Las Vegas. Sinatra living will feature an automated irrigation system to manage watering of plants. A main shut-off valve is installed at the freshwater pump and grey water pump, as well as on the main hot water supply line. Shut-off valves will be provided to all plumbing fixtures for repair isolation.

Fire Protection + Cold Water

To simplify the home's plumbing systems, a dual purpose, non-stagnating fire protection system is used. The fire protection system will consist of a pressurized cold water loop, using supply lines to existing interior plumbing fixtures for draining to prevent stagnation. This type of sprinkler system will cut down on costs and materials, as it will not require any backflow prevention, excess piping, sprinkler risers, or a manifold.

Hot Water

Sinatra Living utilizes a solar thermal powered tank to supply the home with domestic hot water and radiant heating. The solar thermal system, tank and accompanying components are pre-plumbed in a modular mechanical room. This system utilizes insulated cross linked polyethylene (PEX) tubing to deliver hot water to the home. An on-demand electric water is integrated with this system to heat the water when solar thermal is not sufficient. For further information, modeling and calculations See Appendix Energy Modeling: Hot Water Demand.

Separation & Reuse

Collected rainwater and condensate from the A/C unit is stored the gray water tank for use in irrigation. A separate gray water tank will be used to collect interior greywater from fixtures. Interior greywater collection is prohibited in Las Vegas, thus the system will be designed so that it can be plumbed into the sewer line upon the home's permanent installation. In the home, greywater will be collected from the bathroom sink and shower, exterior shower, and laundry washing machine and will pass through a sand filter for debris and soap removal, and then used for landscape irrigation. The team has considered the accessibility for filling and removing water from the storage tanks, as well as the locations of tanks and their proximity to the appropriate plumbing fixtures. Blackwater from the kitchen sink and dishwasher will be stored in a separate black water tank. Waste and sewage pipes will be plumbed appropriately to separate the systems. A single vent for greywater and Blackwater will be located on the north end of the modules. The location is on the northern part of the roof to limit shading of the PV panels.

HOME AUTOMATION

Overview

A unique feature to Sinatra Living is home automation. Our home automation hub keeps our users safe and simplifies everyday tasks. This system can trigger lights and notify caretakers to assist in emergency response. It can also detect and differences between falls and false alarms in the home. We make a seamless integration with these features. Through this system, a homeowner can alert their caregivers if an accident occurs.

Control

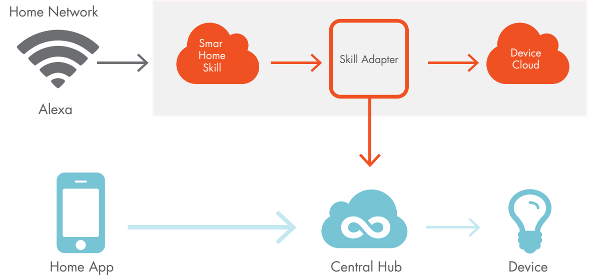
Automated key features of the home use reliable dual-band RF/Power Line communication. A central hub handles communication between the user and key items in the home. Users can control the hub while at home or away. Voice activated commands are for hands free control, during cooking or entertaining. Adjustable items include HVAC, lights, media, and adjustable shades.

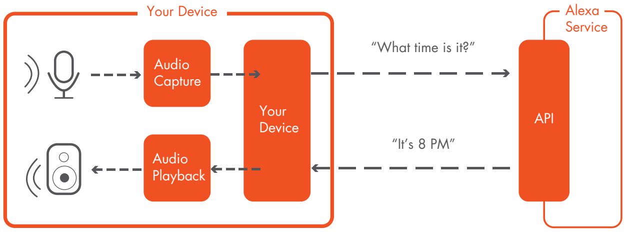
Monitor

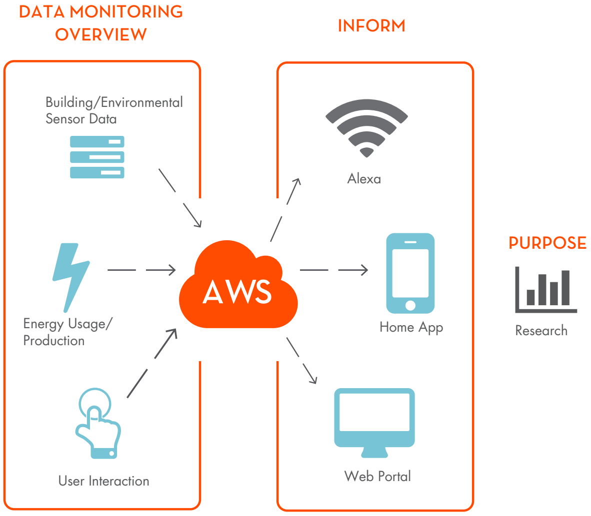
The automation hub stores sensors energy consumption data every half hour. Other measurements include water usage of the house, temperature, humidity, and air quality. All measurements go to Amazon Web Services (AWS) Relational Database Service (RDS) for storage and analysis. The compiled data can help various commercial industries in improving home design. The ideal benefactors of this data are home builders, engineers, and healthcare providers.

Inform

A voice activated system with push buttons can breakdown key features of the home. This can work for exhibition tours or for a homeowner. Voice commands can be used to learn more about any feature. A homeowner can track data of energy usage and production from any mobile device. The home automation app shows monthly water usage, and lets users know what to conserve. Furthermore, maintenance schedules can be entered into the home's database to keep the user informed of service due dates in a timely manner.







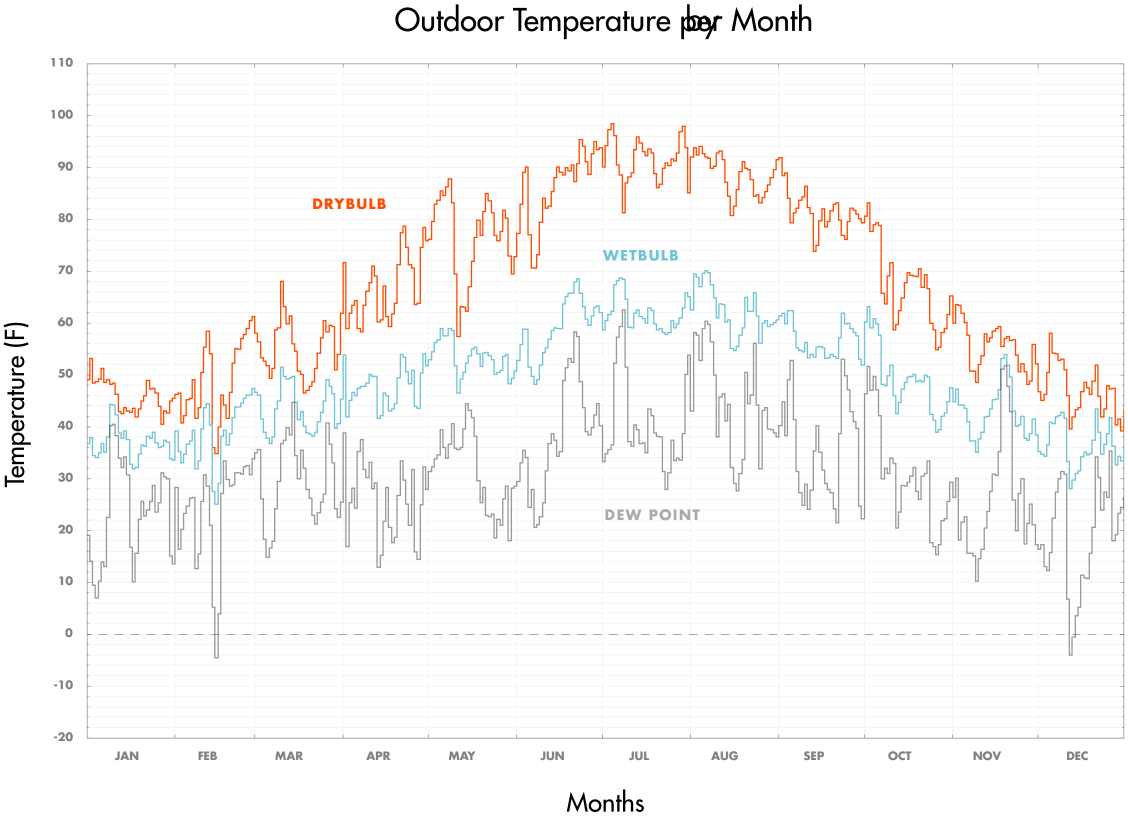
Sinatra

LIVING

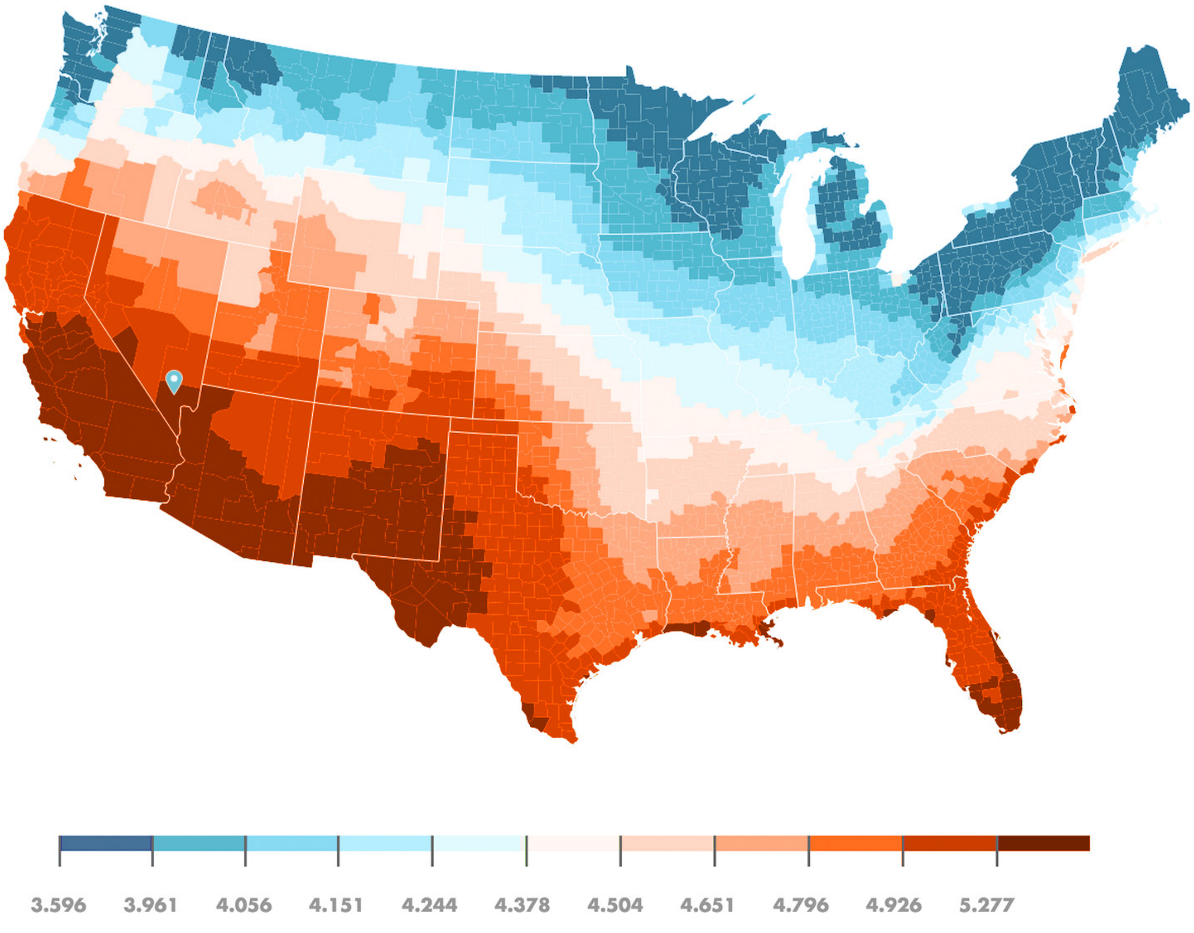
ENGINEERING APPENDIX

INTRODUCTION - Location and Considerations

Nevada and Las Vegas in particular have a unique set of environmental conditions. Temperature, precipitation, and irradiance need special consideration during energy analysis and building design. The average annual temperature in Las Vegas is 69.3 ˚F. Temperatures range from an average low of 56.6 ˚F to an average high of 80 ˚F . At an average of 4.17 inches of rain/year, Las Vegas receives most of it's precipitation over an average 21 days. The rest of the year, Las Vegas experiences plenty of irradiance, approx. 3,817hr of sunshine. Las Vegas is within zone 1, of the solar insolation map for the United States. The city receives 5.3 kWh/m2 in solar irradiance/day, leading the nation in solar energy potential. These environmental conditions guide Sinatra Living's design towards net energy balance.

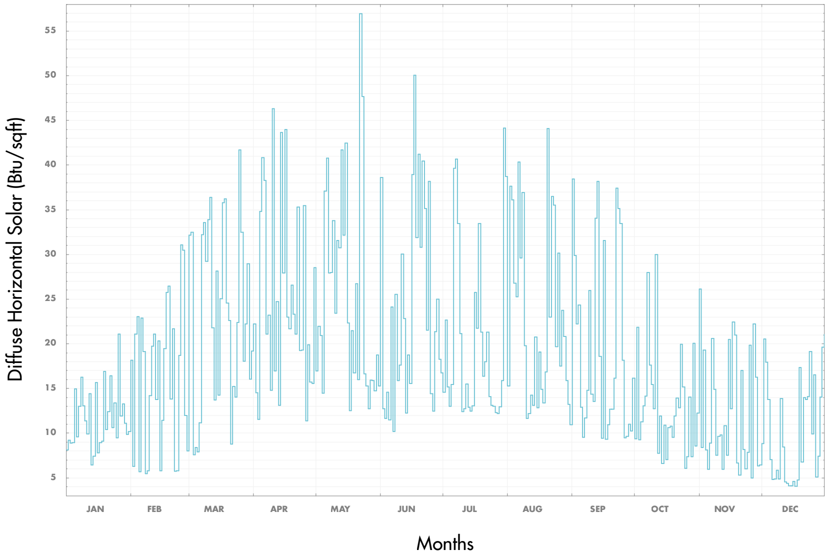


INSOLATION MAP - United States

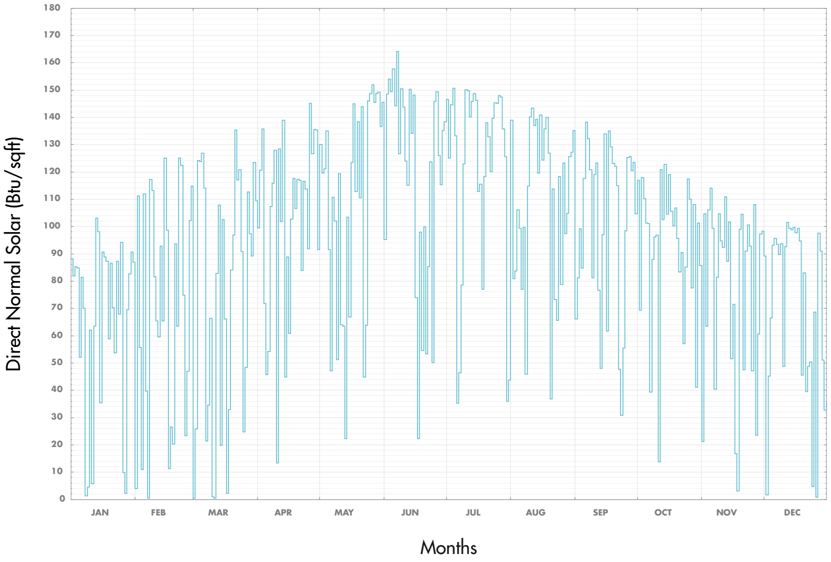


Avg. daily sunlight, 1979-2011 (measured in kilowatt hours of solar radiation per square meter) *SOURCE: North America Land Data Assimilation System (NLDAS) Daily Sunlight (Insolation) years 1979-2011 on CDC WONDER Online Database, released 2012. Published July 13, 2015*

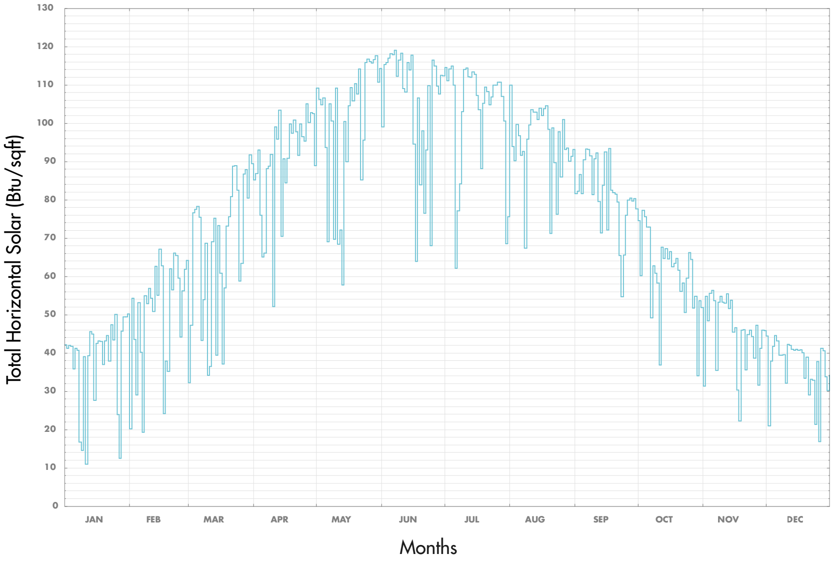
Diffuse Horizontal Solar per Month



Direct Normal Solar per Month



Total Horizontal Solar per Month

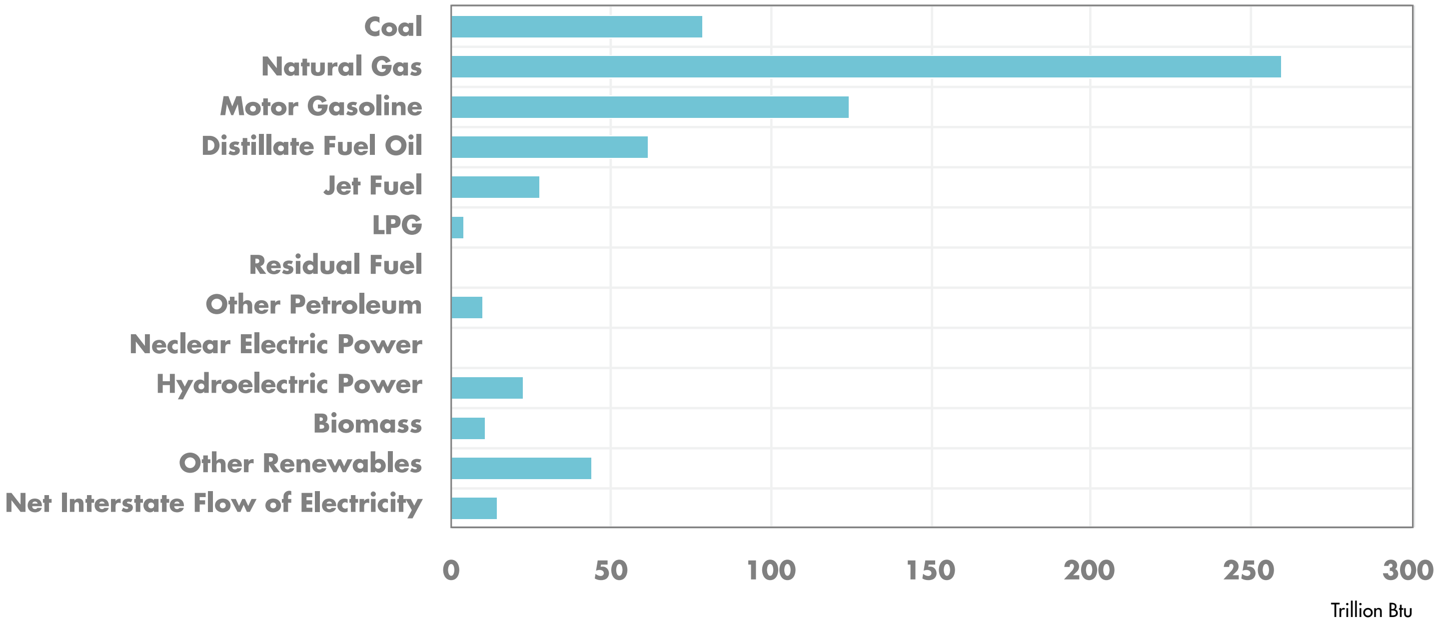


ENERGY CONSUMPTION - Nevada

Las Vegas is the largest city in Nevada attributing to a sizeable amount Nevada's overall energy consumption. Nevada's total energy consumption in 2013 was 667 trillion Btu (ranked 38th in the US), with total energy expenditures for that year residing in the scope of $10 Billion ($10,178,000,000, ranked 36th in the US).

