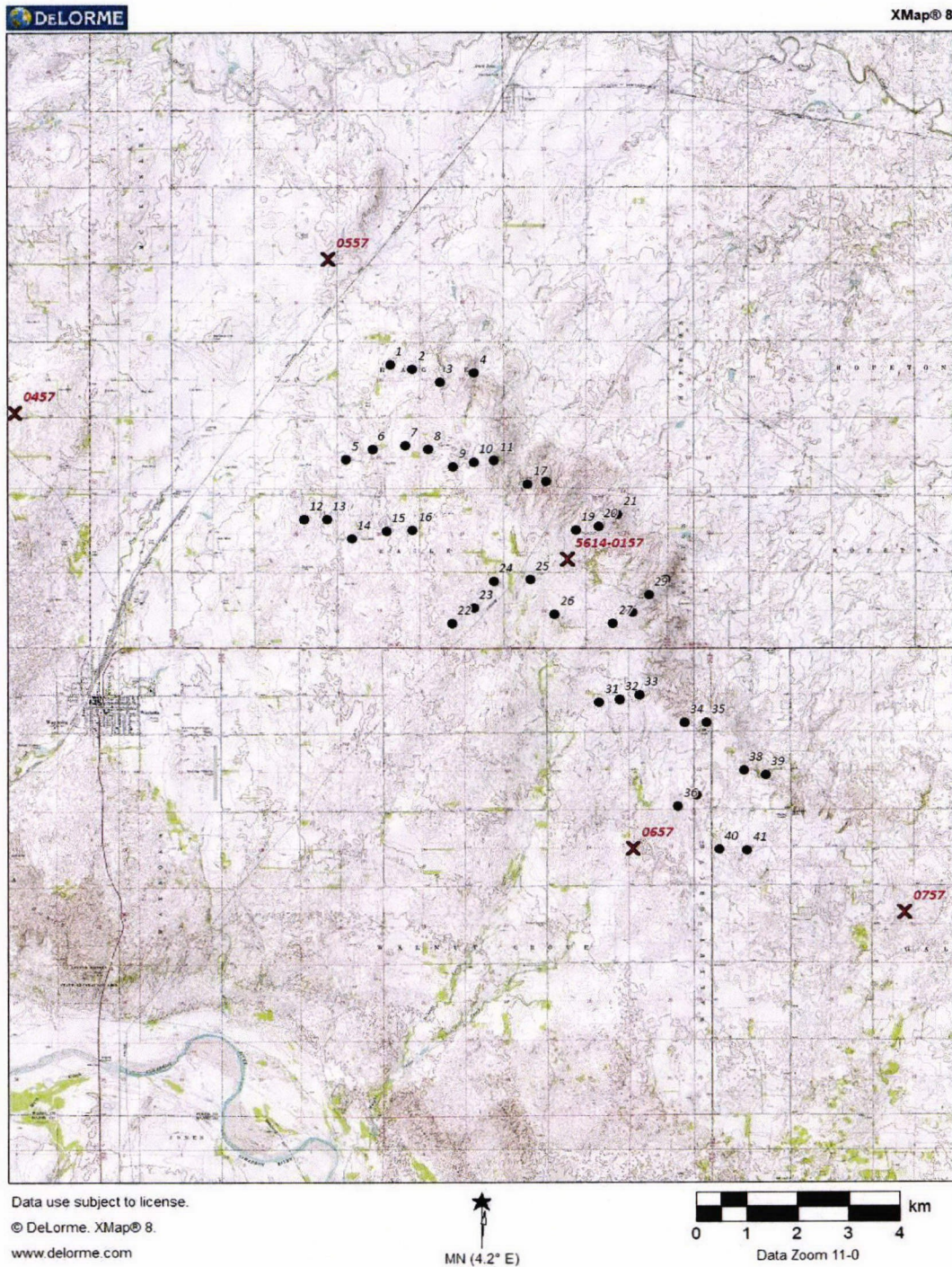
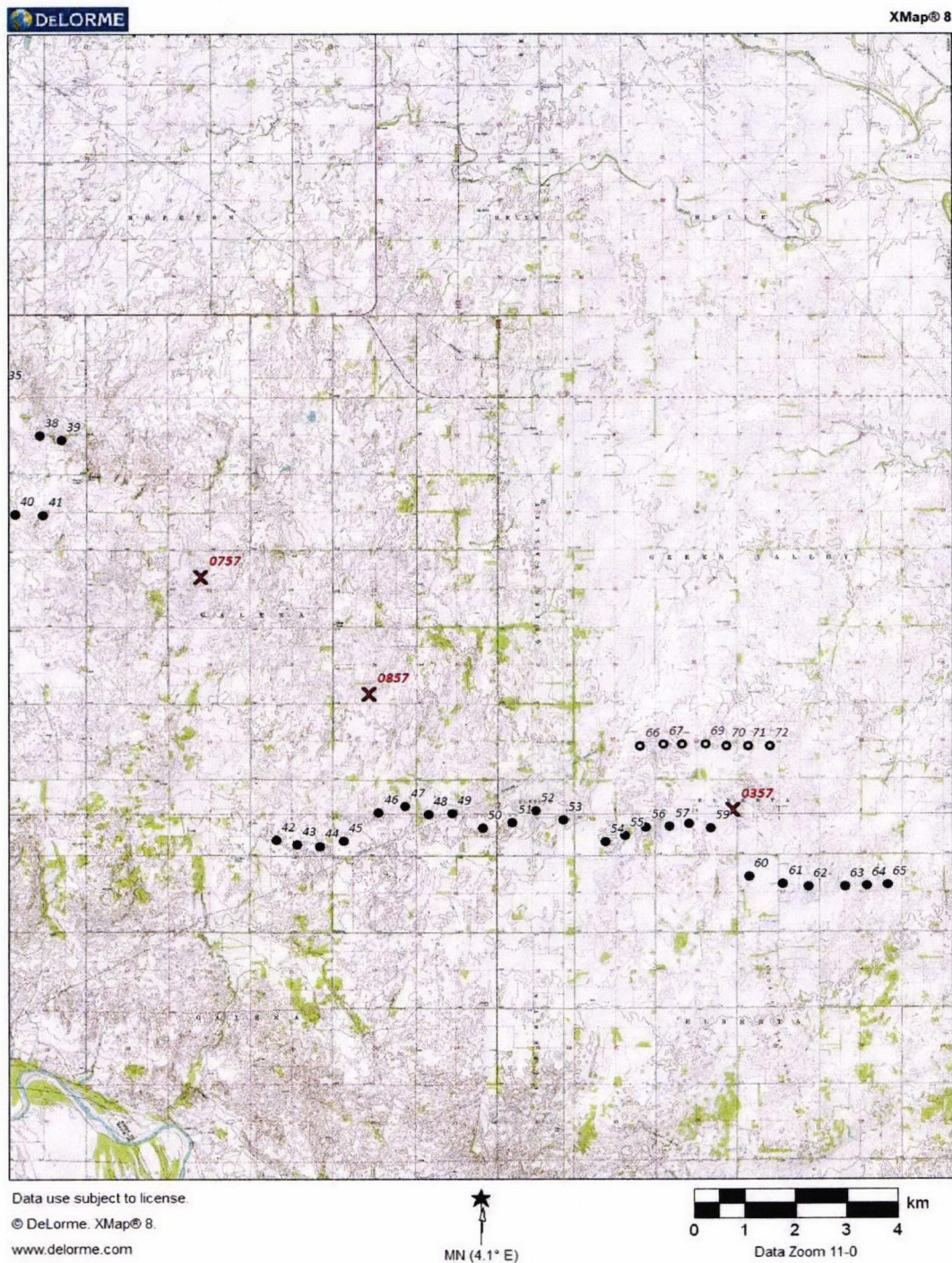


Sundance Met Towers and Turbine Array, Northwest Half



Sundance Met Towers and Turbine Array, Southeast Half



Coords. Prospective Array Plan for GE Turbines
Sundance Project, Oklahoma
American Electric Power
Furnished by Invenergy, LLC
WGS84 Datum, Not Field Checked by Simon Wind

Turbine	Latitude	Longitude	Elevation (m ASL)	Turbine Model	Turbine	Latitude	Longitude	Elevation (m ASL)	Turbine Model
1	36.648037	-98.816297	493	2.82-127	37	36.566987	-98.749718	504	2.82-127
2	36.647263	-98.811520	496	2.82-127	38	36.571572	-98.739291	506	2.82-127
3	36.644781	-98.805412	506	2.82-127	39	36.570744	-98.734618	509	2.82-127
4	36.646546	-98.798268	499	2.82-127	40	36.556698	-98.744694	503	2.82-127
5	36.630278	-98.825988	486	2.82-127	41	36.556519	-98.738672	509	2.82-127
6	36.632125	-98.820075	503	2.82-127	42	36.495025	-98.687865	457	2.82-127
7	36.632912	-98.813048	510	2.82-127	43	36.494094	-98.683462	459	2.82-127
8	36.632195	-98.808030	518	2.82-127	44	36.493844	-98.678461	459	2.82-127
9	36.628971	-98.802716	520	2.82-127	45	36.494757	-98.673251	458	2.82-127
10	36.629705	-98.798228	519	2.82-127	46	36.500199	-98.665814	466	2.82-127
11	36.630085	-98.793859	523	2.82-127	47	36.501417	-98.660021	462	2.82-127
12	36.619027	-98.835066	486	2.82-127	48	36.499863	-98.654808	462	2.82-127
13	36.619077	-98.830110	492	2.82-127	49	36.500042	-98.649572	460	2.82-127
14	36.615394	-98.824638	493	2.82-127	50	36.497331	-98.643016	461	2.82-127
15	36.616835	-98.817180	505	2.82-127	51	36.498235	-98.636395	458	2.82-127
16	36.616950	-98.811486	513	2.82-127	52	36.500568	-98.631293	460	2.82-127
17	36.625558	-98.786561	519	2.82-127	53	36.498747	-98.625260	458	2.82-127
18	36.626171	-98.782332	514	2.82-127	54	36.494588	-98.615956	457	2.82-127
19	36.617018	-98.775872	521	2.82-127	55	36.495915	-98.611642	459	2.82-127
20	36.617696	-98.770919	520	2.82-127	56	36.497462	-98.607156	458	2.82-127
21	36.619868	-98.766947	510	2.82-127	57	36.497547	-98.601926	455	2.82-127
22	36.599293	-98.802814	528	2.82-127	58	36.498048	-98.597724	456	2.82-127
23	36.602218	-98.798099	530	2.82-127	59	36.497161	-98.592926	454	2.82-127
24	36.607198	-98.793885	534	2.82-127	60	36.487997	-98.584493	452	2.82-127
25	36.607595	-98.785921	527	2.82-127	61	36.486655	-98.577286	452	2.82-127
26	36.601051	-98.780603	529	2.82-127	62	36.486225	-98.571683	451	2.82-127
27	36.599246	-98.767902	528	2.82-127	63	36.486165	-98.563627	451	2.82-127
28	36.601359	-98.763713	526	2.82-127	64	36.486343	-98.558843	449	2.82-127
29	36.604694	-98.759934	515	2.82-127	65	36.486583	-98.554391	446	2.82-127
30	36.607541	-98.756405	516	2.82-127	66	36.512770	-98.608405	455	2.3-116
31	36.584456	-98.771013	514	2.82-127	67	36.513160	-98.603346	458	2.3-116
32	36.584910	-98.766506	519	2.82-127	68	36.513203	-98.599130	457	2.3-116
33	36.585848	-98.762241	520	2.82-127	69	36.513206	-98.594089	457	2.3-116
34	36.580656	-98.752330	507	2.82-127	70	36.512822	-98.589416	454	2.3-116
35	36.580701	-98.747412	506	2.82-127	71	36.512900	-98.584717	454	2.3-116
36	36.564873	-98.753744	501	2.82-127	72	36.512819	-98.580145	453	2.3-116

Ref V. Monthly Mean 10-m Wind Speeds (mps)
Medicine Lodge Airport, Kansas
ASOS Period Only
Sonic Conversion Date: 17 November 2005

Latitude: 37° 17.0'N
Longitude: 98° 33.2'W
Elevation: 468 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2005												3.7	
2006	4.1	4.1	5.2	5.2	4.3	4.2	3.9	3.2	3.7	4.2	4.1	3.9	4.14
2007	4.0	4.3	4.6	4.7	4.0	3.9	2.9	3.9	4.0	4.4	3.4	3.7	3.98
2008	4.4	4.2	4.7	5.3	4.9	4.4	3.5	3.0	3.7	4.2	4.2	4.7	4.26
2009	4.0	4.8	5.1	5.3	3.8	3.6	3.4	3.7	3.2	4.3	3.9	4.3	4.12
2010	3.6	3.6	5.2	5.1	3.9	4.2	3.5	3.6	4.0	3.1	4.0	3.4	3.94
2011	3.3	4.3	4.7	5.2	4.9	5.5	3.6	3.5	3.4	3.8	4.4	3.7	4.18
2012	4.0	4.2	4.4	4.4	4.7	4.5	3.7	3.6	3.6	4.3	3.9	4.0	4.10
2013	3.5	4.2	4.5	5.3	4.7	4.7	3.9	3.4	4.0	4.1	4.3	3.8	4.20
2014	4.6	4.1	5.3	5.6	4.4	4.9	3.4	3.5	4.4	3.7	4.3	3.8	4.33
2015	3.7	4.2	3.7	4.5	4.1	3.9	3.7	3.2	4.0	3.3	4.4	4.1	3.90
2016	3.5	4.5	4.9	4.6	4.0	3.7	4.1	3.4	3.9	4.2	3.6	3.7	4.00
2017	4.0	4.0	5.4	5.2	4.2	4.0	3.5	3.1	3.5	4.7	3.9	4.1	4.12
2018	4.3	4.8	5.0	5.4	4.0	4.4	2.9	3.6	3.8	3.7	3.8	4.2	4.15
2019	3.9	4.6	4.5										
Overall	3.91	4.28	4.79	5.05	4.29	4.30	3.55	3.41	3.78	3.99	4.01	3.93	4.11

