Case Study United Airlines Training Center United Airlines Training and Data Center, 1200 E Algonquin Rd Des Plaines, IL 60016

Report

Project Name	United Airlines Training and Data Center
Project Address	1200 E Algonquin Rd Des Plaines, IL 60016
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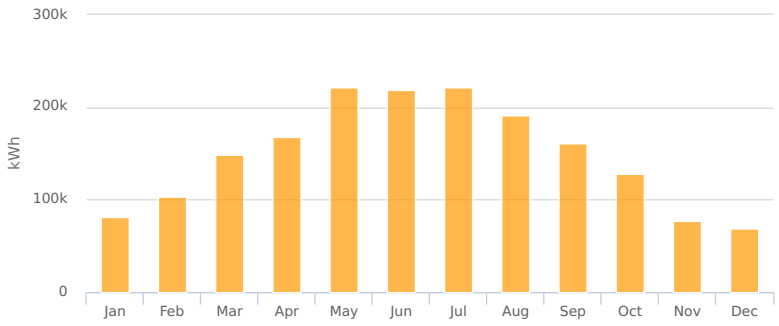
ELEVATE ENERGY
Smarter energy use for all

System Metrics

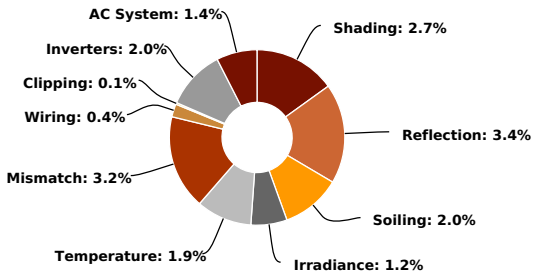
Design	Case Study United Airlines Training Center
Module DC Nameplate	1.41 MW
Inverter AC Nameplate	1.19 MW Load Ratio: 1.19
Annual Production	1.789 GWh
Performance Ratio	83.1%
kWh/kWp	1,267.2
Weather Dataset	TMY, CHICAGO OHARE INTL AP, NSRDB (tmy3, I)
Simulator Version	1413139342-a8a534a3c4-b277d3903c-854342d3fd

Project Location

Monthly Production



Sources of System Loss



Annual Production

	Description	Output	% Delta
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,406.6	
	POA Irradiance	1,524.3	8.4%
	Shaded Irradiance	1,482.5	-2.7%
	Irradiance after Reflection	1,432.7	-3.4%
	Irradiance after Soiling	1,404.1	-2.0%
	Total Collector Irradiance	**1,404.1**	**0.0%**
Energy (kWh)	Nameplate	1,981,859.7	
	Output at Irradiance Levels	1,957,777.5	-1.2%
	Output at Cell Temperature Derate	1,921,291.4	-1.9%
	Output After Mismatch	1,860,344.3	-3.2%
	Optimal DC Output	1,852,258.0	-0.4%
	Constrained DC Output	1,851,241.0	-0.1%
	Inverter Output	1,814,200.0	-2.0%
	Energy to Grid	**1,789,410.0**	**-1.4%**
Temperature Metrics			
	Avg. Operating Ambient Temp	13.1 °C	
	Avg. Operating Cell Temp	19.8 °C	
Simulation Metrics			
	Operating Hours	4696	
	Solved Hours	4696	

Condition Set

Description	Condition Set 1
Weather Dataset	TMY, CHICAGO OHARE INTL AP, NSRDB (tmy3, I)
Solar Angle Location	Meteo Lat/Lng
Transposition Model	Perez Model
Temperature Model	Sandia Model

Temperature Model Parameters

Rack Type	a	b	Temperature Delta
Fixed Tilt	-3.56	-0.075	3°C
Flush Mount	-2.81	-0.0455	0°C

Soiling (%)

J	F	M	A	M	J	J	A	S	O	N	D
2	2	2	2	2	2	2	2	2	2	2	2

Irradiation Variance	5%
Cell Temperature Spread	4° C
Module Binning Range	-2.5% to 2.5%
AC System Derate	2.00%

Module Characterizations

Module	Characterization
CS6U - 325P (Canadian Solar Inc.)	CS6U-325P-AG_MIX_CSI_EXT_V6_52_1500V_2016Q4.PAN, PAN

Component Characterizations

Device	Characterization
PVI 60TL (Solectria)	Spec Sheet
PVI 50TL (Solectria)	Spec Sheet

Components

Component	Name	Count
Inverters	PVI 60TL (Solectria)	19 (1.14 MW)
Inverters	PVI 50TL (Solectria)	1 (50.0 kW)
AC Panels	1 input AC Panel	1
AC Panels	5 input AC Panel	1
AC Panels	7 input AC Panel	2
AC Home Runs	10 AWG (Copper)	14 (3,593.8 ft)
AC Home Runs	500 MCM (Copper)	4 (237.1 ft)
AC Home Runs	8 AWG (Copper)	1 (68.7 ft)
AC Home Runs	1 AWG (Copper)	5 (2,154.6 ft)
Home Runs	2 AWG (Copper)	9 (870.5 ft)
Home Runs	500 MCM (Copper)	5 (1,541.5 ft)
Home Runs	2/0 AWG (Copper)	28 (11,263.1 ft)
Home Runs	3 AWG (Copper)	28 (103.8 ft)
Combiners	1 input Combiner	35
Combiners	4 input Combiner	14
Combiners	5 input Combiner	2
Combiners	9 input Combiner	14
Combiners	12 input Combiner	5
Strings	10 AWG (Copper)	252 (42,727.0 ft)
Modules	Canadian Solar Inc., CS6U - 325P (325W)	4,345 (1.41 MW)

Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
North Building	12	17-18	Along Racking
SE Building	12	17-18	Along Racking
SC Building	12	17-18	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Horizontal (Landscape)	10°	178.045°	1.3 ft	1x1	1,022	1,021	331.8 kW
Field Segment 2	Fixed Tilt	Horizontal (Landscape)	10°	178.431°	1.3 ft	1x1	175	175	56.9 kW
Field Segment 3	Fixed Tilt	Horizontal (Landscape)	17°	178.5°	1.3 ft	1x1	1,701	1,701	552.8 kW
Field Segment 4	Fixed Tilt	Horizontal (Landscape)	8°	178.5°	1.6 ft	1x1	1,449	1,449	470.9 kW

Detailed Layout

Case Study United Airlines Training Center

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Shading Heatmap

Shading by Field Segment

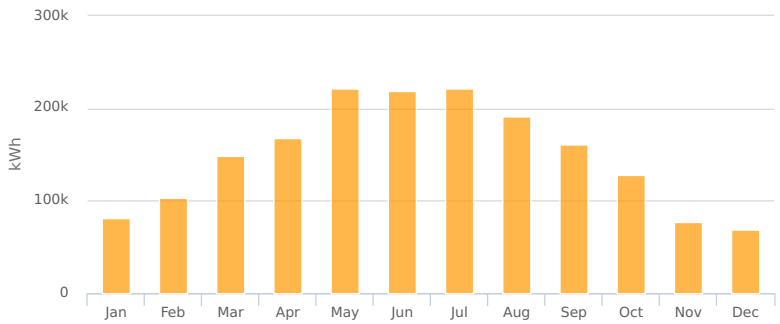
Description	Tilt	Azimuth	Modules	Nameplate	Shaded Irradiance	AC Energy	TOF[2]	Solar Access	TSRF [2]
Field Segment 1	10.0°	178.0°	1,021	331.8 kWp	1,487.1kWh/m^2	421.6 MWh[1]	93.3%	98.5%	91.9%
Field Segment 2	10.0°	178.4°	175	56.9 kWp	1,488.9kWh/m^2	72.3 MWh[1]	93.3%	98.6%	92.0%
Field Segment 3	17.0°	178.5°	1,701	552.8 kWp	1,478.8kWh/m^2	699.7 MWh[1]	96.6%	94.6%	91.4%
Field Segment 4	8.0°	178.5°	1,449	470.9 kWp	1,482.7kWh/m^2	595.8 MWh[1]	92.2%	99.4%	91.6%
Totals, weighted by kWp			**4,346**	**1.41 MWp**	**1,482.5kWh/m^2**	**1.79 GWh**	**94.2%**	**97.3%**	**91.6%**

[1] approximate, varies based on inverter performance
[2] based on location Optimal POA Irradiance of 1,617.9kWh/m^2 at 34.3° tilt and 178.4° azimuth

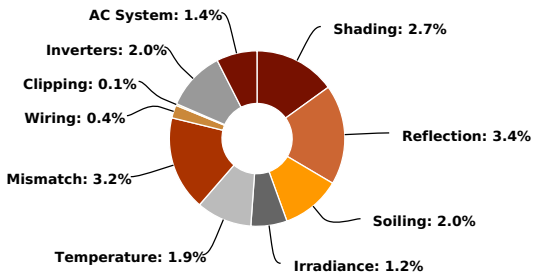
Solar Access by Month

Description	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
Field Segment 1	96%	98%	99%	99%	99%	99%	99%	99%	99%	99%	97%	94%
Field Segment 2	96%	98%	99%	99%	99%	99%	99%	99%	99%	99%	98%	94%
Field Segment 3	81%	90%	97%	97%	98%	98%	97%	97%	98%	94%	85%	78%
Field Segment 4	99%	99%	99%	99%	100%	100%	99%	99%	100%	99%	99%	98%
Solar Access, weighted by kWp	**90.6%**	**95.3%**	**98.4%**	**98.5%**	**98.6%**	**98.6%**	**98.5%**	**98.5%**	**98.6%**	**97.0%**	**92.8%**	**88.6%**
AC Power (kWh)	**81,784.6**	**103,393.7**	**148,104.3**	**167,642.9**	**221,692.0**	**219,337.1**	**221,047.4**	**191,514.7**	**160,462.9**	**127,378.6**	**77,617.8**	**69,434.4**

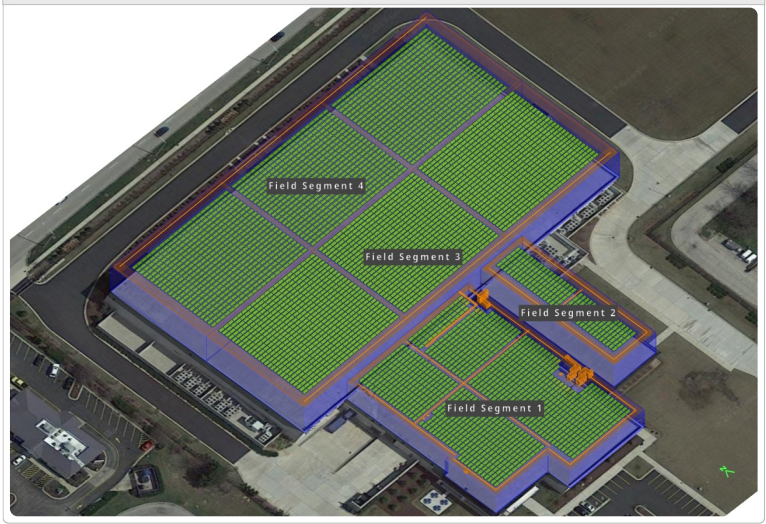
Monthly Production



Sources of System Loss



Southwestern Angle



Southeastern Angle