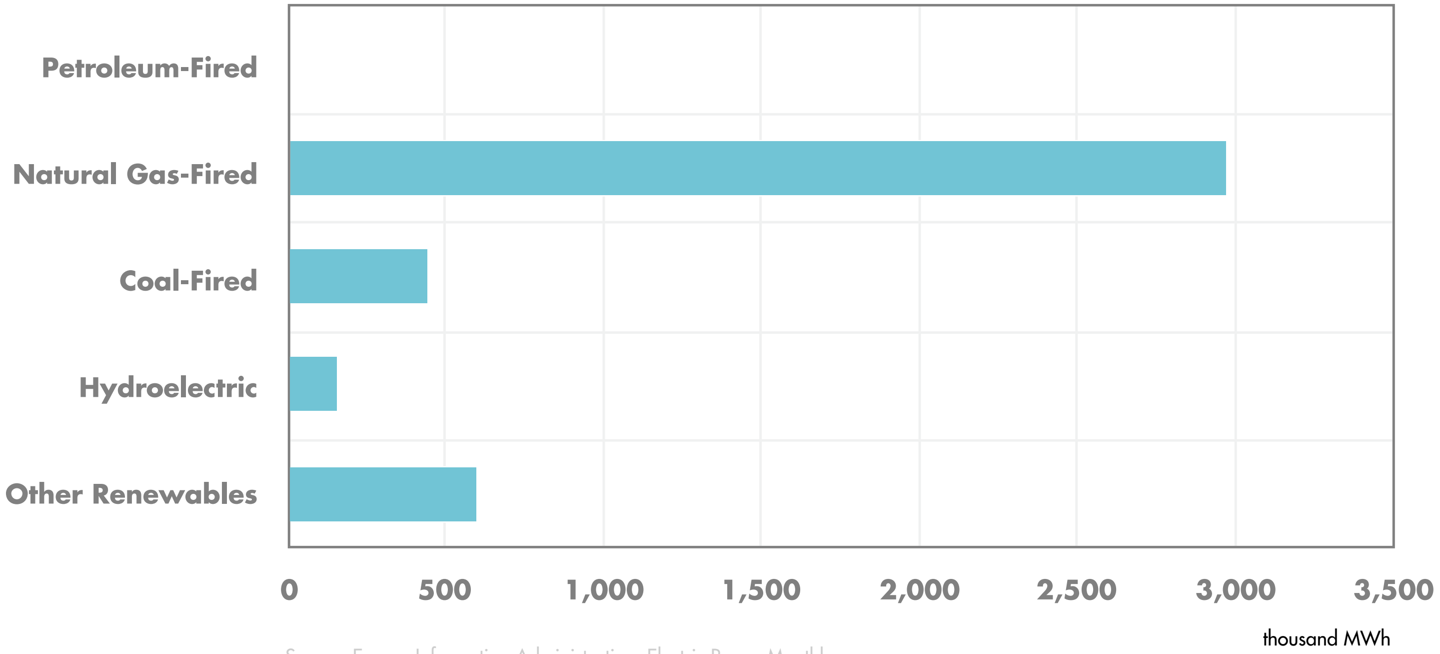
The state's total energy is divided into residential (162 trillion Btu), Commercial (121 trillion Btu), Industrial (166 trillion Btu), and Transportation (208 trillion Btu). As of 2013 Nevada was ranked 41st in energy consumption per capita, with the total consumed per capita at 235 million Btu. Nevada is also ranked 18th in the country in electricity prices across all sectors, and 29th in the country for natural gas prices across all sectors. Currently, more than 90% of the energy Nevada consumes comes from outside the state, with a large portion of that energy coming from natural gas. In 2015 alone, Nevada generated >68% of its electricity from natural gas. Nevada's higher utility costs can be attributed to its lack of onsite energy production geared towards directly fulfilling the state's energy needs as well as purchasing energy from bordering states. Furthermore, the state and specifically Las Vegas (it's largest city) are located in a hot/dry zone that require large HVAC solutions that can satisfy the peak cooling loads of buildings in the summer, attributing to the largest energy load for the city.

Nevada Energy Consumption Estimates, 2014



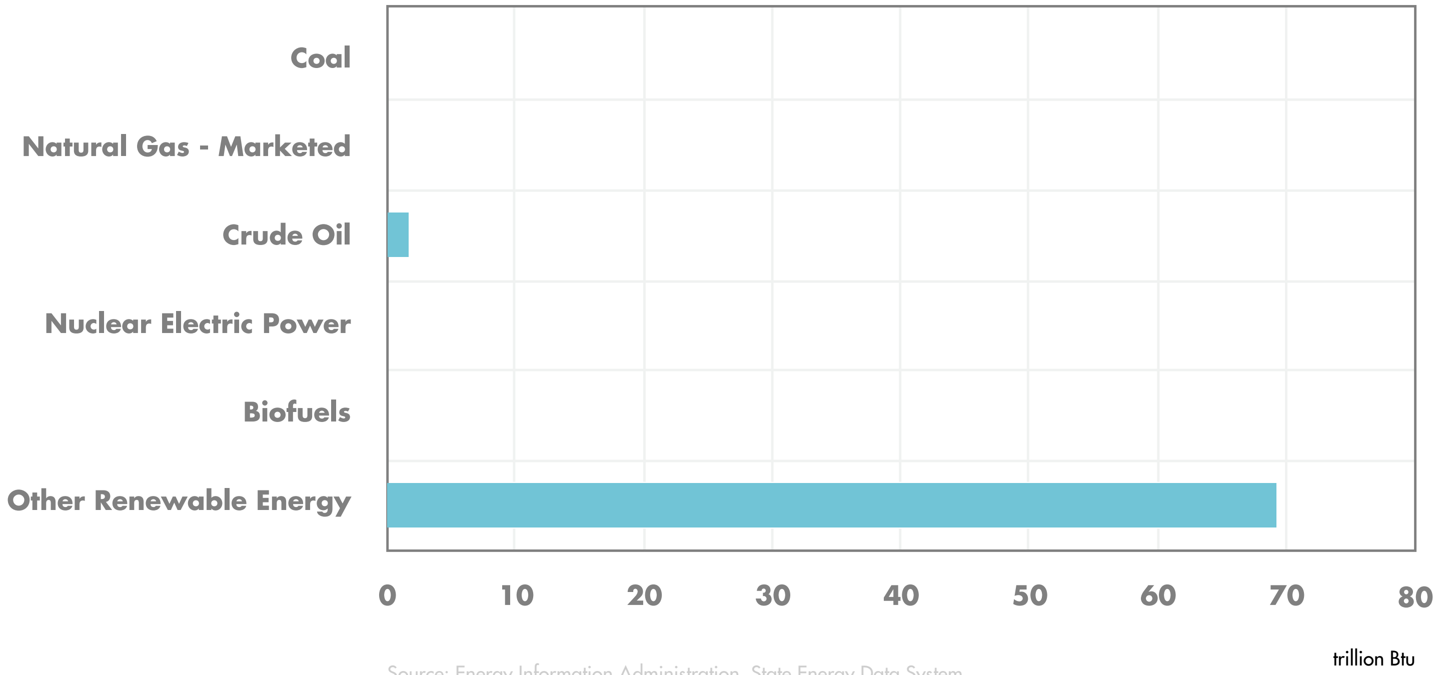
Source: Energy Information Administration, State Energy Data System

Nevada Net Electricity Generation by Source, Jul. 2016



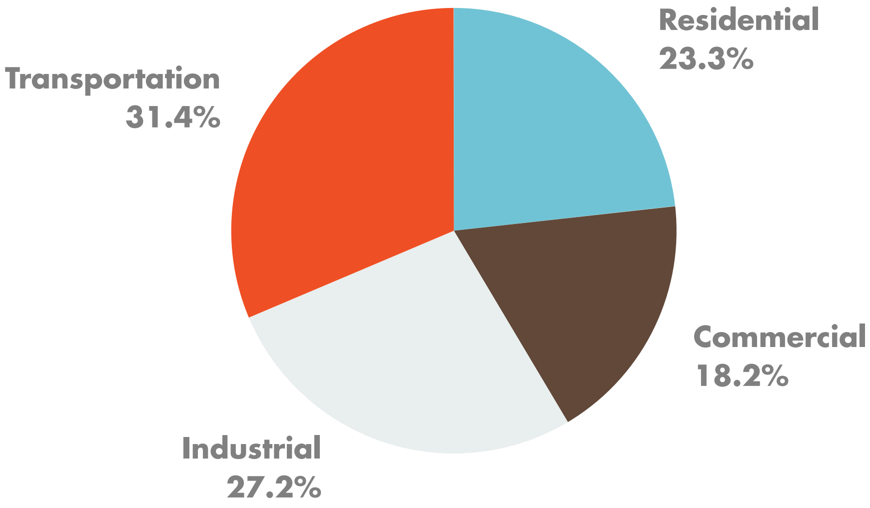
Source: Energy Information Administration, Electric Power Monthly

Nevada Energy Production Estimates, 2014



Source: Energy Information Administration, State Energy Data System

Nevada Energy Production by End-Use Sector, 2014



Source: Energy Information Administration, State Energy Data System

IECC REQUIREMENTS

Fenestration (IECC Sections R303.1.3, R402.3, R402.5)

Required (U-Factor)	Team Las Vegas (U-Factor)
0.32	0.29

Insulation (IECC Section R303.1.4 and R402.2)

Required (R-Value)	Team Las Vegas (R-Factor)
Roof + Ceiling	Roof + Ceiling
38	50.56
Wood Frame Wall	Wood Frame Wall
20	29.75
Floor	Floor
30	38.91
Slab R-Value & Depth	Slab R-Value & Depth
10, 2FT	N/A

Ducts (IECC Section R403.2)

Measured	Measured
Total Leakage: >4cfm/100sqft	TBD
Supply Ducts @ R-8	To comply with 2015 IECC Nevada Requirements
All Other Ducts @ R-6	To comply with 2015 IECC Nevada Requirements

Air Sealing (IECC Section R402.4)

Air Leakage Rate (ACH)	Air Leakage Rate (ACH)
3 ACH	TBD

System (IECC Sections R403)

HVAC System Sizing: See Attached Documents For Manual J

Temperature Controls: To comply with 2015 IECC Nevada Requirements

Mechanical System Piping Insulation: To comply with 2015 IECC Nevada Requirements

Hot Water Piping Insulation: To comply with 2015 IECC Nevada Requirements

Lighting (IECC Sections R202 and R404.1)

Required 75%	Team Las Vegas 75%
50 lm/W if <40W & <15W	TBD

7.3 ENERGY ANALYSIS AND RESULTS DISCUSSION

Building Envelope

Floor: 38.91

THICKNESS (IN) x [QUANTITY]	MATERIAL	THERMAL RESISTANCE (R VALUE)
1 1/8″	Subfloor	1.41
1″	Closed Cell Spray Foam	6
9″	Open Cell Spray Foam	3.5 x 9 = 31.5

Wall: 29.25

THICKNESS (IN) x [QUANTITY]	MATERIAL	THERMAL RESISTANCE (R VALUE)
1/4″	Fiber Cement (Equitone)	.5
1″	Air Space	1
1 1/2″	Zip R-Sheathing	6
1″	Closed Cell Foam	6
4.5″	Open Cell Spray Foam	15.75
5/8″	Gypsum Board	.5

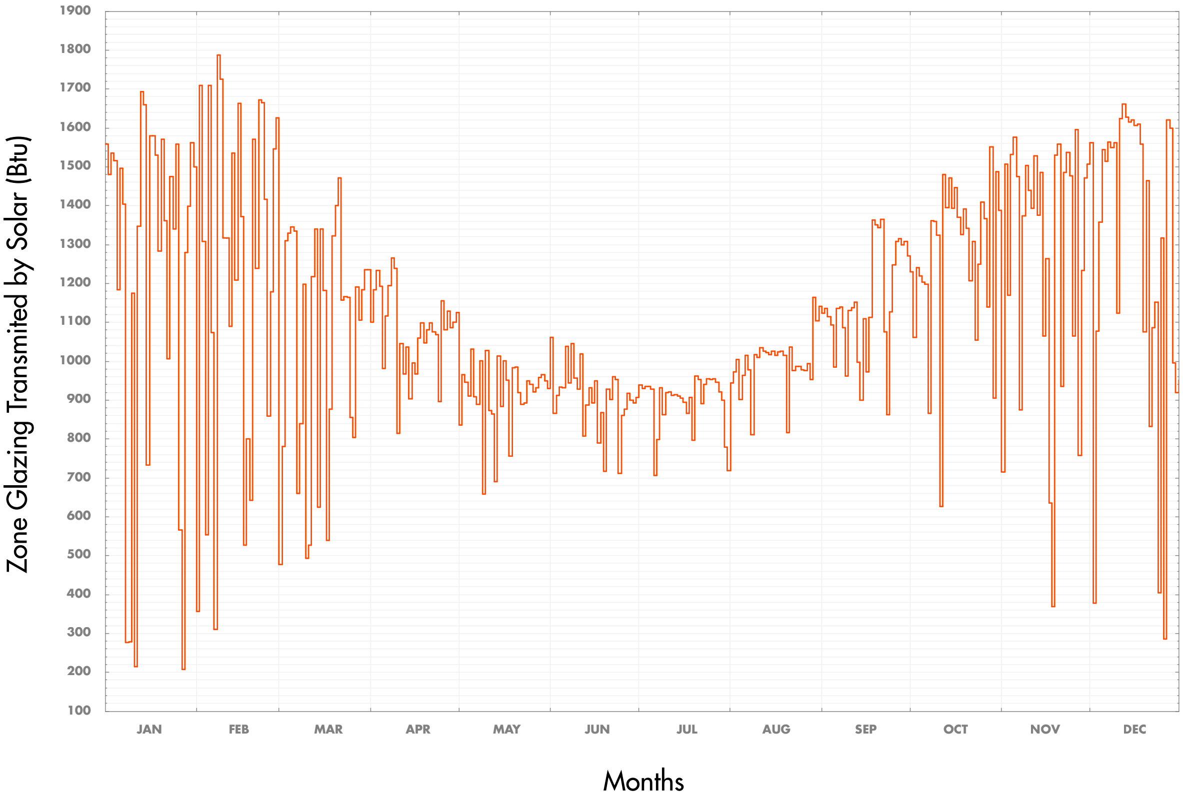
Roof: 50.56

THICKNESS (IN) x [QUANTITY]	MATERIAL	THERMAL RESISTANCE (R VALUE)
1″	Closed Cell	6
10 7/8″	Cellulose	38.06

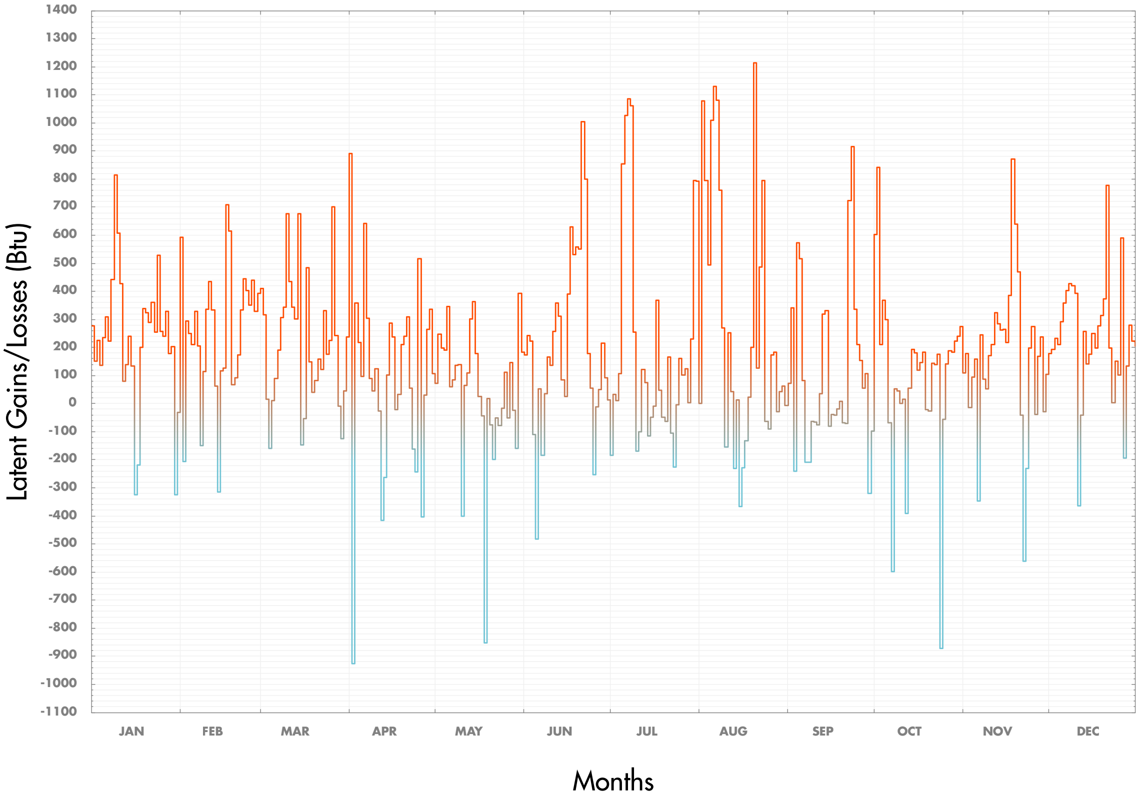
Window

WINDOW TYPE	FRAME	THERMAL RESISTANCE (R VALUE, FRAME + GLASS)
Double Pane	Aluminum w/ thermal break	4

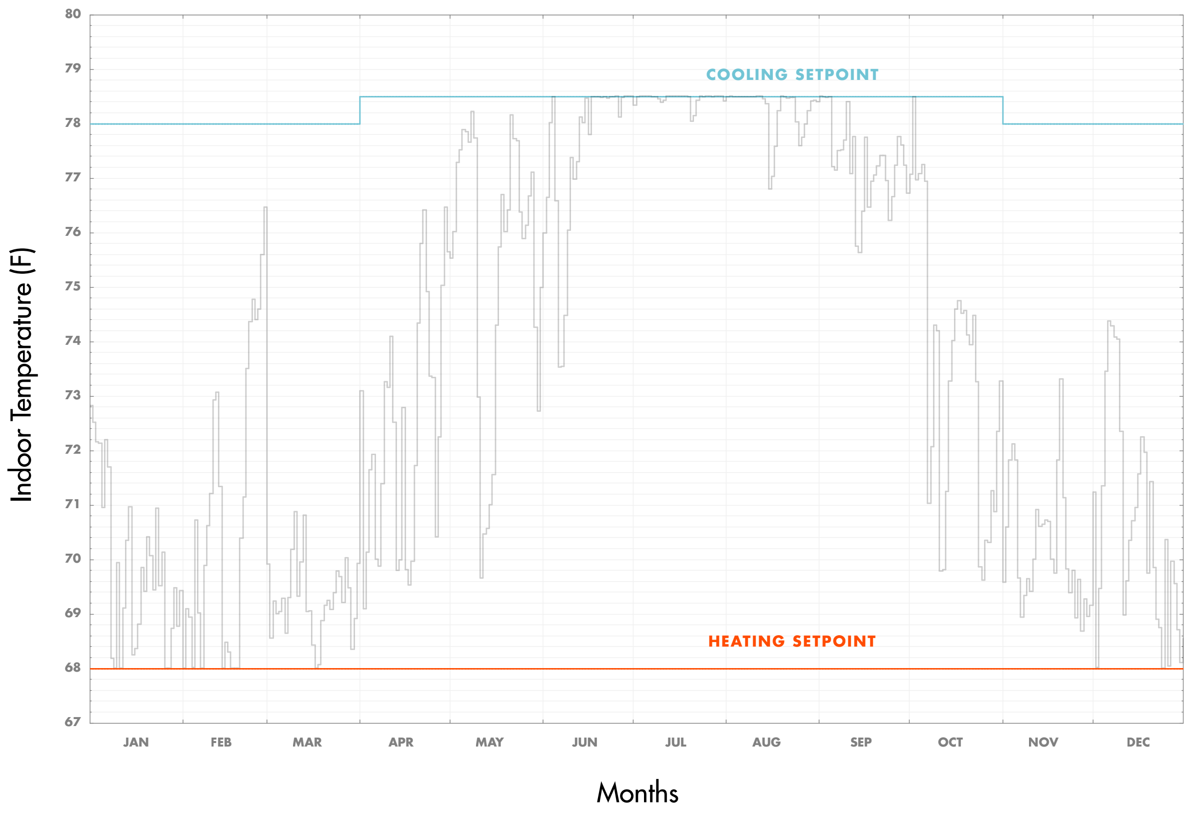
Zone Glazing Transmited by Solar per Month