Monthly Mean 10-m Wind Speeds (mps)
Woodward Oklahoma Mesonet Station

Latitude: 36° 25.4'N
Longitude: 99° 25.0'W
Elevation: 625 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1994	4.6	5.2	5.4	6.4	4.3	5.5	4.7	4.9	4.8	4.3	5.4	4.2	4.96
1995	4.4	5.2	5.5	5.7	4.8	4.5	3.9	4.8	4.1	5.1	5.1	3.7	4.73
1996	5.5	4.7	5.6	6.7	6.6	4.5	4.3	3.7	4.4	5.4	5.0	5.0	5.11
1997	4.8	4.3	5.6	5.3	5.0	4.5	4.9	4.1	4.3	4.9	4.2	4.2	4.66
1998	4.6	4.6	5.7	5.3	5.0	6.3	4.2	3.7	3.9	5.1	5.3	4.2	4.82
1999	4.7	5.5	5.4	5.7	5.4	5.0	5.2	4.1	4.3	4.4	4.7	4.9	4.94
2000	4.0	5.4	4.7	5.4	5.4	5.0	4.7	5.0	5.4	4.8	4.0	4.3	4.83
2001	4.3	4.3	4.1	6.2	4.8	5.3	4.9	4.2	4.0	5.7	5.0	4.8	4.81
2002	4.9	5.5	6.0	6.0	5.7	5.8	4.6	4.8	4.3	3.9	4.5	4.3	5.03
2003	4.4	4.2	5.1	6.1	4.8	4.3	5.1	4.1	4.6	4.0	4.7	5.2	4.72
2004	4.3	4.9	5.1	5.3	6.6	4.6	4.3	4.4	4.7	4.1	4.0	4.7	4.76
2005	4.1	4.3	5.2	5.8	4.8	5.2	4.3	3.8	4.6	4.5	5.5	4.4	4.73
2006	5.5	4.7	5.9	6.1	4.9	5.2	4.7	4.2	4.6	4.8	4.8	4.6	4.99
2007	4.7	4.9	5.4	5.3	4.8	4.3	3.6	4.9	4.7	5.4	4.3	4.4	4.72
2008	5.7	4.6	5.5	6.2	5.7	5.7	4.9	3.9	4.1	4.9	5.0	5.7	5.15
2009	4.9	5.3	5.8	6.1	4.6	5.0	4.6	4.8	3.9	5.0	4.9	4.7	4.97
2010	4.1	4.0	5.4	6.1	5.1	5.3	4.5	4.4	4.9	4.3	5.1	3.7	4.74
2011	3.9	5.0	5.4	6.3	6.3	6.5	4.3	4.2	4.3	5.1	5.6	4.5	5.13
2012	5.2	5.0	5.8	5.2	5.5	5.4	4.6	3.9	4.0	4.8	4.7	4.9	4.91
2013	4.3	4.5	4.7	6.1	5.7	5.4	4.5	4.0	4.4	4.8	5.0	4.4	4.81
2014	5.3	4.2	5.9	6.3	5.4	6.0	4.5	4.3	4.6	4.1	5.0	4.2	4.99
2015	4.1	4.4	4.2	5.1	4.8	4.7	4.5	3.8	5.1	3.9	5.4	4.8	4.57
2016	4.1	5.1	5.8	5.4	5.0	4.2	4.9	4.0	4.8	5.3	4.5	4.3	4.77
2017	4.9	4.9	6.0	6.2	5.0	5.2	4.1	3.4	4.6	5.5	4.5	4.6	4.91
2018	5.2	5.0	5.4	6.0	5.7	5.7	3.5	4.4	4.3	4.0	4.4	4.4	4.83
2019	4.5	4.5	4.9										
Overall	4.65	4.77	5.37	5.86	5.26	5.16	4.48	4.23	4.46	4.72	4.83	4.52	4.86

Monthly Mean 10-m Wind Speeds (mps)
Alva Mesonet Station, Oklahoma

Latitude: 36° 42.5'N
Longitude: 98° 42.6'W
Elevation: 439 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1999	4.7	5.0	5.4	5.2	4.9	4.7	5.0	4.1	4.2	4.3	4.2	4.7	4.70
2000	4.0	5.2	4.6	5.0	4.9	4.8	4.5	4.5	5.3	4.6	4.2	4.3	4.65
2001	4.2	4.7	4.0	5.7	4.6	5.3	4.9	4.0	4.2	5.3	4.7	4.5	4.68
2002	4.7	5.3	6.0	6.1	5.6	5.5	4.3	4.3	4.2	4.1	4.3	3.9	4.84
2003	4.5	4.2	4.7	5.7	4.4	4.1	4.6	4.0	4.5	3.7	4.8	5.0	4.50
2004	4.3	4.8	5.0	5.0	5.6	4.6	4.3	4.3	4.7	4.1	4.4	4.5	4.65
2005	4.0	4.2	5.0	5.5	4.3	5.0	4.1	3.7	4.5	4.4	5.3	4.4	4.53
2006	5.1	4.8	5.7	5.6	4.7	5.1	4.6	4.1	4.8	4.9	4.8	4.7	4.88
2007	4.8	5.1	5.4	5.0	4.3	4.3	3.3	4.5	4.4	5.3	4.2	4.4	4.59
2008	5.3	4.9	5.5	5.8	5.2	5.3	4.4	3.9	4.1	4.9	5.0	5.5	4.97
2009	4.9	5.4	5.6	6.0	4.2	4.5	4.4	4.4	4.1	5.1	4.7	4.8	4.84
2010	4.2	4.2	5.7	6.0	4.6	4.9	4.1	4.1	4.9	3.8	4.9	3.7	4.59
2011	4.2	5.0	5.2	5.9	5.7	6.3	4.1	4.3	4.1	4.8	5.2	4.3	4.92
2012	4.7	4.8	5.2	4.8	4.8	5.1	4.3	3.9	4.1	5.0	4.4	4.6	4.64
2013	4.3	4.8	4.8	5.8	5.1	4.9	4.3	3.6	4.2	4.8	4.9	4.2	4.65
2014	5.2	4.5	5.8	6.2	5.1	5.4	4.1	4.0	4.8	4.2	4.9	4.3	4.87
2015	4.4	4.6	4.0	5.0	4.3	4.3	4.2	3.7	4.5	3.6	5.0	4.2	4.33
2016	4.0	5.2	5.6	5.1	4.4	4.0	4.5	3.8	4.2	4.8	4.2	4.3	4.51
2017	4.7	4.5	5.9	5.6	4.6	4.7	3.9	3.3	4.3	5.5	4.4	4.8	4.67
2018	4.9	5.0	5.4	6.2	5.0	5.2	3.4	4.0	3.9	4.0	4.2	4.7	4.67
2019	4.5	4.9	5.0										
Overall	4.55	4.81	5.22	5.56	4.81	4.89	4.27	4.02	4.40	4.56	4.63	4.49	4.68

Monthly Mean 10-m Wind Speeds (mps)
Fairview Mesonet Station, Oklahoma

Latitude: 36° 15.8'N
Longitude: 98° 29.9'W
Elevation: 405 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1994	4.3	4.9	5.1	5.7	3.2	4.7	4.5	4.6	4.3	3.5	4.8	3.5	4.40
1995	4.1	5.0	4.9	4.8	3.9	4.0	3.9	4.0	3.8	4.5	4.7	3.3	4.23
1996	5.4	4.4	5.3	5.9	5.5	3.9	3.8	3.4	3.8	4.8	4.5	4.6	4.60
1997	4.6	4.0	5.1	4.5	4.1	3.8	4.3	3.6	3.9	4.3	3.8	4.2	4.19
1998	4.4	4.1	5.3	4.5	3.9	5.6	4.0	3.5	3.8	4.1	4.6	3.7	4.28
1999	4.3	4.8	4.8	4.9	4.4	4.4	4.6	3.6	3.8	3.9	4.2	4.5	4.36
2000	3.8	4.8	4.2	4.3	4.4	4.4	4.2	4.7	4.7	4.3	3.7	3.8	4.26
2001	3.9	4.2	3.6	5.8	4.1	4.8	4.6	3.7	3.6	4.8	4.4	4.4	4.31
2002	4.5	4.9	5.9	5.4	4.9	4.7	4.2	4.0	3.7	3.5	4.2	3.9	4.49
2003	4.2	4.0	4.4	5.3	3.8	3.5	4.6	3.6	3.9	3.6	4.4	4.8	4.18
2004	4.1	4.5	4.6	4.5	5.3	4.2	4.0	4.0	4.1	3.8	3.8	4.3	4.26
2005	3.6	4.2	4.8	5.0	3.7	4.5	3.9	3.6	4.0	4.0	5.1	4.2	4.22
2006	5.2	4.4	5.1	5.3	4.5	4.4	4.3	3.8	4.1	4.5	4.4	4.5	4.53
2007	4.5	4.7	4.9	4.4	3.7	3.6	3.1	4.2	3.8	4.5	4.0	3.9	4.10
2008	5.2	4.5	5.0	5.1	4.7	5.0	4.0	3.3	3.3	4.4	4.5	5.3	4.53
2009	4.6	5.3	5.3	5.5	3.7	4.4	4.1	4.2	3.5	4.4	4.4	4.6	4.51
2010	3.9	3.9	5.1	5.2	4.0	4.5	3.8	3.9	4.3	3.7	4.6	3.5	4.19
2011	3.8	4.5	4.8	5.4	5.4	6.0	4.0	4.0	3.8	4.3	4.9	3.8	4.56
2012	4.6	4.4	4.8	4.2	4.4	4.5	4.1	3.5	3.7	4.8	4.3	4.5	4.33
2013	4.0	4.3	4.4	5.1	4.6	4.3	3.9	3.2	3.6	4.3	4.4	4.1	4.17
2014	5.2	4.2	5.9	5.6	4.8	4.8	3.9	3.8	4.3	3.8	4.5	3.8	4.55
2015	3.9	4.3	3.7	4.4	3.8	3.8	3.8	3.3	3.8	3.2	4.6	3.9	3.86

2016	3.9	4.9	5.2	4.4	4.0	3.6	4.2	3.4	3.8	4.4	4.0	3.9	4.13
2017	4.2	4.3	5.1	4.8	3.9	4.3	3.6	3.1	3.7	4.6	3.9	4.3	4.14
2018	4.7	4.4	4.8	5.6	4.6	5.0	3.1	3.8	3.6	3.5	3.8	4.1	4.24
2019	4.1	4.6	4.4										
Overall	4.34	4.48	4.86	5.02	4.29	4.43	4.02	3.75	3.86	4.13	4.33	4.14	4.30

Monthly Mean 50-m Wind Speeds (mps)
MERRA-2 West Upper-Air Data Point

Latitude: 36° 30.0'N
Longitude: 98° 45.0'W

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2002	7.4	7.9	8.4	8.1	7.9	8.0	6.8	6.9	6.9	6.0	6.8	6.7	7.31
2003	6.7	6.0	7.3	8.5	6.9	6.0	7.4	6.2	7.3	6.4	7.4	7.9	6.99
2004	6.4	7.1	7.6	7.5	9.0	6.5	6.4	6.5	7.3	6.9	6.6	7.3	7.09
2005	5.8	6.4	7.6	8.5	6.6	7.9	6.6	6.0	7.4	7.0	8.4	7.1	7.10
2006	8.2	7.0	8.1	8.5	7.0	7.1	7.1	6.0	6.9	7.3	7.3	7.1	7.29
2007	7.0	7.3	7.8	7.6	6.8	6.5	5.6	7.7	7.2	8.3	7.0	6.7	7.12
2008	8.1	6.9	7.6	8.4	8.4	8.0	7.3	5.9	6.6	7.9	7.8	8.2	7.58
2009	7.3	8.0	8.4	8.6	6.7	7.3	6.3	6.9	6.3	7.6	7.3	7.2	7.31
2010	6.2	6.1	8.0	9.2	7.2	7.7	6.7	6.8	7.8	6.9	8.0	6.0	7.21
2011	6.4	7.2	7.7	8.9	8.9	9.6	6.5	6.3	6.5	7.7	8.0	6.5	7.50
2012	7.7	7.0	7.8	7.6	8.2	7.7	7.0	6.2	6.4	7.8	7.3	7.2	7.32
2013	6.6	7.4	7.5	8.1	8.2	7.9	6.9	6.2	7.1	7.8	7.6	6.6	7.32
2014	8.2	6.6	8.4	9.1	7.8	8.3	6.7	6.8	7.3	7.0	7.7	6.3	7.53
2015	6.7	6.8	6.4	7.4	7.2	7.2	6.8	6.2	7.5	6.4	8.2	7.3	7.00
2016	6.5	8.1	8.6	7.7	7.2	6.4	7.2	6.2	7.2	8.0	7.3	6.9	7.26
2017	7.1	7.3	8.6	8.4	7.4	7.6	6.0	5.7	7.0	8.5	7.1	7.0	7.31
2018	7.7	7.2	7.8	8.6	7.6	7.8	5.1	7.0	6.7	6.8	6.9	7.2	7.20
2019	7.0	6.9	7.2										
Overall	7.05	7.05	7.82	8.26	7.58	7.50	6.60	6.43	7.03	7.30	7.46	7.01	7.26

Monthly Mean 50-m Wind Speeds (mps)
MERRA-2 East Upper-Air Data Point

Latitude: 36° 30.0'N
Longitude: 98° 07.5'W

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2002	7.2	7.6	8.2	8.0	7.7	7.7	6.4	6.5	6.7	6.0	6.7	6.5	7.10
2003	6.6	5.9	7.0	8.5	6.6	6.0	7.2	5.8	7.1	6.3	7.2	7.8	6.83
2004	6.4	7.0	7.6	7.5	9.0	6.5	6.2	6.4	7.1	6.9	6.6	7.2	7.03
2005	5.8	6.3	7.4	8.3	6.5	7.5	6.3	5.7	7.1	6.9	8.3	6.9	6.91
2006	8.0	6.9	8.0	8.5	6.9	6.8	7.1	5.9	6.8	7.3	7.2	7.1	7.19
2007	6.7	7.1	7.7	7.4	6.6	6.6	5.4	7.4	6.9	8.1	6.8	6.6	6.93
2008	7.9	6.8	7.5	8.5	8.2	7.9	7.0	5.8	6.4	7.8	7.6	8.0	7.44
2009	7.2	8.0	8.3	8.5	6.4	7.3	6.1	6.8	6.2	7.5	7.3	7.1	7.22
2010	6.1	6.0	8.0	9.1	6.9	7.4	6.5	6.7	7.6	6.7	8.0	6.1	7.08
2011	6.3	7.2	7.7	8.9	8.8	9.4	6.4	6.2	6.5	7.3	8.1	6.3	7.41
2012	7.6	6.8	7.7	7.4	8.0	7.4	6.7	6.2	6.3	7.8	7.3	7.1	7.18
2013	6.5	7.4	7.4	7.9	7.9	7.8	6.7	6.0	6.8	7.9	7.5	6.5	7.19
2014	8.1	6.6	8.3	8.9	7.8	8.0	6.4	6.5	7.1	7.0	7.6	6.3	7.38
2015	6.5	6.7	6.1	7.4	7.1	7.0	6.6	6.0	7.2	6.1	8.1	7.2	6.83
2016	6.5	7.9	8.5	7.6	6.9	6.0	7.0	6.0	6.9	7.7	7.2	6.8	7.09
2017	7.0	7.1	8.3	8.1	7.3	7.3	5.9	5.5	6.6	8.2	7.0	6.8	7.08
2018	7.5	7.0	7.7	8.4	7.2	7.6	4.9	6.7	6.4	6.6	6.8	7.2	7.00
2019	6.9	6.9	7.1										
Overall	6.93	6.96	7.68	8.17	7.40	7.28	6.39	6.23	6.80	7.18	7.36	6.90	7.11

