

# DOE Commercial Building Energy Asset Score: Software Development for Phase II Building Types

## Operational and Equipment Sizing Assumptions<sup>1</sup>

To estimate a building's energy use per year, the Asset Scoring Tool applies standard assumptions concerning how the building is operated. To allow building owners and operators to understand how well these assumptions reflect their building's actual operations, the following tables provide a simplified list of assumptions used for each building type.

These tables reflect the full-time equivalent occupancy hours assumed for each building type, but a building's level of operations varies according to the day of the week, hour of the day, and even by season in cases such as schools. To accommodate the fact that operations fluctuate, the Asset Scoring Tool applies a specific set of operational assumptions to every hour of the year, depending on each building type. Precise schedules of these assumptions are presented in the appendix at the end of this document.

To get an overall idea of the assumptions used to estimate a building's energy use, consult the tables. For a more granular understanding of the assumptions, see the graphs in the appendix.

## Operational Assumptions

### Schedules of Operation

	Occupancy Schedule <sup>2</sup> (hrs/wk)	Lighting Schedule (hrs/wk)	Equipment Schedule (hrs/wk)	Service Hot Water Schedule (hrs/wk)	Heating Temperature Setpoints (°F)	Cooling Temperature Setpoints (°F)
<b>School</b>	41.75	80.38	85.8	29.05	70	75
<b>Office</b>	48.6	56	86.15	27.7	70	75
<b>Retail</b>	46.3	70.85	89.40	38.6	70	75
<b>Warehouse</b>	0	54.5	60	0	60	80
<b>Hotel</b>	106	69	57.7	55.6	70	70
<b>Apartment</b>	115	55	111	88	70	75
<b>Courthouse</b>	49	56.5	86	28	70	75
<b>Library</b>	46	69	88	38.5	70	75

<sup>1</sup> Operational assumptions listed here are based on ASHRAE Standard 90.1 2013 (to be published) and ASHRAE Standard 90.1 Prototype Building Model. New operational assumptions will be developed as other building types are added to the Asset Scoring Tool. Furthermore, some of the assumptions listed here are under review and may be modified to better reflect standard building operations.

<sup>2</sup> Closing times reflect those hours when occupant density is less than 20 percent and are only used for illustrative purposes.

## Internal Loads

	Occupant Density (sq ft/occupant)	Equipment Power Density (plug and process loads) (W/sq ft)
School	40	1.39
Office	200	0.75
Retail	67	0.30
Warehouse	N.A.	0.66
Hotel	250	1.11
Apartment	380	0.62
Courthouse	14	0.25
Library	100	1.5

## Outdoor Air Ventilation Rates

	Outdoor Air Ventilation Rates
School	<ul style="list-style-type: none"> <li>• 0.12 cfm/sq ft (for classroom)</li> <li>• 10 cfm/occupant (occ)</li> <li>• 0.339 cfm/sq ft (calculated outdoor air ventilation rate for building)</li> </ul>
Office	<ul style="list-style-type: none"> <li>• 0.06 cfm/sq ft (for office space)</li> <li>• 5 cfm/occ</li> <li>• 0.085 cfm/sq ft (calculated outdoor air ventilation rate for building)</li> </ul>
Retail	<ul style="list-style-type: none"> <li>• 0.12 cfm/sq ft (for sales space)</li> <li>• 7.5 cfm/occ</li> <li>• 0.21 cfm/sq ft (calculated outdoor air ventilation rate for building)</li> </ul>
Warehouse	<ul style="list-style-type: none"> <li>• 0.06 cfm/sq.ft</li> </ul>
Hotel	<ul style="list-style-type: none"> <li>• 0.06 cfm/sq ft (for rooms)</li> <li>• 5 cfm/occ</li> <li>• 0.08 cfm/sq ft (calculated outdoor air ventilation rate for building)</li> </ul>
Apartment	<ul style="list-style-type: none"> <li>• 0.06 cfm/sq ft (calculated outdoor air ventilation rate for building)</li> </ul>
Courthouse	<ul style="list-style-type: none"> <li>• 0.41 cfm/sq ft (calculated outdoor air ventilation rate for building)</li> </ul>
Library	<ul style="list-style-type: none"> <li>• 0.11 cfm/sq ft (calculated outdoor air ventilation rate for building)</li> </ul>

## Service Hot Water Use (for faucets/shower heads, etc.)

	Service Hot Water Use
<b>School</b>	1.2 gal/day/occ <sup>3</sup>
<b>Office</b>	1 gal/day/occ
<b>Retail</b>	0.61 gal/day/occ
<b>Warehouse</b>	0.61 gal/day/occ
<b>Hotel</b>	14 gal/day/occ <sup>4</sup>
<b>Apartment</b>	40 gal/day/dwelling unit <sup>5</sup>
<b>Courthouse</b>	0.26 gal/day/occ
<b>Library</b>	0.18 gal/day/occ

<sup>3</sup> COMNET specifies this value as 0.61 gal/day/occupant for k-12 schools and 1.8 gal/day/occupant for high schools. An average of 1.2 gals/day/occupant is assumed for all schools.

<sup>4</sup> COMNET specifies this value in accordance with number of rooms. For hotels with less than 20 rooms, a value of 20 gal/day/occupant is prescribed, for 20-100 rooms, 14 gal/day/occupant, for greater than 100 rooms, 10 gal/day/occupant. An average for 20-100 rooms is assumed.

<sup>5</sup> Assuming each dwelling unit to be 1,000 sq ft

## Equipment Sizing<sup>6</sup>

### Heating and Cooling Equipment

- Cooling and Heating Capacity
- Sensible Heat Ratio
- Supply Air flow rate
- CHW and HW Loops: Maximum flow rate

Heating and cooling equipment is automatically sized based on the assumed internal loads specified above. The equipment capacity used in the energy model is based on the standard operation assumptions and does not reflect the actual equipment capacity. A building may have larger equipment to meet the specifically designed loads.

### Ventilation Equipment

Maximum and minimum outdoor air flow rate are automatically calculated by the software based on the design outdoor air requirements specified.

### Fans

Maximum air flow rate for fans is autosized in the simulation software based on the system loads.

### Pumps

Rated flow rate is autosized based on plant loads.

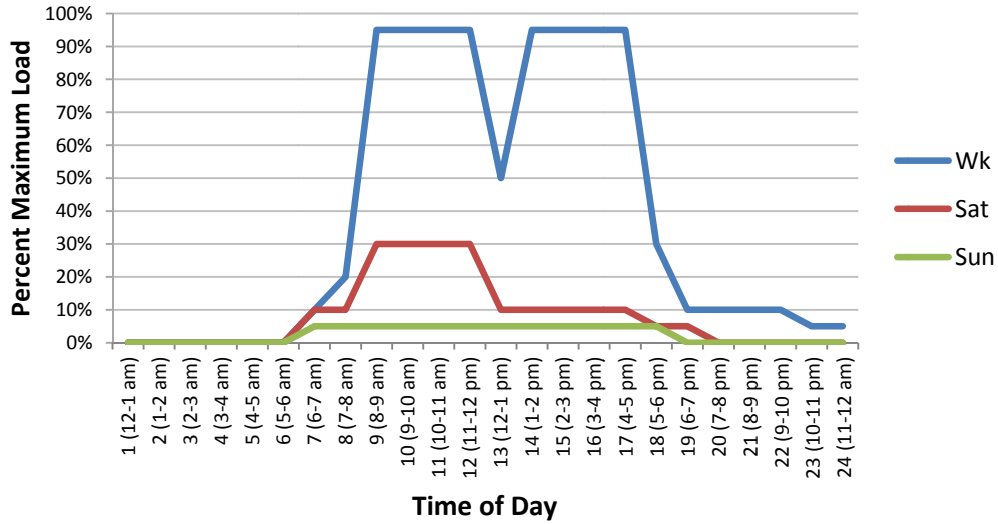
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<sup>6</sup> The scoring tool assumes that the energy equipment listed here is sized specifically to meet the load requirements corresponding to the operational assumptions.

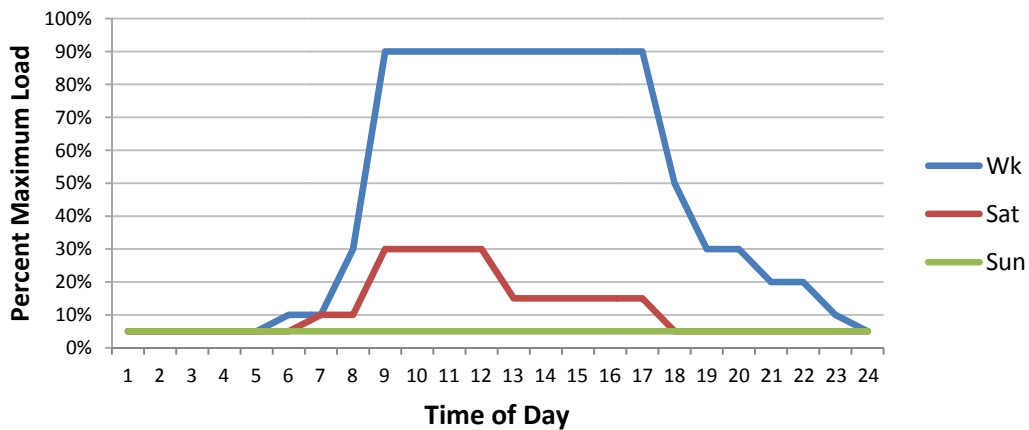
## Appendix: Schedules for Each Building Type