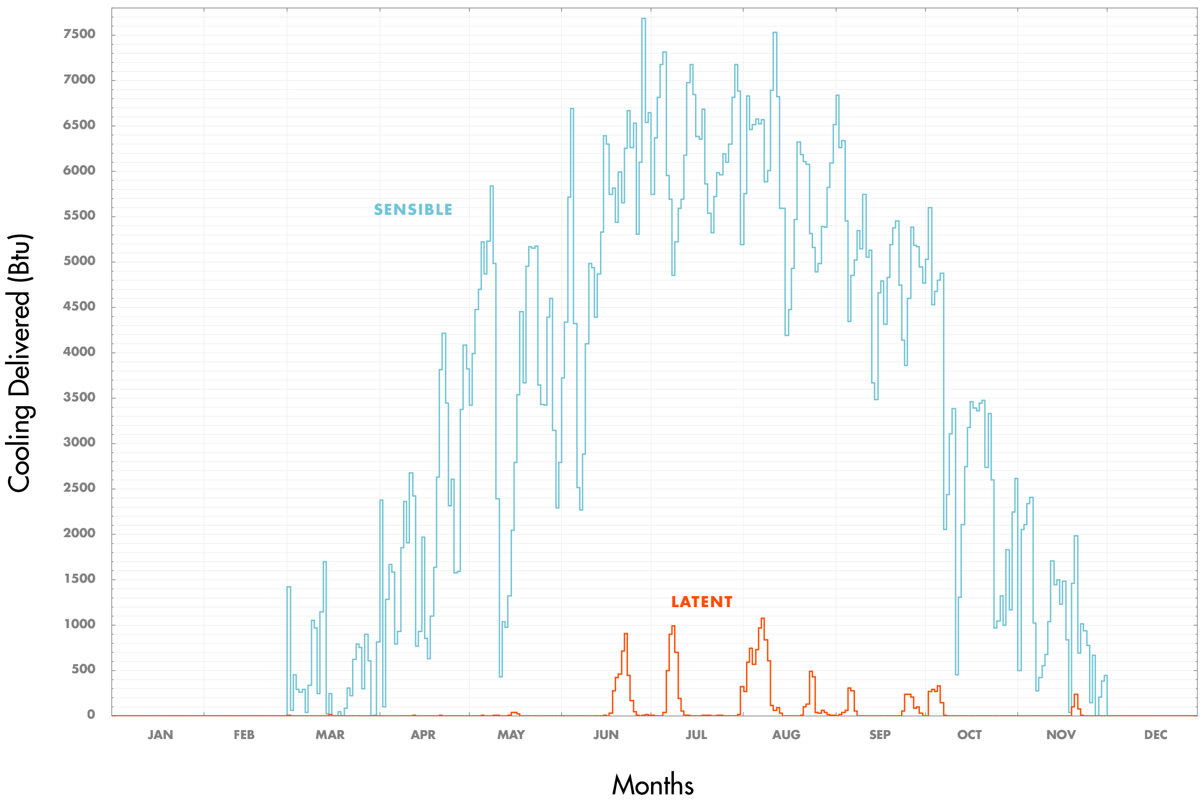
Latent Gains/Losses per Month

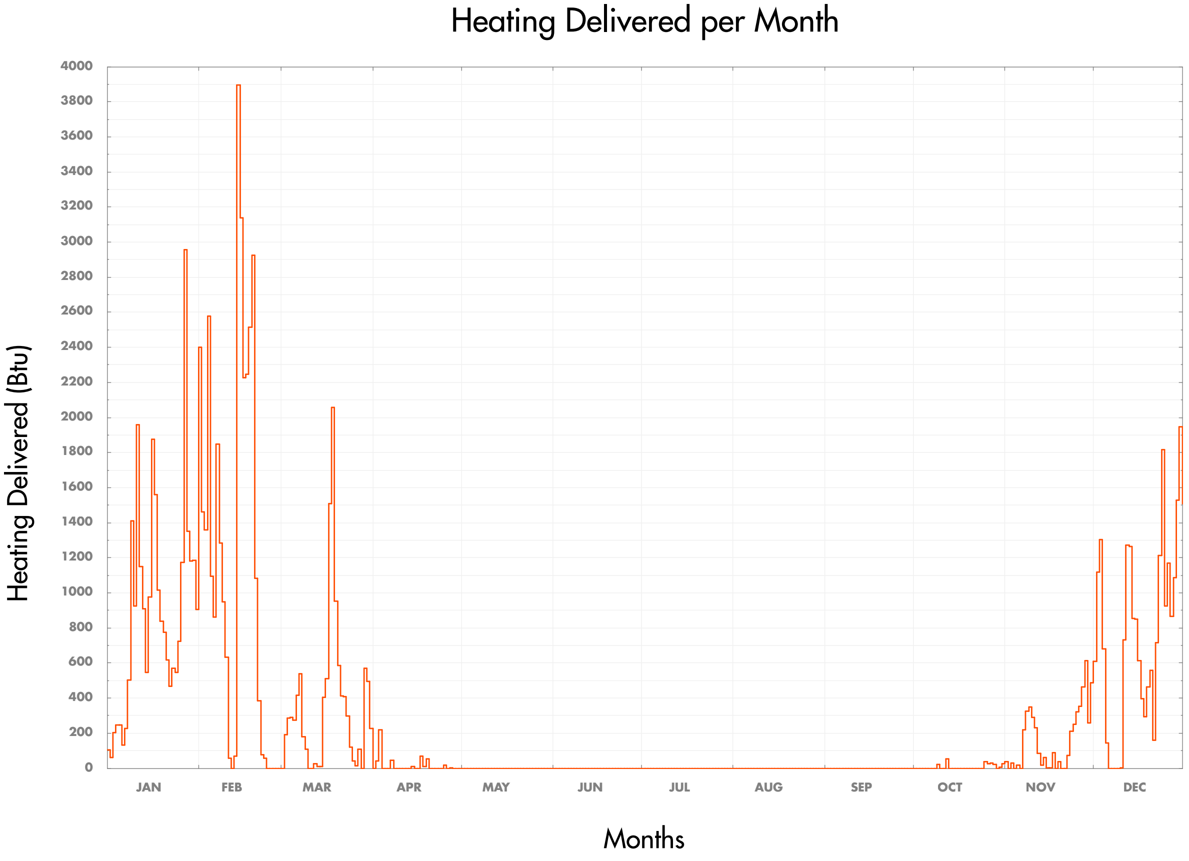


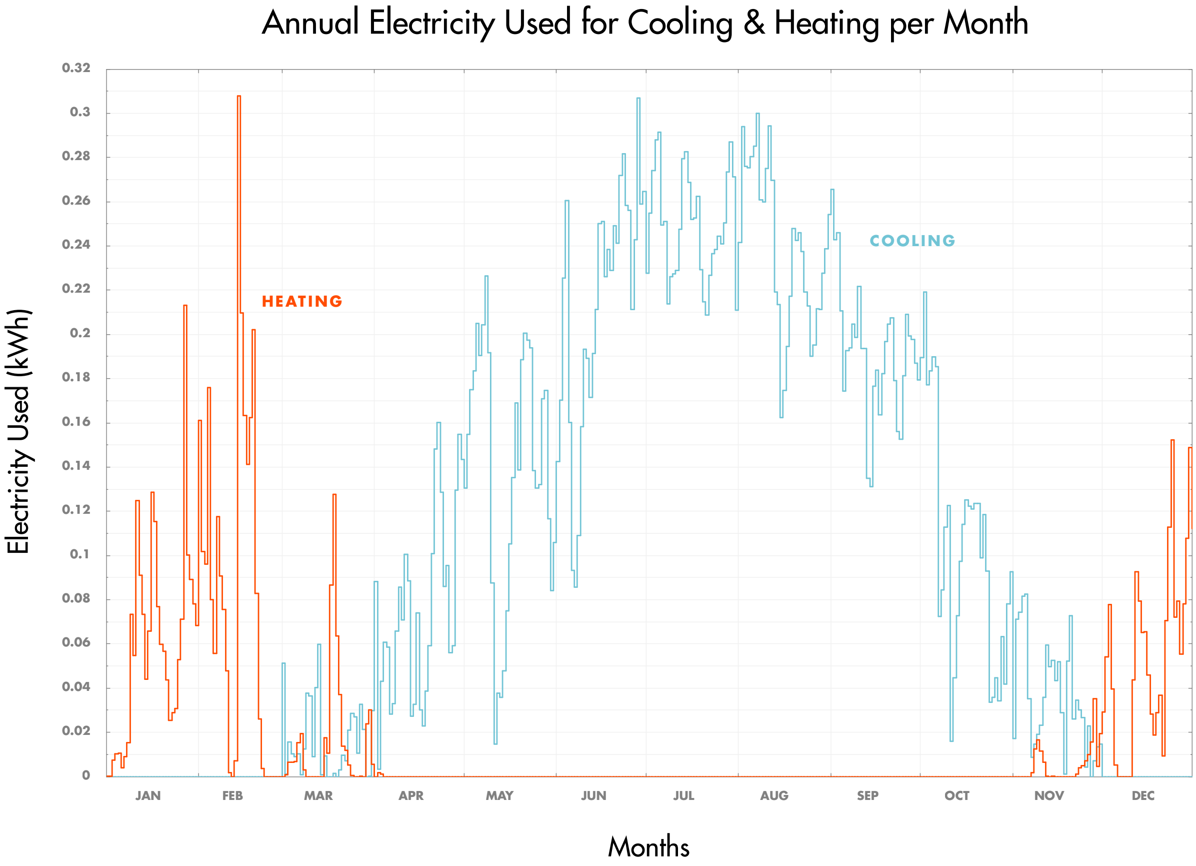
Indoor Temperature with Heating & Cooling Setpoints per Month



Cooling Delivered to Sensible and Latent Loads per Month




Heating Delivered per Month
Heating Delivered (Btu)
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
800
600
400
200
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Months


Annual Electricity Used for Cooling & Heating per Month
Electricity Used (kWh)
0.32
0.3
0.28
0.26
0.24
0.22
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
HEATING
COOLING
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Months

Heating + Cooling Loads

		Design State & City	NV		
Indoor Design Heating db	70	@outdoor (winter) 99% db	30	HTD	40
Indoor Design Cooling db	75	@outdoor (summer) 1%db	106	CTD	31
Indoor Design Cooling RH	50%	Grains Difference	-32	Daily Range	high
Latitude	36	Elevation	2162	ACF	0.93

Manual J8AE - Summary Report

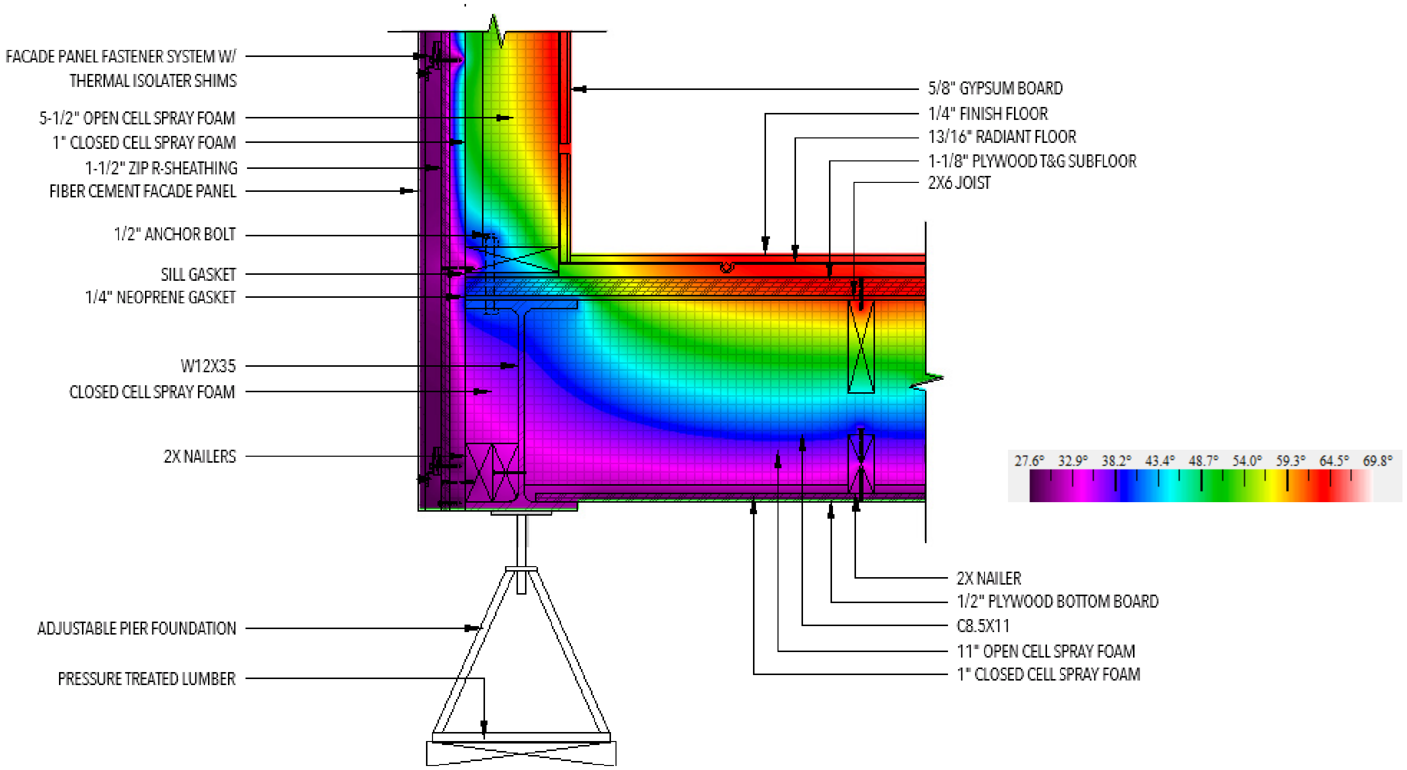
Mfg. Equipment Sensible Heat Ratio 0.75

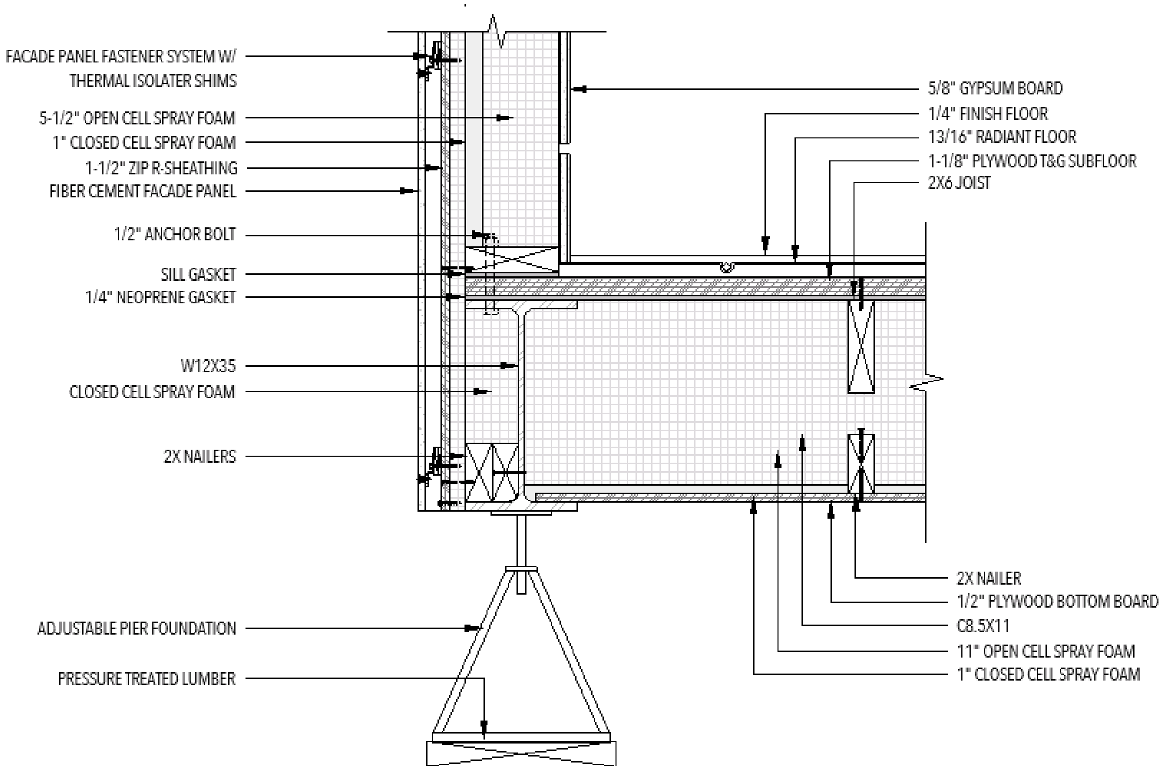
Manual Overide Entry for Design CFM

Room Name	Heat Loss	HTG CFM	Heat Gain	CLG CFM	ACCA Manual D CFM
BEDROOM	3233	228	4773	234	234
BATHROOM	1487	105	2407	118	118
OFFICE	1761	124	2139	105	124
KITCHEN/DINING	4451	314	6802	334	334
LIVING ROOM	3235	228	4259	209	228
Room Envelope Totals	**14166**	**1000**	**20381**	**1000**	

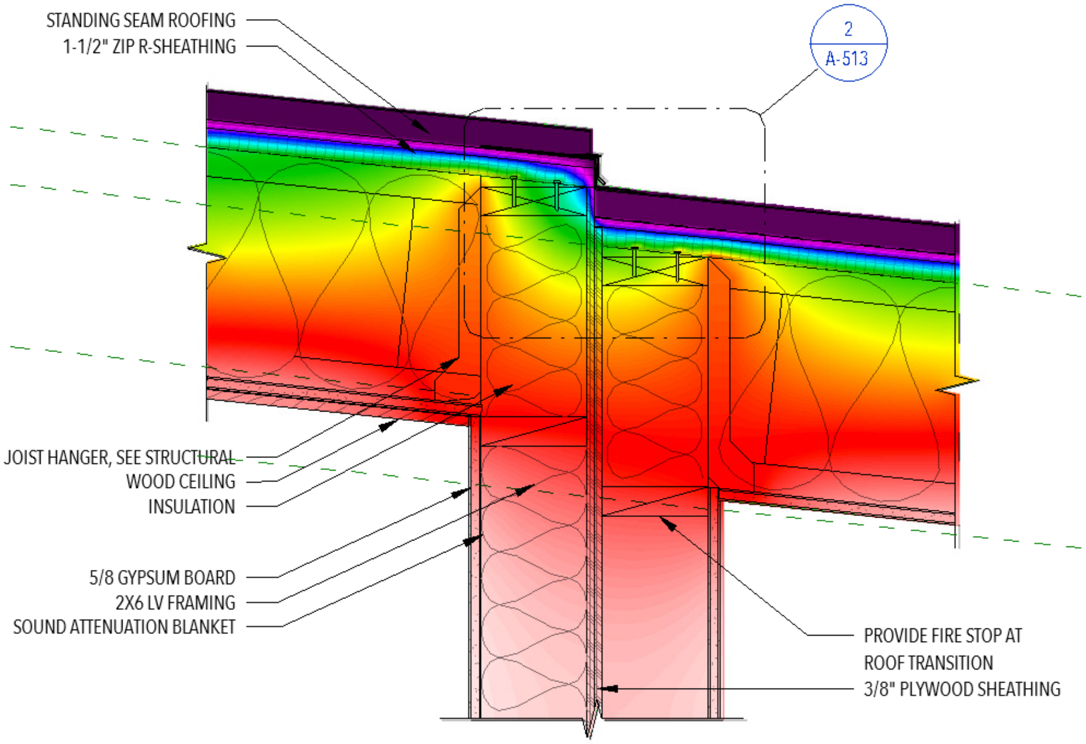
Total Area	Construction Components	Heat Loss		Heat Gain	
267	Windows & Glass Doors	5989 BTU	42.28%	5579 BTU	25.26%
	Skylights				
23	Wood & Metal Doors	351 BTU	2.48%	316 BTU	1.43%
2192	Above Grade Walls	2893 BTU	20.42&	1563 BTU	7.08%
210	Partition Walls	396 BTU	2.80%	1624 BTU	7.35%
	Below Grade Walls				
826	Ceilings	628 BTU	4.43%	1256 BTU	5.68%
	Partition Ceilings				
826	Passive Floors	637 BTU	4.50%	2611 BTU	11.82%
	Exposed Floors				
	Slab Floors				
	Basement Floors				
	Partition Floors				
	Infiltration	1396 BTU	9.86%	581 BTU	2.63%
	Internal Gains			2860 BTU	12.95%
	Duct Loss & Gain	1877 BTU	13.25%	3991 BTU	18.07%
	Ventilation				
	Blower Heat Gain			1707 BTU	7.73%
	Total Sensible	14166 BTU	100.00%	22088 BTU	100.00%
	Total Latent			29 BTU	
	Total Cooling Load			22117 BTU	