Mo Speeds. Monthly Mean Wind Speeds (mps)
Sundance Project, Oklahoma
American Electric Power

YEAR: 2008 likely dry friction whip

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w			5.4	6.2	5.7	5.7	4.7	3.8	4.4	5.1	5.2	5.8	
	31.5-e			7.2	7.9	7.3	7.4	6.3	5.2	5.9	6.8	6.9	7.6	
	31.5-w			7.2	7.9	7.4	7.4	6.3	5.2	6.0	6.9	6.8	7.5	
	47-w			7.9	8.7	8.1	8.1	7.0	5.7	6.5	7.5	7.7	8.4	
	57-e			8.3	9.0	8.3	8.4	7.3	6.1	6.9	7.9	8.0	8.7	
	57-w			8.3	9.0	8.4	8.5	7.3	6.0	6.9	8.1	8.2	8.9	
Medicine Lodge	10			4.7	5.3	4.9	4.4	3.5	3.0	3.7	4.2	4.2	4.7	
Woodward	10			5.5	6.2	5.7	5.7	4.9	3.9	4.1	4.9	5.0	5.7	
Alva	10			5.5	5.8	5.2	5.3	4.4	3.9	4.1	4.9	5.0	5.5	
Fairview	10			5.0	5.1	4.7	5.0	4.0	3.3	3.3	4.4	4.5	5.3	
MERRA-2 West	50			7.6	8.4	8.4	8.0	7.3	5.9	6.6	7.9	7.8	8.2	
MERRA-2 East	50			7.5	8.5	8.2	7.9	7.0	5.8	6.4	7.8	7.6	8.0	

YEAR: 2009 likely dry friction whip

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	5.0	5.6	5.7	6.0	4.5	4.7	4.4	4.7	3.9	5.0	5.0	4.9	4.94
	31.5-e	6.7	7.4	7.6	7.6	5.8	6.2	5.8	6.1	5.2	6.5	6.6	6.5	6.50
	31.5-w	6.6	7.4	7.6	7.6	6.0	6.2	5.6	6.0	5.2	6.5	6.7	6.6	6.49
	47-w	7.4	8.0	8.3	8.1	6.4	6.7	6.2	6.6	5.9	7.2	7.6	7.5	7.15
	57-e	7.7	8.3	8.9	x	x	x	x	x	x	x	x	x	x
	57-w	7.8	8.5	8.8	8.7	6.9	7.4	6.7	7.1	6.3	7.5	7.9	7.8	7.61
Medicine Lodge	10	4.0	4.8	5.1	5.3	3.8	3.6	3.4	3.7	3.2	4.3	3.9	4.3	4.12
Woodward	10	4.9	5.3	5.8	6.1	4.6	5.0	4.6	4.8	3.9	5.0	4.9	4.7	4.97
Alva	10	4.9	5.4	5.6	6.0	4.2	4.5	4.4	4.4	4.1	5.1	4.7	4.8	4.84
Fairview	10	4.6	5.3	5.3	5.5	3.7	4.4	4.1	4.2	3.5	4.4	4.4	4.6	4.51
MERRA-2 West	50	7.3	8.0	8.4	8.6	6.7	7.3	6.3	6.9	6.3	7.6	7.3	7.2	7.31
MERRA-2 East	50	7.2	8.0	8.3	8.5	6.4	7.3	6.1	6.8	6.2	7.5	7.3	7.1	7.22

YEAR: 2010 likely dry friction whip

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	4.3	4.1	5.6	6.0	4.8	5.1	4.2	3.9	4.7	4.1	4.9	3.8	4.63
	31.5-e	5.8	5.4	7.2	7.8	6.2	6.6	5.6	5.6	6.5	5.8	6.9	5.5	6.23
	31.5-w	5.8	5.5	7.4	7.8	6.2	6.7	5.7	5.7	6.6	6.1	7.1	5.6	6.34
	47-w	6.4	5.9	8.0	8.8	7.0	7.6	6.4	6.5	7.6	6.9	8.0	6.3	7.11
	57-e	x	x	x	x	x	x	x	x	x	x	x	x	x
	57-w	6.6	6.2	8.5	9.2	7.3	8.0	6.8	6.8	7.9	7.2	8.4	6.6	7.45
Medicine Lodge	10	3.6	3.6	5.2	5.1	3.9	4.2	3.5	3.6	4.0	3.1	4.0	3.4	3.94
Woodward	10	4.1	4.0	5.4	6.1	5.1	5.3	4.5	4.4	4.9	4.3	5.1	3.7	4.74
Alva	10	4.2	4.2	5.7	6.0	4.6	4.9	4.1	4.1	4.9	3.8	4.9	3.7	4.59
Fairview	10	3.9	3.9	5.1	5.2	4.0	4.5	3.8	3.9	4.3	3.7	4.6	3.5	4.19
MERRA-2 West	50	6.2	6.1	8.0	9.2	7.2	7.7	6.7	6.8	7.8	6.9	8.0	6.0	7.21
MERRA-2 East	50	6.1	6.0	8.0	9.1	6.9	7.4	6.5	6.7	7.6	6.7	8.0	6.1	7.08

YEAR: 2011 likely dry friction whip

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	4.1												
	31.5-e	6.2												
	31.5-w	6.5												
	47-w	7.3												
	57-e	x												
	57-w	7.5												
Medicine Lodge	10	3.3												
Woodward	10	3.9												
Alva	10	4.2												
Fairview	10	3.8												
MERRA-2 West	50	6.4												
MERRA-2 East	50	6.3												

YEAR: 2015

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w											5.5	4.9	
	31-e											7.4	6.7	
	31-w											7.5	6.8	
	47-e											8.2	7.4	
	47-w											8.2	7.5	
	56.5-e											8.5	7.8	
	56.5-w											8.6	7.9	
0257	30-ne											7.1	6.5	
	30-sw											7.2	6.4	
	45-ne											7.9	7.3	
	45-sw											7.8	7.2	
	60-ne											8.4	7.7	
	60-sw											8.4	7.8	
0357	30-ne											7.3	6.5	
	30-sw											7.3	6.4	
	45-ne											7.9	7.0	
	45-sw											7.9	7.0	
	60-ne											8.5	7.6	
	60-sw											8.4	7.5	
Medicine Lodge	10										3.3	4.4	4.1	
Woodward	10										3.9	5.4	4.8	
Alva	10										3.6	5.0	4.2	
Fairview	10										3.2	4.6	3.9	
MERRA-2 West	50										6.4	8.2	7.3	
MERRA-2 East	50										6.1	8.1	7.2	

YEAR: 2016

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	4.2					4.4	4.7	4.1	4.7	5.2	4.6	4.6	4.84
	31-e	5.8	7.3	7.7	7.0	6.4	5.8	6.3	5.6	6.5	7.3	6.5	6.4	6.54
	31-w	5.7	7.2	7.6	6.9	6.3	5.7	6.2	5.5	6.4	7.2	6.5	6.3	6.45
	47-e	6.3	8.0	8.4	7.6	7.0	6.4	7.0	6.2	7.2	8.1	7.2	7.1	7.21
	47-w	6.3	8.0	8.4	7.6	7.0	6.3	6.8	6.1	7.1	8.0	7.2	7.0	7.15
	56.5-e	6.6	8.4	8.8	8.0	7.3	6.7	7.3	6.5	7.6	8.5	7.6	7.5	7.56
0257	56.5-w	6.7	8.5	8.8	8.1	7.4	6.7	7.3	6.5	7.6	8.5	7.7	7.4	7.60
	30-ne	5.5	7.2	7.6	7.1	6.3	5.6	6.1	5.5	6.3	7.0	6.3	6.1	6.39
	30-sw	5.4	7.1	7.5	7.0	6.3	5.6	6.1	5.4	6.2	6.9	6.3	6.1	6.33
	45-ne	6.0	7.9	8.2	7.7	6.9	6.2	6.8	6.1	7.0	7.7	7.0	6.8	7.02
	45-sw	6.0	7.9	8.2	7.6	6.9	6.2	6.7	6.0	6.9	7.7	7.0	6.8	6.99
	60-ne	6.4	8.5	8.7	8.1	7.4	6.6	7.2	6.4	7.5	8.3	7.5	7.3	7.50
0357	60-sw	6.4	8.4	8.7	8.1	7.4	6.6	7.2	6.4	7.4	8.2	7.5	7.2	7.46
	30-ne	5.7	7.1	7.7	7.0	6.3	5.7	6.2	5.4	6.3	6.9	6.4	6.2	6.39
	30-sw	5.8	7.1	7.7	7.0	6.3	5.7	6.2	5.5	6.3	6.9	6.3	6.1	6.39
	45-ne	6.2	7.7	8.2	7.5	6.8	6.1	6.7	5.9	6.8	7.5	7.0	6.7	6.92
	45-sw	6.3	7.6	8.1	7.4	6.8	6.1	6.6	5.9	6.8	7.5	7.0	6.7	6.89
	60-ne	6.7	8.3	8.8	8.0	7.3	6.6	7.2	6.4	7.3	8.1	7.5	7.2	7.45
0457	60-sw	6.7	8.3	8.7	8.0	7.2	6.5	7.1	6.3	7.2	8.0	7.5	7.1	7.37
	30-ne				6.7	6.0	5.2	5.8	5.0	5.9	6.5	5.8	5.7	5.95
	30-sw				6.7	6.0	5.2	5.8	5.0	5.9	6.5	5.8	5.6	5.94
	45-ne				7.2	6.5	5.7	6.3	5.5	6.5	7.2	6.4	6.2	6.49
	45-sw				7.2	6.4	5.7	6.3	5.5	6.4	7.1	6.4	6.1	6.46
	60-ne				7.7	6.9	6.1	6.7	5.9	7.0	7.6	6.9	6.7	6.94
0557	60-sw				7.6	6.9	6.1	6.7	5.9	6.9	7.6	6.9	6.7	6.91
	30-ne				6.8	6.1	5.6	6.1	5.3	6.1	6.8	5.8	5.7	6.15
	30-sw				6.8	6.2	5.6	6.2	5.4	6.1	6.8	5.8	5.7	6.17
	45-ne				7.4	6.7	6.1	6.7	5.9	6.8	7.5	6.5	6.3	6.77
	45-sw				7.4	6.7	6.1	6.7	5.9	6.7	7.4	6.5	6.4	6.78
	60-ne				7.8	7.1	6.5	7.1	6.2	7.2	8.0	7.0	6.8	7.17
0657	60-sw				7.8	7.1	6.5	7.2	6.3	7.3	8.0	7.0	6.8	7.21
	30-ne				7.0	6.1	5.4	6.0	5.2	6.0	6.8	5.9	5.8	6.15
	30-sw				7.0	6.1	5.4	5.9	5.1	5.9	6.7	5.9	5.8	6.11
	45-ne				7.5	6.6	5.9	6.5	5.7	6.6	7.3	6.5	6.5	6.69
	45-sw				7.5	6.7	5.9	6.5	5.7	6.6	7.4	6.6	6.5	6.71
	60-ne				8.0	7.1	6.3	7.0	6.1	7.1	7.8	7.1	7.0	7.16
0757	60-sw				8.0	7.1	6.3	6.9	6.1	7.0	7.8	7.1	7.0	7.14
	30-ne				7.0	6.3	5.5	6.0	5.4	6.1	6.8	6.4	6.3	6.31
	30-sw				6.9	6.3	5.5	6.0	5.3	6.1	6.8	6.3	6.1	6.27
	45-ne				7.5	6.8	6.0	6.6	5.9	6.7	7.6	7.0	6.9	6.90
	45-sw				7.5	6.8	6.0	6.6	5.9	6.7	7.6	7.0	6.9	6.91
	60-ne				8.0	7.3	6.4	7.0	6.3	7.2	8.1	7.5	7.4	7.36

	60-sw				8.0	7.3	6.5	7.1	6.3	7.2	8.1	7.5	7.5	7.39
0857	30-ne				6.3	5.6	5.0	5.4	4.9	5.5	6.1	5.6	5.5	5.66
	30-sw				6.3	5.7	5.0	5.4	4.9	5.4	6.1	5.7	5.6	5.67
	45-ne				7.0	6.3	5.7	6.1	5.5	6.3	7.0	6.5	6.3	6.42
	45-sw				7.0	6.3	5.6	6.1	5.5	6.2	7.0	6.5	6.3	6.39
	60-ne				7.5	6.8	6.1	6.7	6.0	6.8	7.6	7.1	6.9	6.95
	60-sw				7.5	6.8	6.0	6.6	6.0	6.7	7.6	7.1	6.9	6.92
Medicine Lodge	10	3.5	4.5	4.9	4.6	4.0	3.7	4.1	3.4	3.9	4.2	3.6	3.7	4.00
Woodward	10	4.1	5.1	5.8	5.4	5.0	4.2	4.9	4.0	4.8	5.3	4.5	4.3	4.77
Alva	10	4.0	5.2	5.6	5.1	4.4	4.0	4.5	3.8	4.2	4.8	4.2	4.3	4.51
Fairview	10	3.9	4.9	5.2	4.4	4.0	3.6	4.2	3.4	3.8	4.4	4.0	3.9	4.13
MERRA-2 West	50	6.5	8.1	8.6	7.7	7.2	6.4	7.2	6.2	7.2	8.0	7.3	6.9	7.26
MERRA-2 East	50	6.5	7.9	8.5	7.6	6.9	6.0	7.0	6.0	6.9	7.7	7.2	6.8	7.09