### Office Building

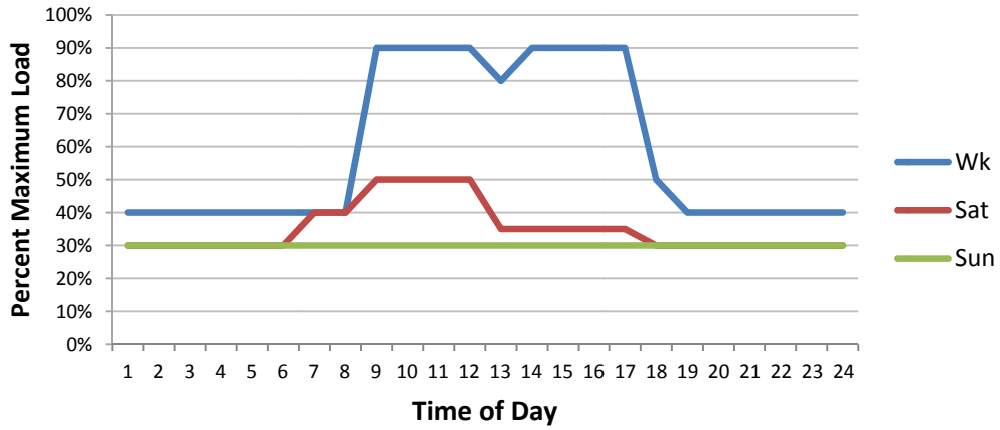
#### Office: Occupancy



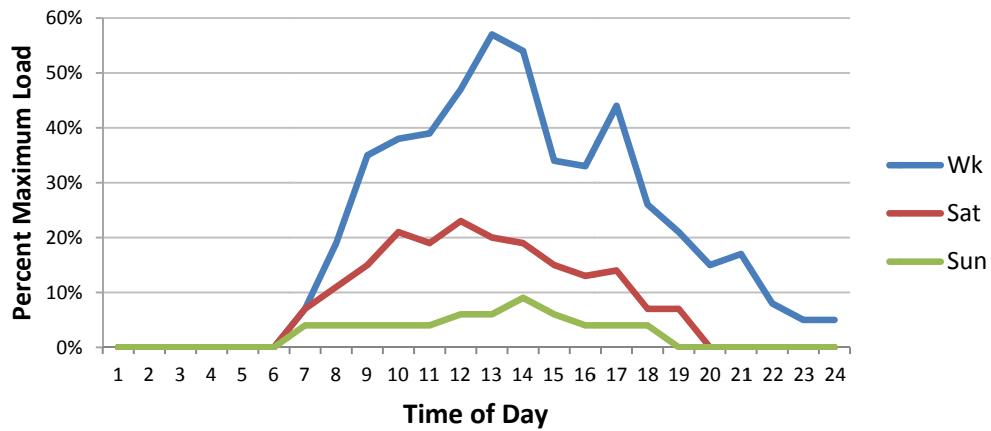
#### Office: Lighting



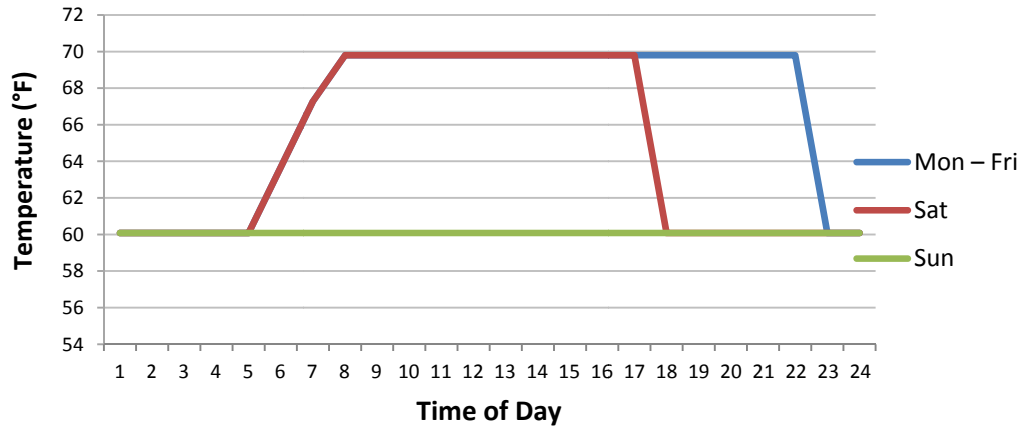
### Office: Equipment



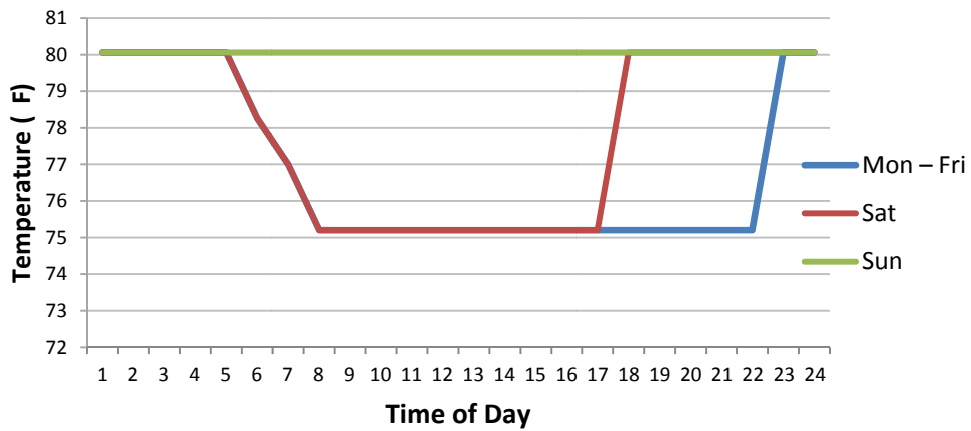
### Office: Service Hot Water



### Office: Heating Setpoint

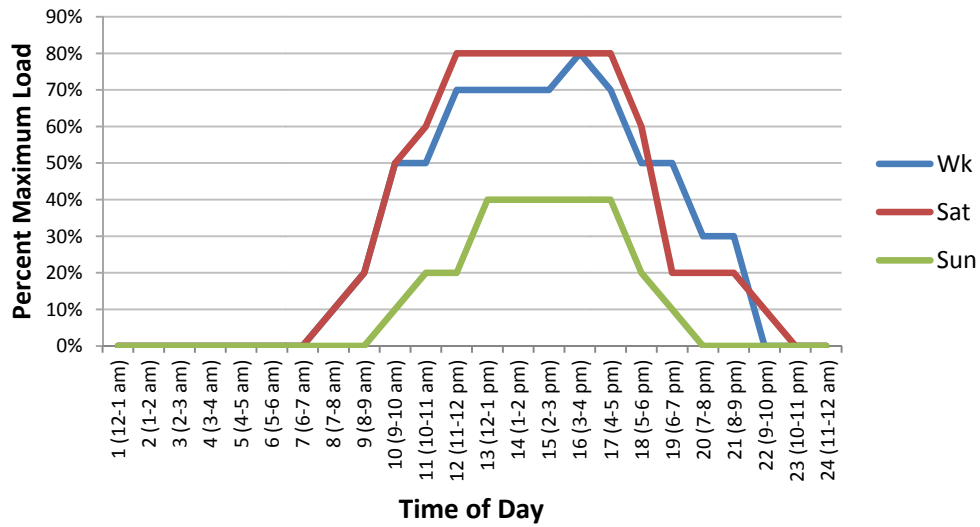


### Office: Cooling Setpoint

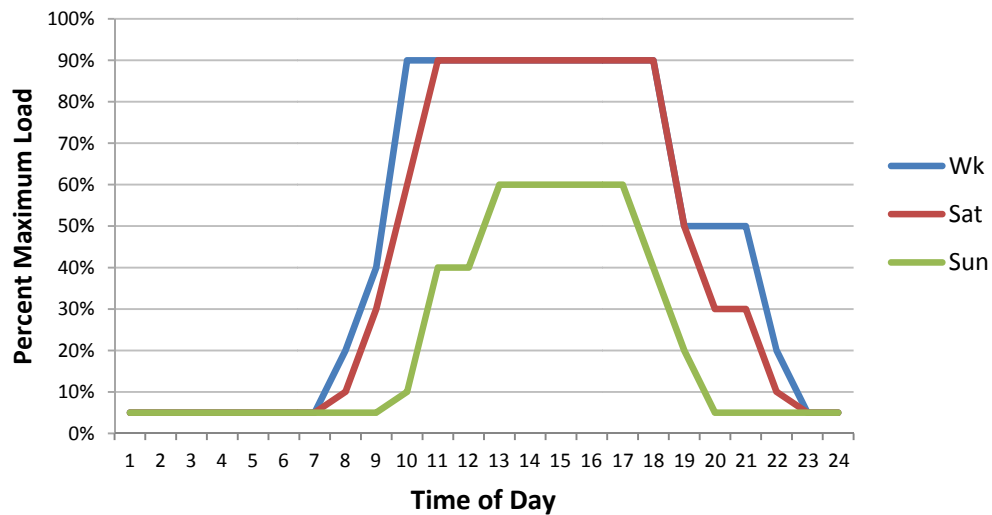