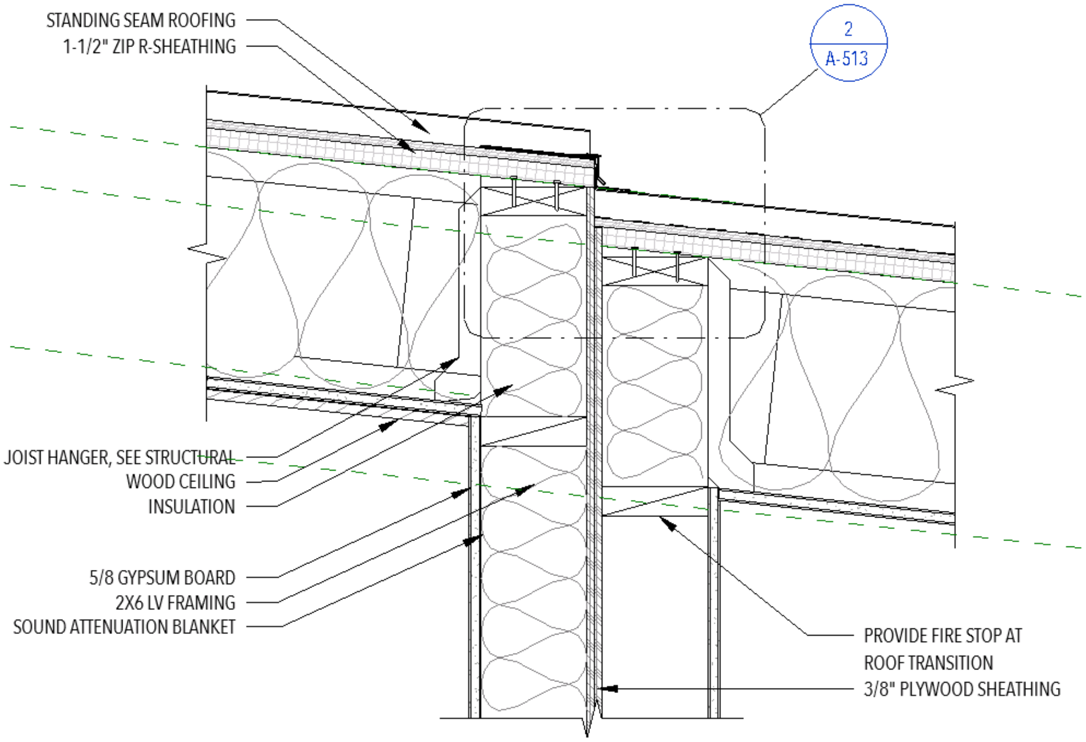
THERM — HEAT TRANSFER MODEL — FLOOR & WALL



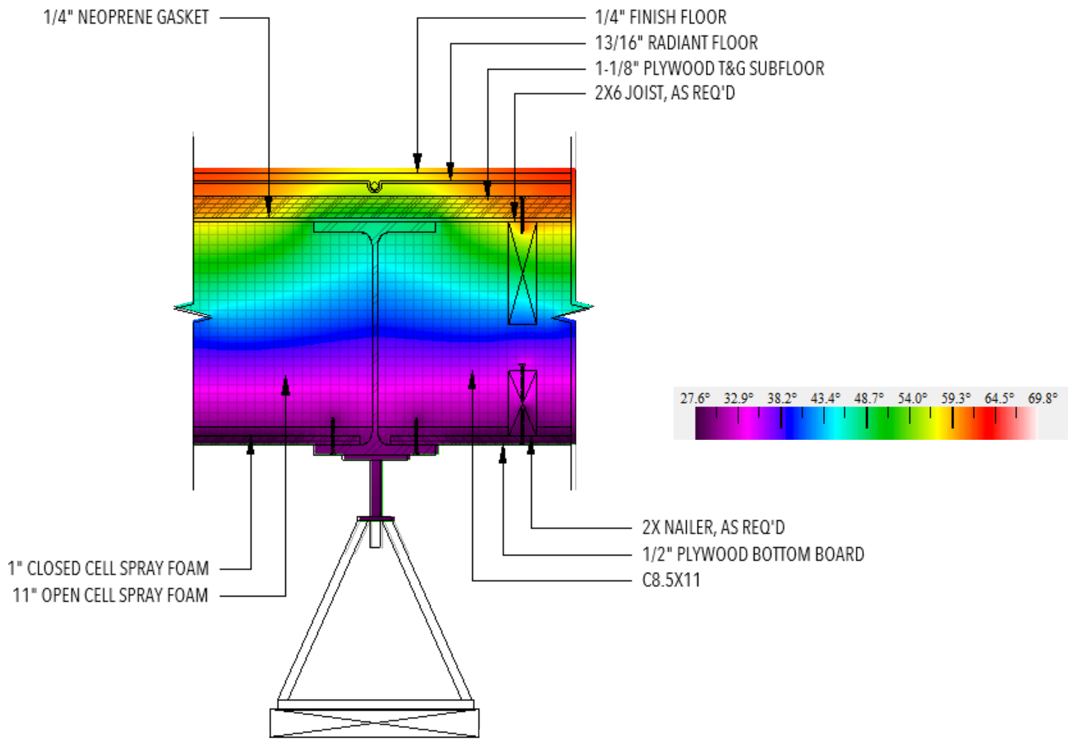


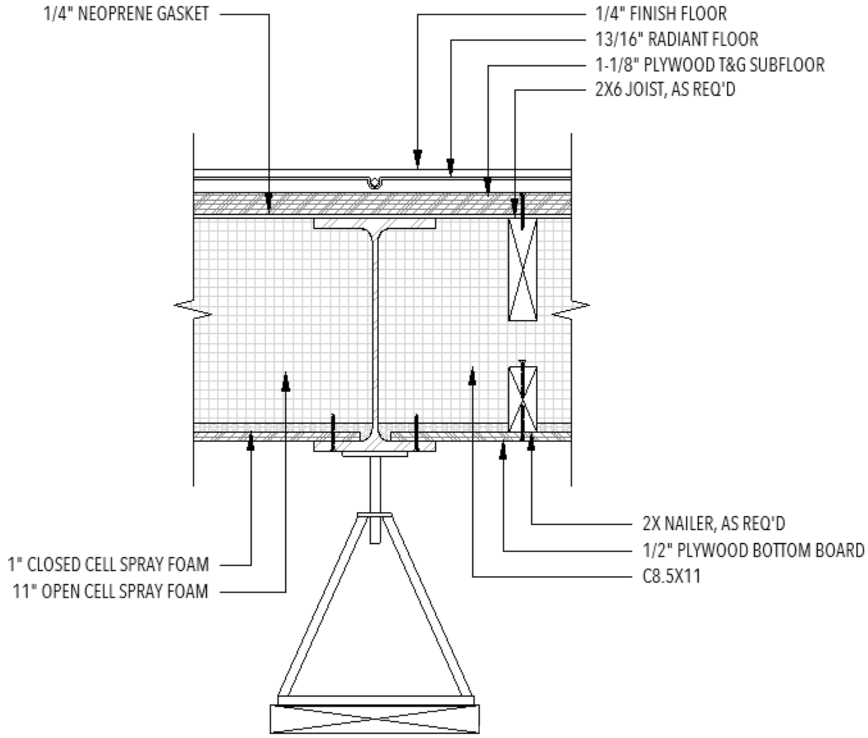
THERM — HEAT TRANSFER MODEL — SPLIT ROOF LINE



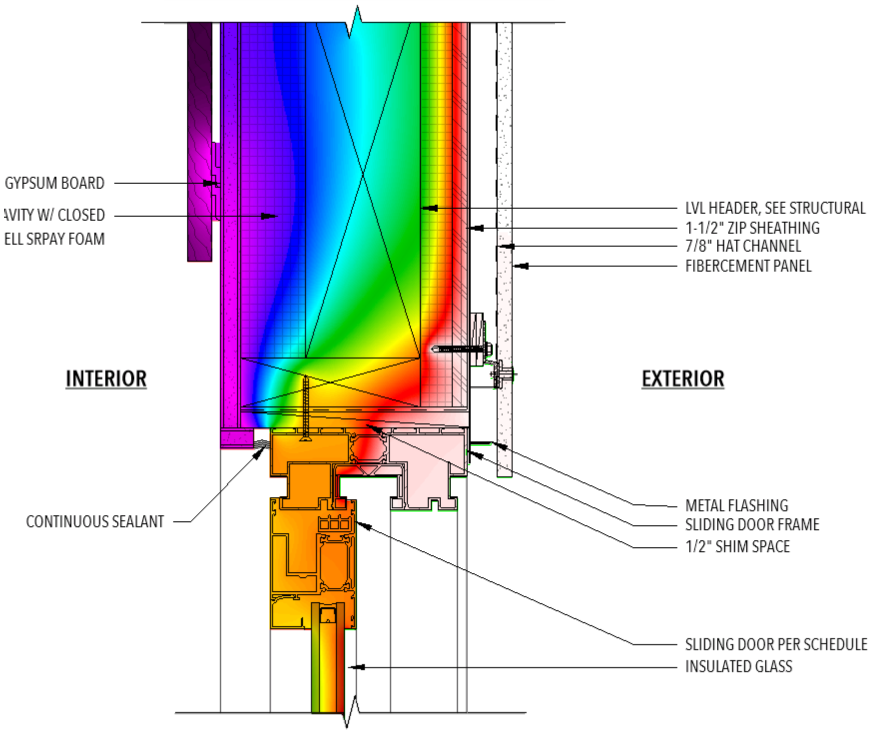


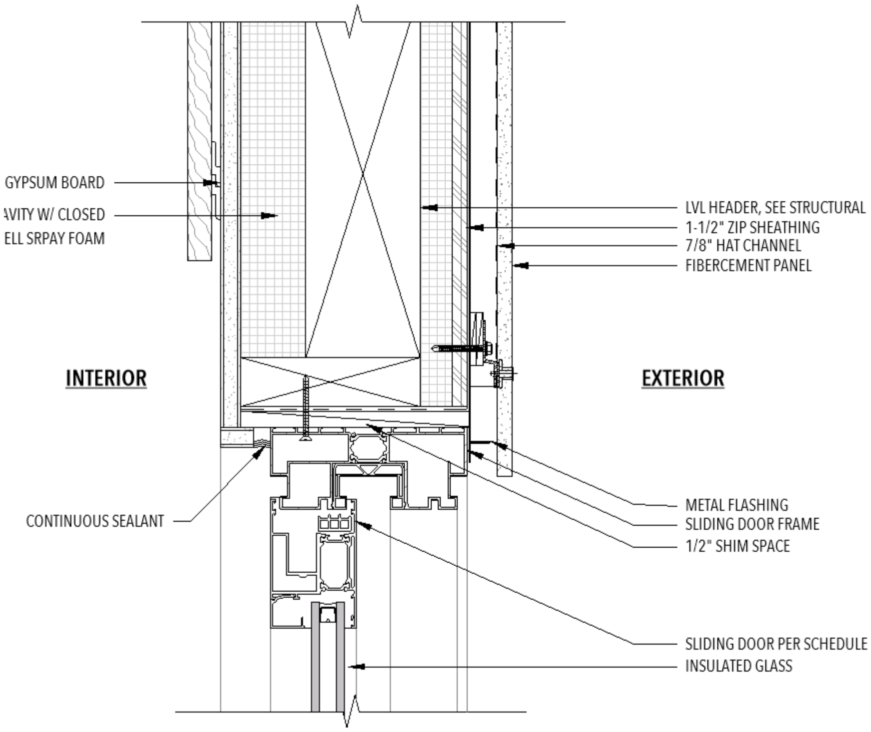
THERM — HEAT TRANSFER MODEL — FLOOR



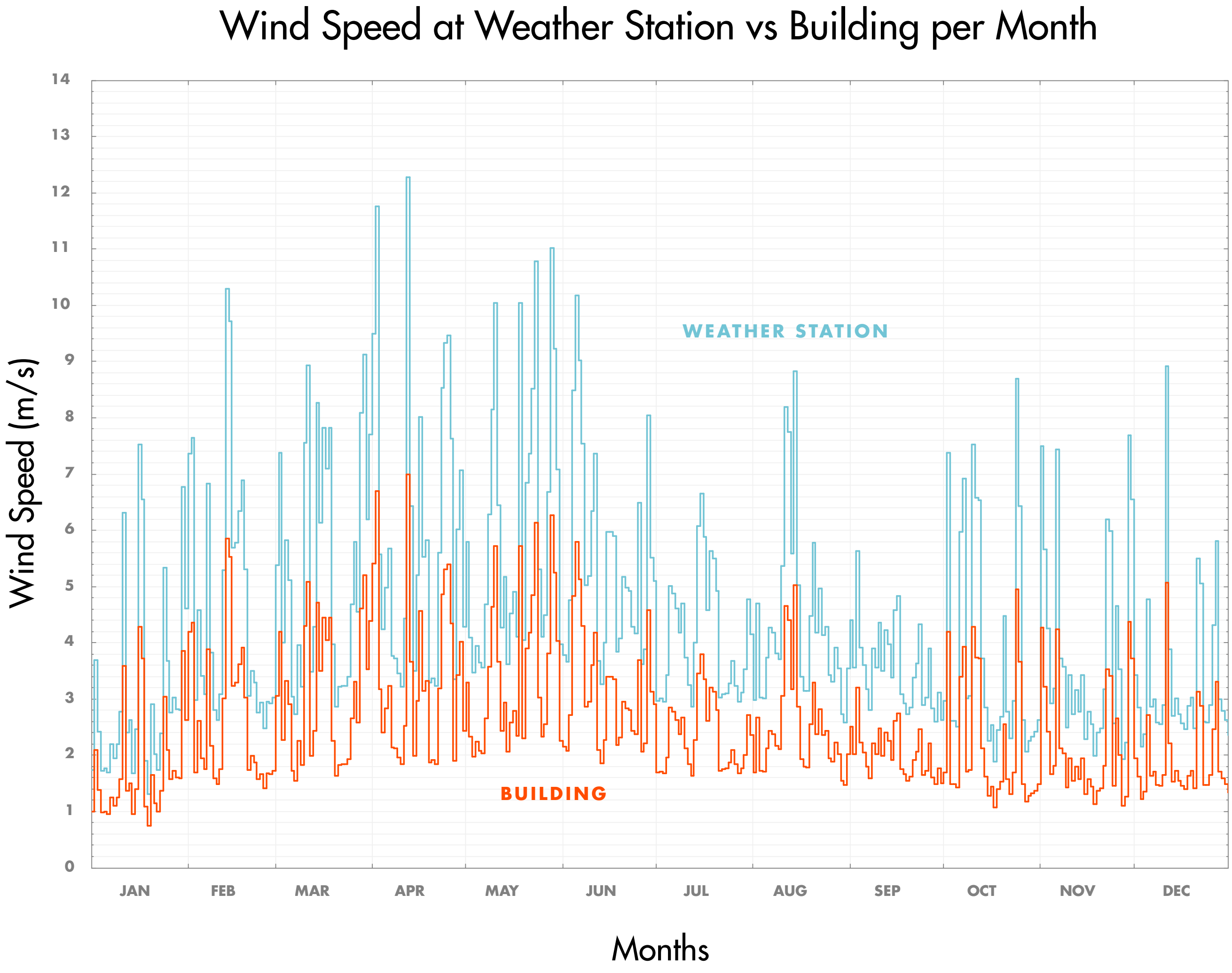


THERM — HEAT TRANSFER MODEL — WINDOW

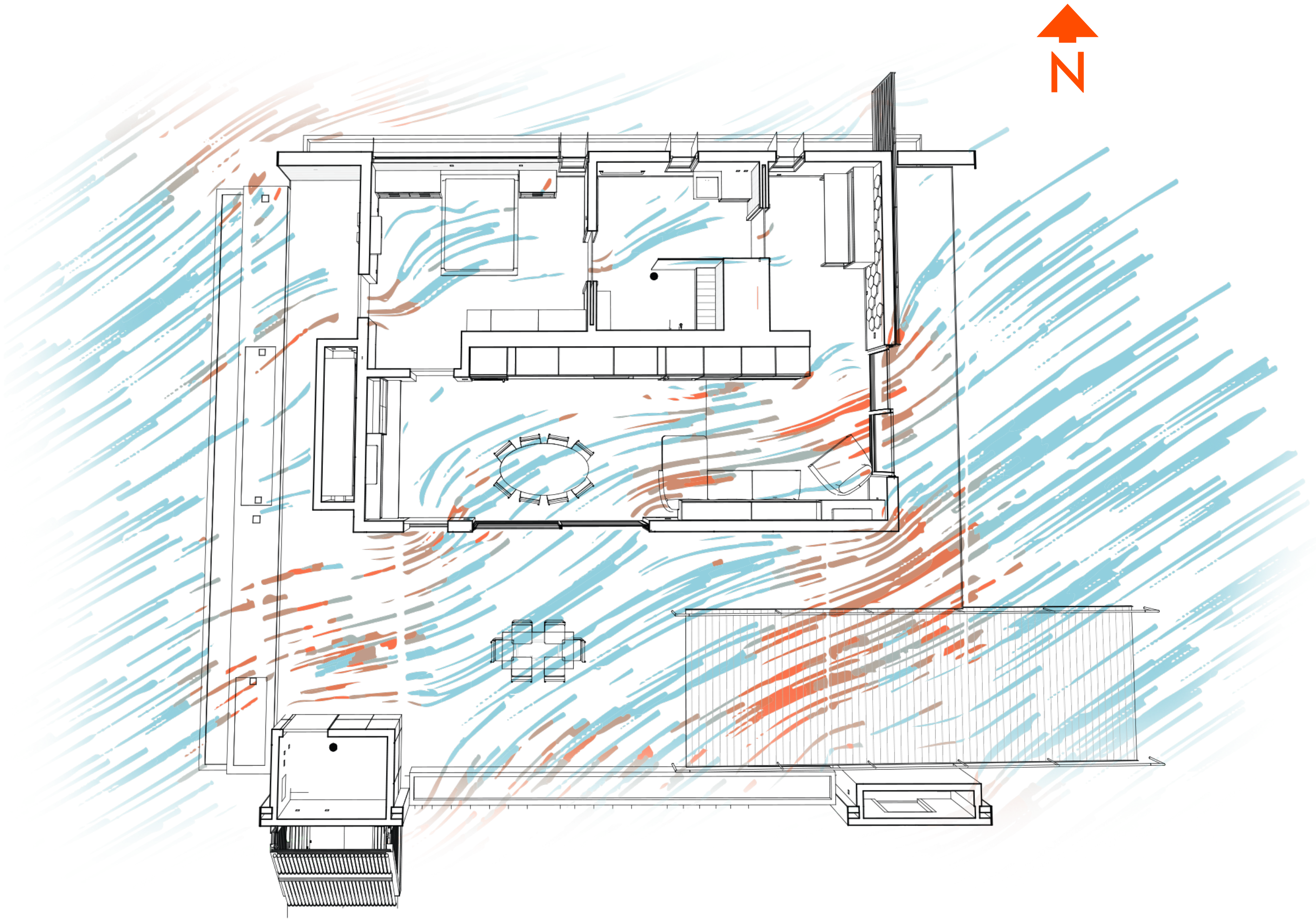




WIND SPEED


Wind Speed at Weather Station vs Building per Month
Wind Speed (m/s)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
WEATHER STATION
BUILDING
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Months

CROSS VENTILATION SIMULATION



RADIANT DESIGN

RADIANT DESIGN - SUMMARY

DESIGN DATA LOCATION	Las Vegas, NV	
Outdoor Temp: Wind Speed:	30 Degrees F	
Total Area: Construction Quality	19 mph 826 FT2 best	
Water Channel 1:	.3 USGPM @ 1.1 FT (H2O) Head (includes S&R and temp. control device head loss	
Total Loops:	6	
Total Manifolds:	1	
Total Zones:	2	
Min. Tubing Required	908 FT	
Total Load:	12,898 Btu/hr	
Total Radiant Load:	11,743 Btu/hr	
Total Supplemental Load:	0 Btu/hr	
RFH Glycol Level:	100% Water	
Design Temp. Drop:	20 Degrees F	(20 Degrees F for all QuickTrak)
Radiant Tubing Volume:	8 gallons (US)	
Volume Water:	8 gallons (US)	
Volume Glycol:	0 gallons (US)	