YEAR: 2017

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	4.8	4.9	5.9	5.9	4.9	5.1	3.9	3.4	4.6	5.6	4.7	4.8	4.86
	31-e	6.5	6.8	7.7	7.7	6.5	6.7	5.4	4.8	6.4	7.7	6.5	6.5	6.60
	31-w	6.5	6.7	7.6	7.7	6.5	6.7	5.3	4.7	6.3	7.7	6.5	6.6	6.56
	47-e	7.1	7.5	8.5	8.4	7.2	7.3	6.0	5.3	7.1	8.5	7.3	7.2	7.28
	47-w	7.2	7.5	8.4	8.4	7.1	7.3	5.9	5.3	7.1	8.6	7.3	7.3	7.28
	56.5-e	7.4	7.9	8.8	8.8	7.5	7.6	6.3	5.7	7.4	8.9	7.6	7.5	7.62
	56.5-w	7.6	8.0	8.8	8.8	7.6	7.7	6.2	5.6	7.5	9.0	7.6	7.7	7.67
0257	30-ne	6.3	6.6	7.8	7.6	6.5	6.6	5.5	4.9	6.2	7.5	6.2	6.3	6.49
	30-sw	6.2	6.5	7.7	7.6	6.5	6.5	5.5	4.8	6.1	7.4	6.1	6.3	6.43
	45-ne	7.0	7.3	8.5	8.3	7.2	7.2	6.1	5.4	6.8	8.2	6.9	6.9	7.14
	45-sw	6.9	7.2	8.4	8.2	7.1	7.1	6.1	5.3	6.8	8.2	6.8	6.9	7.07
	60-ne	7.4	7.8	9.0	8.8	7.6	7.6	6.5	5.8	7.3	8.8	7.4	7.4	7.62
	60-sw	7.4	7.7	9.0	8.7	7.6	7.6	6.5	5.7	7.3	8.8	7.4	7.4	7.57
0357	30-ne	6.4	6.5	7.6	7.5	6.4	6.6	5.3	4.7	6.0	7.5	6.3	6.4	6.44
	30-sw	6.4	6.5	7.6	7.5	6.4	6.6	5.3	4.7	6.0	7.5	6.3	6.4	6.43
	45-ne	6.9	7.1	8.1	8.1	7.0	7.1	5.7	5.2	6.5	8.1	6.9	6.9	6.98
	45-sw	6.9	7.2	8.1	8.1	7.0	7.1	5.7	5.2	6.5	8.2	6.9	7.0	6.99
	60-ne	7.5	7.7	8.7	8.7	7.5	7.6	6.1	5.6	7.1	8.8	7.4	7.5	7.51
	60-sw	7.4	7.6	8.6	8.6	7.5	7.5	6.1	5.5	7.0	8.7	7.4	7.4	7.44
0457	30-ne	6.1	6.1	7.4	7.4	6.1	6.2	5.1	4.4	5.6	7.2	5.7	6.1	6.12
	30-sw	6.1	6.1	7.3	7.3	6.0	6.2	5.1	4.3	5.6	7.2	5.7	6.2	6.09
	45-ne	6.7	6.7	8.0	8.0	6.7	6.7	5.5	4.8	6.2	7.9	6.3	6.7	6.68
	45-sw	6.7	6.7	7.9	7.9	6.6	6.7	5.5	4.7	6.1	7.9	6.3	6.7	6.64
	60-ne	7.1	7.2	8.5	8.4	7.1	7.1	6.0	5.2	6.6	8.4	6.7	7.1	7.13
	60-sw	7.1	7.1	8.4	8.4	7.1	7.1	5.9	5.2	6.6	8.4	6.7	7.1	7.08
0557	30-ne	5.9	6.2	7.6	7.5	6.2	6.3	5.5	4.5	6.0	7.3	5.9	6.0	6.22
	30-sw	5.9	6.2	7.5	7.4	6.3	6.3	5.5	4.5	5.9	7.3	5.9	6.1	6.23
	45-ne	6.5	6.9	8.2	8.1	6.9	6.9	6.0	5.1	6.5	8.0	6.4	6.6	6.83
	45-sw	6.5	6.9	8.2	8.1	6.9	6.9	6.0	5.1	6.6	8.0	6.5	6.6	6.84
	60-ne	7.0	7.3	8.6	8.5	7.3	7.3	6.3	5.4	7.0	8.5	6.9	7.0	7.26
	60-sw	7.0	7.4	8.6	8.5	7.3	7.3	6.3	5.4	7.1	8.5	6.9	7.1	7.27
0657	30-ne	5.9	6.1	7.5	7.6	6.3	6.5	5.2	4.5	5.8	7.0	5.9	5.9	6.20
	30-sw	6.0	6.1	7.4	7.5	6.3	6.4	5.2	4.5	5.8	7.0	5.8	5.9	6.17
	45-ne	6.6	6.8	8.1	8.2	6.9	7.0	5.6	5.1	6.4	7.8	6.5	6.6	6.79
	45-sw	6.6	6.8	8.1	8.2	6.9	7.0	5.6	5.0	6.4	7.8	6.5	6.6	6.79
	60-ne	7.1	7.4	8.7	8.7	7.4	7.4	6.0	5.5	6.9	8.4	7.0	7.1	7.30
	60-sw	7.1	7.4	8.6	8.7	7.4	7.3	5.9	5.4	6.9	8.4	7.0	7.1	7.27
0757	30-ne	6.4	6.5	7.5	7.6	6.4	6.5	5.2	4.6	6.0	7.4	6.3	6.5	6.40
	30-sw	6.4	6.5	7.5	7.5	6.4	6.4	5.1	4.6	5.9	7.3	6.2	6.5	6.36
	45-ne	7.0	7.2	8.2	8.2	7.0	7.0	5.7	5.1	6.6	8.1	6.9	7.1	7.00
	45-sw	7.1	7.2	8.1	8.2	7.1	7.0	5.7	5.2	6.6	8.1	7.0	7.2	7.04

	60-ne	7.5	7.7	8.7	8.7	7.5	7.5	6.1	5.6	7.1	8.7	7.5	7.7	7.52
	60-sw	7.6	7.7	8.6	8.7	7.6	7.5	6.1	5.6	7.1	8.7	7.5	7.7	7.52
0857	30-ne	5.7	5.7	6.8	6.8	5.7	5.9	4.7	4.2	5.3	6.5	5.6	5.7	5.72
	30-sw	5.7	5.8	6.8	6.8	5.8	5.9	4.7	4.2	5.3	6.5	5.6	5.7	5.72
	45-ne	6.5	6.6	7.7	7.7	6.6	6.6	5.3	4.8	6.0	7.5	6.4	6.5	6.52
	45-sw	6.5	6.6	7.6	7.6	6.5	6.5	5.3	4.8	6.0	7.5	6.4	6.6	6.51
	60-ne	7.1	7.2	8.2	8.3	7.1	7.1	5.8	5.3	6.6	8.1	7.0	7.1	7.08
	60-sw	7.0	7.3	8.2	8.2	7.1	7.0	5.7	5.3	6.5	8.2	7.0	7.1	7.05
Medicine Lodge	10	4.0	4.0	5.4	5.2	4.2	4.0	3.5	3.1	3.5	4.7	3.9	4.1	4.12
Woodward	10	4.9	4.9	6.0	6.2	5.0	5.2	4.1	3.4	4.6	5.5	4.5	4.6	4.91
Alva	10	4.7	4.5	5.9	5.6	4.6	4.7	3.9	3.3	4.3	5.5	4.4	4.8	4.67
Fairview	10	4.2	4.3	5.1	4.8	3.9	4.3	3.6	3.1	3.7	4.6	3.9	4.3	4.14
MERRA-2 West	50	7.1	7.3	8.6	8.4	7.4	7.6	6.0	5.7	7.0	8.5	7.1	7.0	7.31
MERRA-2 East	50	7.0	7.1	8.3	8.1	7.3	7.3	5.9	5.5	6.6	8.2	7.0	6.8	7.08

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	5.4	5.1	5.4	6.0	5.2	5.4	3.4	4.4	4.2	4.1	4.5	4.7	4.82
	31-e	7.4	6.9	7.1	7.8	6.9	7.2	4.7	6.1	5.9	5.6	6.2	6.5	6.52
	31-w	7.4	6.8	7.1	7.8	6.9	7.2	4.7	6.1	5.9	5.6	6.2	6.5	6.52
	47-e	8.2	7.6	7.8	8.5	7.5	7.9	5.2	6.8	6.6	6.2	6.8	7.1	7.19
	47-w	8.3	7.6	7.8	8.5	7.6	7.9	5.2	6.8	6.6	6.2	6.8	7.2	7.21
	56.5-e	8.6	7.9	8.2	8.8	7.8	8.2	5.4	7.1	7.0	6.5	7.1	7.5	7.51
	56.5-w	8.7	7.9	8.1	8.8	7.9	8.3	5.4	7.1	7.0	6.6	7.2	7.6	7.55
0257	30-ne	7.2	6.4	7.2	7.8	6.8	7.0	4.8	6.0	5.8	5.7	6.2	6.4	6.45
	30-sw	7.1	6.4	7.1	7.8	6.8	7.0	4.8	5.9	5.7	5.7	6.2	6.4	6.41
	45-ne	7.9	7.0	7.8	8.5	7.4	7.7	5.3	6.6	6.5	6.2	6.8	7.1	7.06
	45-sw	7.9	7.0	7.7	8.4	7.4	7.6	5.3	6.5	6.3	6.2	6.8	7.1	7.01
	60-ne	8.4	7.5	8.2	8.9	7.9	8.2	5.7	7.0	6.9	6.7	7.2	7.5	7.52
	60-sw	8.4	7.5	8.2	8.9	7.8	8.2	5.7	x	6.8	6.6	7.2	7.5	7.49
0357	30-ne	7.2	6.7	7.2	8.0	6.9	7.3	4.7	6.0	5.8	5.6	6.1	6.5	6.48
	30-sw	7.2	6.7	7.2	7.9	6.9	7.3	4.7	6.0	5.7	5.5	6.1	6.5	6.46
	45-ne	7.8	7.2	7.7	8.5	7.4	7.8	5.2	6.5	6.3	6.1	6.7	7.1	7.01
	45-sw	7.8	7.3	7.8	8.5	7.4	7.8	5.1	6.5	6.3	6.1	6.6	7.1	7.01
	60-ne	8.4	7.8	8.3	9.0	7.9	8.3	5.5	7.0	6.7	x	x	x	7.50
	60-sw	8.3	7.7	8.2	8.9	7.8	8.2	5.5	6.9	6.6	6.4	7.0	7.5	7.42
0457	30-ne	6.7	6.0	6.8	7.5	6.4	6.7	4.5	5.6	5.4	5.3	5.7	6.1	6.05
	30-sw	6.6	6.0	6.8	7.5	6.4	6.7	4.4	5.5	5.4	5.2	5.6	6.1	6.02
	45-ne	7.3	6.5	7.3	8.0	6.9	7.3	4.9	6.1	6.0	5.7	6.2	6.7	6.58
	45-sw	7.3	6.5	7.3	8.0	6.9	7.3	4.9	6.1	5.9	5.7	6.2	6.7	6.56
	60-ne	7.8	7.0	7.7	8.4	7.4	7.7	5.2	6.6	6.4	6.1	6.7	7.1	7.01
	60-sw	7.8	6.9	7.7	8.3	7.3	7.7	5.1	6.5	6.4	6.1	6.6	7.1	6.94
0557	30-ne	6.7	6.3	6.9	7.7	6.7	7.0	4.6	5.9					
	30-sw	6.8	6.4	6.9	7.7	6.7	6.9	4.5	5.9					
	45-ne	7.4	6.9	7.5	8.2	7.2	7.7	5.0	6.5					
	45-sw	7.4	6.9	7.5	8.2	7.2	7.7	5.0	6.5					
	60-ne	7.9	7.3	7.9	8.6	7.6	8.1	5.3	6.9					
	60-sw	8.0	7.3	7.9	8.6	7.6	8.1	5.3	6.9					
0657	30-ne	6.6	6.2	6.8	7.6	6.7	7.0	4.8	5.7	5.6	5.3	5.7	6.0	6.16
	30-sw	6.6	6.2	6.8	7.6	6.6	7.0	4.7	5.7	5.6	5.3	5.6	6.0	6.14
	45-ne	7.3	6.8	7.4	8.2	7.2	7.6	5.2	6.3	6.1	5.9	6.3	6.7	6.74
	45-sw	7.3	6.8	7.4	8.2	7.2	7.6	5.2	6.3	6.2	5.9	6.3	6.8	6.75
	60-ne	7.9	7.3	7.9	8.7	7.7	8.1	5.5	6.8	6.7	6.4	6.8	7.2	7.24
	60-sw	7.8	7.2	7.9	8.7	7.6	8.0	5.5	6.7	6.6	6.3	6.8	7.2	7.19
0757	30-ne	7.1	6.6	7.0	7.8	6.7	7.0	4.7	5.9	5.6				
	30-sw	7.0	6.6	7.0	7.7	6.7	6.9	4.7	5.8	5.5				
	45-ne	7.7	7.1	7.6	8.3	7.3	7.5	5.1	6.5	6.1				
	45-sw	7.8	7.2	7.7	8.4	7.3	7.6	5.1	6.5	6.1				

	60-ne	8.4	7.7	8.1	8.8	7.8	8.1	5.5	6.9	6.6				
	60-sw	8.4	7.7	8.1	8.8	7.7	8.0	5.5	6.9	6.6				
0857	30-ne	6.3	5.8	6.3	7.0	6.1	6.2	4.2	5.3	5.0				
	30-sw	6.2	5.8	6.3	7.0	6.1	6.2	4.2	5.3	4.9				
	45-ne	7.2	6.6	7.1	7.8	6.8	7.0	4.8	6.0	5.7				
	45-sw	7.2	6.6	7.1	7.8	6.8	7.0	4.8	6.0	5.6				
	60-ne	7.9	7.2	7.7	8.4	7.4	7.6	5.2	6.6	6.3				
	60-sw	7.9	7.2	7.7	8.4	7.4	7.6	5.2	6.5	6.1				
Medicine Lodge	10	4.3	4.8	5.0	5.4	4.0	4.4	2.9	3.6	3.8	3.7	3.8	4.2	4.15
Woodward	10	5.2	5.0	5.4	6.0	5.7	5.7	3.5	4.4	4.3	4.0	4.4	4.4	4.83
Alva	10	4.9	5.0	5.4	6.2	5.0	5.2	3.4	4.0	3.9	4.0	4.2	4.7	4.67
Fairview	10	4.7	4.4	4.8	5.6	4.6	5.0	3.1	3.8	3.6	3.5	3.8	4.1	4.24
MERRA-2 West	50	7.7	7.2	7.8	8.6	7.6	7.8	5.1	7.0	6.7	6.8	6.9	7.2	7.20
MERRA-2 East	50	7.5	7.0	7.7	8.4	7.2	7.6	4.9	6.7	6.4	6.6	6.8	7.2	7.00

