



Shadow Flicker Analysis

Shady Oaks Wind 2, LLC

Shady Oaks II Wind Project
Project No. 118183

Revision 3
3/11/2020



Shadow Flicker Analysis

prepared for

**Shady Oaks Wind 2, LLC
Shady Oaks II Wind Project
Lee County, Illinois**

Project No. 118183

**Revision 3
3/11/2020**

prepared by

**Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri**

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LIST OF ABBREVIATIONS

<u>Abbreviation</u>	<u>Term/Phrase/Name</u>
Burns & McDonnell	Burns & McDonnell Engineering Company, Inc.
Developer	Shady Oaks Wind 2, LLC
hr	Hour
kg/m ³	Kilograms per cubic meter
m	Meter
m/s	Meters per second
MW	Megawatt
Project	Shady Oaks II Wind Project
Project Site	Location of Project in Lee County, Illinois
Study	Shadow Flicker Analysis
yr	Year

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1.0 INTRODUCTION

1.1 Study Overview

Burns & McDonnell Engineering Company, Inc. (“Burns & McDonnell”) was retained by Shady Oaks Wind 2, LLC (the “Developer”) to conduct a shadow flicker analysis (the “Study”) for the proposed Shady Oaks II Wind Project (the “Project”). The objective of the Study was to estimate the annual frequency of shadow flicker on occupied residences caused by Project wind turbines.

1.2 Project Overview

The proposed Project will be located in Lee County, Illinois (the “Project Site”). The Project is an expansion of the Shady Oaks Wind I wind farm and will include a quantity of approximately 16 Vestas V150-5.6 wind turbines with a 105-meter hub height and a nameplate capacity of 5.6 megawatts (“MW”) along with 12 Gamesa G114-2.625 wind turbines with an 80-meter hub height and a nameplate capacity of approximately 2.625 MW. A map showing the general location and configuration of the Project is included in Appendix D.

1.3 Shadow Flicker Overview

Shadow flicker occurs when wind turbine blades pass in front of the sun to create recurring shadows on an object. Such shadows occur only under very specific conditions, including sun position, wind direction, time of day, and other similar factors.

The intensity of shadow flicker varies significantly with distance, and as separation between a turbine and receptor increases, shadow flicker intensity correspondingly diminishes. Shadow flicker intensity for distances greater than 10 rotor diameters is generally low and considered imperceptible. At such distances, shadow flicker most commonly occurs at sunrise or sunset, when cast shadows are sufficiently long.

1.4 Applicable Regulations

Shadow flicker impacts are not currently regulated in applicable state or federal law, nor are there requirements in the current Lee County ordinances with regard to limitations on shadow flicker durations. This report identifies those receptors that may experience shadow flicker more than 30 hours per year, although it is noted that this threshold is presented as a typical industry benchmark for similar studies and not as a suggested limitation.

1.5 Site Visit

Burns & McDonnell did not visit the Project Site as part of this Study. The contents of this evaluation are based exclusively upon desktop analysis by Burns & McDonnell.

2.0 MODELING PARAMETERS AND INPUTS

2.1 Modeling Overview

Shadow flicker was modeled for the Project Site using WindPRO, an industry-leading software package for the design and planning of wind energy projects. This package models the sun's path with respect to every turbine location during every minute over a complete year. Any shadow flicker caused by each turbine is then aggregated for each receptor for the entire year.

The following sections are summaries of the inputs utilized in the WindPRO model for this Study.

2.2 Wind Turbines

The Project will include up to 28 wind turbines when constructed. A summary of the turbine model and its respective dimensions that was modeled as part of this Study is included in Table 2-1. It is noted that Turbine T17 is being considered for both turbine models, but it was modeled herein as the V150-5.6 as this machine is larger, providing a more conservative estimate of shadow flicker duration.

Table 2-1: Turbine Model Dimensions

Turbine Model	Quantity	Hub Height [m]	Rotor Diameter [m]
V150-5.6	16	105	150
G114-2.625	12	80	114

Shadow flicker intensity is partially dependent upon the distance from a receptor to the turbine causing the shadow. The Developer-provided coordinates of each wind turbine are presented in Appendix A and the location of each wind turbine is presented graphically in Appendix D.

2.3 Receptors

A quantity of 509 receptors were modeled at the Project Site. The Developer-provided coordinates of each receptor are presented in Appendix C and the location of each receptor is presented graphically in Appendix D.

Each receptor was modeled in “green house” mode within the WindPRO model. This approach provides a conservative estimate of the amount of time when shadow flicker could occur by modeling each receptor as having windows on all sides and effectively causing the home to be susceptible to flicker effects in all directions.

2.4 Terrain

The WindPRO model utilizes topography data to place turbines and receptors at the proper elevations. This information is also used by the model to consider any natural land features between a turbine and a receptor that may block shadows from being seen at a receptor.

Publicly-available terrain data was downloaded from the National Elevation Dataset, a product of the United States Geological Survey. The 10-meter resolution digital elevation model was exported at 10-foot intervals for use in the WindPRO model. Elevations were assigned by Burns & McDonnell to each turbine and each receptor using this data.

2.5 Obstacles

Obstacles located between a receptor and a turbine, such as trees or buildings, may significantly reduce or eliminate the duration and/or intensity of shadow flicker. However, to provide the most conservative estimate of the amount of time when shadow flicker could occur, no attempt was made to model the presence of potential obstacles.

2.6 Turbine Operation

Shadow flicker is contingent upon the movement of the turbine blades. Shadow flicker can only occur when the turbine is in operation (i.e., when the turbine blades are rotating). Moreover, shadow flicker is generally most notable when a turbine is facing a receptor, as this results in the widest-possible shadow being cast. To more accurately reflect the periods of operation of each Project wind turbine, on-site hub-height wind data was provided by Developer and used to indicate the periods when the turbines are inactive due to wind speeds below the turbine cut-in speed or above the turbine cut-out speed, at which time the turbine rotor is not in motion and no shadow flicker will occur.

Project Site-specific wind data was also utilized to model the actual orientation of the turbines relative to each receptor. The Developer provided wind data includes data collected by an on-site meteorological mast, as shown in Appendix B.

Power curves for the proposed turbines were provided by Developer. These power curves were added to the WindPRO model to more accurately reflect the turbine's operational characteristics. The Developer-provided power curves are shown in Appendix B.

2.7 Flicker Relevance

At distances beyond 10 rotor diameters, shadow flicker effects are generally considered low, as shadows diffuse and become imperceptible. Thus, a distance equal to 10 times the rotor diameter of each turbine

(i.e., 1,500 meters for the V150-5.6 and 1,140 meters for the G114-2.625) was modeled as the maximum distance at which shadow flicker was considered relevant; receptors greater than this distance from a given turbine were not evaluated. The proximity of this buffer relative to each receptor is presented graphically in Appendix D.

2.8 Sun Angle

The sun's path with respect to each turbine location is calculated by the WindPRO model to determine the cast shadow paths during every minute over a complete year. However, at very low sun angles, the light must pass through more atmosphere and becomes too diffused to form a coherent shadow. Thus, a value of three (3) degrees was utilized for the height at which the sun would not cause noticeable flicker.

2.9 Environment

Shadow flicker is only caused when the sun is shining. Sunshine probability data was obtained by Burns & McDonnell, as shown in Appendix B. This data represents the percentage of hours each month that the sun is expected to be shining during daylight hours, with consideration given for cloud cover, rainy days, fog, or other similar occurrences that may diminish the potential occurrence or severity of shadow flicker.

3.0 RESULTS

Using the inputs and parameters defined in Section 2.0, the WindPRO model was used to calculate shadow flicker for the identified receptors at the Project Site. Table 3-1 presents a summary of these results, while detailed tables are included within Appendix C that present shadow flicker durations by receptor, including estimated hours per year. Additionally, maps are provided in Appendix D that illustrate the shadow flicker vectors (in hours per year) caused by each Project turbine.

Table 3-1: Summary of Results

Turbine Layout	No. of Turbines	No. of Receptors	No. of Receptors, Flicker $\geq$ 30 hr/yr	No. of Receptors, Flicker = 0 hr/yr
16 x V150-5.6 12 x G114-2.625	28	509	5	458

The following is a set of key observations from the results of the Study:

- With the current layout, five of the 509 known receptors exceed 30 hours per year of shadow flicker, while 15 of the 509 known receptors fall between 10 and 30 hours per year of shadow flicker. Refer to Appendix C for a complete listing of results.
- The majority of observed shadow flicker on each receptor occurs during early morning and/or late afternoon and evening hours, as shown in Appendix E.
- The Study was performed using a conservative modeling approach with Project Site-specific conditions. For example, the Study modeled each receptor as a “green house”, meaning each receptor was modeled as having windows on all sides and effectively causing the home to be susceptible to flicker effects in all directions. Further, the Project Site was modeled as if no obstacles were present, including trees or buildings, which may significantly reduce or eliminate the duration and/or intensity of shadow flicker at a receptor. Due to the conservative approach of the Study, the actual duration and intensity of shadow flicker experienced at each receptor is expected to be less than those reported in the Study.
- Notwithstanding any shadow flicker which may occur at the Project Site, mitigation techniques may be utilized to reduce these effects. Common techniques include planting vegetation, awning installation, and/or reduced turbine operation.

APPENDIX A - WIND TURBINE COORDINATES

Table A-1: Wind Turbine Coordinates

Turbine Number [Primary]	Turbine Number [Appendix E Only]	Easting [m]	Northing [m]	Wind Turbine Model
T01	T04	330,445	4,611,006	G114-2.625
T02	T10	331,443	4,611,077	V150-5.6
T03	T22	333,470	4,611,368	V150-5.6
T04	T03	330,259	4,611,384	G114-2.625
T05	T13	332,041	4,611,397	V150-5.6
T06	T23	333,518	4,612,381	G114-2.625
T07	T11	331,465	4,612,515	G114-2.625
T08	T17	332,819	4,612,554	V150-5.6
T09	T21	333,281	4,612,684	G114-2.625
T10	T26	334,322	4,612,912	G114-2.625
T11	T18	332,913	4,613,077	V150-5.6
T12	T27	334,720	4,613,139	G114-2.625
T13	T28	334,728	4,613,915	G114-2.625
T14	T24	333,552	4,613,959	G114-2.625
T15	T07	331,003	4,614,312	G114-2.625
T16	T25	334,109	4,614,530	G114-2.625
T17	T01	329,901	4,614,973	V150-5.6
T18	T08	331,010	4,614,757	V150-5.6
T19	T06	330,687	4,614,653	V150-5.6
T20	T12	331,898	4,614,886	V150-5.6
T21	T02	330,189	4,614,595	V150-5.6
T22	T16	332,811	4,615,092	V150-5.6
T23	T14	332,364	4,615,107	V150-5.6
T24	T20	333,269	4,615,312	V150-5.6
T25	T09	331,079	4,615,734	V150-5.6
T26	T15	332,755	4,615,773	V150-5.6
T27	T05	330,653	4,615,812	G114-2.625
T28	T19	333,148	4,616,156	V150-5.6

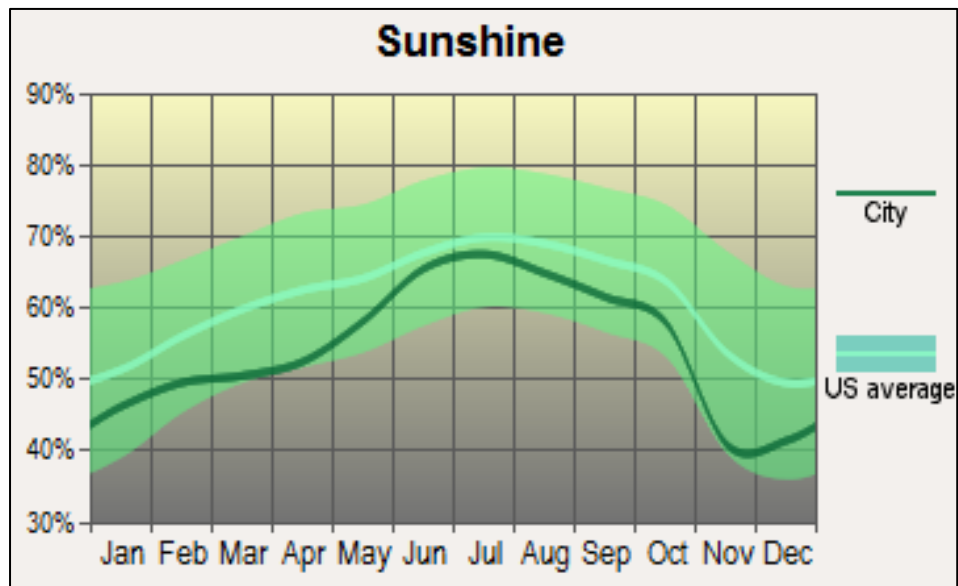
Notes:

[1] Coordinates presented in UTM NAD83 Zone 16N (meters)

[2] Coordinates provided by Developer via "SOII_RevisedCoordinates_PermittingLayout_Feb272020_DT" on February 27, 2020

[3] Turbine Number [Appendix E Only] is used solely to relate turbine numbering shown in Appendix E of this report to other turbine numbering used herein

APPENDIX B - MODELING INPUTS

Figure B-1: Monthly Sunshine Probability Data for Mendota, Illinois**Table B-1: Monthly Sunshine Probability for Mendota, Illinois**

Month	Avg. Possible Sunshine
January	46%
February	50%
March	51%
April	53%
May	58%
June	65%
July	68%
August	65%
September	62%
October	58%
November	41%
December	43%

Notes:[1] Data source: <https://www.city-data.com/city/Mendota-Illinois.html>

[2] Data location: Mendota, Illinois

[3] Data in Table B-1 estimated by Burns & McDonnell from source data in Figure B-1

Table B-2: V150-6.5 Power Curve

Wind Speed [m/s]	Power [kW]
0.0	0
0.5	0
1.0	0
1.5	0
2.0	0
2.5	0
3.0	45
3.5	143
4.0	259
4.5	403
5.0	580
5.5	798
6.0	1,062
6.5	1,374
7.0	1,740
7.5	2,158
8.0	2,633
8.5	3,166
9.0	3,747
9.5	4,328
10.0	4,851
10.5	5,232
11.0	5,477
11.5	5,562
12.0	5,590
12.5	5,599
13.0	5,600
13.5	5,600
14.0	5,600
14.5	5,600
15.0	5,600
15.5	5,600
16.0	5,600
16.5	5,600
17.0	5,598

Wind Speed [m/s]	Power [kW]
17.5	5,565
18.0	5,436
18.5	5,231
19.0	5,003
19.5	4,771
20.0	4,542
20.5	4,310
21.0	4,079
21.5	3,845
22.0	3,608
22.5	3,357
23.0	3,118
23.5	2,876
24.0	2,639
24.5	2,384
25.0	2,126

Notes:

[1] Power curve for air density of 1.25 kg/m³ and Turbine Mode 0

[2] Data provided by Developer via "0081-5059_V02 - Performance Specification V150-5.6 MW.pdf" on January 24, 2020

Table B-3: G114-2.625 Power Curve

Wind Speed [m/s]	Power [kW]
0.0	0
1.0	0
2.0	0
3.0	36
4.0	139
5.0	330
6.0	616
7.0	1,013
8.0	1,523
9.0	2,059
10.0	2,424
11.0	2,574
12.0	2,614
13.0	2,623
14.0	2,625
15.0	2,625
16.0	2,625
17.0	2,625
18.0	2,625
19.0	2,625
20.0	2,625
21.0	2,625
22.0	2,394
23.0	2,163
24.0	1,931
25.0	1,700

Notes:

[1] Power curve for air density of 1.24 kg/m³ and Standard Power Operational Mode

[2] Data provided by Developer via "G114 2.625MW 50 60 Hz Wind Turbine Power Curve and Noise Emission Levels_Rev04.pdf" on January 16, 2020

APPENDIX C - FLICKER RESULTS BY RECEPTOR

SHADOW FLICKER DURATION RESULTS

Receptor Name	Easting [m]	Northing [m]	Flicker Duration [hours/year]
REC-001	325,237	4,616,947	0.00
REC-002	325,997	4,616,928	0.00
REC-003	325,921	4,617,020	0.00
REC-004	326,044	4,615,956	0.00
REC-005	325,897	4,615,320	0.00
REC-006	325,976	4,615,140	0.00
REC-007	325,855	4,613,374	0.00
REC-008	324,371	4,613,456	0.00
REC-009	326,142	4,612,934	0.00
REC-010	324,270	4,609,789	0.00
REC-011	327,501	4,610,907	0.00
REC-012	326,955	4,612,117	0.00
REC-013	327,525	4,611,691	0.00
REC-014	327,596	4,616,635	0.00
REC-015	327,468	4,614,893	0.00
REC-016	327,603	4,619,014	0.00
REC-017	326,849	4,619,248	0.00
REC-018	327,200	4,619,396	0.00
REC-019	326,158	4,619,419	0.00
REC-020	326,626	4,619,358	0.00
REC-021	326,263	4,619,431	0.00
REC-022	325,916	4,618,285	0.00
REC-023	325,640	4,618,304	0.00
REC-024	325,944	4,618,167	0.00
REC-025	325,939	4,618,013	0.00
REC-026	326,035	4,618,024	0.00
REC-027	326,375	4,618,120	0.00
REC-028	321,114	4,617,375	0.00
REC-029	315,324	4,618,244	0.00
REC-030	316,138	4,618,730	0.00
REC-031	317,035	4,618,387	0.00
REC-032	316,774	4,618,469	0.00
REC-033	317,874	4,618,294	0.00
REC-034	318,245	4,618,323	0.00
REC-035	319,320	4,618,041	0.00
REC-036	315,064	4,617,778	0.00
REC-037	316,126	4,617,589	0.00
REC-038	315,675	4,617,302	0.00
REC-039	315,795	4,617,289	0.00
REC-040	317,454	4,617,252	0.00
REC-041	317,232	4,617,263	0.00
REC-042	319,502	4,617,213	0.00
REC-043	320,793	4,618,032	0.00
REC-044	321,129	4,618,205	0.00
REC-045	321,125	4,618,088	0.00
REC-046	321,304	4,618,110	0.00
REC-047	321,533	4,618,112	0.00
REC-048	321,523	4,618,091	0.00
REC-049	321,528	4,618,071	0.00
REC-050	321,529	4,618,049	0.00

SHADOW FLICKER DURATION RESULTS

REC-051	321,528	4,618,015	0.00
REC-052	321,507	4,618,013	0.00
REC-053	321,125	4,618,007	0.00
REC-054	321,125	4,618,065	0.00
REC-055	321,235	4,618,557	0.00
REC-056	321,180	4,617,725	0.00
REC-057	321,115	4,617,814	0.00
REC-058	321,126	4,617,872	0.00
REC-059	321,252	4,617,739	0.00
REC-060	321,530	4,617,858	0.00
REC-061	321,422	4,617,812	0.00
REC-062	321,415	4,617,772	0.00
REC-063	321,308	4,617,770	0.00
REC-064	321,190	4,617,826	0.00
REC-065	321,249	4,617,774	0.00
REC-066	321,256	4,617,860	0.00
REC-067	321,251	4,617,820	0.00
REC-068	321,252	4,617,843	0.00
REC-069	321,178	4,617,773	0.00
REC-070	321,131	4,617,741	0.00
REC-071	321,105	4,617,764	0.00
REC-072	321,371	4,617,777	0.00
REC-073	321,486	4,617,899	0.00
REC-074	321,174	4,617,903	0.00
REC-075	321,197	4,617,904	0.00
REC-076	321,227	4,617,898	0.00
REC-077	321,254	4,617,899	0.00
REC-078	321,291	4,617,903	0.00
REC-079	321,440	4,617,903	0.00
REC-080	321,419	4,617,901	0.00
REC-081	321,322	4,617,905	0.00
REC-082	321,349	4,617,898	0.00
REC-083	321,375	4,617,897	0.00
REC-084	321,374	4,617,842	0.00
REC-085	321,302	4,617,855	0.00
REC-086	321,299	4,617,829	0.00
REC-087	321,371	4,617,857	0.00
REC-088	321,418	4,617,841	0.00
REC-089	321,349	4,617,812	0.00
REC-090	321,174	4,618,031	0.00
REC-091	321,181	4,618,089	0.00
REC-092	321,207	4,618,093	0.00
REC-093	321,257	4,618,073	0.00
REC-094	321,382	4,618,112	0.00
REC-095	321,376	4,618,090	0.00
REC-096	321,418	4,618,071	0.00
REC-097	321,295	4,618,012	0.00
REC-098	321,190	4,618,018	0.00
REC-099	321,360	4,618,012	0.00
REC-100	321,379	4,618,054	0.00
REC-101	321,296	4,618,071	0.00
REC-102	321,485	4,618,011	0.00

SHADOW FLICKER DURATION RESULTS

REC-103	321,339	4,617,975	0.00
REC-104	317,593	4,617,081	0.00
REC-105	319,014	4,617,096	0.00
REC-106	318,812	4,617,098	0.00
REC-107	320,596	4,617,238	0.00
REC-108	321,108	4,617,031	0.00
REC-109	321,157	4,616,191	0.00
REC-110	321,049	4,615,245	0.00
REC-111	321,003	4,614,813	0.00
REC-112	321,135	4,614,784	0.00
REC-113	321,119	4,614,324	0.00
REC-114	321,105	4,613,987	0.00
REC-115	320,900	4,614,010	0.00
REC-116	321,422	4,613,906	0.00
REC-117	320,521	4,613,955	0.00
REC-118	320,982	4,612,817	0.00
REC-119	321,050	4,611,584	0.00
REC-120	321,096	4,610,999	0.00
REC-121	321,688	4,610,892	0.00
REC-122	319,797	4,610,998	0.00
REC-123	319,593	4,611,440	0.00
REC-124	319,169	4,612,121	0.00
REC-125	318,572	4,613,564	0.00
REC-126	320,207	4,613,953	0.00
REC-127	319,381	4,614,111	0.00
REC-128	316,441	4,614,167	0.00
REC-129	316,070	4,614,007	0.00
REC-130	319,619	4,616,283	0.00
REC-131	316,688	4,616,696	0.00
REC-132	316,310	4,615,672	0.00
REC-133	316,665	4,615,648	0.00
REC-134	316,904	4,615,554	0.00
REC-135	317,396	4,615,500	0.00
REC-136	318,527	4,615,504	0.00
REC-137	318,650	4,615,510	0.00
REC-138	319,613	4,615,569	0.00
REC-139	316,086	4,615,182	0.00
REC-140	317,868	4,615,060	0.00
REC-141	315,917	4,613,376	0.00
REC-142	316,054	4,612,562	0.00
REC-143	316,623	4,612,469	0.00
REC-144	316,922	4,612,539	0.00
REC-145	316,930	4,612,472	0.00
REC-146	317,738	4,612,452	0.00
REC-147	318,223	4,612,513	0.00
REC-148	315,258	4,611,851	0.00
REC-149	315,800	4,610,959	0.00
REC-150	316,149	4,610,972	0.00
REC-151	317,028	4,610,819	0.00
REC-152	318,489	4,611,402	0.00
REC-153	318,657	4,610,968	0.00
REC-154	318,622	4,611,069	0.00

SHADOW FLICKER DURATION RESULTS

REC-155	322,454	4,610,705	0.00
REC-156	322,608	4,610,521	0.00
REC-157	323,207	4,610,654	0.00
REC-158	323,557	4,610,539	0.00
REC-159	323,471	4,610,537	0.00
REC-160	324,167	4,610,650	0.00
REC-161	323,756	4,610,536	0.00
REC-162	325,435	4,610,586	0.00
REC-163	326,359	4,610,454	0.00
REC-164	326,689	4,610,384	0.00
REC-165	327,478	4,610,240	0.00
REC-166	327,433	4,610,344	0.00
REC-167	327,430	4,610,305	0.00
REC-168	322,589	4,611,246	0.00
REC-169	322,669	4,611,600	0.00
REC-170	322,614	4,612,048	0.00
REC-171	322,621	4,612,636	0.00
REC-172	322,692	4,612,922	0.00
REC-173	322,711	4,613,190	0.00
REC-174	322,704	4,613,131	0.00
REC-175	322,622	4,613,458	0.00
REC-176	322,642	4,613,901	0.00
REC-177	322,757	4,614,761	0.00
REC-178	322,664	4,615,053	0.00
REC-179	322,902	4,615,506	0.00
REC-180	324,222	4,615,849	0.00
REC-181	322,767	4,616,527	0.00
REC-182	322,553	4,616,390	0.00
REC-183	323,351	4,617,943	0.00
REC-184	324,305	4,617,776	0.00
REC-185	324,479	4,618,079	0.00
REC-186	324,317	4,618,022	0.00
REC-187	324,498	4,618,071	0.00
REC-188	324,786	4,618,155	0.00
REC-189	324,285	4,611,207	0.00
REC-190	324,213	4,611,568	0.00
REC-191	324,185	4,611,814	0.00
REC-192	324,114	4,612,243	0.00
REC-193	324,813	4,612,188	0.00
REC-194	324,246	4,612,205	0.00
REC-195	324,233	4,612,540	0.00
REC-196	324,263	4,614,004	0.00
REC-197	324,352	4,614,577	0.00
REC-198	324,345	4,614,798	0.00
REC-199	324,275	4,615,060	0.00
REC-200	324,380	4,617,060	0.00
REC-201	324,382	4,616,953	0.00
REC-202	324,751	4,616,810	0.00
REC-203	325,961	4,611,265	0.00
REC-204	325,892	4,611,641	0.00
REC-205	325,780	4,612,014	0.00
REC-206	325,849	4,612,142	0.00

SHADOW FLICKER DURATION RESULTS

REC-207	325,980	4,612,137	0.00
REC-208	318,886	4,610,414	0.00
REC-209	320,508	4,610,020	0.00
REC-210	320,144	4,610,023	0.00
REC-211	316,155	4,610,146	0.00
REC-212	315,939	4,610,557	0.00
REC-213	315,708	4,610,868	0.00
REC-214	314,850	4,612,578	0.00
REC-215	314,804	4,612,574	0.00
REC-216	314,762	4,612,578	0.00
REC-217	314,829	4,612,577	0.00
REC-218	314,469	4,613,931	0.00
REC-219	314,078	4,614,216	0.00
REC-220	316,148	4,618,922	0.00
REC-221	319,203	4,619,314	0.00
REC-222	318,783	4,619,443	0.00
REC-223	318,819	4,619,460	0.00
REC-224	321,204	4,619,025	0.00
REC-225	321,223	4,619,107	0.00
REC-226	321,212	4,619,193	0.00
REC-227	325,999	4,617,977	0.00
REC-228	326,000	4,618,020	0.00
REC-229	325,997	4,617,870	0.00
REC-230	326,086	4,617,813	0.00
REC-231	326,137	4,617,807	0.00
REC-232	326,054	4,617,865	0.00
REC-233	326,088	4,617,907	0.00
REC-234	326,142	4,617,860	0.00
REC-235	326,237	4,617,812	0.00
REC-236	326,258	4,617,902	0.00
REC-237	326,146	4,617,905	0.00
REC-238	326,192	4,617,860	0.00
REC-239	326,161	4,617,860	0.00
REC-240	326,170	4,617,906	0.00
REC-241	326,323	4,617,856	0.00
REC-242	326,321	4,617,822	0.00
REC-243	326,319	4,617,901	0.00
REC-244	326,091	4,617,974	0.00
REC-245	326,176	4,617,947	0.00
REC-246	326,135	4,617,974	0.00
REC-247	326,290	4,617,902	0.00
REC-248	326,096	4,618,022	0.00
REC-249	326,206	4,618,020	0.00
REC-250	326,282	4,617,843	0.00
REC-251	326,275	4,617,969	0.00
REC-252	326,137	4,618,015	0.00
REC-253	326,165	4,618,017	0.00
REC-254	326,223	4,617,902	0.00
REC-255	326,193	4,617,903	0.00
REC-256	326,086	4,617,862	0.00
REC-257	326,278	4,617,946	0.00
REC-258	326,319	4,617,971	0.00

SHADOW FLICKER DURATION RESULTS

REC-259	326,322	4,617,949	0.00
REC-260	326,234	4,617,857	0.00
REC-261	326,378	4,617,855	0.00
REC-262	326,277	4,618,024	0.00
REC-263	326,326	4,618,118	0.00
REC-264	326,330	4,618,077	0.00
REC-265	326,370	4,618,077	0.00
REC-266	326,422	4,618,070	0.00
REC-267	326,467	4,618,078	0.00
REC-268	326,404	4,618,115	0.00
REC-269	326,500	4,618,079	0.00
REC-270	326,539	4,618,075	0.00
REC-271	326,564	4,618,076	0.00
REC-272	326,601	4,618,075	0.00
REC-273	326,372	4,618,010	0.00
REC-274	326,404	4,618,006	0.00
REC-275	326,423	4,618,008	0.00
REC-276	326,471	4,618,009	0.00
REC-277	326,518	4,618,002	0.00
REC-278	326,552	4,618,002	0.00
REC-279	326,578	4,618,000	0.00
REC-280	326,617	4,618,004	0.00
REC-281	326,371	4,617,962	0.00
REC-282	326,395	4,617,962	0.00
REC-283	326,410	4,617,962	0.00
REC-284	326,430	4,617,959	0.00
REC-285	326,466	4,617,959	0.00
REC-286	326,519	4,617,954	0.00
REC-287	326,554	4,617,955	0.00
REC-288	326,570	4,617,952	0.00
REC-289	326,587	4,617,953	0.00
REC-290	326,618	4,617,952	0.00
REC-291	326,368	4,617,900	0.00
REC-292	326,390	4,617,856	0.00
REC-293	326,410	4,617,852	0.00
REC-294	326,394	4,617,897	0.00
REC-295	326,409	4,617,895	0.00
REC-296	326,427	4,617,893	0.00
REC-297	326,436	4,617,852	0.00
REC-298	326,547	4,617,808	0.00
REC-299	326,569	4,617,904	0.00
REC-300	326,606	4,617,885	0.00
REC-301	326,575	4,617,887	0.00
REC-302	326,611	4,617,842	0.00
REC-303	326,613	4,617,806	0.00
REC-304	326,550	4,617,844	0.00
REC-305	326,574	4,617,843	0.00
REC-306	326,597	4,617,841	0.00
REC-307	326,658	4,617,883	0.00
REC-308	326,687	4,617,891	0.00
REC-309	326,752	4,617,885	0.00
REC-310	326,755	4,617,905	0.00

SHADOW FLICKER DURATION RESULTS

REC-311	326,812	4,617,869	0.00
REC-312	326,714	4,617,883	0.00
REC-313	326,757	4,617,948	0.00
REC-314	326,901	4,617,939	0.00
REC-315	326,797	4,617,925	0.00
REC-316	326,801	4,617,945	0.00
REC-317	326,920	4,617,976	0.00
REC-318	326,655	4,617,997	0.00
REC-319	326,673	4,617,997	0.00
REC-320	326,697	4,617,995	0.00
REC-321	326,751	4,617,997	0.00
REC-322	326,796	4,618,005	0.00
REC-323	326,797	4,618,030	0.00
REC-324	326,796	4,618,097	0.00
REC-325	326,748	4,618,062	0.00
REC-326	326,729	4,618,094	0.00
REC-327	326,912	4,618,070	0.00
REC-328	326,800	4,618,055	0.00
REC-329	326,696	4,618,067	0.00
REC-330	326,676	4,618,068	0.00
REC-331	326,628	4,618,071	0.00
REC-332	328,509	4,618,946	0.00
REC-333	328,876	4,618,871	0.00
REC-334	330,021	4,618,568	0.00
REC-335	330,534	4,618,509	0.00
REC-336	330,480	4,618,536	0.00
REC-337	330,131	4,618,546	0.00
REC-338	328,335	4,617,948	0.00
REC-339	328,218	4,616,871	0.00
REC-340	328,655	4,615,732	3.43
REC-341	328,643	4,615,719	3.28
REC-342	329,268	4,616,329	0.00
REC-343	329,137	4,615,930	0.00
REC-344	329,123	4,615,974	0.00
REC-345	327,924	4,615,291	0.00
REC-346	327,779	4,614,896	0.00
REC-347	329,069	4,614,489	6.77
REC-348	329,110	4,614,220	9.77
REC-349	328,230	4,613,661	0.00
REC-350	329,089	4,612,950	0.00
REC-351	329,139	4,612,169	0.00
REC-352	328,857	4,611,940	0.00
REC-353	329,064	4,611,643	0.00
REC-354	329,135	4,611,550	1.97
REC-355	328,389	4,610,468	0.00
REC-356	328,614	4,610,459	0.00
REC-357	328,684	4,610,451	0.00
REC-358	329,027	4,610,417	0.00
REC-359	329,103	4,610,441	0.00
REC-360	329,192	4,610,470	0.00
REC-361	329,296	4,610,501	0.00
REC-362	329,234	4,610,783	0.00

SHADOW FLICKER DURATION RESULTS

REC-363	329,287	4,610,909	7.00
REC-364	329,780	4,610,976	9.83
REC-365	329,596	4,610,903	5.97
REC-366	329,604	4,610,815	6.68
REC-367	329,587	4,610,630	12.35
REC-368	329,747	4,610,455	0.00
REC-369	330,254	4,610,556	11.12
REC-370	329,929	4,610,557	0.00
REC-371	331,516	4,610,321	0.00
REC-372	333,694	4,610,462	0.00
REC-373	336,931	4,610,714	0.00
REC-374	336,855	4,610,776	0.00
REC-375	336,953	4,612,721	0.00
REC-376	336,853	4,612,554	0.00
REC-377	336,894	4,613,131	0.00
REC-378	336,362	4,613,581	0.00
REC-379	336,824	4,614,702	0.00
REC-380	336,513	4,614,964	0.00
REC-381	336,601	4,614,894	0.00
REC-382	336,655	4,614,859	0.00
REC-383	336,437	4,615,011	0.00
REC-384	336,274	4,615,151	0.00
REC-385	335,883	4,615,413	0.00
REC-386	335,468	4,615,740	0.00
REC-387	335,243	4,615,822	0.00
REC-388	335,347	4,615,888	0.00
REC-389	335,254	4,615,894	0.00
REC-390	329,401	4,611,935	3.75
REC-391	330,023	4,612,043	0.00
REC-392	330,244	4,611,932	4.62
REC-393	330,426	4,611,845	6.98
REC-394	330,343	4,611,926	5.48
REC-395	330,419	4,613,547	0.00
REC-396	330,604	4,614,002	0.00
REC-397	329,212	4,614,486	7.87
REC-398	330,517	4,615,311	25.82
REC-399	330,520	4,616,534	0.00
REC-400	329,672	4,616,897	0.00
REC-401	330,533	4,617,317	0.00
REC-402	330,525	4,617,619	0.00
REC-403	332,006	4,617,542	0.00
REC-404	331,967	4,617,523	0.00
REC-405	332,004	4,617,582	0.00
REC-406	331,998	4,617,518	0.00
REC-407	332,231	4,616,932	6.47
REC-408	332,335	4,616,702	10.27
REC-409	332,080	4,616,413	20.50
REC-410	332,220	4,615,927	40.75
REC-411	332,068	4,615,822	36.07
REC-412	332,055	4,615,671	53.32
REC-413	332,066	4,614,436	13.05
REC-414	332,028	4,613,598	6.78

SHADOW FLICKER DURATION RESULTS

REC-415	332,021	4,613,623	6.80
REC-416	331,238	4,613,520	0.00
REC-417	331,149	4,613,525	0.00
REC-418	330,680	4,612,129	9.05
REC-419	330,980	4,611,997	4.57
REC-420	331,225	4,612,006	9.88
REC-421	331,387	4,612,001	8.43
REC-422	330,790	4,611,875	6.60
REC-423	331,333	4,611,787	10.98
REC-424	330,688	4,611,679	36.07
REC-425	330,856	4,611,345	50.03
REC-426	332,261	4,617,928	0.00
REC-427	332,952	4,618,234	0.00
REC-428	332,867	4,617,732	0.00
REC-429	333,098	4,617,656	0.00
REC-430	333,208	4,617,634	0.00
REC-431	334,076	4,617,598	0.00
REC-432	333,764	4,617,415	0.00
REC-433	333,765	4,617,463	0.00
REC-434	333,764	4,617,513	0.00
REC-435	333,836	4,617,513	0.00
REC-436	333,972	4,617,507	0.00
REC-437	333,970	4,617,575	0.00
REC-438	333,881	4,617,577	0.00
REC-439	333,765	4,617,360	0.00
REC-440	333,692	4,615,809	26.68
REC-441	333,277	4,614,654	23.67
REC-442	336,532	4,610,217	0.00
REC-443	335,328	4,611,467	0.00
REC-444	335,258	4,611,691	0.00
REC-445	335,208	4,613,082	24.42
REC-446	335,230	4,613,363	14.22
REC-447	336,161	4,613,610	0.00
REC-448	336,092	4,613,580	0.00
REC-449	335,291	4,614,498	0.00
REC-450	334,622	4,615,390	3.05
REC-451	334,254	4,615,206	9.87
REC-452	333,830	4,614,927	7.22
REC-453	335,258	4,609,831	0.00
REC-454	334,339	4,611,801	7.45
REC-455	333,807	4,613,524	21.08
REC-456	334,382	4,613,511	20.98
REC-457	332,924	4,612,007	9.15
REC-458	333,164	4,611,989	3.97
REC-459	332,502	4,611,902	23.47
REC-460	333,381	4,613,571	9.22
REC-461	333,118	4,613,443	17.28
REC-462	332,787	4,613,927	6.05
REC-463	332,921	4,614,144	8.05
REC-464	335,229	4,616,215	0.00
REC-465	335,003	4,616,435	0.00
REC-466	335,126	4,616,405	0.00

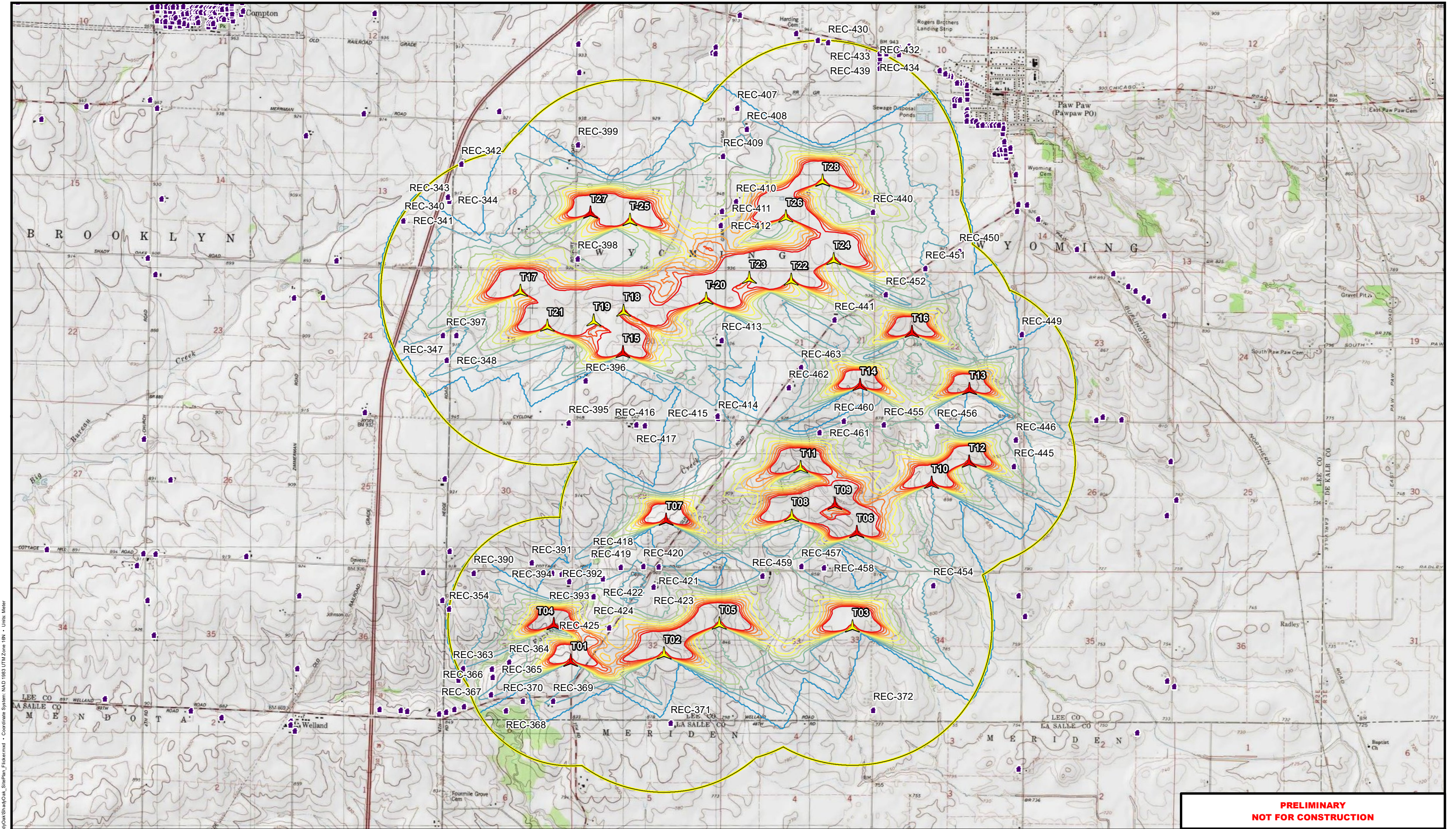
SHADOW FLICKER DURATION RESULTS

REC-467	335,053	4,616,433	0.00
REC-468	335,048	4,616,487	0.00
REC-469	335,089	4,616,439	0.00
REC-470	335,117	4,616,439	0.00
REC-471	335,078	4,616,486	0.00
REC-472	335,111	4,616,516	0.00
REC-473	335,120	4,616,484	0.00
REC-474	335,105	4,616,544	0.00
REC-475	335,172	4,616,469	0.00
REC-476	335,168	4,616,501	0.00
REC-477	335,104	4,616,574	0.00
REC-478	335,088	4,616,658	0.00
REC-479	334,569	4,616,959	0.00
REC-480	334,566	4,617,023	0.00
REC-481	334,598	4,617,020	0.00
REC-482	334,628	4,617,018	0.00
REC-483	334,702	4,616,911	0.00
REC-484	334,698	4,616,864	0.00
REC-485	334,702	4,616,839	0.00
REC-486	334,699	4,616,790	0.00
REC-487	334,763	4,616,792	0.00
REC-488	334,801	4,616,785	0.00
REC-489	334,821	4,616,745	0.00
REC-490	334,904	4,616,744	0.00
REC-491	334,947	4,616,745	0.00
REC-492	334,868	4,616,749	0.00
REC-493	334,990	4,616,747	0.00
REC-494	334,969	4,616,750	0.00
REC-495	335,090	4,616,745	0.00
REC-496	335,094	4,616,712	0.00
REC-497	335,012	4,616,749	0.00
REC-498	335,047	4,616,745	0.00
REC-499	334,705	4,617,028	0.00
REC-500	334,705	4,617,087	0.00
REC-501	334,702	4,617,141	0.00
REC-502	334,701	4,617,176	0.00
REC-503	334,650	4,617,206	0.00
REC-504	334,628	4,617,201	0.00
REC-505	334,595	4,617,203	0.00
REC-506	334,533	4,617,270	0.00
REC-507	334,498	4,617,281	0.00
REC-508	334,470	4,617,296	0.00
REC-509	334,409	4,617,336	0.00

Notes:

- [1] Coordinates presented in UTM NAD83 Zone 16N (meters)
- [2] Coordinates provided by Shady Oaks Wind 2, LLC via "Houses_GoogleEarth_Nov212018.xlsx" on November 14, 2019
- [3] Results based on turbine layout in Table A-1

APPENDIX D - SHADOW FLICKER DURATION MAP



LEGEND

Wind Turbine, G114-2.625, 80m HH

Wind Turbine, V150-5.6, 105m HH

SOII_RevisedCoordinates_PermittinLayout_Feb272020_DT" on February 27, 2020

Wind Turbine Buffer - 10 x RD

Residence (src: Developer, 11-21-2019)

Shadow Flicker Vectors [hours per year]

* Routes / locations based on third-party and/or publicly available data and have not been field verified

REFERENCE

**PRELIMINARY
NOT FOR CONSTRUCTION**

**SHADY OAKS II WIND FARM
Shadow Flicker Duration [Hr/Yr]**

LOCATION:	Lee County, Illinois
CLIENT:	Shady Oaks Wind 2, LLC
PROJ. NO.:	118183
CREATED:	03/11/2020

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& MCDONNELL**
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C:\Users\jdhall\Desktop\Work\ShadyOak\ShadyOak_SitePlan_Edited.mxd • Coordinate System: NAD 1983 UTM Zone 18N • Units: Meter

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APPENDIX E - SHADOW FLICKER CALENDAR

Project:

118183 - Shady Oaks II Wind Project

Description:

Burns & McDonnell has relied upon information provided by third-party sources to complete this study. While there is no reason to believe that the information provided is inaccurate or incomplete in any material respect, Burns & McDonnell has not independently verified such information and cannot guarantee or warranty its accuracy or completeness.

Licensed user:

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(816) 333 9400

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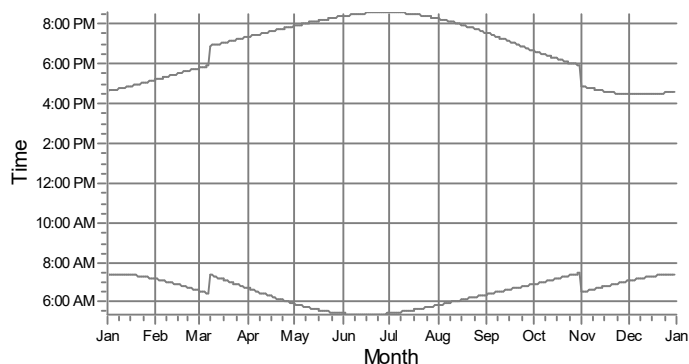
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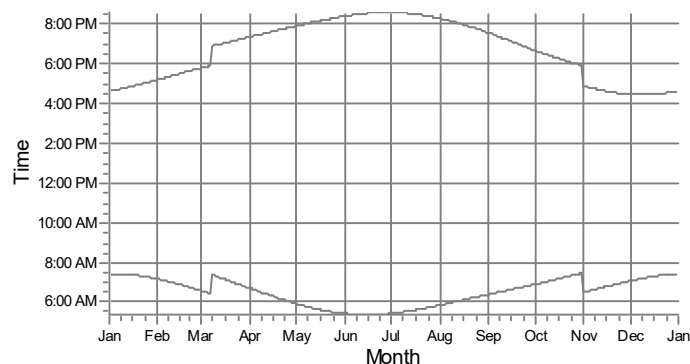
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Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

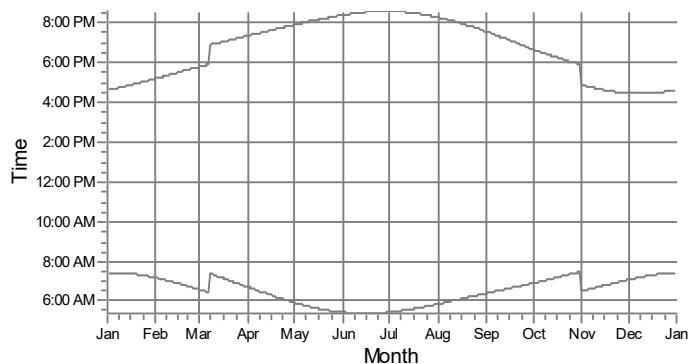
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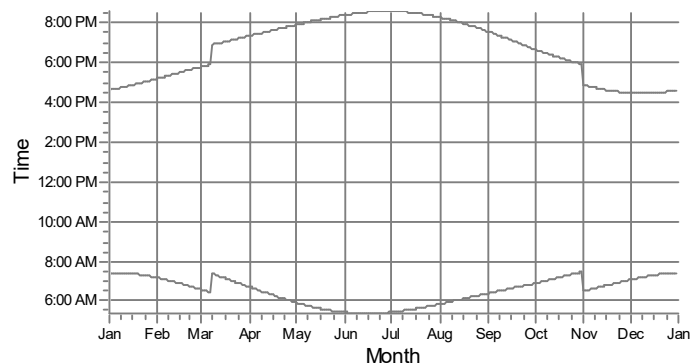
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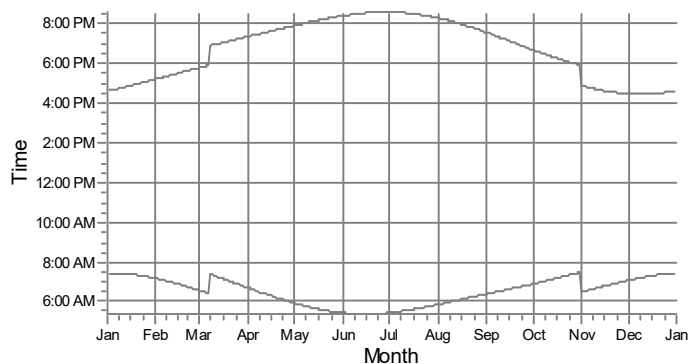
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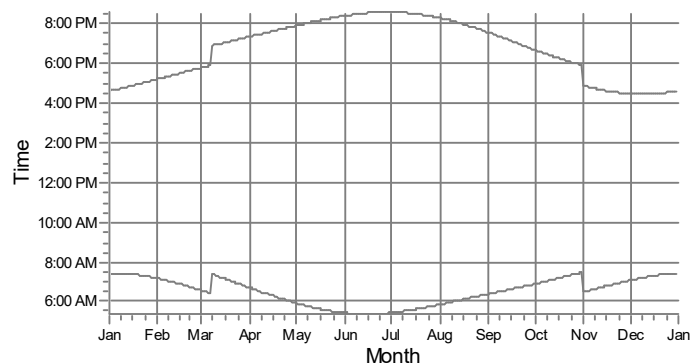
D: REC-004



E: REC-005



F: REC-006



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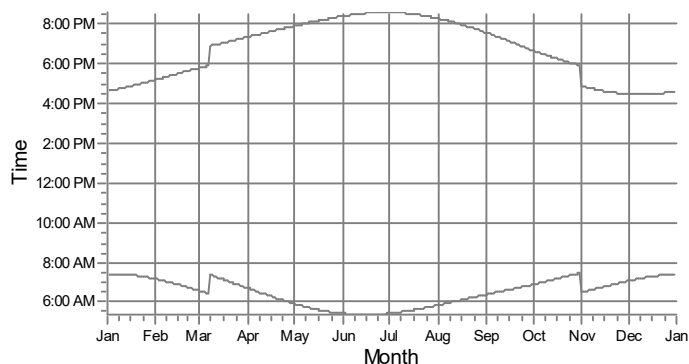
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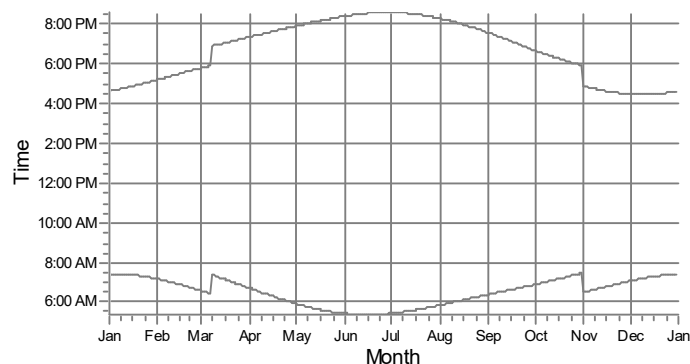
SHADOW - Calendar, graphical

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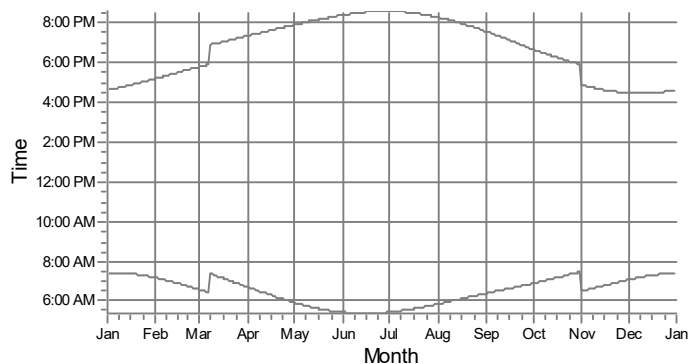
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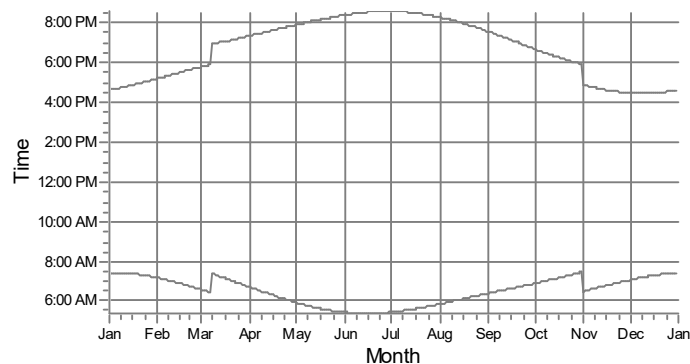
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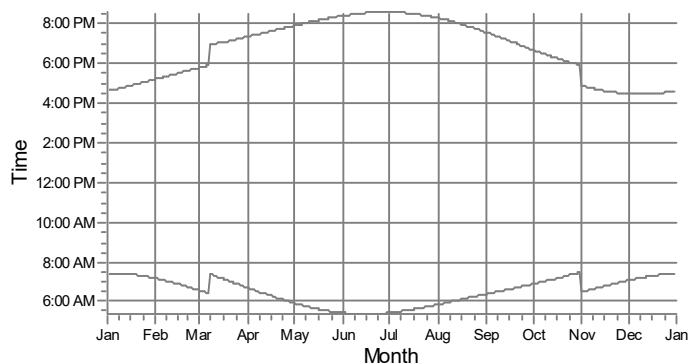
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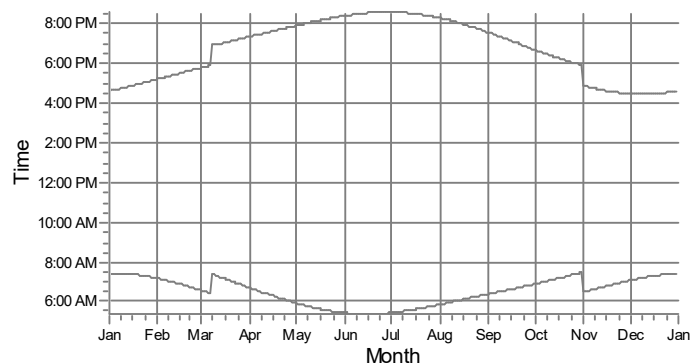
J: REC-010



K: REC-011



L: REC-012



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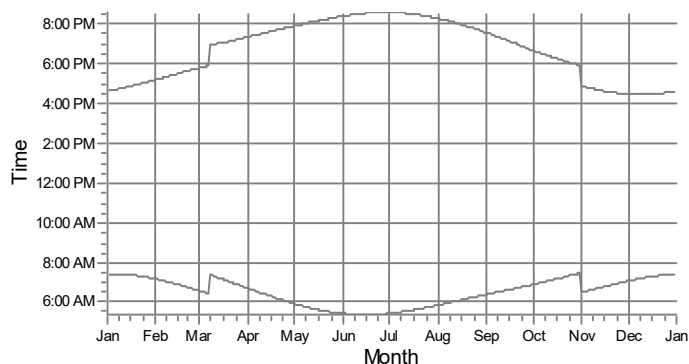
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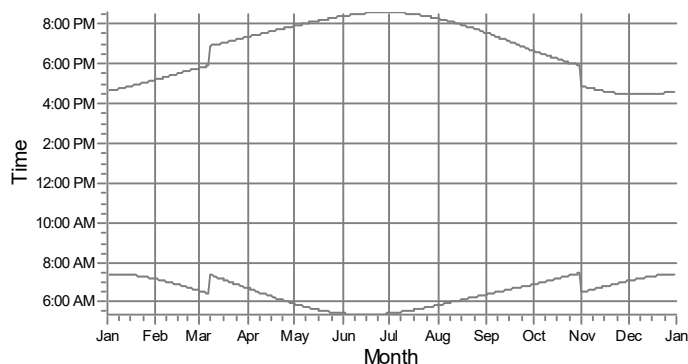
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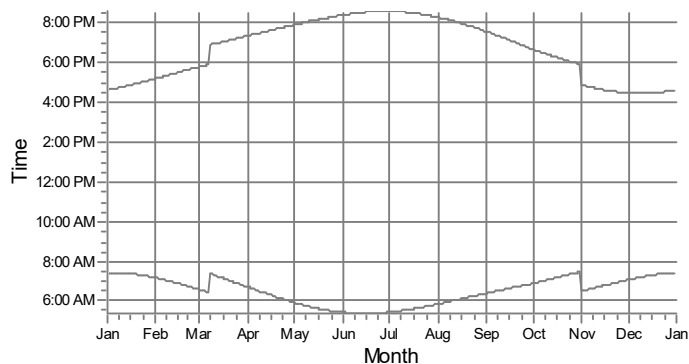
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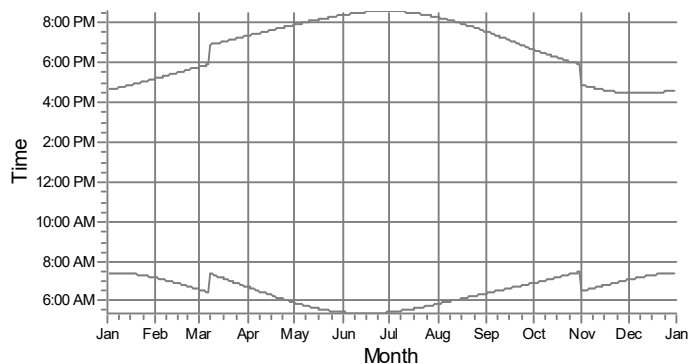
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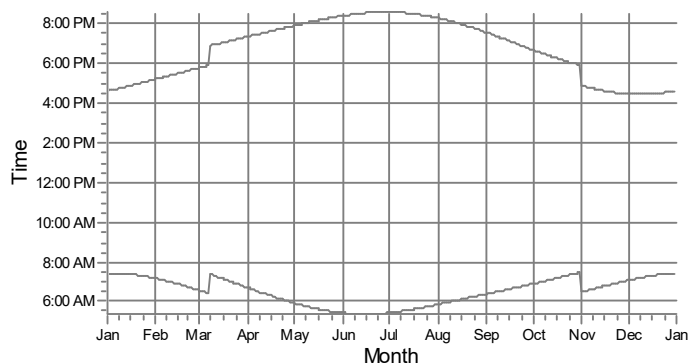
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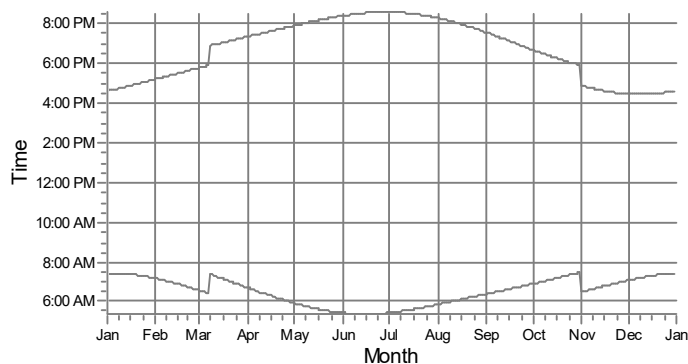
P: REC-016