PHASE CHANGE MATERIAL CALCULATIONS

Sensible:

Airflow x Change in temperature x 1.08 (sensible heat constant) = Sensible Heat BTU of ventilation

Airflow - ASHREA 62.2

- 7.5 x 3 (# of occupants) + 3 * 10 (every 100 sq ft) = 52.5 CFM

The loads are calculated as follows:

- 52.5 CFM x (110 degrees – 85 degrees) x 1.08 = 1,417.5 BTU
- 1,417.5 BTU x 12 hours = 17,010 BTU
- 17,010 BTU divided by 84 BTU/lbs. (NEAL ENERGY CAP) = 202.5 lbs

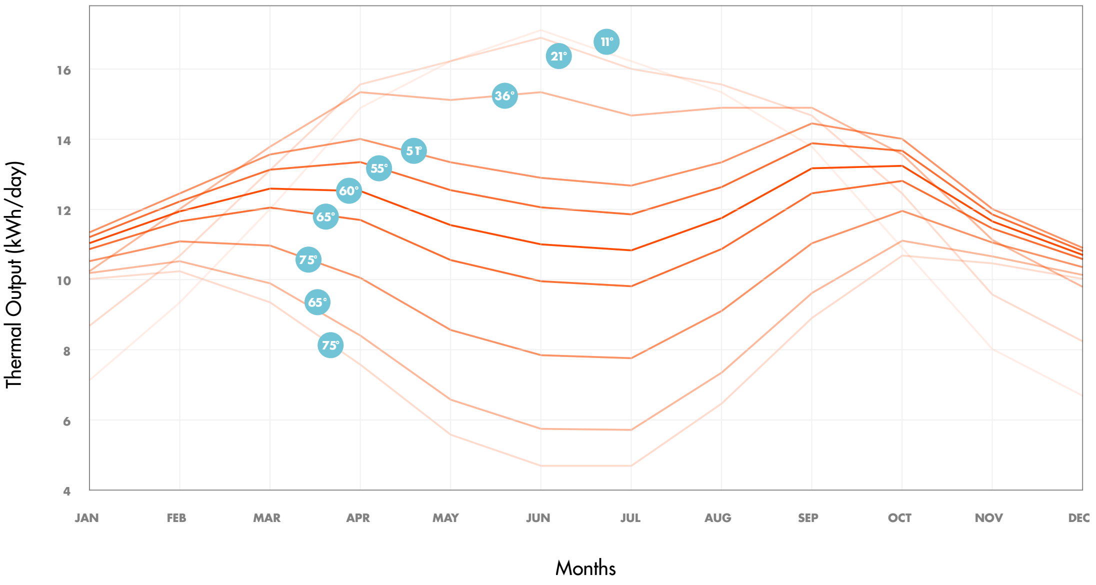
0.5 lbs per packet of NPCM * 202.5 lbs = 101.25 packets.

SOLAR THERMAL SIMULATION

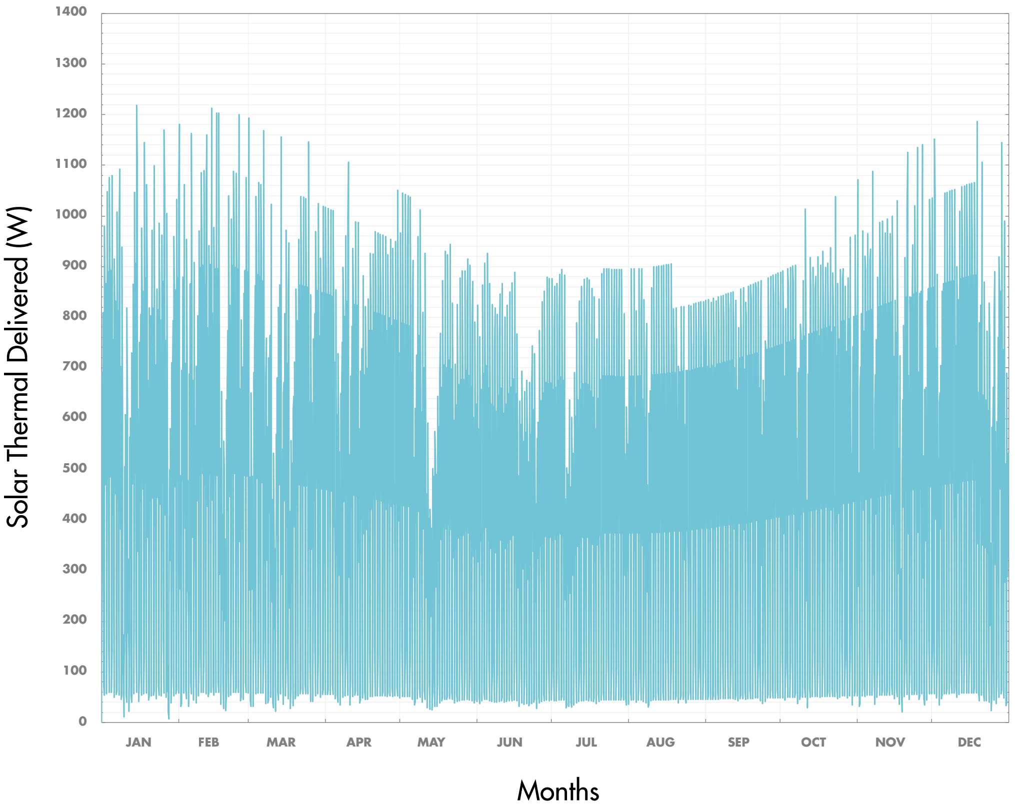
EVACUATED TUBE COLLECTOR

Collector Area	2.436x2
FRIa	0.689
FRUL	3.85 w/m2.c
Incidence Angle Modifier	0.2
Working Fluid	Water
Azimuth	180 deg
Tilt	60 deg
Rate System Size	3.8 kW

Solar Thermal Tank	
Solar Tank Volume	.45 m^3
Solar Tank Height to diameter ratio	2.7
Solar Tank U Value	1 W/m2.c
Solar Tank Max Water Temperature	180 F (82.22 C)
Pump Power	45 W

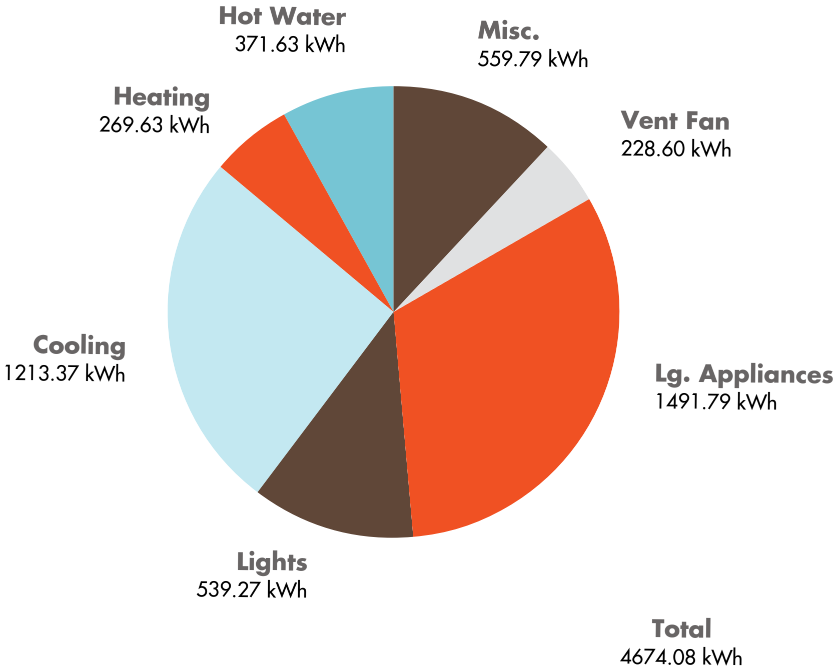


Solar Thermal Performance at Various Tilt Degrees per Month

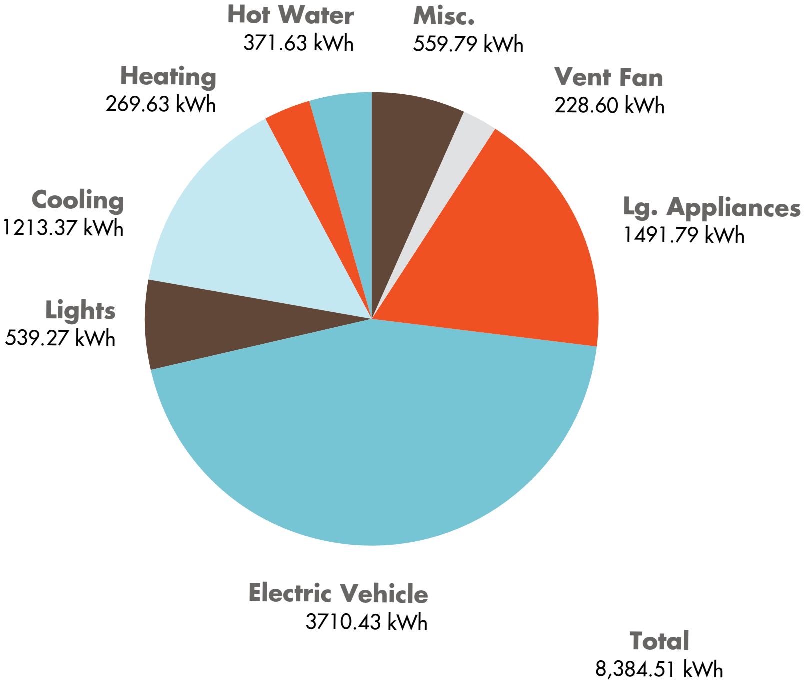


Solar Thermal Delivered per Month

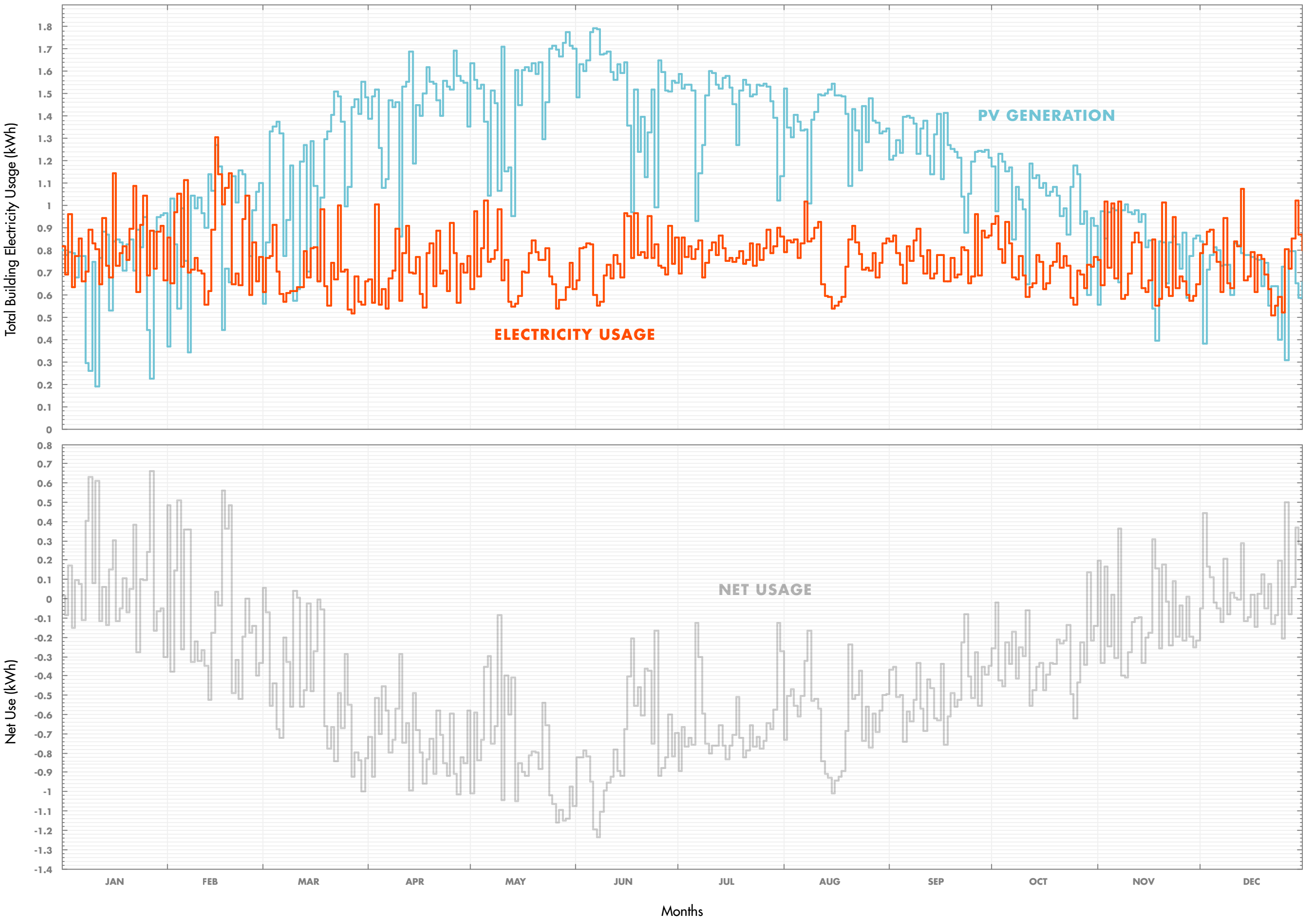
Site Electricty Usage



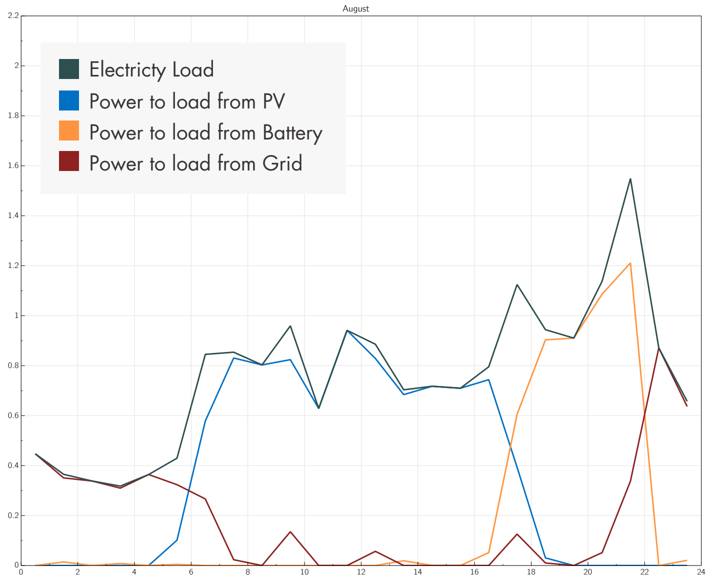
Site Electricty Usage + EV

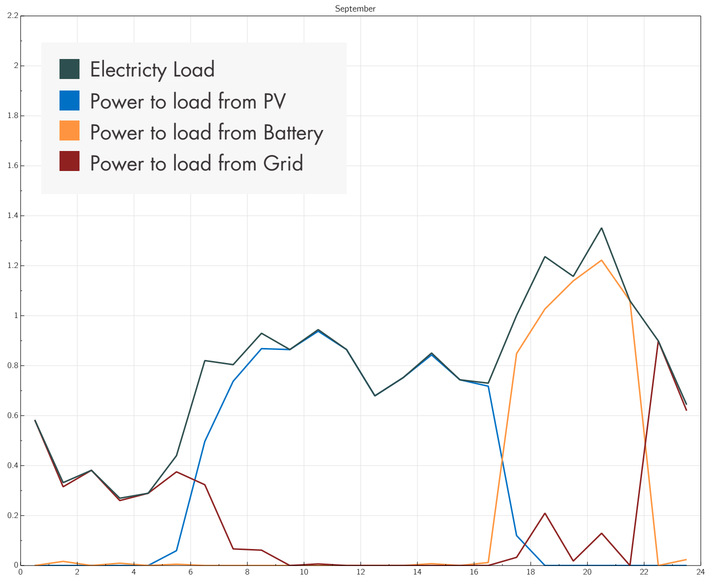


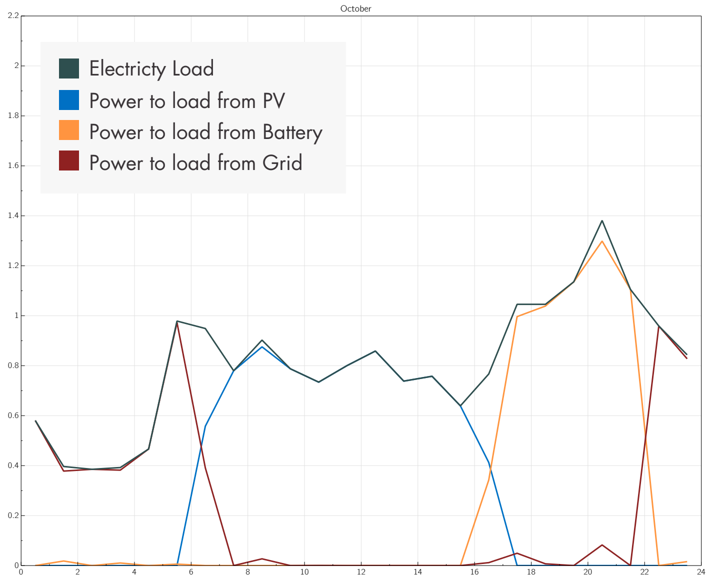
Total Building Electricity Usage vs PV Generation per Month