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	4.6	4.8	5.0										
	31-e	6.3	6.3	6.6										
	31-w	6.4	6.3	6.6										
	47-e	6.8	6.9	7.2										
	47-w	7.0	6.9	7.3										
	56.5-e	7.2	7.2	7.6										
	56.5-w	7.4	7.2	7.6										
0257	30-ne	6.2	6.1	6.6										
	30-sw	6.2	6.1	6.6										
	45-ne	6.8	6.7	7.2										
	45-sw	6.8	6.6	7.1										
	60-ne	7.2	7.1	7.6										
	60-sw	7.3	7.1	7.6										
0357	30-ne	6.3	6.4	6.7										
	30-sw	6.3	6.4	6.7										
	45-ne	6.8	6.9	7.2										
	45-sw	6.8	6.9	7.2										
	60-ne	x	x	x										
	60-sw	7.2	7.3	7.6										
0457	30-ne	5.8	6.0	6.3										
	30-sw	5.7	5.9	6.3										
	45-ne	6.2	6.4	6.8										
	45-sw	6.2	6.4	6.8										
	60-ne	6.7	6.8	7.2										
	60-sw	6.6	6.8	7.2										
0657	30-ne	5.7	6.2	6.4										
	30-sw	5.7	6.0	6.4										
	45-ne	6.3	6.6	7.0										
	45-sw	6.4	6.5	7.0										
	60-ne	6.8	7.0	7.5										
	60-sw	6.8	6.9	7.4										
Medicine Lodge	10	3.9	4.6	4.5										
Woodward	10	4.5	4.5	4.9										
Alva	10	4.5	4.9	5.0										
Fairview	10	4.1	4.6	4.4										
MERRA-2 West	50	7.0	6.9	7.2										
MERRA-2 East	50	6.9	6.9	7.1										

Data Recovery Key: black = 90-100%; green = 75-90%; blue = 50-75%; orange = 25-50%; purple = 10-25%; "x" = 0-10%.
All values represent full-month estimates when data recovery is less than 100%.

Composite Mean Wind Speeds (mps), March 2008-January 2011 and October 2015-March 2019

this includes the entire period of record, with likely dry friction whip November 2008-January 2011

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	4.6	5.0	5.5	5.9	5.0	5.1	4.2	4.0	4.4	4.7	4.9	4.8	4.84
	31-e	6.4	6.7	7.3	7.6	6.5	6.7	5.7	5.6	6.1	6.4	6.7	6.5	6.51
	31-w	6.4	6.6	7.3	7.6	6.5	6.6	5.6	5.5	6.1	6.5	6.7	6.5	6.51
	47-e	7.0	7.3	8.0	8.4	7.2	7.4	6.3	6.2	6.8	7.2	7.5	7.3	7.22
	47-w	7.1	7.3	8.0	8.3	7.2	7.3	6.2	6.2	6.8	7.2	7.5	7.3	7.21
	57-e	7.3	7.6	8.4	8.7	7.5	7.7	6.6	6.5	7.1	7.5	7.8	7.6	7.55
	57-w	7.5	7.7	8.4	8.8	7.6	7.7	6.6	6.5	7.2	7.6	7.9	7.7	7.60
Medicine Lodge	10	3.8	4.4	5.0	5.2	4.1	4.1	3.5	3.4	3.7	3.9	4.0	4.1	4.08
Woodward	10	4.5	4.8	5.5	6.0	5.2	5.2	4.4	4.2	4.4	4.7	4.8	4.6	4.86
Alva	10	4.5	4.9	5.5	5.8	4.7	4.8	4.1	3.9	4.2	4.5	4.6	4.6	4.67
Fairview	10	4.2	4.6	5.0	5.1	4.1	4.5	3.8	3.6	3.7	4.0	4.2	4.2	4.25
MERRA-2 West	50	6.9	7.2	8.0	8.5	7.4	7.5	6.4	6.4	6.9	7.4	7.5	7.1	7.27
MERRA-2 East	50	6.8	7.2	7.9	8.4	7.2	7.2	6.2	6.2	6.7	7.2	7.4	7.0	7.12

Composite Mean Wind Speeds (mps), March-October 2008 and November 2015-March 2019

no dry friction whip

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	4.7	5.1	5.5	5.9	5.1	5.1	4.2	3.9	4.5	5.0	4.8	4.7	4.88
	31-e	6.5	6.8	7.3	7.6	6.8	6.8	5.7	5.4	6.2	6.8	6.6	6.5	6.58
	31-w	6.5	6.8	7.2	7.6	6.7	6.7	5.6	5.4	6.2	6.9	6.7	6.5	6.56
	47-e	7.1	7.5	8.0	8.3	7.4	7.4	6.3	6.0	6.8	7.6	7.4	7.2	7.25
	47-w	7.2	7.5	8.0	8.3	7.4	7.4	6.2	6.0	6.8	7.6	7.4	7.3	7.25
	56.5-e	7.5	7.9	8.3	8.6	7.8	7.7	6.6	6.3	7.2	7.9	7.7	7.6	7.59
	56.5-w	7.6	7.9	8.3	8.7	7.8	7.8	6.6	6.3	7.2	8.0	7.8	7.6	7.64
Medicine Lodge	10	3.9	4.5	4.9	5.1	4.2	4.1	3.5	3.2	3.7	4.2	3.9	4.0	4.12
Woodward	10	4.7	4.9	5.5	6.0	5.3	5.2	4.3	3.9	4.4	4.9	4.7	4.5	4.86
Alva	10	4.5	4.9	5.5	5.7	4.8	4.8	4.1	3.8	4.1	4.8	4.4	4.5	4.65
Fairview	10	4.2	4.6	4.9	5.0	4.3	4.5	3.7	3.4	3.6	4.2	4.1	4.0	4.20
MERRA-2 West	50	7.1	7.4	7.9	8.3	7.6	7.4	6.4	6.2	6.9	7.8	7.4	7.1	7.28
MERRA-2 East	50	6.9	7.2	7.8	8.2	7.4	7.2	6.2	6.0	6.6	7.6	7.3	7.0	7.11

Composite Mean Wind Speeds (mps), October 2015-March 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0257	30-ne	6.3	6.6	7.3	7.5	6.5	6.4	5.5	5.4	6.1	6.7	6.5	6.3	6.43
	30-sw	6.2	6.5	7.2	7.4	6.5	6.4	5.5	5.3	6.0	6.7	6.4	6.3	6.38
	45-ne	6.9	7.2	7.9	8.1	7.2	7.0	6.1	6.0	6.7	7.4	7.1	7.0	7.06
	45-sw	6.9	7.2	7.9	8.1	7.1	7.0	6.0	5.9	6.7	7.4	7.1	7.0	7.01
	60-ne	7.4	7.7	8.4	8.6	7.6	7.5	6.5	6.4	7.2	7.9	7.6	7.5	7.53
	60-sw	7.4	7.7	8.4	8.6	7.6	7.4	6.5	6.1	7.2	7.9	7.6	7.5	7.47
0357	30-ne	6.4	6.7	7.3	7.5	6.5	6.5	5.4	5.4	6.0	6.7	6.5	6.4	6.43
	30-sw	6.4	6.7	7.3	7.5	6.5	6.5	5.4	5.4	6.0	6.6	6.5	6.4	6.42
	45-ne	6.9	7.2	7.8	8.0	7.0	7.0	5.8	5.9	6.5	7.2	7.1	6.9	6.96
	45-sw	7.0	7.2	7.8	8.0	7.1	7.0	5.8	5.9	6.5	7.2	7.1	7.0	6.96
	60-ne	7.5	7.8	8.4	8.6	7.6	7.5	6.3	6.3	7.1	7.8	7.6	7.5	7.48
	60-sw	7.4	7.7	8.3	8.5	7.5	7.4	6.2	6.2	6.9	7.7	7.6	7.4	7.40
0157	57-w	7.6	7.9	8.3	8.6	7.6	7.6	6.3	6.4	7.4	8.0	7.8	7.6	7.59

Composite Mean Wind Speeds (mps), April 2016-March 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0457	30-ne	6.2	6.0	6.8	7.2	6.1	6.0	5.1	5.0	5.6	6.3	5.7	6.0	6.02
	30-sw	6.2	6.0	6.8	7.2	6.1	6.0	5.1	4.9	5.6	6.3	5.7	6.0	5.99
	45-ne	6.7	6.6	7.4	7.7	6.7	6.6	5.6	5.5	6.2	6.9	6.3	6.5	6.55
	45-sw	6.7	6.5	7.3	7.7	6.7	6.5	5.6	5.4	6.2	6.9	6.3	6.5	6.53
	60-ne	7.2	7.0	7.8	8.2	7.1	7.0	6.0	5.9	6.7	7.4	6.7	7.0	6.99
	60-sw	7.2	6.9	7.8	8.1	7.1	6.9	5.9	5.9	6.6	7.3	6.7	7.0	6.95
0657	30-ne	6.1	6.2	6.9	7.4	6.4	6.3	5.3	5.2	5.8	6.4	5.8	5.9	6.14
	30-sw	6.1	6.1	6.9	7.4	6.4	6.3	5.3	5.1	5.8	6.3	5.8	5.9	6.10
	45-ne	6.7	6.7	7.5	8.0	6.9	6.8	5.8	5.7	6.4	7.0	6.4	6.6	6.70
	45-sw	6.8	6.7	7.5	8.0	6.9	6.8	5.8	5.7	6.4	7.0	6.5	6.6	6.71
	60-ne	7.3	7.2	8.0	8.5	7.4	7.3	6.2	6.1	6.9	7.5	7.0	7.1	7.20
	60-sw	7.3	7.2	8.0	8.4	7.4	7.2	6.1	6.1	6.8	7.5	7.0	7.1	7.16
0157	57-w	7.9	7.7	8.2	8.6	7.6	7.6	6.3	6.4	7.4	8.0	7.5	7.6	7.56

Composite Mean Wind Speeds (mps), April 2016-September 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0557	30-ne	6.3	6.2	7.2	7.3	6.3	6.3	5.4	5.2	5.9	7.0	5.9	5.9	6.24
	30-sw	6.3	6.3	7.2	7.3	6.4	6.3	5.4	5.3	5.9	7.0	5.9	5.9	6.25
	45-ne	7.0	6.9	7.8	7.9	6.9	6.9	5.9	5.8	6.4	7.7	6.5	6.5	6.85
	45-sw	7.0	6.9	7.8	7.9	6.9	6.9	5.9	5.8	6.4	7.7	6.5	6.5	6.85
	60-ne	7.4	7.3	8.3	8.3	7.3	7.3	6.2	6.2	6.9	8.2	6.9	6.9	7.27
	60-sw	7.5	7.4	8.2	8.3	7.3	7.3	6.3	6.2	6.9	8.2	7.0	6.9	7.29
0757	30-ne	6.7	6.5	7.3	7.4	6.5	6.3	5.3	5.3	5.9	7.1	6.3	6.4	6.42
	30-sw	6.7	6.5	7.2	7.4	6.5	6.3	5.3	5.2	5.8	7.1	6.3	6.3	6.38
	45-ne	7.4	7.2	7.9	8.0	7.0	6.9	5.8	5.8	6.5	7.8	7.0	7.0	7.01
	45-sw	7.5	7.2	7.9	8.0	7.1	6.9	5.8	5.8	6.5	7.9	7.0	7.1	7.04
	60-ne	7.9	7.7	8.4	8.5	7.5	7.3	6.2	6.3	7.0	8.4	7.5	7.6	7.52
	60-sw	8.0	7.7	8.4	8.5	7.5	7.3	6.2	6.3	7.0	8.4	7.5	7.6	7.52
0857	30-ne	6.0	5.8	6.6	6.7	5.8	5.7	4.8	4.8	5.3	6.3	5.6	5.6	5.74
	30-sw	6.0	5.8	6.5	6.7	5.8	5.7	4.8	4.8	5.2	6.3	5.6	5.6	5.74
	45-ne	6.8	6.6	7.4	7.5	6.6	6.4	5.4	5.5	6.0	7.3	6.4	6.4	6.53
	45-sw	6.9	6.6	7.3	7.5	6.5	6.4	5.4	5.4	5.9	7.2	6.5	6.4	6.51
	60-ne	7.5	7.2	8.0	8.1	7.1	6.9	5.9	6.0	6.6	7.9	7.0	7.0	7.09
	60-sw	7.5	7.2	7.9	8.0	7.1	6.9	5.8	5.9	6.5	7.9	7.1	7.0	7.06
0157	57-w	8.1	7.9	8.5	8.6	7.6	7.6	6.3	6.4	7.4	8.8	7.6	7.5	7.69

L-T Speeds. Estimated Long-Term Mean Annual Wind Speeds (mps)
Sundance Project, Oklahoma
American Electric Power

Estimated Long-Term Winds for Site 0157 Based on Its Composite Mean Annual Wind Speed Ratios to the Reference Stations (starting 2015)...

Site	Level (m)	Composite Mean Oct 2015 to Mar 2019	Estimated Long-Term Based on...							Shears		Extrapolated to	
			Medicine Lodge	Woodward	Alva	Fairview	MERRA-2 West	MERRA-2 East	Combined*	Levels (m)	Exponent	80 m	88.6 m
0157	10-w	4.88	4.91	4.88	4.89	4.94	4.87	4.87	4.88	10-31	0.263		
	31-e	6.58	6.62	6.58	6.59	6.66	6.57	6.57	6.59	31-47	0.237		
	31-w	6.56	6.60	6.56	6.57	6.64	6.54	6.55	6.57	47-56.5	0.263		
	47-e	7.25	7.30	7.25	7.27	7.34	7.24	7.24	7.26				
	47-w	7.25	7.30	7.25	7.26	7.34	7.23	7.24	7.26				
	56.5-e	7.59	7.64	7.59	7.60	7.68	7.57	7.58	7.60	10-56.5	0.257	8.33	8.56
	56.5-w	7.64	7.69	7.64	7.65	7.73	7.62	7.63	7.65				
Medicine Lodge	10	4.12	4.11										
Woodward	10	4.86		4.86									
Alva	10	4.65			4.68								
Fairview	10	4.20				4.30							
MERRA-2 West	50	7.28					7.26						
MERRA-2 East	50	7.11						7.11					

* weighting Medicine Lodge 9%, Woodward, Alva and Fairview each 12%, MERRA-2 West 30%, and MERRA-2 East 25%

Estimates for All Other Sites Based on Their Composite Mean Annual Wind Speed Ratios to Site 0157...