Q: REC-017



R: REC-018



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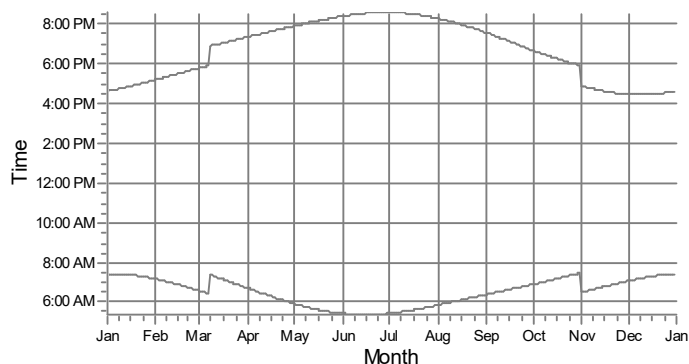
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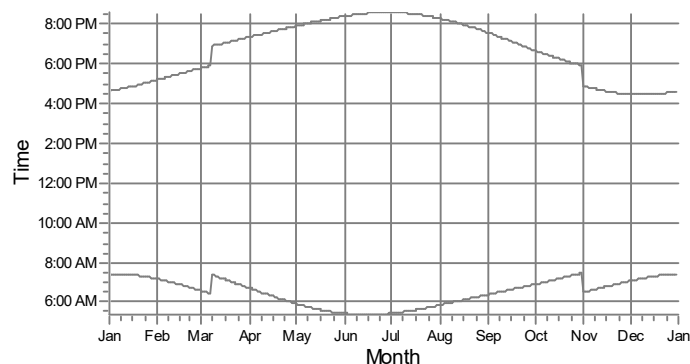
SHADOW - Calendar, graphical

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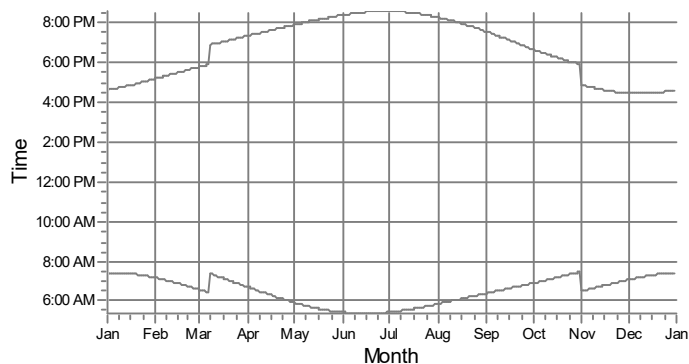
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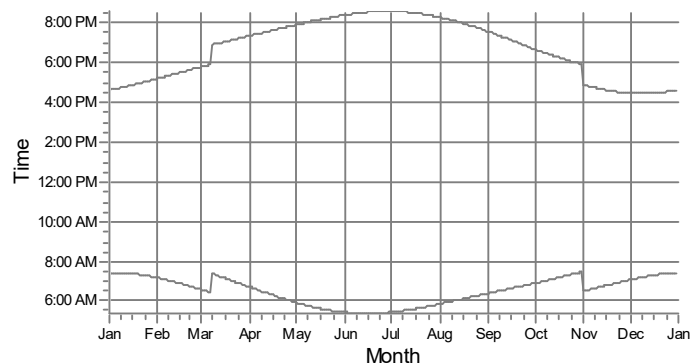
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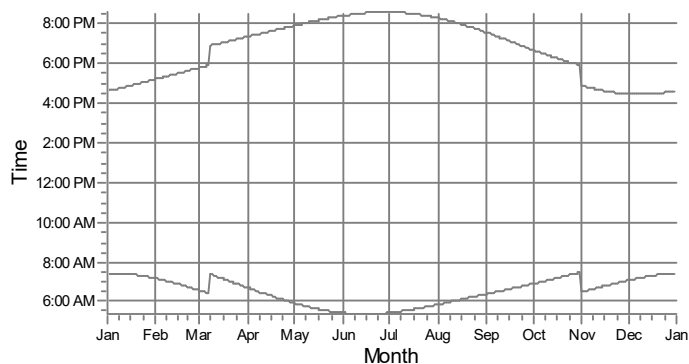
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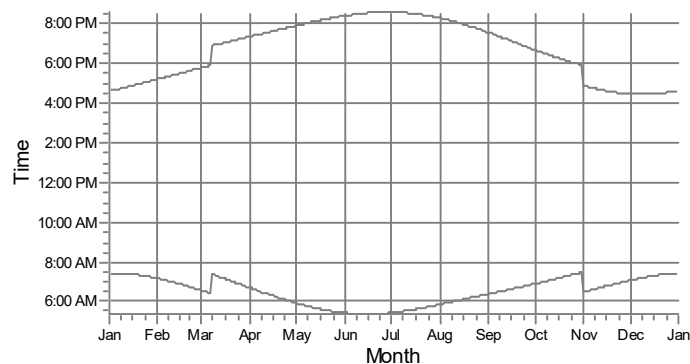
V: REC-022



W: REC-023



X: REC-024



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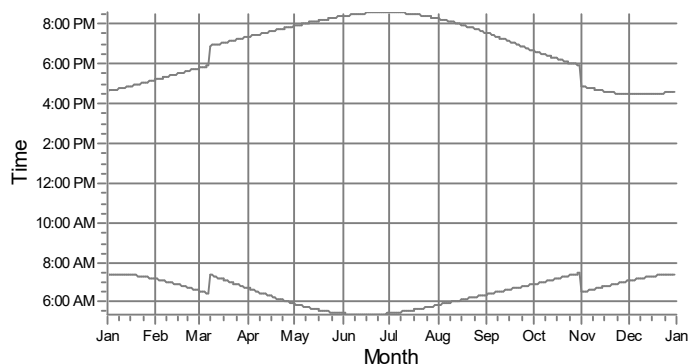
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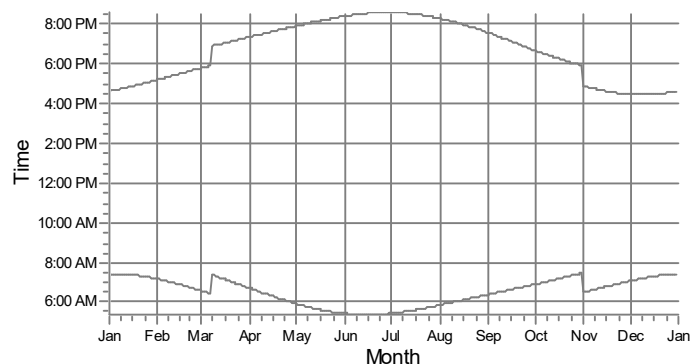
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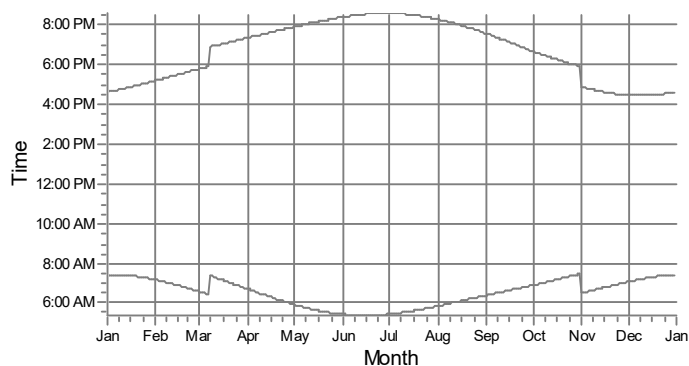
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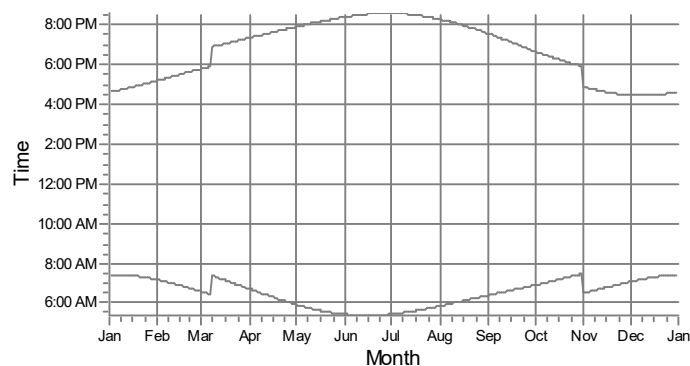
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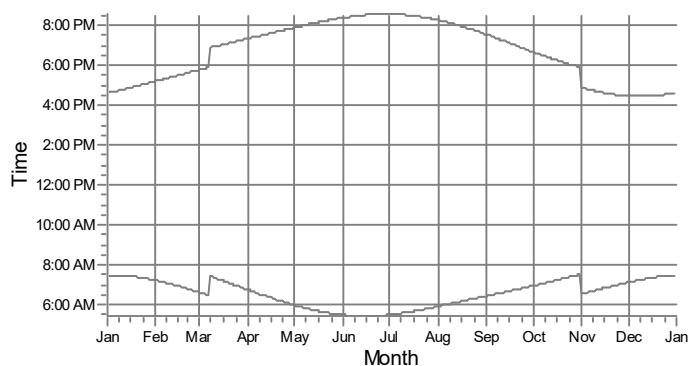
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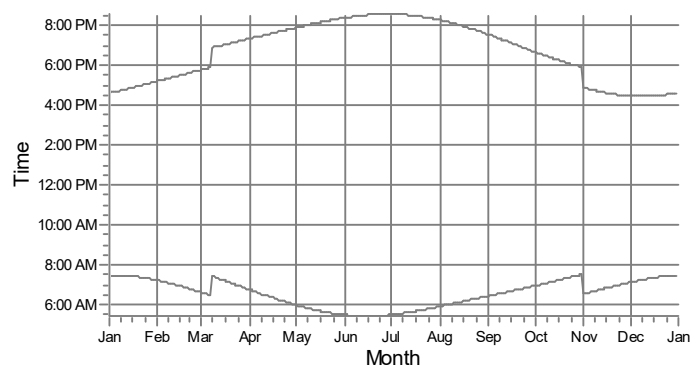
AB: REC-028



AC: REC-029



AD: REC-030



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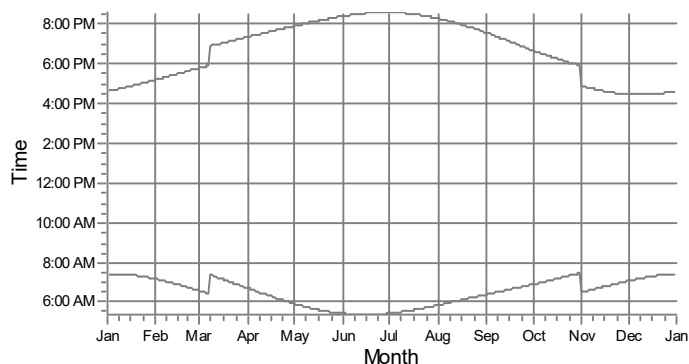
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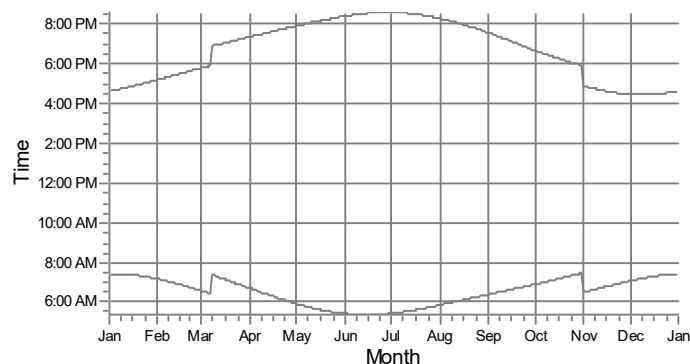
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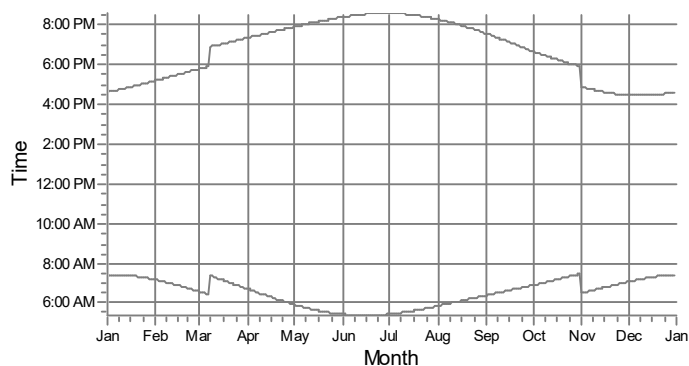
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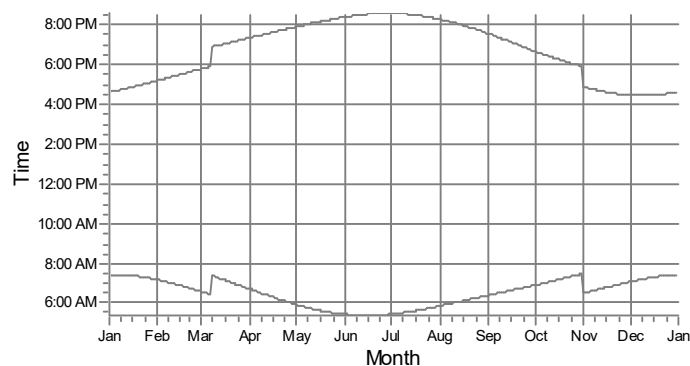
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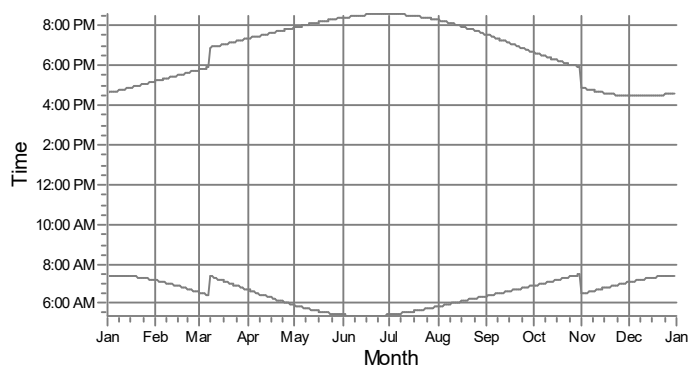
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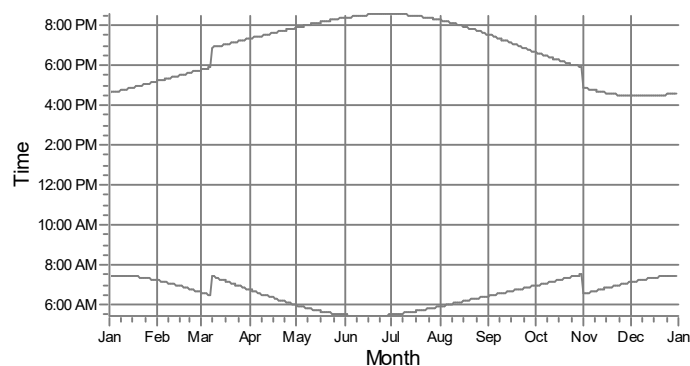
AH: REC-034



AI: REC-035



AJ: REC-036



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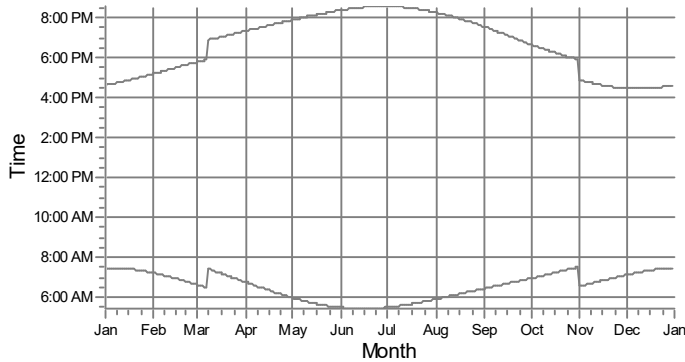
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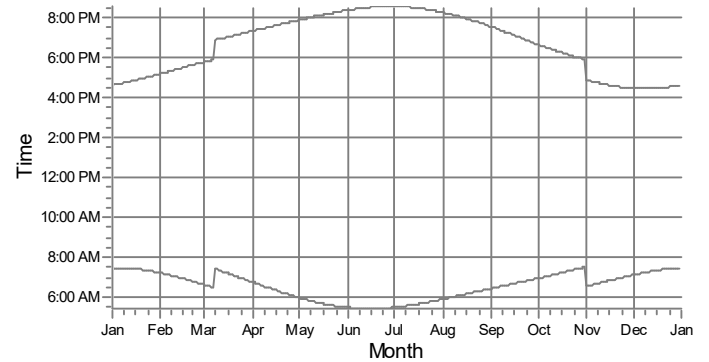
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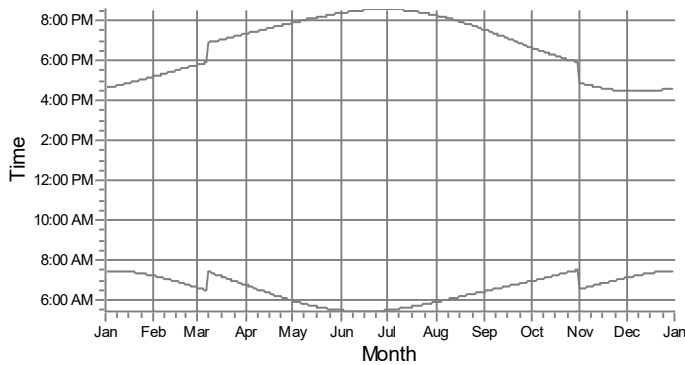
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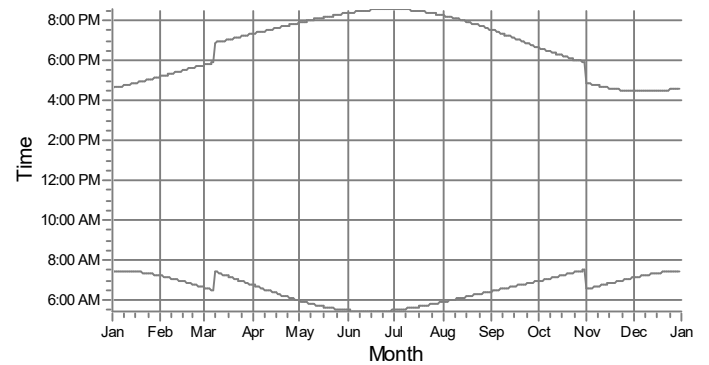
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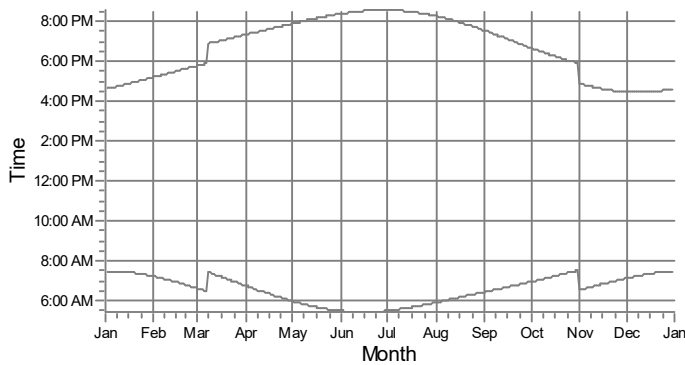
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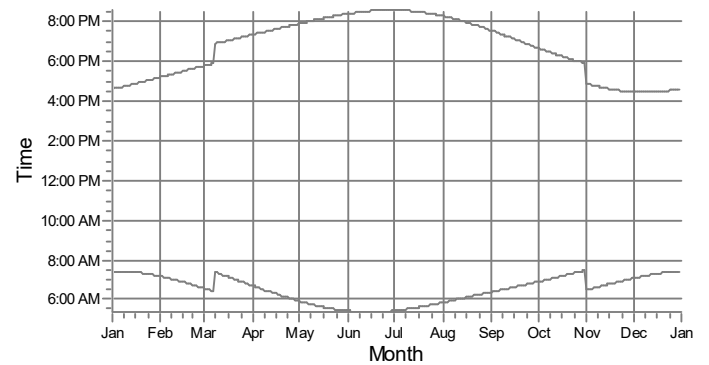
AN: REC-040



AO: REC-041



AP: REC-042



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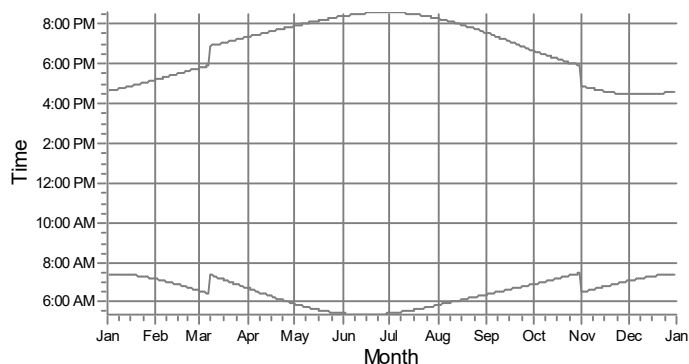
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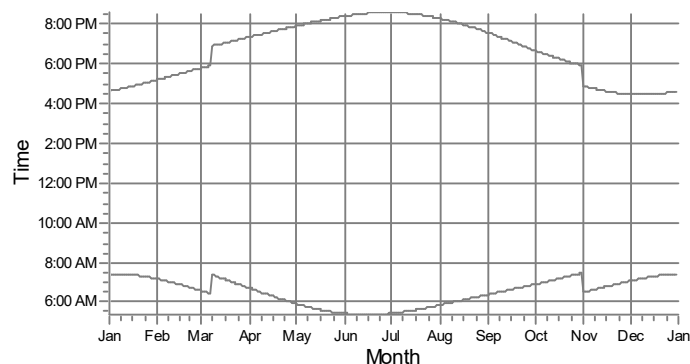
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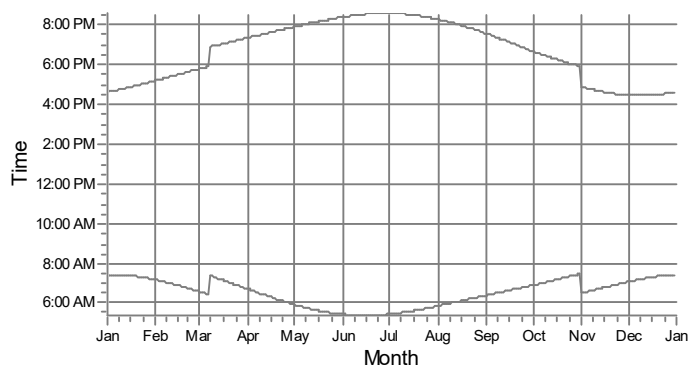
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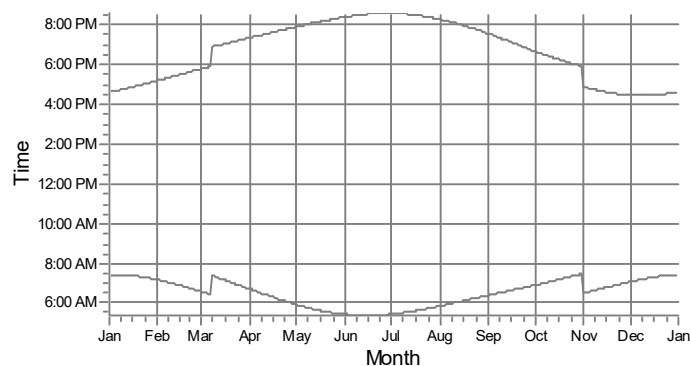
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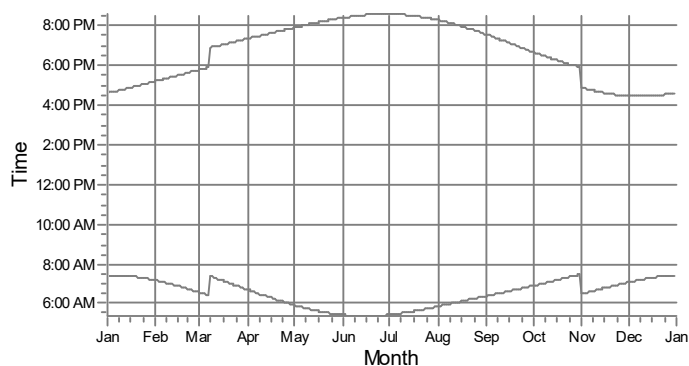
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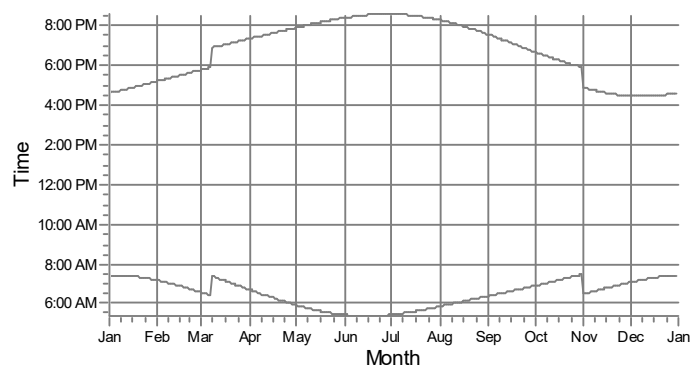
AT: REC-046



AU: REC-047



AV: REC-048



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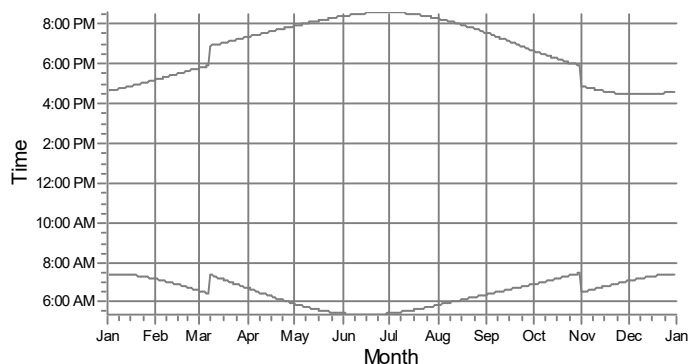
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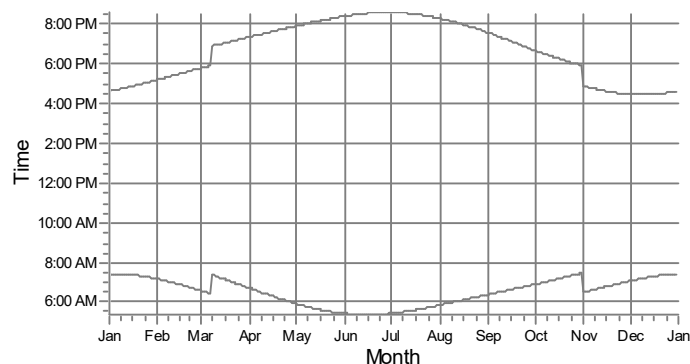
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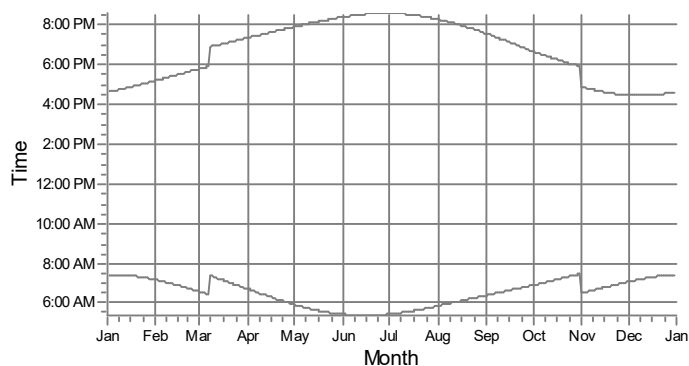
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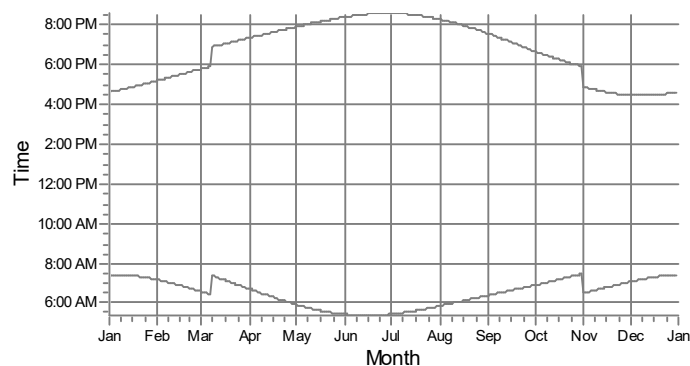
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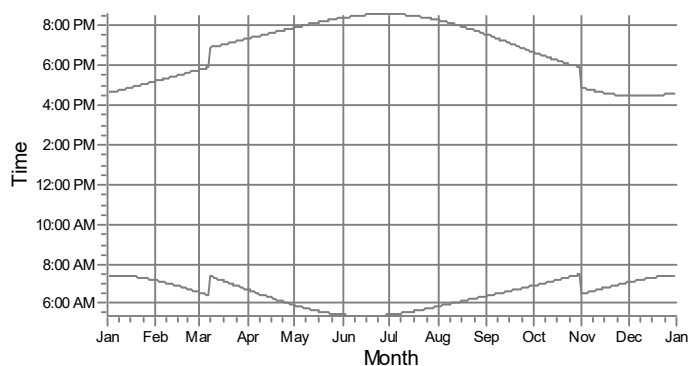
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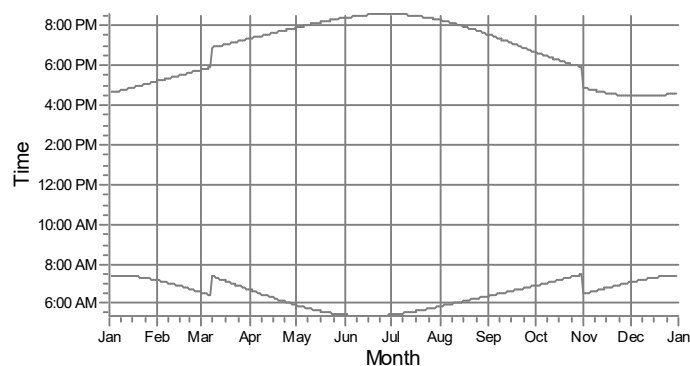
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BA: REC-053



BB: REC-054



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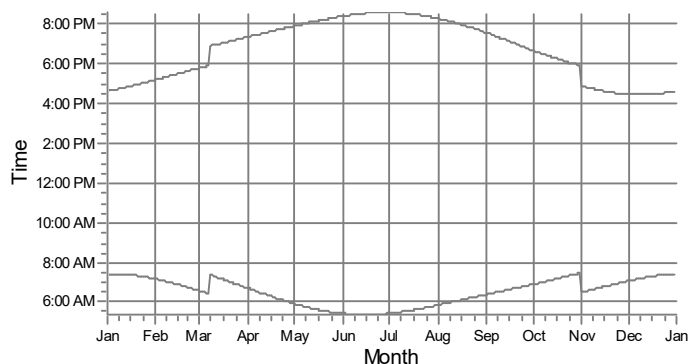
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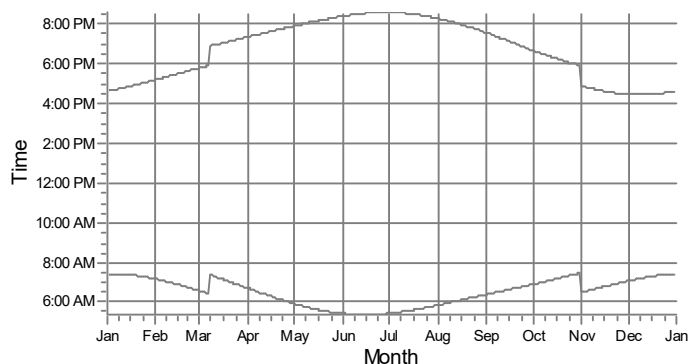
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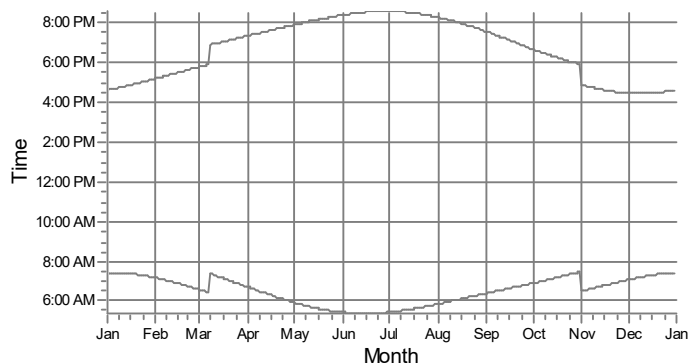
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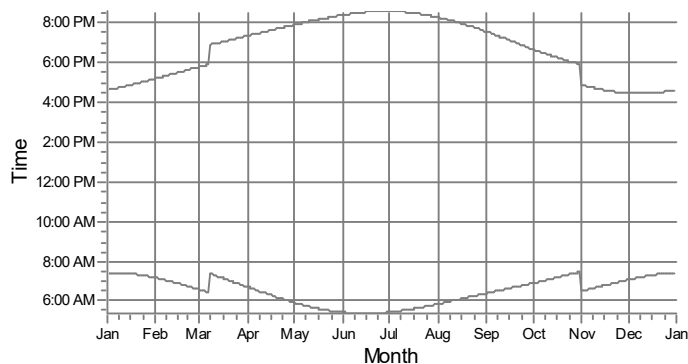
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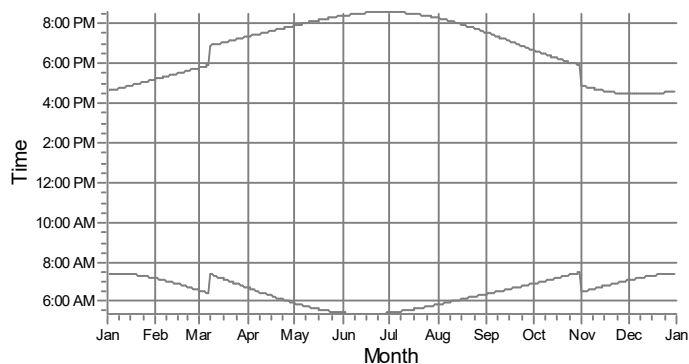
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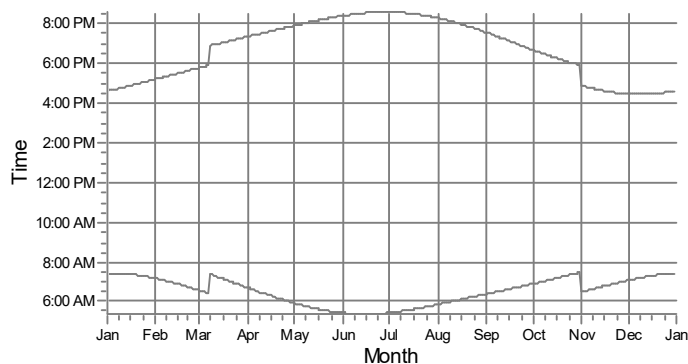
BF: REC-058



BG: REC-059



BH: REC-060



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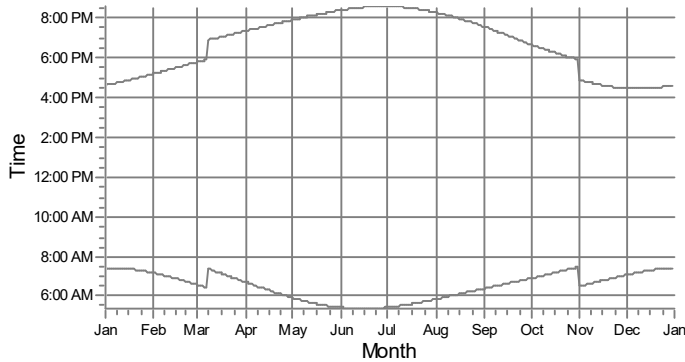
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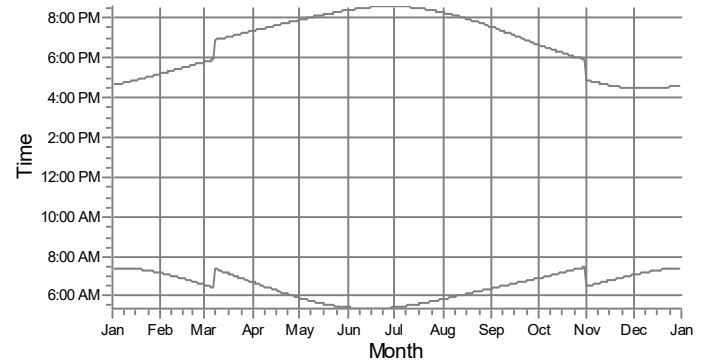
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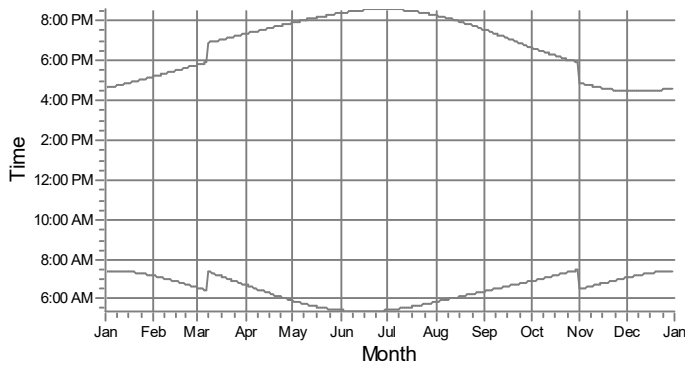
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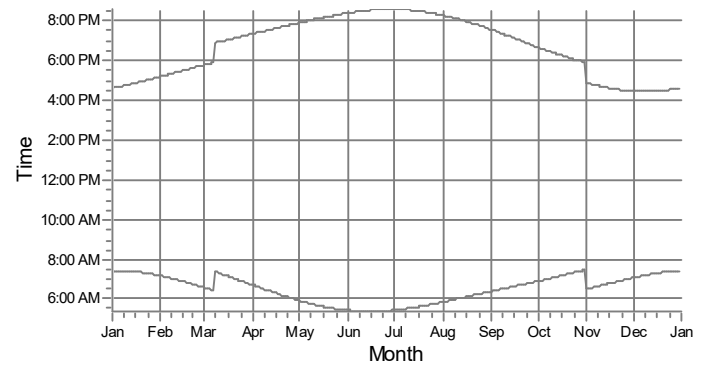
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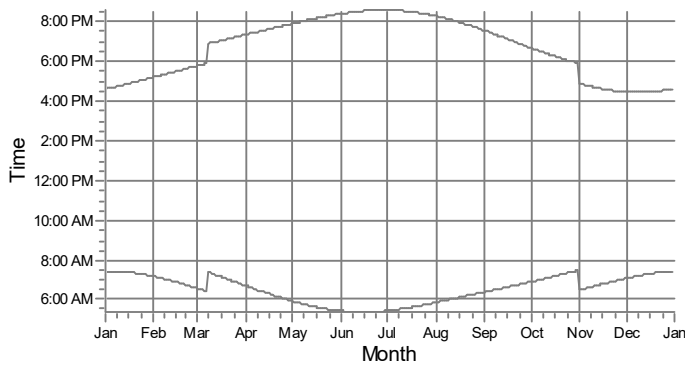
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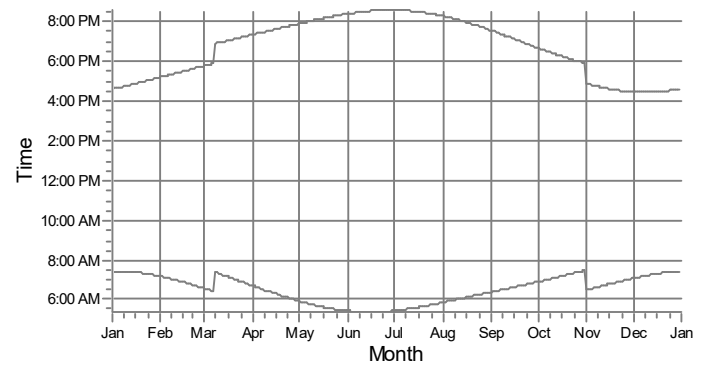
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BM: REC-065



BN: REC-066



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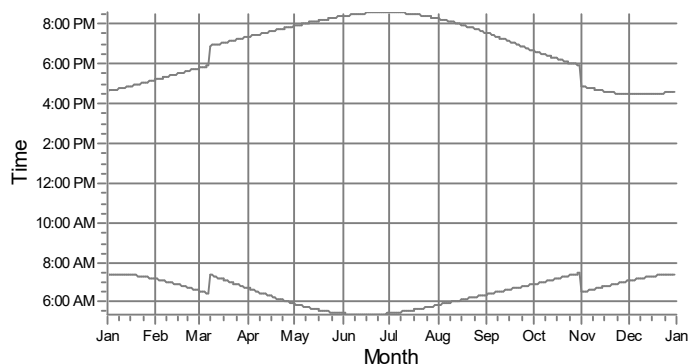
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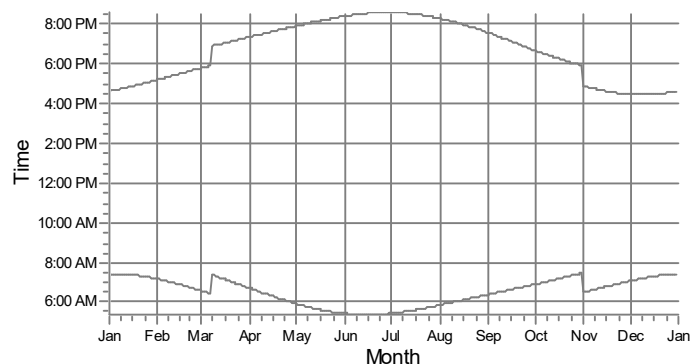
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

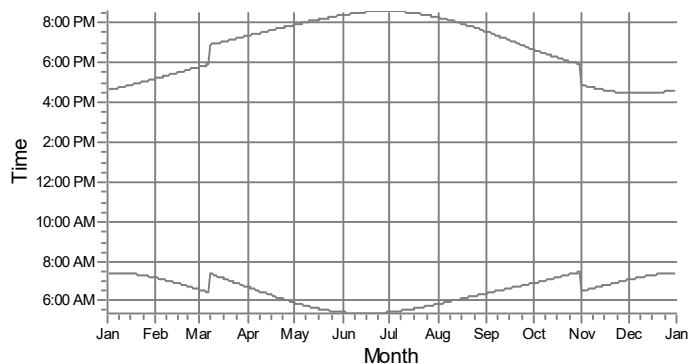
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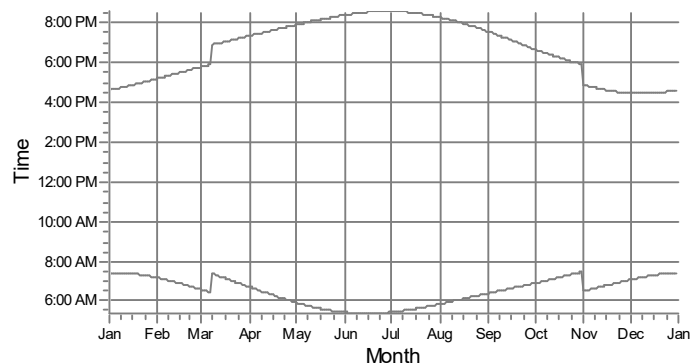
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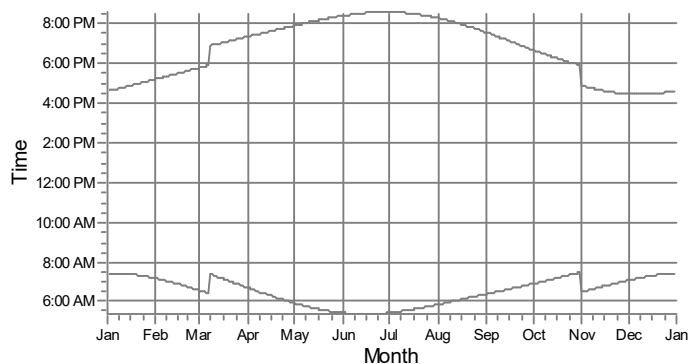
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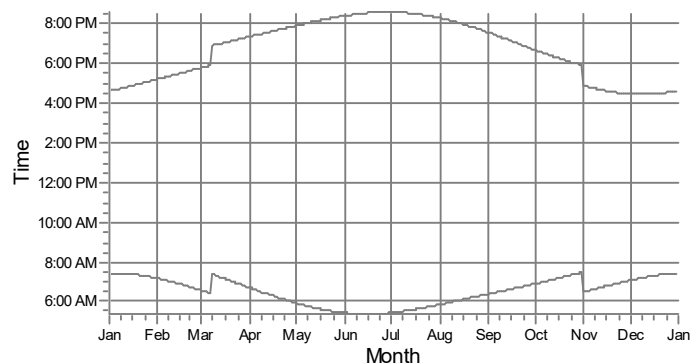
BR: REC-070



BS: REC-071



BT: REC-072



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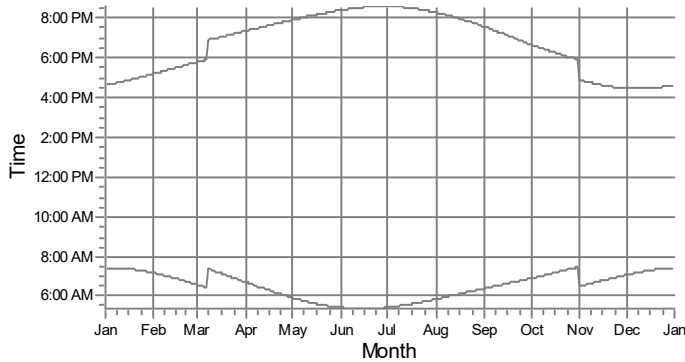
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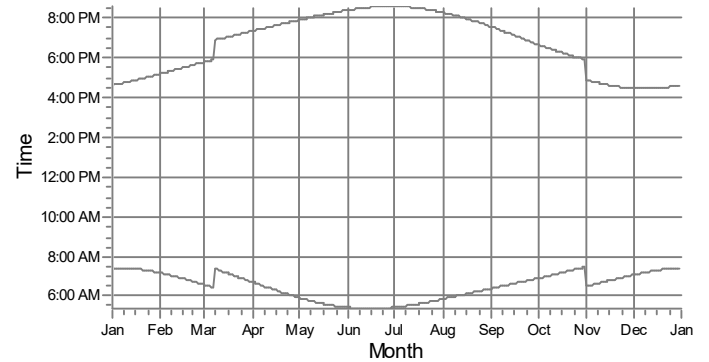
SHADOW - Calendar, graphical

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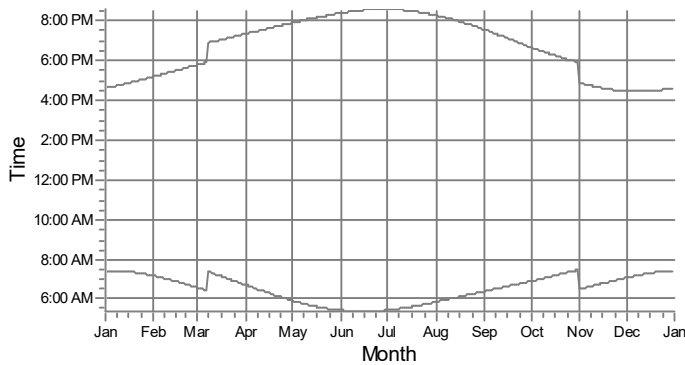
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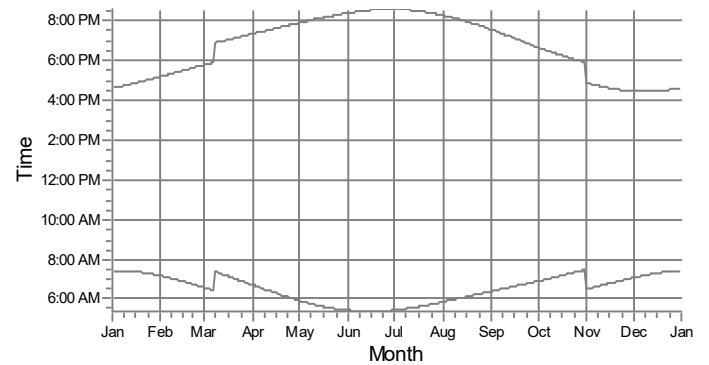
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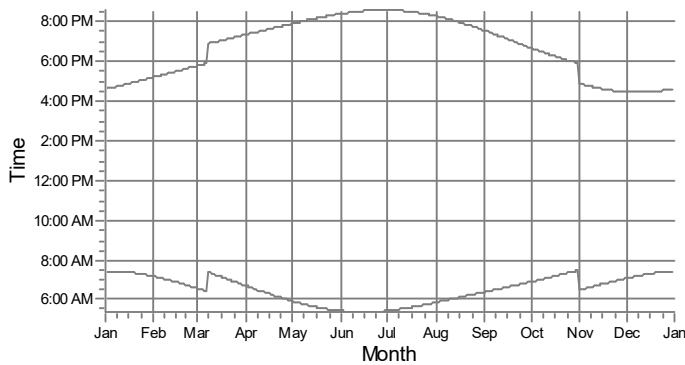
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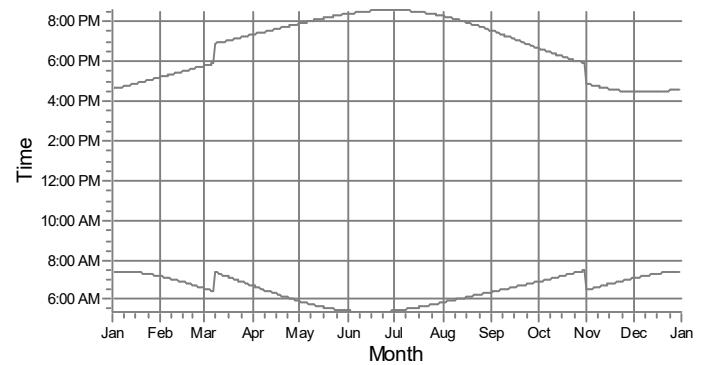
BX: REC-076



BY: REC-077



BZ: REC-078



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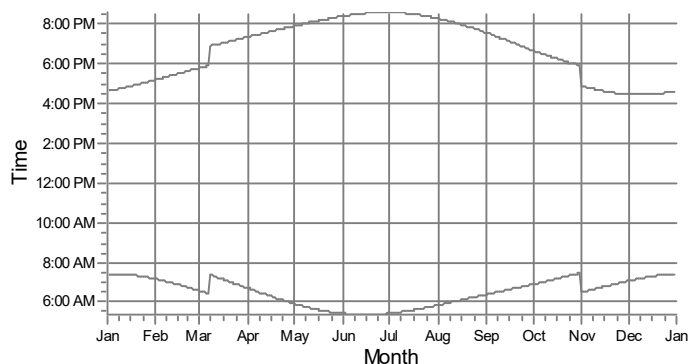
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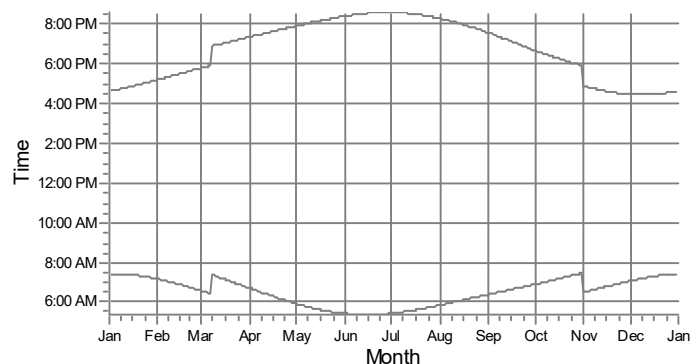
SHADOW - Calendar, graphical

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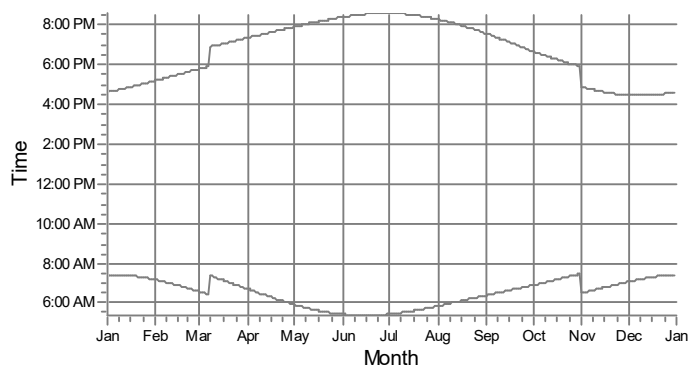
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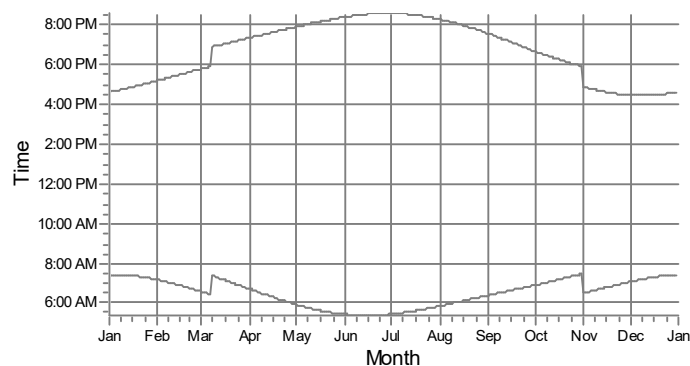
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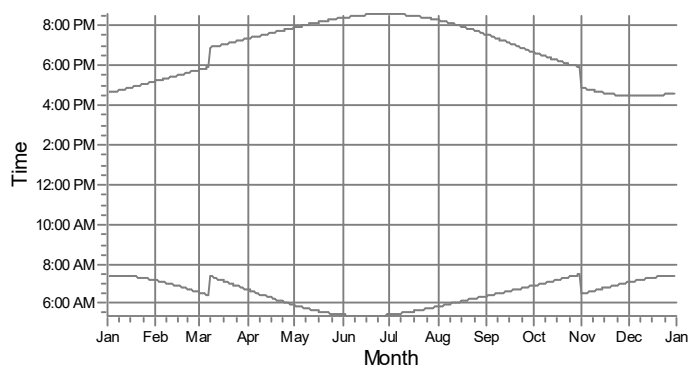
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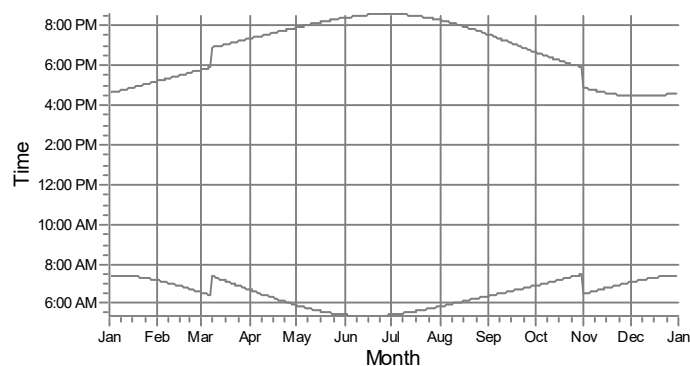
CD: REC-082