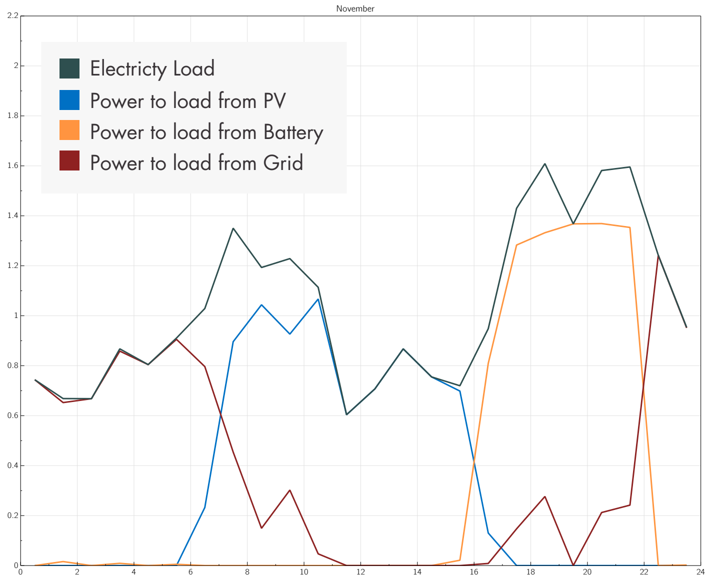


LAS VEGAS PV BATTERY & GRID ANALYSIS

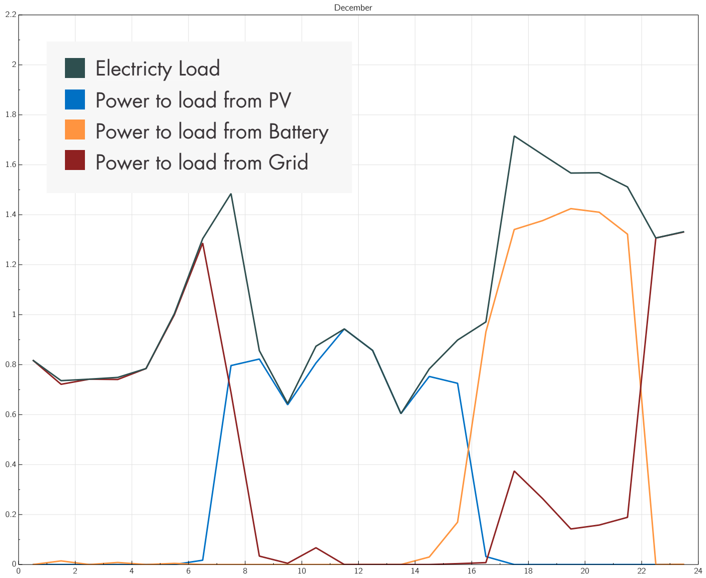


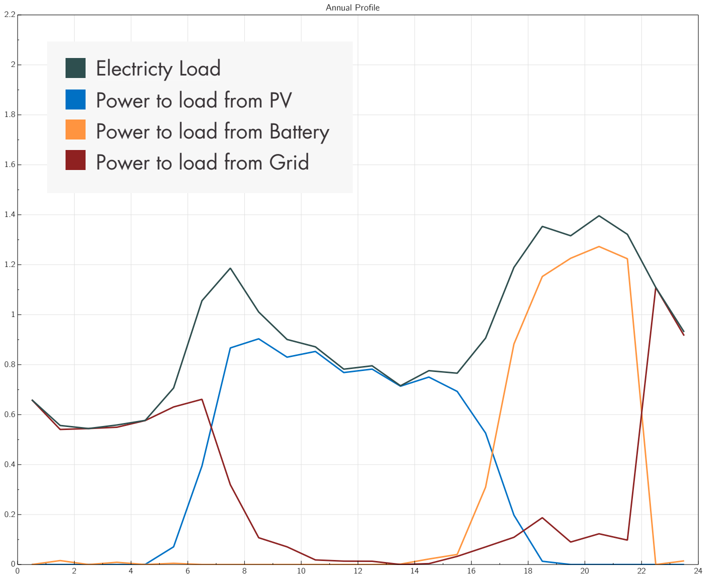


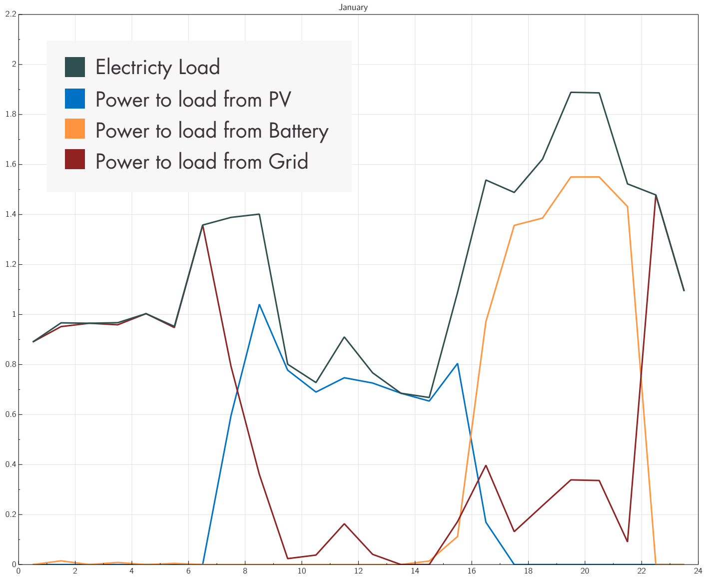


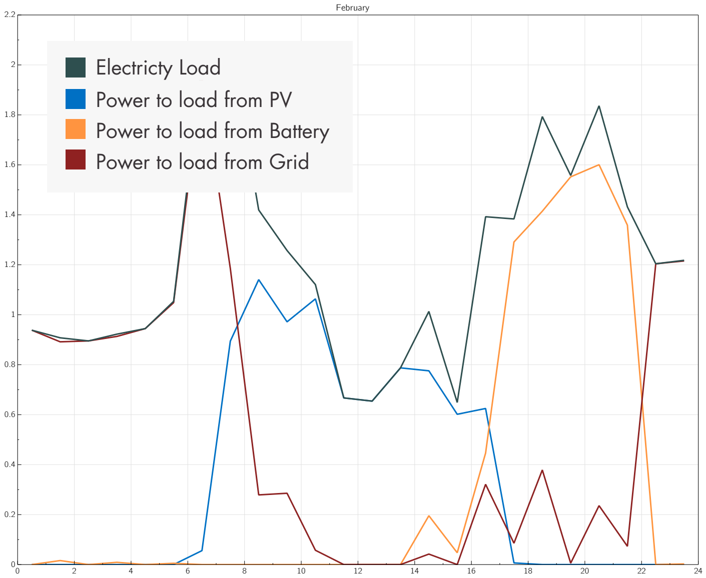


LAS VEGAS PV BATTERY & GRID ANALYSIS

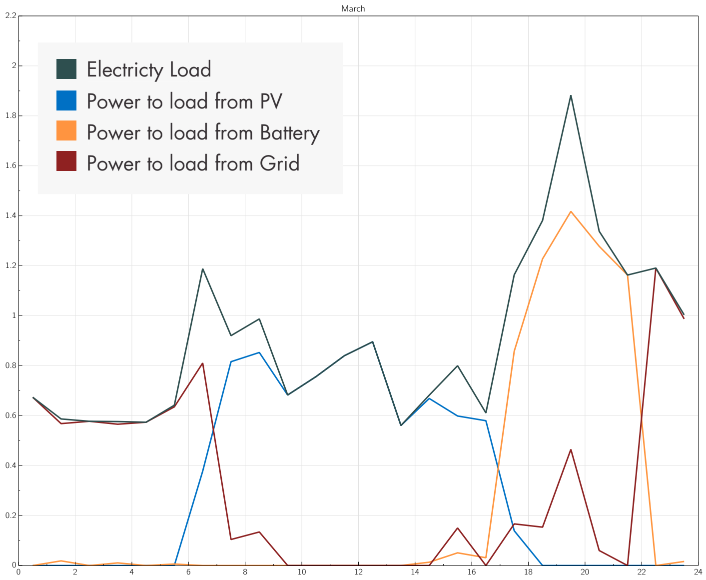


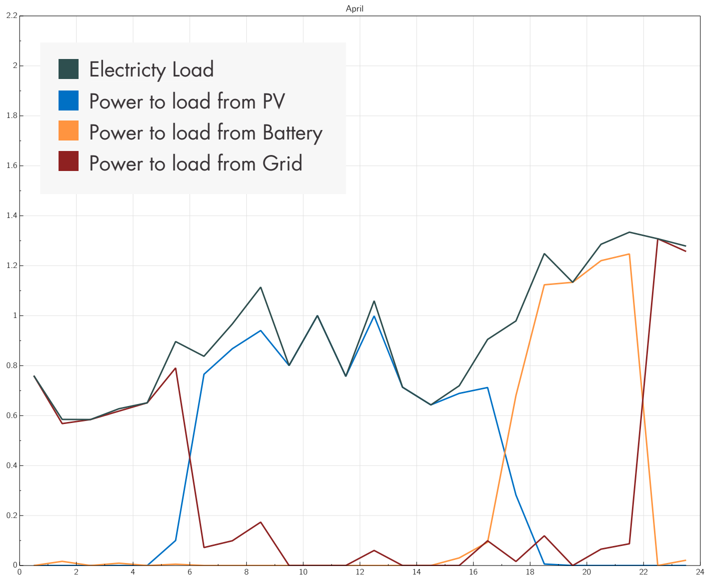


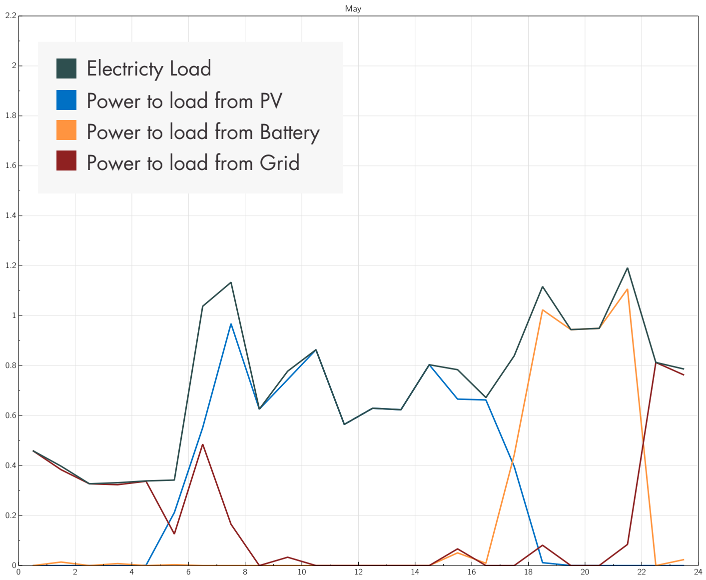


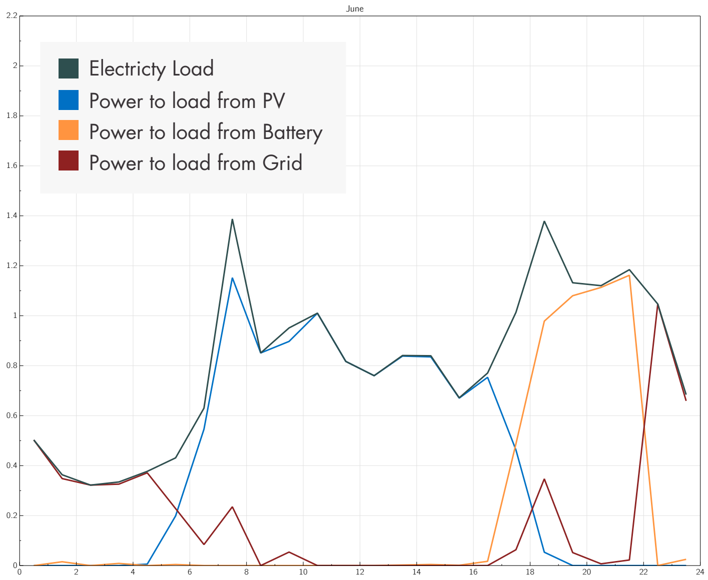


LAS VEGAS PV BATTERY & GRID ANALYSIS

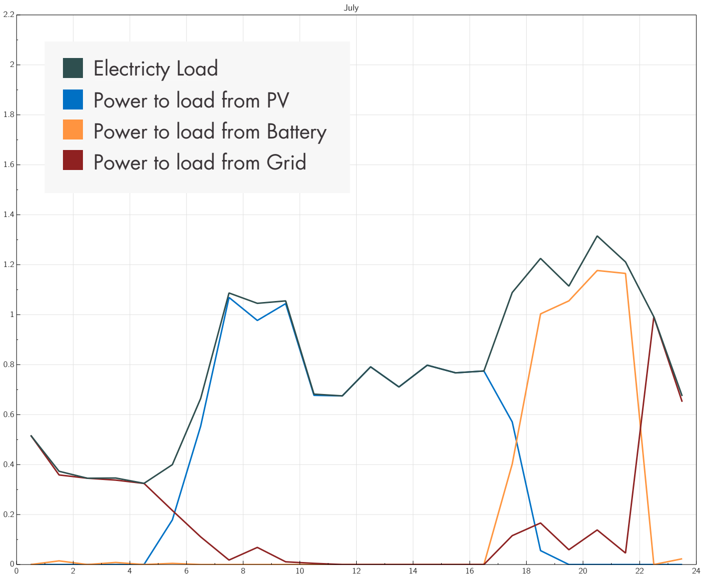




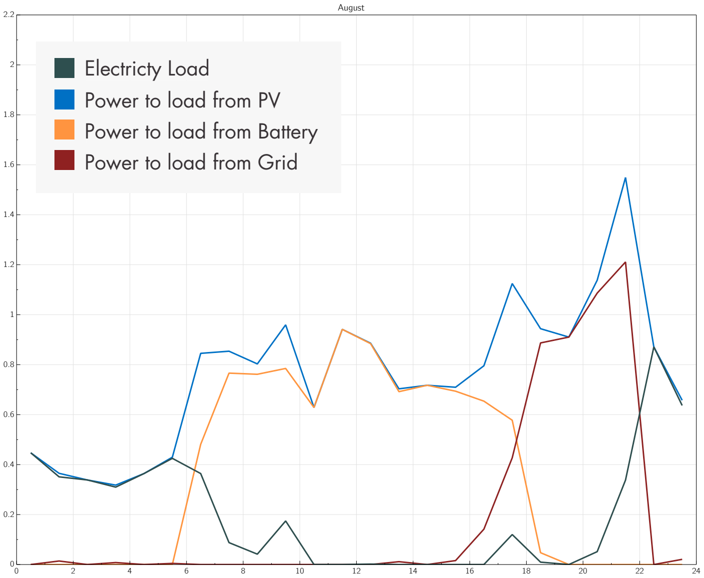


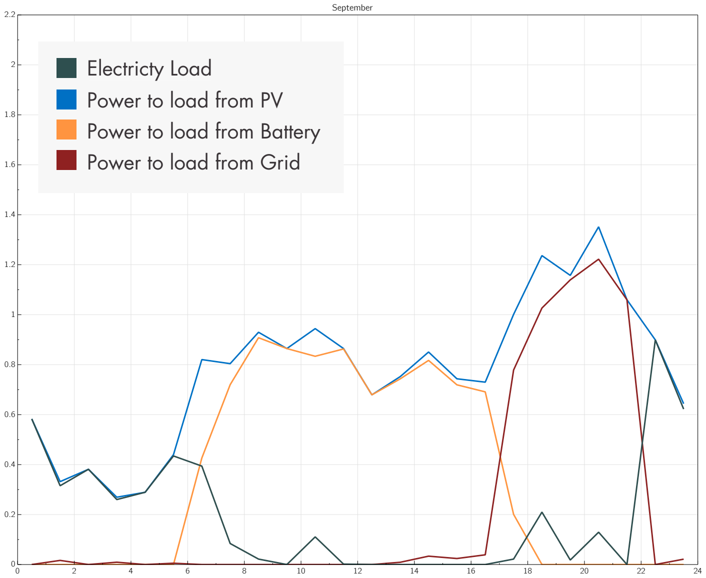


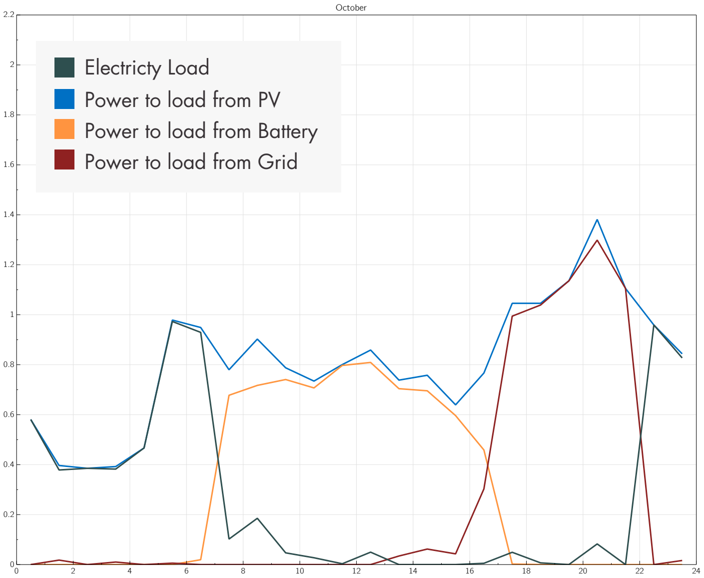
LAS VEGAS PV BATTERY & GRID ANALYSIS

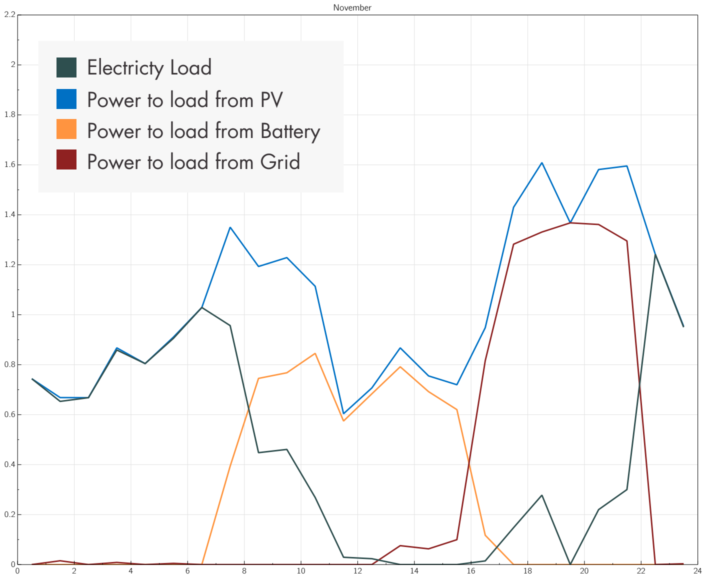


DENVER PV BATTERY & GRID ANALYSIS

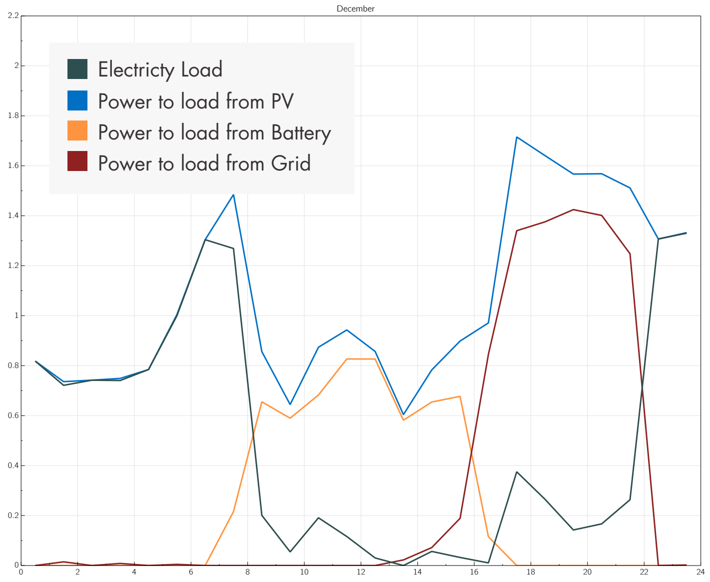


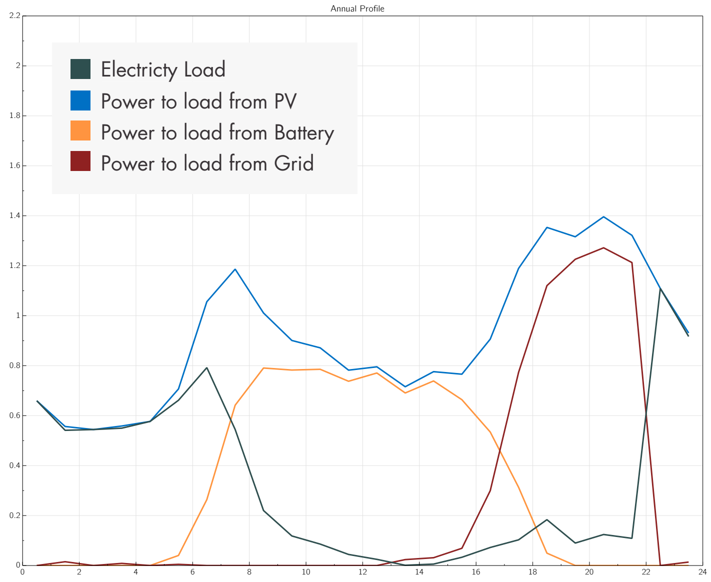


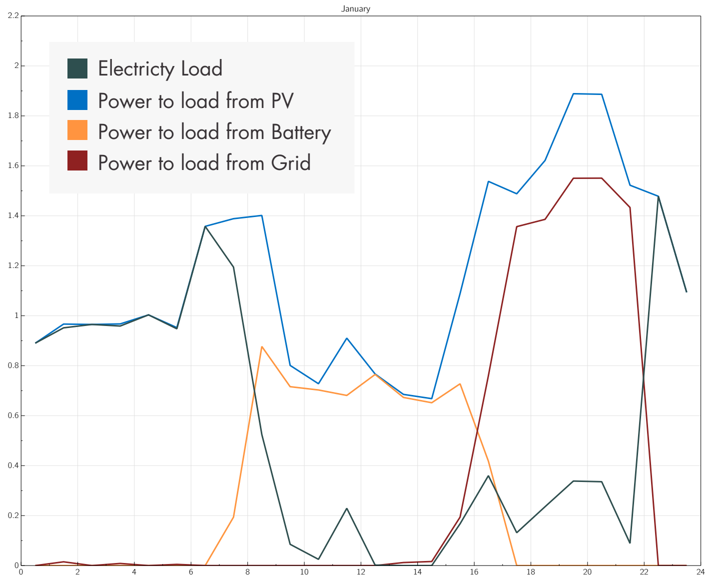


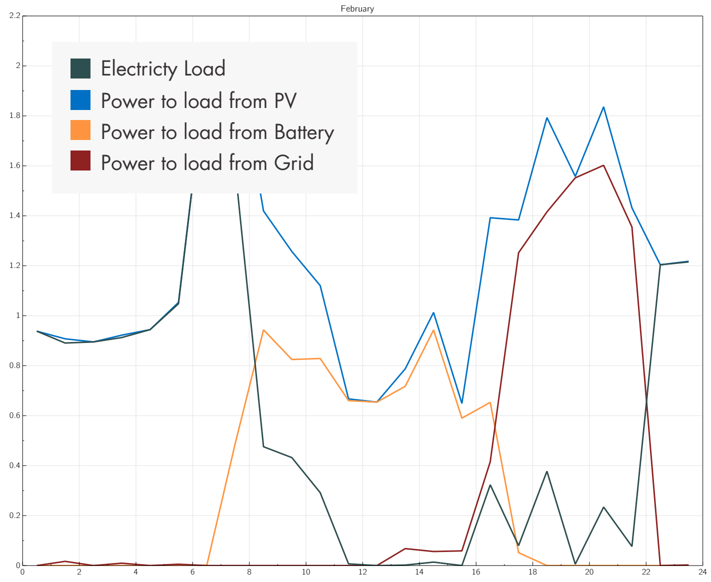


DENVER PV BATTERY & GRID ANALYSIS

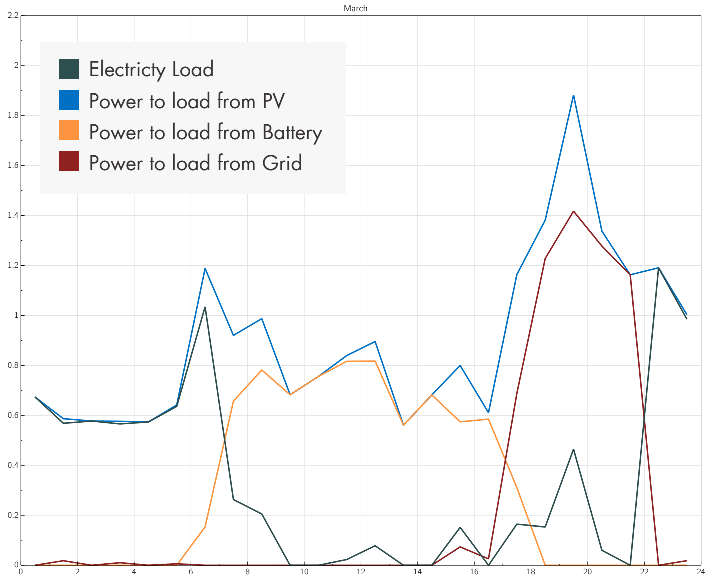


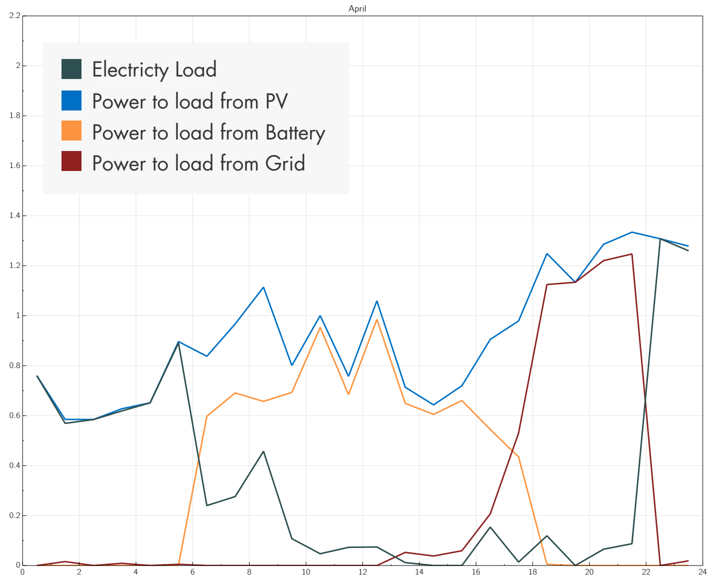


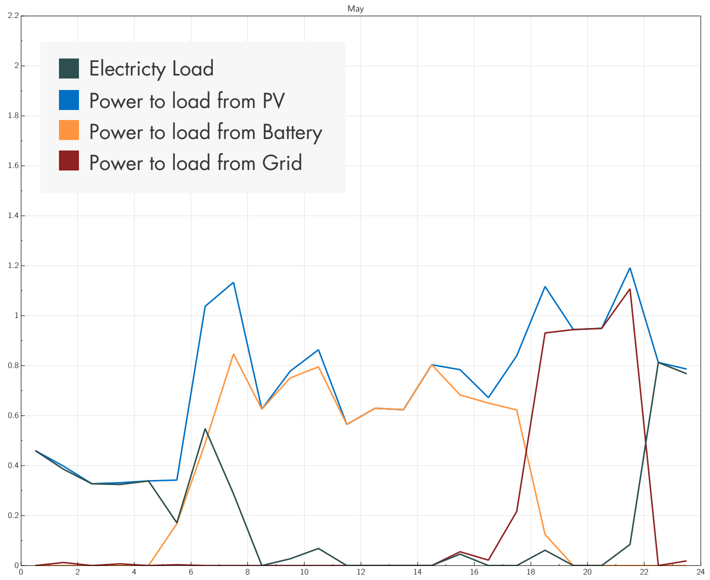


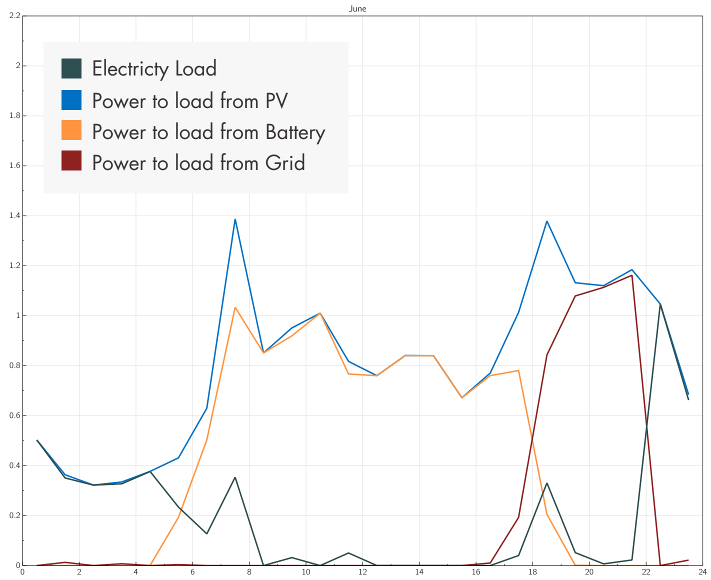


DENVER PV BATTERY & GRID ANALYSIS

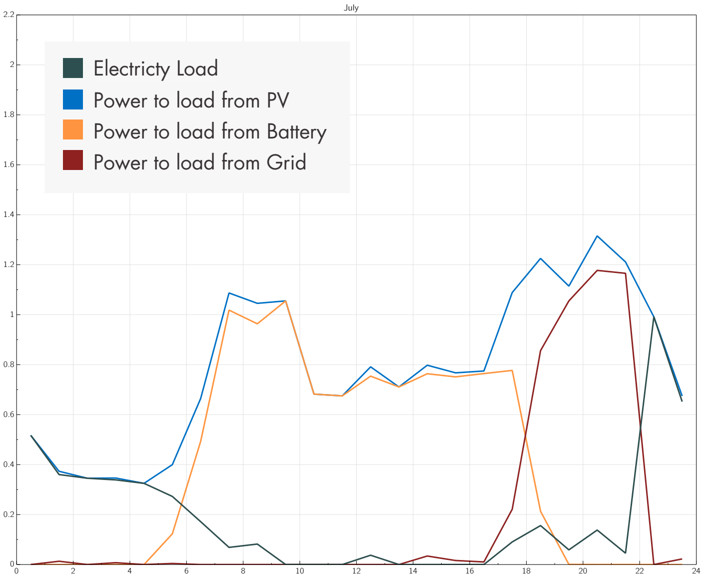




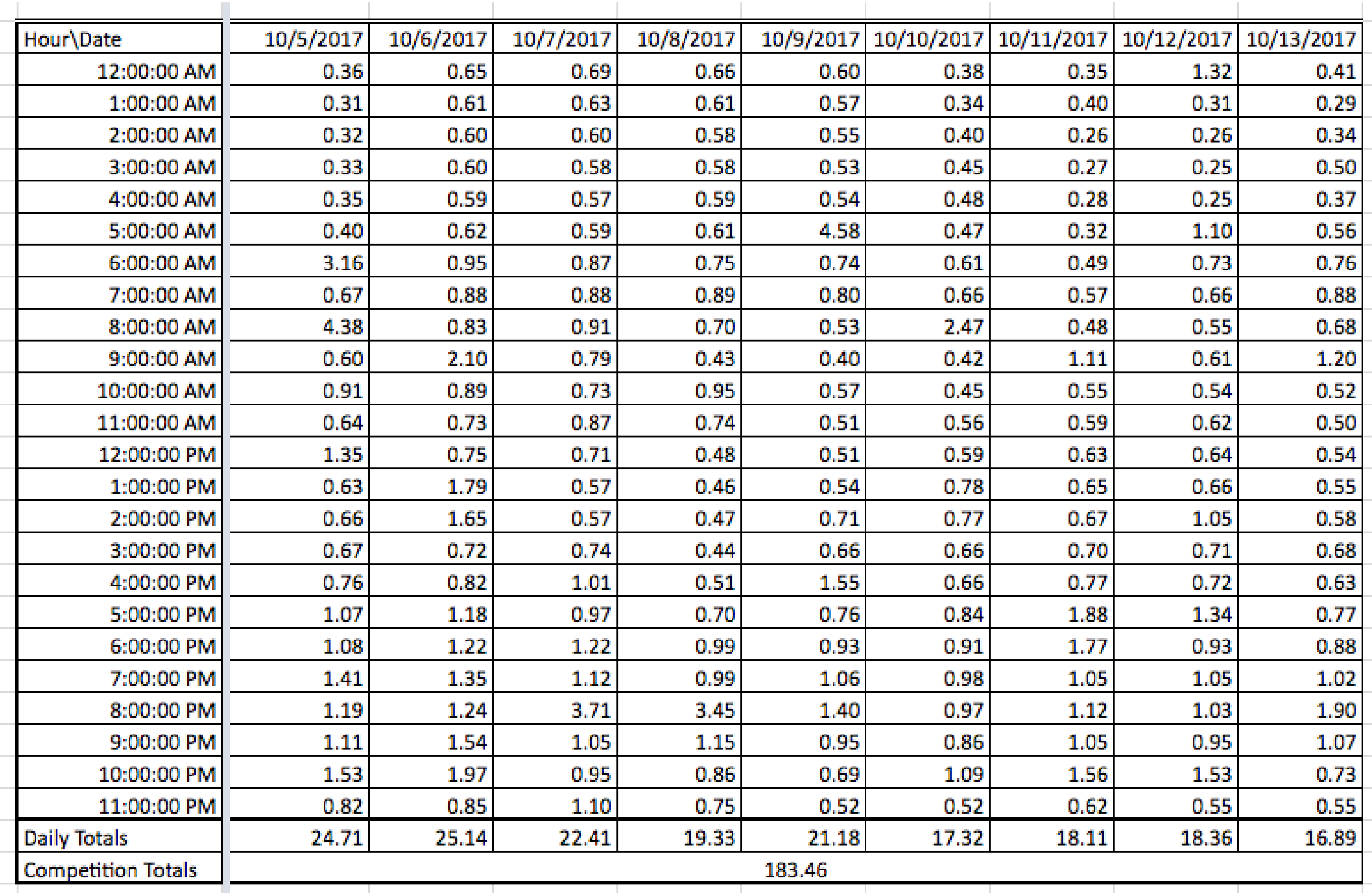




DENVER PV BATTERY & GRID ANALYSIS

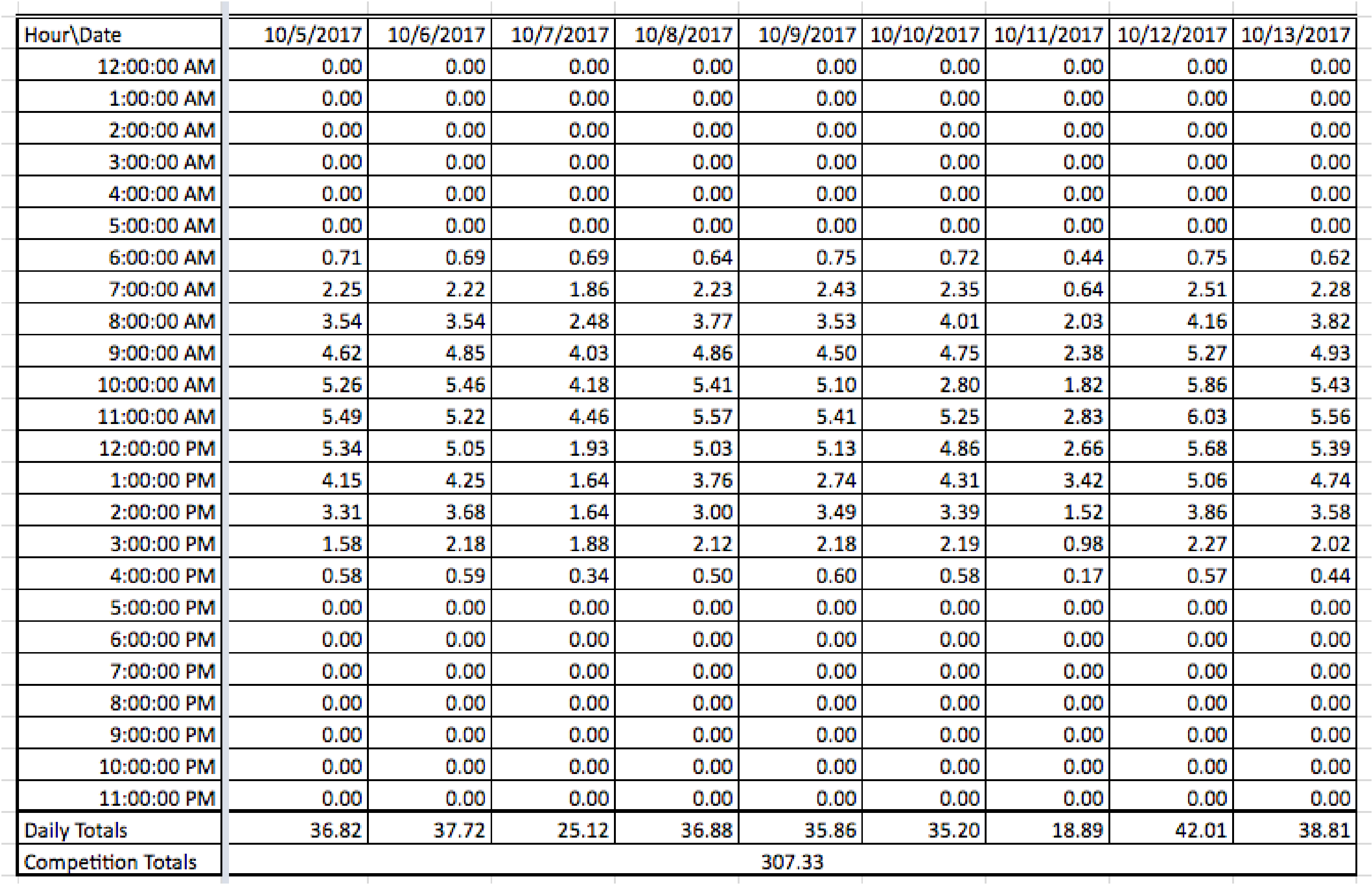


OCTOBER 2017 SOLAR DECATHLON HOUSE LOADS, DENVER, CO



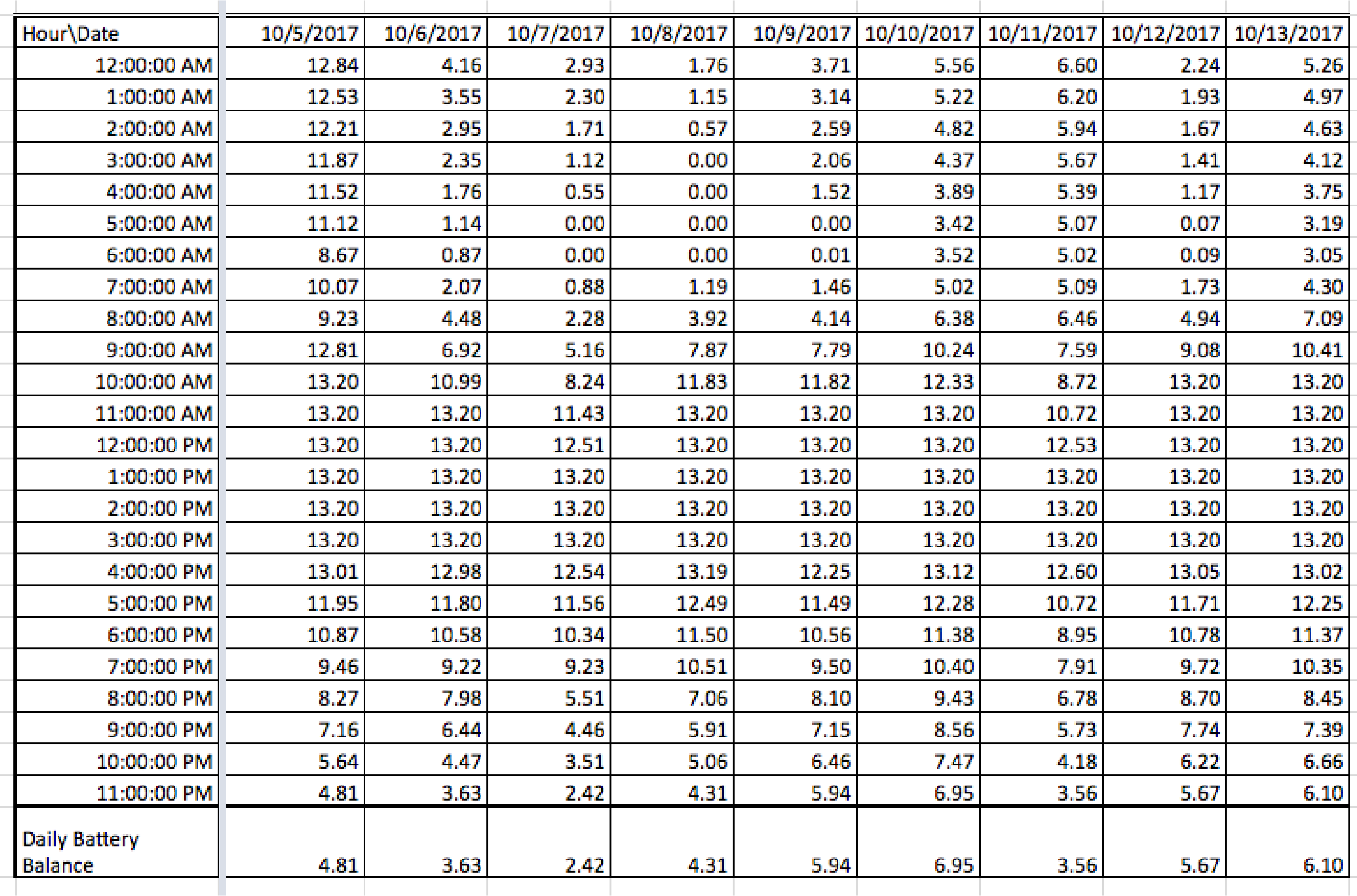
Hour\Date	10/5/2017	10/6/2017	10/7/2017	10/8/2017	10/9/2017	10/10/2017	10/11/2017	10/12/2017	10/13/2017