Site	Level (m)	Composite Mean Nov 2015 to Mar 2019	Estimated Long-Term	Shears		Extrapolated to	
				Levels (m)	Exponent	80 m	88.6 m
0257	30-ne	6.43	6.48				
	30-sw	6.38	6.43	30-45	0.232		
	45-ne	7.06	7.11	45-60	0.221		
	45-sw	7.01	7.07				
	60-ne	7.53	7.59	30-60	0.227	8.07	8.26
	60-sw	7.47	7.52				
0357	30-ne	6.43	6.48				
	30-sw	6.42	6.47	30-45	0.196		
	45-ne	6.96	7.01	45-60	0.231		
	45-sw	6.96	7.01				
	60-ne	7.48	7.53	30-60	0.210	7.96	8.13
	60-sw	7.40	7.45				
0157	56.5-w	7.59	7.65				

Site	Level (m)	Composite Mean Apr 2016 to Mar 2019	Estimated Long-Term	Shears		Extrapolated to	
				Levels (m)	Exponent	80 m	88.6 m
0457	30-ne	6.02	6.09				
	30-sw	5.99	6.06	30-45	0.211		
	45-ne	6.55	6.63	45-60	0.221		
	45-sw	6.53	6.60				
	60-ne	6.99	7.08	30-60	0.215	7.50	7.67
	60-sw	6.95	7.03				
0657	30-ne	6.14	6.21				
	30-sw	6.10	6.18	30-45	0.226		
	45-ne	6.70	6.78	45-60	0.236		
	45-sw	6.71	6.79				
	60-ne	7.20	7.28	30-60	0.230	7.76	7.95
	60-sw	7.16	7.25				
0157	56.5-w	7.56	7.65				

Site	Level (m)	Composite Mean Apr 2016 to Sep 2018	Estimated Long-Term	Shears		Extrapolated to	
				Levels (m)	Exponent	80 m	88.6 m
0557	30-ne	6.24	6.21				
	30-sw	6.25	6.21	30-45	0.228		
	45-ne	6.85	6.81	45-60	0.211		
	45-sw	6.85	6.81				
	60-ne	7.27	7.23	30-60	0.221	7.71	7.89
	60-sw	7.29	7.25				
0757	30-ne	6.42	6.38				
	30-sw	6.38	6.34	30-45	0.231		
	45-ne	7.01	6.97	45-60	0.237		
	45-sw	7.04	7.00				
	60-ne	7.52	7.48	30-60	0.233	8.00	8.19
	60-sw	7.52	7.48				
0857	30-ne	5.74	5.71				
	30-sw	5.74	5.70	30-45	0.315		
	45-ne	6.53	6.49	45-60	0.286		
	45-sw	6.51	6.47				
	60-ne	7.09	7.05	30-60	0.303	7.68	7.92
	60-sw	7.06	7.02				
0157	56.5-w	7.69	7.65				

Sodar. Sodar Data Analysis, Triton near Site 0757
Sundance Project, OK
American Electric Power

Latitude (WGS84): 36° 32.717'N
Longitude (WGS84): 98° 42.227'W
This is 84 m northeast of Site 0757

Data Period: 5 October 2016-16 November 2017

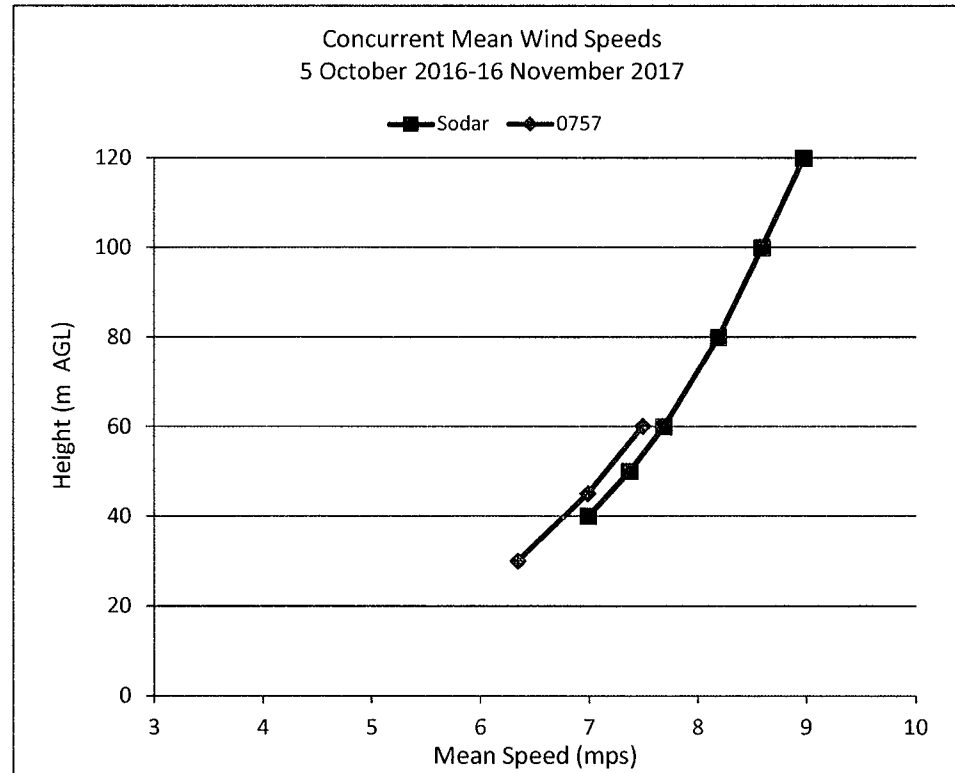
Mean Wind Speeds (mps)...

Site	Level (m)	% Data Recovery*	Mean Speed*
Sodar	40	84	6.99
	50	84	7.37
	60	84	7.68
	80	84	8.19
	100	84	8.59
	120	77	8.97
	140	68	9.33
	160	59	9.63
	180	50	9.93
	200	42	10.19
0757	30	77	6.34
	45	77	6.99
	60	77	7.49

Mean Shear Exponents...

Site	Levels (m)	Mean Shear*
Sodar	40-50	0.239
	50-60	0.228
	60-80	0.222
	80-100	0.214
	100-120	0.239
	120-140	0.249
	140-160	0.244
	160-180	0.252
	180-200	0.247
0757	30-45	0.238
	45-60	0.243
	30-60	0.240

* to be incorporated into these tables, there must be valid data at all sodar levels up to 100 m



En Sims. Gross Annual Energy Simulations

Sundance Project, Oklahoma, Site **0157**

American Electric Power

Using Extrapolated 80-m Data, April 2008-December 2010 and January 2016-March 2019

Turbine: GE-2.82/127 (power curve for moderate turbulence)

Air Density: 1.15 kg/m³

Speed (mps)	Hours/Year at Mean Speed of:				Power (kW)	Energy (kWh) at Mean Speed of:			
	6 mps	7 mps	8 mps	9 mps		6 mps	7 mps	8 mps	9 mps
0	25.6	18.9	15.0	11.9	0	0	0	0	0
1	197.4	138.1	102.6	81.6	0	0	0	0	0
2	527.7	367.1	263.4	192.8	0	0	0	0	0
3	846.6	620.4	459.9	353.8	27	22,859	16,750	12,418	9,552
4	1053.0	812.7	635.8	504.4	179	188,494	145,471	113,804	90,280
5	1187.3	938.1	762.4	617.5	401	476,121	376,185	305,716	247,625
6	1240.5	1033.1	845.3	704.1	712	883,247	735,568	601,845	501,308
7	1240.7	1063.2	912.2	765.0	1138	1,411,930	1,209,907	1,038,050	870,520
8	997.1	1070.1	929.8	815.5	1663	1,658,157	1,779,612	1,546,233	1,356,099
9	655.3	939.1	940.1	826.4	2189	1,434,436	2,055,683	2,057,825	1,809,082
10	385.3	682.9	865.7	838.6	2575	992,153	1,758,443	2,229,175	2,159,408
11	208.5	450.9	682.3	795.8	2768	577,064	1,248,164	1,888,538	2,202,843
12	111.0	276.2	492.3	668.7	2819	313,002	778,603	1,387,818	1,885,184
13	52.3	165.1	330.0	507.6	2820	147,528	465,530	930,586	1,431,362
14	18.8	94.5	214.1	369.0	2820	52,908	266,592	603,675	1,040,503
15	8.2	50.9	132.7	255.4	2820	23,261	143,665	374,222	720,136
16	3.0	21.3	82.5	170.1	2820	8,437	60,083	232,765	479,644
17	0.8	9.8	48.6	111.4	2820	2,365	27,519	137,120	314,138
18	0.3	4.8	23.4	73.1	2820	946	13,405	65,997	206,114
19	0.3	1.5	10.6	45.8	2820	788	4,258	29,884	129,156
20	0.1	0.7	6.1	24.7	2820	158	2,050	17,268	69,624
21	0	0.3	3.0	12.4	2820	0	710	8,437	34,930
22	0.0	0.2	1.0	7.0	2820	79	631	2,839	19,634
23	0	0.1	0.6	4.0	1200	0	168	738	4,798
24	0	0	0.2	1.9	1200	0	0	268	2,248
25	0	0	0.2	0.7	1200	0	0	235	805
26	0	0.0	0.2	0.4	1200	0	34	235	537
27	0	0	0	0.2	1200	0	0	0	268
28	0	0	0	0.2	1200	0	0	0	201
29	0	0	0.0	0.2	1200	0	0	34	268
30+	0	0	0	0.0	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		8,193,933	11,089,029	13,585,725	15,586,269

Gross Capacity Factor (%): 33.17 44.89 55.00 63.09

Gross Annual Energy Simulations
Sundance Project, Oklahoma, Site 0257
American Electric Power
Using Extrapolated 80-m Data, January 2016-December 2018
Turbine: GE-2.82/127 (power curve for moderate turbulence)
Air Density: 1.15 kg/m³

Speed (mps)	Hours/Year at Mean Speed of:				Power (kW)	Energy (kWh) at Mean Speed of:			
	6 mps	7 mps	8 mps	9 mps		6 mps	7 mps	8 mps	9 mps
0	20.7	15.3	11.9	8.9	0	0	0	0	0
1	177.0	119.3	90.1	68.9	0	0	0	0	0
2	494.8	342.6	239.0	175.5	0	0	0	0	0
3	831.1	600.5	442.7	335.2	27	22,440	16,213	11,952	9,051
4	1060.0	805.9	619.2	489.1	179	189,740	144,253	110,835	87,557
5	1229.0	956.9	761.0	612.6	401	492,829	383,699	305,142	245,653
6	1295.5	1063.8	866.0	702.4	712	922,377	757,461	616,627	500,113
7	1259.3	1112.1	941.7	786.5	1138	1,433,090	1,265,601	1,071,626	895,054
8	998.5	1097.0	976.4	845.2	1663	1,660,586	1,824,315	1,623,738	1,405,525
9	672.0	931.1	966.6	869.8	2189	1,470,980	2,038,114	2,115,939	1,903,966
10	357.5	700.1	862.0	865.0	2575	920,659	1,802,657	2,219,727	2,227,488
11	193.7	451.5	692.5	795.3	2768	536,080	1,249,670	1,916,913	2,201,484
12	92.1	251.8	504.5	665.2	2819	259,763	709,745	1,422,165	1,875,137
13	42.3	151.3	316.2	524.8	2820	119,146	426,533	891,785	1,479,960
14	19.4	78.0	195.6	370.4	2820	54,773	220,034	551,503	1,044,456
15	11.3	41.4	120.2	237.1	2820	31,951	116,628	338,866	668,603
16	4.1	18.8	67.8	155.9	2820	11,490	52,884	191,232	439,597
17	1.0	12.4	39.4	102.4	2820	2,833	34,941	111,119	288,657
18	0.2	6.4	19.4	60.4	2820	472	18,100	54,773	170,298
19	0.2	2.6	13.1	36.8	2820	630	7,397	36,830	103,879
20	0.1	0.8	8.1	20.3	2820	315	2,204	22,979	57,133
21	0	0.2	4.0	12.9	2820	0	472	11,332	36,358
22	0.1	0.2	1.4	8.9	2820	157	472	3,935	25,183
23	0	0.2	0.7	5.7	1200	0	201	804	6,898
24	0	0	0.2	2.7	1200	0	0	201	3,215
25	0	0	0.2	0.9	1200	0	0	201	1,139
26	0	0.1	0.1	0.5	1200	0	67	134	603
27	0	0	0.1	0.1	1200	0	0	67	134
28	0	0	0	0.1	1200	0	0	0	134
29	0	0	0	0.2	1200	0	0	0	201
30+	0	0	0.1	0.1	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		8,130,309	11,071,662	13,630,422	15,677,475
Gross Capacity Factor (%):						32.91	44.82	55.18	63.46

Gross Annual Energy Simulations
Sundance Project, Oklahoma, Site 0357
American Electric Power
Using Extrapolated 80-m Data, January 2016-December 2018
Turbine: GE-2.82/127 (power curve for moderate turbulence)
Air Density: 1.15 kg/m³