## Retail Building

### Retail: Occupancy

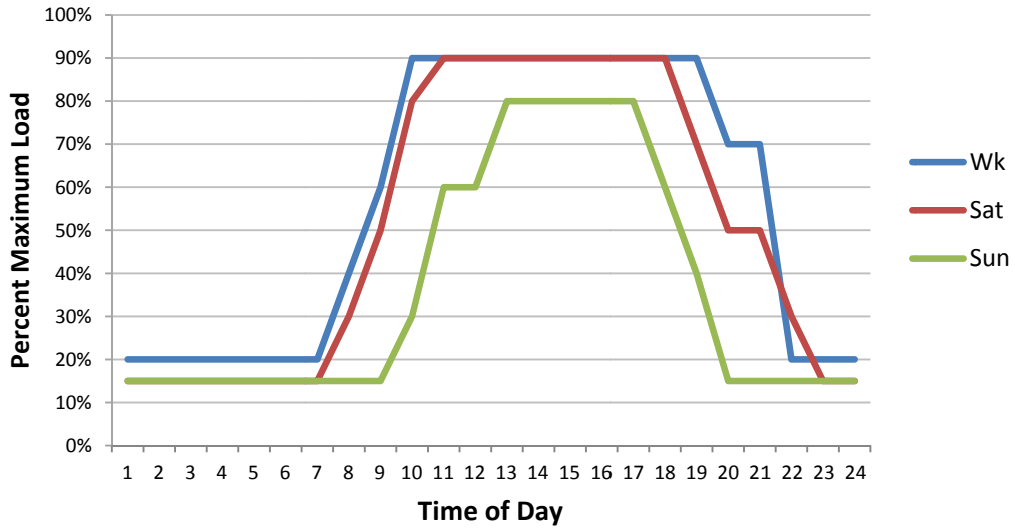


### Retail: Lighting

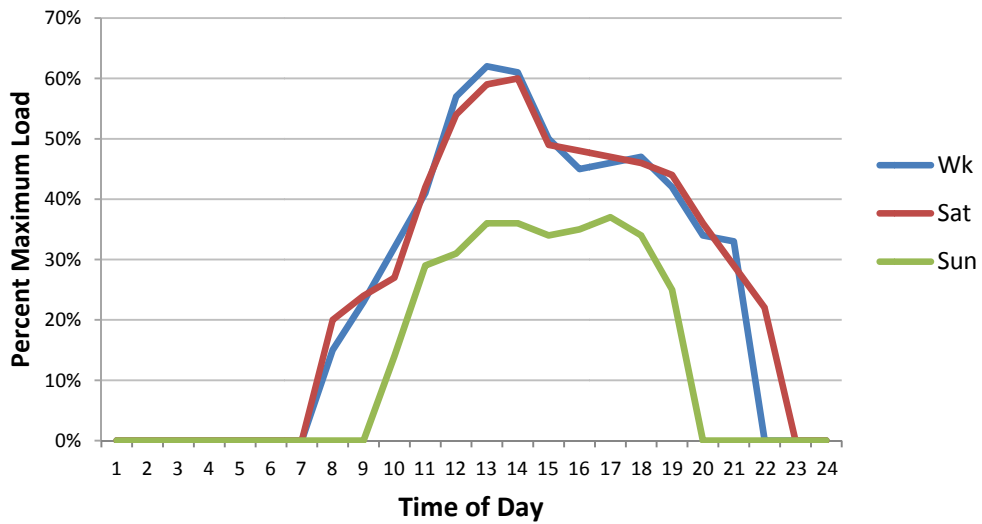




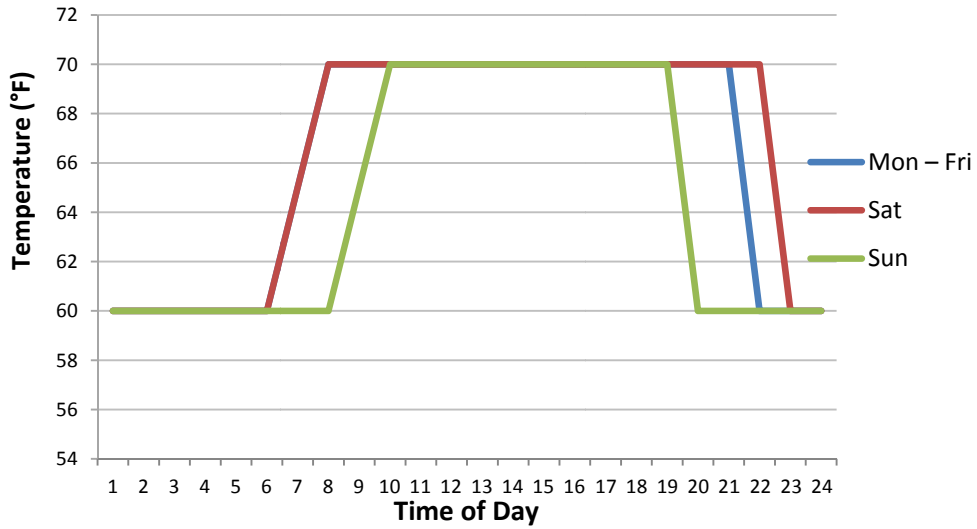
### Retail: Equipment



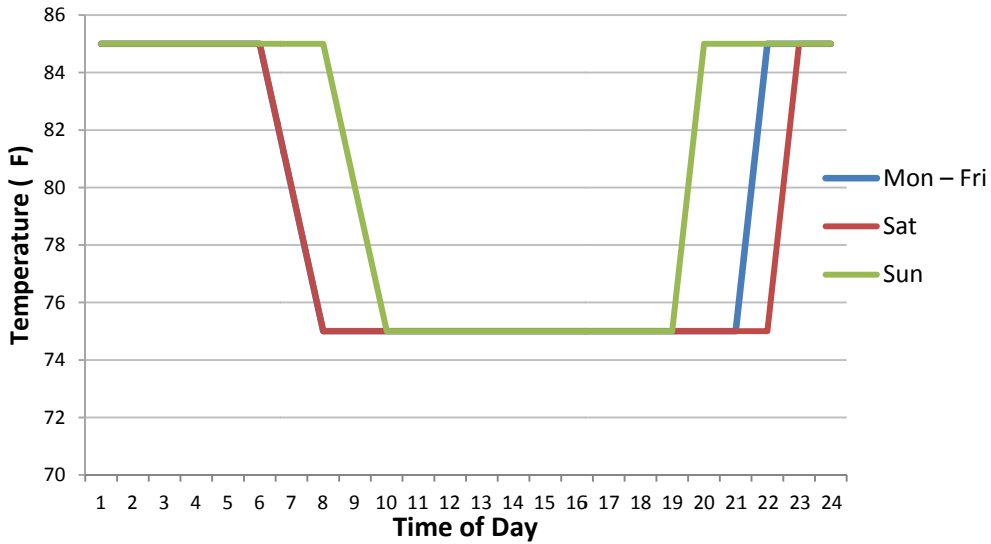
### Retail: Service Hot Water



### Retail: Heating Setpoint

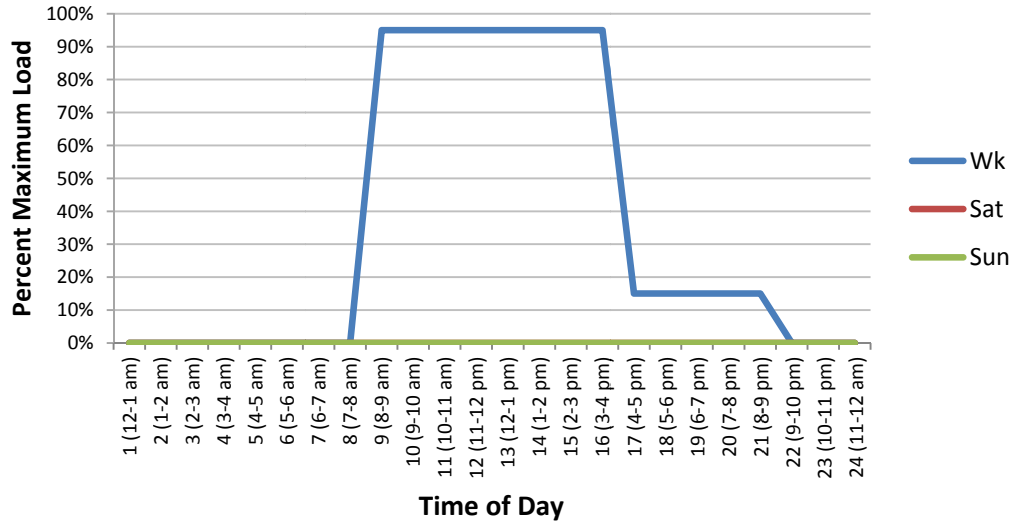


### Retail: Cooling Setpoint

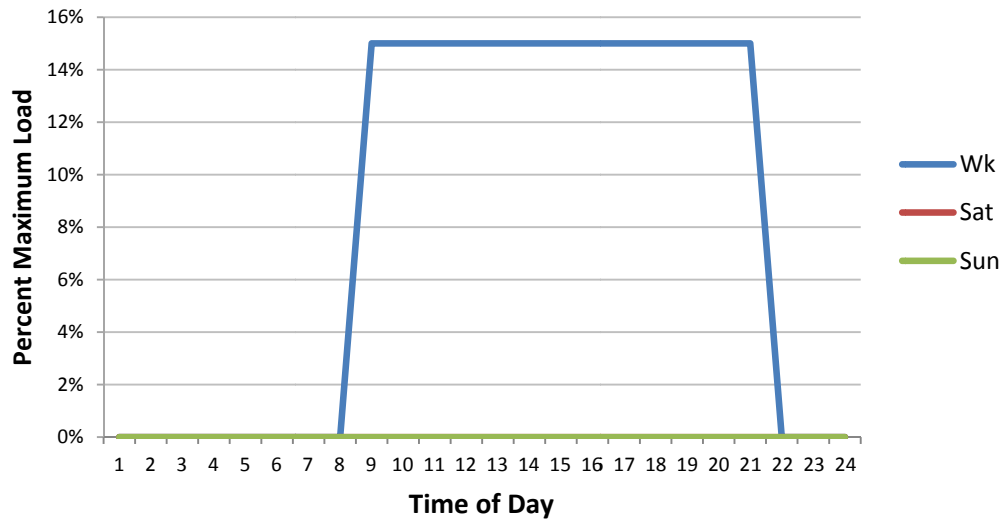