12:00:00 AM	0.36	0.65	0.69	0.66	0.60	0.38	0.35	1.32	0.41
1:00:00 AM	0.31	0.61	0.63	0.61	0.57	0.34	0.40	0.31	0.29
2:00:00 AM	0.32	0.60	0.60	0.58	0.55	0.40	0.26	0.26	0.34
3:00:00 AM	0.33	0.60	0.58	0.58	0.53	0.45	0.27	0.25	0.50
4:00:00 AM	0.35	0.59	0.57	0.59	0.54	0.48	0.28	0.25	0.37
5:00:00 AM	0.40	0.62	0.59	0.61	4.58	0.47	0.32	1.10	0.56
6:00:00 AM	3.16	0.95	0.87	0.75	0.74	0.61	0.49	0.73	0.76
7:00:00 AM	0.67	0.88	0.88	0.89	0.80	0.66	0.57	0.66	0.88
8:00:00 AM	4.38	0.83	0.91	0.70	0.53	2.47	0.48	0.55	0.68
9:00:00 AM	0.60	2.10	0.79	0.43	0.40	0.42	1.11	0.61	1.20
10:00:00 AM	0.91	0.89	0.73	0.95	0.57	0.45	0.55	0.54	0.52
11:00:00 AM	0.64	0.73	0.87	0.74	0.51	0.56	0.59	0.62	0.50
12:00:00 PM	1.35	0.75	0.71	0.48	0.51	0.59	0.63	0.64	0.54
1:00:00 PM	0.63	1.79	0.57	0.46	0.54	0.78	0.65	0.66	0.55
2:00:00 PM	0.66	1.65	0.57	0.47	0.71	0.77	0.67	1.05	0.58
3:00:00 PM	0.67	0.72	0.74	0.44	0.66	0.66	0.70	0.71	0.68
4:00:00 PM	0.76	0.82	1.01	0.51	1.55	0.66	0.77	0.72	0.63
5:00:00 PM	1.07	1.18	0.97	0.70	0.76	0.84	1.88	1.34	0.77
6:00:00 PM	1.08	1.22	1.22	0.99	0.93	0.91	1.77	0.93	0.88
7:00:00 PM	1.41	1.35	1.12	0.99	1.06	0.98	1.05	1.05	1.02
8:00:00 PM	1.19	1.24	3.71	3.45	1.40	0.97	1.12	1.03	1.90
9:00:00 PM	1.11	1.54	1.05	1.15	0.95	0.86	1.05	0.95	1.07
10:00:00 PM	1.53	1.97	0.95	0.86	0.69	1.09	1.56	1.53	0.73
11:00:00 PM	0.82	0.85	1.10	0.75	0.52	0.52	0.62	0.55	0.55
Daily Totals	24.71	25.14	22.41	19.33	21.18	17.32	18.11	18.36	16.89
Competition Totals	183.46								

OCTOBER 2017 PV PRODUCTION. DENVER, CO.