Speed (mps)	Hours/Year at Mean Speed of:				Power (kW)	Energy (kWh) at Mean Speed of:			
	6 mps	7 mps	8 mps	9 mps		6 mps	7 mps	8 mps	9 mps
0	31.1	23.1	17.1	13.5	0	0	0	0	0
1	225.4	166.7	127.5	101.6	0	0	0	0	0
2	519.9	359.2	266.5	204.7	0	0	0	0	0
3	832.8	618.5	453.3	345.6	27	22,487	16,698	12,238	9,331
4	1003.3	777.3	632.8	502.2	179	179,594	139,141	113,272	89,892
5	1160.6	907.8	714.3	595.4	401	465,390	364,040	286,449	238,752
6	1276.9	1007.2	826.9	666.3	712	909,148	717,108	588,763	474,374
7	1275.6	1091.2	886.2	750.1	1138	1,451,579	1,241,805	1,008,517	853,649
8	1013.8	1112.5	957.1	798.4	1663	1,685,981	1,850,075	1,591,629	1,327,704
9	656.3	954.8	985.2	851.2	2189	1,436,676	2,090,166	2,156,664	1,863,290
10	374.0	693.3	880.5	877.5	2575	962,990	1,785,349	2,267,347	2,259,439
11	202.8	444.6	694.6	813.3	2768	561,405	1,230,701	1,922,564	2,251,184
12	102.9	270.3	488.0	674.0	2819	289,967	762,069	1,375,534	1,899,899
13	46.9	156.0	327.7	518.2	2820	132,122	439,987	924,225	1,461,216
14	22.7	87.8	204.7	362.8	2820	64,093	247,552	577,306	1,022,961
15	10.0	44.0	127.5	247.5	2820	28,188	124,091	359,517	698,089
16	3.3	23.3	75.8	165.6	2820	9,291	65,825	213,695	467,073
17	0.9	13.2	42.4	107.8	2820	2,520	37,322	119,524	303,928
18	0.3	5.8	24.6	66.5	2820	945	16,220	69,447	187,553
19	0.3	1.6	14.0	40.0	2820	787	4,567	39,369	112,910
20	0.1	0.6	7.4	25.2	2820	157	1,732	20,944	71,021
21	0	0.3	3.6	14.4	2820	0	945	10,078	40,471
22	0.2	0.3	1.0	9.5	2820	472	787	2,835	26,928
23	0.1	0	0.3	4.7	1200	67	0	402	5,629
24	0	0.1	0.3	2.1	1200	0	67	402	2,479
25	0	0.2	0.2	0.9	1200	0	201	201	1,139
26	0	0	0.1	0.3	1200	0	0	134	335
27	0	0.1	0.1	0.2	1200	0	67	67	268
28	0	0	0	0.3	1200	0	0	0	335
29	0	0	0.2	0.1	1200	0	0	201	134
30+	0	0	0.1	0.3	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		8,203,858	11,136,514	13,661,324	15,669,987
Gross Capacity Factor (%):						33.21	45.08	55.30	63.43

Gross Annual Energy Simulations
Sundance Project, Oklahoma, Site 0457
American Electric Power
Using Extrapolated 80-m Data, April 2016-April 2019
Turbine: GE-2.82/127 (power curve for moderate turbulence)
Air Density: 1.15 kg/m³

Speed (mps)	Hours/Year at Mean Speed of:				Power (kW)	Energy (kWh) at Mean Speed of:			
	6 mps	7 mps	8 mps	9 mps		6 mps	7 mps	8 mps	9 mps
0	42.6	31.9	24.0	17.9	0	0	0	0	0
1	241.4	182.1	142.9	116.0	0	0	0	0	0
2	534.2	371.5	278.6	217.1	0	0	0	0	0
3	845.7	623.4	464.9	353.2	27	22,834	16,831	12,552	9,537
4	1060.8	801.5	633.5	504.5	179	189,880	143,476	113,396	90,309
5	1226.8	971.1	750.0	612.7	401	491,949	389,410	300,762	245,694
6	1239.0	1057.6	880.7	707.0	712	882,186	753,041	627,048	503,371
7	1135.5	1063.2	933.3	802.4	1138	1,292,196	1,209,975	1,062,053	913,110
8	909.0	996.5	924.3	828.0	1663	1,511,747	1,657,254	1,537,101	1,376,959
9	630.2	835.3	885.6	821.3	2189	1,379,487	1,828,436	1,938,496	1,797,885
10	391.7	651.0	774.4	798.0	2575	1,008,602	1,676,432	1,994,110	2,054,730
11	232.9	441.3	640.8	714.0	2768	644,654	1,221,507	1,773,691	1,976,319
12	132.1	291.0	469.5	609.1	2819	372,272	820,230	1,323,492	1,716,937
13	67.0	184.6	328.0	484.0	2820	188,889	520,512	924,845	1,364,901
14	37.1	112.8	227.6	360.1	2820	104,482	318,187	641,906	1,015,574
15	18.2	62.8	153.0	259.0	2820	51,213	177,192	431,520	730,423
16	9.0	37.1	98.3	184.7	2820	25,449	104,482	277,090	520,986
17	3.8	21.2	59.6	128.8	2820	10,748	59,907	168,024	363,078
18	1.8	12.7	36.8	87.7	2820	5,058	35,881	103,849	247,215
19	0.9	6.2	22.8	56.3	2820	2,529	17,387	64,333	158,698
20	0.3	2.2	14.3	35.2	2820	790	6,323	40,307	99,265
21	0.1	1.6	7.6	25.0	2820	316	4,426	21,497	70,497
22	0	0.8	5.0	14.0	2820	0	2,371	14,226	39,517
23	0	0.3	1.7	10.4	1200	0	404	2,085	12,511
24	0	0.1	1.4	5.5	1200	0	67	1,682	6,592
25	0	0.1	0.9	3.9	1200	0	135	1,076	4,641
26	0	0	0.3	1.5	1200	0	0	404	1,749
27	0	0	0.1	1.3	1200	0	0	135	1,547
28	0	0	0.1	1.0	1200	0	0	67	1,143
29	0	0	0.1	0.2	1200	0	0	67	269
30+	0	0	0	0.3	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		8,185,280	10,963,865	13,375,814	15,323,458
Gross Capacity Factor (%):						33.13	44.38	54.15	62.03

Gross Annual Energy Simulations
Sundance Project, Oklahoma, Site 0557
American Electric Power
Using Extrapolated 80-m Data, June 2016-May 2018
Turbine: GE-2.82/127 (power curve for moderate turbulence)
Air Density: 1.15 kg/m³

Speed (mps)	Hours/Year at Mean Speed of:				Power (kW)	Energy (kWh) at Mean Speed of:			
	6 mps	7 mps	8 mps	9 mps		6 mps	7 mps	8 mps	9 mps
0	38.3	28.1	20.4	16.3	0	0	0	0	0
1	258.2	187.9	142.9	115.1	0	0	0	0	0
2	545.8	398.4	309.2	237.2	0	0	0	0	0
3	850.0	626.2	463.0	362.9	27	22,949	16,906	12,501	9,799
4	1048.7	794.5	641.2	508.9	179	187,712	142,216	114,766	91,096
5	1193.1	960.4	739.8	610.0	401	478,449	385,132	296,653	244,601
6	1218.7	1025.2	862.7	706.9	712	867,713	729,946	614,255	503,337
7	1106.2	1051.4	907.1	765.2	1138	1,258,901	1,196,533	1,032,316	870,769
8	955.1	955.7	925.7	815.5	1663	1,588,412	1,589,388	1,539,497	1,356,241
9	646.3	868.8	847.0	824.5	2189	1,414,853	1,901,697	1,854,186	1,804,842
10	396.7	682.4	780.3	762.4	2575	1,021,522	1,757,131	2,009,382	1,963,204
11	235.8	448.4	672.2	706.8	2768	652,728	1,241,205	1,860,763	1,956,330
12	138.1	288.4	485.9	635.8	2819	389,309	813,108	1,369,669	1,792,287
13	69.8	188.1	332.9	511.3	2820	196,850	530,527	938,880	1,441,995
14	36.2	120.0	226.3	366.0	2820	102,088	338,403	638,051	1,032,224
15	16.3	65.5	156.3	259.2	2820	45,845	184,798	440,728	730,923
16	4.9	37.1	105.8	185.0	2820	13,943	104,688	298,230	521,784
17	0.8	20.9	62.6	132.0	2820	2,127	59,079	176,527	372,196
18	0.5	8.5	36.4	93.4	2820	1,418	23,868	102,561	263,491
19	0.2	2.6	22.6	58.9	2820	473	7,326	63,805	166,130
20	0.2	0.6	11.5	35.0	2820	473	1,654	32,375	98,780
21	0.1	0.4	5.6	23.7	2820	236	1,182	15,833	66,877
22	0	0.2	1.4	15.3	2820	0	473	4,017	43,009
23	0	0.1	0.3	6.9	1200	0	101	302	8,246
24	0	0.2	0.3	3.5	1200	0	201	402	4,224
25	0	0	0.3	1.2	1200	0	0	302	1,408
26	0	0	0	0.2	1200	0	0	0	201
27	0	0	0.3	0.3	1200	0	0	302	302
28	0	0	0	0.2	1200	0	0	0	201
29	0	0	0	0.1	1200	0	0	0	101
30+	0	0	0	0.3	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		8,246,003	11,025,560	13,416,303	15,344,596
Gross Capacity Factor (%):						33.38	44.63	54.31	62.12

Gross Annual Energy Simulations
Sundance Project, Oklahoma, Site 0657
American Electric Power
Using Extrapolated 80-m Data, April 2016-April 2019
Turbine: GE-2.82/127 (power curve for moderate turbulence)
Air Density: 1.15 kg/m³

Speed (mps)	Hours/Year at Mean Speed of:				Power (kW)	Energy (kWh) at Mean Speed of:			
	6 mps	7 mps	8 mps	9 mps		6 mps	7 mps	8 mps	9 mps
0	29.7	21.7	16.3	12.8	0	0	0	0	0
1	214.9	154.1	116.6	90.6	0	0	0	0	0
2	518.2	368.0	268.9	205.7	0	0	0	0	0
3	847.1	607.1	451.7	346.1	27	22,873	16,392	12,197	9,344
4	1040.0	811.0	638.8	495.9	179	186,164	145,166	114,344	88,762
5	1205.7	931.6	745.8	622.1	401	483,489	373,589	299,078	249,456
6	1293.1	1052.0	847.4	689.8	712	920,701	749,040	603,368	491,150
7	1186.1	1113.0	930.6	771.1	1138	1,349,828	1,266,624	1,058,997	877,468
8	977.4	1033.6	969.7	832.9	1663	1,625,408	1,718,931	1,612,541	1,385,122
9	631.6	907.2	924.6	869.2	2189	1,382,611	1,985,854	2,023,902	1,902,639
10	377.4	665.6	826.7	825.6	2575	971,807	1,713,908	2,128,705	2,125,962
11	221.6	438.7	668.6	758.4	2768	613,502	1,214,278	1,850,593	2,099,222
12	114.4	276.1	475.2	650.2	2819	322,598	778,281	1,339,547	1,833,005
13	55.2	174.4	321.2	494.8	2820	155,585	491,737	905,839	1,395,362
14	25.6	95.9	218.0	357.4	2820	72,100	270,534	614,750	1,007,823
15	13.3	54.0	142.2	249.4	2820	37,473	152,264	401,137	703,294
16	4.7	27.8	82.8	177.6	2820	13,123	78,425	233,377	500,749
17	1.8	13.6	51.0	119.4	2820	5,060	38,264	143,884	336,784
18	1.2	8.1	28.9	71.7	2820	3,478	22,927	81,429	202,070
19	0.6	2.9	14.9	49.1	2820	1,739	8,064	42,059	138,509
20	0.2	1.4	10.0	28.2	2820	474	3,953	28,144	79,532
21	0.1	1.1	5.3	17.7	2820	158	3,162	14,863	49,964
22	0.1	0.7	1.7	10.0	2820	316	1,897	4,744	28,144
23	0	0.2	1.2	7.1	1200	0	202	1,413	8,478
24	0	0	0.9	3.0	1200	0	0	1,077	3,566
25	0	0.1	0.7	1.5	1200	0	135	807	1,749
26	0	0.1	0.3	1.0	1200	0	67	404	1,144
27	0	0	0	0.8	1200	0	0	0	1,009
28	0	0	0.1	0.7	1200	0	0	67	807
29	0	0	0.1	0.3	1200	0	0	135	336
30+	0	0	0	0.3	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		8,168,489	11,033,692	13,517,400	15,521,451
Gross Capacity Factor (%):						33.07	44.67	54.72	62.83

Gross Annual Energy Simulations
Sundance Project, Oklahoma, Site **0757**
American Electric Power
Using Extrapolated 80-m Data, June 2016-May 2018
Turbine: GE-2.82/127 (power curve for moderate turbulence)
Air Density: 1.15 kg/m³

Speed (mps)	Hours/Year at Mean Speed of:				Power (kW)	Energy (kWh) at Mean Speed of:			
	6 mps	7 mps	8 mps	9 mps		6 mps	7 mps	8 mps	9 mps
0	23.8	18.7	15.2	11.2	0	0	0	0	0
1	200.8	140.1	105.3	82.3	0	0	0	0	0
2	519.4	357.3	256.4	192.3	0	0	0	0	0
3	793.3	611.4	454.9	347.0	27	21,420	16,509	12,282	9,369
4	991.0	733.7	592.5	494.6	179	177,383	131,331	106,063	88,526
5	1190.8	915.6	695.3	555.8	401	477,501	367,156	278,812	222,881
6	1329.7	1030.2	852.4	657.1	712	946,722	733,508	606,919	467,887
7	1309.3	1141.5	901.2	771.5	1138	1,490,020	1,299,071	1,025,602	877,967
8	1041.7	1143.3	1003.2	818.1	1663	1,732,378	1,901,312	1,668,242	1,360,556
9	651.1	983.7	1005.0	892.4	2189	1,425,248	2,153,413	2,199,947	1,953,485
10	365.3	693.4	909.3	896.0	2575	940,731	1,785,615	2,341,443	2,307,258
11	192.7	436.6	709.1	832.5	2768	533,297	1,208,465	1,962,709	2,304,363
12	90.5	264.2	489.3	702.8	2819	255,099	744,692	1,379,243	1,981,107
13	36.1	149.4	317.4	515.2	2820	101,886	421,289	895,179	1,452,948
14	17.9	76.8	196.5	357.0	2820	50,469	216,568	554,215	1,006,780
15	4.5	33.1	121.8	242.1	2820	12,795	93,356	343,570	682,639
16	1.3	19.1	67.6	161.7	2820	3,554	53,787	190,504	455,883
17	0.4	8.2	31.8	100.2	2820	1,185	22,984	89,565	282,676
18	0.2	2.4	19.7	59.7	2820	474	6,871	55,682	168,231
19	0	0.8	10.7	31.3	2820	0	2,132	30,092	88,144
20	0	0.3	3.2	18.3	2820	0	711	9,004	51,654
21	0.2	0.2	1.3	11.4	2820	474	474	3,554	32,224
22	0	0	0.4	5.6	2820	0	0	1,185	15,875
23	0	0	0.3	2.4	1200	0	0	303	2,823
24	0	0.2	0.2	0.4	1200	0	202	202	504
25	0	0	0	0.4	1200	0	0	0	504
26	0	0	0	0.3	1200	0	0	0	303
27	0	0	0	0.2	1200	0	0	0	202
28	0	0	0.2	0	1200	0	0	202	0
29	0	0	0	0	1200	0	0	0	0
30+	0	0	0	0.2	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		8,170,638	11,159,444	13,754,518	15,814,790
Gross Capacity Factor (%):						33.08	45.17	55.68	64.02