CE: REC-083



CF: REC-084



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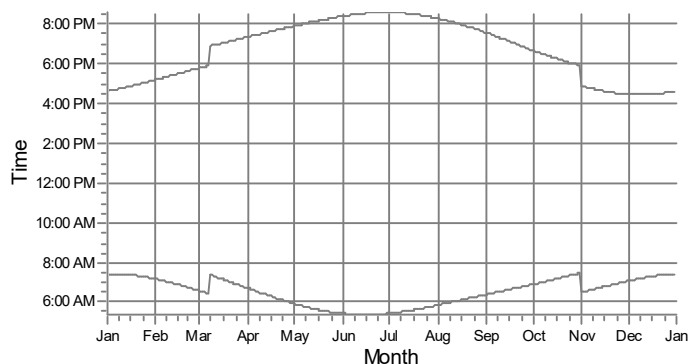
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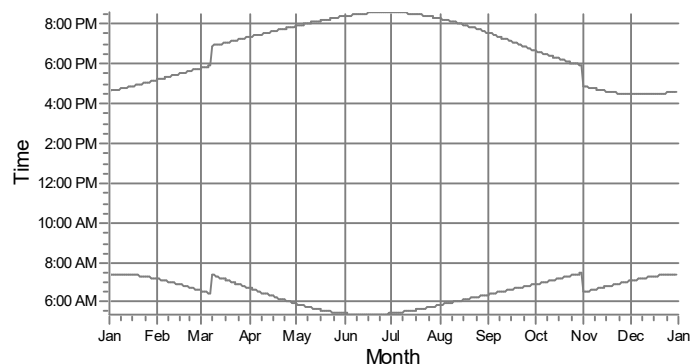
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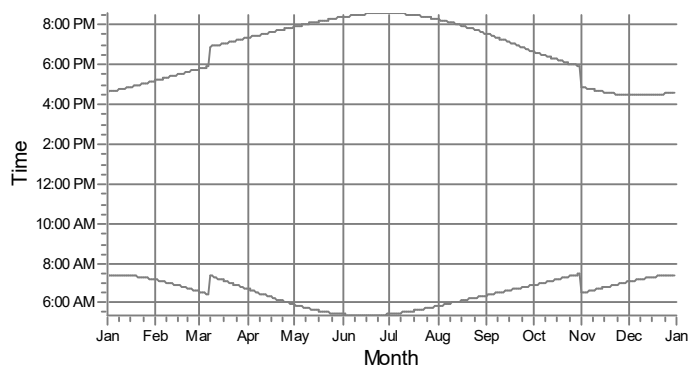
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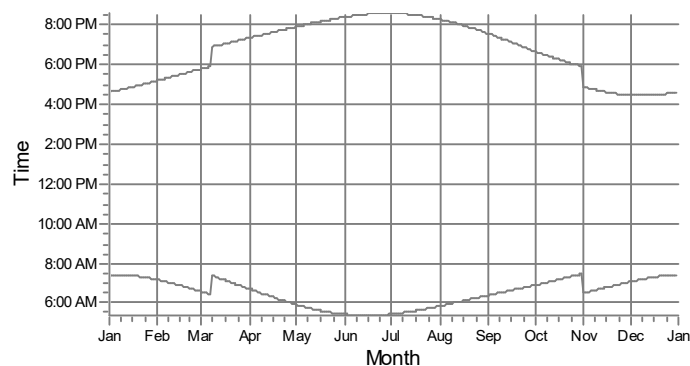
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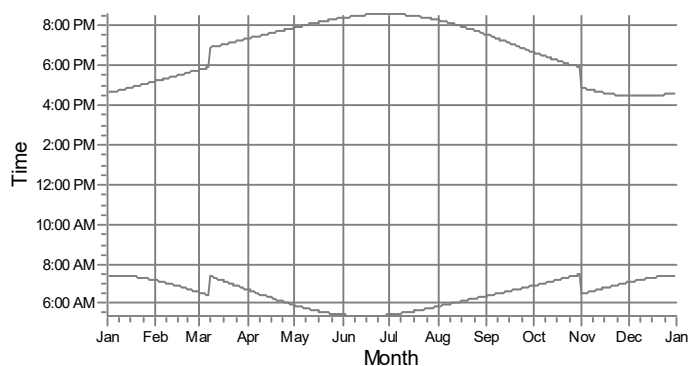
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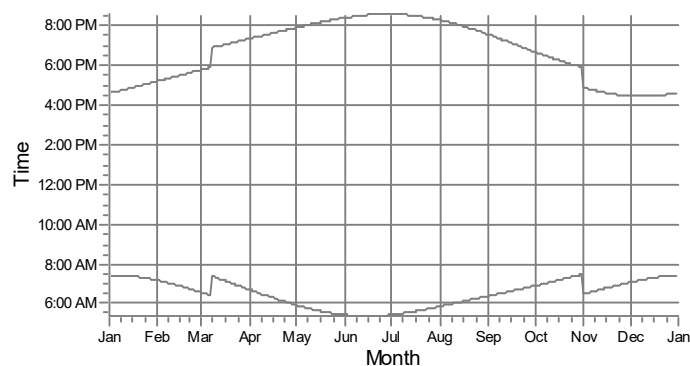
CJ: REC-088



CK: REC-089



CL: REC-090



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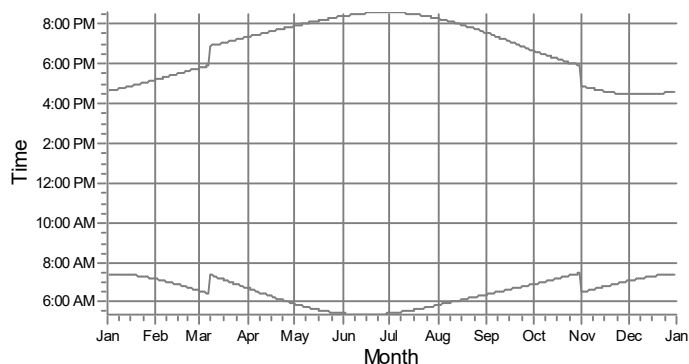
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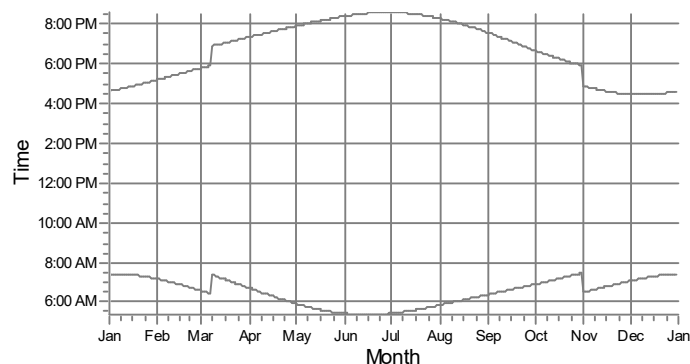
SHADOW - Calendar, graphical

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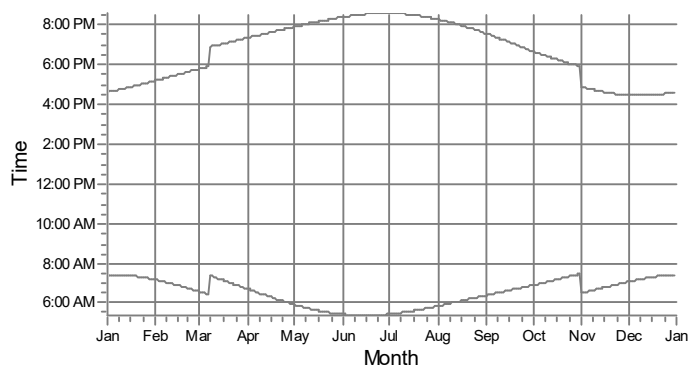
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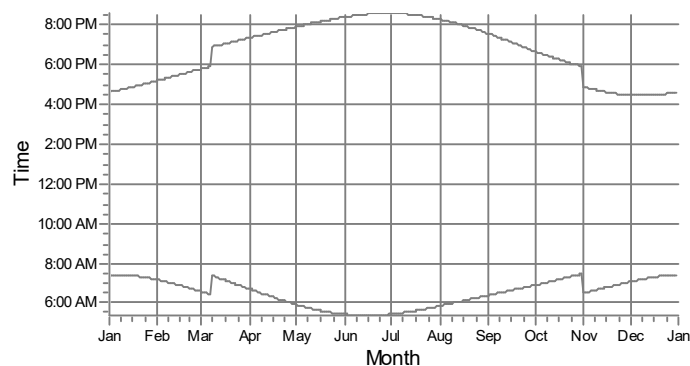
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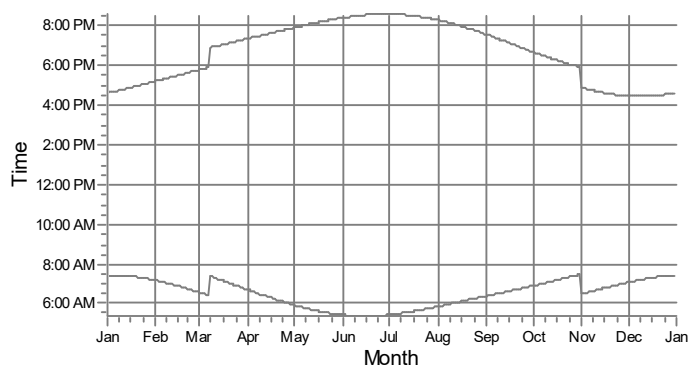
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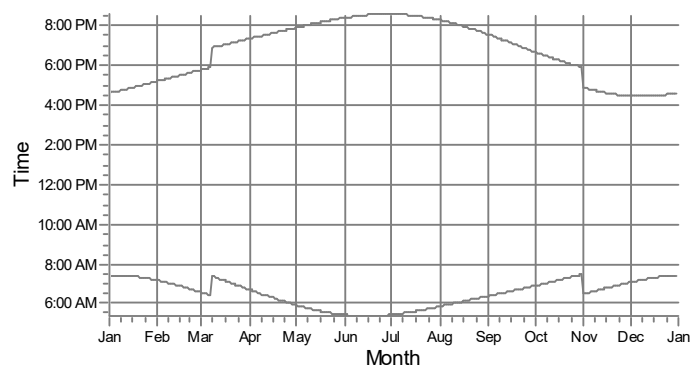
CP: REC-094



CQ: REC-095



CR: REC-096



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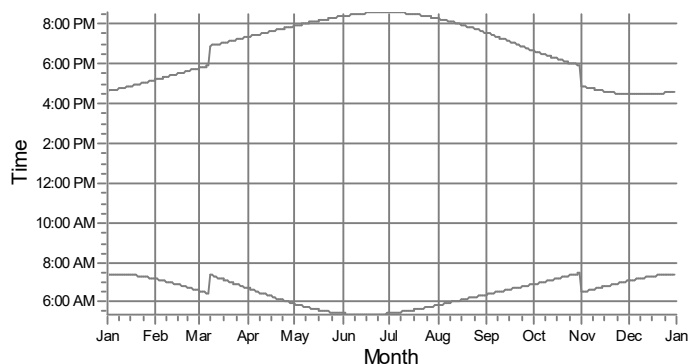
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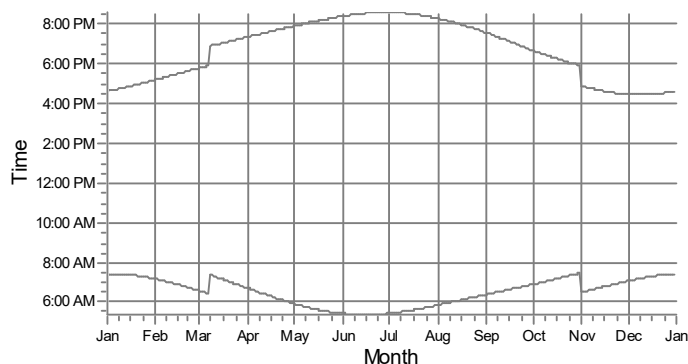
SHADOW - Calendar, graphical

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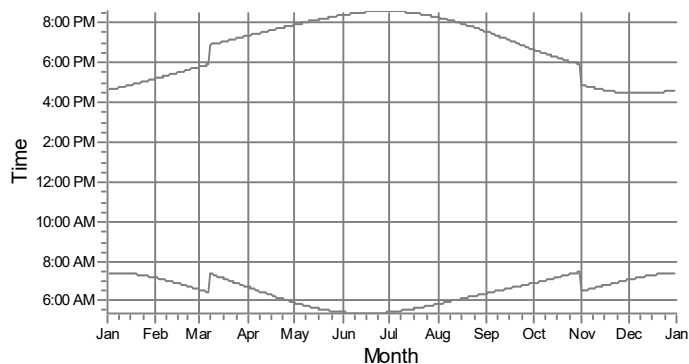
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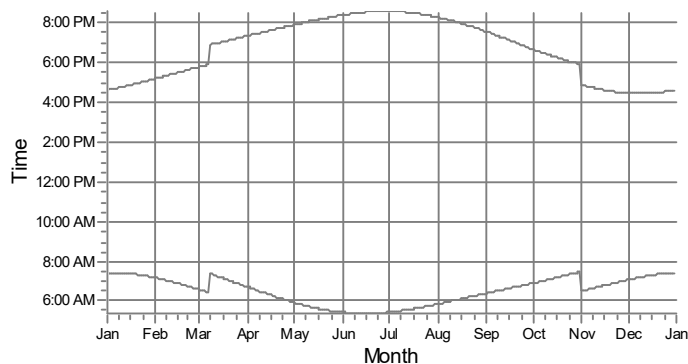
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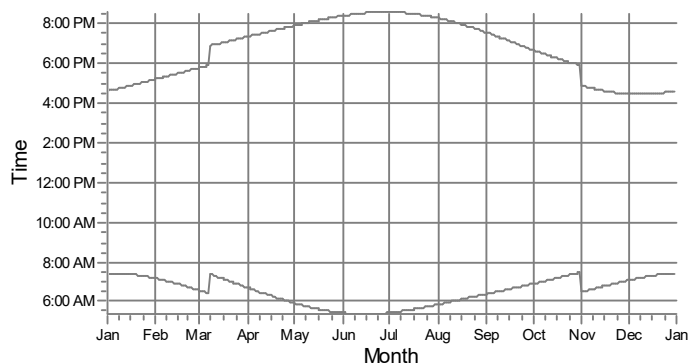
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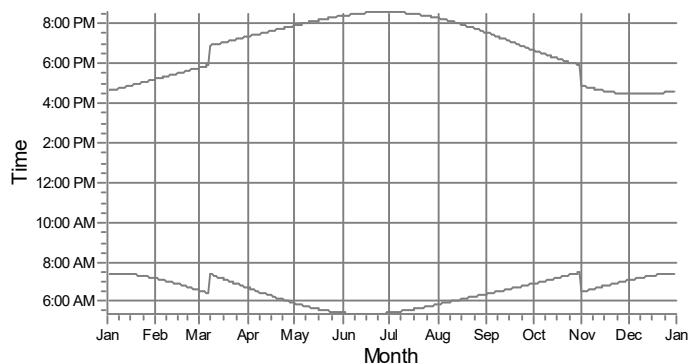
CV: REC-100



CW: REC-101



CX: REC-102



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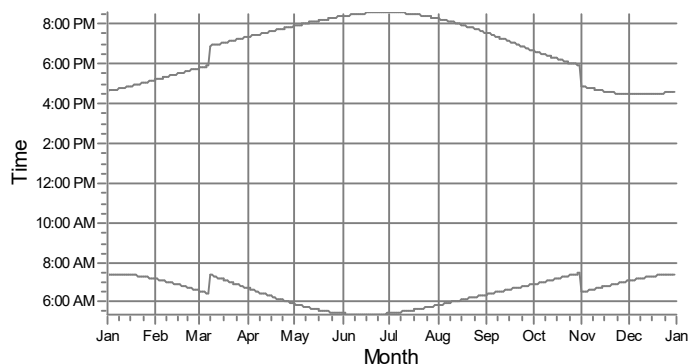
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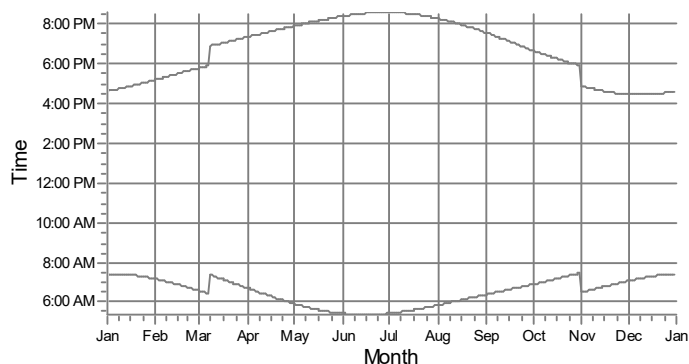
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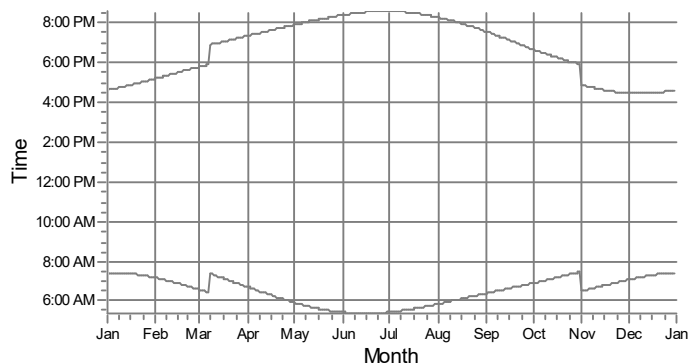
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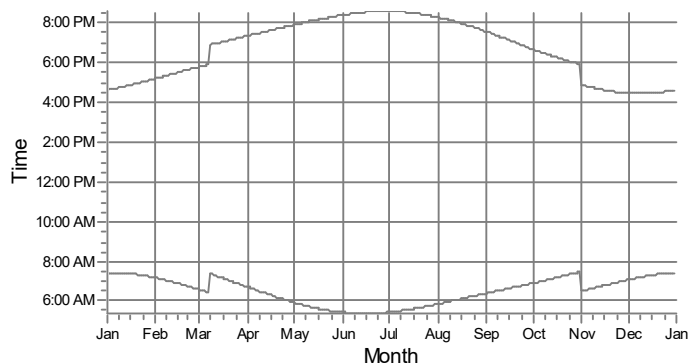
CZ: REC-104



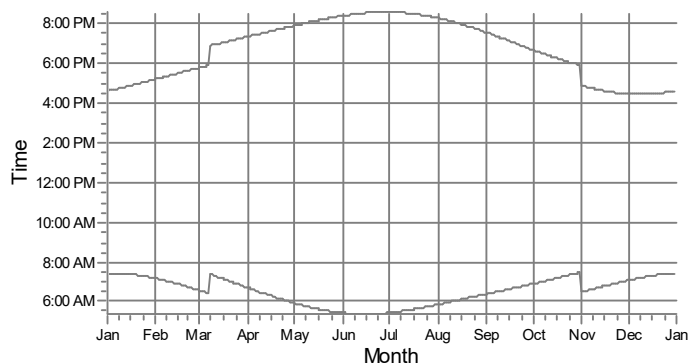
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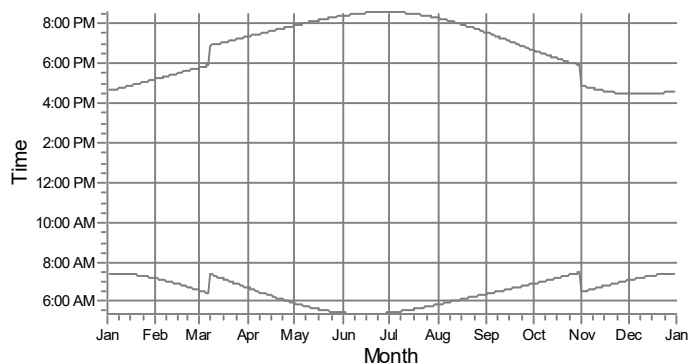
DB: REC-106



DC: REC-107



DD: REC-108



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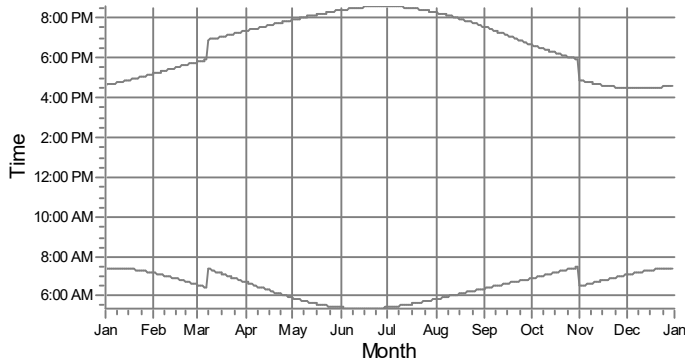
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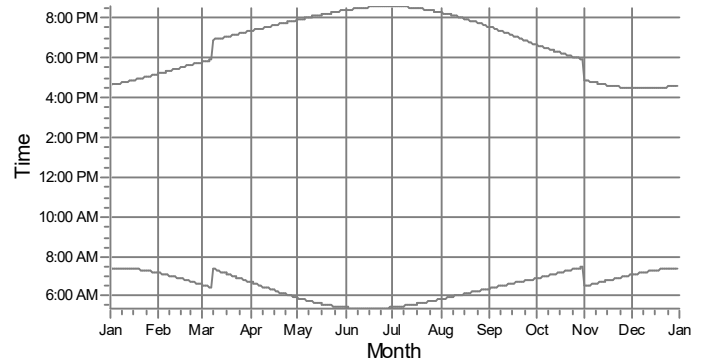
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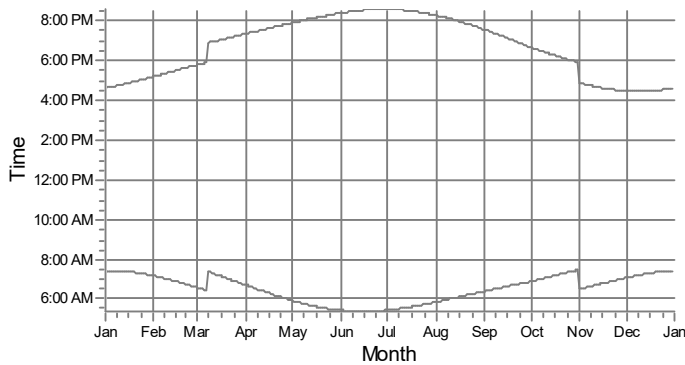
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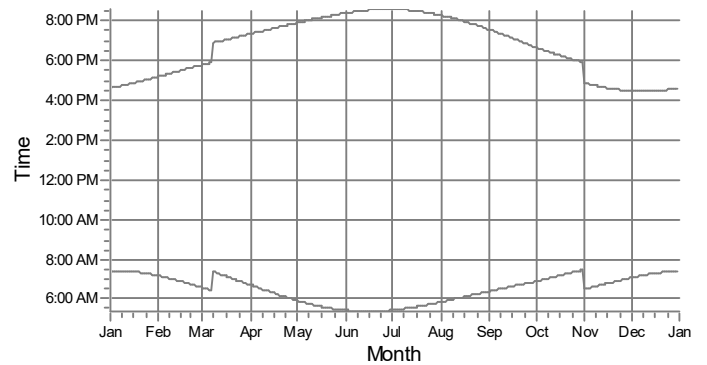
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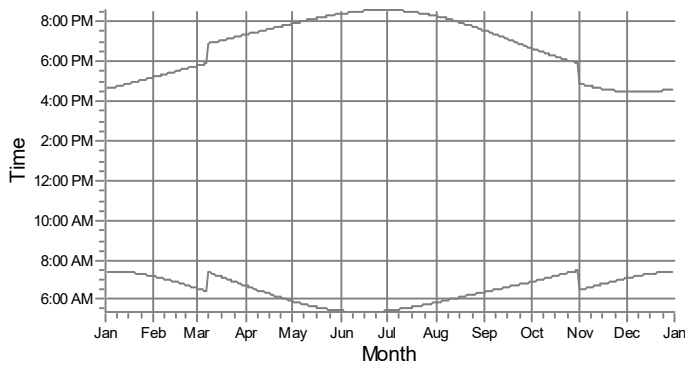
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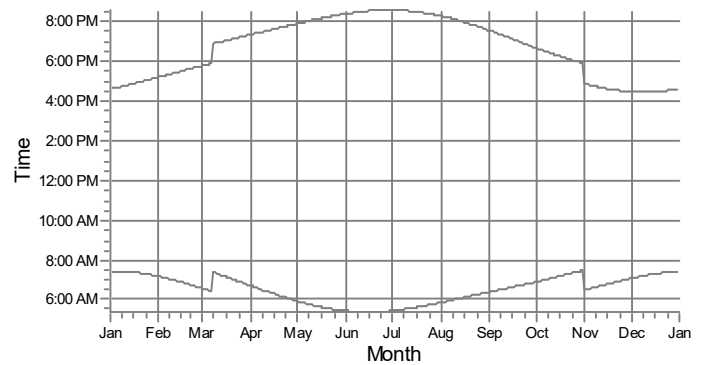
DH: REC-112



DI: REC-113



DJ: REC-114



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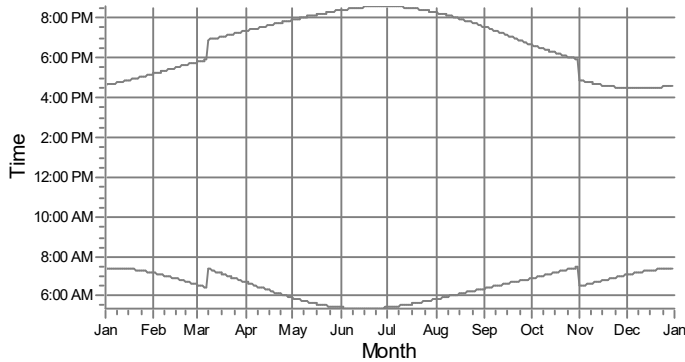
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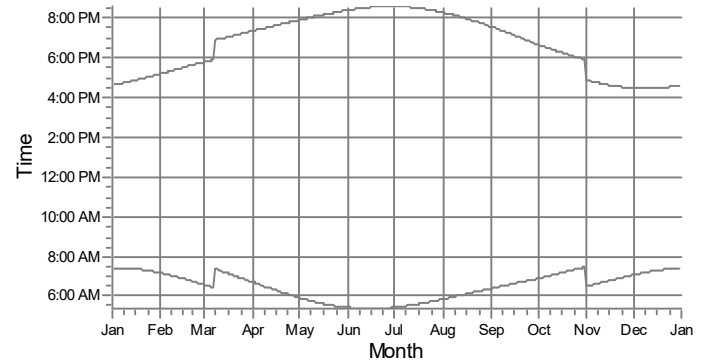
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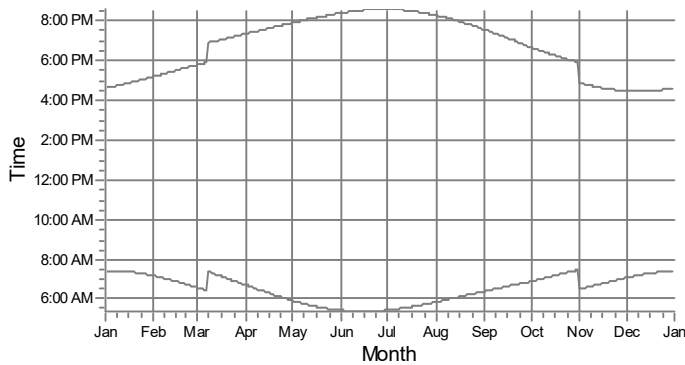
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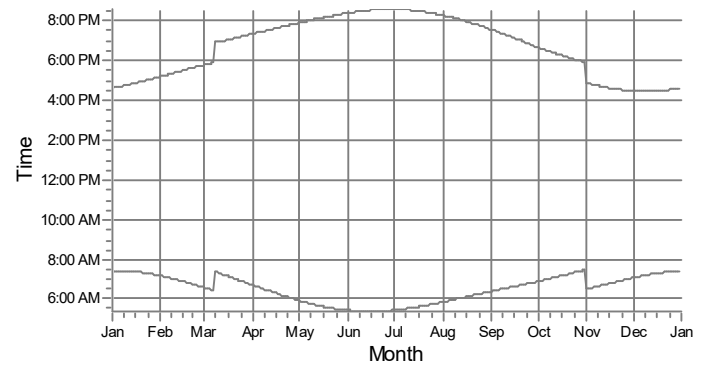
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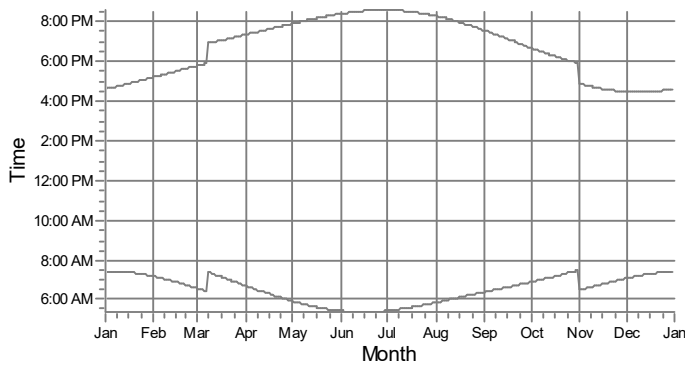
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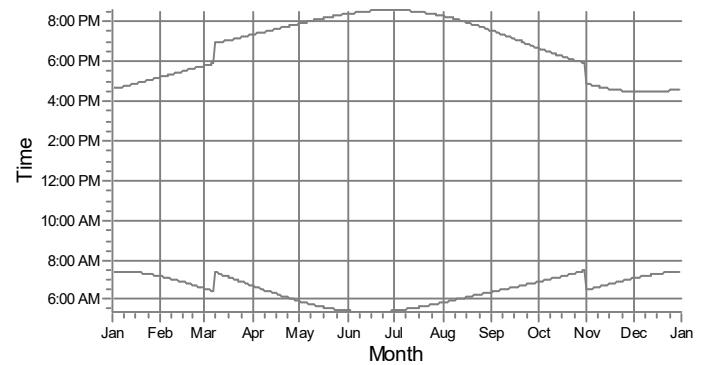
DN: REC-118



DO: REC-119



DP: REC-120



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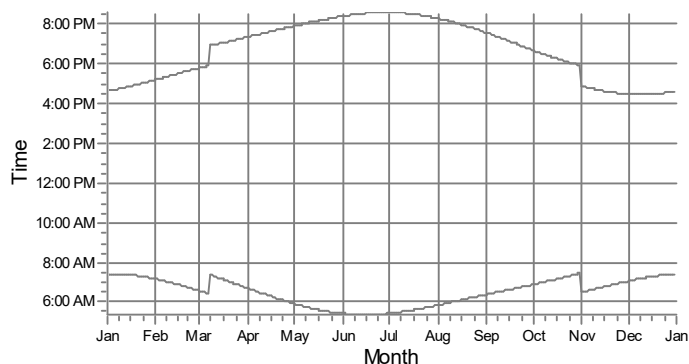
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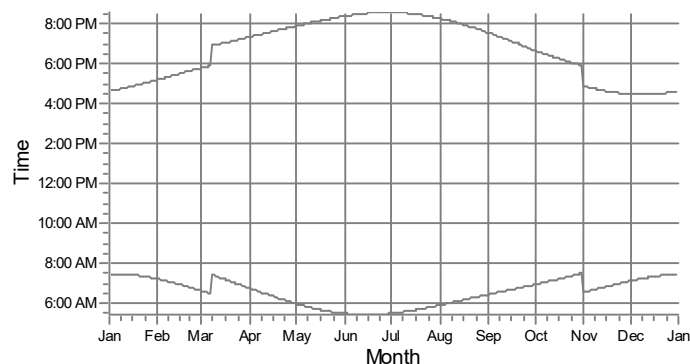
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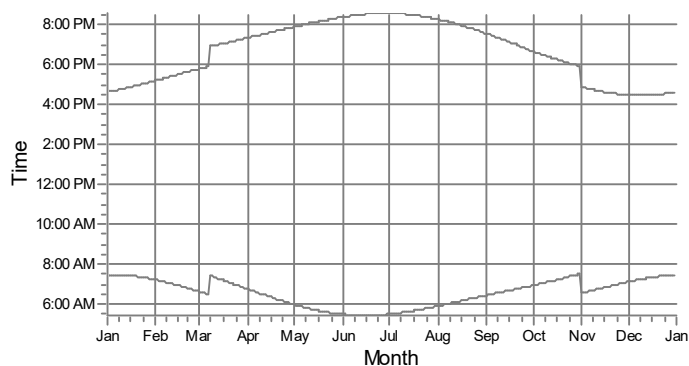
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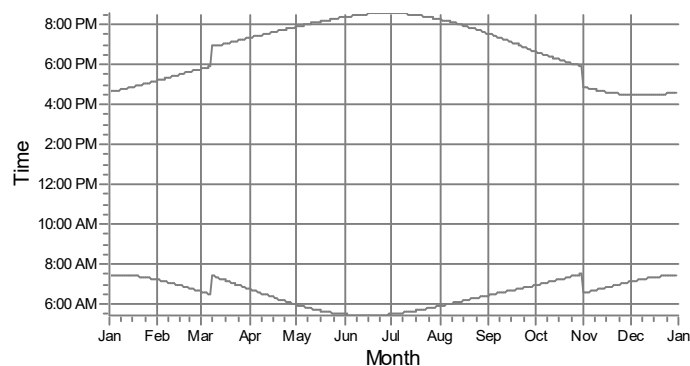
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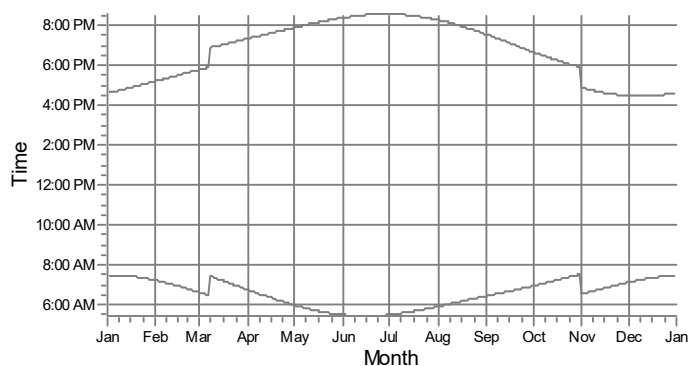
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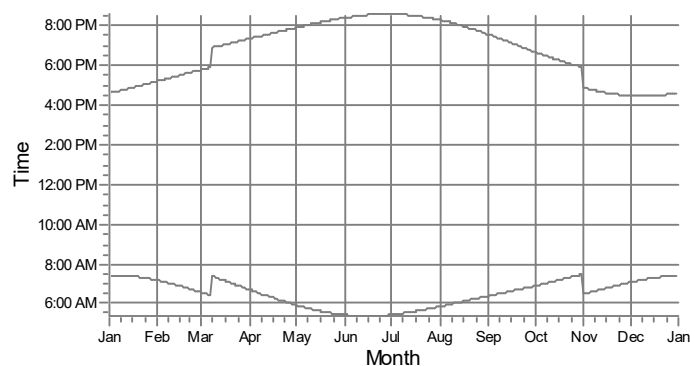
DT: REC-124



DU: REC-125



DV: REC-126



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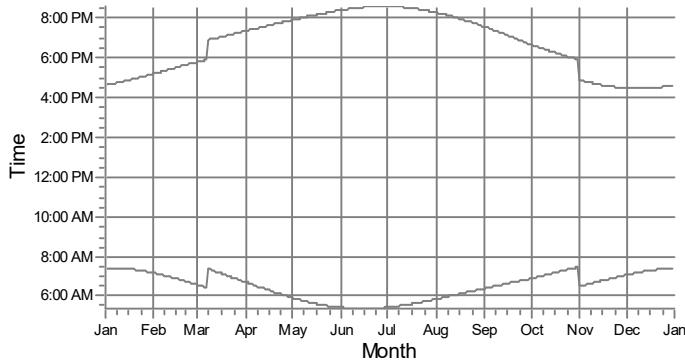
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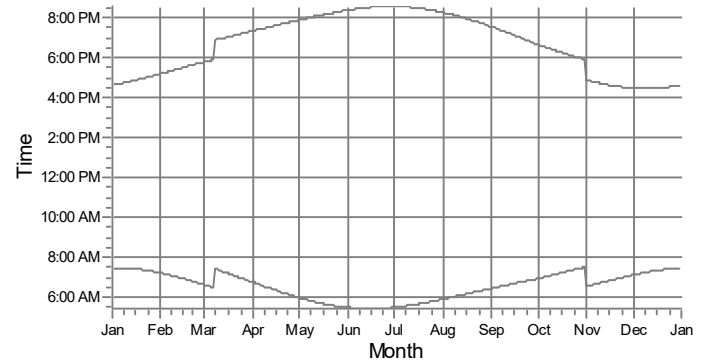
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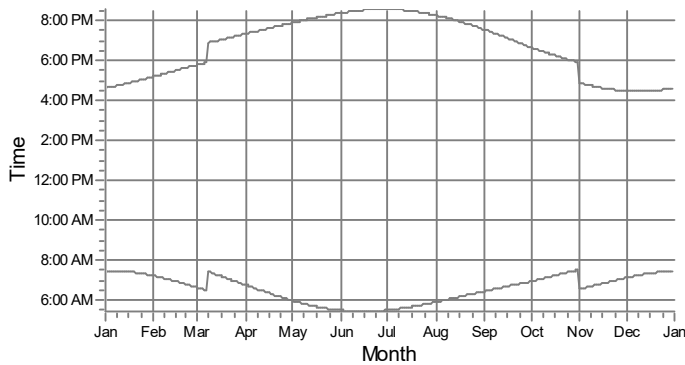
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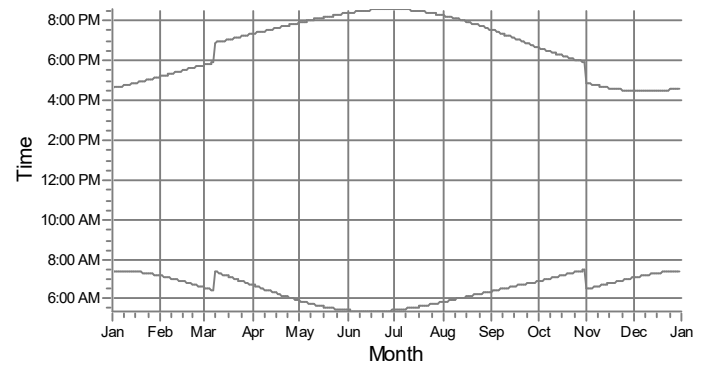
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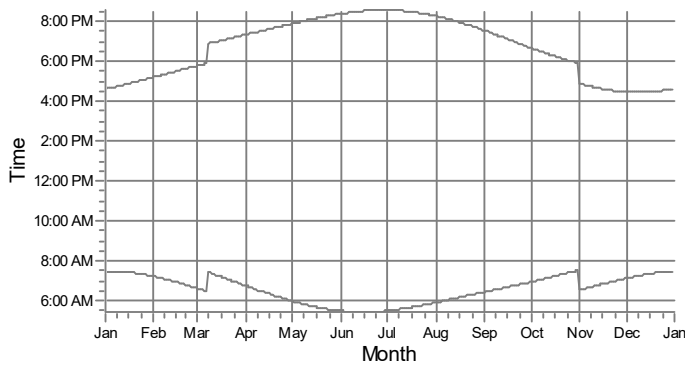
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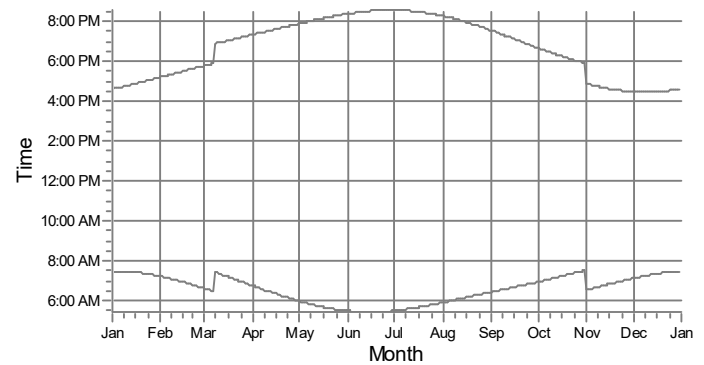
DZ: REC-130



EA: REC-131



EB: REC-132



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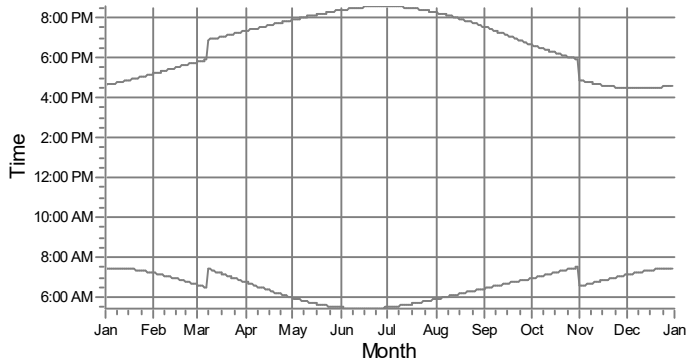
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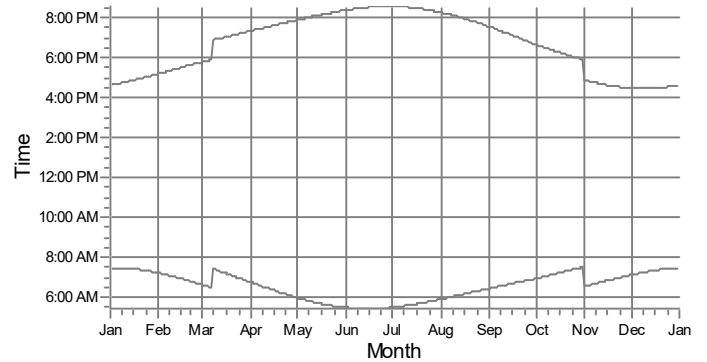
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

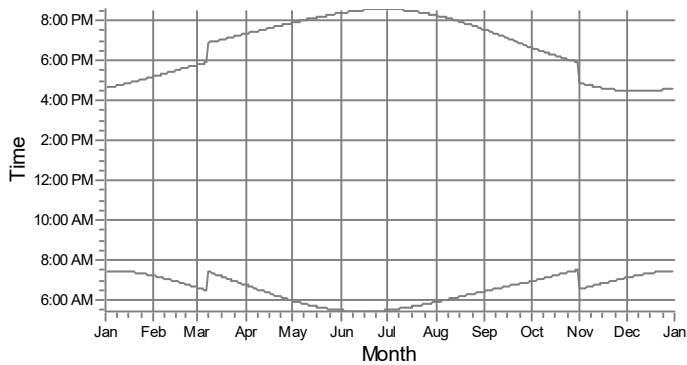
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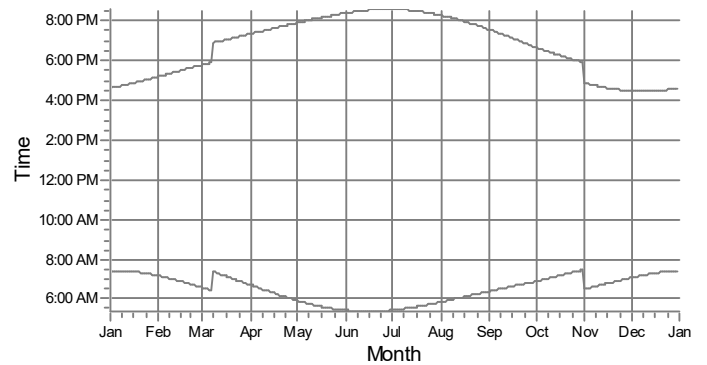
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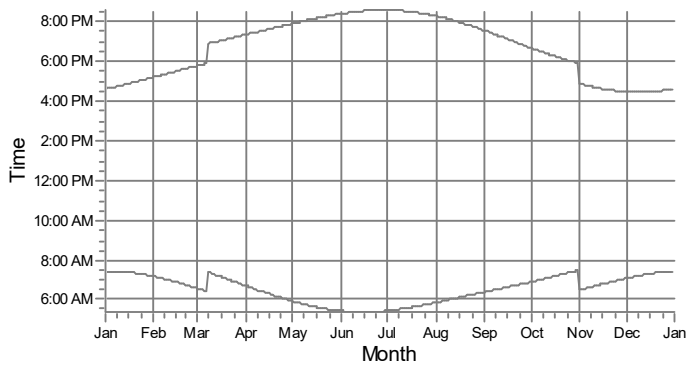
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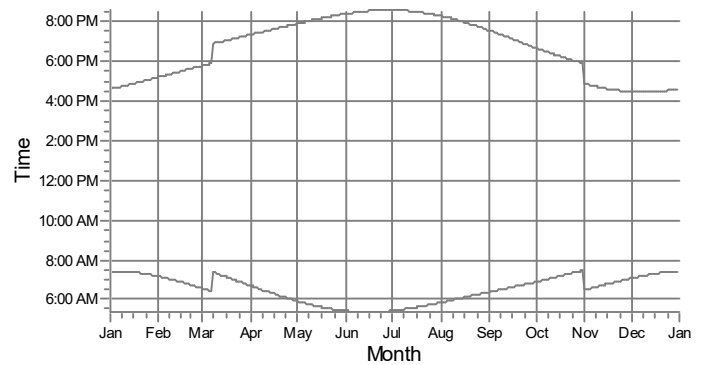
EF: REC-136



EG: REC-137



EH: REC-138



WTGs

Project:

118183 - Shady Oaks II Wind Project

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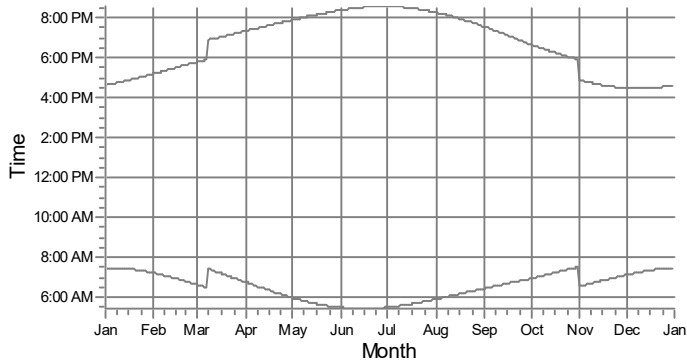
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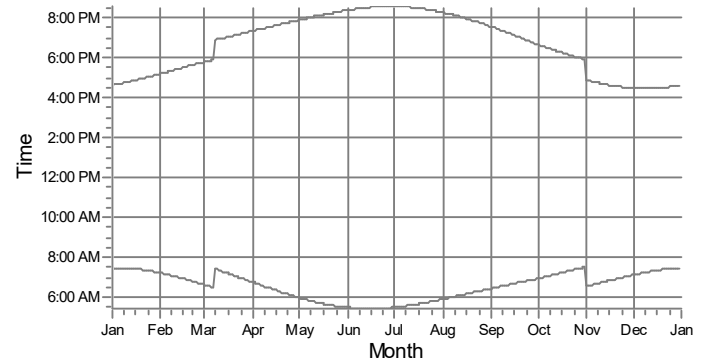
SHADOW - Calendar, graphical

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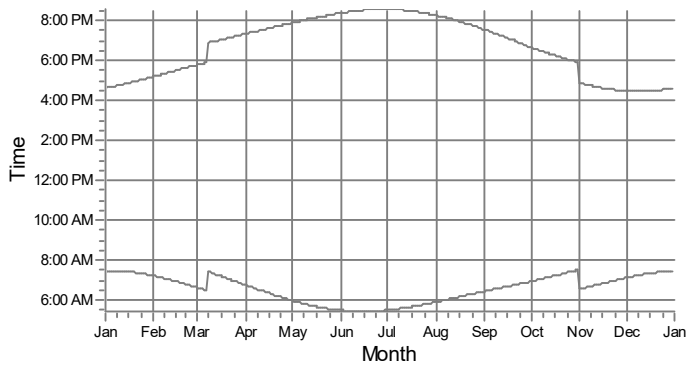
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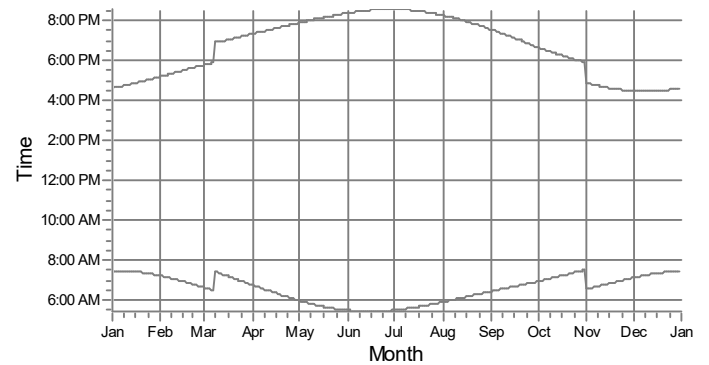
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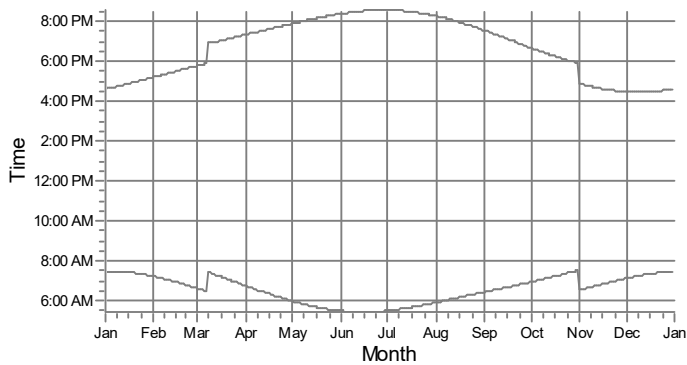
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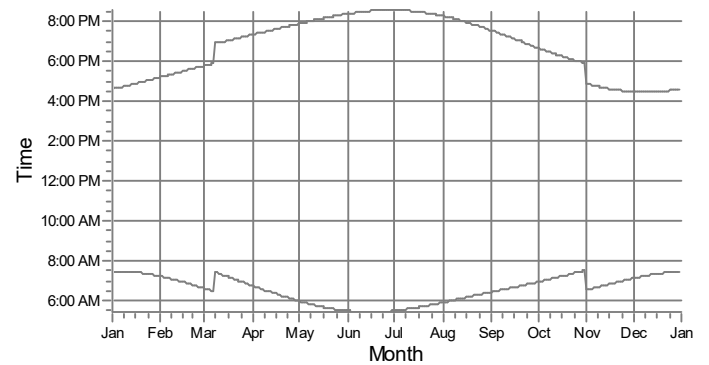
EL: REC-142



EM: REC-143



EN: REC-144



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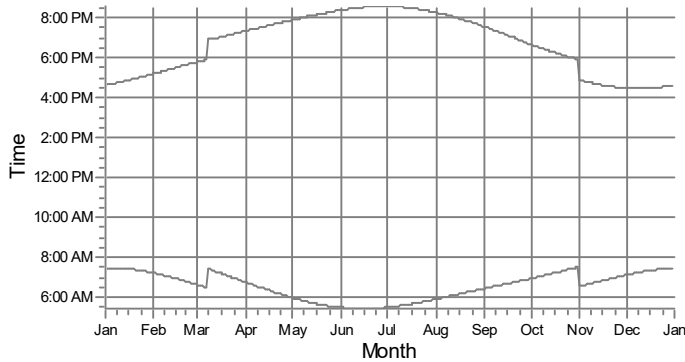
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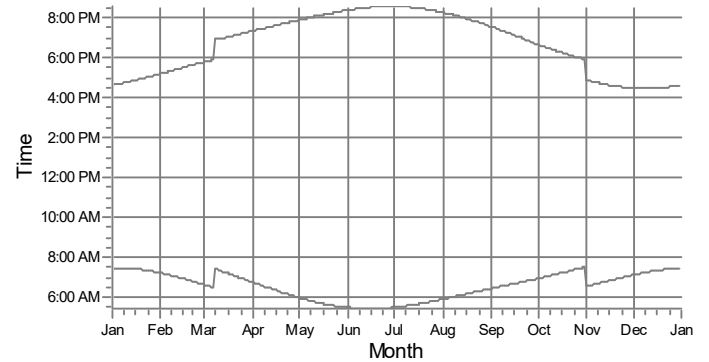
SHADOW - Calendar, graphical

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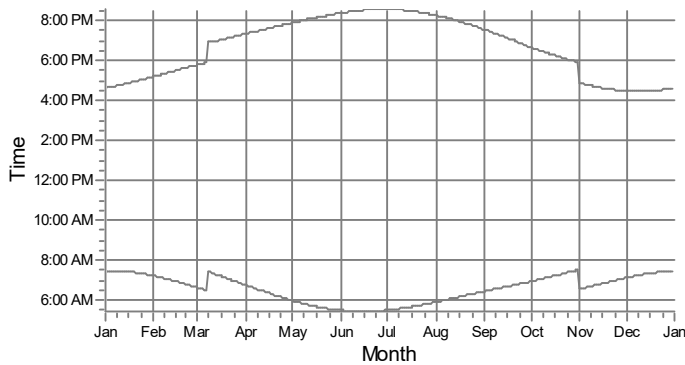
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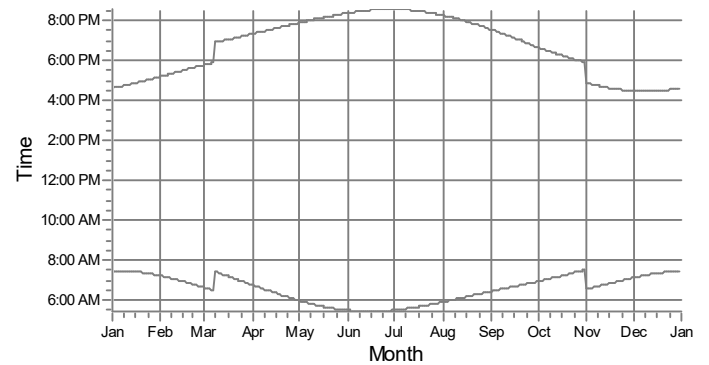
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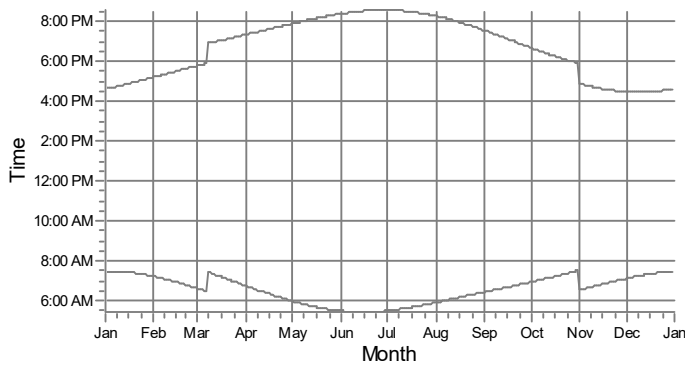
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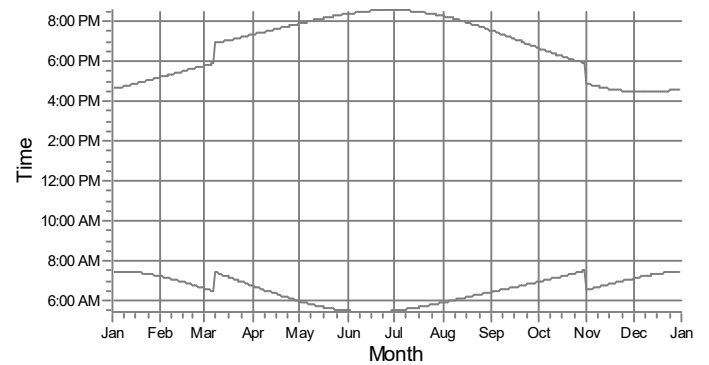
ER: REC-148



ES: REC-149



ET: REC-150



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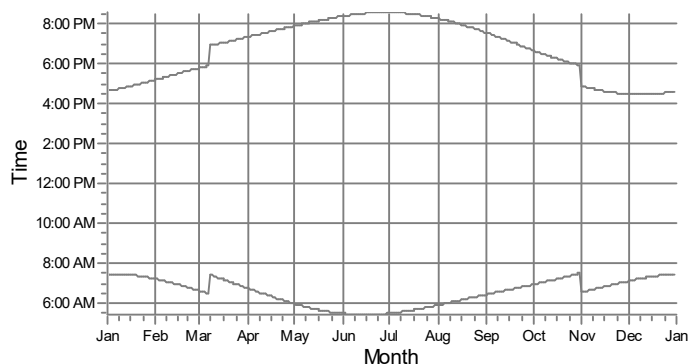
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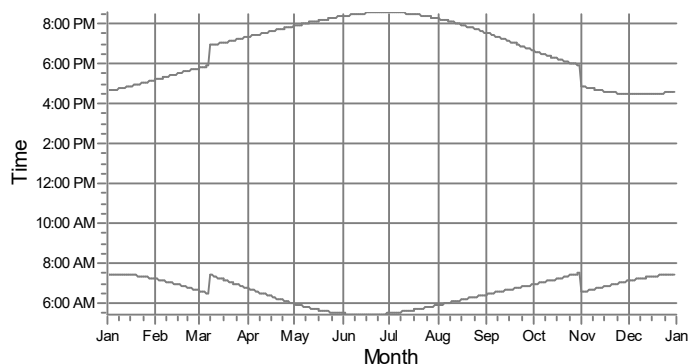
SHADOW - Calendar, graphical

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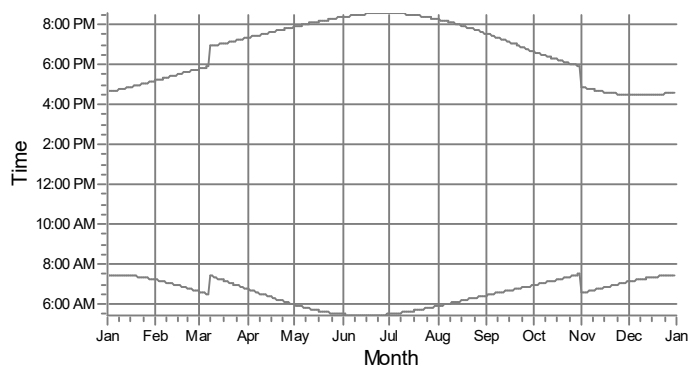
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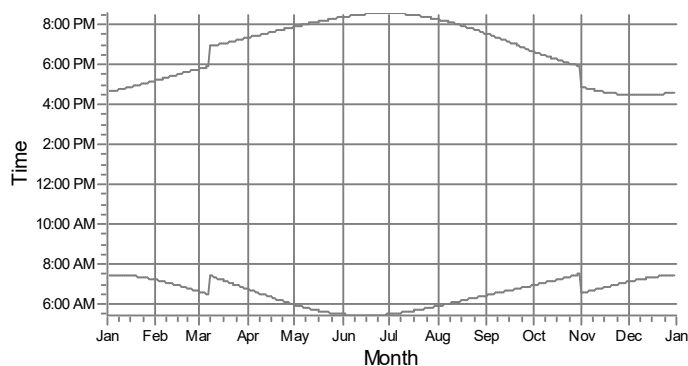
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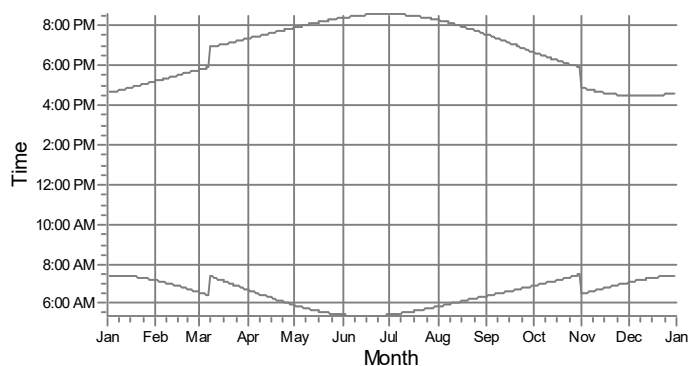
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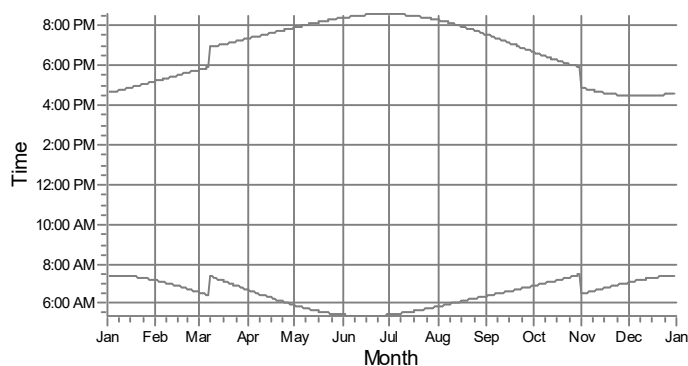
EX: REC-154