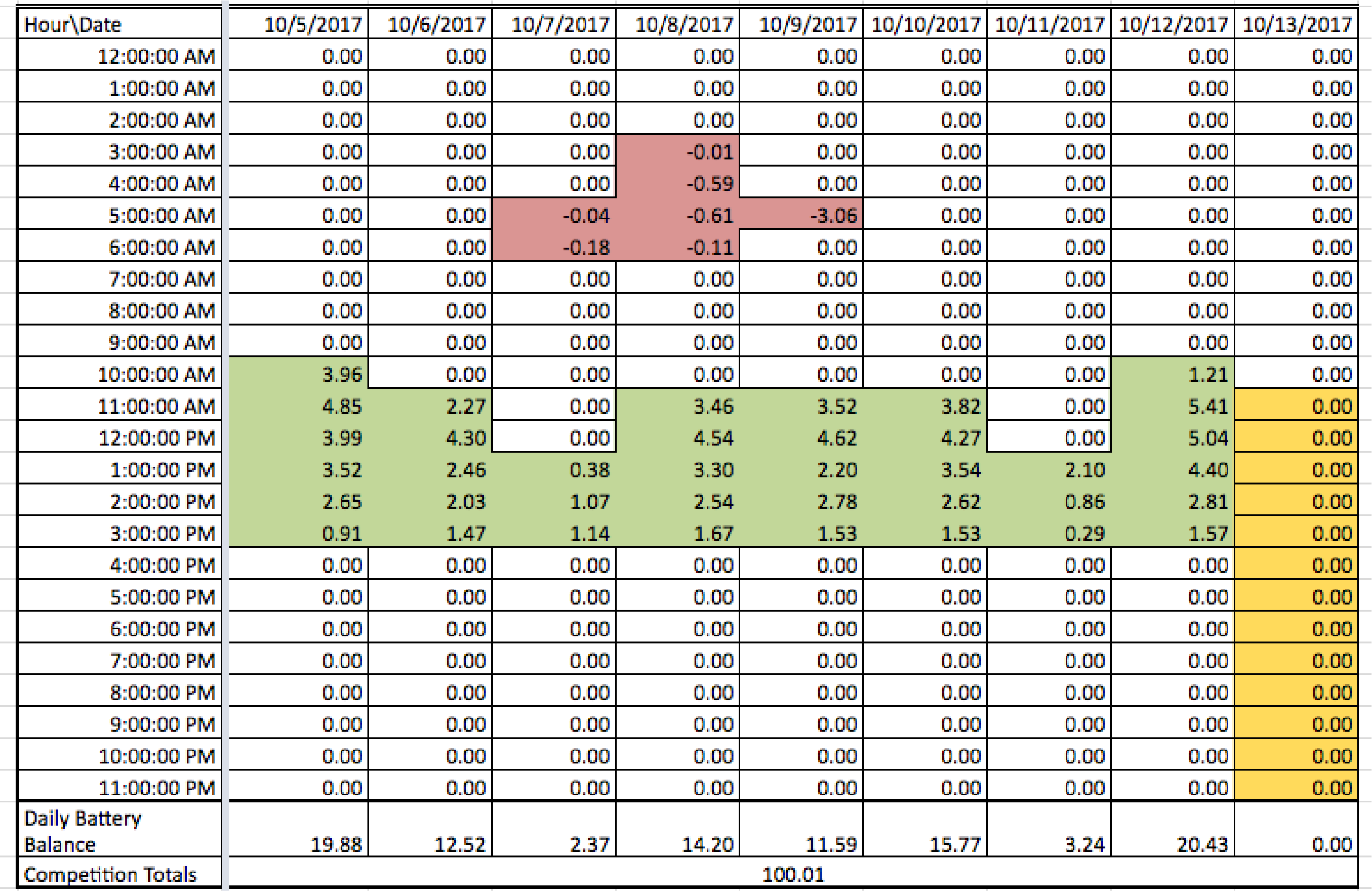
Hour\Date	10/5/2017	10/6/2017	10/7/2017	10/8/2017	10/9/2017	10/10/2017	10/11/2017	10/12/2017	10/13/2017
12:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00 AM	0.71	0.69	0.69	0.64	0.75	0.72	0.44	0.75	0.62
7:00:00 AM	2.25	2.22	1.86	2.23	2.43	2.35	0.64	2.51	2.28
8:00:00 AM	3.54	3.54	2.48	3.77	3.53	4.01	2.03	4.16	3.82
9:00:00 AM	4.62	4.85	4.03	4.86	4.50	4.75	2.38	5.27	4.93
10:00:00 AM	5.26	5.46	4.18	5.41	5.10	2.80	1.82	5.86	5.43
11:00:00 AM	5.49	5.22	4.46	5.57	5.41	5.25	2.83	6.03	5.56
12:00:00 PM	5.34	5.05	1.93	5.03	5.13	4.86	2.66	5.68	5.39
1:00:00 PM	4.15	4.25	1.64	3.76	2.74	4.31	3.42	5.06	4.74
2:00:00 PM	3.31	3.68	1.64	3.00	3.49	3.39	1.52	3.86	3.58
3:00:00 PM	1.58	2.18	1.88	2.12	2.18	2.19	0.98	2.27	2.02
4:00:00 PM	0.58	0.59	0.34	0.50	0.60	0.58	0.17	0.57	0.44
5:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily Totals	36.82	37.72	25.12	36.88	35.86	35.20	18.89	42.01	38.81
Competition Totals	307.33								

OCTOBER 2017 BATTERY ENERGY BALANCE. DENVER, CO.



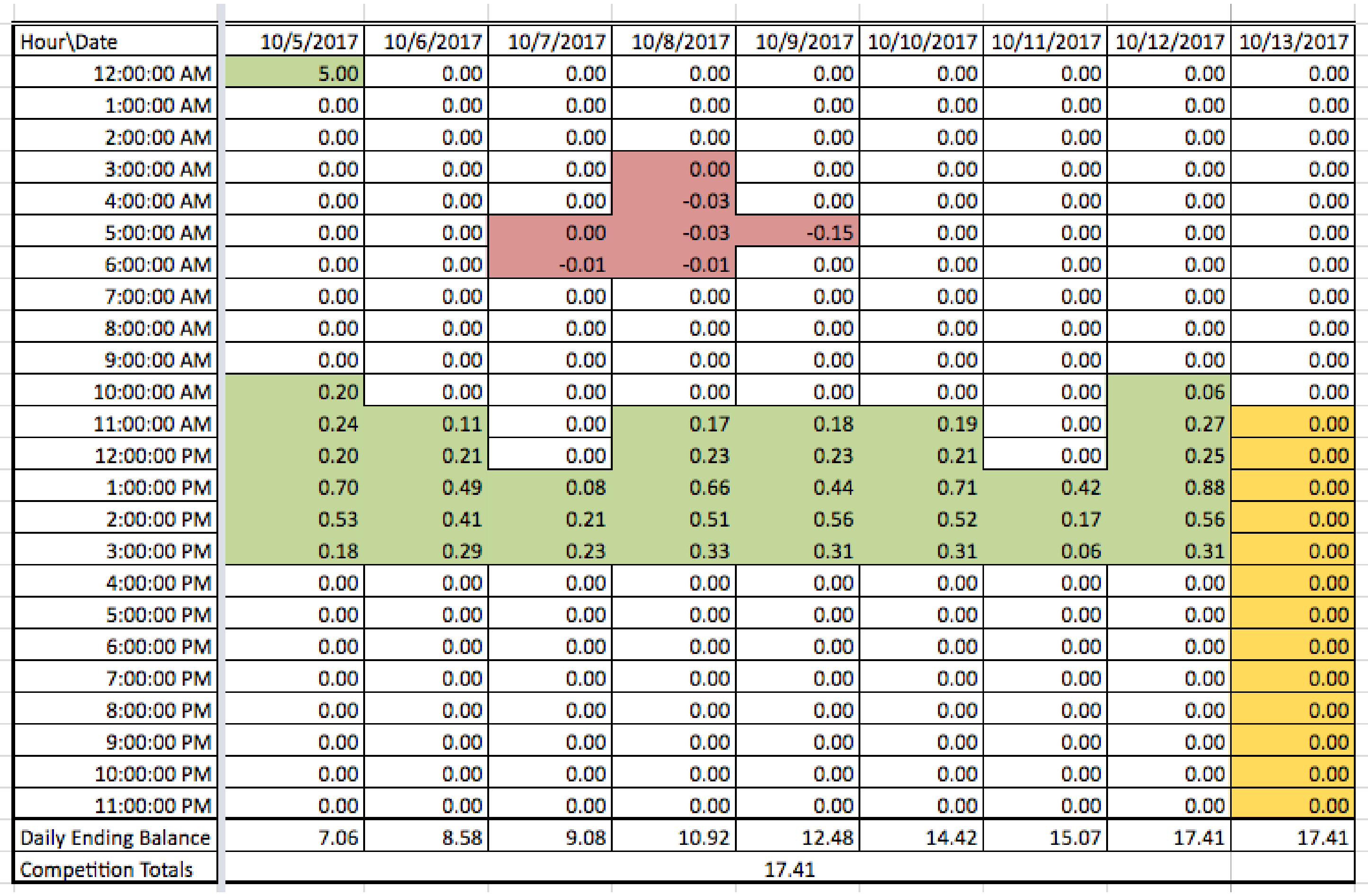
Hour\Date	10/5/2017	10/6/2017	10/7/2017	10/8/2017	10/9/2017	10/10/2017	10/11/2017	10/12/2017	10/13/2017
12:00:00 AM	12.84	4.16	2.93	1.76	3.71	5.56	6.60	2.24	5.26
1:00:00 AM	12.53	3.55	2.30	1.15	3.14	5.22	6.20	1.93	4.97
2:00:00 AM	12.21	2.95	1.71	0.57	2.59	4.82	5.94	1.67	4.63
3:00:00 AM	11.87	2.35	1.12	0.00	2.06	4.37	5.67	1.41	4.12
4:00:00 AM	11.52	1.76	0.55	0.00	1.52	3.89	5.39	1.17	3.75
5:00:00 AM	11.12	1.14	0.00	0.00	0.00	3.42	5.07	0.07	3.19
6:00:00 AM	8.67	0.87	0.00	0.00	0.01	3.52	5.02	0.09	3.05
7:00:00 AM	10.07	2.07	0.88	1.19	1.46	5.02	5.09	1.73	4.30
8:00:00 AM	9.23	4.48	2.28	3.92	4.14	6.38	6.46	4.94	7.09
9:00:00 AM	12.81	6.92	5.16	7.87	7.79	10.24	7.59	9.08	10.41
10:00:00 AM	13.20	10.99	8.24	11.83	11.82	12.33	8.72	13.20	13.20
11:00:00 AM	13.20	13.20	11.43	13.20	13.20	13.20	10.72	13.20	13.20
12:00:00 PM	13.20	13.20	12.51	13.20	13.20	13.20	12.53	13.20	13.20
1:00:00 PM	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20
2:00:00 PM	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20
3:00:00 PM	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20
4:00:00 PM	13.01	12.98	12.54	13.19	12.25	13.12	12.60	13.05	13.02
5:00:00 PM	11.95	11.80	11.56	12.49	11.49	12.28	10.72	11.71	12.25
6:00:00 PM	10.87	10.58	10.34	11.50	10.56	11.38	8.95	10.78	11.37
7:00:00 PM	9.46	9.22	9.23	10.51	9.50	10.40	7.91	9.72	10.35
8:00:00 PM	8.27	7.98	5.51	7.06	8.10	9.43	6.78	8.70	8.45
9:00:00 PM	7.16	6.44	4.46	5.91	7.15	8.56	5.73	7.74	7.39
10:00:00 PM	5.64	4.47	3.51	5.06	6.46	7.47	4.18	6.22	6.66
11:00:00 PM	4.81	3.63	2.42	4.31	5.94	6.95	3.56	5.67	6.10
Daily Battery Balance	4.81	3.63	2.42	4.31	5.94	6.95	3.56	5.67	6.10

OCTOBER 2017 GRID USE/EXPORT. DENVER, CO.



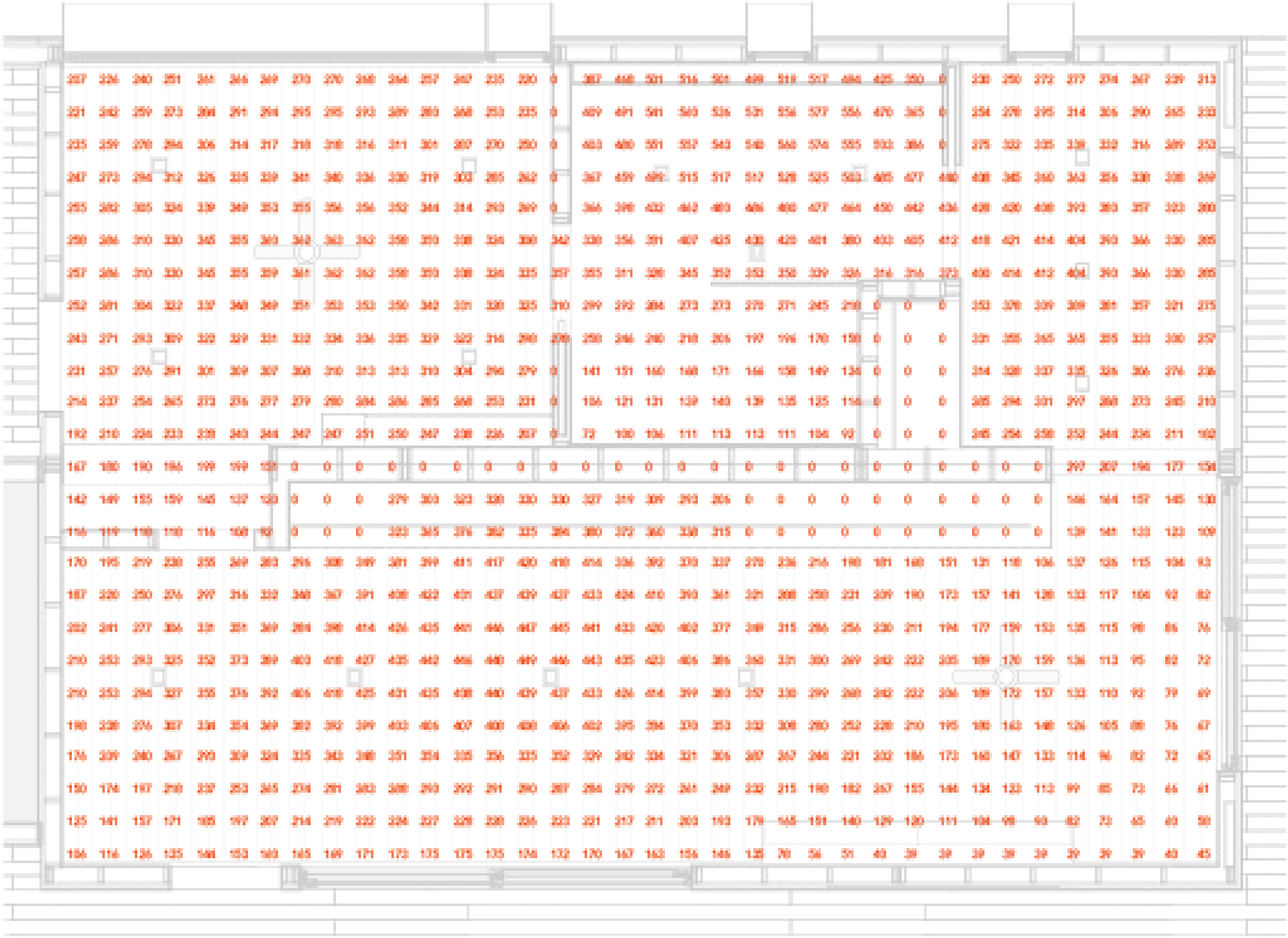
Hour\Date	10/5/2017	10/6/2017	10/7/2017	10/8/2017	10/9/2017	10/10/2017	10/11/2017	10/12/2017	10/13/2017
12:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:00:00 AM	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00
4:00:00 AM	0.00	0.00	0.00	-0.59	0.00	0.00	0.00	0.00	0.00
5:00:00 AM	0.00	0.00	-0.04	-0.61	-3.06	0.00	0.00	0.00	0.00
6:00:00 AM	0.00	0.00	-0.18	-0.11	0.00	0.00	0.00	0.00	0.00
7:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10:00:00 AM	3.96	0.00	0.00	0.00	0.00	0.00	0.00	1.21	0.00
11:00:00 AM	4.85	2.27	0.00	3.46	3.52	3.82	0.00	5.41	0.00
12:00:00 PM	3.99	4.30	0.00	4.54	4.62	4.27	0.00	5.04	0.00
1:00:00 PM	3.52	2.46	0.38	3.30	2.20	3.54	2.10	4.40	0.00
2:00:00 PM	2.65	2.03	1.07	2.54	2.78	2.62	0.86	2.81	0.00
3:00:00 PM	0.91	1.47	1.14	1.67	1.53	1.53	0.29	1.57	0.00
4:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily Battery Balance	19.88	12.52	2.37	14.20	11.59	15.77	3.24	20.43	0.00
Competition Totals	100.01								

OCTOBER 2017 ACCOUNT BALANCE ($). DENVER, CO.



Hour\Date	10/5/2017	10/6/2017	10/7/2017	10/8/2017	10/9/2017	10/10/2017	10/11/2017	10/12/2017	10/13/2017
12:00:00 AM	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00 AM	0.00	0.00	0.00	-0.03	0.00	0.00	0.00	0.00	0.00
5:00:00 AM	0.00	0.00	0.00	-0.03	-0.15	0.00	0.00	0.00	0.00
6:00:00 AM	0.00	0.00	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00
7:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9:00:00 AM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10:00:00 AM	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00
11:00:00 AM	0.24	0.11	0.00	0.17	0.18	0.19	0.00	0.27	0.00
12:00:00 PM	0.20	0.21	0.00	0.23	0.23	0.21	0.00	0.25	0.00
1:00:00 PM	0.70	0.49	0.08	0.66	0.44	0.71	0.42	0.88	0.00
2:00:00 PM	0.53	0.41	0.21	0.51	0.56	0.52	0.17	0.56	0.00
3:00:00 PM	0.18	0.29	0.23	0.33	0.31	0.31	0.06	0.31	0.00
4:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11:00:00 PM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daily Ending Balance	7.06	8.58	9.08	10.92	12.48	14.42	15.07	17.41	17.41
Competition Totals	17.41								

POINT LOCATION LUX VALUES



AVG. 300 LUX

MAKING COMPARISONS - Homes in Las Vegas

TYPICAL HOME IN LAS VEGAS

12031 kWh/year

VS

TEAM LAS VEGAS

4674 kWh/year