## School

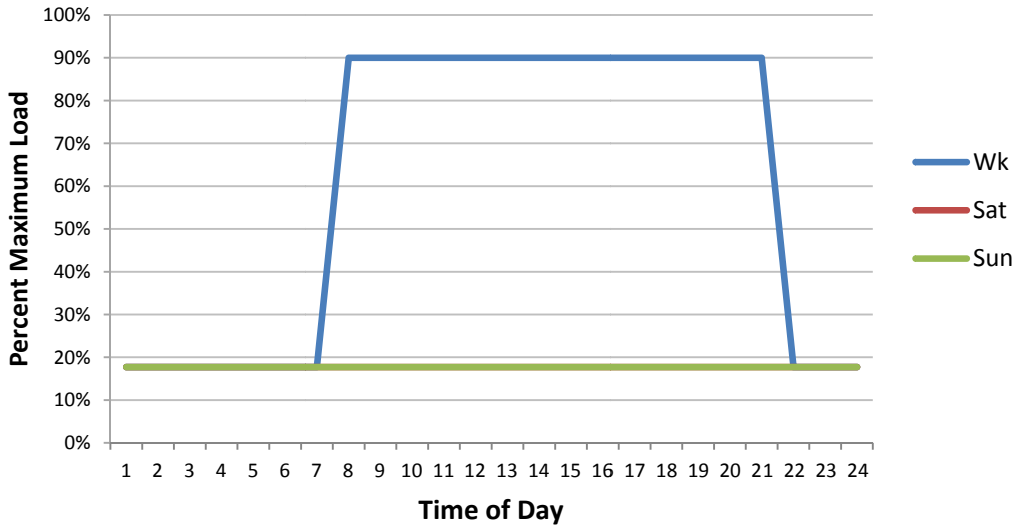
### School: Occupancy



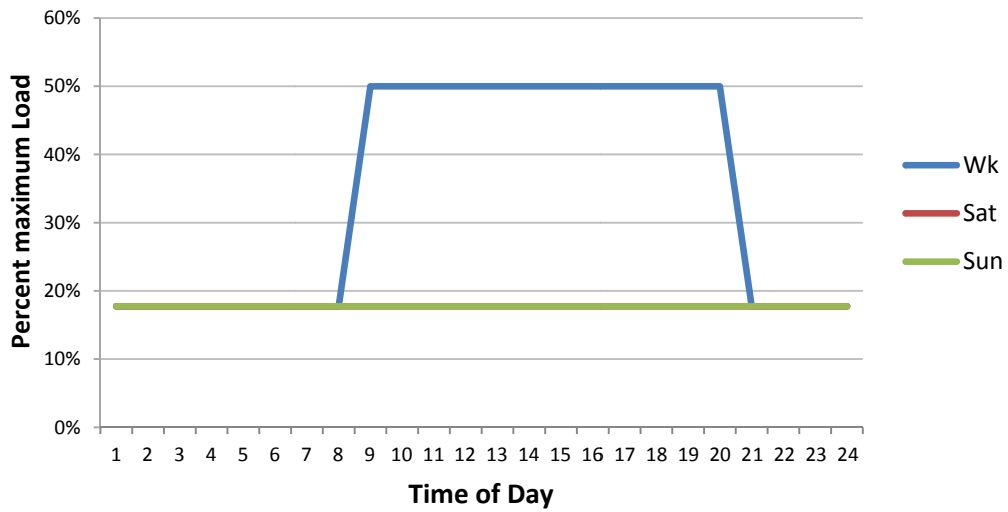
### School: Seasonal Occupancy



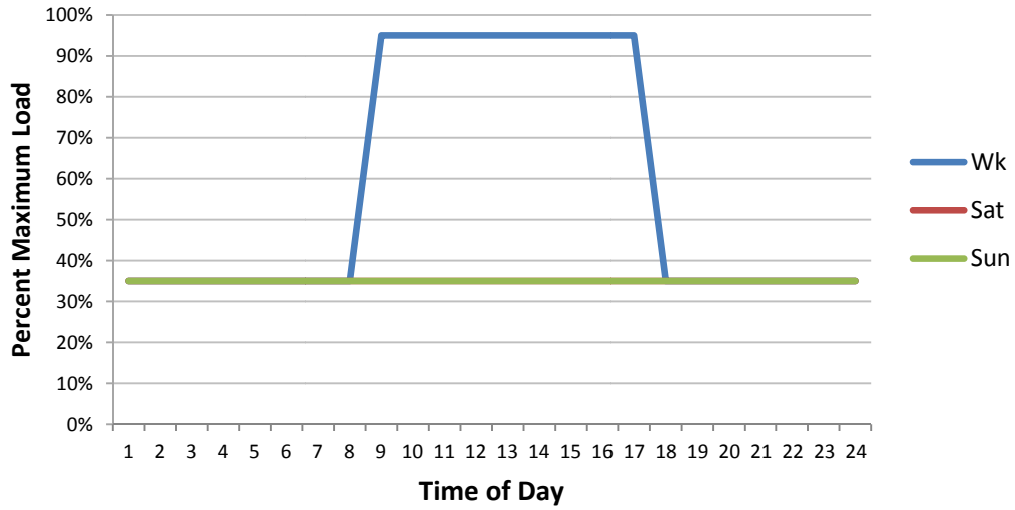
### School: Lighting



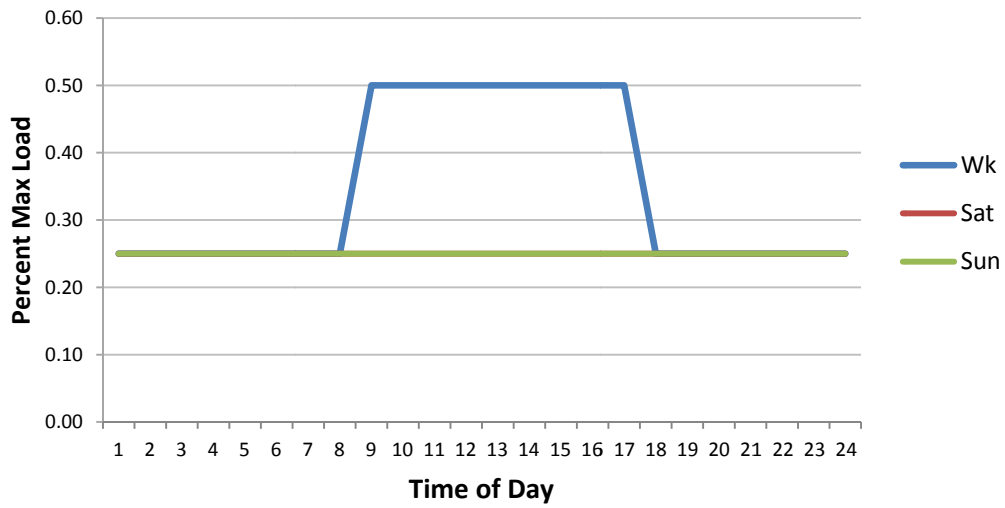
### School: Seasonal Lighting



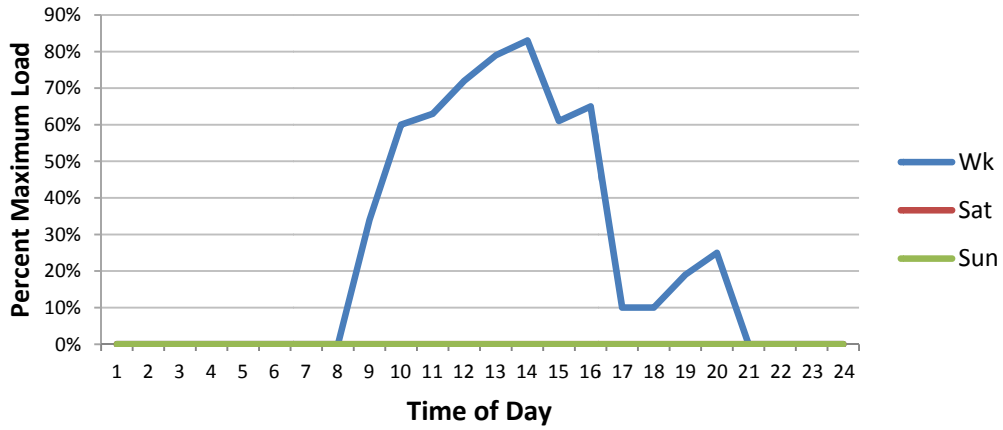
### School: Equipment



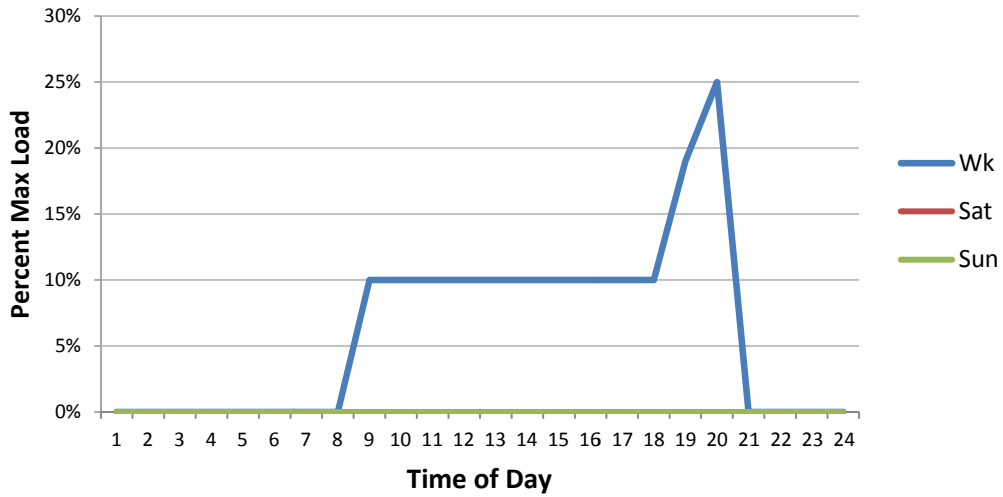