EY: REC-155



EZ: REC-156



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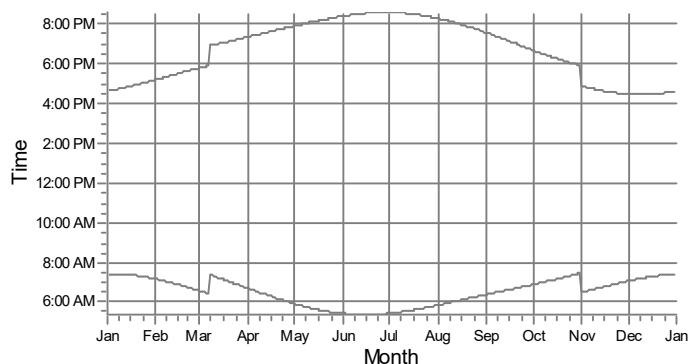
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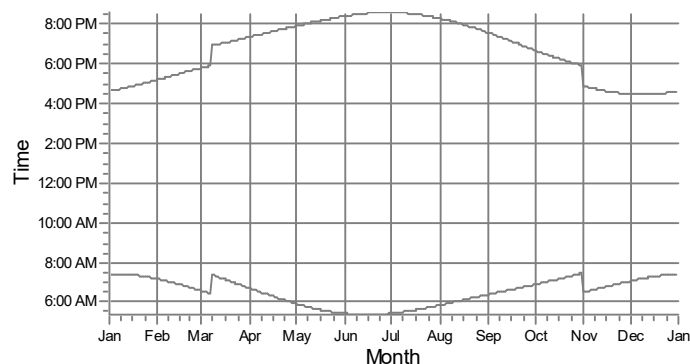
SHADOW - Calendar, graphical

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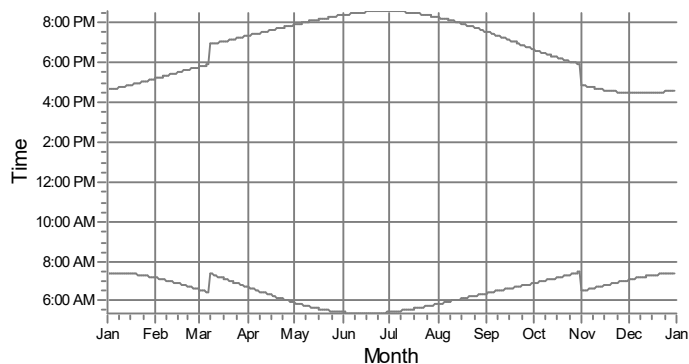
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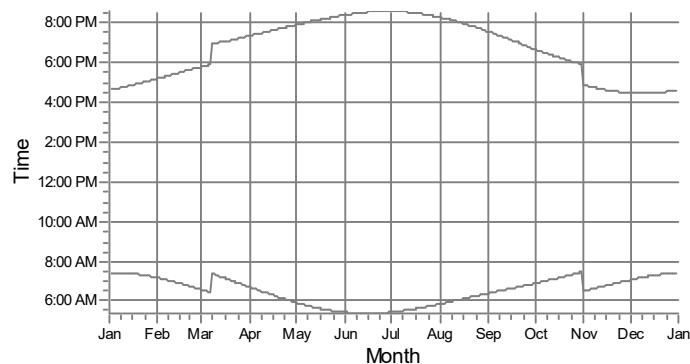
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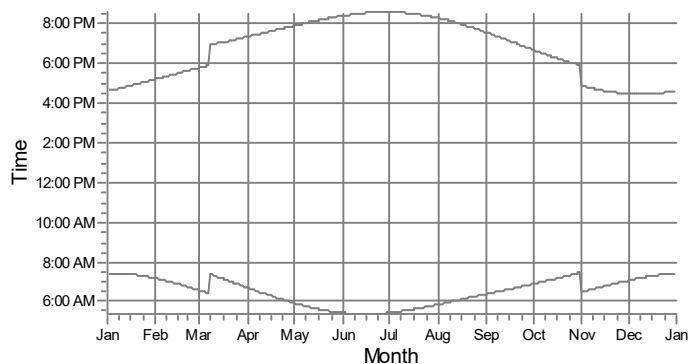
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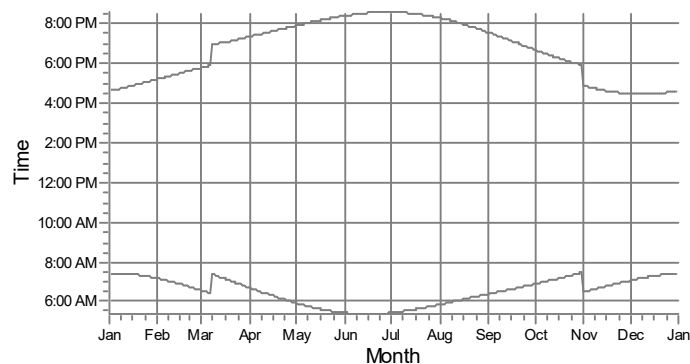
FD: REC-160



FE: REC-161



FF: REC-162



WTGs

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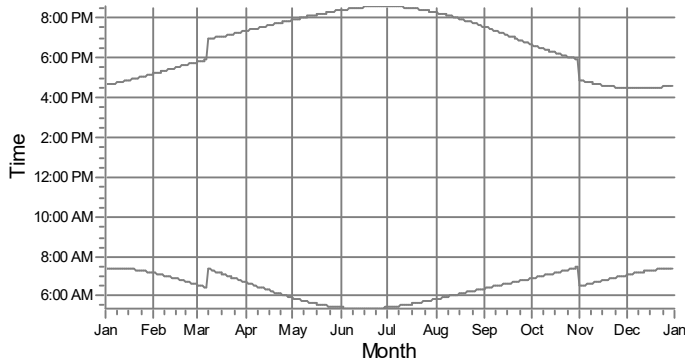
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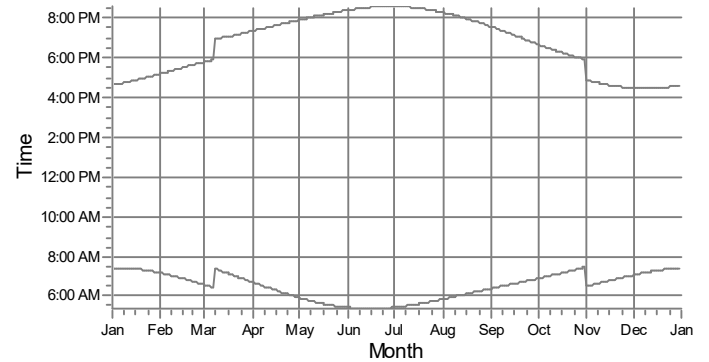
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

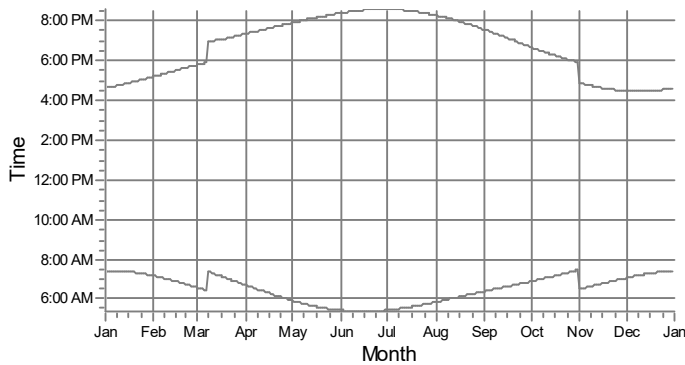
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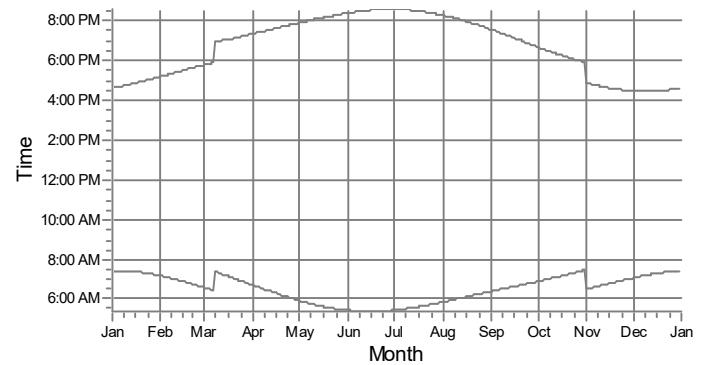
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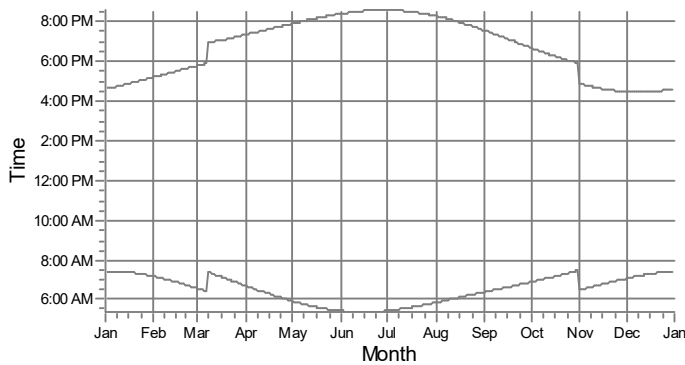
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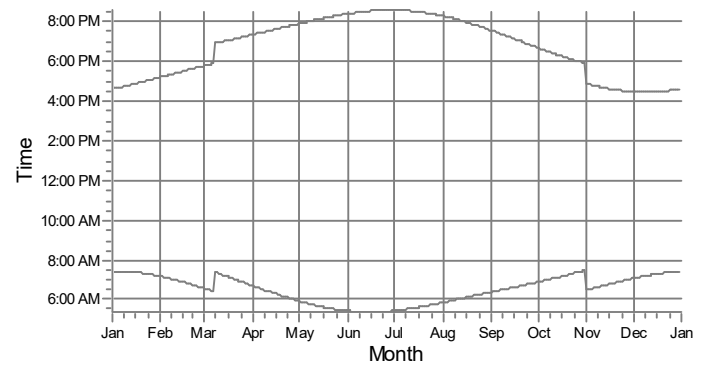
FJ: REC-166



FK: REC-167



FL: REC-168



WTGs

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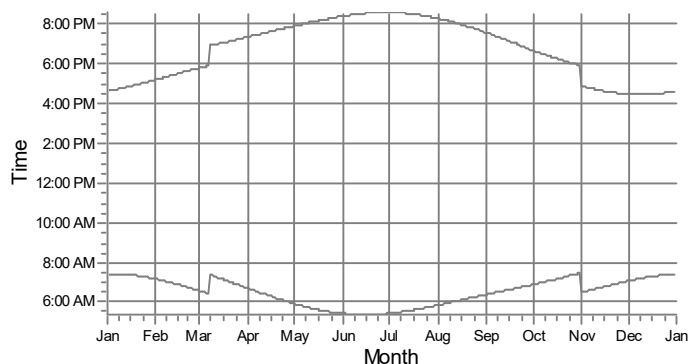
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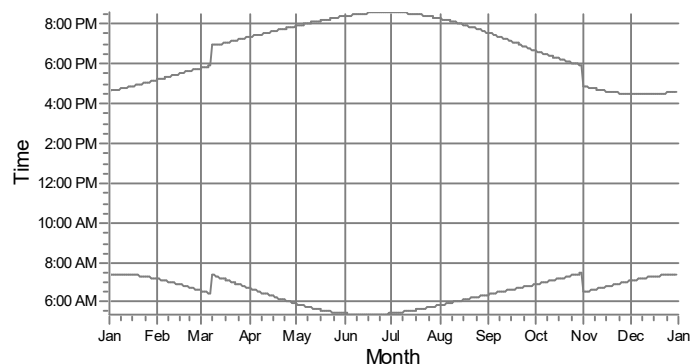
SHADOW - Calendar, graphical

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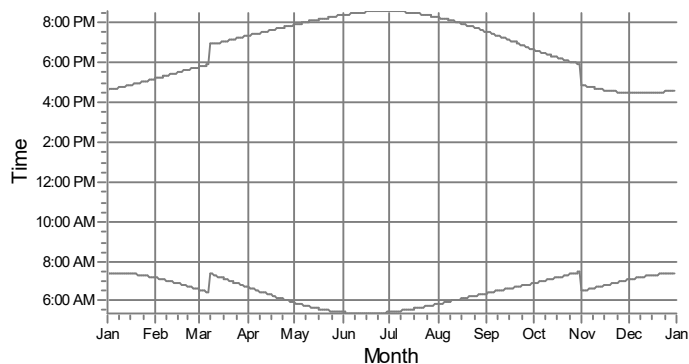
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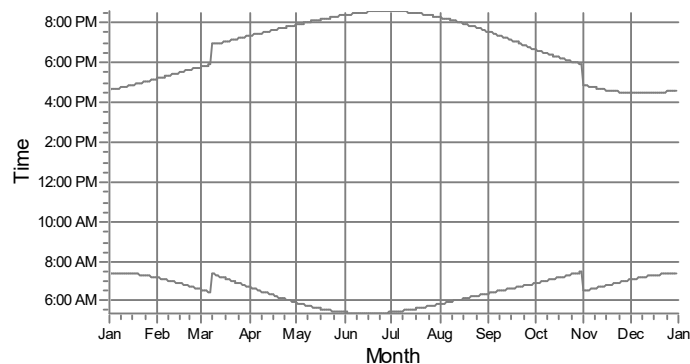
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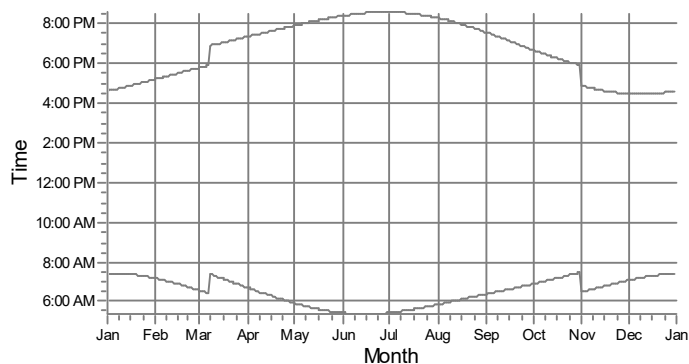
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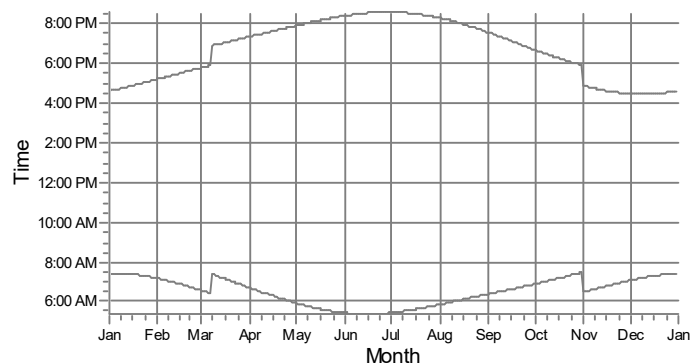
FP: REC-172



FQ: REC-173



FR: REC-174



WTGs

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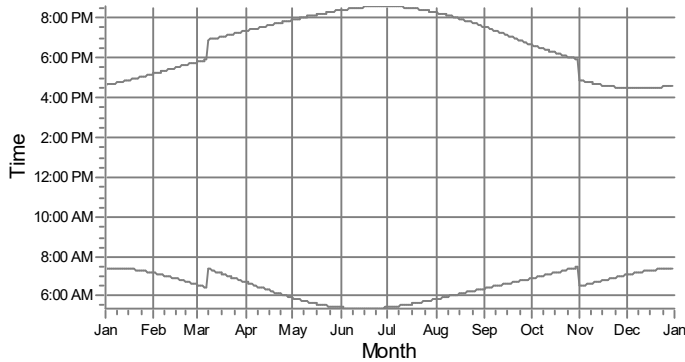
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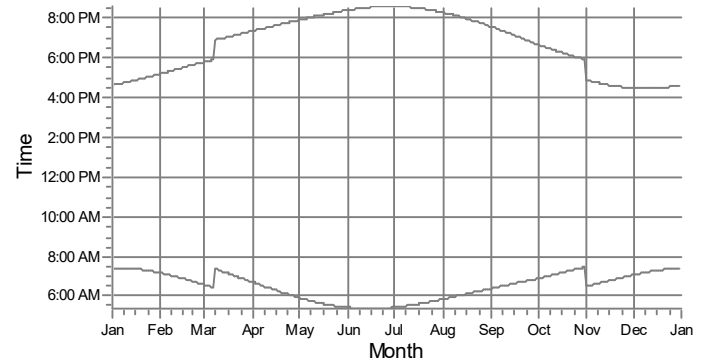
SHADOW - Calendar, graphical

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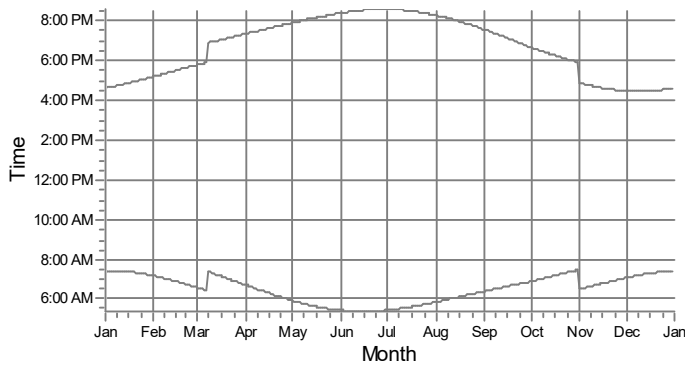
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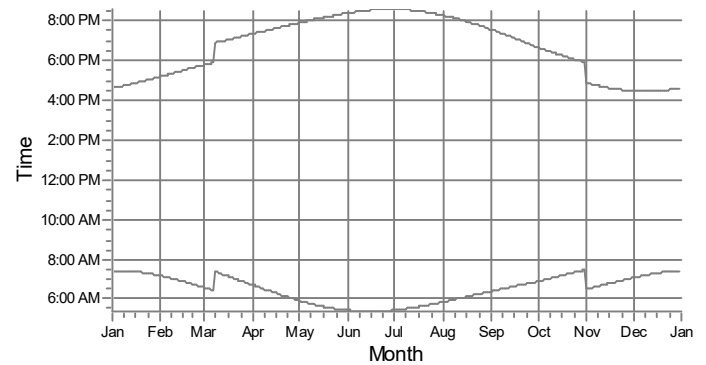
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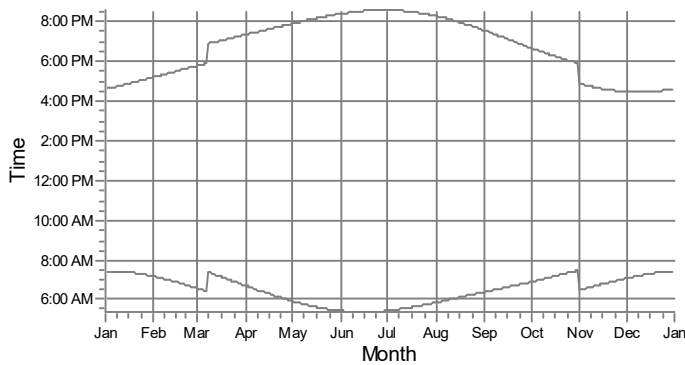
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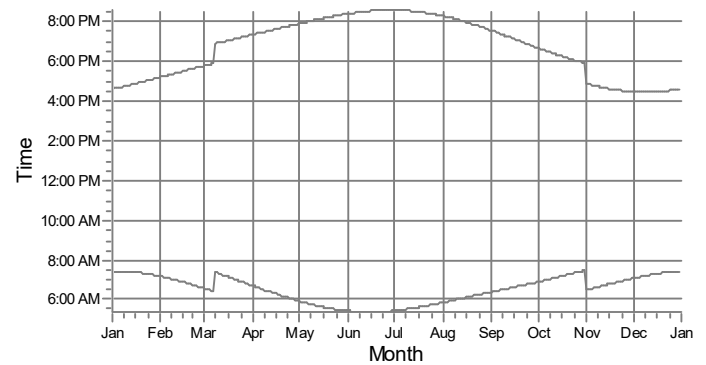
FV: REC-178



FW: REC-179



FX: REC-180



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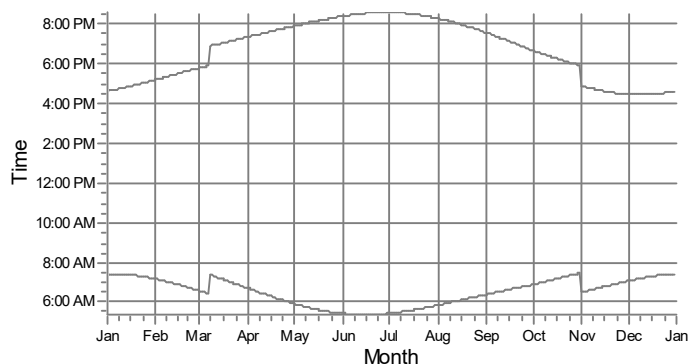
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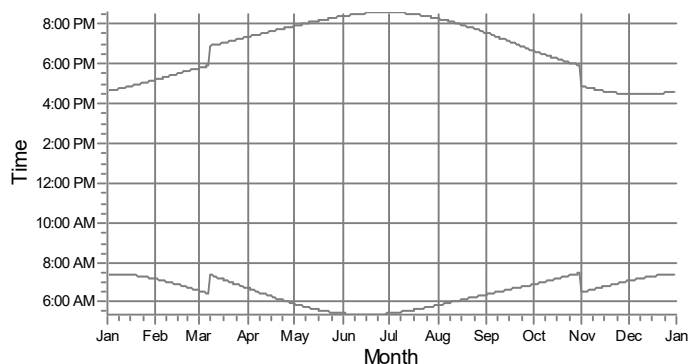
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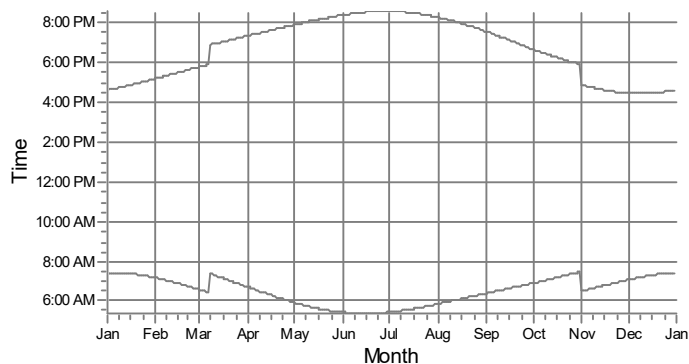
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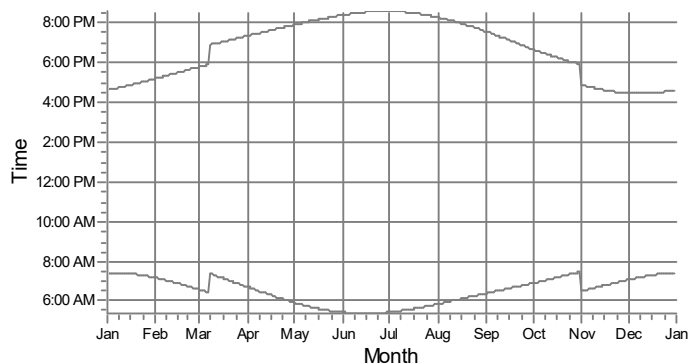
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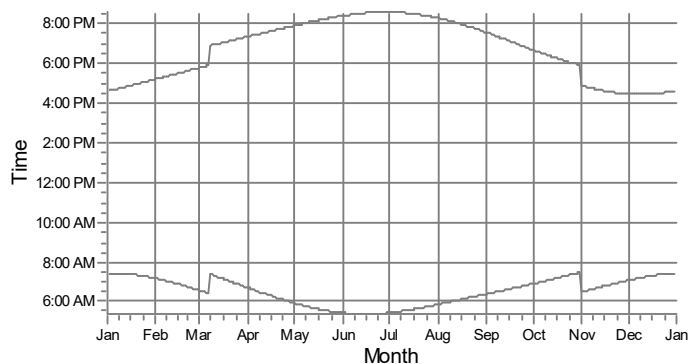
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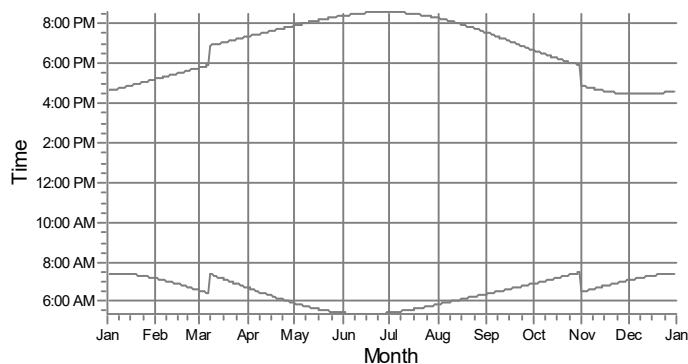
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GC: REC-185



GD: REC-186



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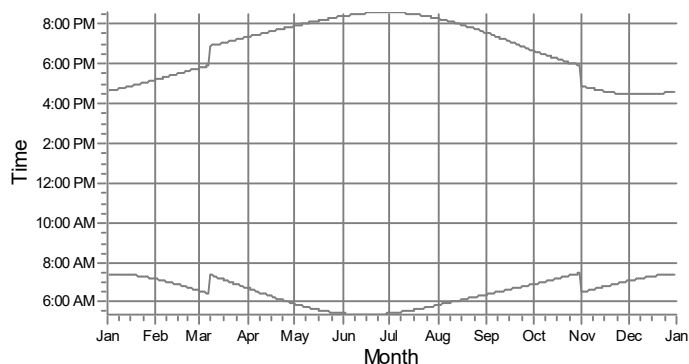
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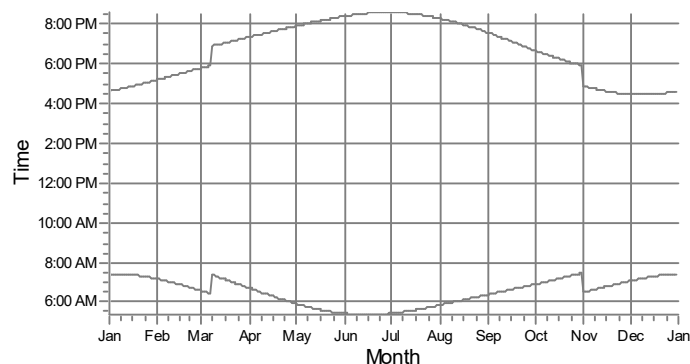
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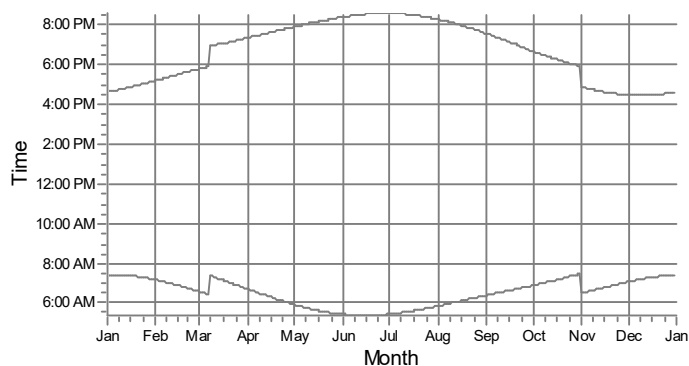
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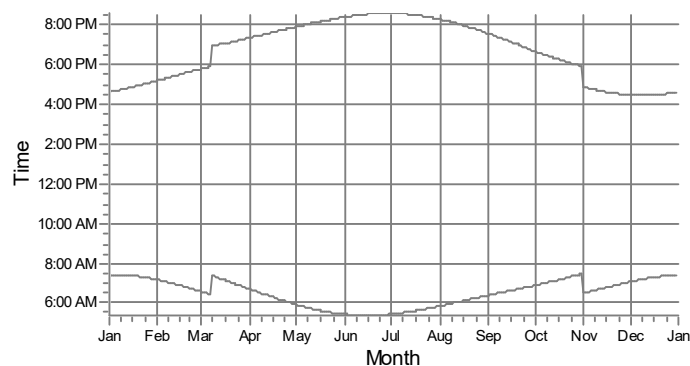
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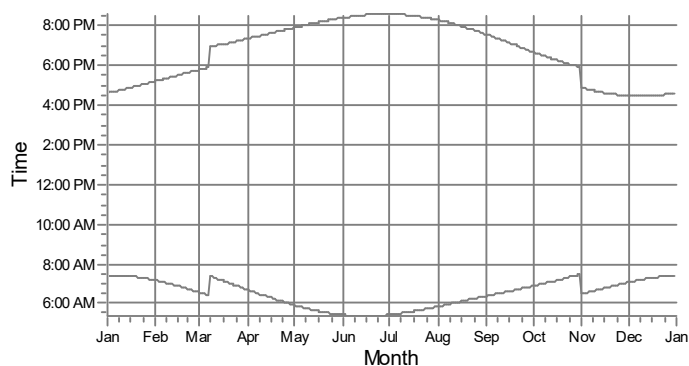
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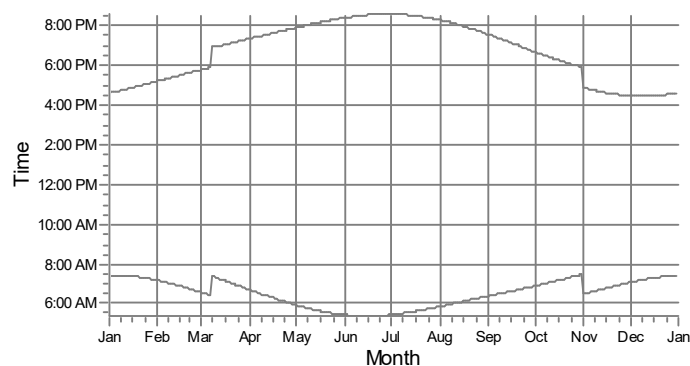
GH: REC-190



GI: REC-191



GJ: REC-192



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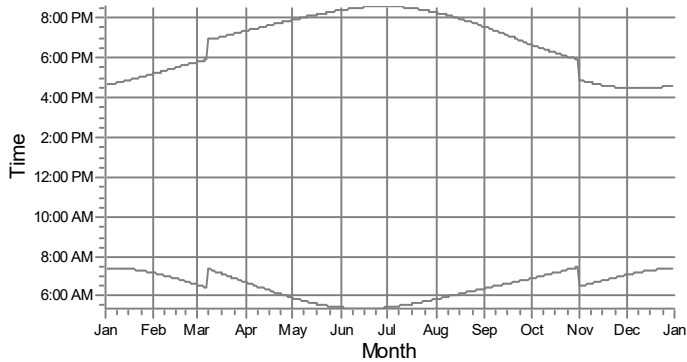
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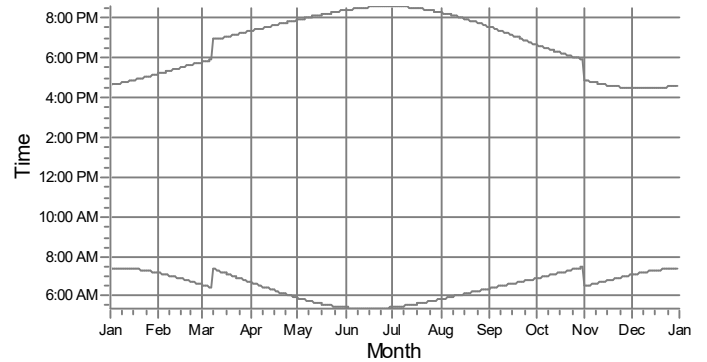
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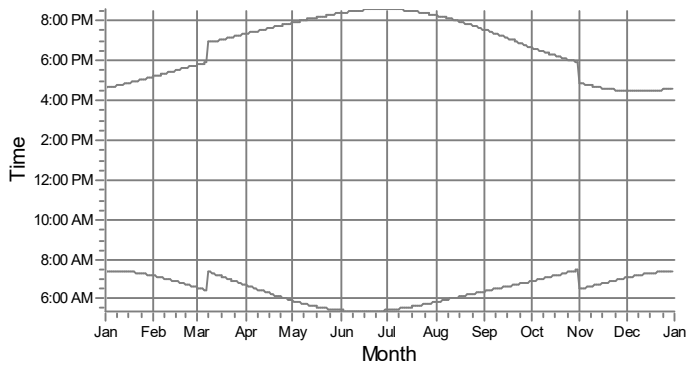
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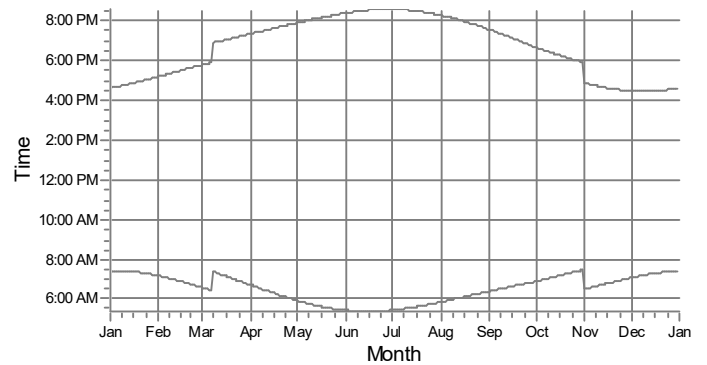
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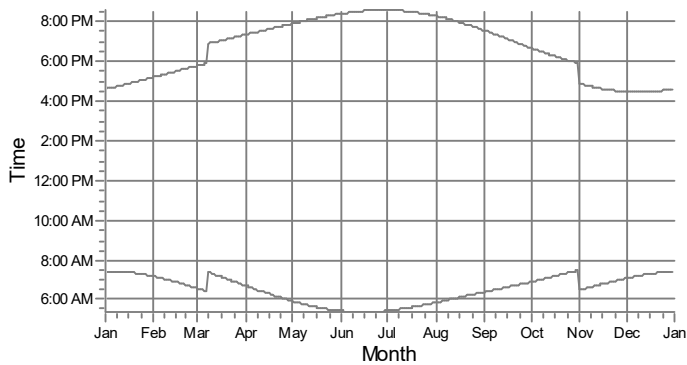
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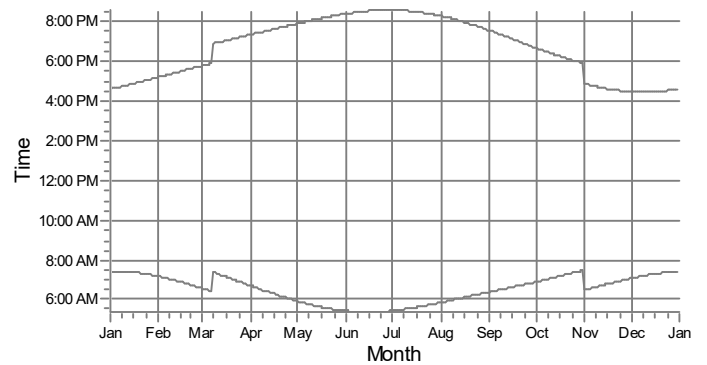
GN: REC-196



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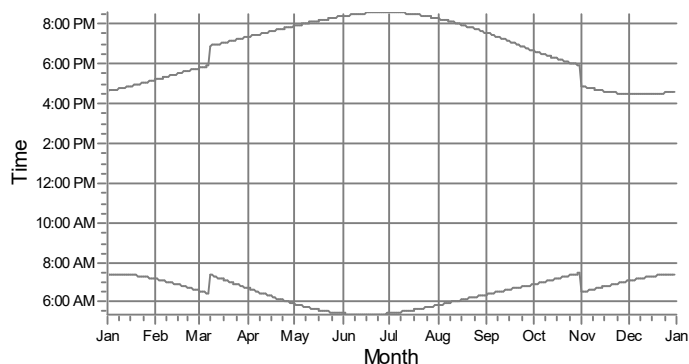
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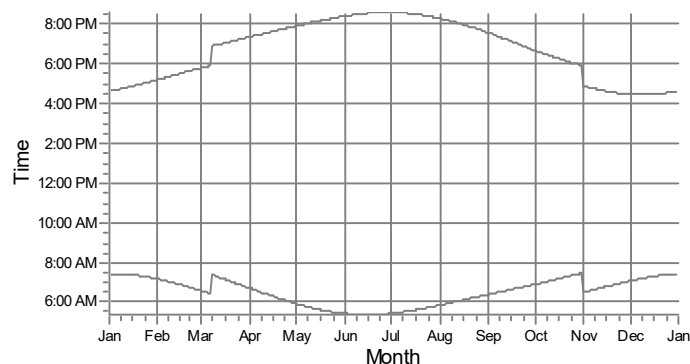
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

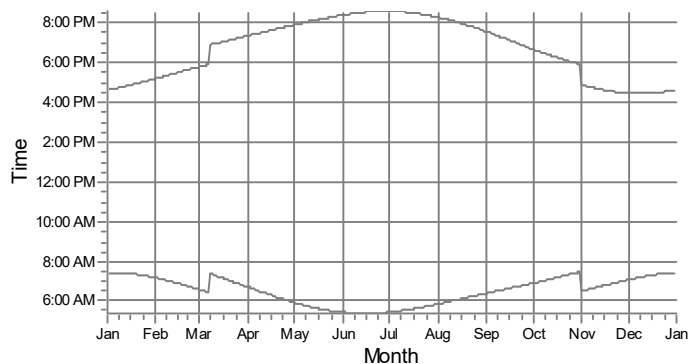
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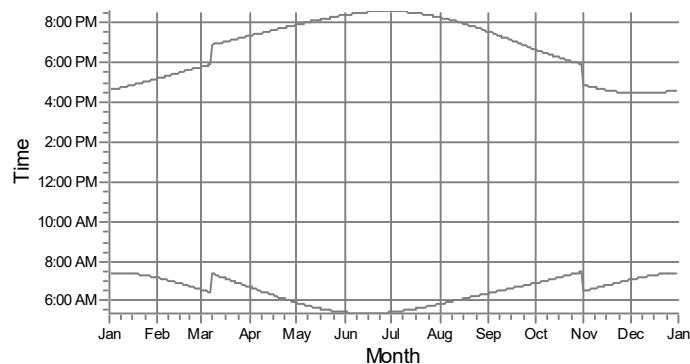
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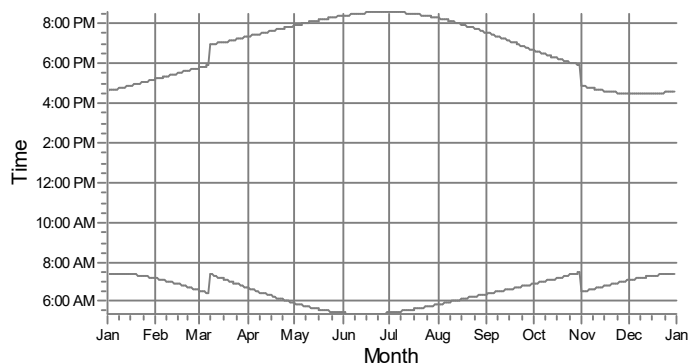
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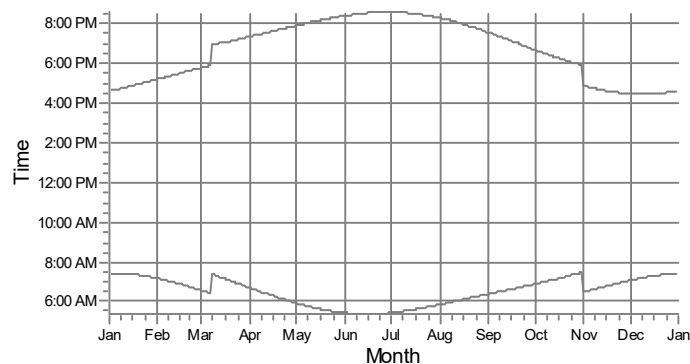
GT: REC-202



GU: REC-203



GV: REC-204



WTGs

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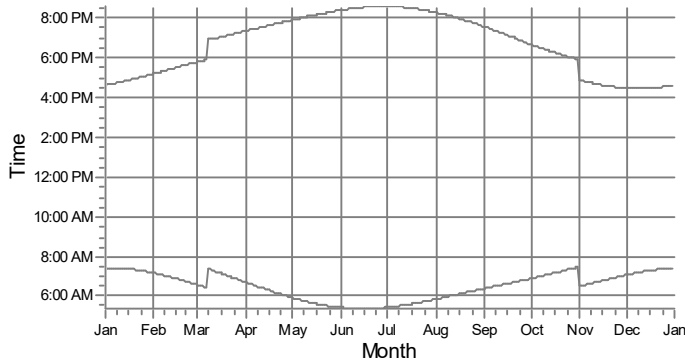
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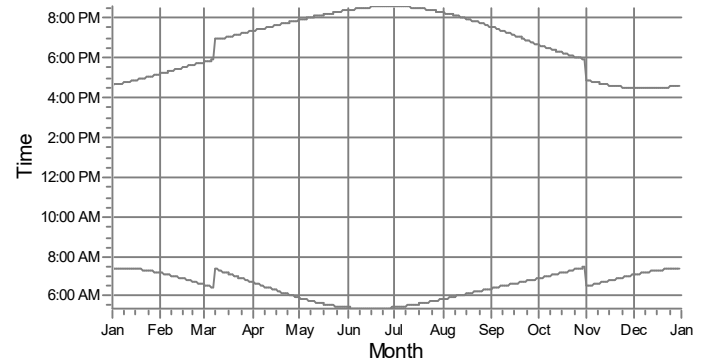
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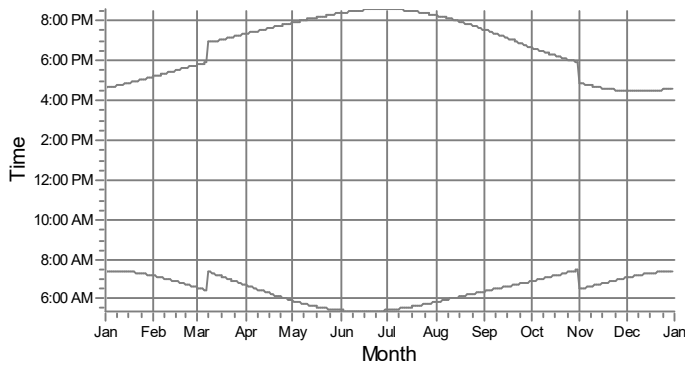
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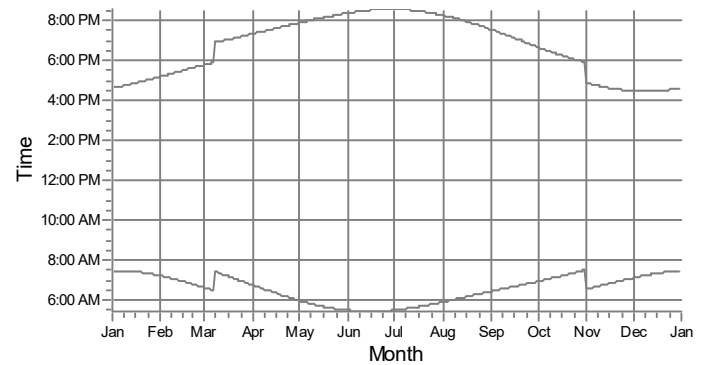
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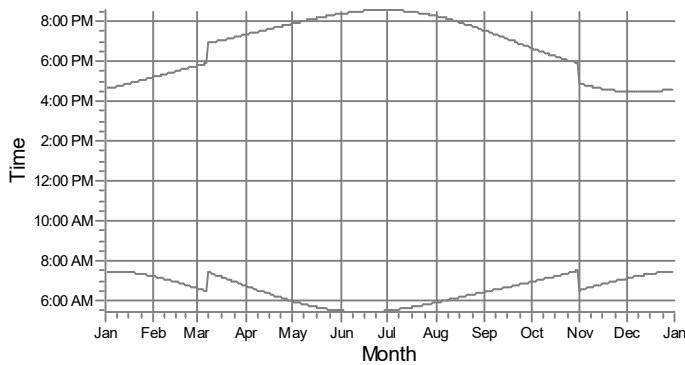
GY: REC-207



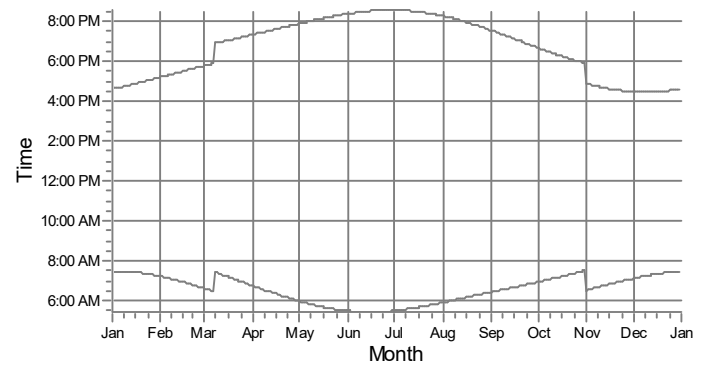
GZ: REC-208



HA: REC-209



HB: REC-210



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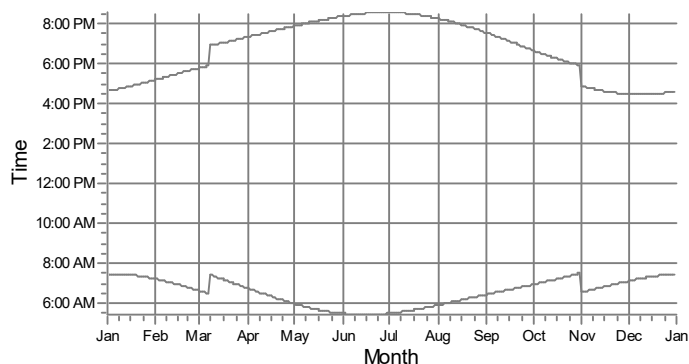
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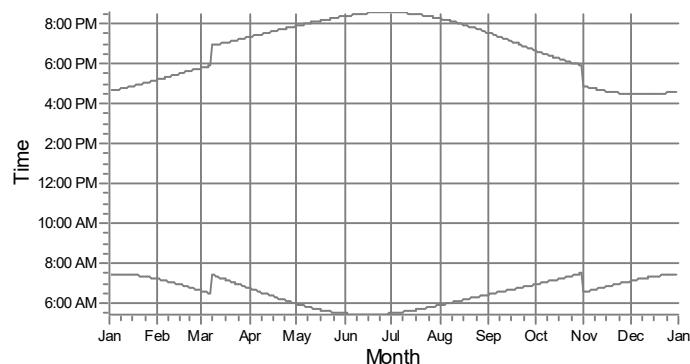
SHADOW - Calendar, graphical

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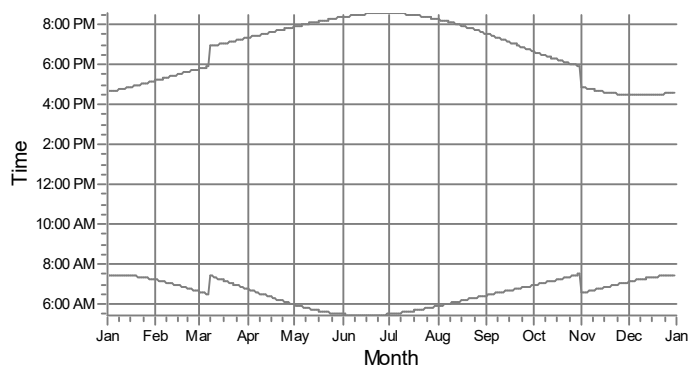
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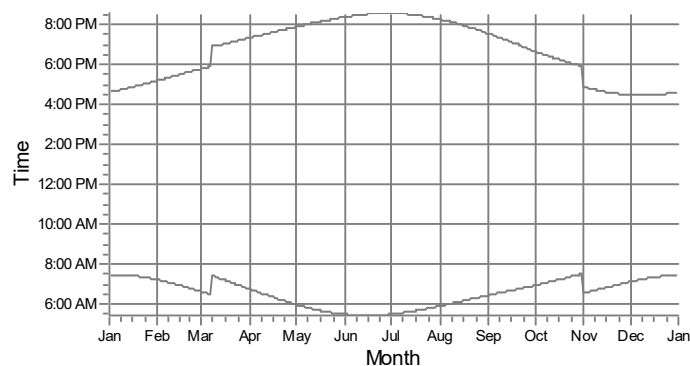
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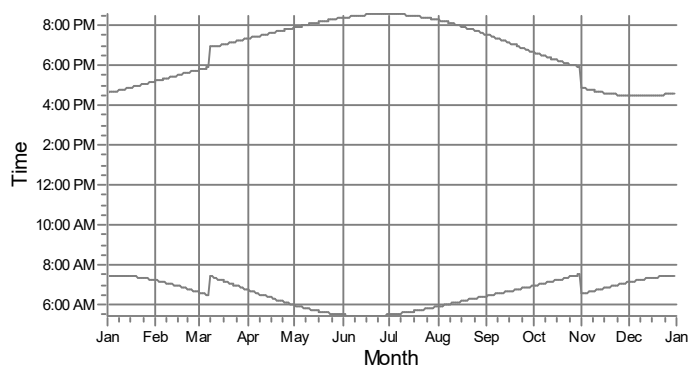
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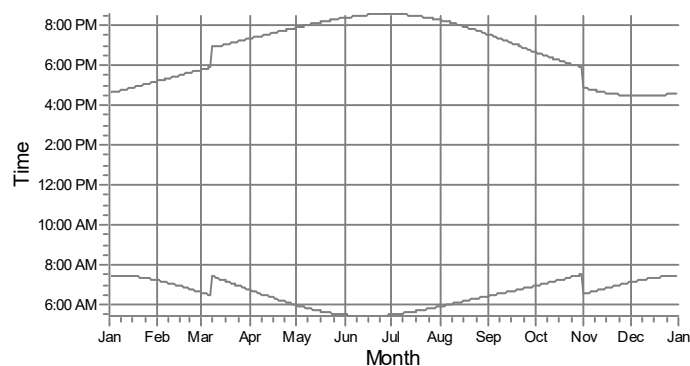
HF: REC-214



HG: REC-215



HH: REC-216



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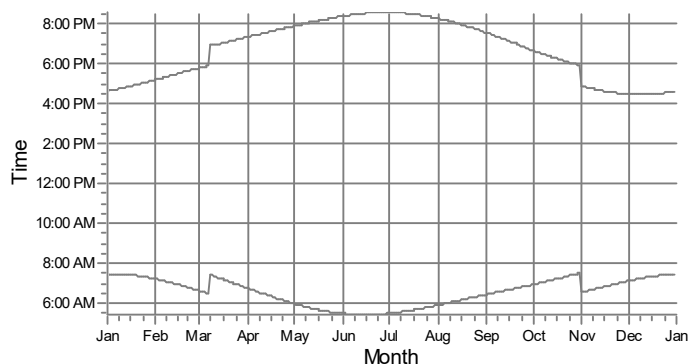
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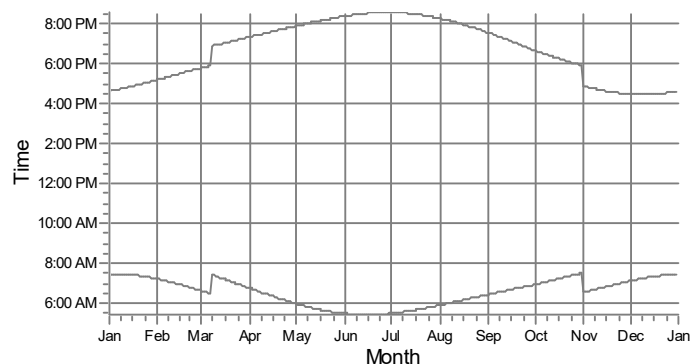
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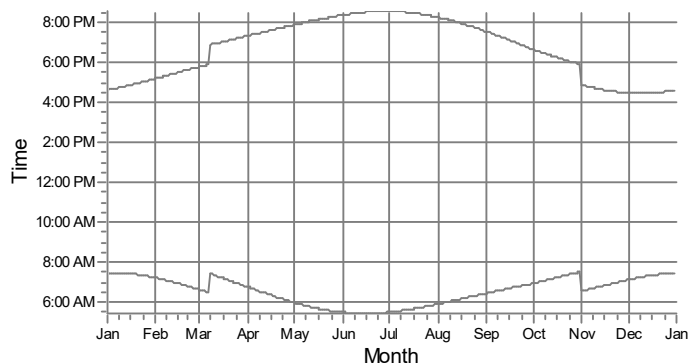
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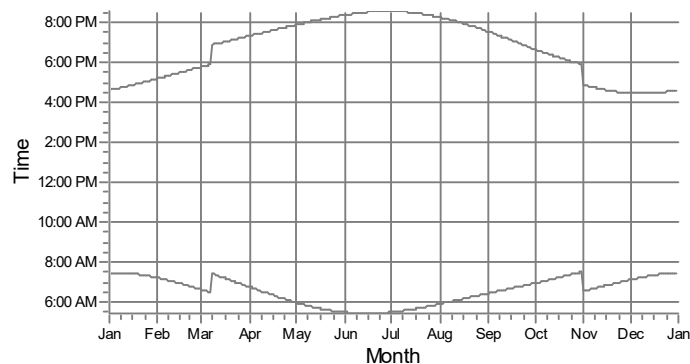
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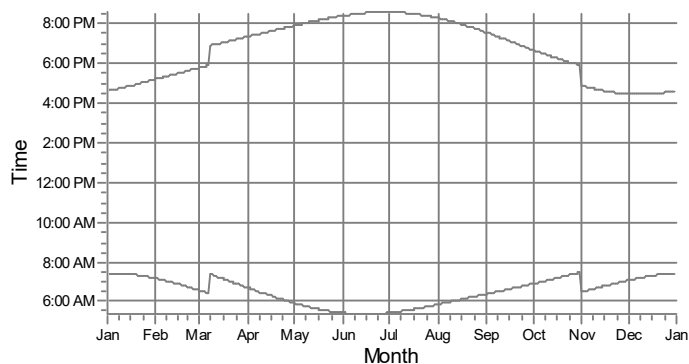
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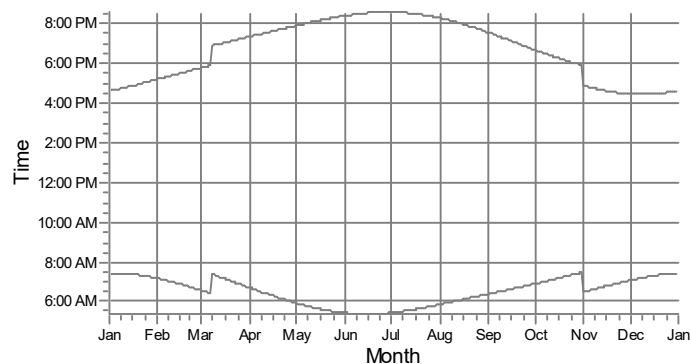
HL: REC-220



HM: REC-221



HN: REC-222



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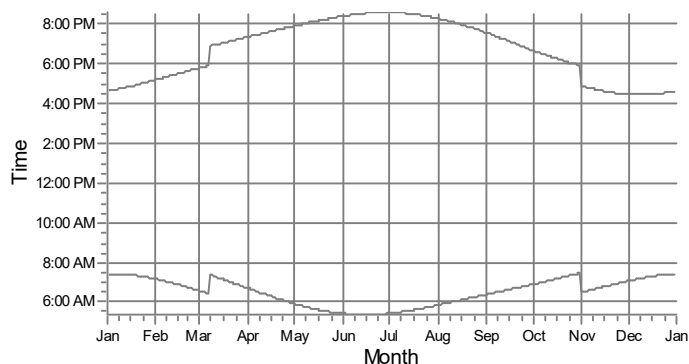
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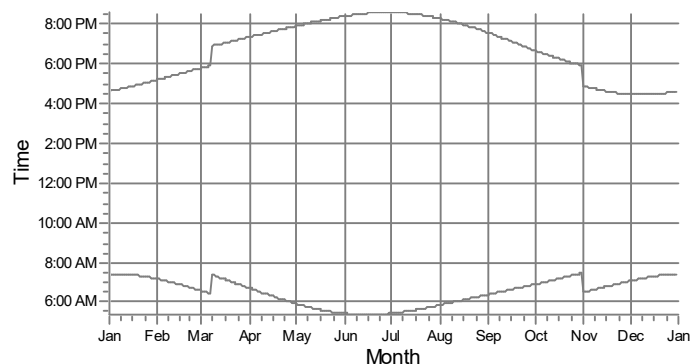
SHADOW - Calendar, graphical

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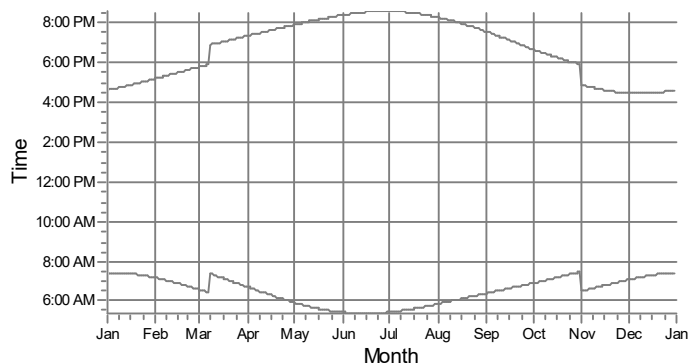
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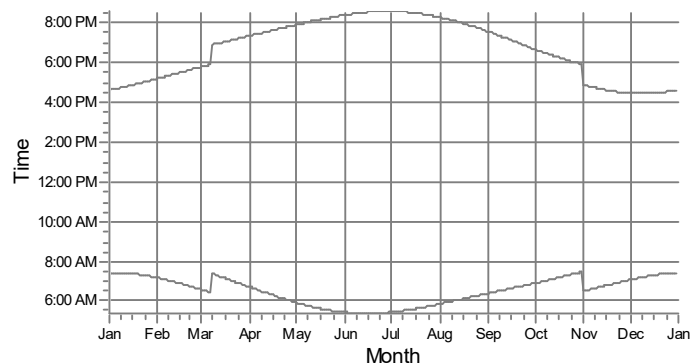
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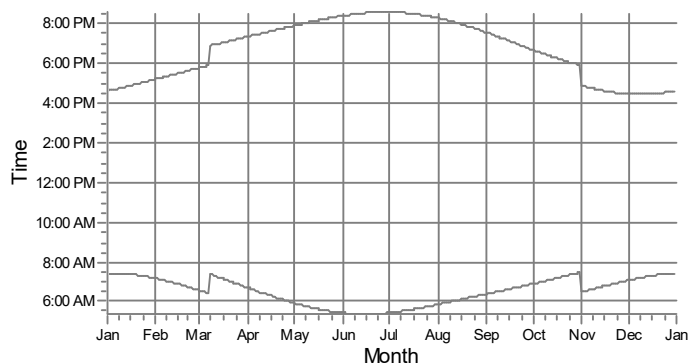
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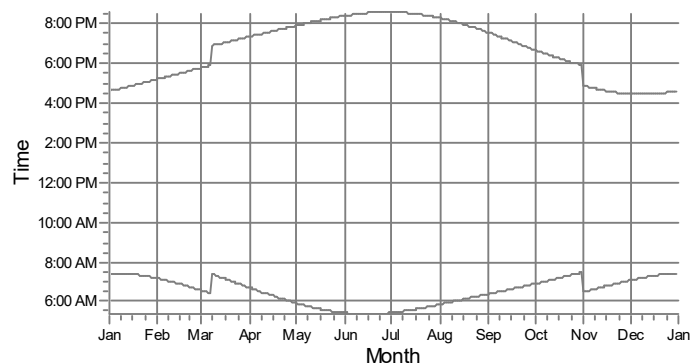
HR: REC-226



HS: REC-227



HT: REC-228



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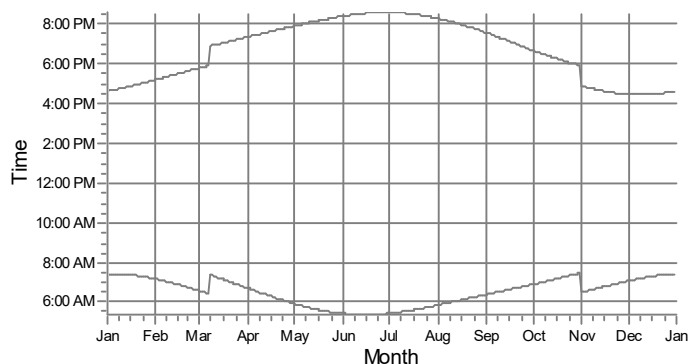
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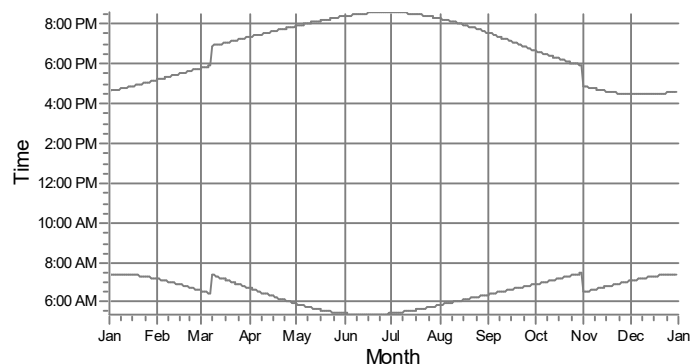
SHADOW - Calendar, graphical

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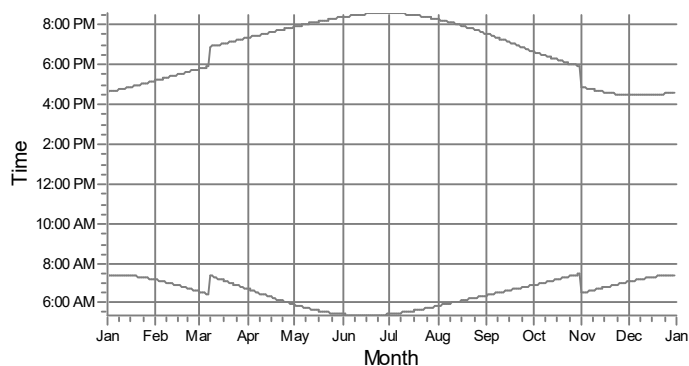
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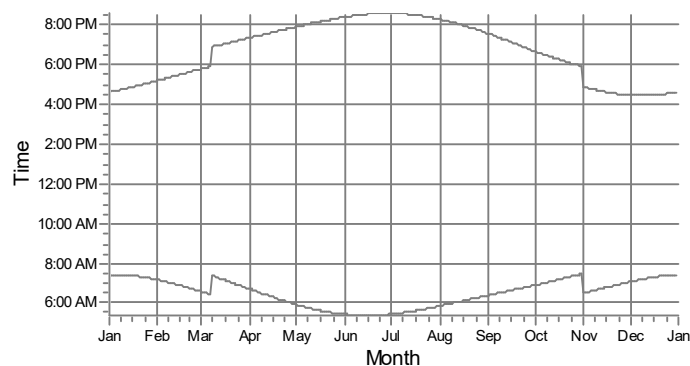
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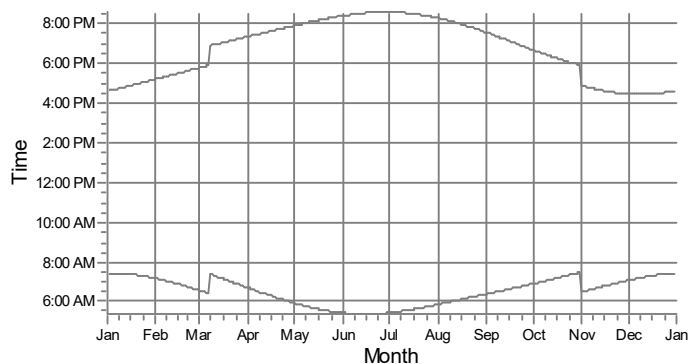
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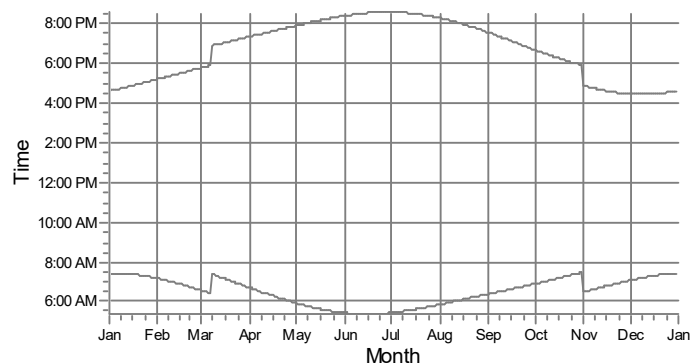
HX: REC-232



HY: REC-233



HZ: REC-234



WTGs

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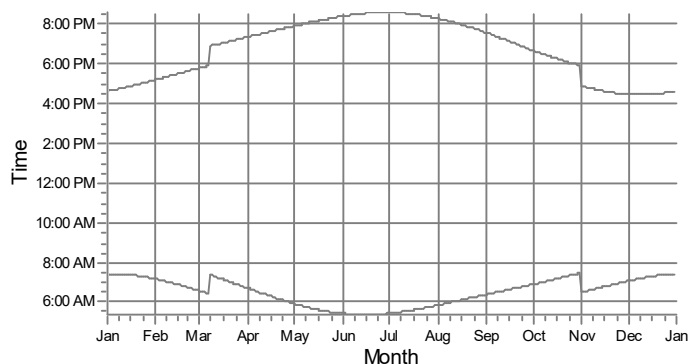
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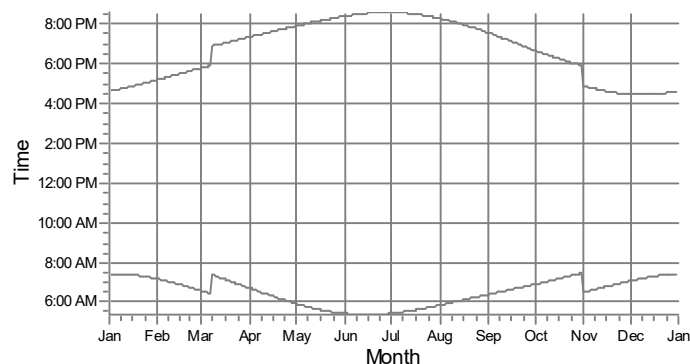
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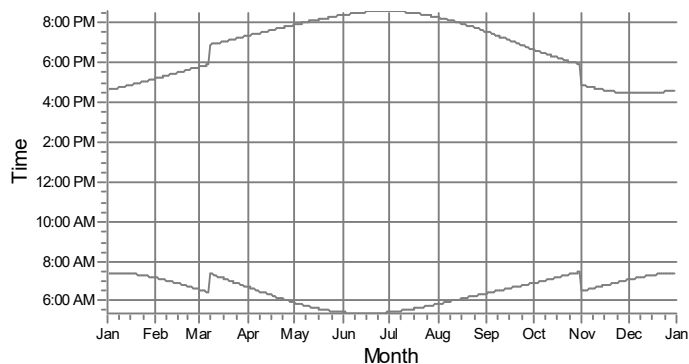
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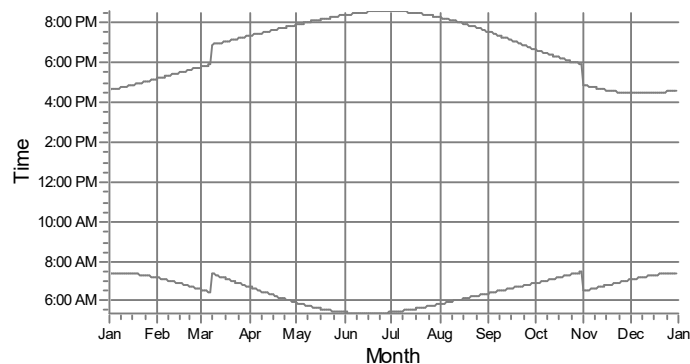
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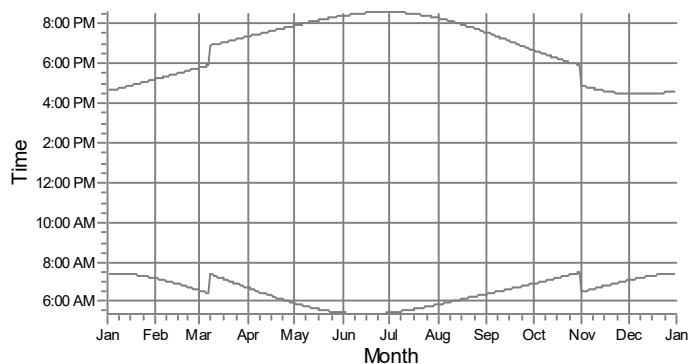
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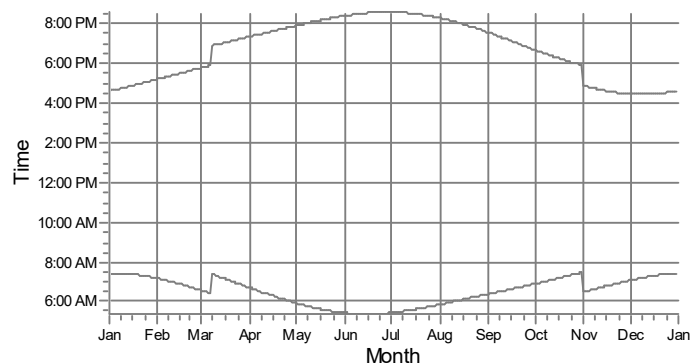
ID: REC-238



IE: REC-239



IF: REC-240



WTGs

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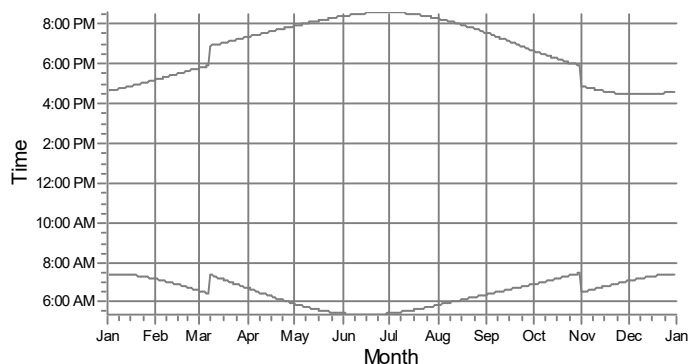
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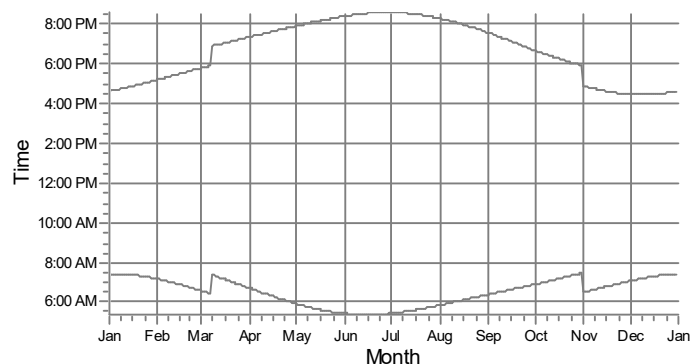
SHADOW - Calendar, graphical

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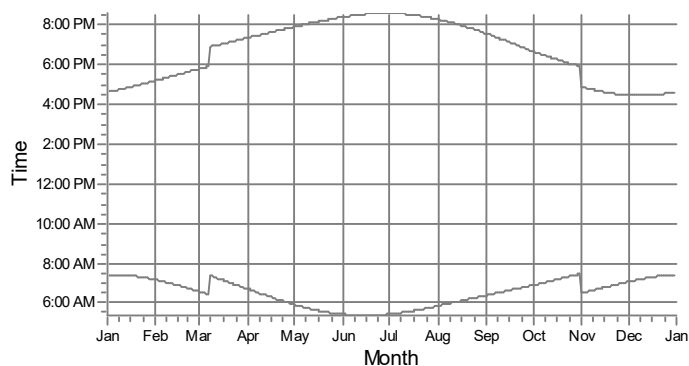
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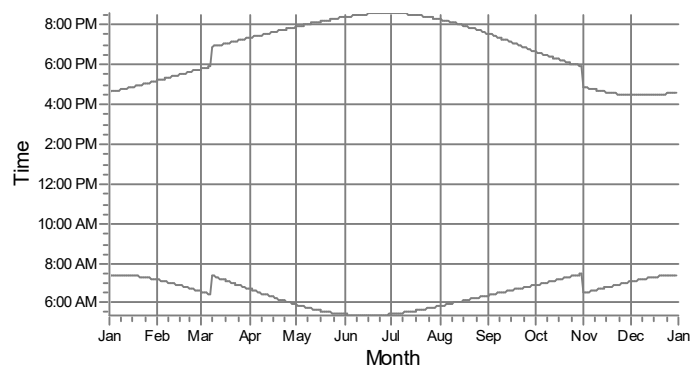
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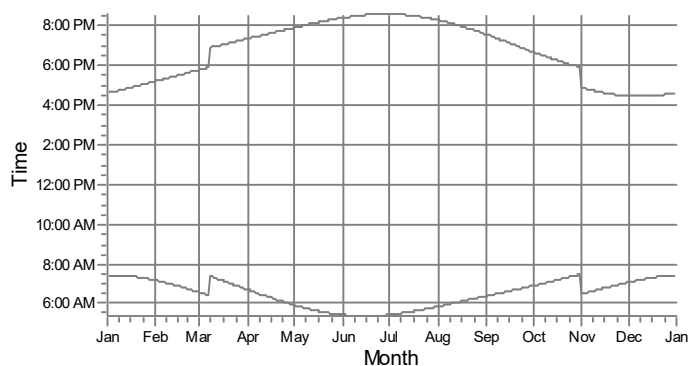
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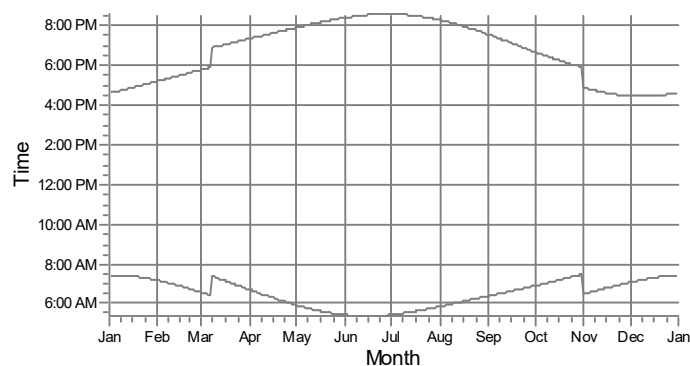
IJ: REC-244



IK: REC-245



IL: REC-246



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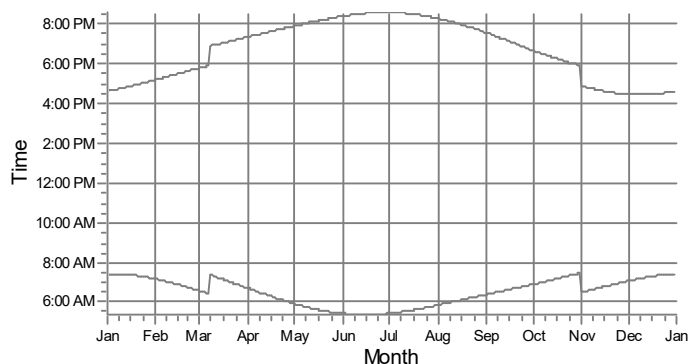
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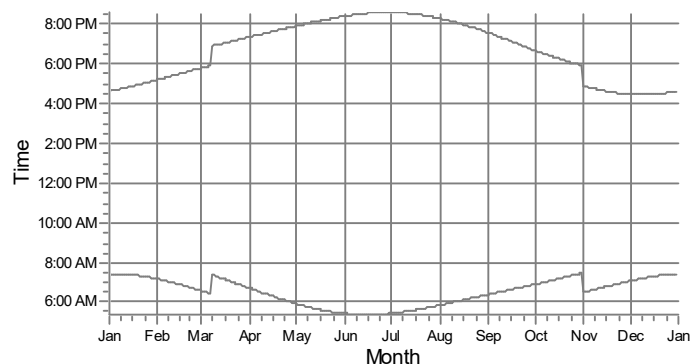
SHADOW - Calendar, graphical

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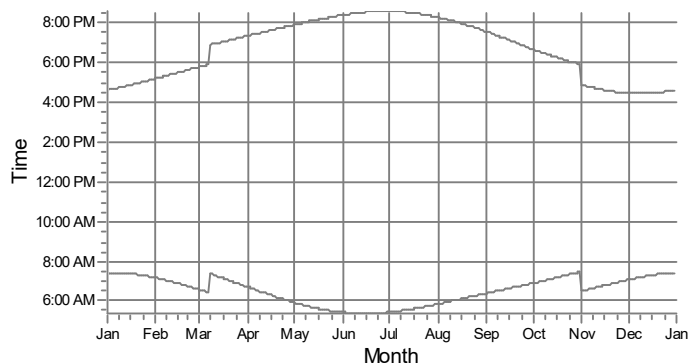
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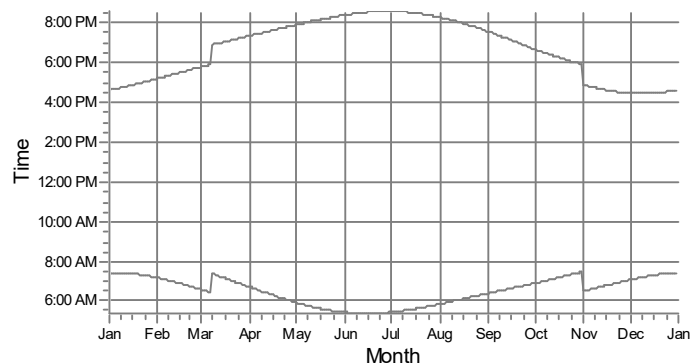
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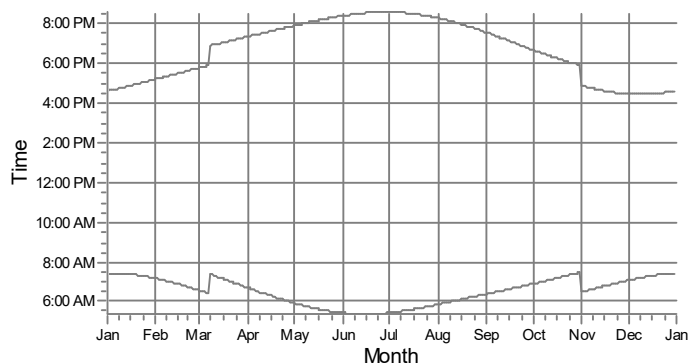
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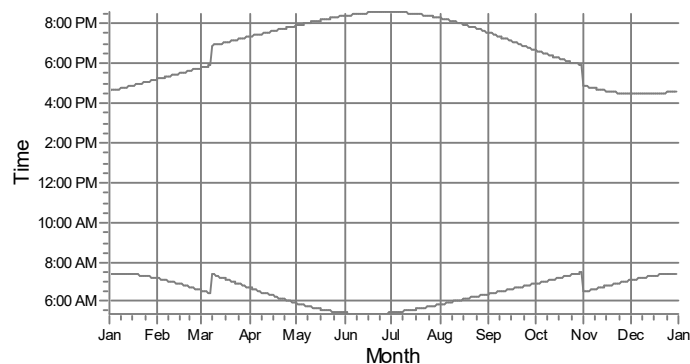
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IQ: REC-251



IR: REC-252



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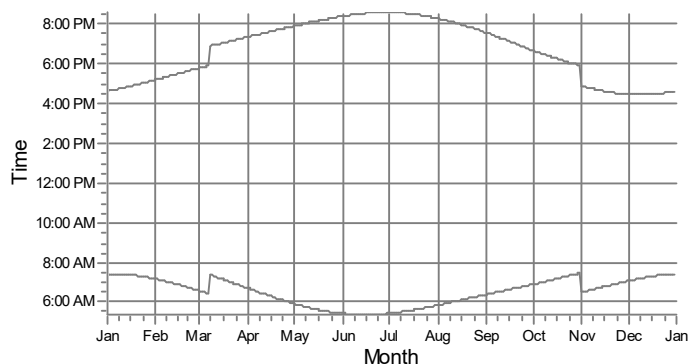
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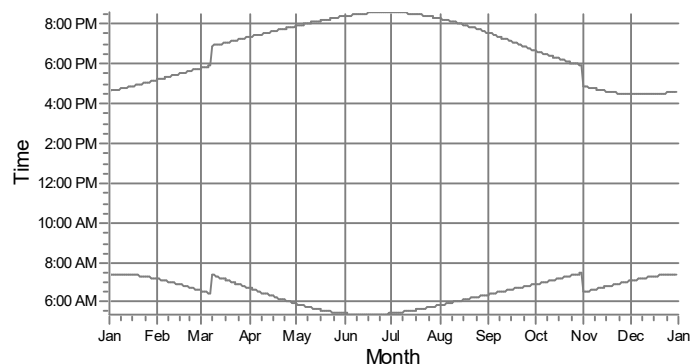
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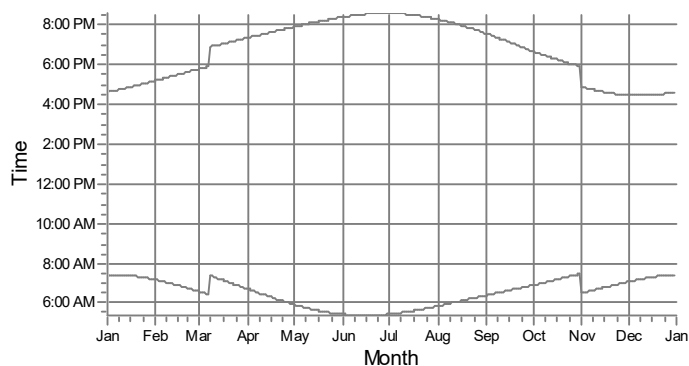
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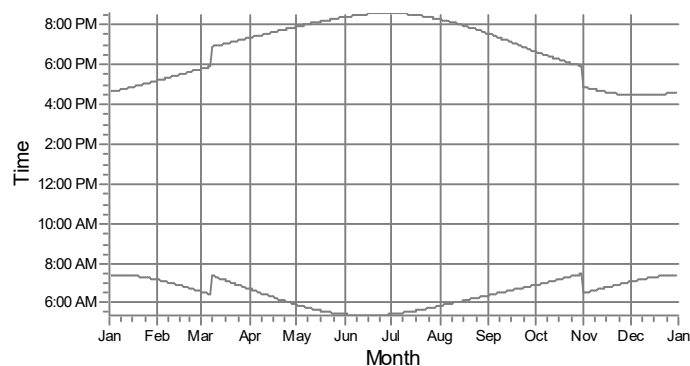
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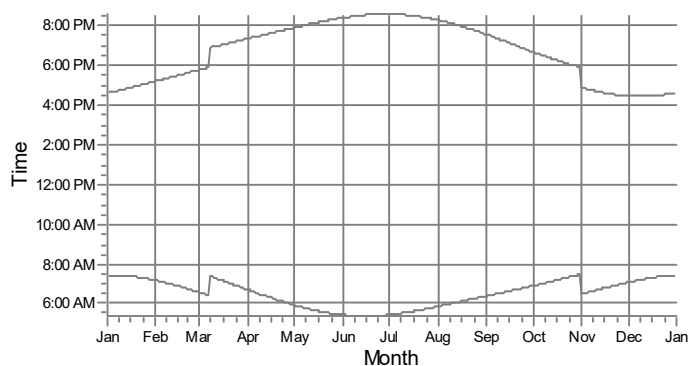
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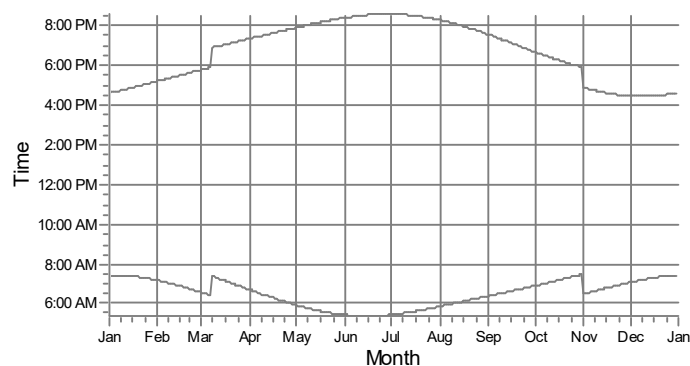
IV: REC-256



IV: REC-257



IX: REC-258



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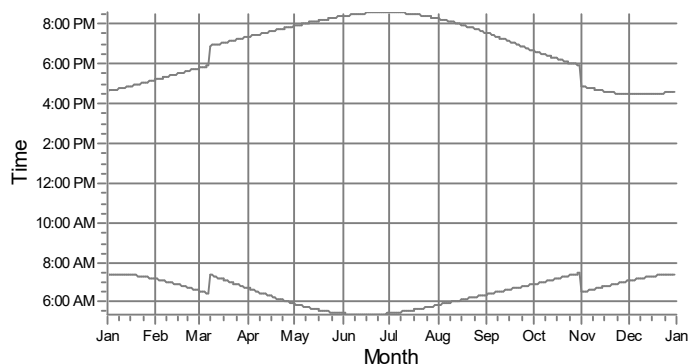
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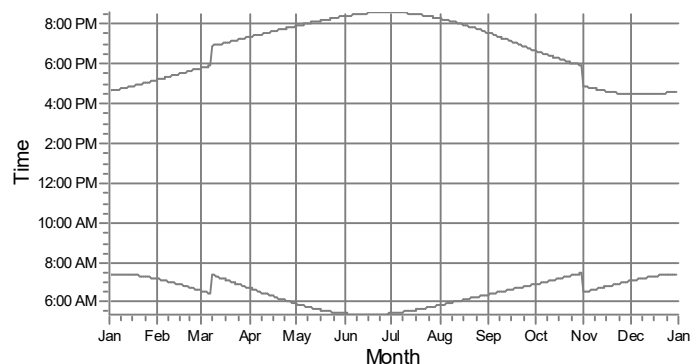
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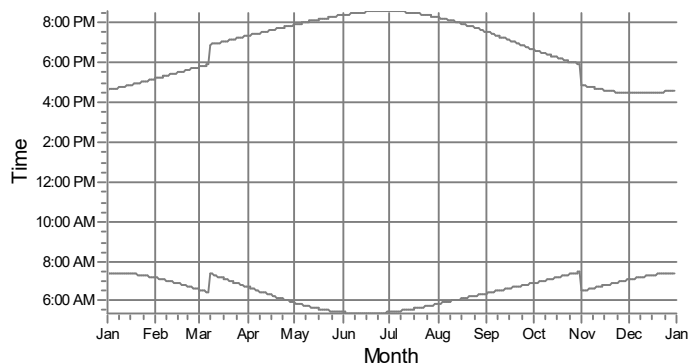
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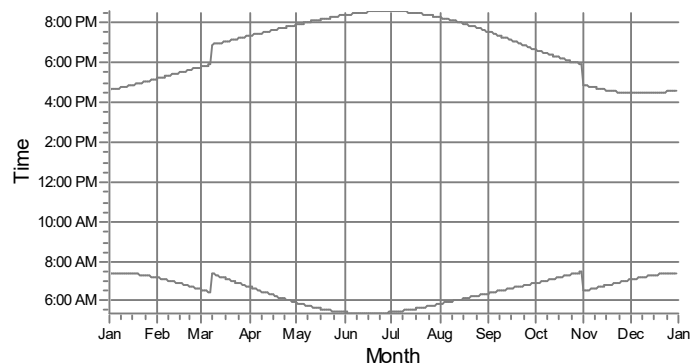
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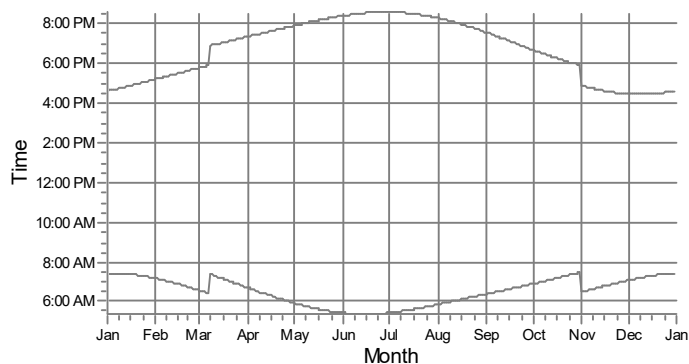
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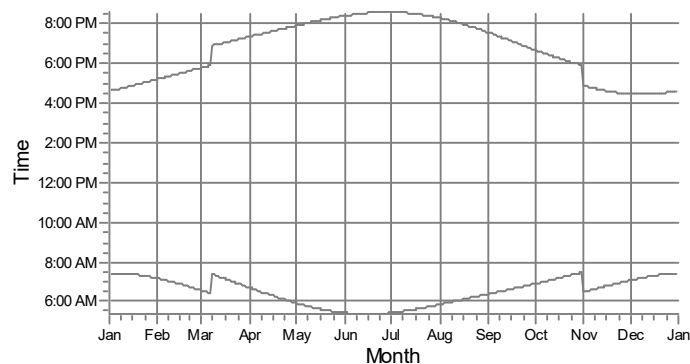
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JC: REC-263



JD: REC-264



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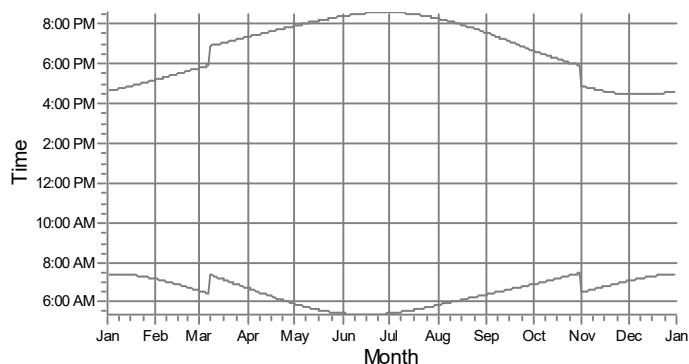
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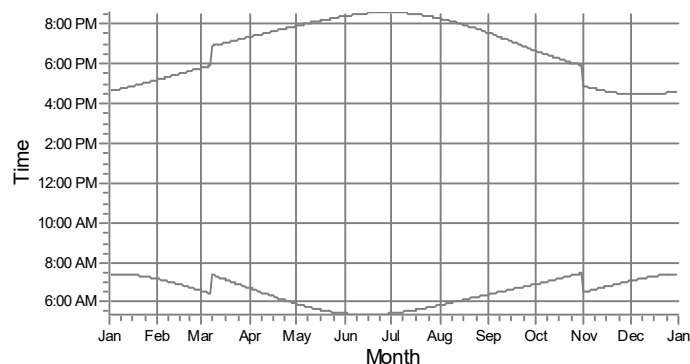
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

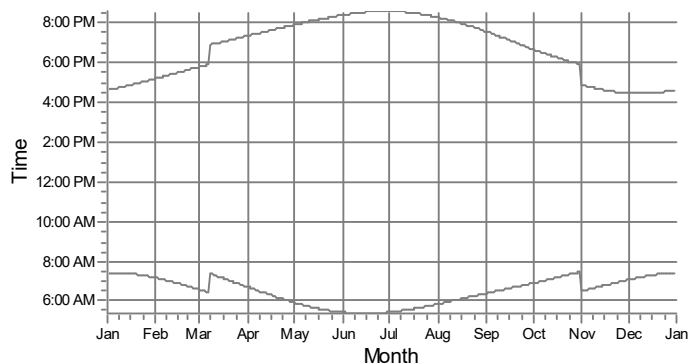
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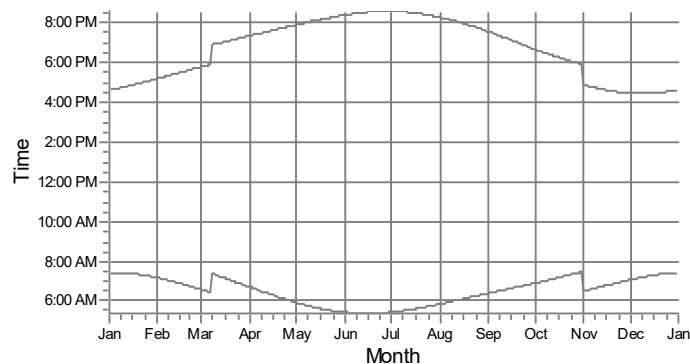
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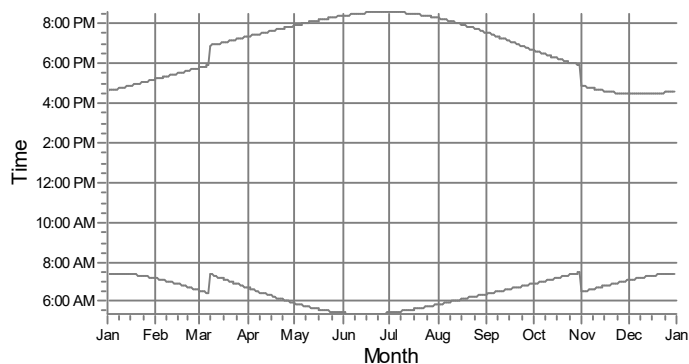
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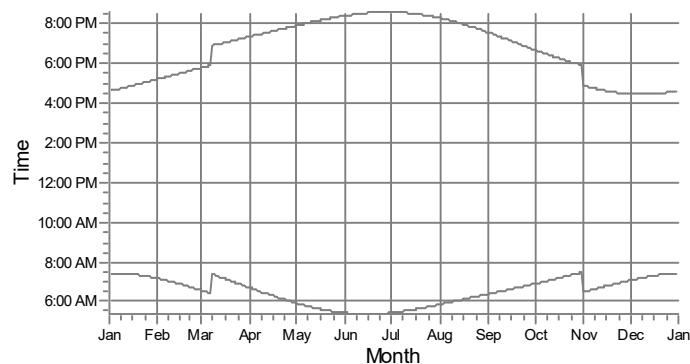
JH: REC-268



JI: REC-269



JJ: REC-270



WTGs

Project:

118183 - Shady Oaks II Wind Project

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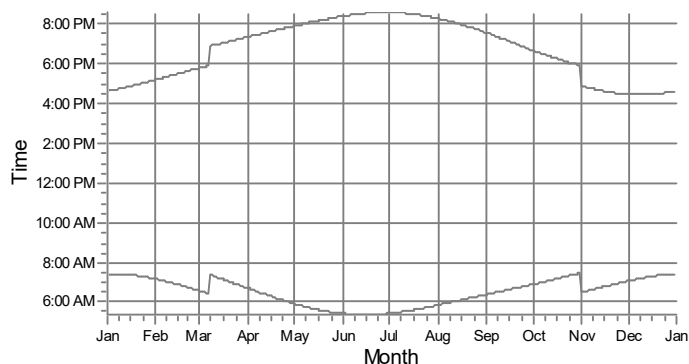
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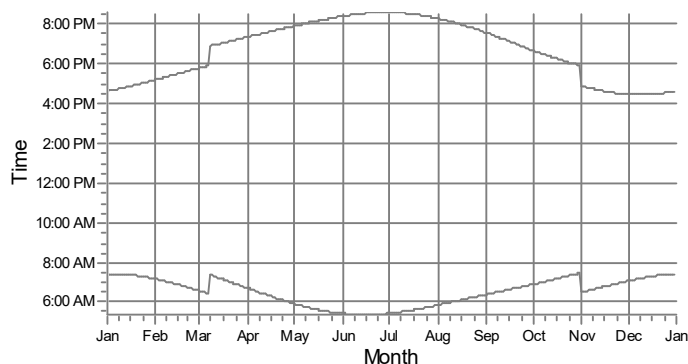
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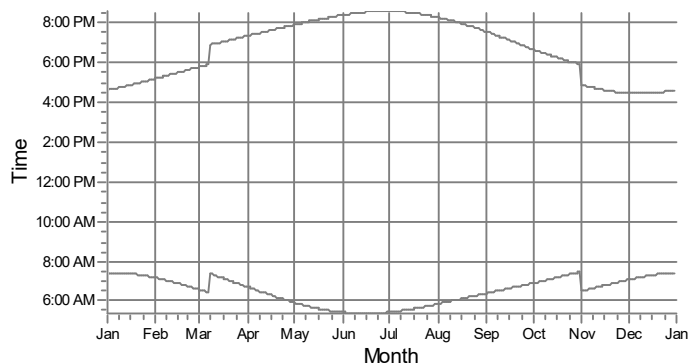
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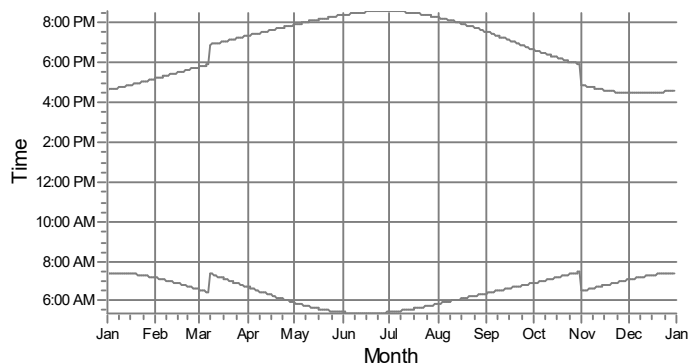
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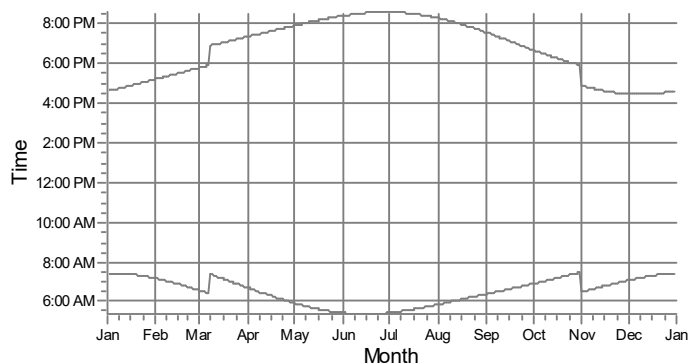
JM: REC-273



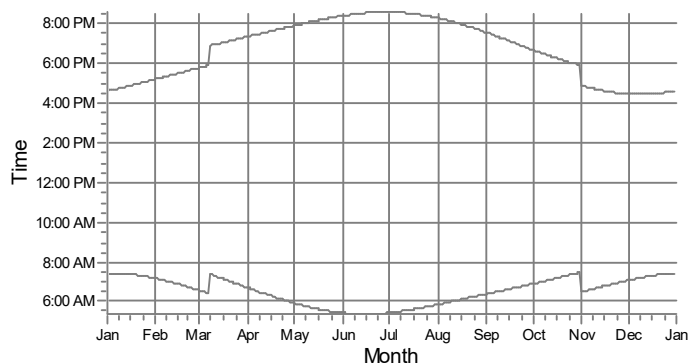
JN: REC-274



JO: REC-275



JP: REC-276



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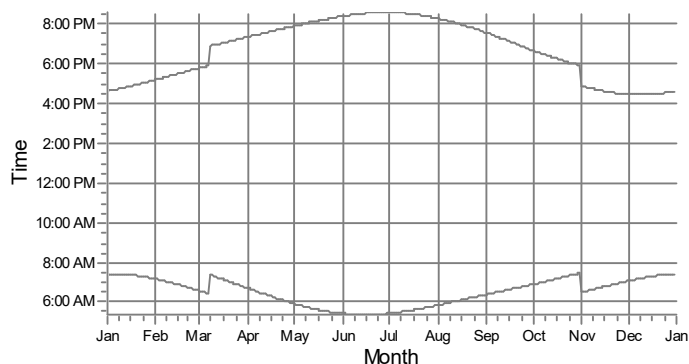
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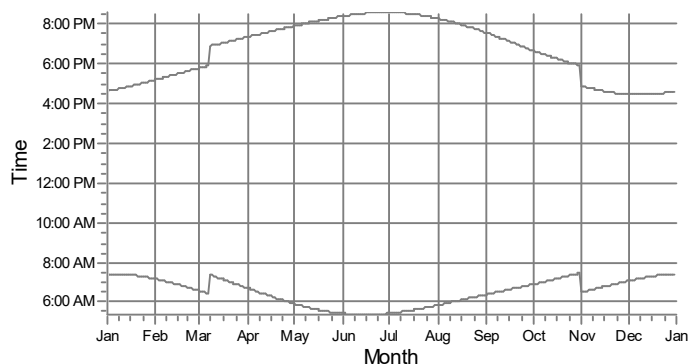
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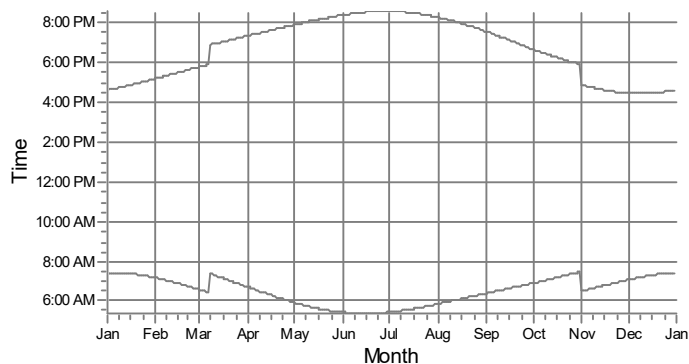
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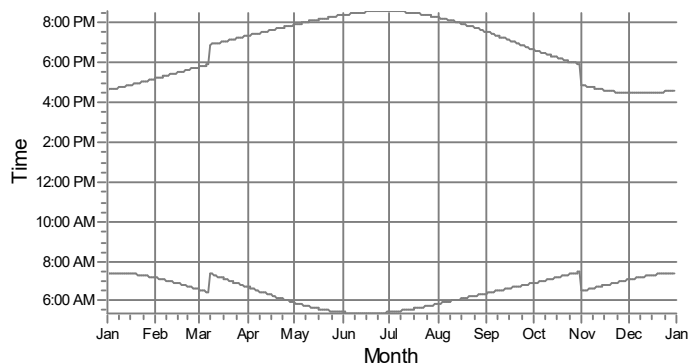
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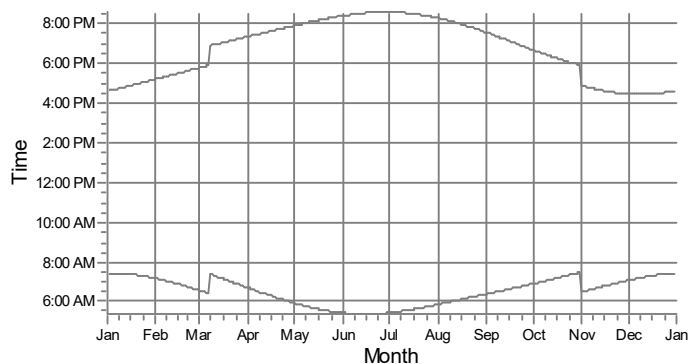
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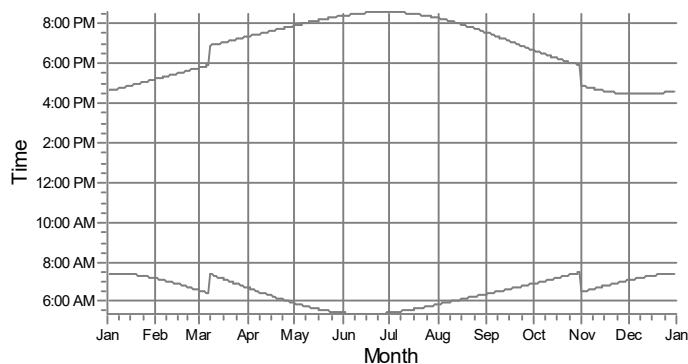
JT: REC-280



JU: REC-281



JV: REC-282



WTGs

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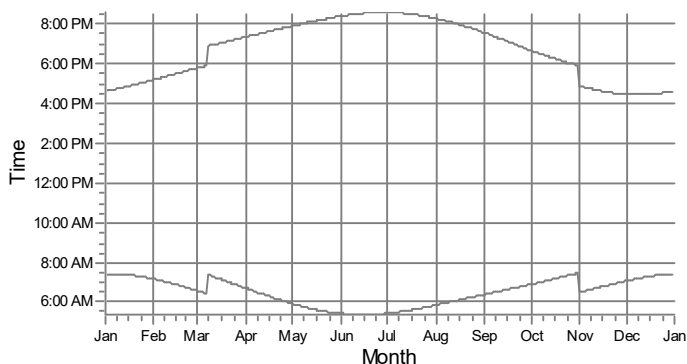
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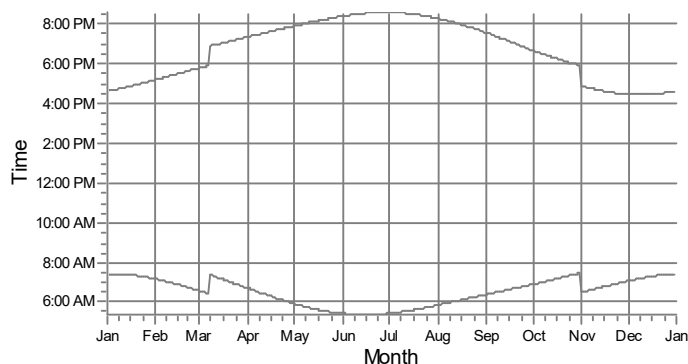
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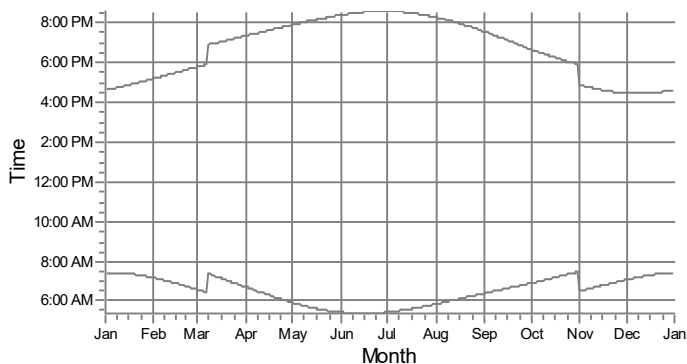
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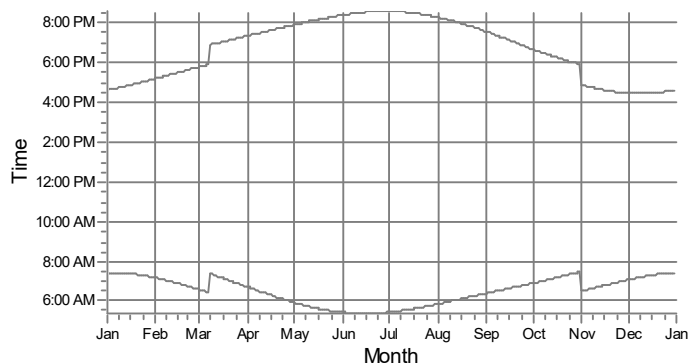
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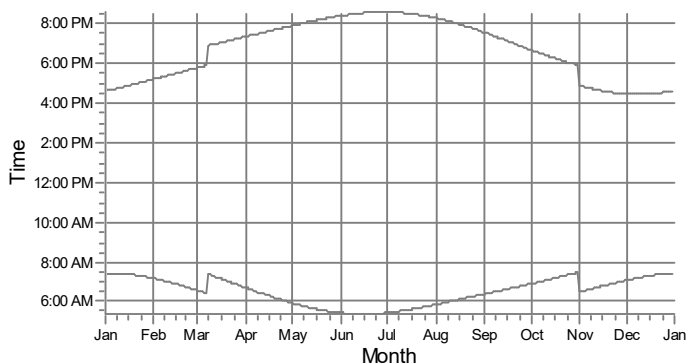
JY: REC-285



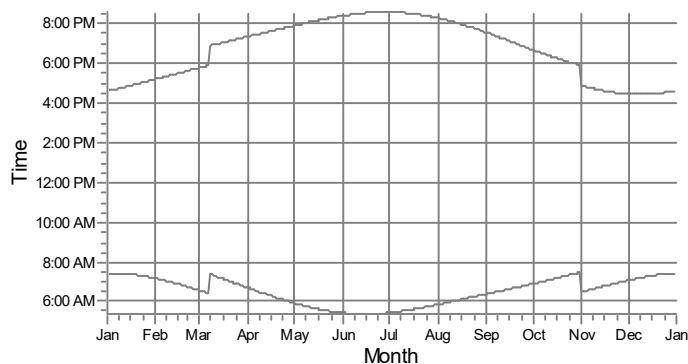
JZ: REC-286



KA: REC-287



KB: REC-288



WTGs

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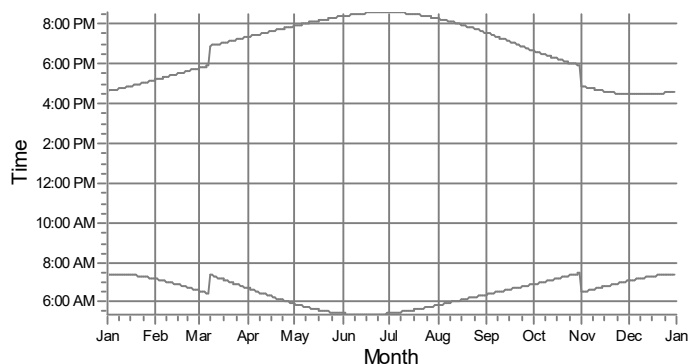
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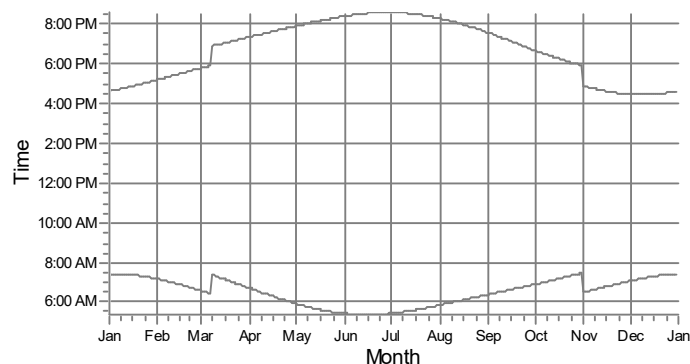
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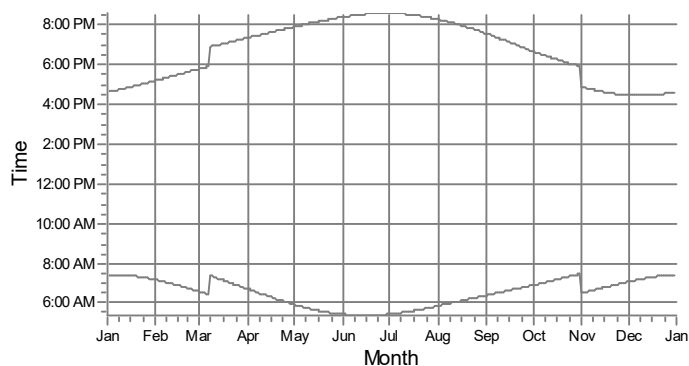
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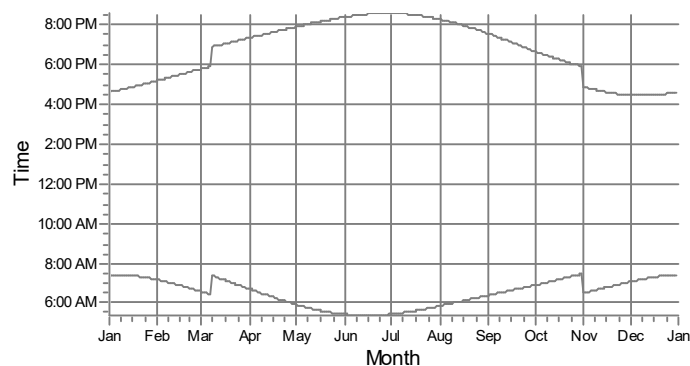
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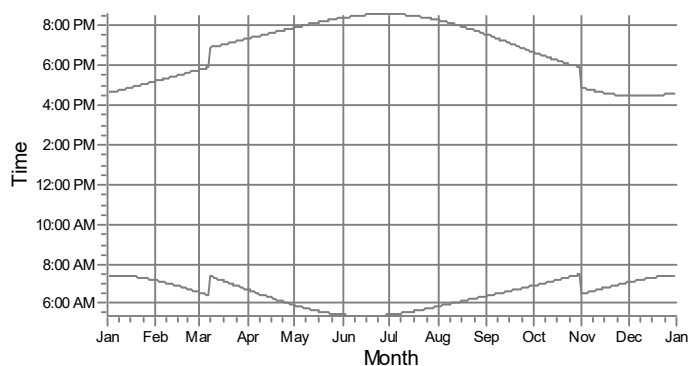
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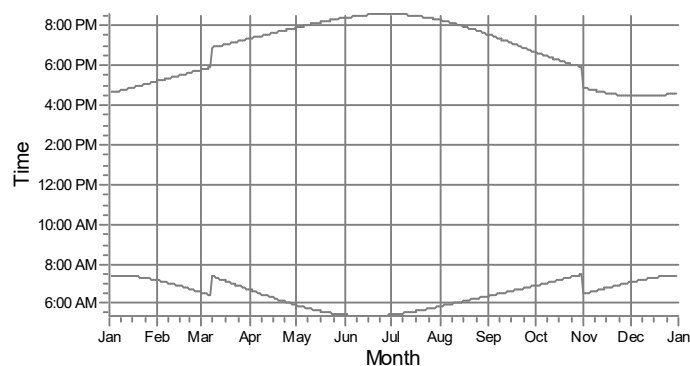
KF: REC-292



KG: REC-293



KH: REC-294



WTGs

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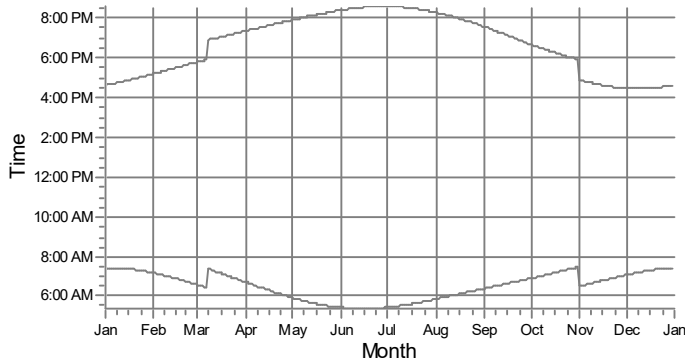
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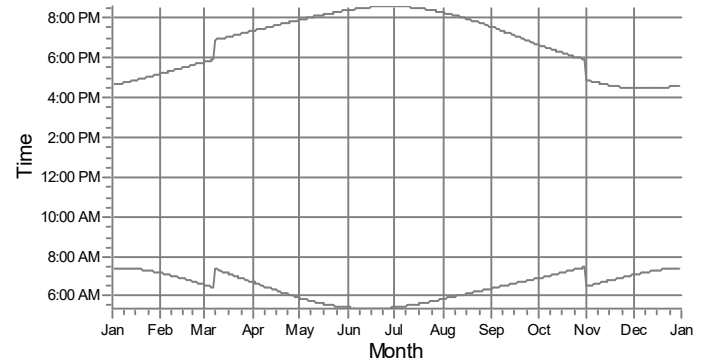
SHADOW - Calendar, graphical

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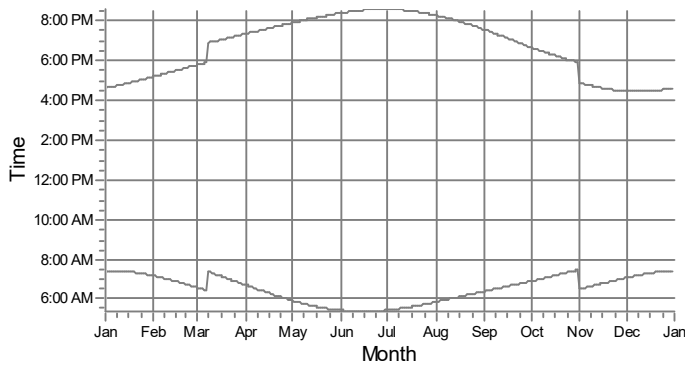
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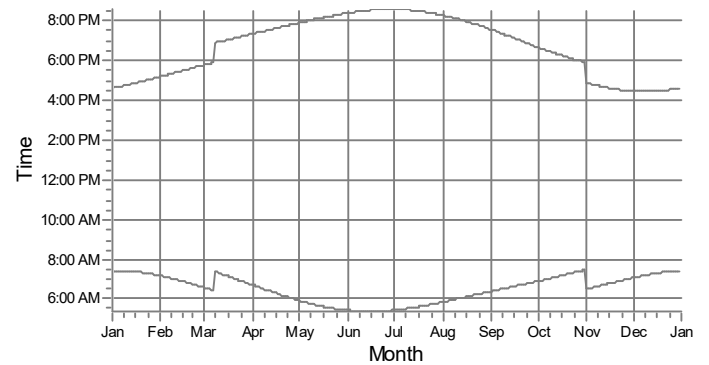
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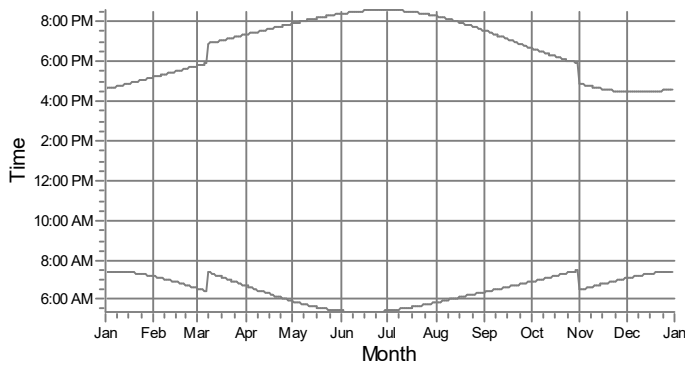
KK: REC-297