### School: Seasonal Equipment



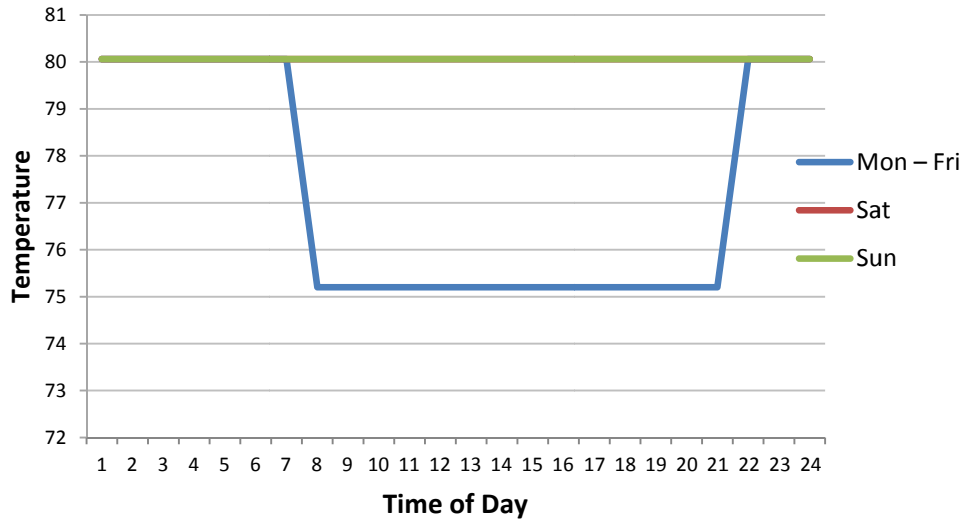
### School: Service Hot Water



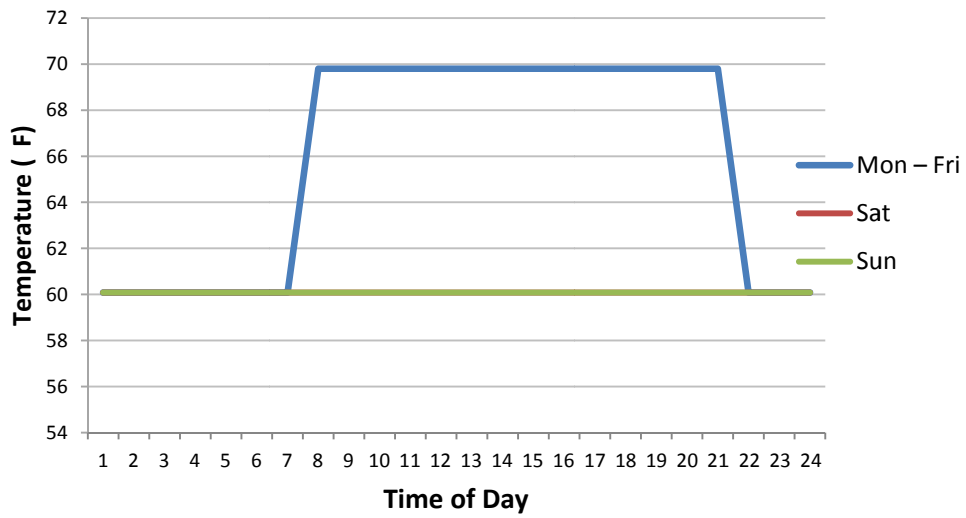
### School: Seasonal Service Hot Water



### School: Cooling Setpoint

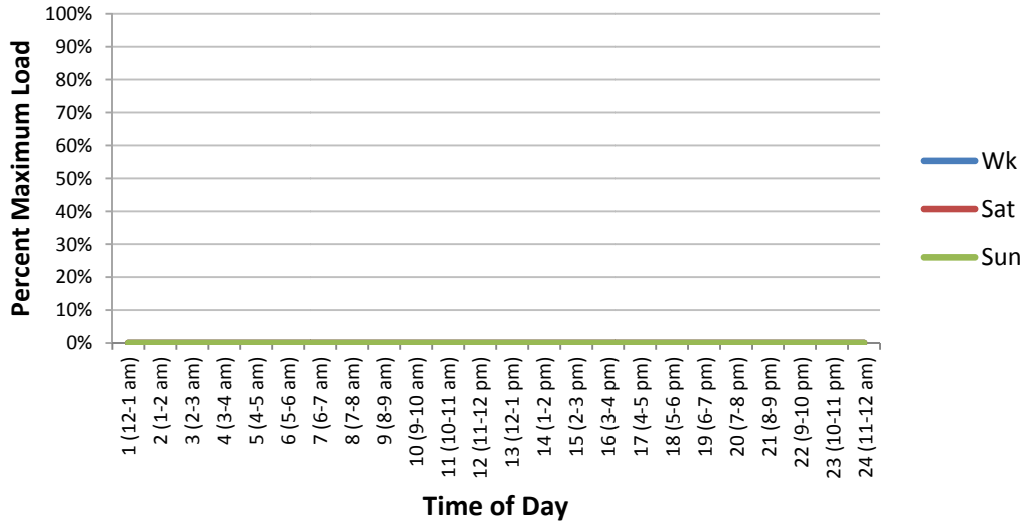


### School: Heating Setpoint

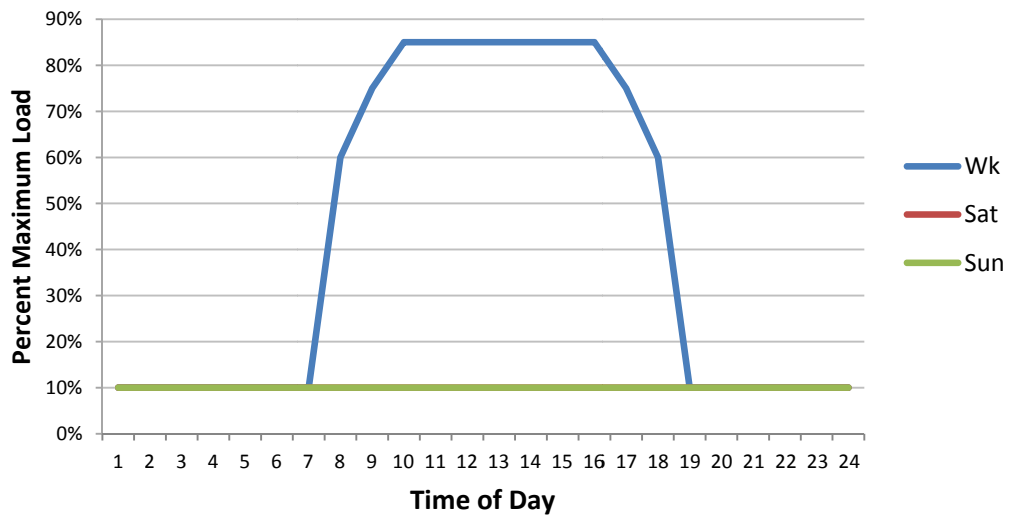


## Warehouse

### Warehouse: Occupancy

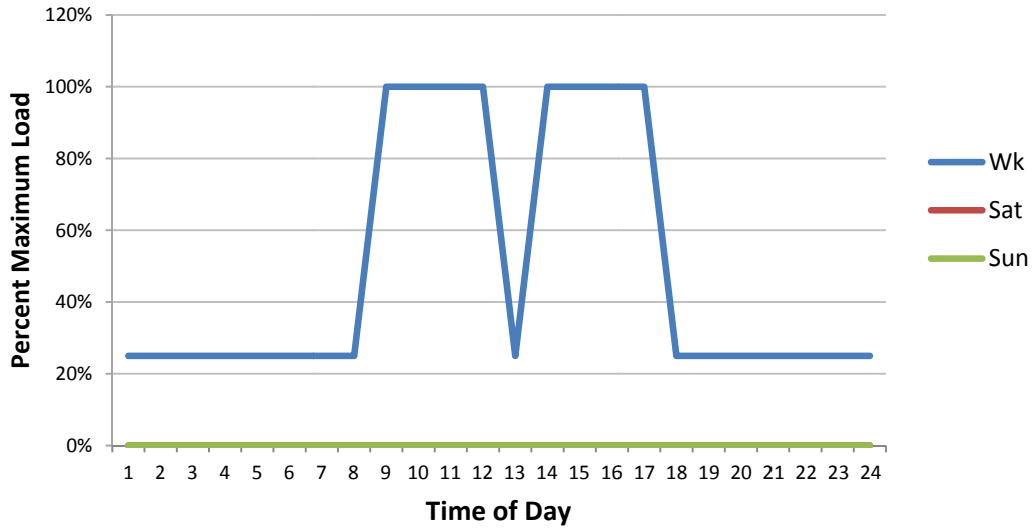


### Warehouse: Lighting

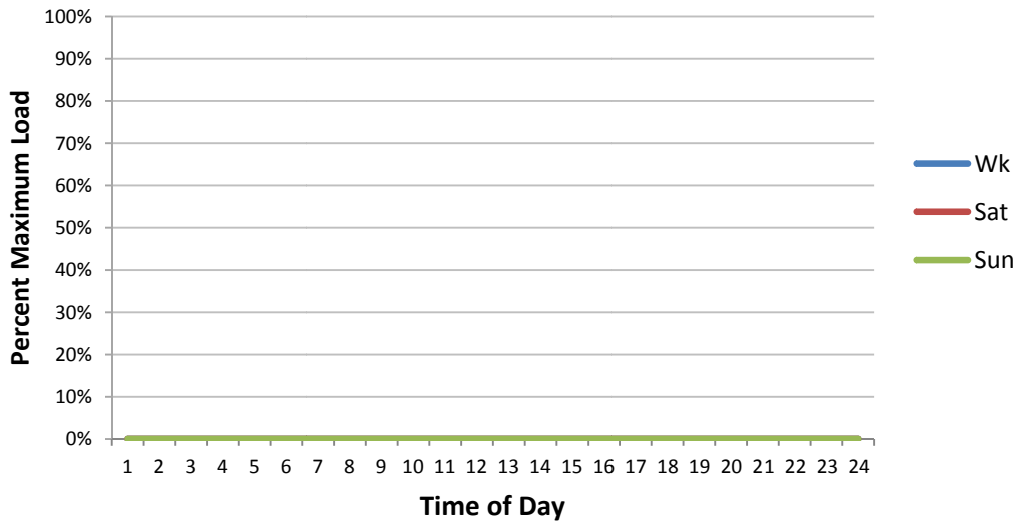