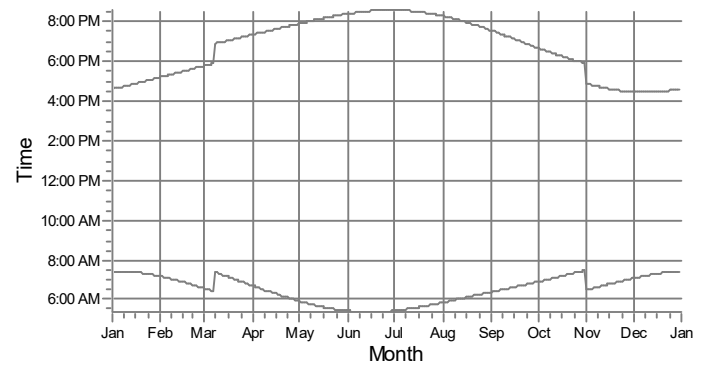
KL: REC-298



KM: REC-299



KN: REC-300



WTGs

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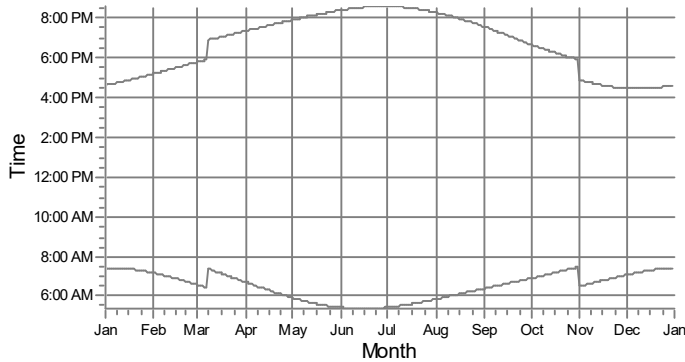
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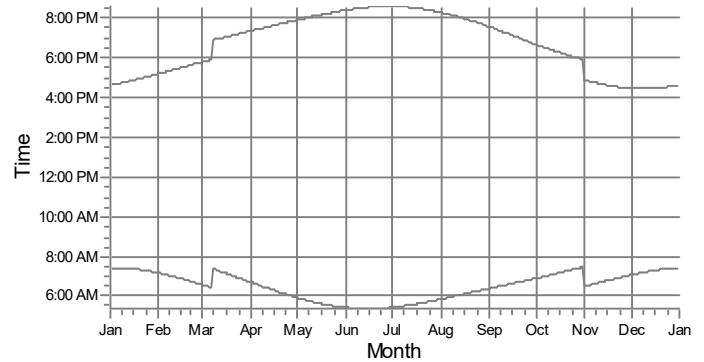
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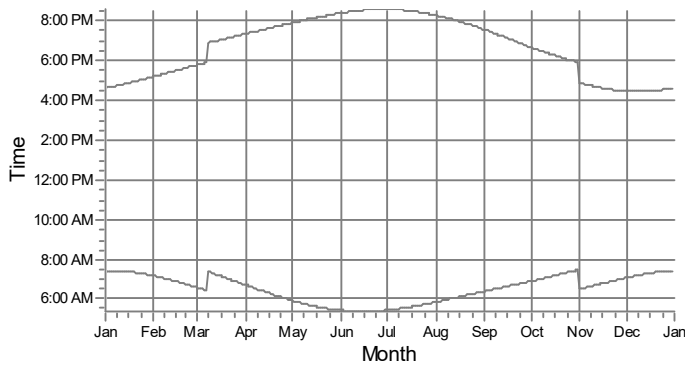
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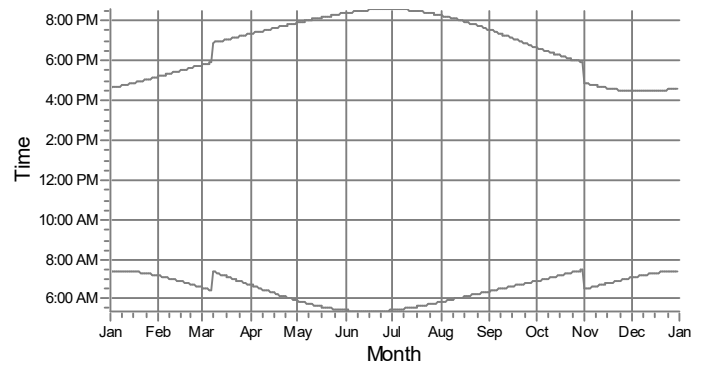
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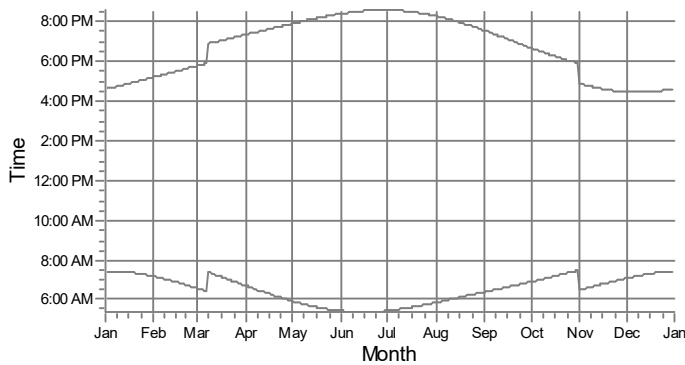
KQ: REC-303



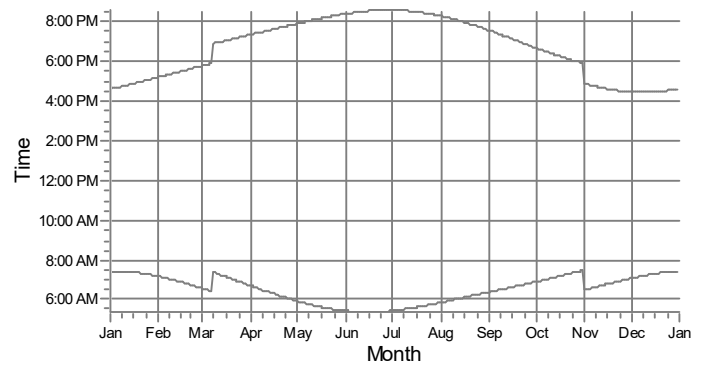
KR: REC-304



KS: REC-305



KT: REC-306



WTGs

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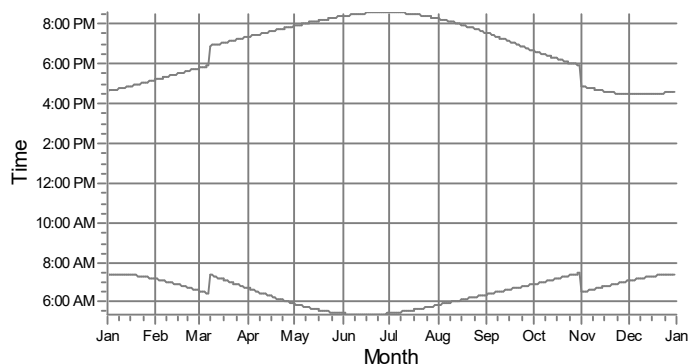
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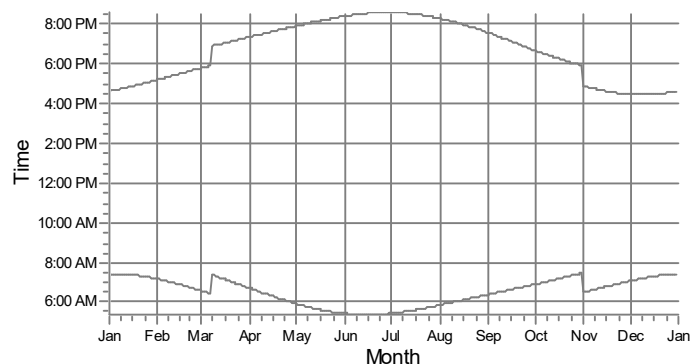
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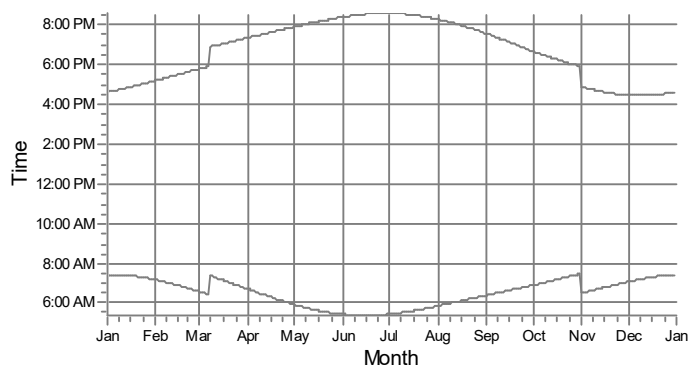
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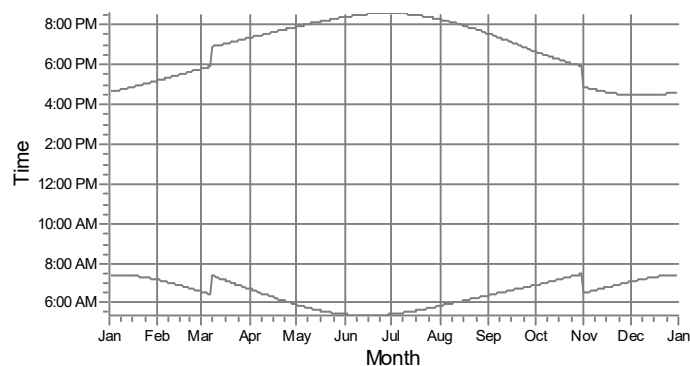
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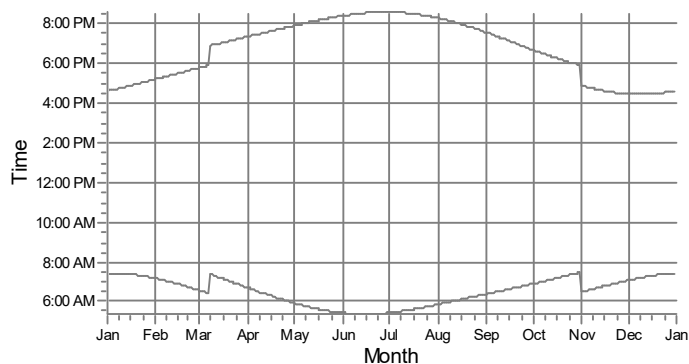
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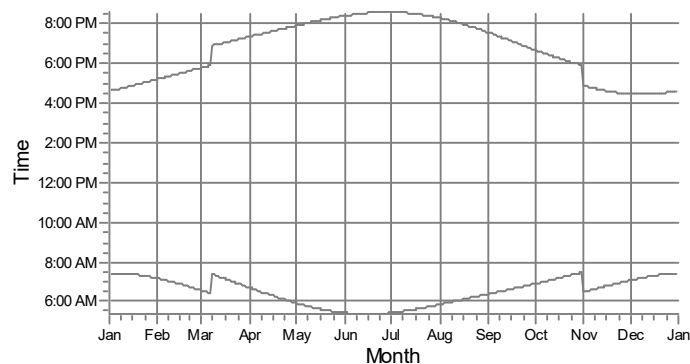
KX: REC-310



KY: REC-311



KZ: REC-312



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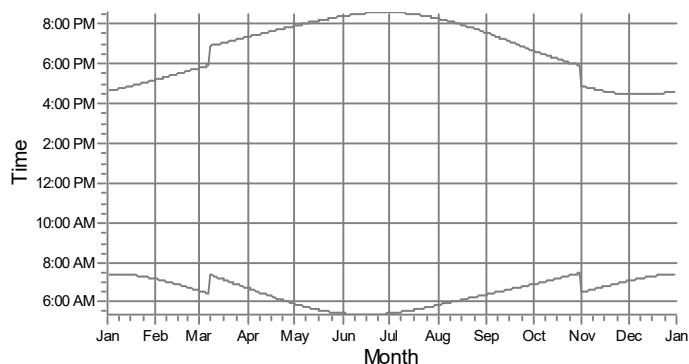
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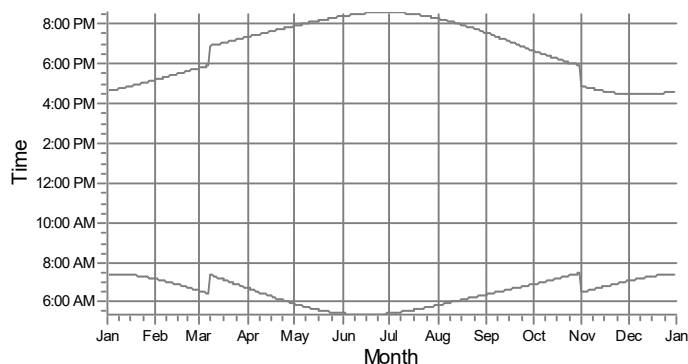
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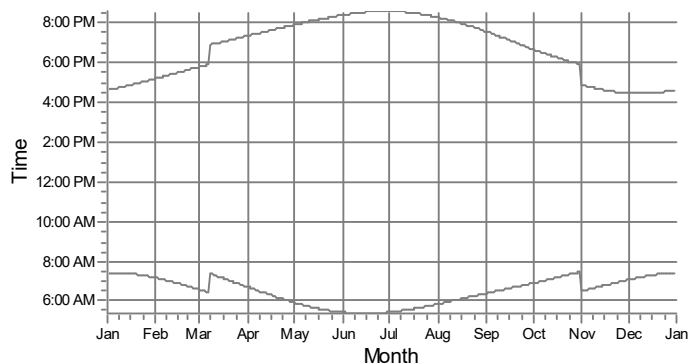
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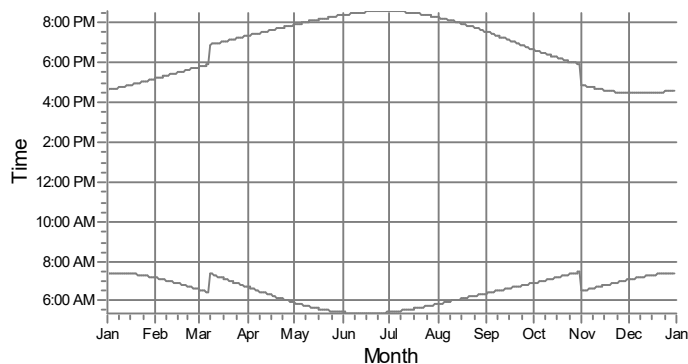
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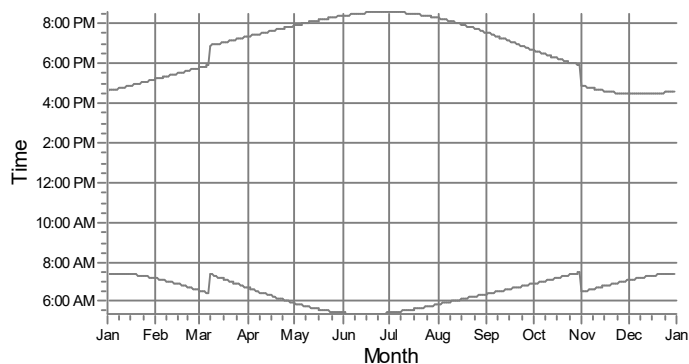
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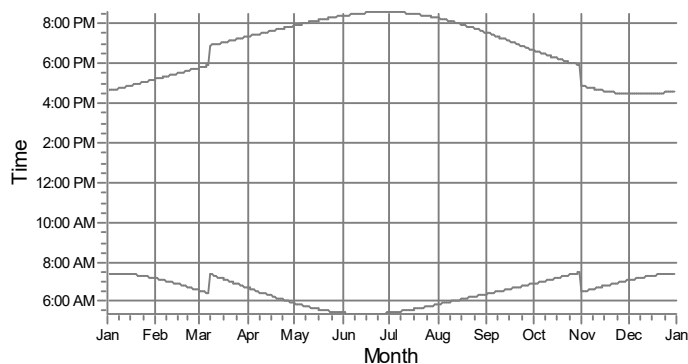
LD: REC-316



LE: REC-317



LF: REC-318



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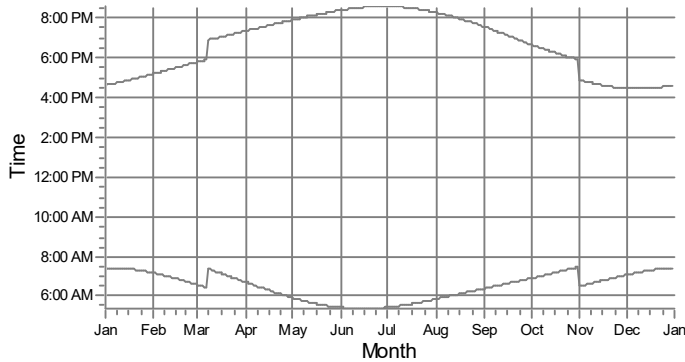
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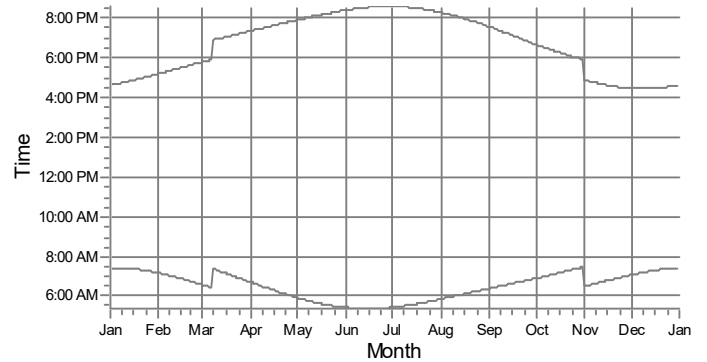
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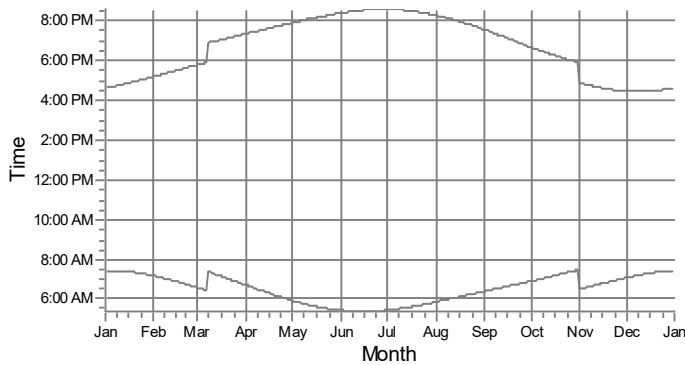
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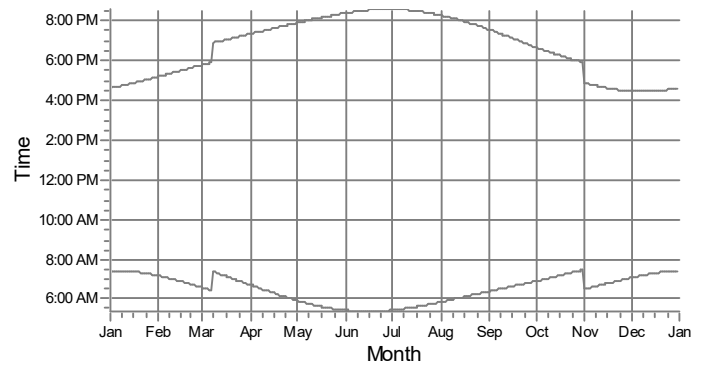
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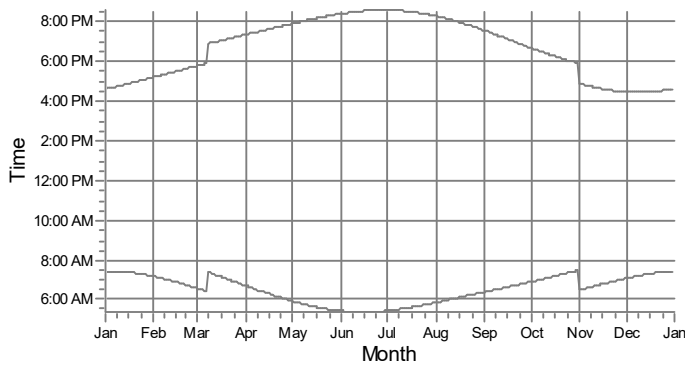
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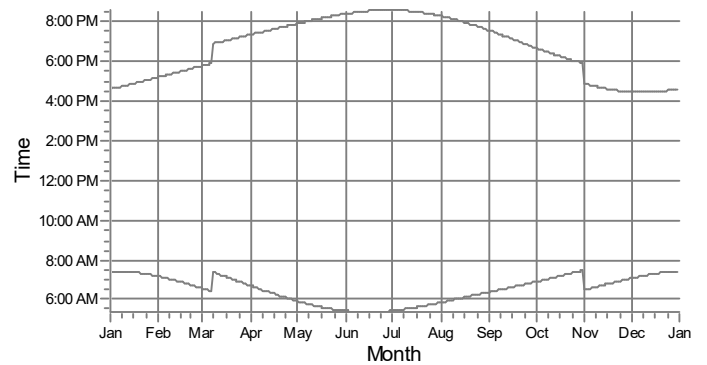
LJ: REC-322



LK: REC-323



LL: REC-324



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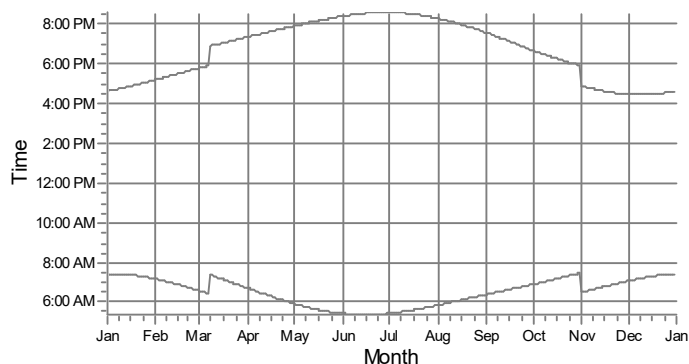
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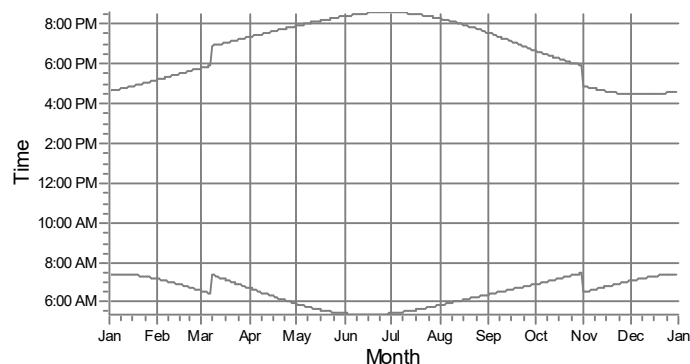
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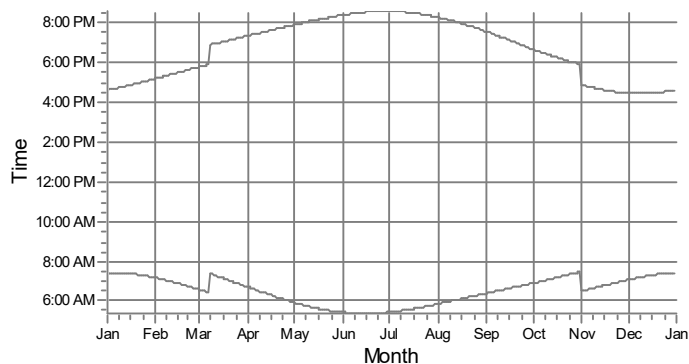
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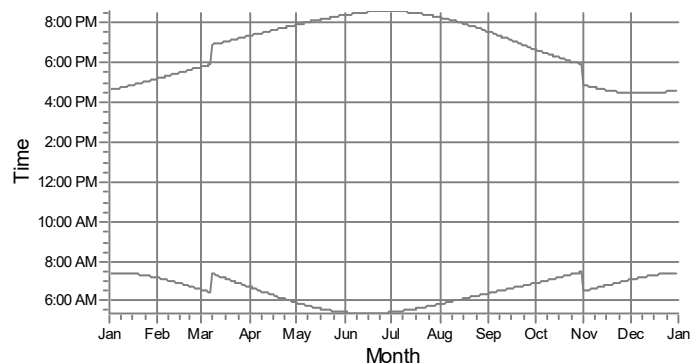
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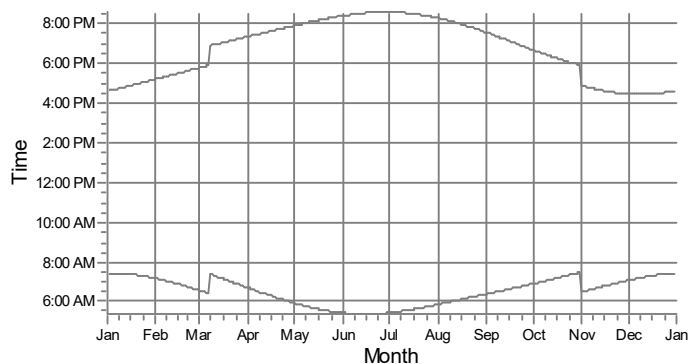
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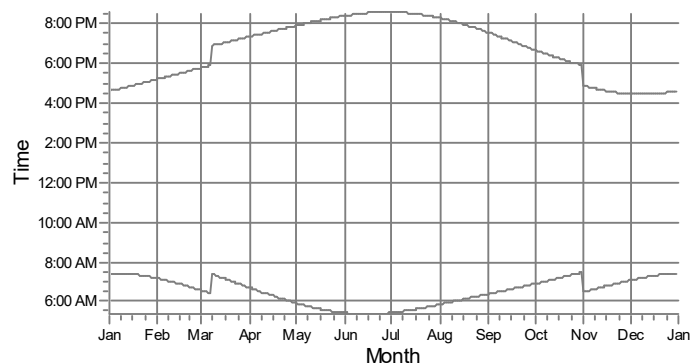
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LQ: REC-329



LR: REC-330



WTGs

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118183 - Shady Oaks II Wind Project

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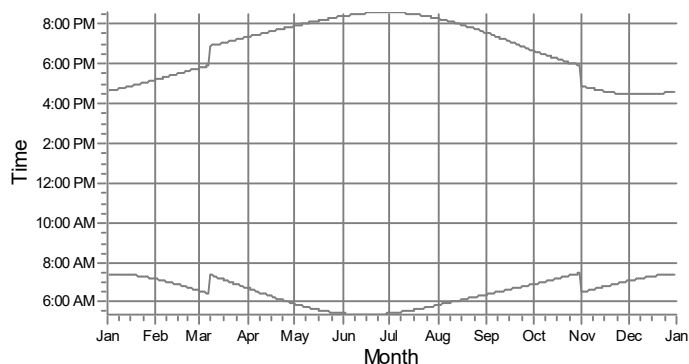
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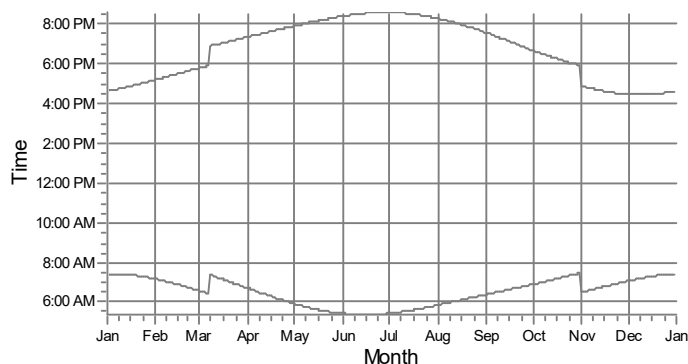
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

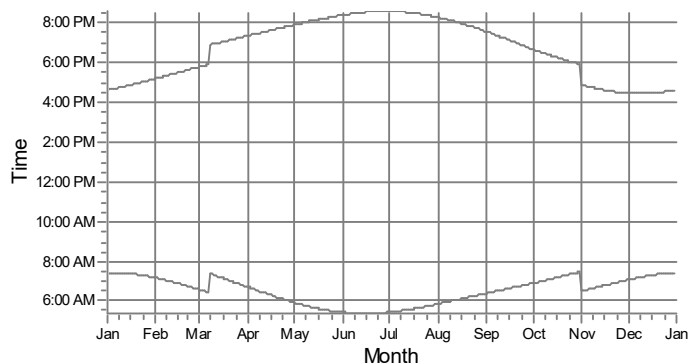
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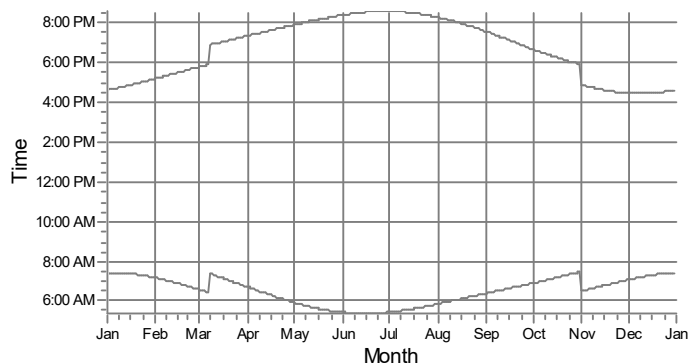
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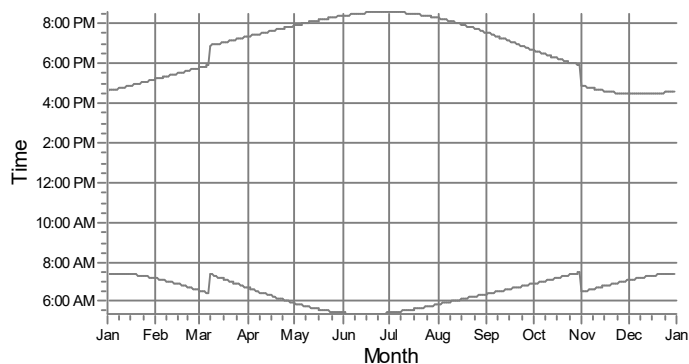
LU: REC-333



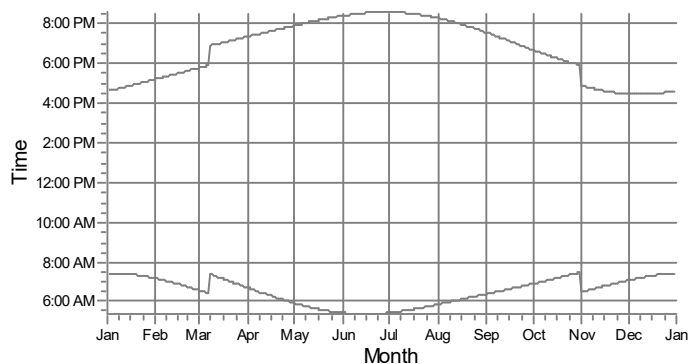
LV: REC-334



LW: REC-335



LX: REC-336



WTGs

Project:

118183 - Shady Oaks II Wind Project

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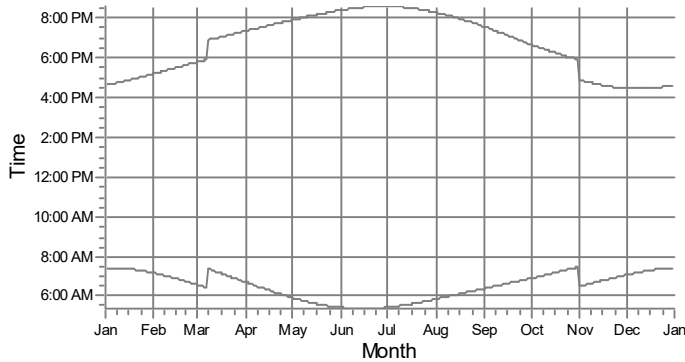
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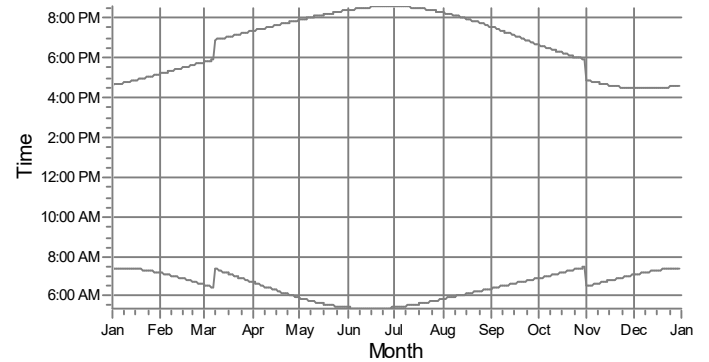
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

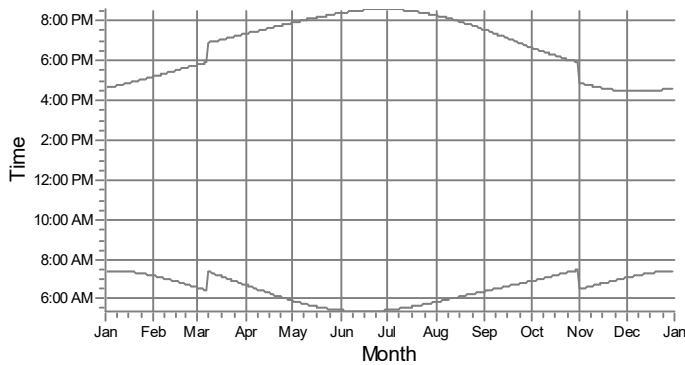
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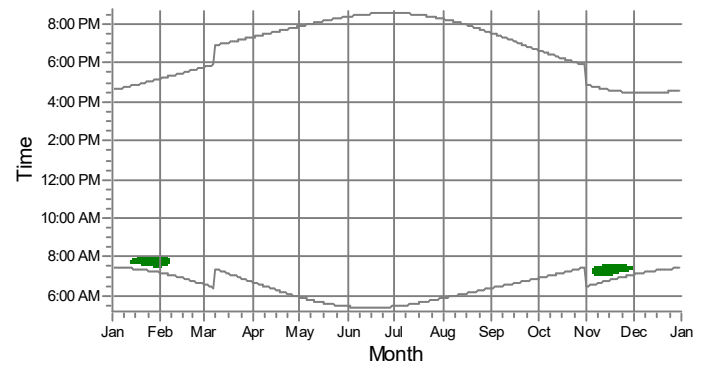
LZ: REC-338



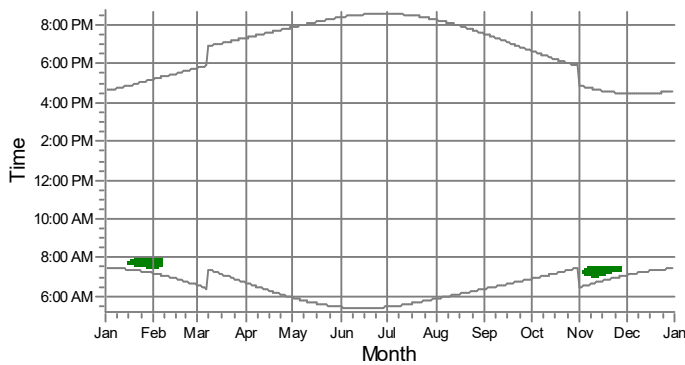
MA: REC-339



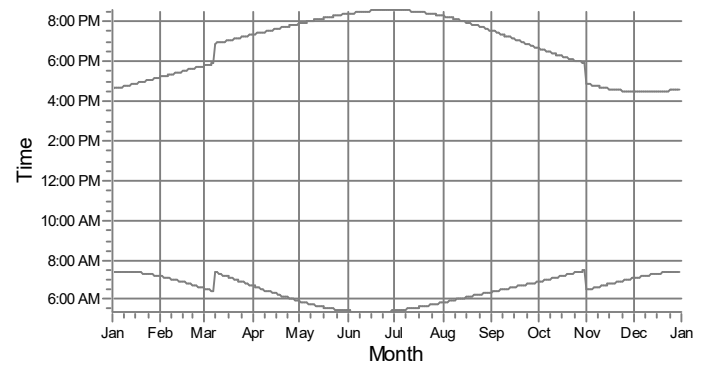
MB: REC-340



MC: REC-341



MD: REC-342



WTGs

1: T01

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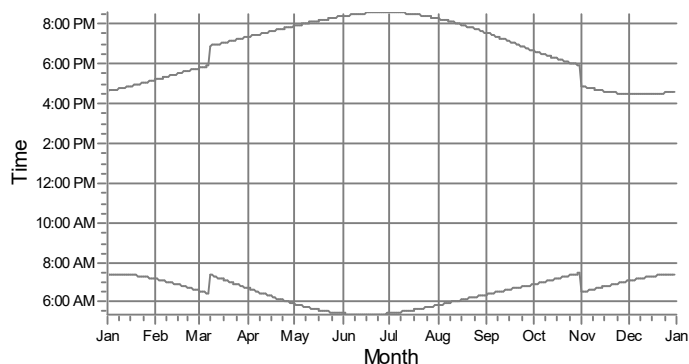
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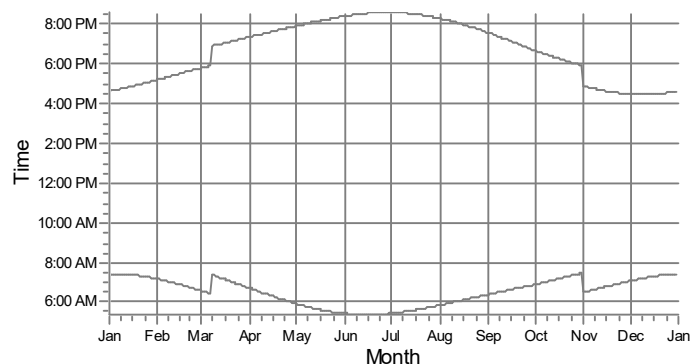
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

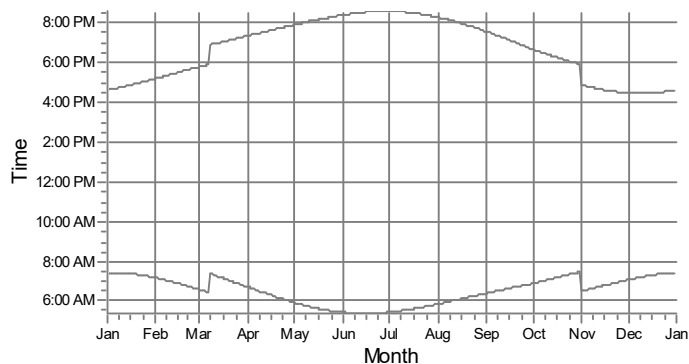
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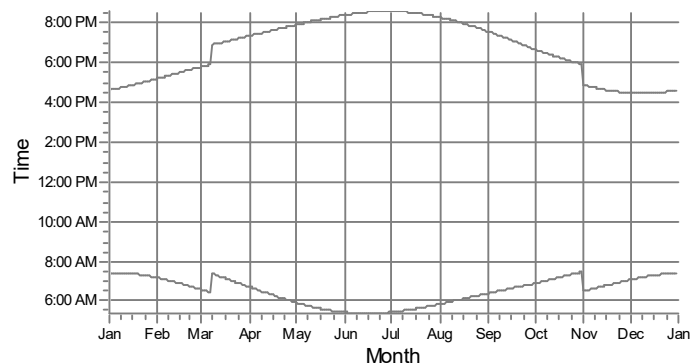
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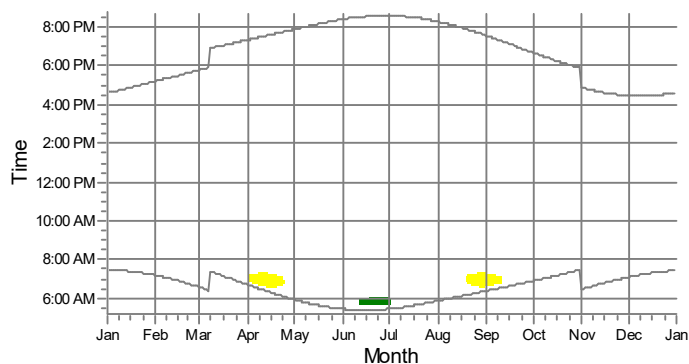
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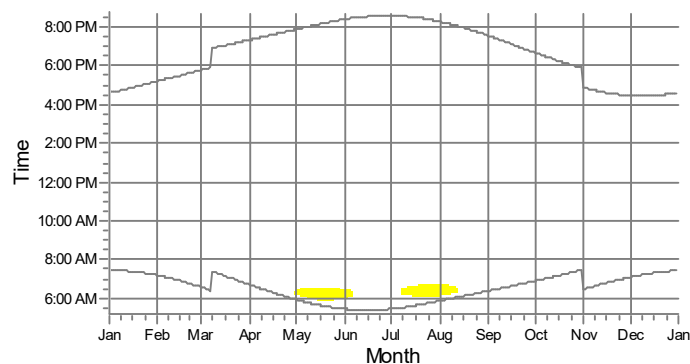
MH: REC-346



MI: REC-347



MJ: REC-348



WTGs



1: T01



2: T02

Project:

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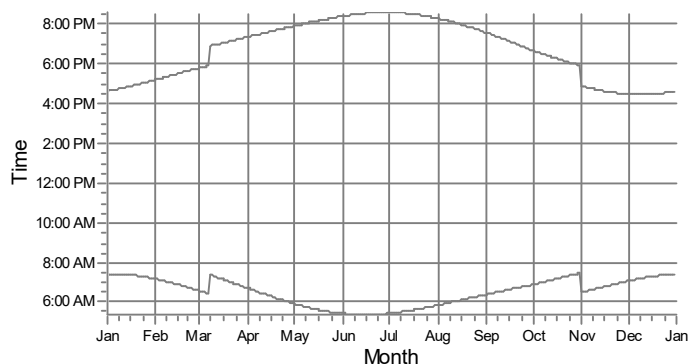
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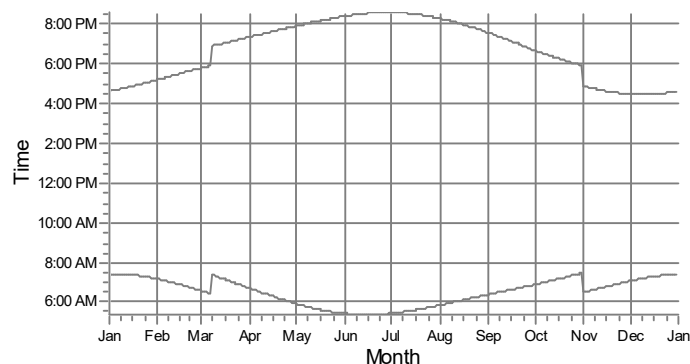
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

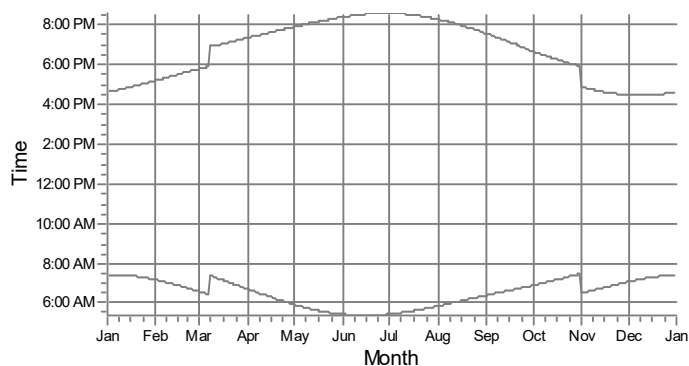
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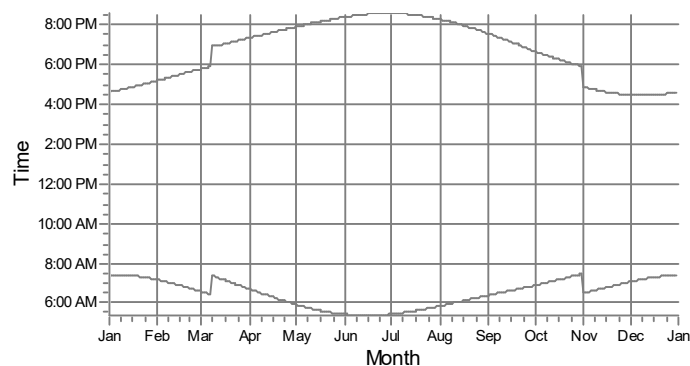
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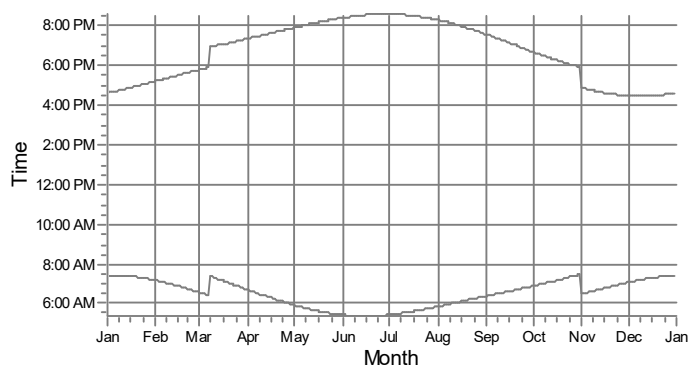
MM: REC-351



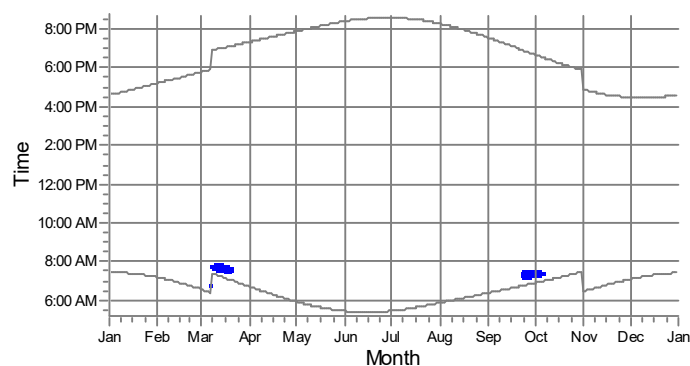
MN: REC-352



MO: REC-353



MP: REC-354



WTGs

3: T03

Project:

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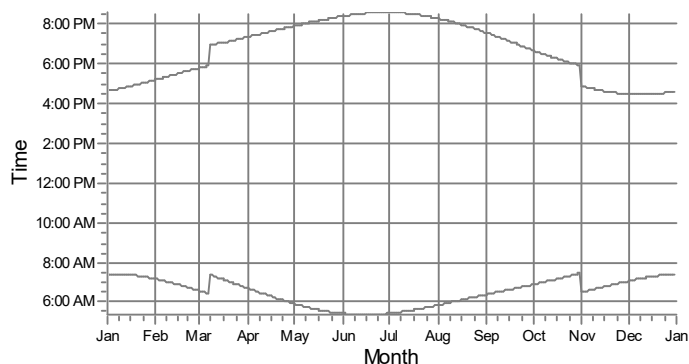
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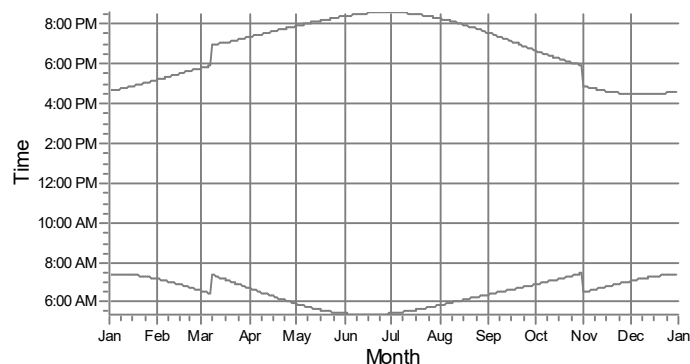
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

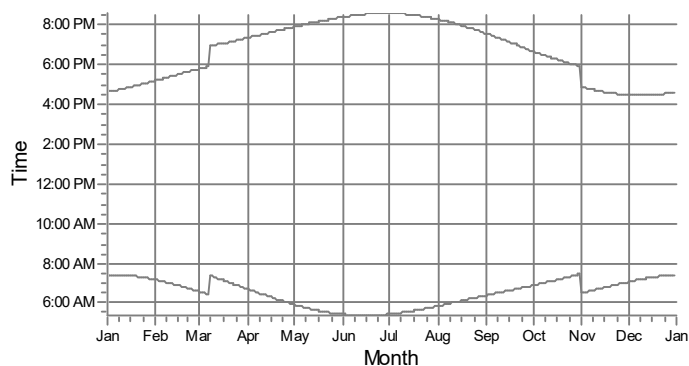
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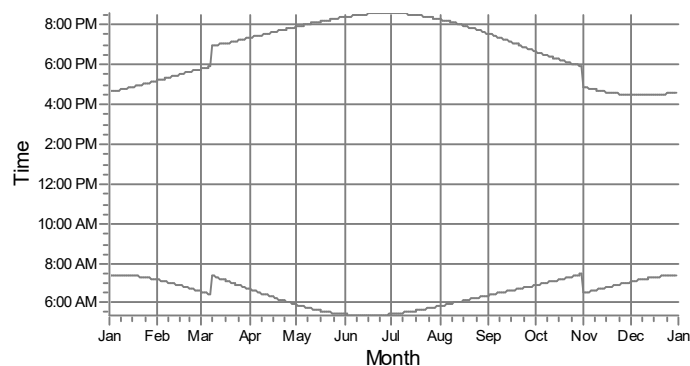
MR: REC-356



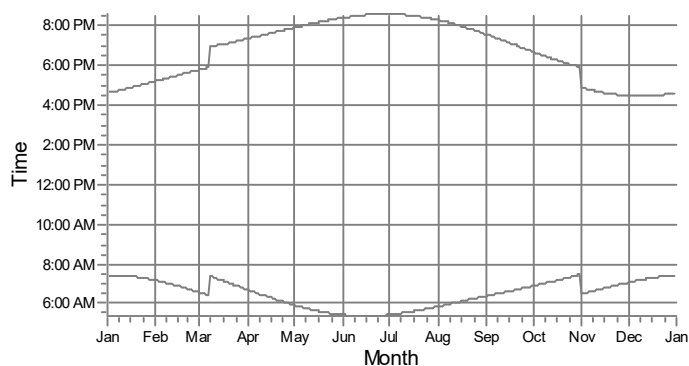
MS: REC-357



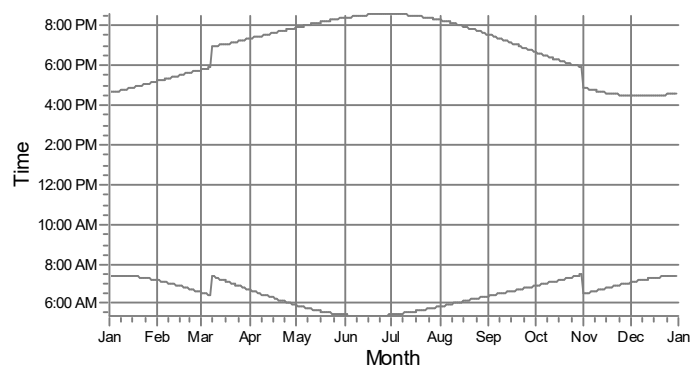
MT: REC-358



MU: REC-359



MV: REC-360



WTGs

Project:

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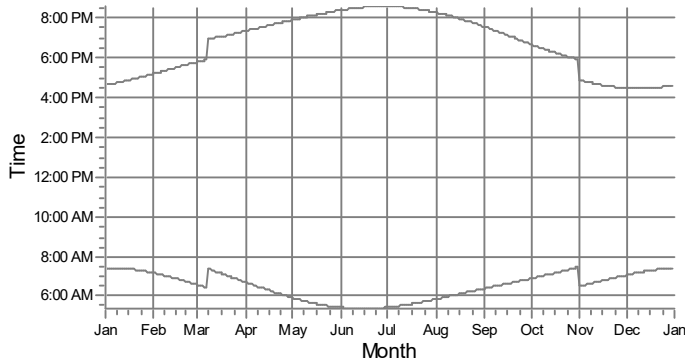
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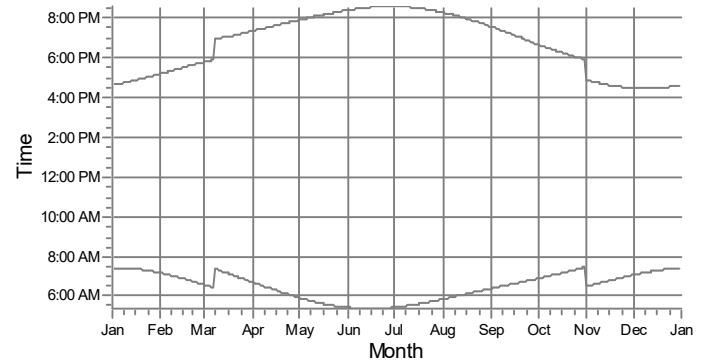
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

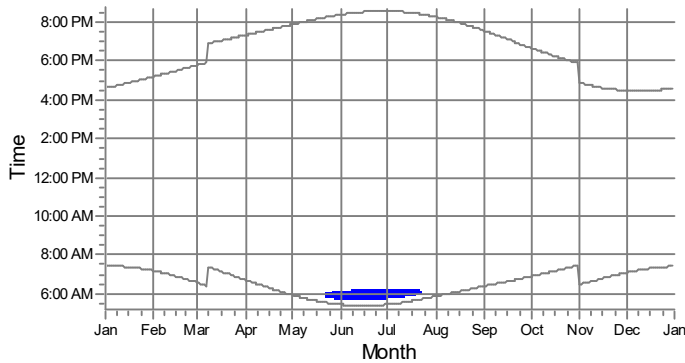
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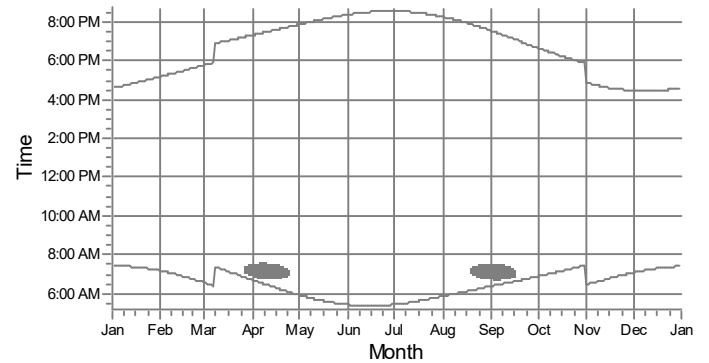
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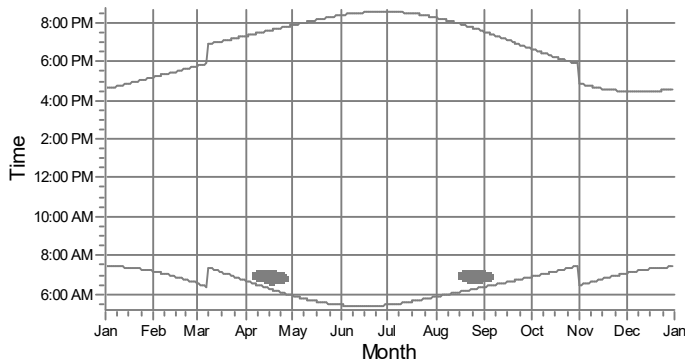
MY: REC-363



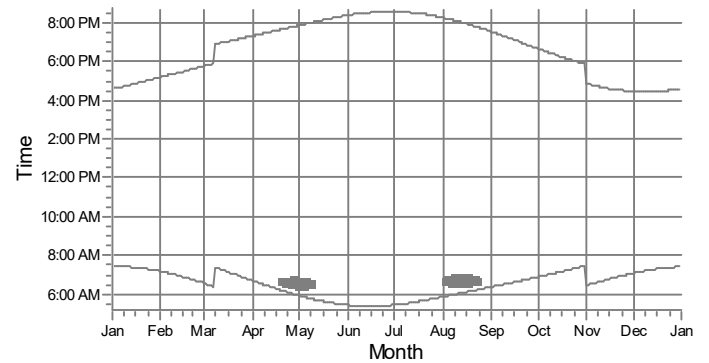
MZ: REC-364



NA: REC-365



NB: REC-366



WTGs



3: T03



4: T04

Project:

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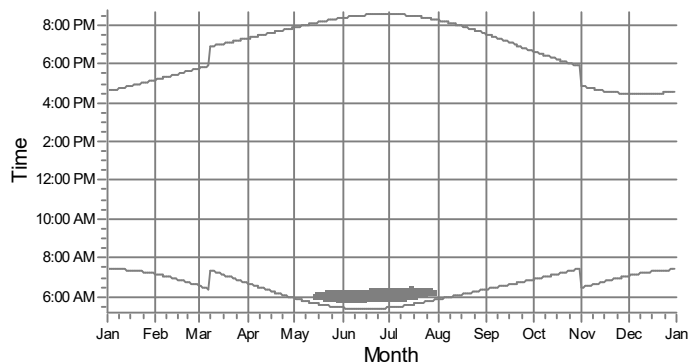
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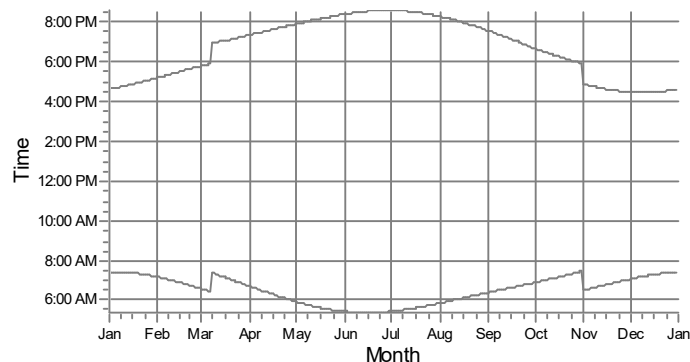
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