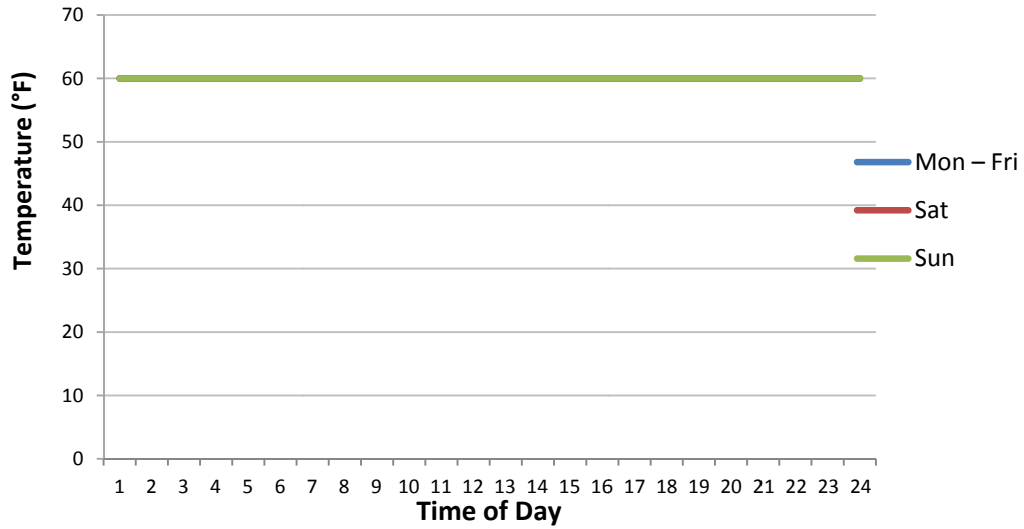
### Warehouse: Equipment



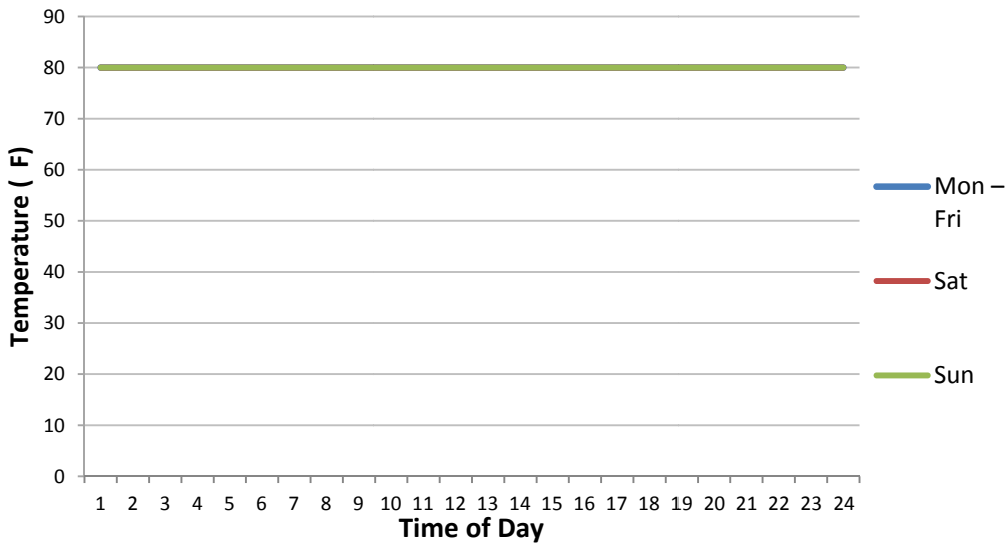
### Warehouse: Service Hot Water



### Warehouse: Heating Setpoint

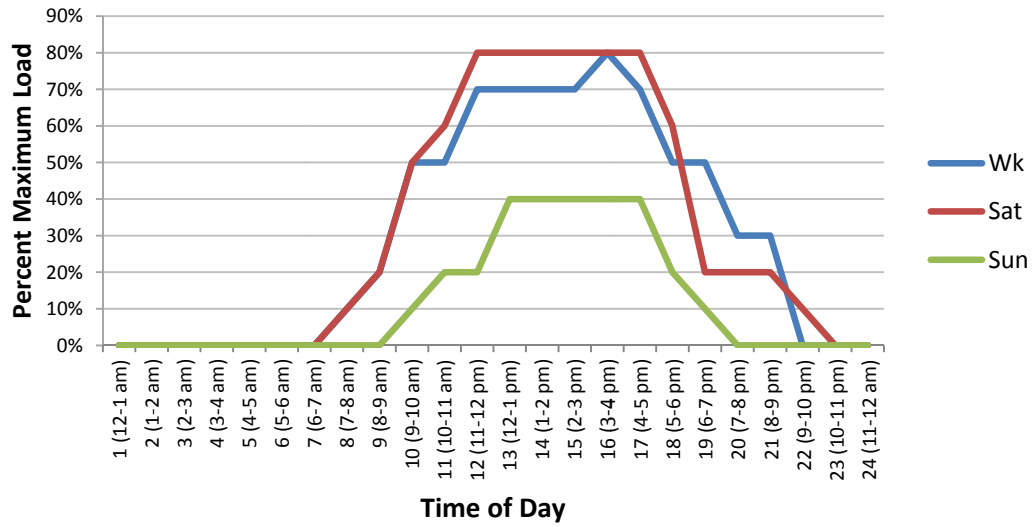


### Warehouse: Cooling Setpoint

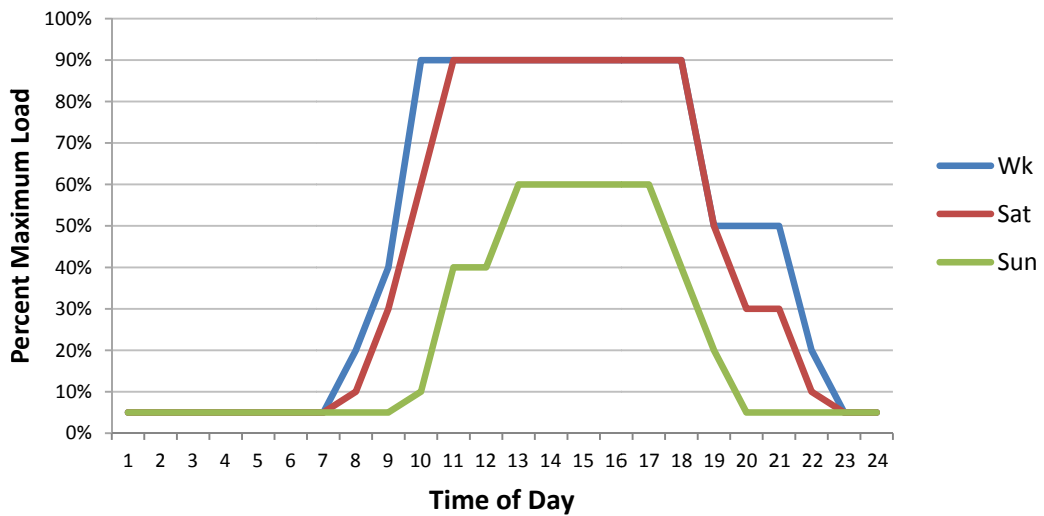


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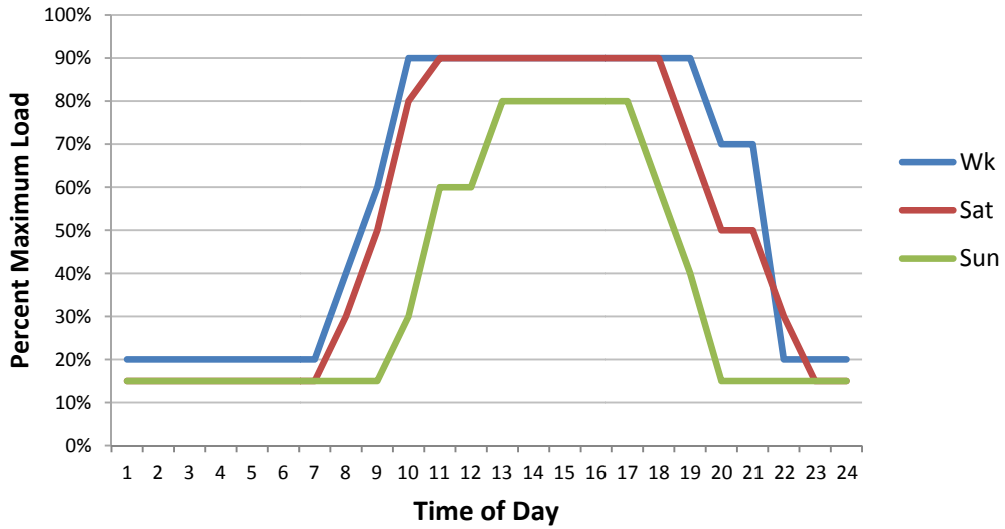
### Library: Occupancy



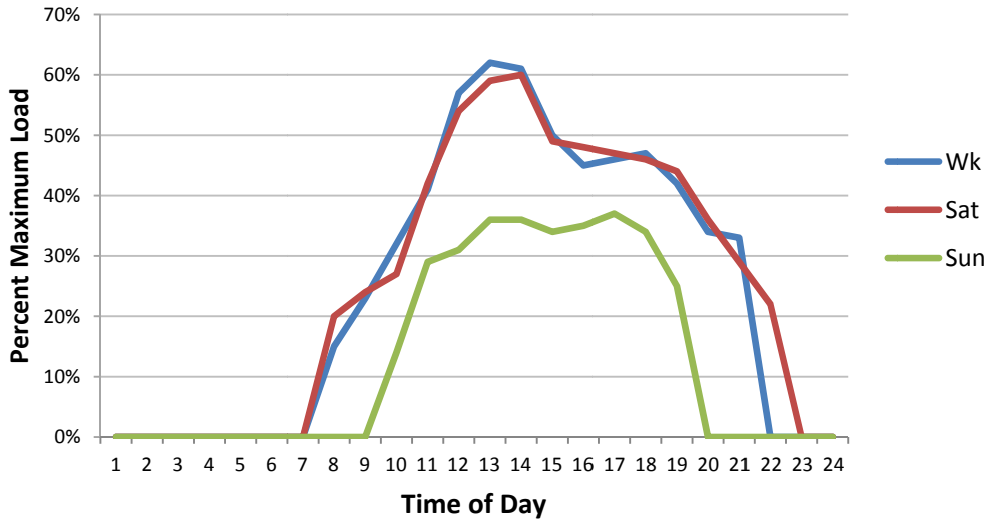
### Library: Lighting



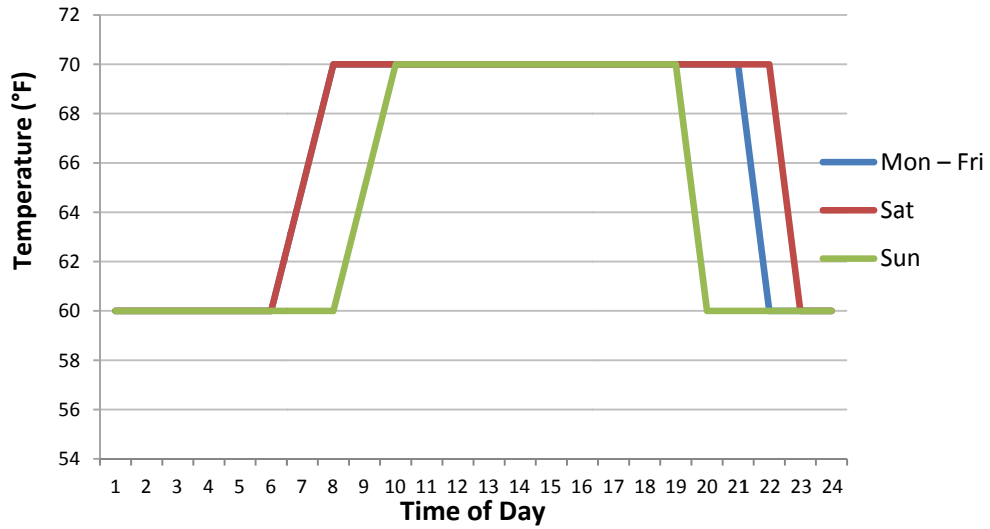
### Library: Equipment



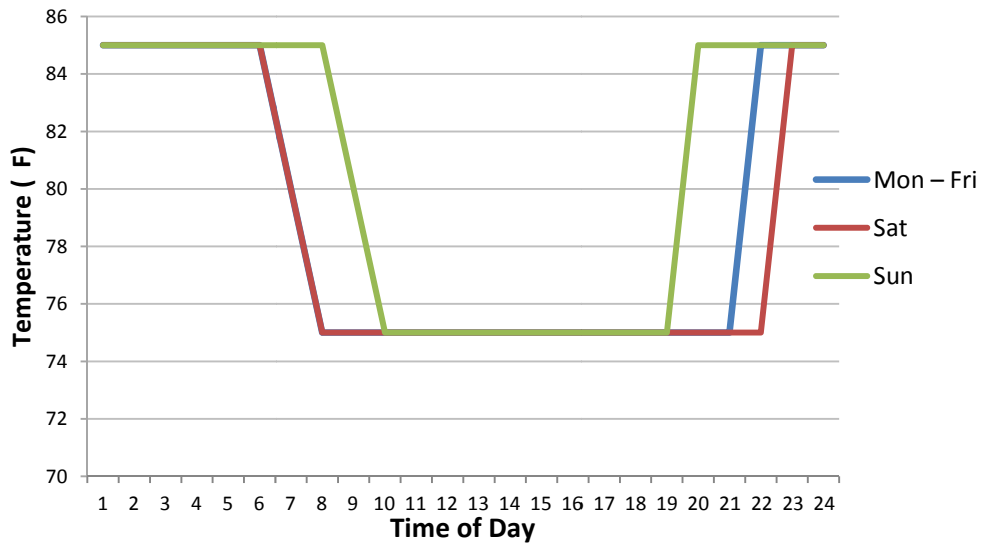
### Library: Service Hot Water



### Library: Heating Setpoint

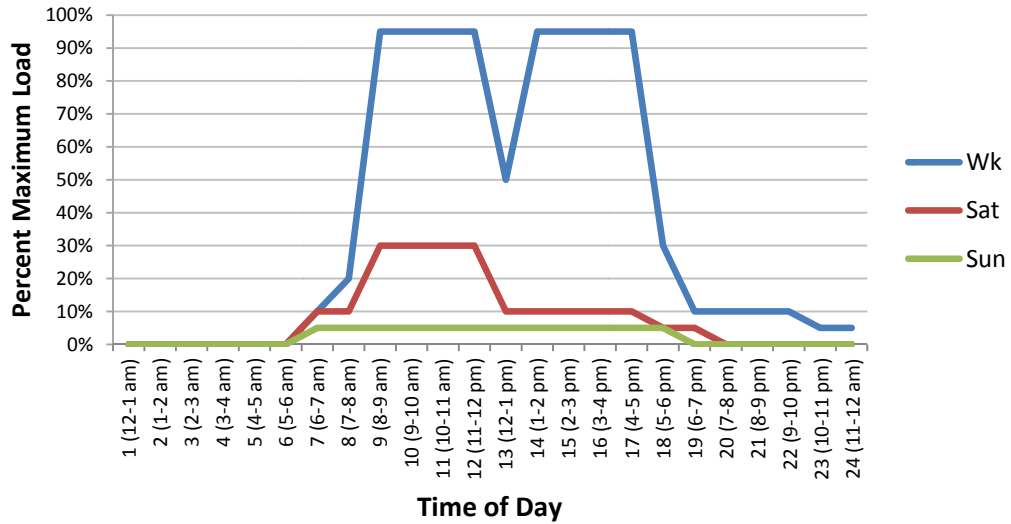


### Library: Cooling Setpoint

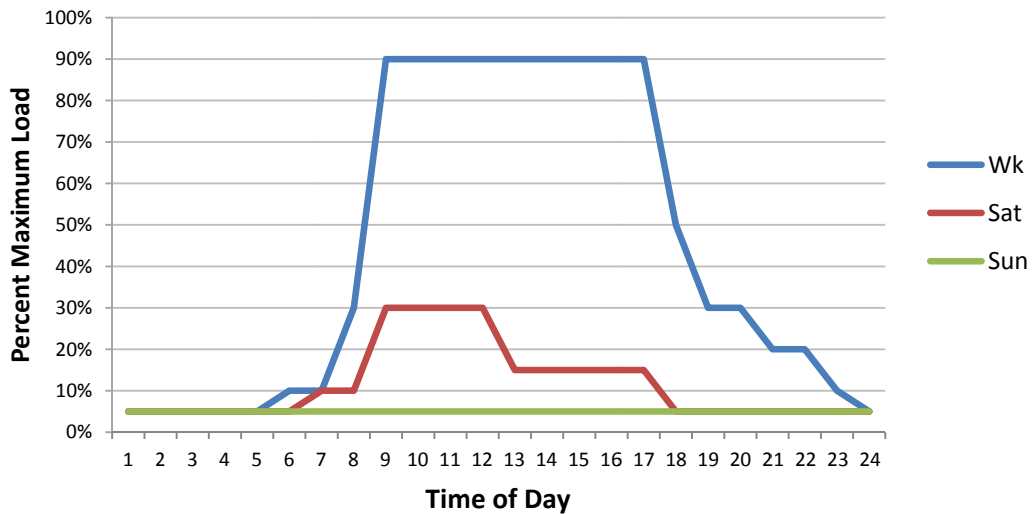


## Courthouse

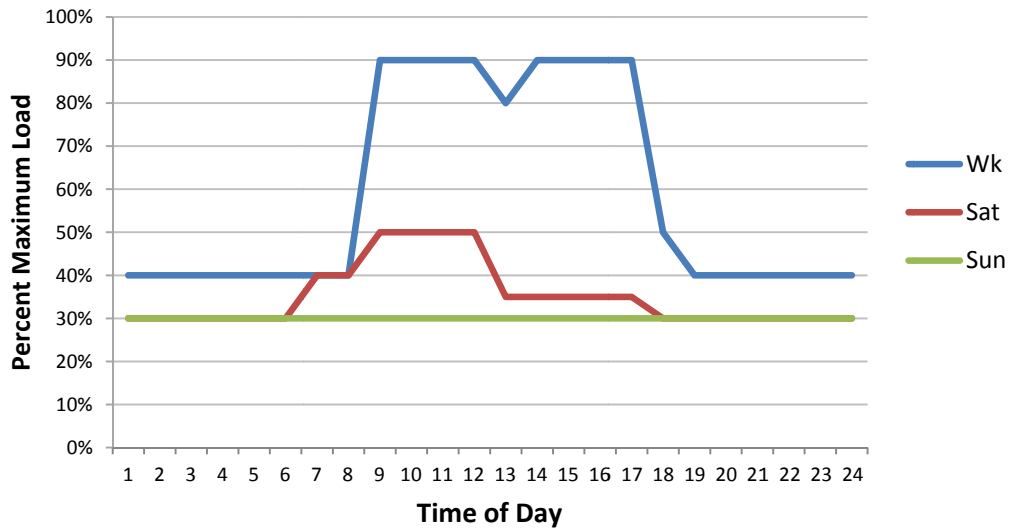
### Courthouse: Occupancy



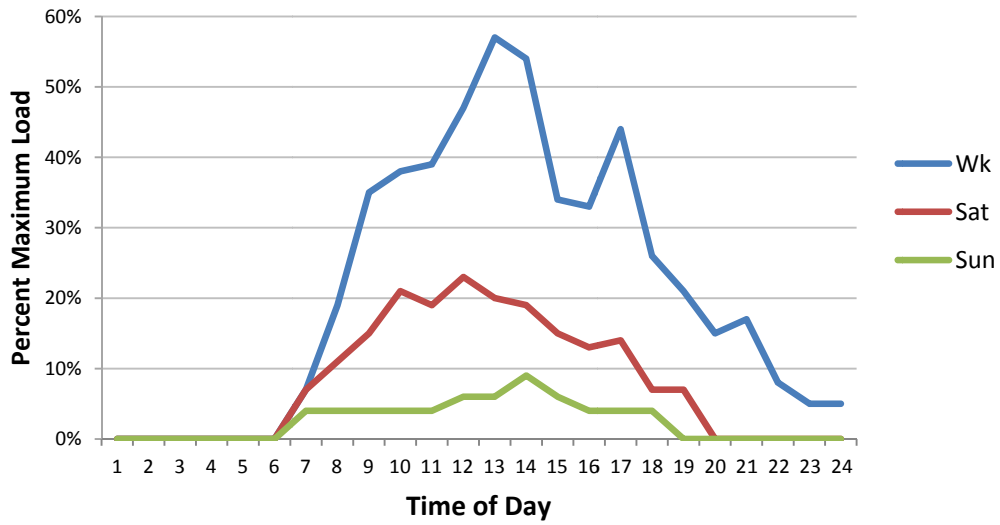
### Courthouse: Lighting



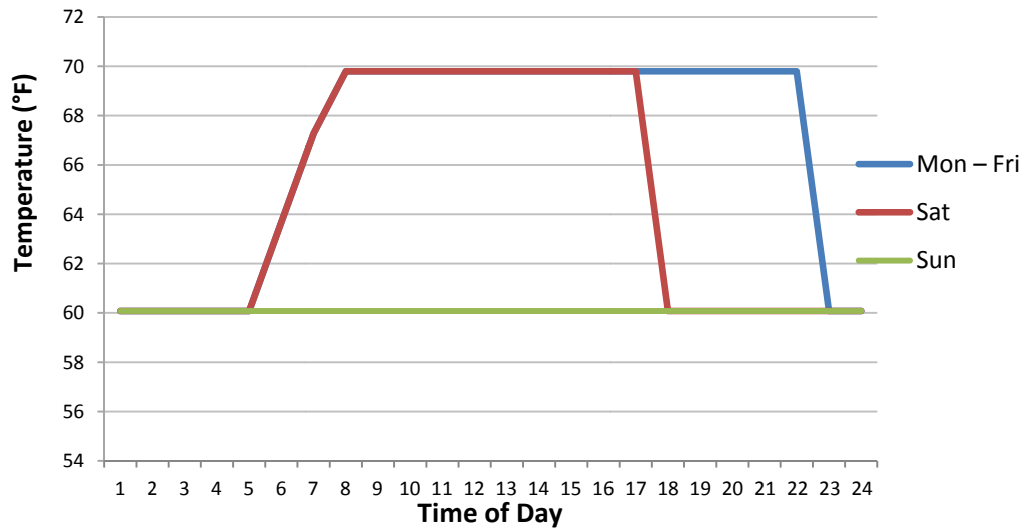