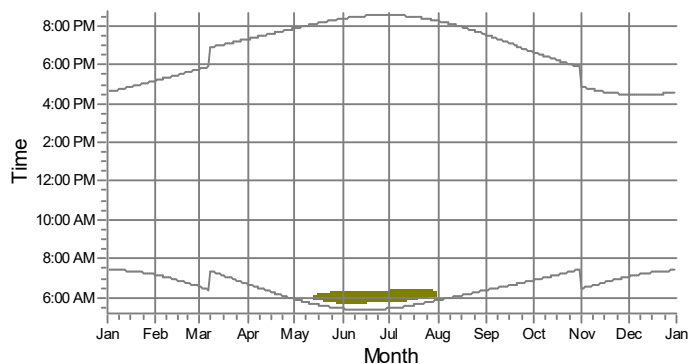
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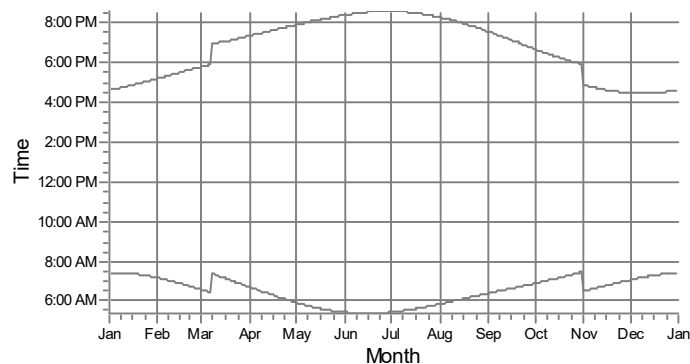
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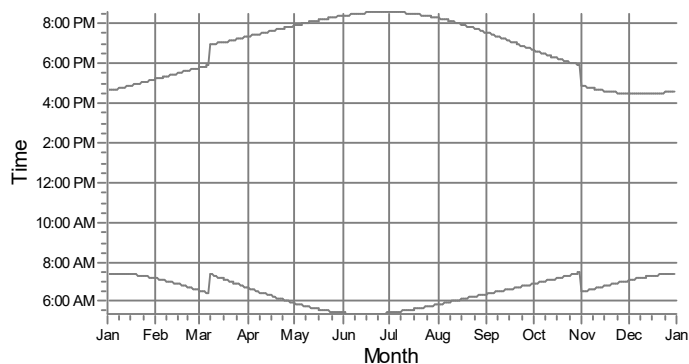
NE: REC-369



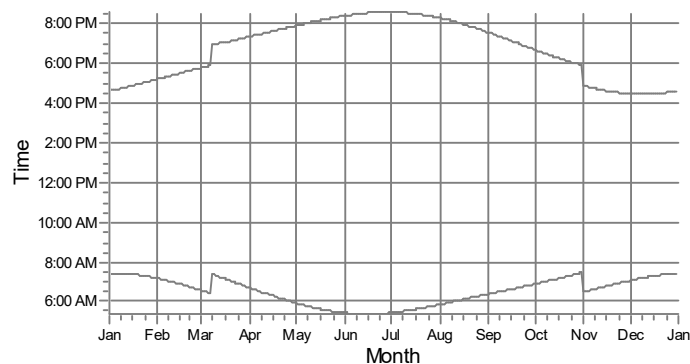
NF: REC-370



NG: REC-371



NH: REC-372



WTGs



4: T04



10: T10

Project:

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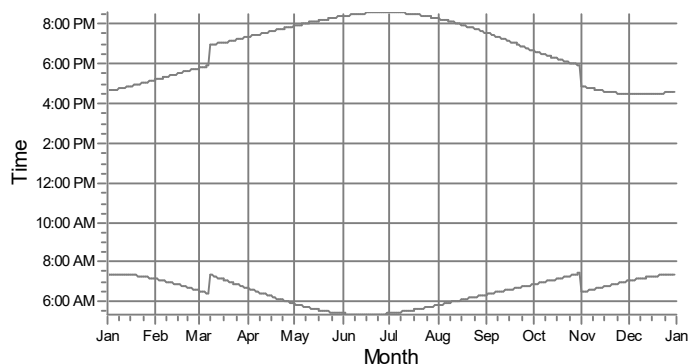
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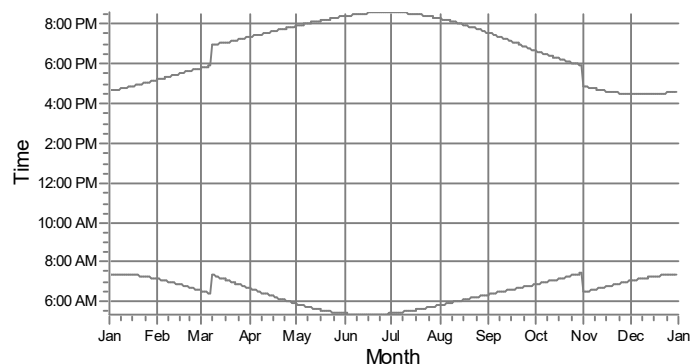
SHADOW - Calendar, graphical

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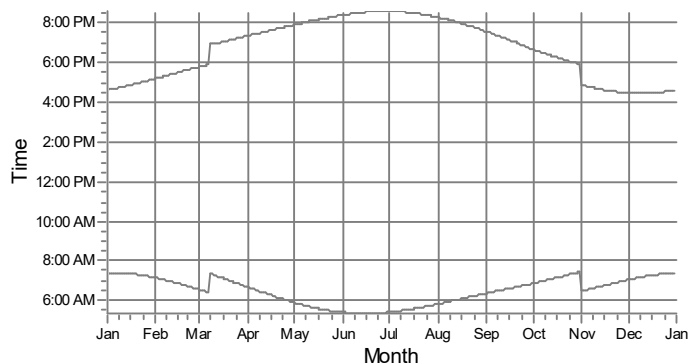
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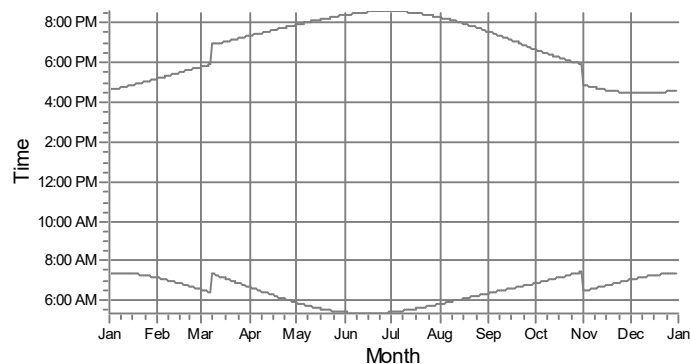
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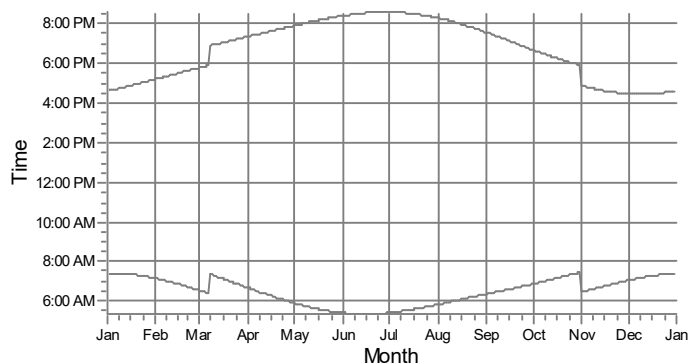
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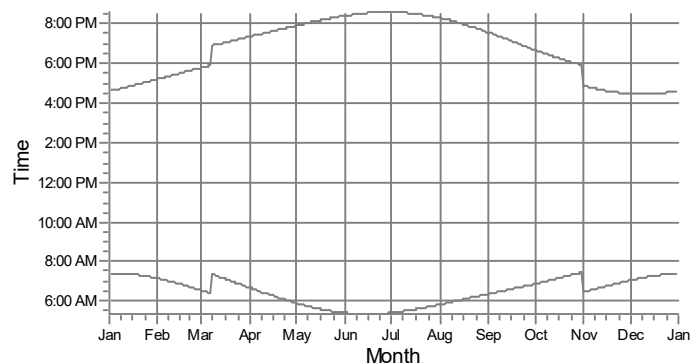
NL: REC-376



NM: REC-377



NN: REC-378



WTGs

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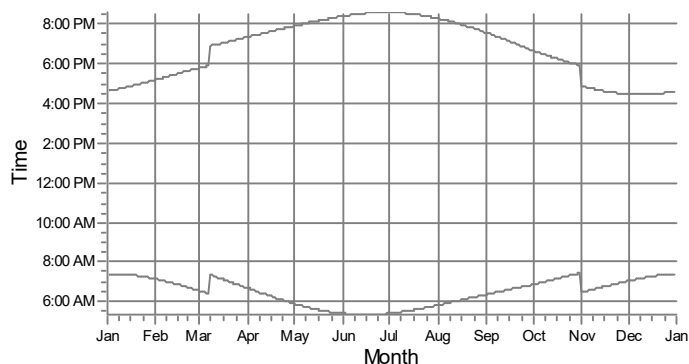
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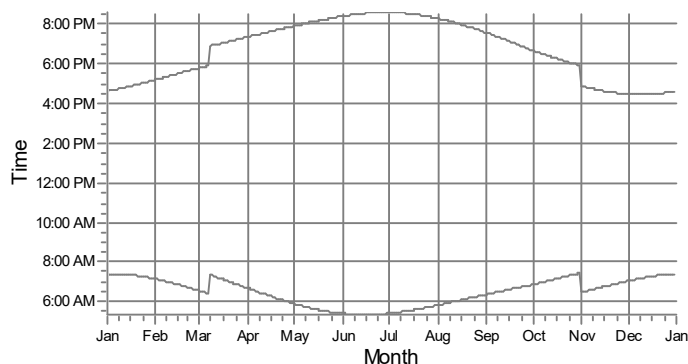
SHADOW - Calendar, graphical

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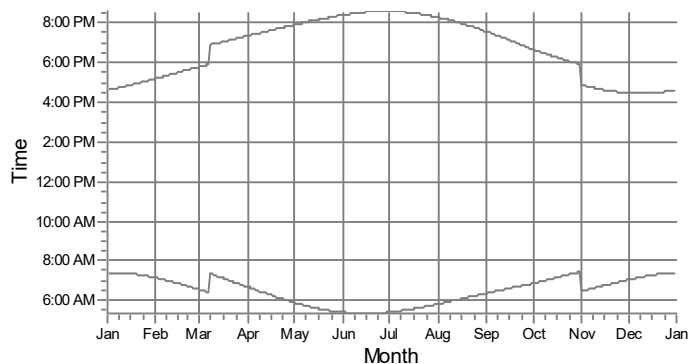
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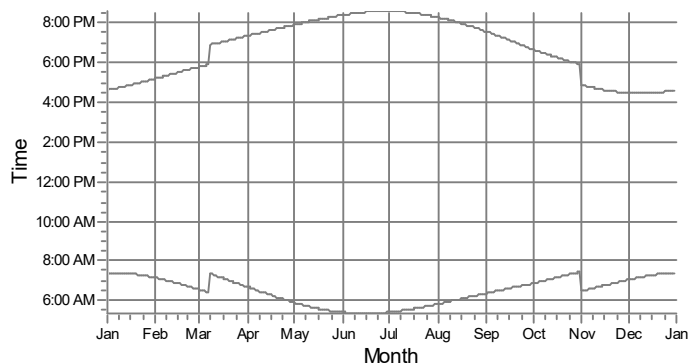
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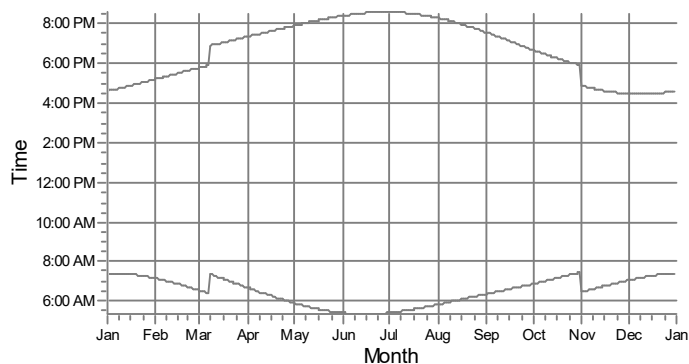
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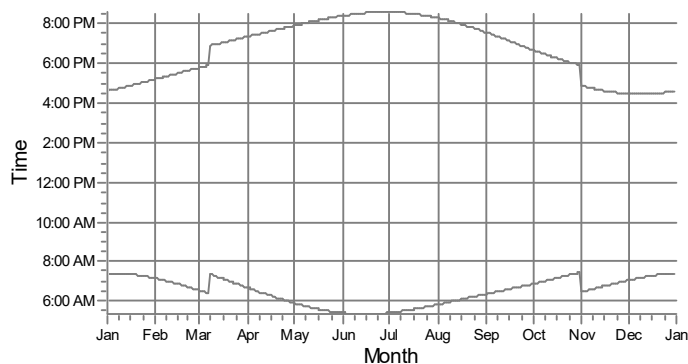
NR: REC-382



NS: REC-383



NT: REC-384



WTGs

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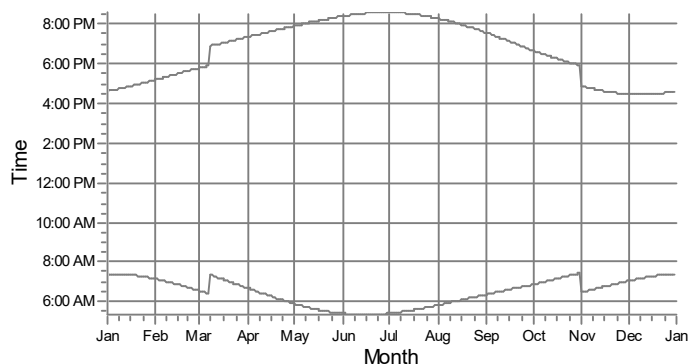
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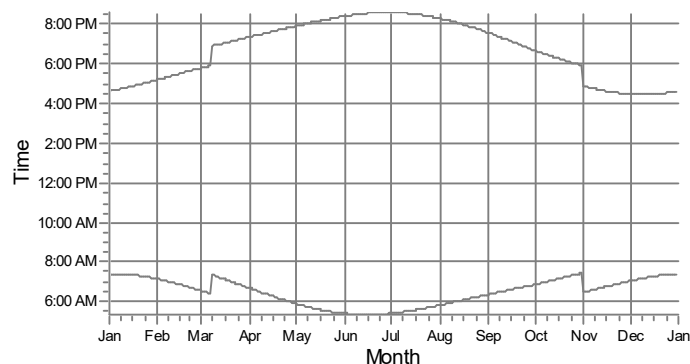
SHADOW - Calendar, graphical

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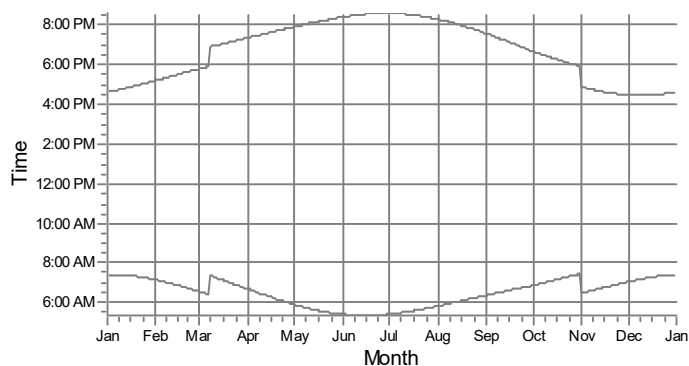
NU: REC-385



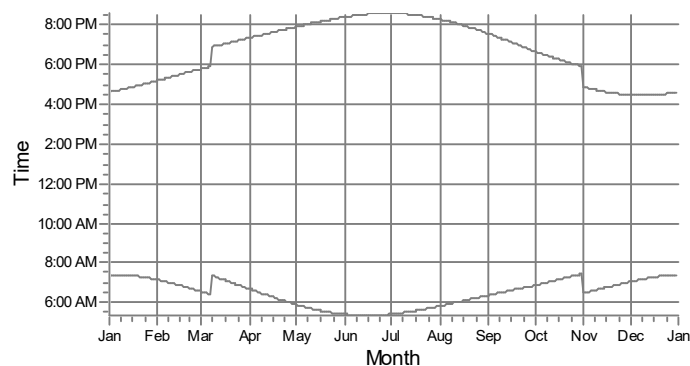
NV: REC-386



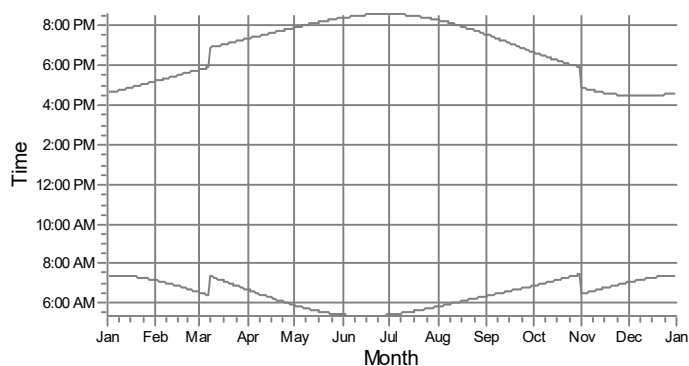
NW: REC-387



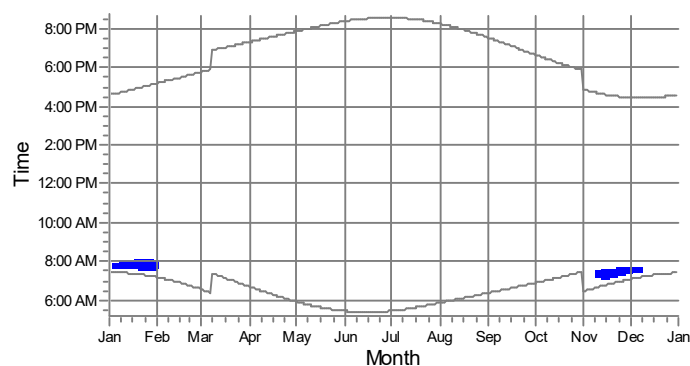
NX: REC-388



NY: REC-389



NZ: REC-390



WTGs

3: T03

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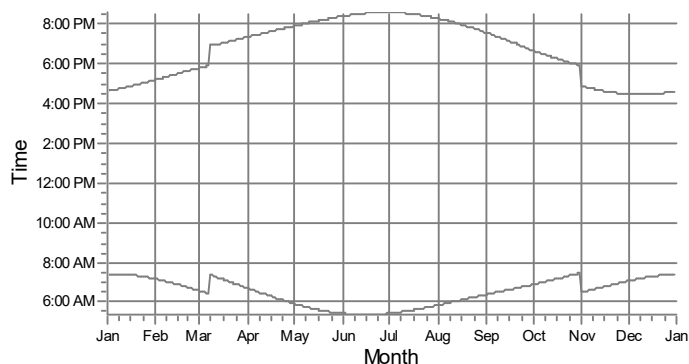
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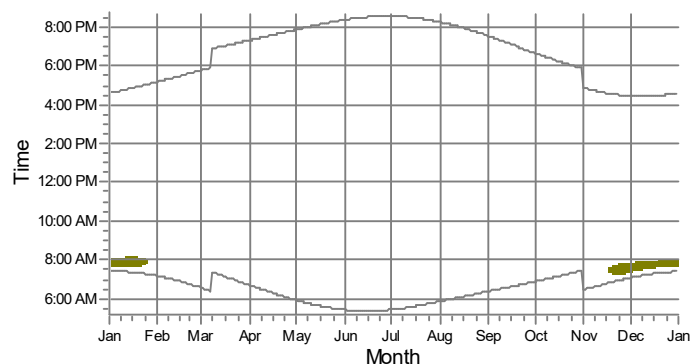
SHADOW - Calendar, graphical

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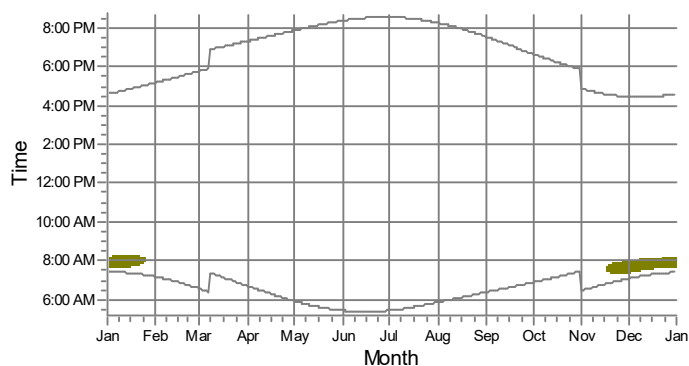
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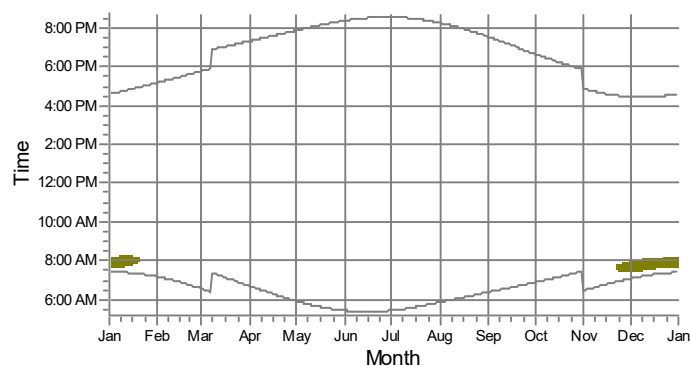
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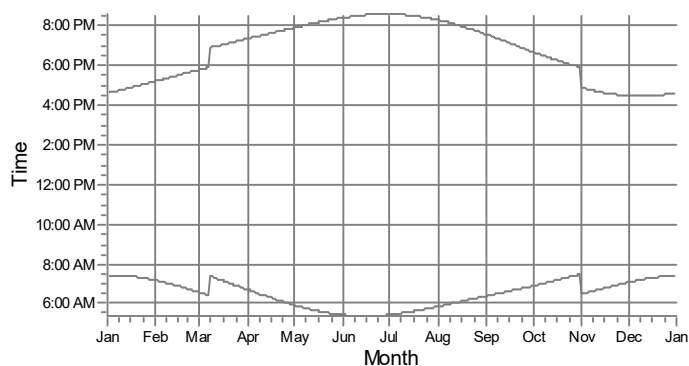
OC: REC-393



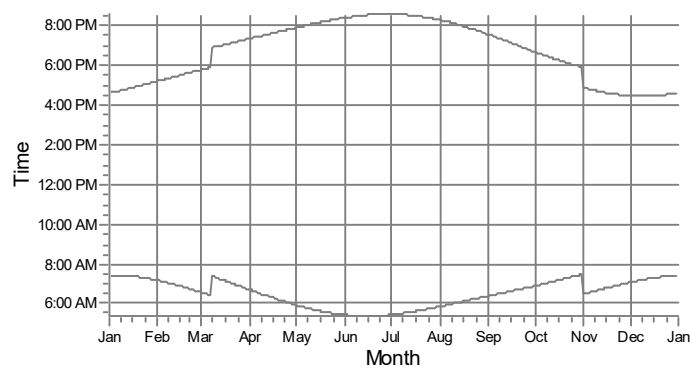
OD: REC-394



OE: REC-395



OF: REC-396



WTGs



10: T10

Project:

118183 - Shady Oaks II Wind Project

Description:

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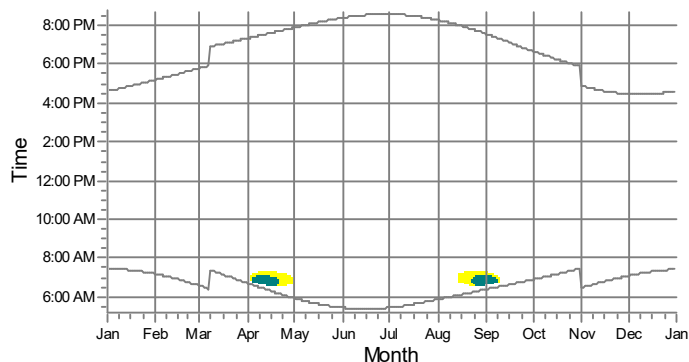
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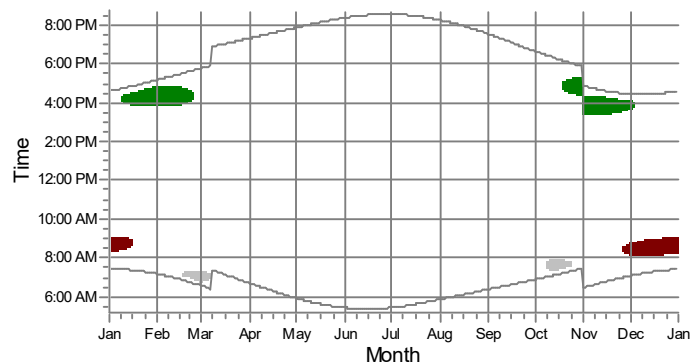
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

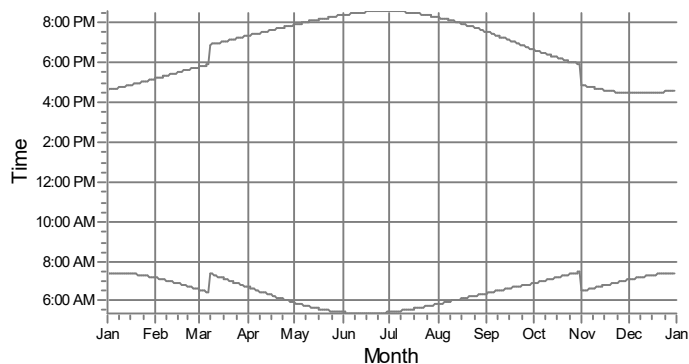
OG: REC-397



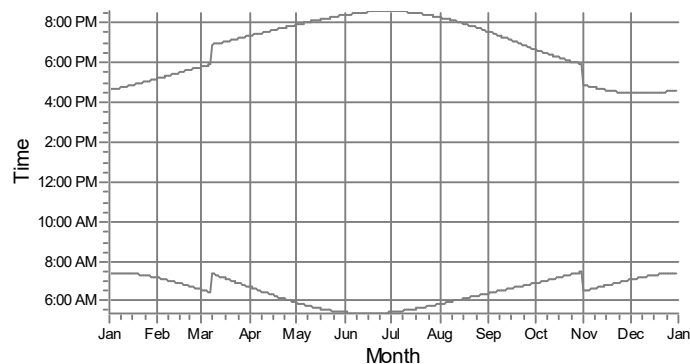
OH: REC-398



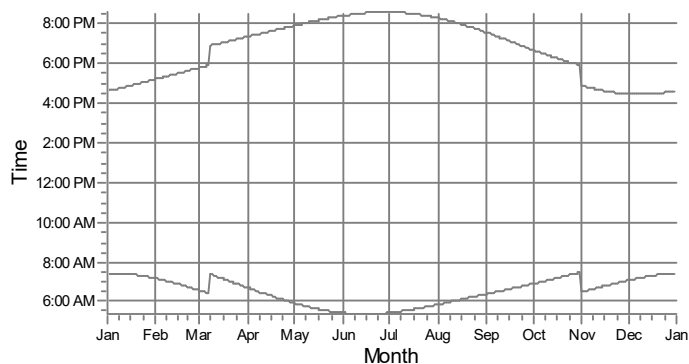
OI: REC-399



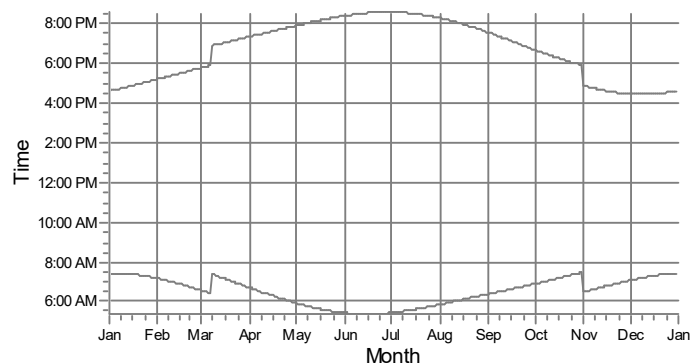
OJ: REC-400



OK: REC-401



OL: REC-402



WTGs



1: T01



2: T02



6: T06



8: T08



12: T12

Project:

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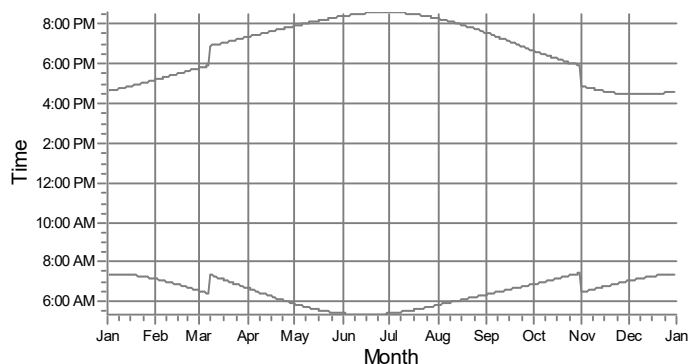
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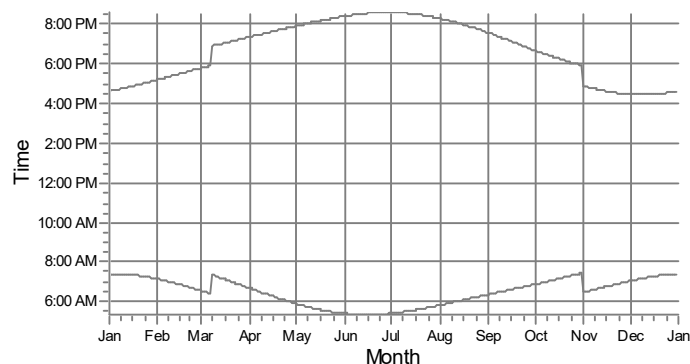
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

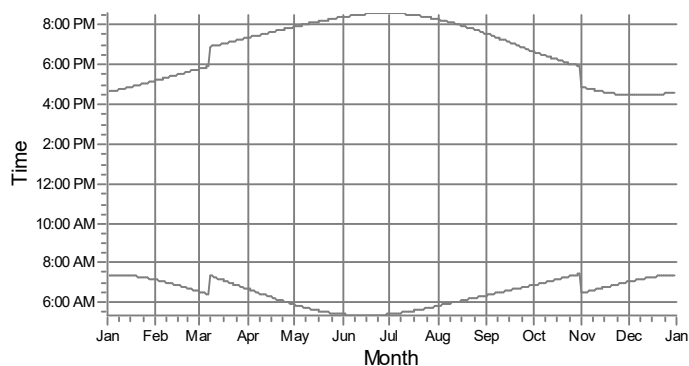
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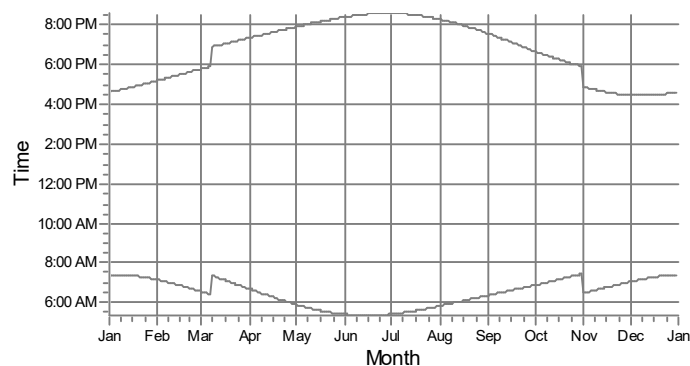
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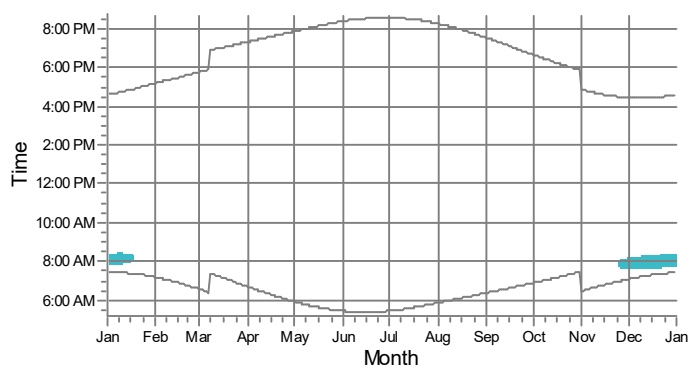
OO: REC-405



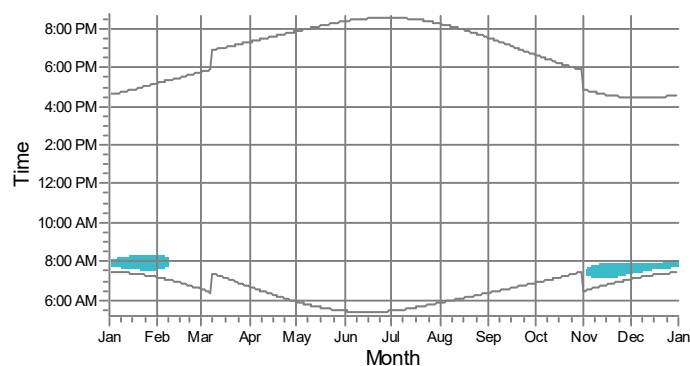
OP: REC-406



OQ: REC-407



OR: REC-408



WTGs

19: T19

Project:

118183 - Shady Oaks II Wind Project

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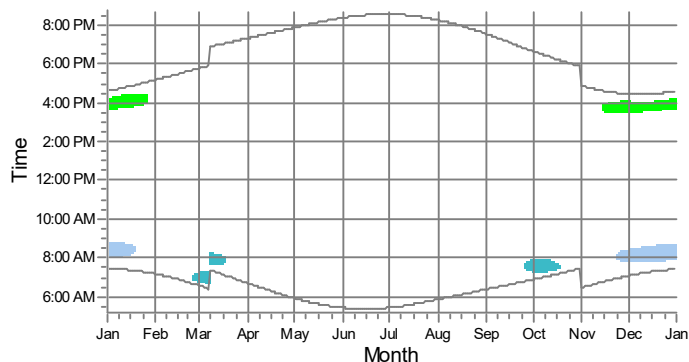
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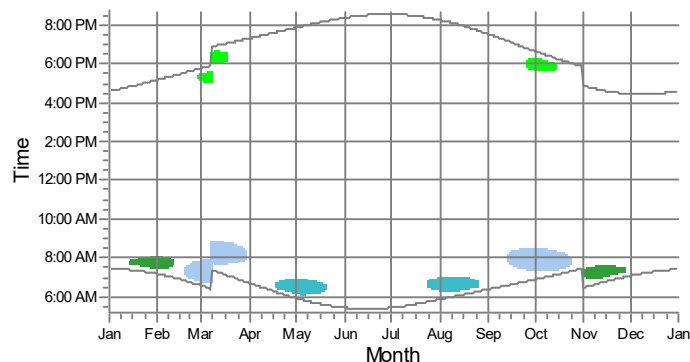
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

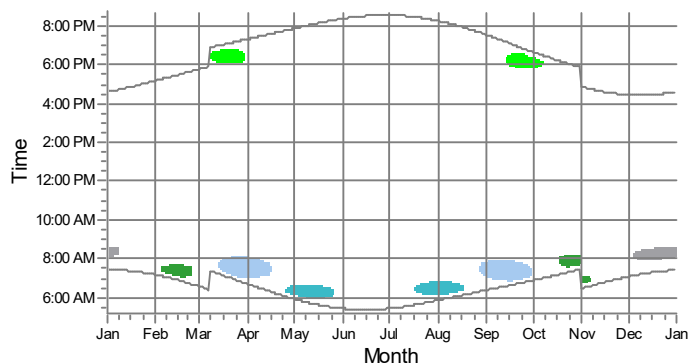
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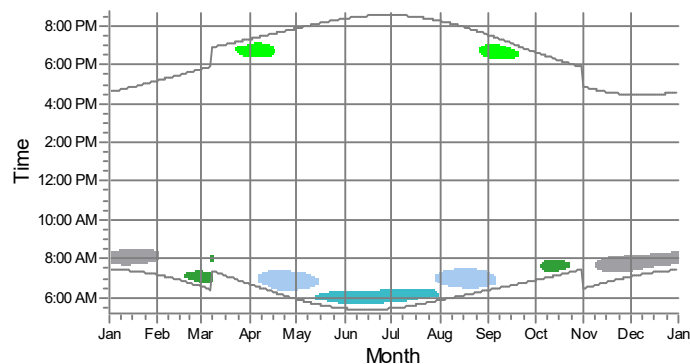
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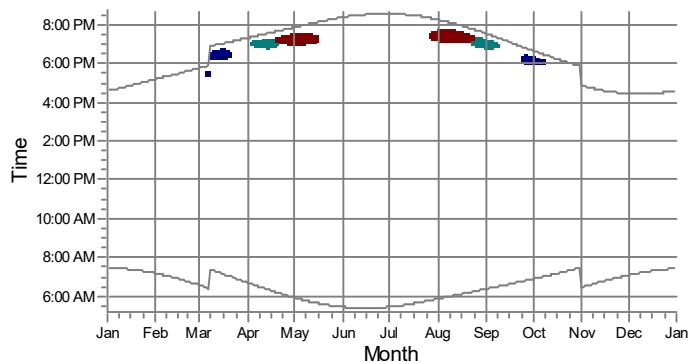
OU: REC-411



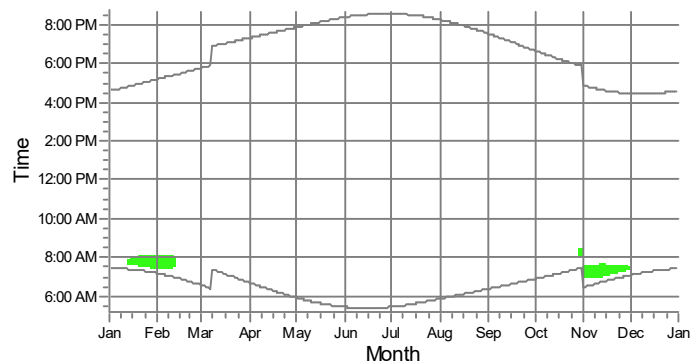
OV: REC-412



OW: REC-413



OX: REC-414



WTGs



Project:

118183 - Shady Oaks II Wind Project

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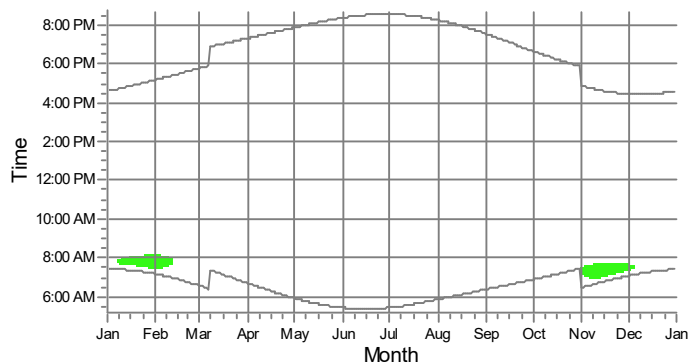
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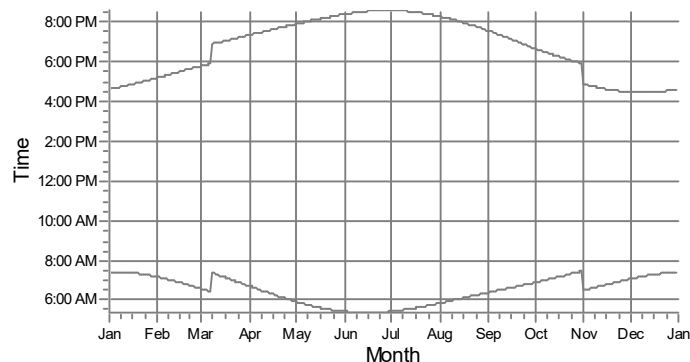
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

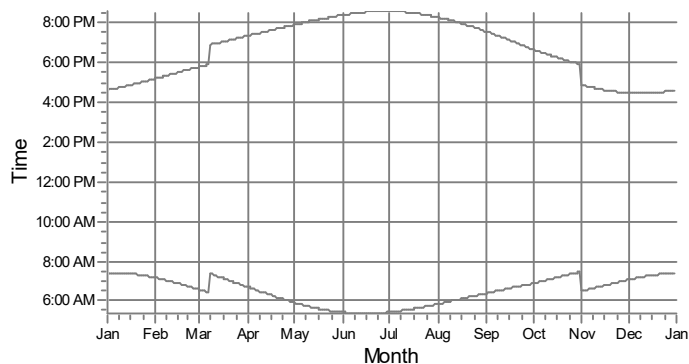
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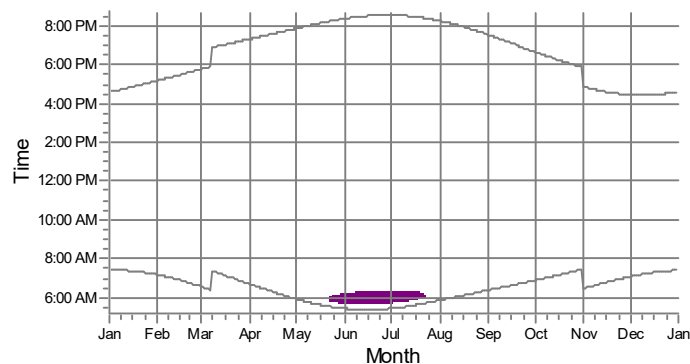
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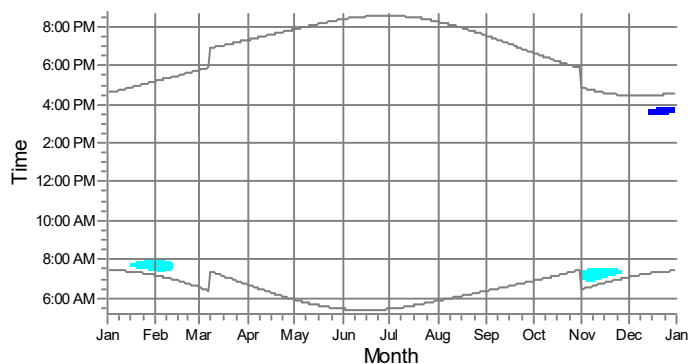
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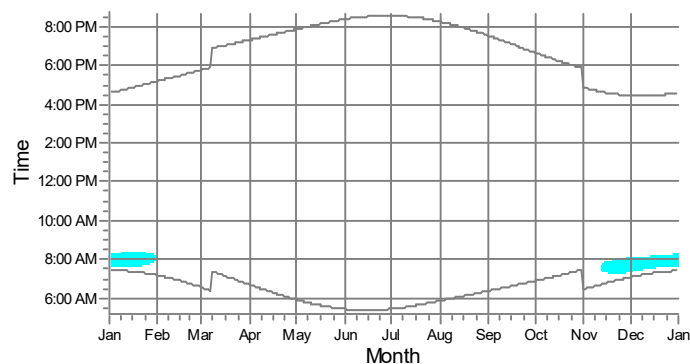
PB: REC-418



PC: REC-419



PD: REC-420



WTGs

3: T03 11: T11 13: T13 18: T18

Project:

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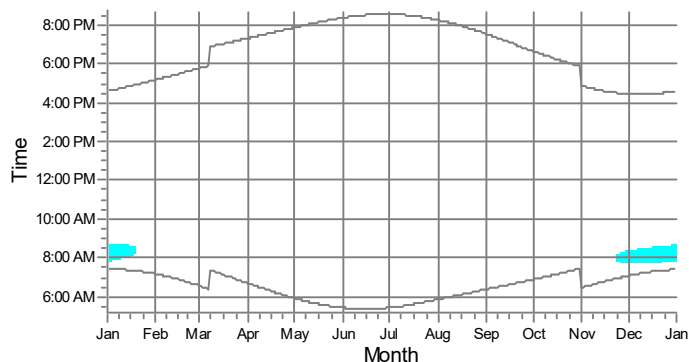
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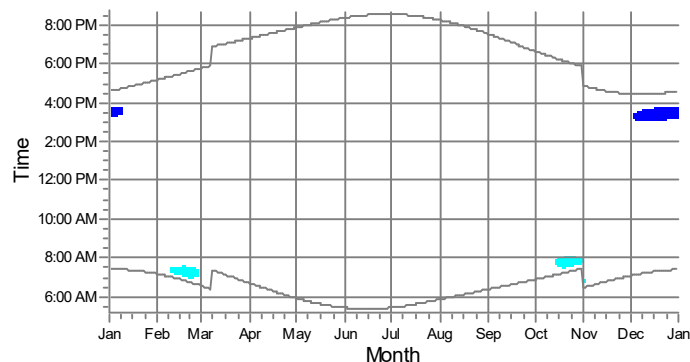
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

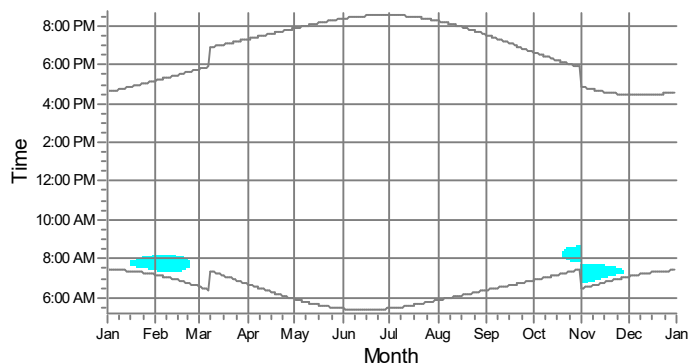
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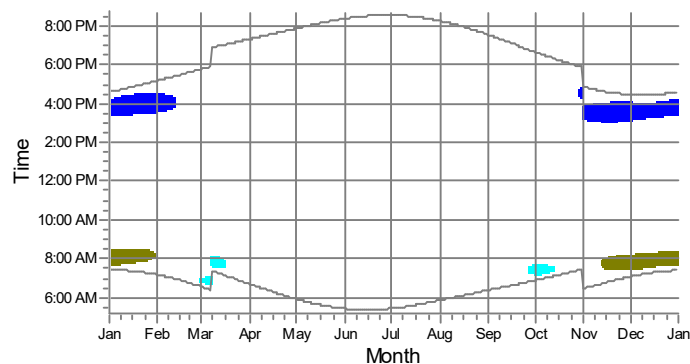
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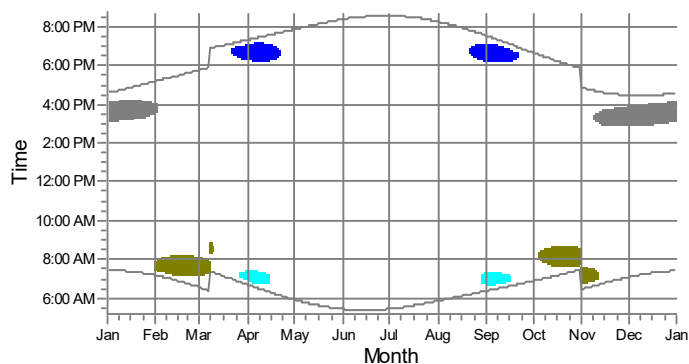
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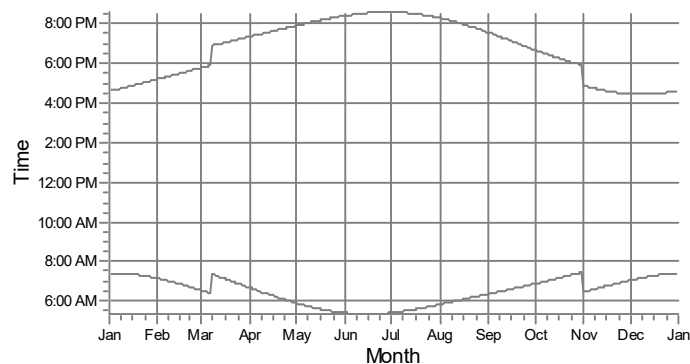
PH: REC-424



PI: REC-425



PJ: REC-426



WTGs

3: T03 4: T04 10: T10 13: T13

Project:

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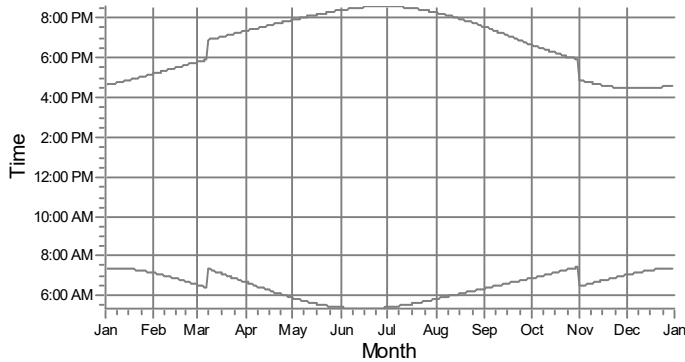
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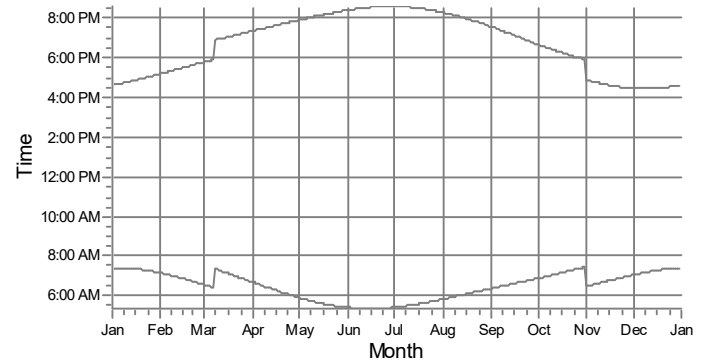
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

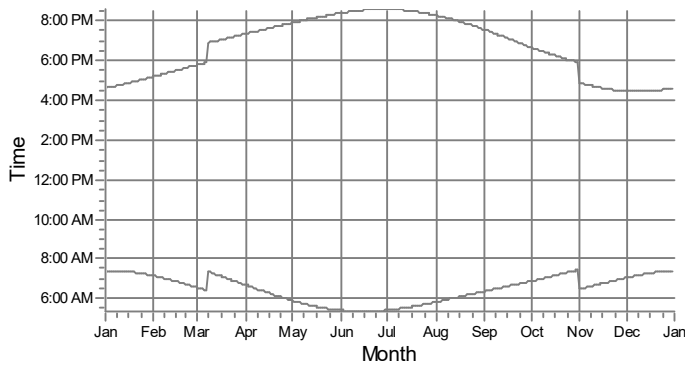
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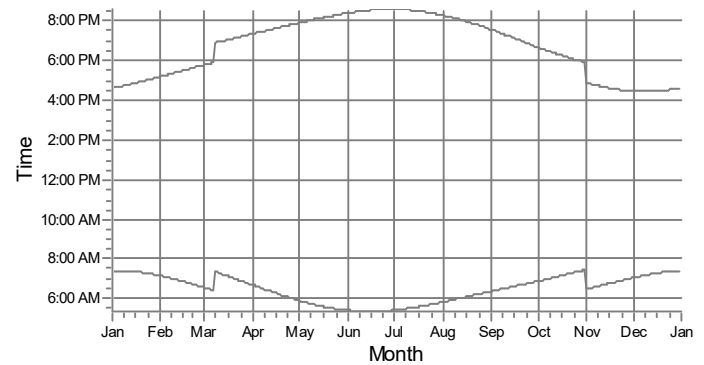
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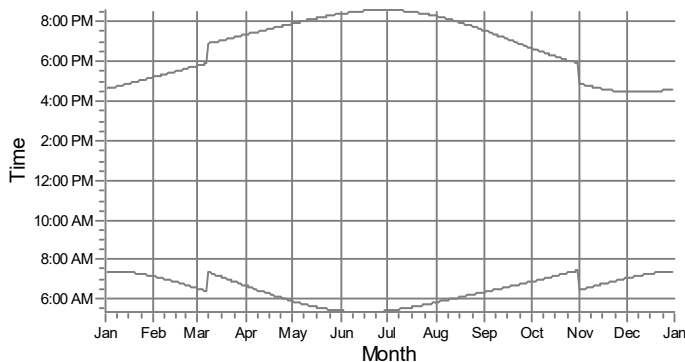
PM: REC-429



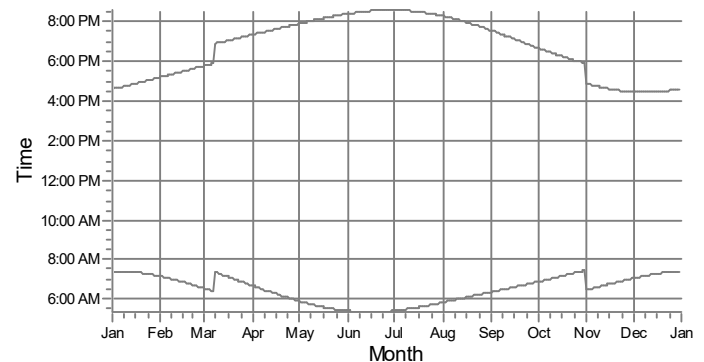
PN: REC-430



PO: REC-431



PP: REC-432



WTGs

Project:

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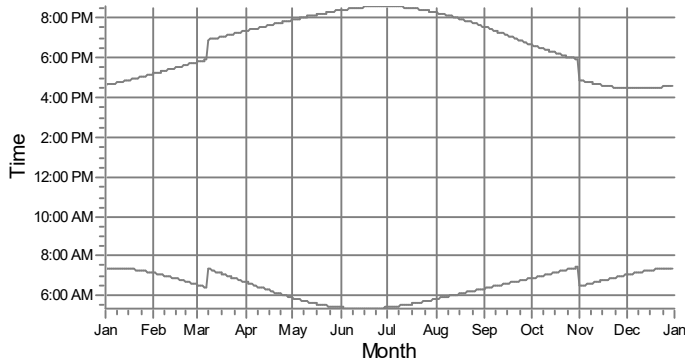
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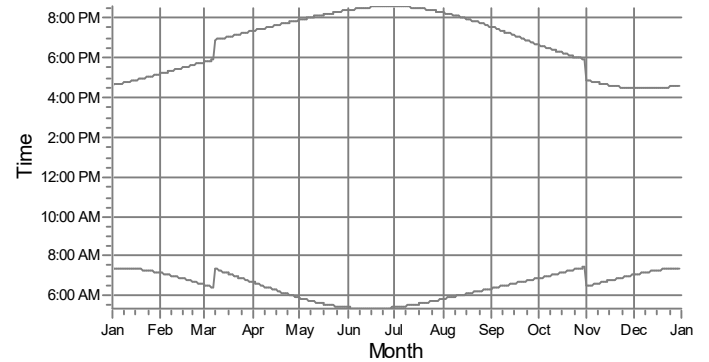
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

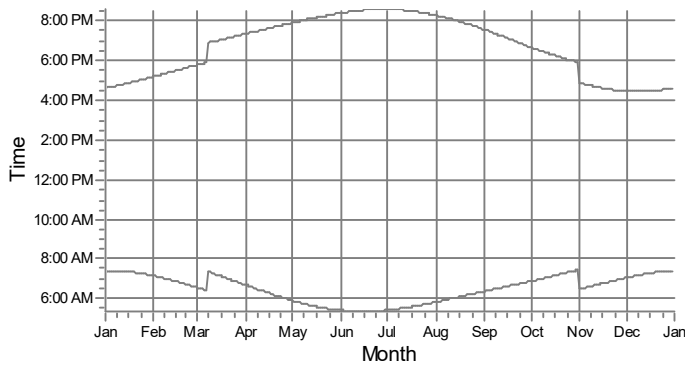
PQ: REC-433



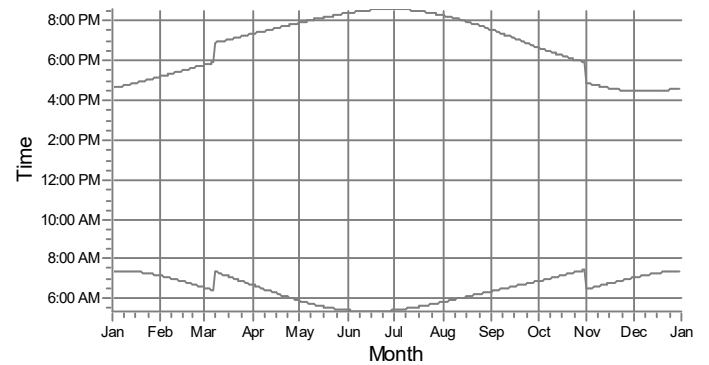
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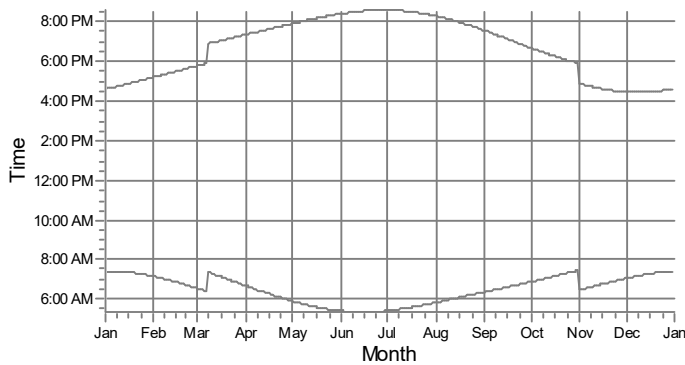
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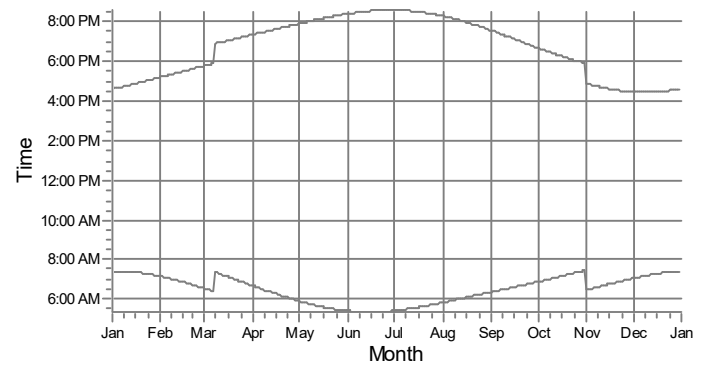
PT: REC-436



PU: REC-437



PV: REC-438



WTGs

Project:

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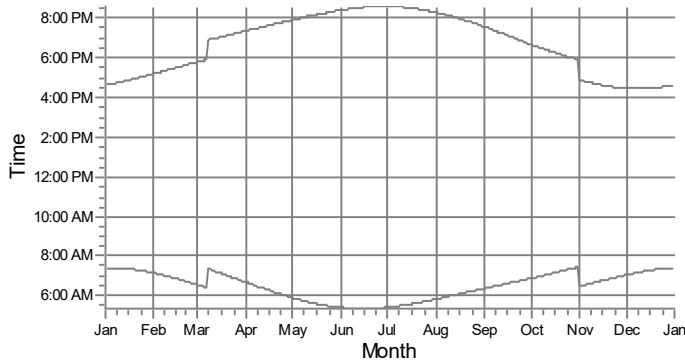
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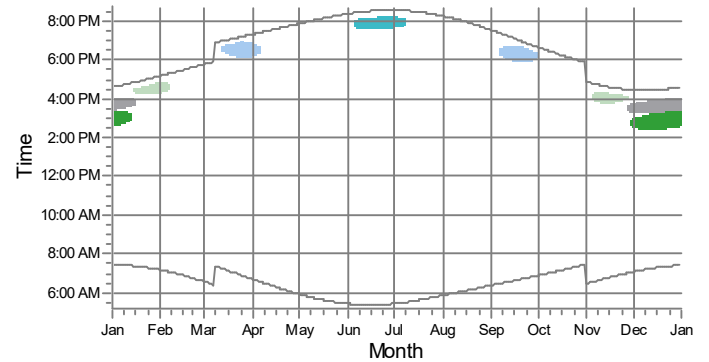
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

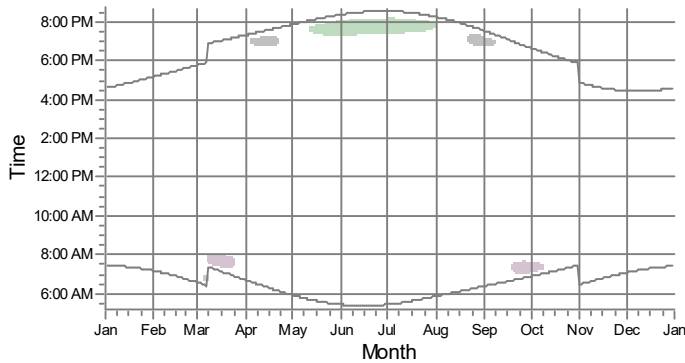
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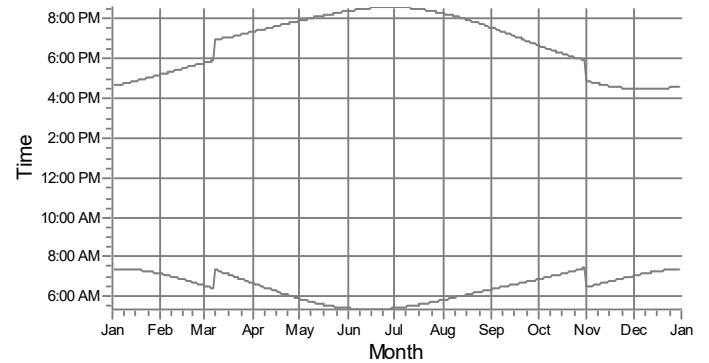
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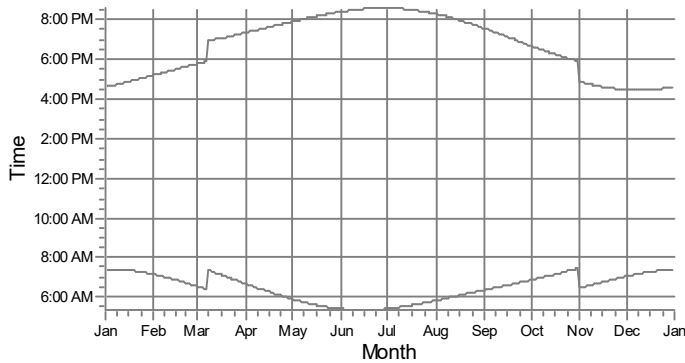
PY: REC-441



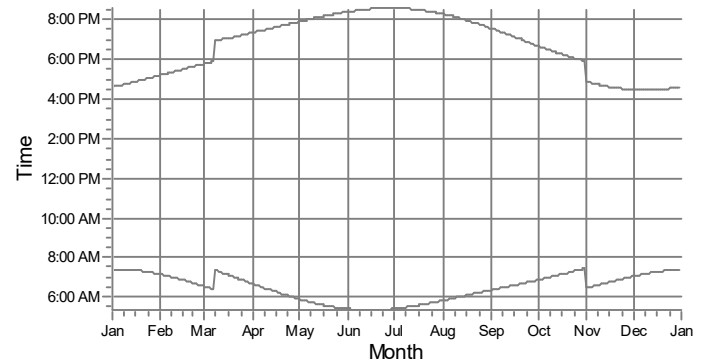
PZ: REC-442



QA: REC-443



QB: REC-444



WTGs

12: T12	15: T15	19: T19	25: T25
14: T14	16: T16	20: T20	

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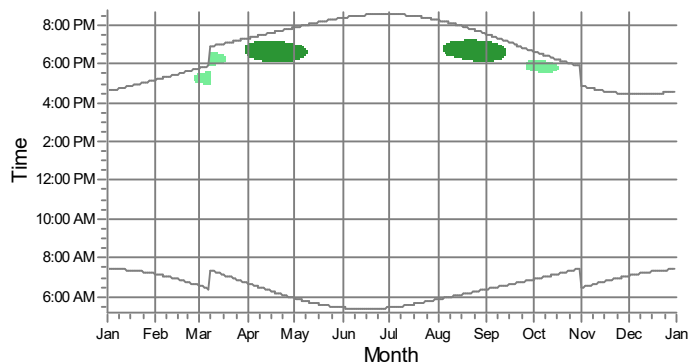
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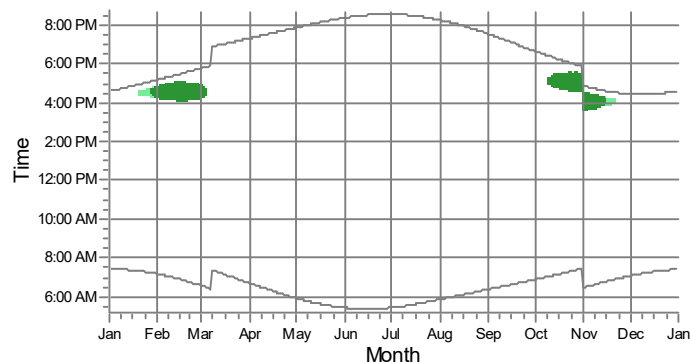
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

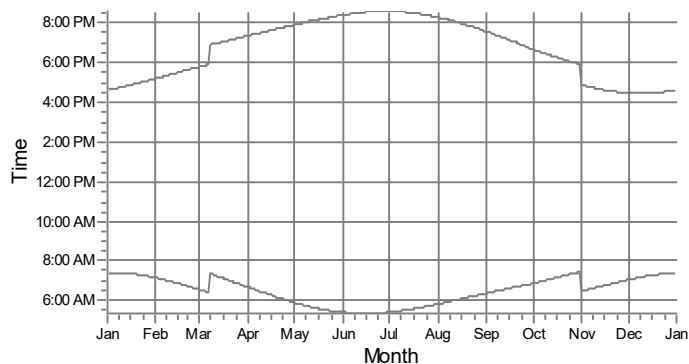
QC: REC-445



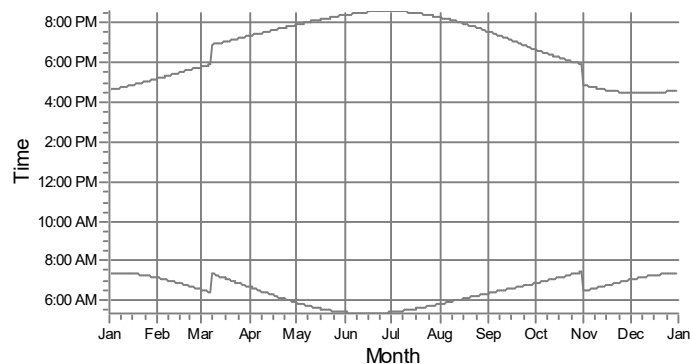
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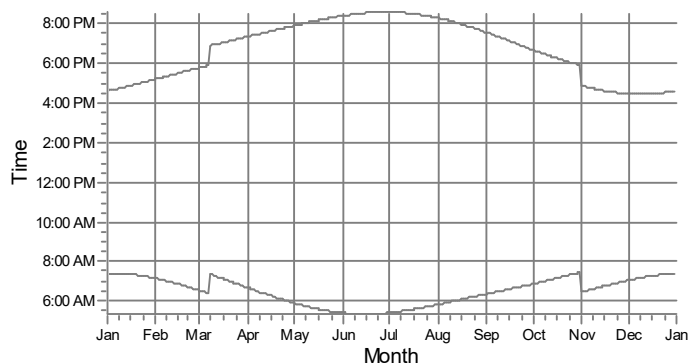
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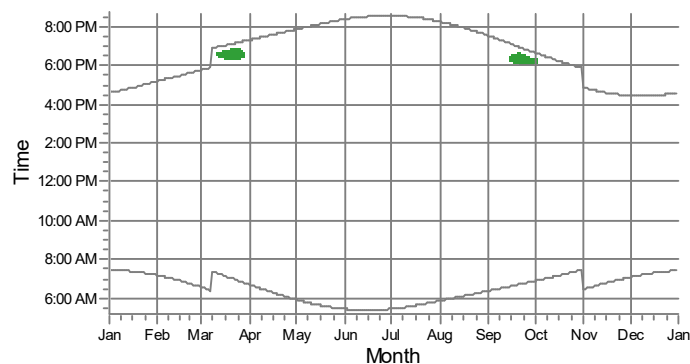
QF: REC-448



QG: REC-449



QH: REC-450



WTGs

20: T20 26: T26 27: T27

Project:

118183 - Shady Oaks II Wind Project

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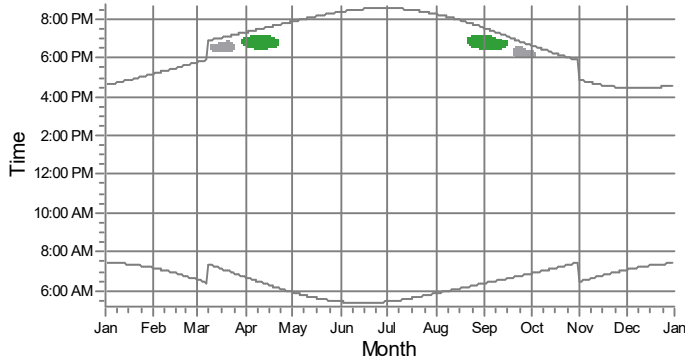
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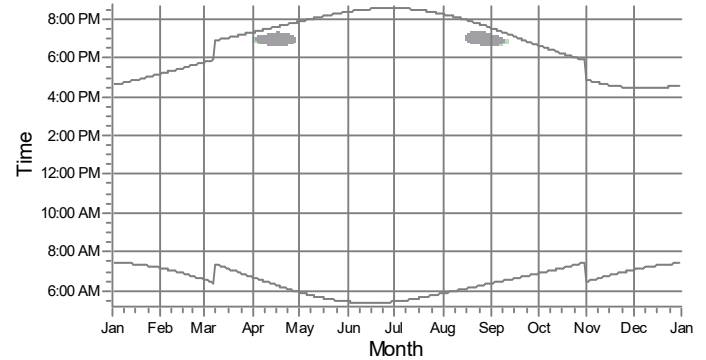
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

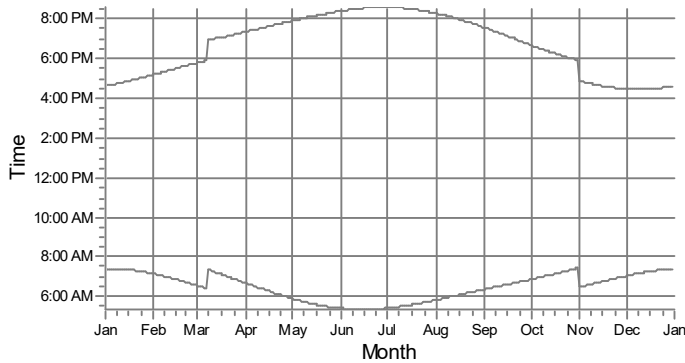
QI: REC-451



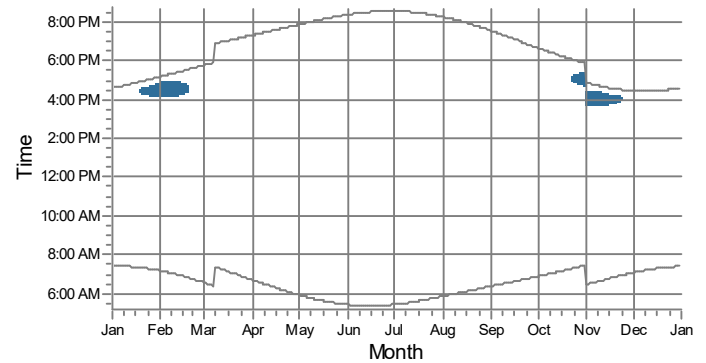
QJ: REC-452



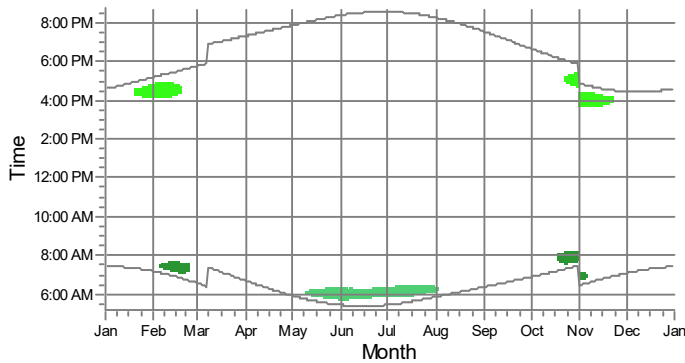
QK: REC-453



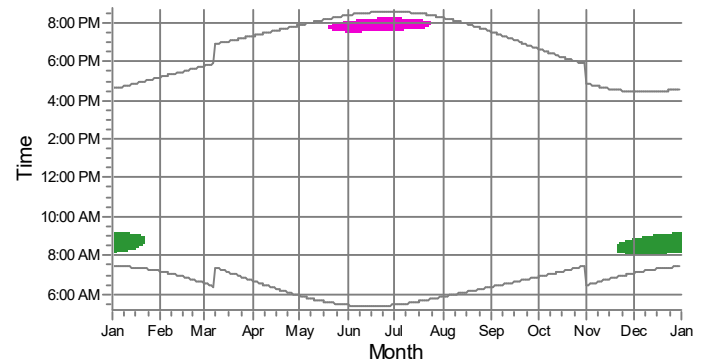
QL: REC-454



QM: REC-455



QN: REC-456



WTGs

14: T14	18: T18	22: T22	27: T27
16: T16	20: T20	24: T24	28: T28

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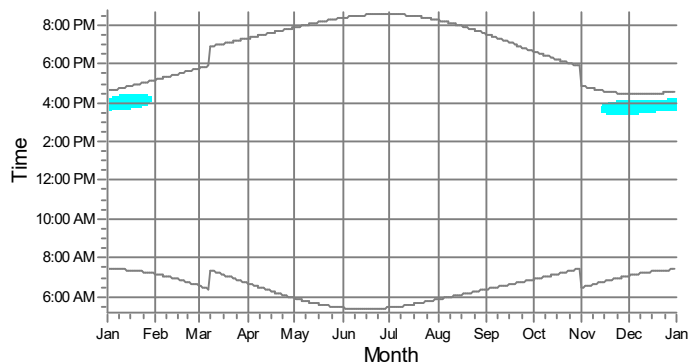
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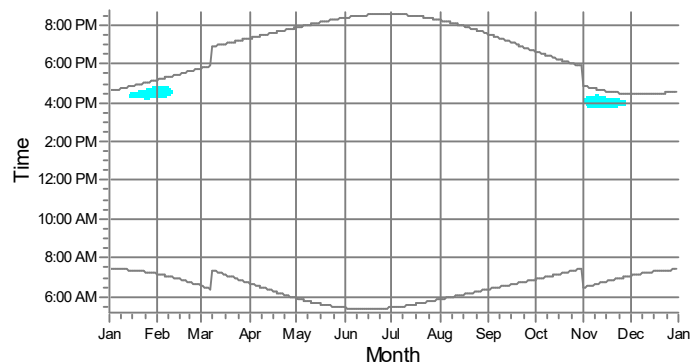
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

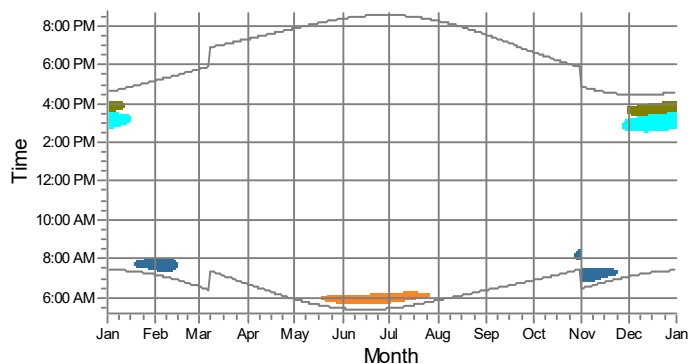
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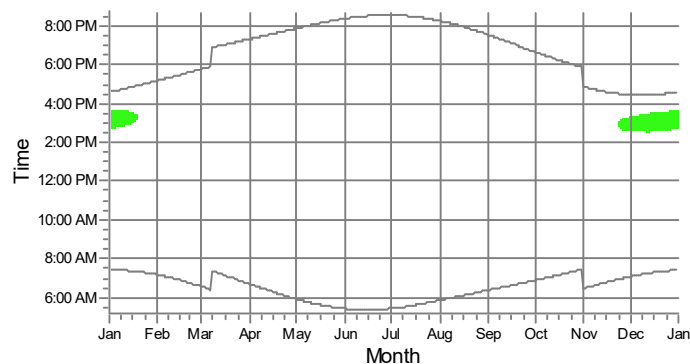
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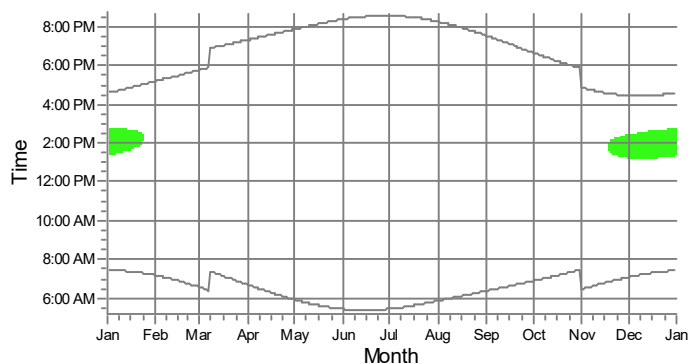
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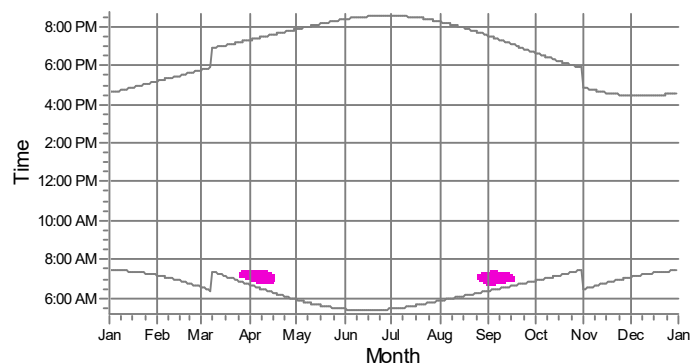
QR: REC-460



QS: REC-461



QT: REC-462



WTGs



Project:

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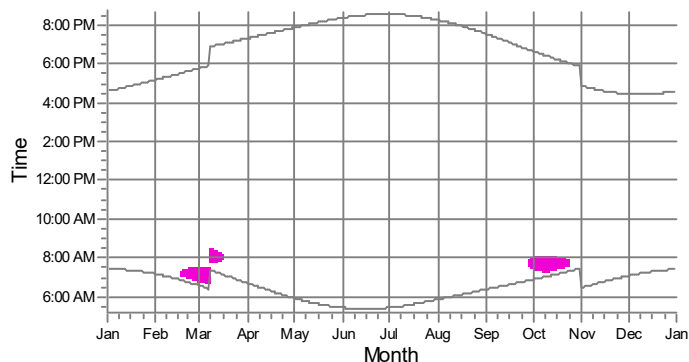
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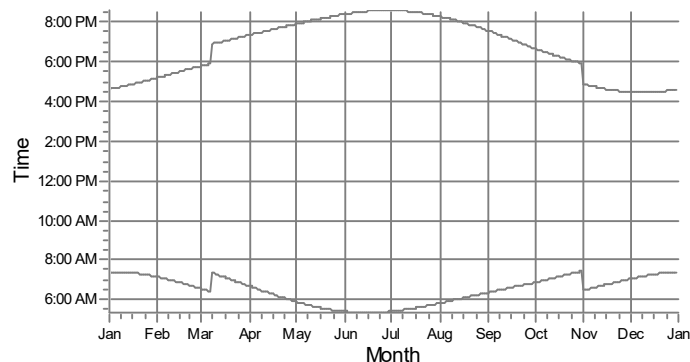
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

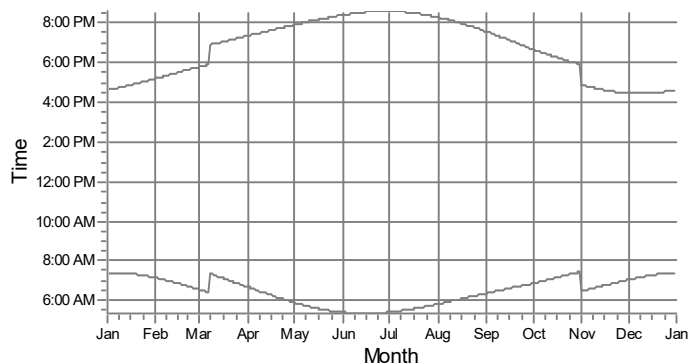
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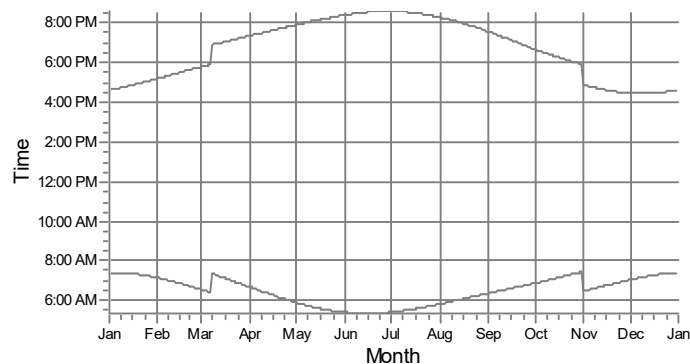
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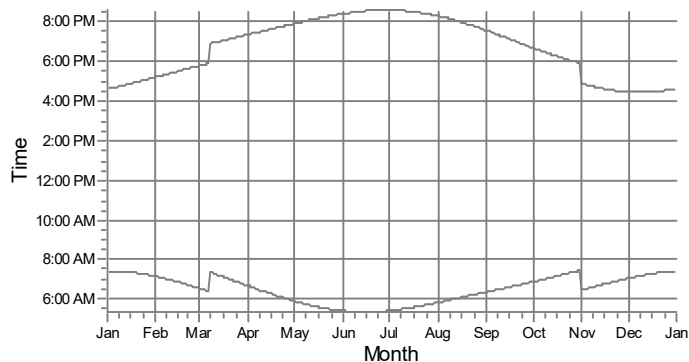
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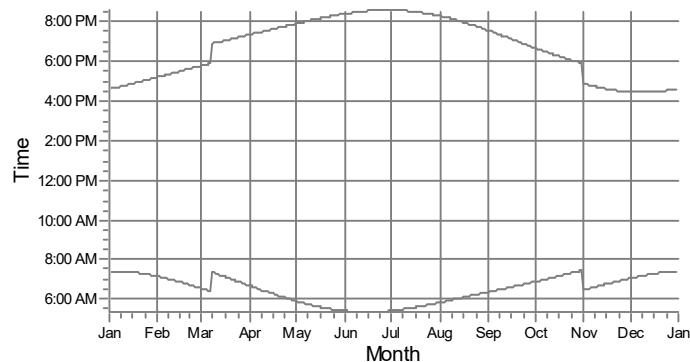
QX: REC-466



QY: REC-467



QZ: REC-468



WTGs



24: T24

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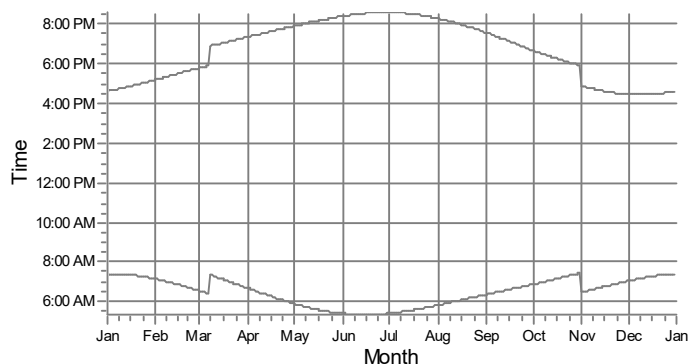
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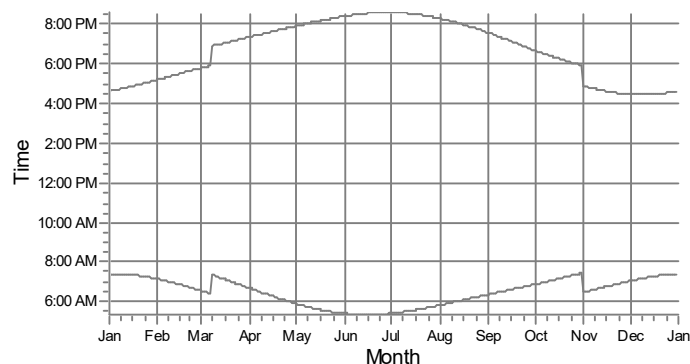
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

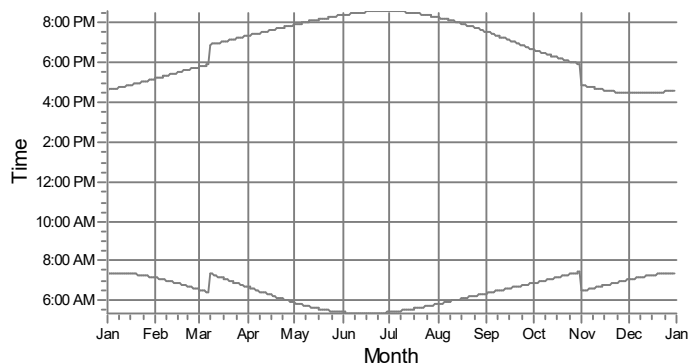
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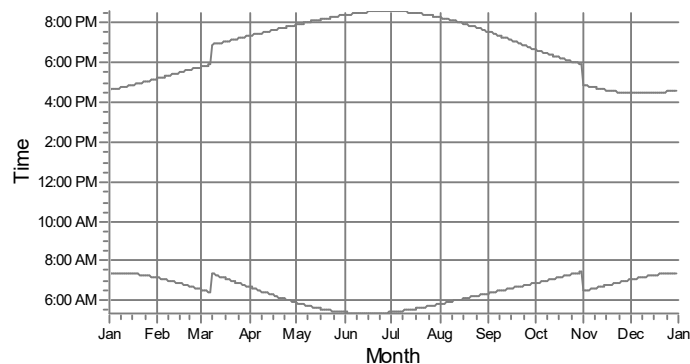
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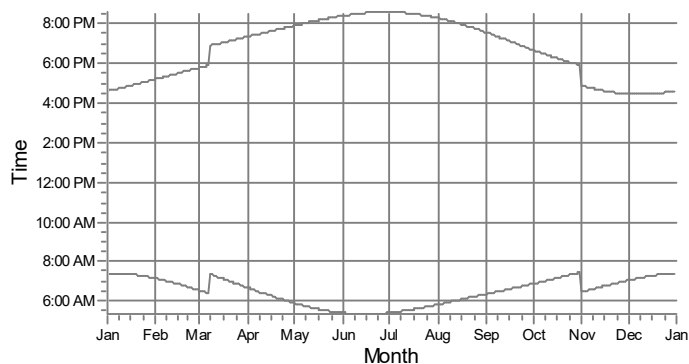
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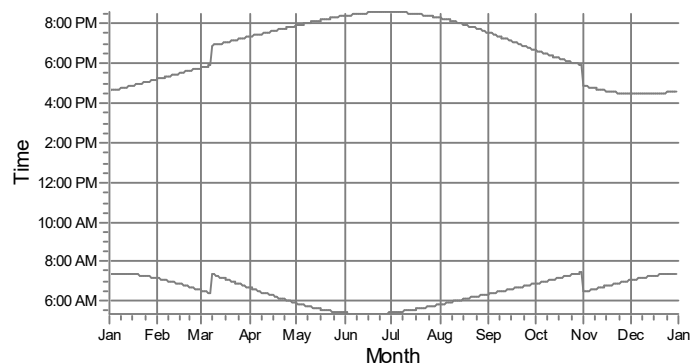
RD: REC-472



RE: REC-473



RF: REC-474



WTGs

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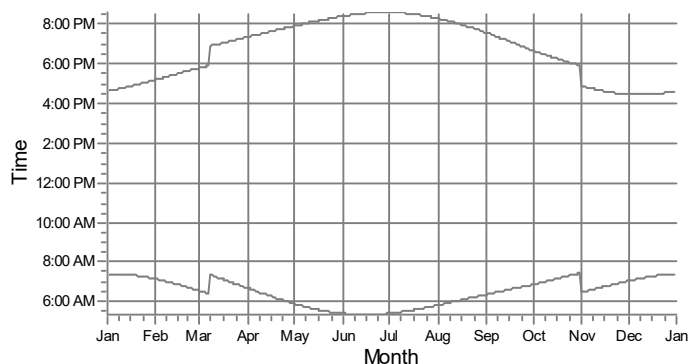
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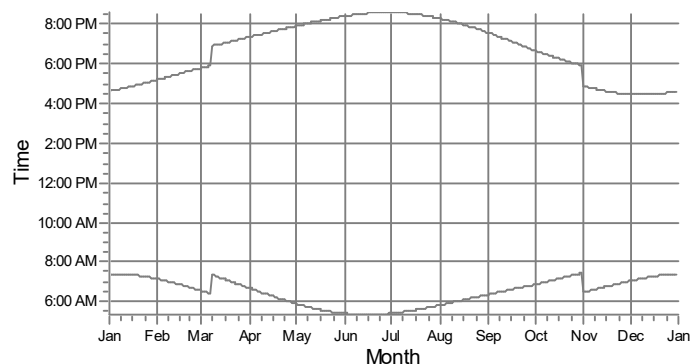
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

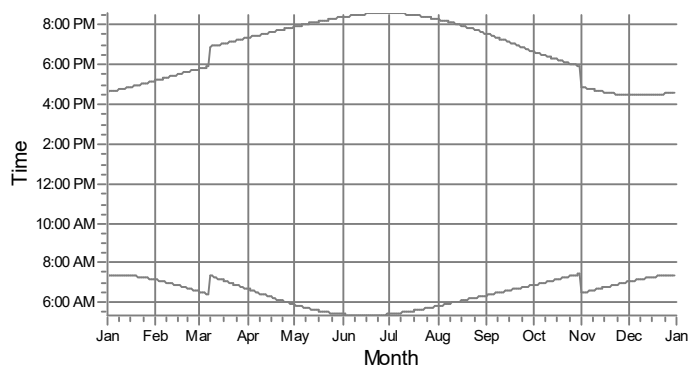
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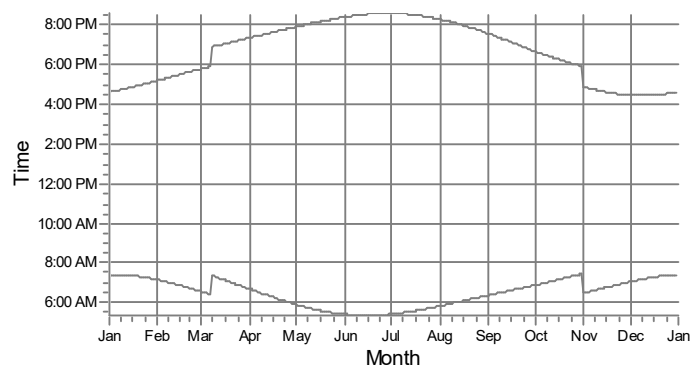
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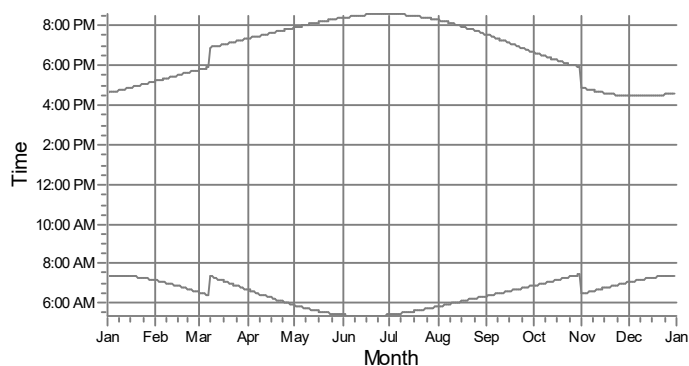
RI: REC-477



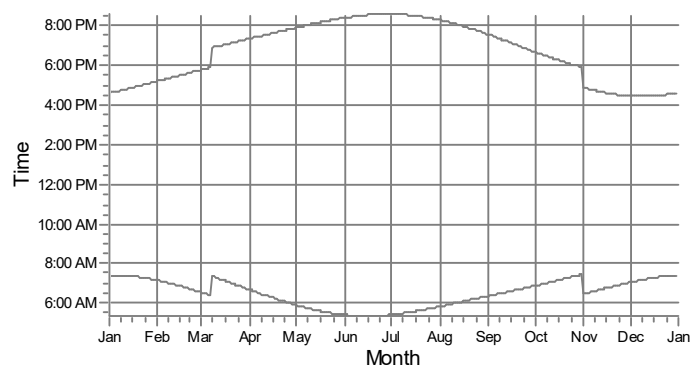
RJ: REC-478



RK: REC-479



RL: REC-480



WTGs

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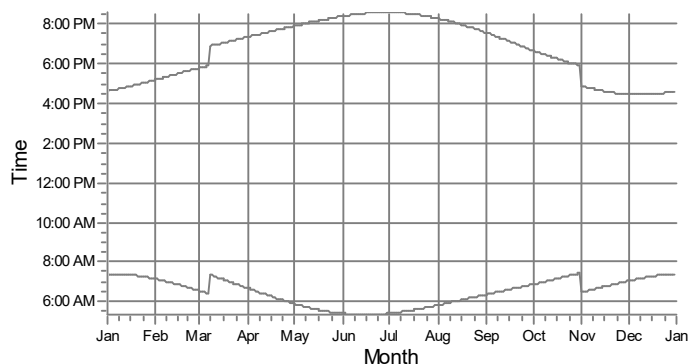
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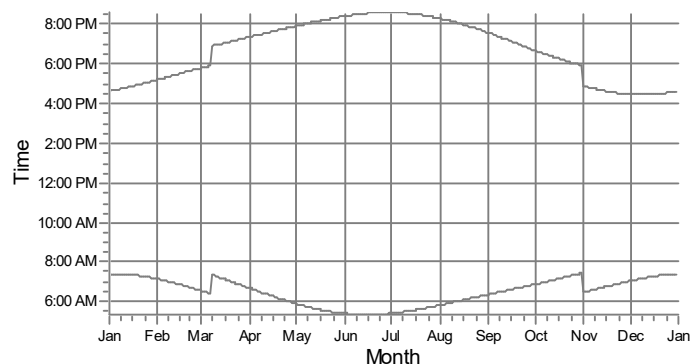
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

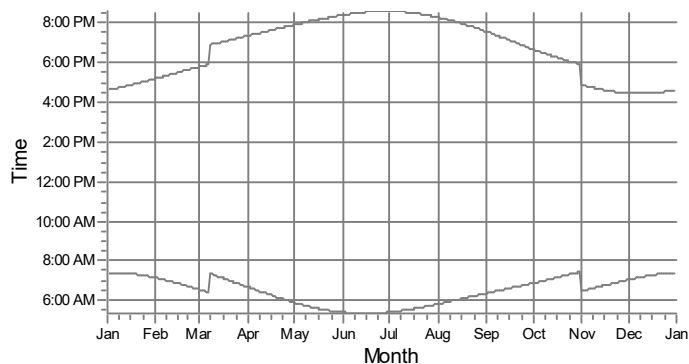
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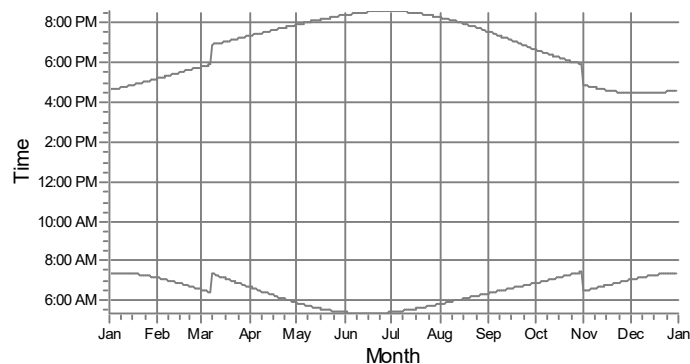
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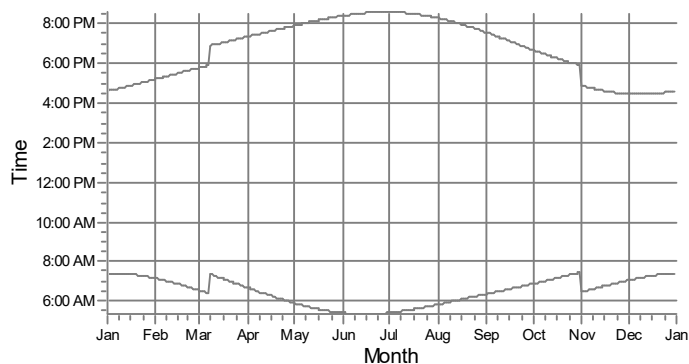
RO: REC-483



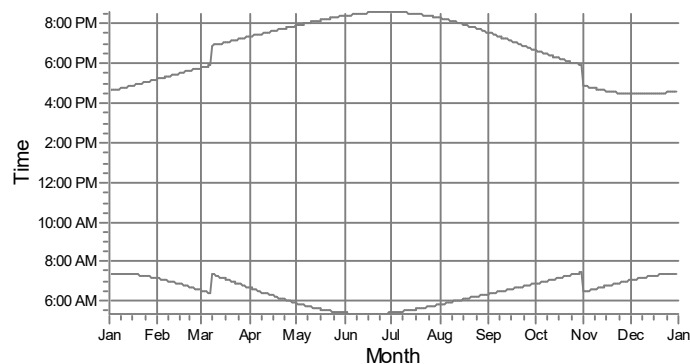
RP: REC-484



RQ: REC-485



RR: REC-486



WTGs

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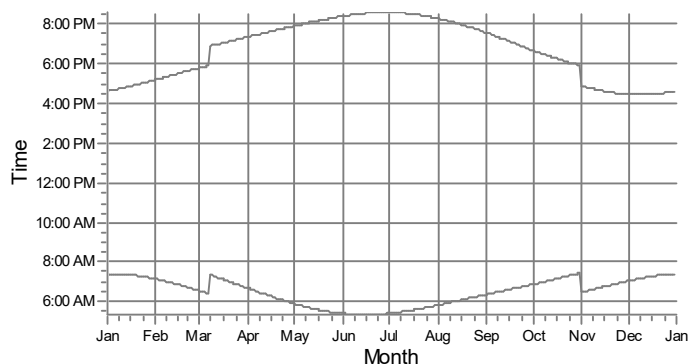
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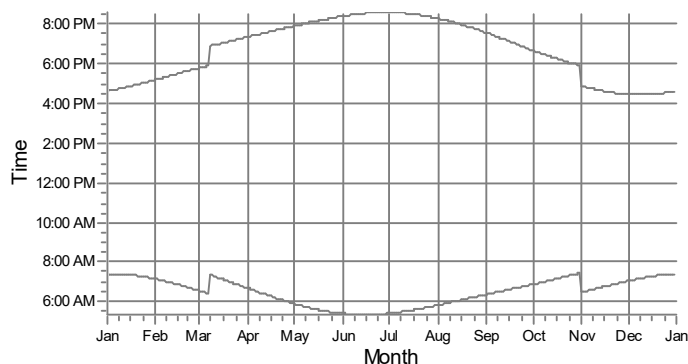
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

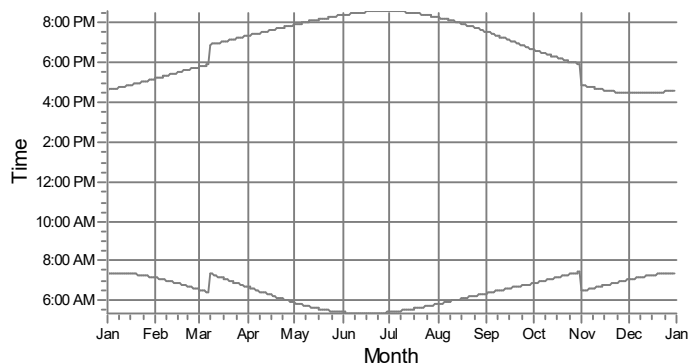
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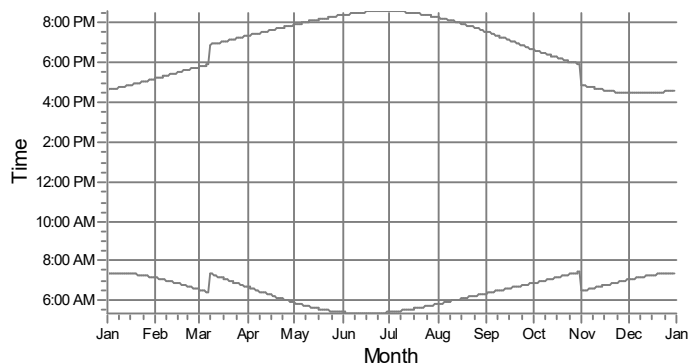
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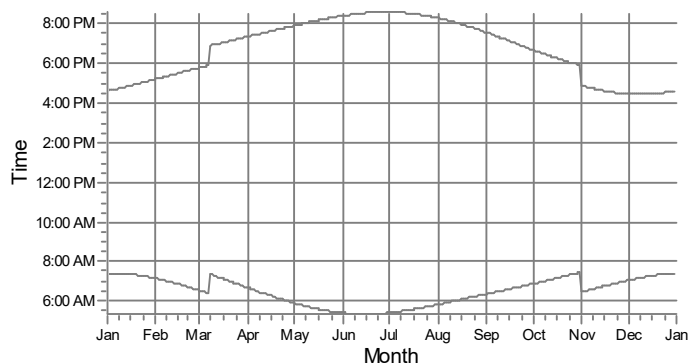
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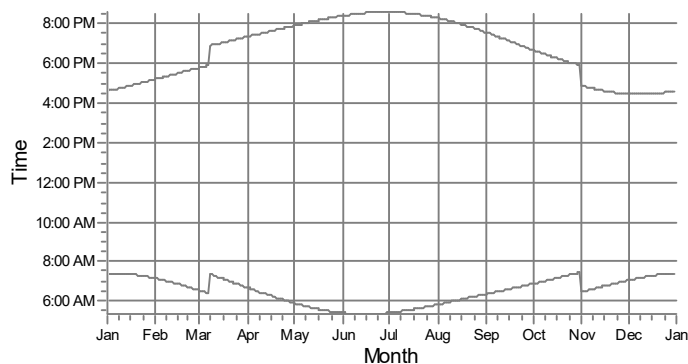
RV: REC-490



RW: REC-491



RX: REC-492



WTGs

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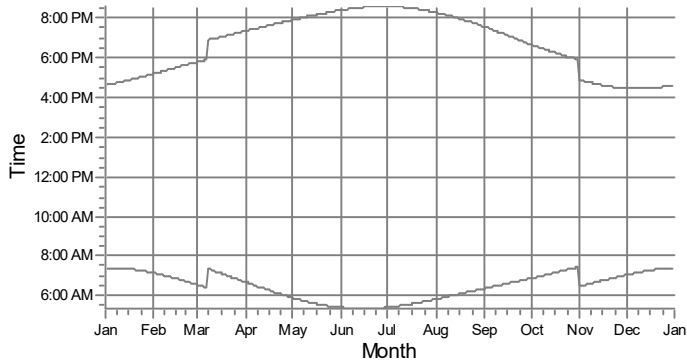
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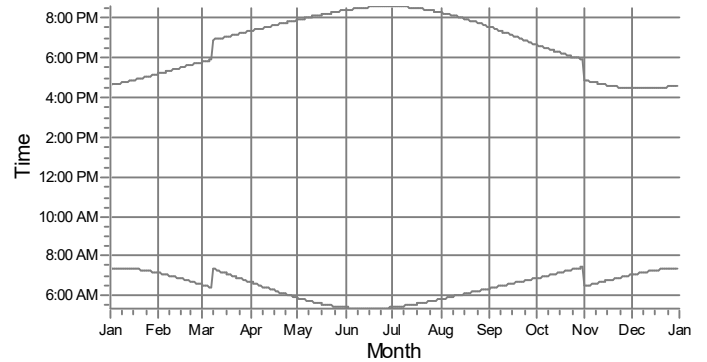
SHADOW - Calendar, graphical

Calculation: 118183 - Shady Oaks Wind 2, LLC - Shady Oaks II Wind Project - Rev 2

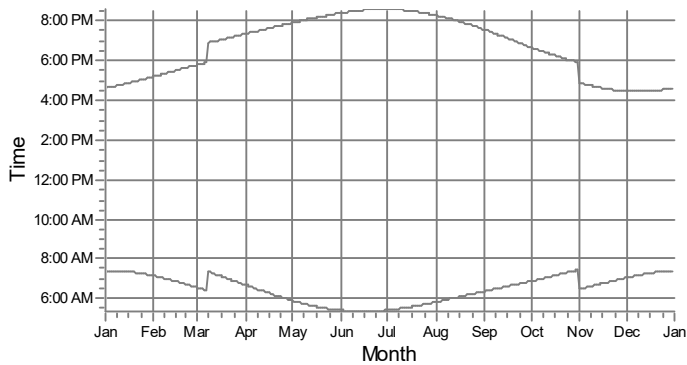
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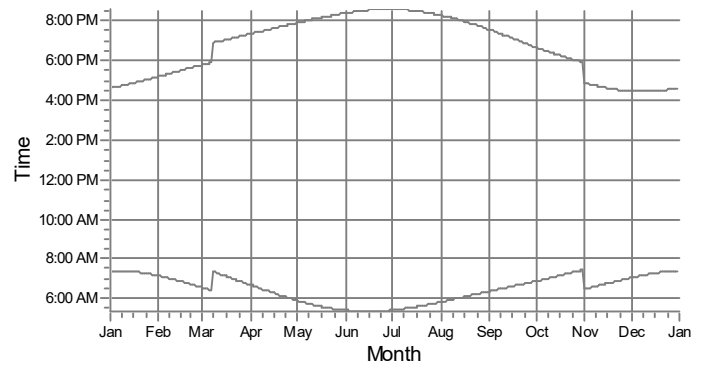
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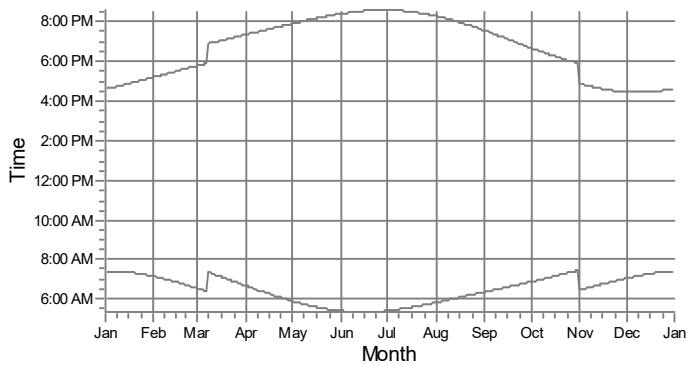
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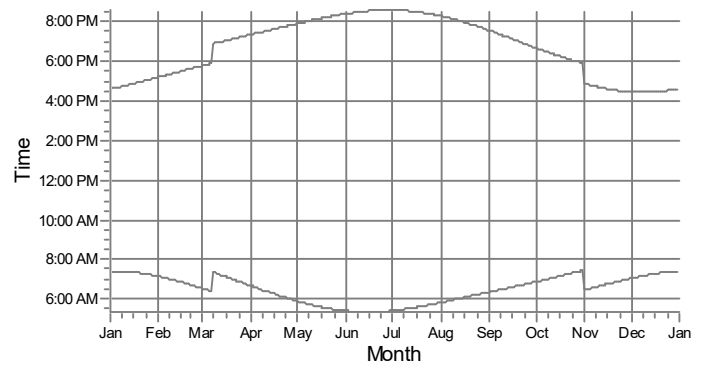
SB: REC-496



SC: REC-497



SD: REC-498



WTGs

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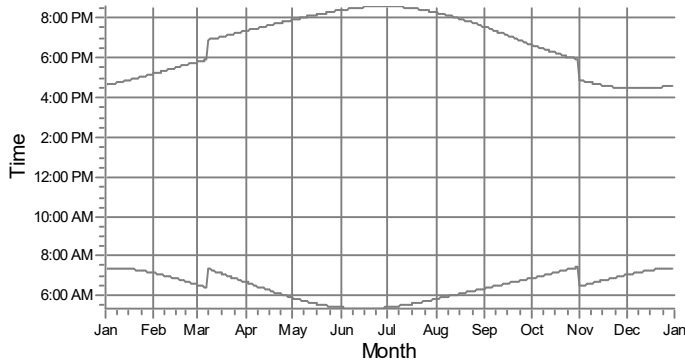
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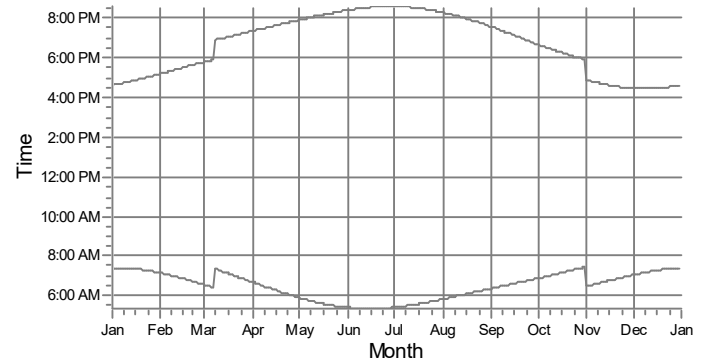
SHADOW - Calendar, graphical

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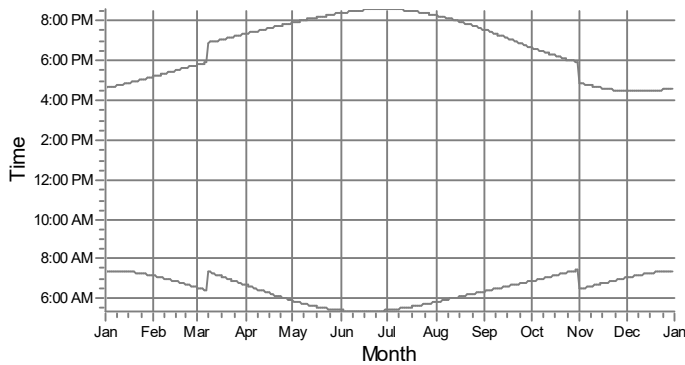
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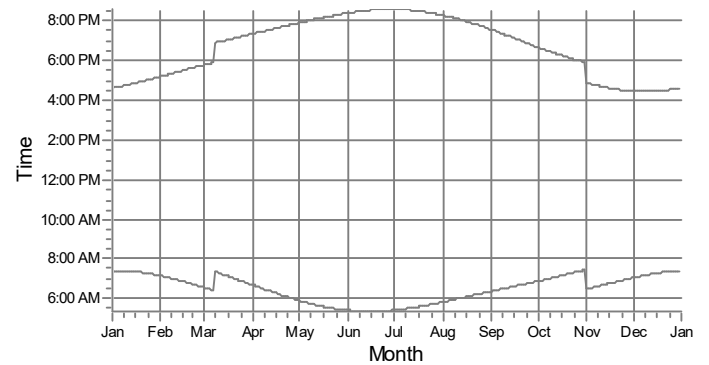
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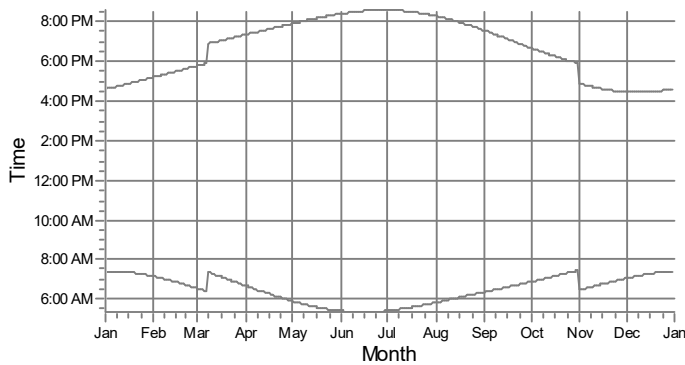
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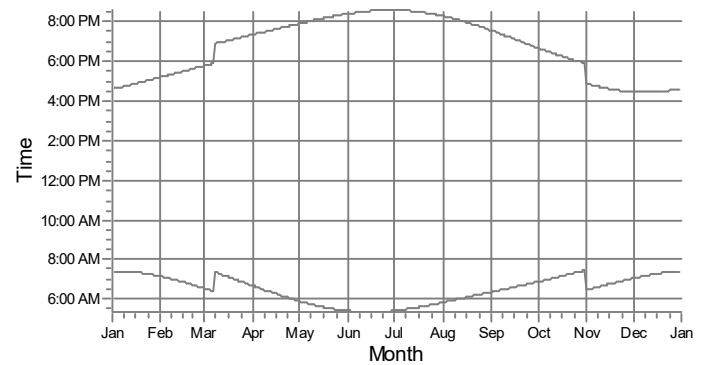
SH: REC-502



SI: REC-503



SJ: REC-504



WTGs

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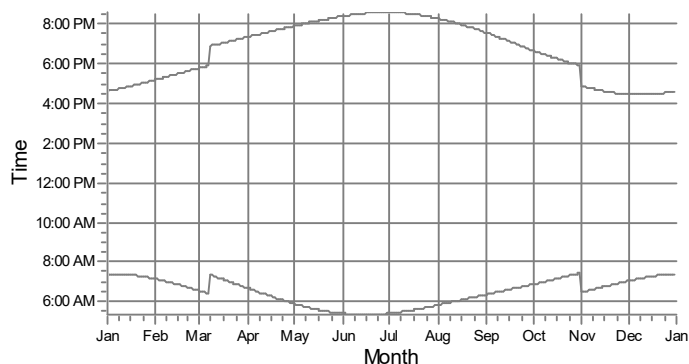
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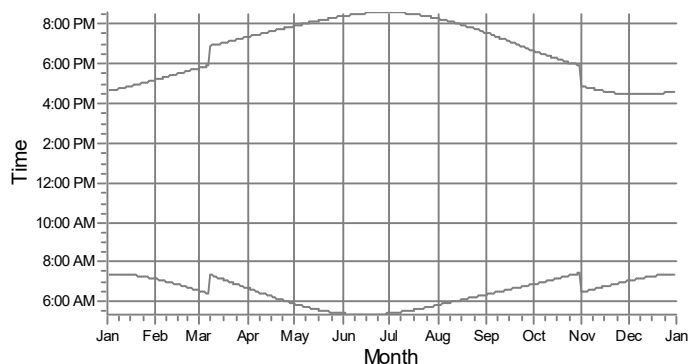
SHADOW - Calendar, graphical

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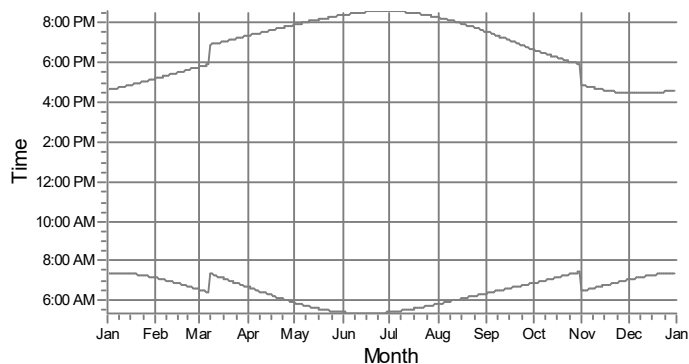
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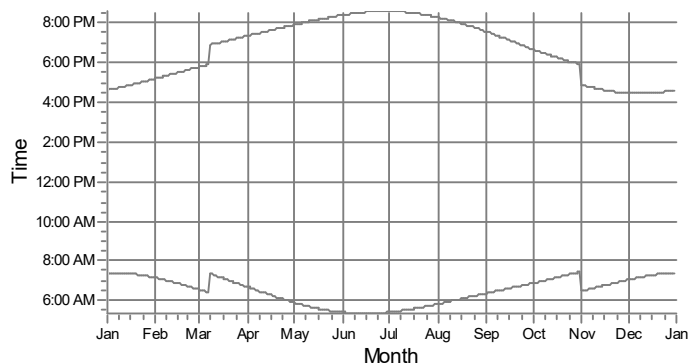
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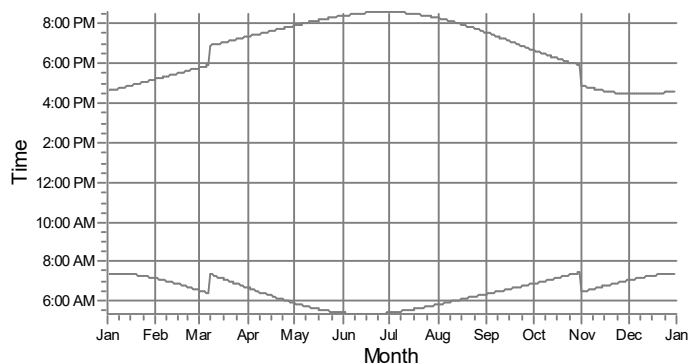
SM: REC-507



SN: REC-508



SO: REC-509



WTGs



CREATE AMAZING.

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