### Courthouse: Equipment



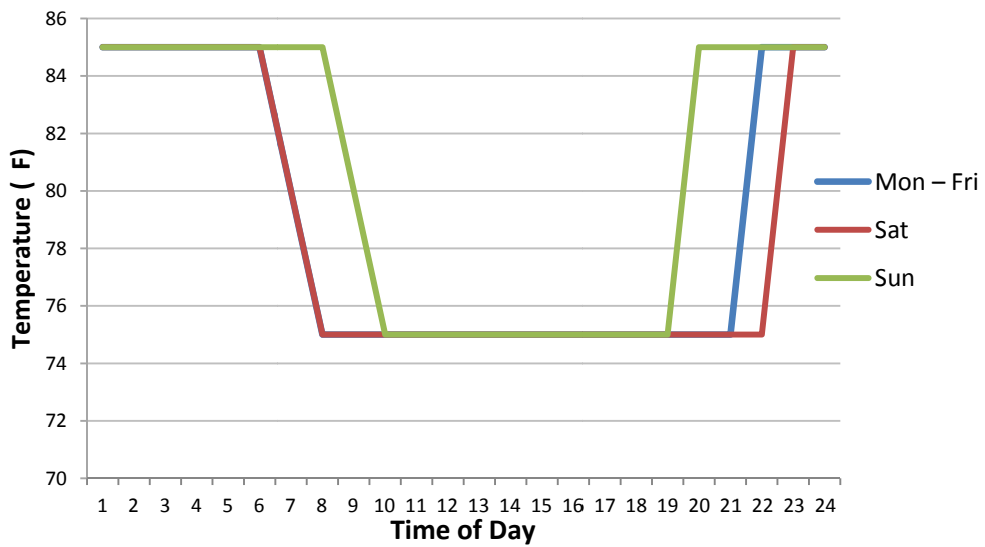
### Courthouse: Service Hot Water



### Courthouse: Heating Setpoint



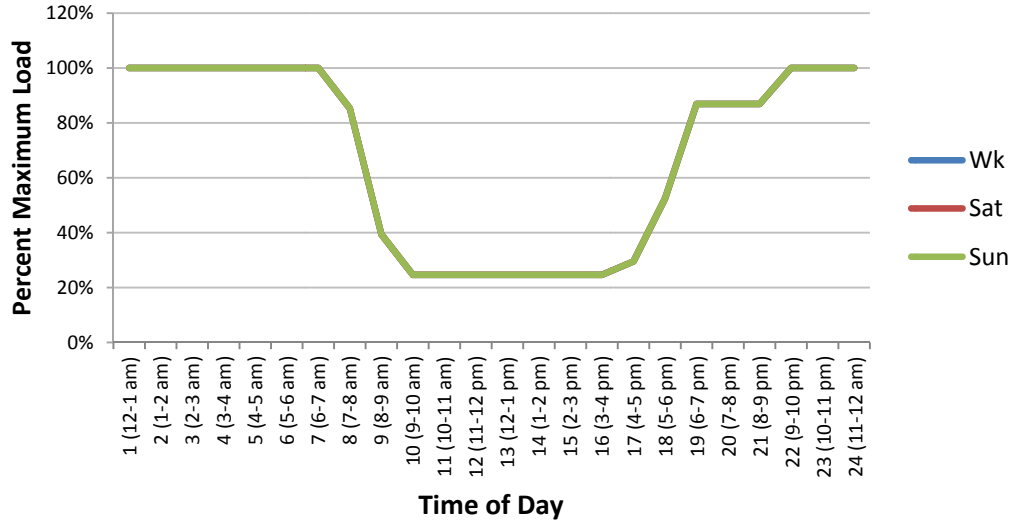
### Courthouse: Cooling Setpoint



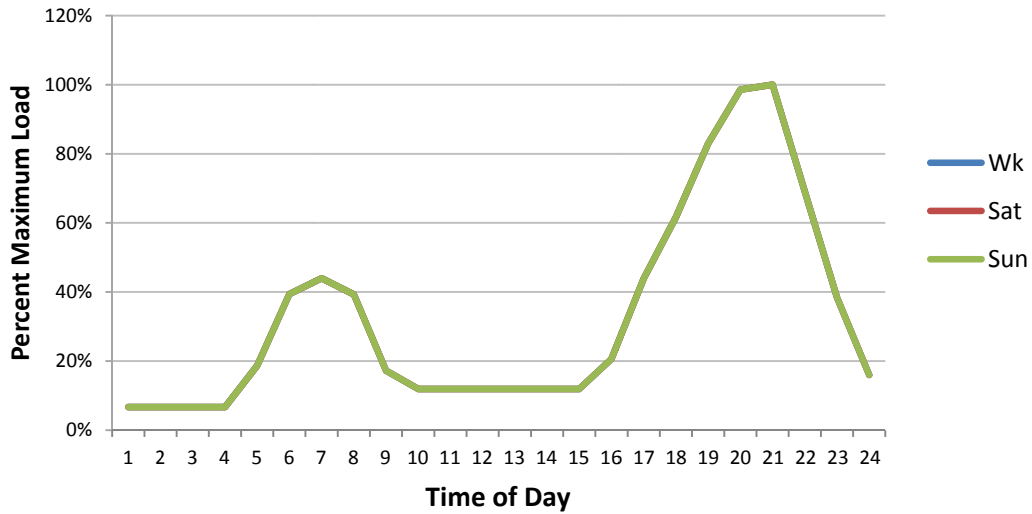


## Apartment

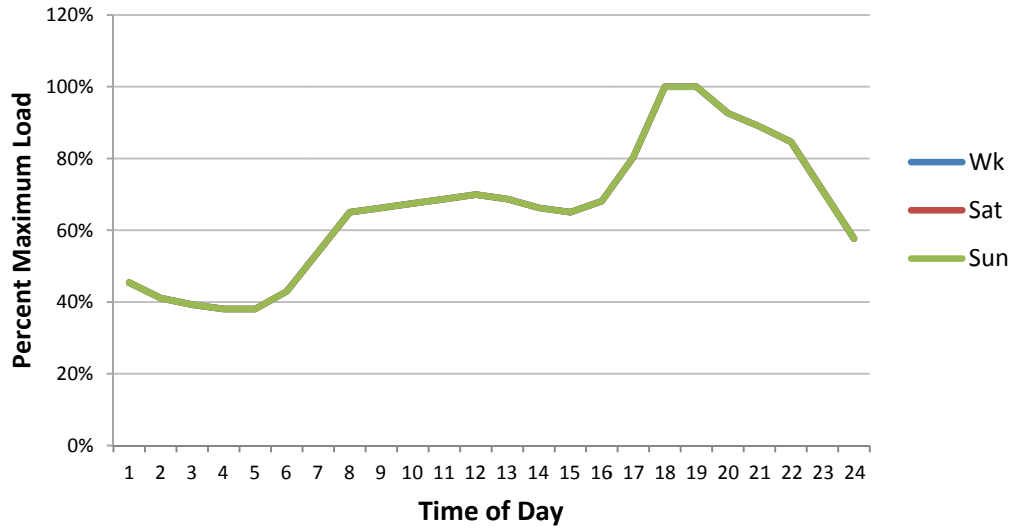
### Apartment: Occupancy



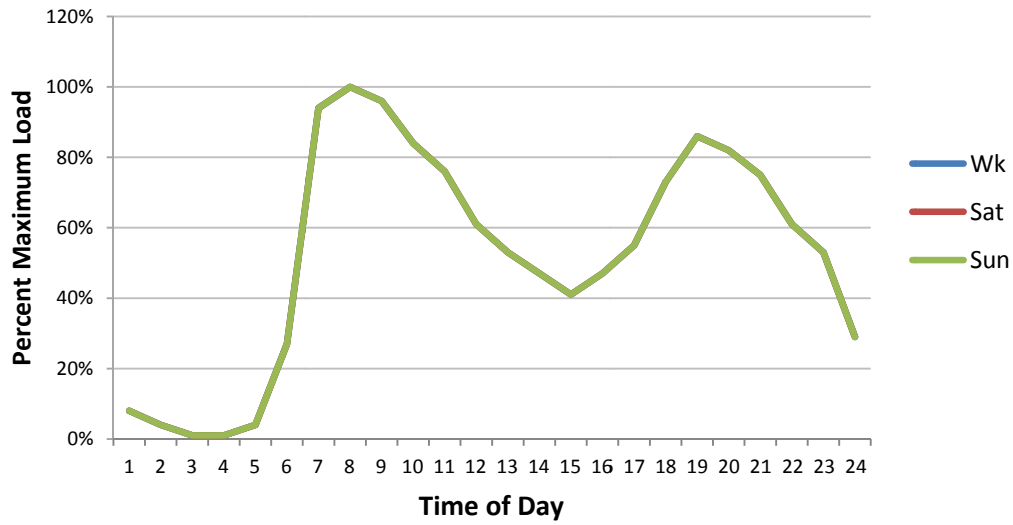
### Apartment: Lighting



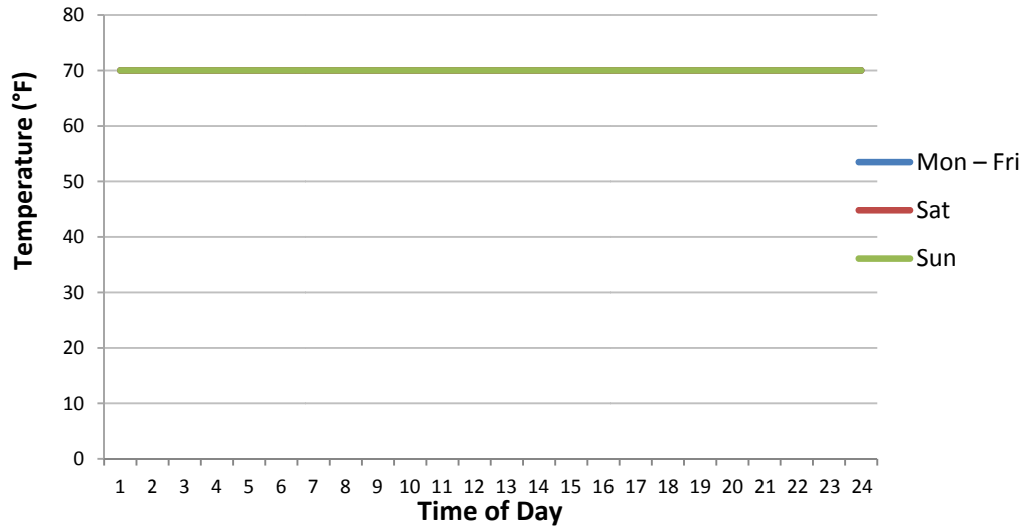
### Apartment: Equipment



### Apartment: Service Hot Water



### Apartment: Heating Setpoint



### Apartment: Cooling Setpoint