Gross Annual Energy Simulations
Sundance Project, Oklahoma, Site 0857
American Electric Power
Using Extrapolated 80-m Data, June 2016-May 2018
Turbine: GE-2.82/127 (power curve for moderate turbulence)
Air Density: 1.15 kg/m³

Speed (mps)	Hours/Year at Mean Speed of:				Power (kW)	Energy (kWh) at Mean Speed of:			
	6 mps	7 mps	8 mps	9 mps		6 mps	7 mps	8 mps	9 mps
0	28.8	21.3	15.1	11.7	0	0	0	0	0
1	217.1	155.5	117.1	94.5	0	0	0	0	0
2	494.0	347.8	257.5	199.5	0	0	0	0	0
3	795.5	589.8	436.8	329.0	27	21,477	15,924	11,795	8,882
4	1001.2	753.5	598.9	479.7	179	179,220	134,881	107,207	85,865
5	1203.5	922.2	716.3	572.0	401	482,593	369,821	287,238	229,352
6	1307.9	1038.0	838.1	671.2	712	931,237	739,079	596,695	477,882
7	1313.8	1121.0	916.8	770.6	1138	1,495,102	1,275,656	1,043,302	876,924
8	1032.6	1143.5	981.1	825.3	1663	1,717,164	1,901,610	1,631,648	1,372,446
9	653.5	975.0	1010.2	868.1	2189	1,430,411	2,134,305	2,211,371	1,900,348
10	352.1	697.5	907.3	903.6	2575	906,772	1,796,018	2,336,273	2,326,753
11	192.0	435.2	705.3	831.3	2768	531,441	1,204,755	1,952,262	2,301,129
12	95.4	254.2	483.5	691.3	2819	268,840	716,512	1,362,912	1,948,676
13	44.4	146.1	310.0	517.4	2820	125,108	412,052	874,099	1,459,123
14	17.6	82.1	192.6	356.8	2820	49,759	231,498	543,084	1,006,316
15	7.7	42.8	120.6	235.1	2820	21,799	120,606	340,020	662,979
16	1.6	19.8	71.3	155.9	2820	4,502	55,919	201,168	439,774
17	1.0	9.8	41.6	98.7	2820	2,843	27,723	117,289	278,413
18	0.1	2.5	21.0	63.7	2820	237	7,108	59,237	179,606
19	0.1	1.4	10.3	41.1	2820	237	4,028	28,908	115,867
20	0.1	0.6	5.3	19.6	2820	237	1,659	14,928	55,209
21	0.1	0.1	1.3	12.0	2820	237	237	3,791	33,883
22	0	0.1	1.0	7.1	2820	0	237	2,843	19,904
23	0	0.1	0.6	2.1	1200	0	101	706	2,521
24	0	0.1	0.1	1.1	1200	0	101	101	1,311
25	0	0	0.1	0.9	1200	0	0	101	1,109
26	0	0	0.1	0.4	1200	0	0	101	504
27	0	0	0	0.1	1200	0	0	0	101
28	0	0	0.1	0.1	1200	0	0	101	101
29	0	0	0	0	1200	0	0	0	0
30+	0	0	0	0.2	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		8,169,218	11,149,830	13,727,179	15,784,979
Gross Capacity Factor (%):						33.07	45.14	55.57	63.90

Gross Annual Energy Simulations
Sundance Project, Oklahoma, Site 0357
American Electric Power
Using Extrapolated 80-m Data, January 2016-December 2018
Turbine: **GE-2.3/116** (power curve for moderate turbulence)
Air Density: 1.15 kg/m³

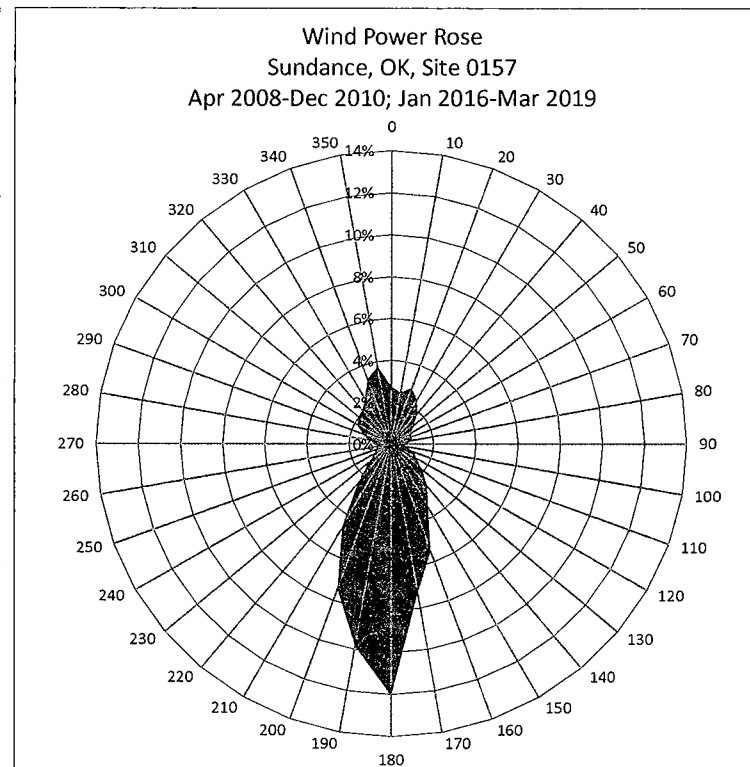
Speed (mps)	Hours/Year at Mean Speed of:				Power (kW)	Energy (kWh) at Mean Speed of:			
	6 mps	7 mps	8 mps	9 mps		6 mps	7 mps	8 mps	9 mps
0	31.1	23.1	17.1	13.5	0	0	0	0	0
1	225.4	166.7	127.5	101.6	0	0	0	0	0
2	519.9	359.2	266.5	204.7	0	0	0	0	0
3	832.8	618.5	453.3	345.6	0	0	0	0	0
4	1003.3	777.3	632.8	502.2	135	135,549	105,017	85,492	67,846
5	1160.6	907.8	714.3	595.4	326	378,463	296,043	232,945	194,157
6	1276.9	1007.2	826.9	666.3	595	760,007	599,470	492,180	396,556
7	1275.6	1091.2	886.2	750.1	952	1,214,517	1,039,002	843,814	714,237
8	1013.8	1112.5	957.1	798.4	1387	1,406,167	1,543,027	1,327,474	1,107,352
9	656.3	954.8	985.2	851.2	1803	1,183,009	1,721,116	1,775,873	1,534,299
10	374.0	693.3	880.5	877.5	2130	796,383	1,476,466	1,875,074	1,868,534
11	202.8	444.6	694.6	813.3	2278	462,023	1,012,838	1,582,226	1,852,672
12	102.9	270.3	488.0	674.0	2300	236,582	621,766	1,122,287	1,550,113
13	46.9	156.0	327.7	518.2	2300	107,759	358,855	753,800	1,191,772
14	22.7	87.8	204.7	362.8	2300	52,274	201,904	470,852	834,330
15	10.0	44.0	127.5	247.5	2300	22,990	101,209	293,223	569,364
16	3.3	23.3	75.8	165.6	2300	7,578	53,687	174,290	380,946
17	0.9	13.2	42.4	107.8	2300	2,055	30,440	97,484	247,885
18	0.3	5.8	24.6	66.5	2300	771	13,229	56,641	152,969
19	0.3	1.6	14.0	40.0	2300	642	3,725	32,109	92,090
20	0.1	0.6	7.4	25.2	2300	128	1,413	17,082	57,925
21	0	0.3	3.6	14.4	2300	0	771	8,220	33,008
22	0.2	0.3	1.0	9.5	2300	385	642	2,312	21,963
23	0.1	0	0.3	4.7	0	0	0	0	0
24	0	0.1	0.3	2.1	0	0	0	0	0
25	0	0.2	0.2	0.9	0	0	0	0	0
26	0	0	0.1	0.3	0	0	0	0	0
27	0	0.1	0.1	0.2	0	0	0	0	0
28	0	0	0	0.3	0	0	0	0	0
29	0	0	0.2	0.1	0	0	0	0	0
30+	0	0	0.1	0.3	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		6,767,283	9,180,620	11,243,379	12,868,018
Gross Capacity Factor (%):						27.39	37.16	45.51	52.09

Rose. Extrapolated 80-m Wind Rose
Sundance Project, Oklahoma, Site 0157
April 2008-December 2010 and January 2016-March 2019

Joint Frequency of 10-Minute Samples

Wind Speed (mps)...										GE-2 82/127 Energy ..		
Direction	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-25	26+	Row Total	Mean Speed	kWh Percent
0	535	1835	3030	2225	871	236	70	5	0	8806	8.2	2,348,332 2.75
10	526	2047	2890	2086	748	155	32	8	0	8492	7.9	2,141,081 2.50
20	541	2306	3429	2336	811	175	11	1	0	9610	7.8	2,412,943 2.82
30	545	2379	3199	1986	627	101	6	1	0	8844	7.5	2,082,085 2.44
40	609	2798	3116	1410	305	41	3	1	1	8284	6.8	1,632,413 1.91
50	743	2757	2724	822	119	19	1	0	0	7185	6.2	1,166,345 1.36
60	793	2767	2494	493	67	5	1	1	0	6620	5.8	929,400 1.09
70	813	2561	2320	446	41	2	2	0	0	6184	5.7	847,247 0.99
80	809	2423	2298	484	21	2	0	0	0	6037	5.7	842,181 0.98
90	930	2689	1732	237	18	0	0	2	0	5608	5.2	605,614 0.71
100	944	2921	1674	181	8	1	0	0	0	5729	5.1	567,974 0.66
110	750	2522	2242	681	45	3	0	0	0	6241	5.9	943,699 1.10
120	651	2210	2474	1015	92	6	1	2	0	6450	6.4	1,172,588 1.37
130	561	2359	3197	1394	221	15	5	1	0	7753	6.9	1,580,102 1.85
140	572	2129	3562	2399	428	55	2	0	1	9147	7.5	2,235,318 2.61
150	538	2015	3561	3507	897	84	5	2	0	10608	8.2	2,972,934 3.48
160	542	2036	3878	5615	2071	304	24	0	0	14470	9.1	4,671,799 5.46
170	573	2212	4405	6518	3411	940	116	8	0	18184	9.7	6,185,198 7.23
180	553	2304	5737	9689	6615	2373	410	35	0	27716	10.6	10,291,642 12.04
190	439	1899	4455	7794	5468	2006	418	66	1	22545	10.7	8,409,479 9.84
200	409	1598	3493	5990	4192	1281	230	64	8	17265	10.5	6,321,150 7.39
210	427	1499	2860	4121	2353	412	42	9	0	11722	9.5	3,927,988 4.59
220	410	1196	2000	2299	1001	141	13	2	0	7061	8.7	2,100,173 2.46
230	386	1024	1293	1219	456	64	19	14	0	4476	7.9	1,150,126 1.35
240	358	910	1040	800	202	51	20	6	0	3387	7.4	771,754 0.90
250	381	865	913	665	144	45	24	1	1	3039	7.1	644,226 0.75
260	332	986	864	537	129	33	23	6	0	2910	6.8	569,872 0.67
270	356	1044	1015	555	104	18	4	1	0	3097	6.6	588,208 0.69
280	374	1152	1238	1031	260	44	5	0	0	4105	7.4	948,645 1.11
290	399	1165	1319	1397	384	86	6	0	0	4755	7.8	1,209,968 1.42
300	344	1163	1571	1859	545	131	27	7	0	5646	8.4	1,590,462 1.86
310	330	1145	1575	1795	700	266	67	4	0	5882	8.8	1,716,500 2.01
320	337	1084	1721	1976	639	232	78	3	0	6069	8.7	1,789,913 2.09
330	331	1188	2096	2342	785	259	58	7	0	7067	8.8	2,122,062 2.48
340	383	1474	2692	2958	1173	367	108	15	2	9173	9.0	2,812,992 3.29
350	437	1901	3407	3305	1345	346	62	1	2	10806	8.8	3,202,301 3.75
Calms	0									0		
Totals	18959	66564	91515	84167	37293	10298	1891	271	16	310973	8.4	85,504,710 100.00

98.6 % Data Recovery

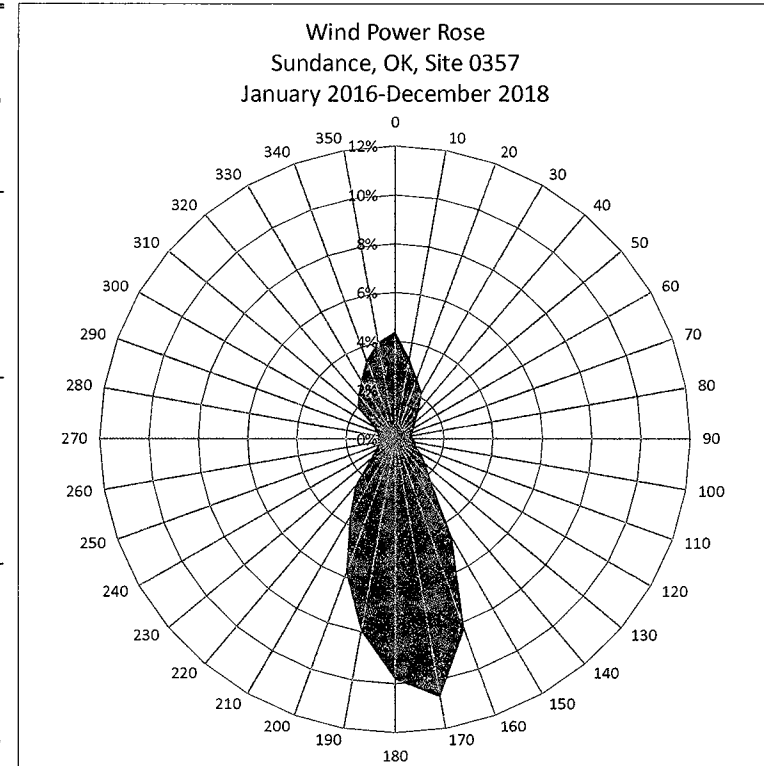


Extrapolated 80-m Wind Rose
Sundance Project, Oklahoma, Site 0357
January 2016-December 2018

Joint Frequency of 10-Minute Samples

Wind Speed (mps)...										GE-2 82/127 Energy		
Direction	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-25	26+	Row Total	Mean Speed	kWh Percent
0	330	1262	2029	1830	668	183	43	5	0	6348	8.4	1,776,319 4.39
10	342	1343	1713	1397	446	89	22	1	1	5354	7.8	1,347,004 3.33
20	369	1280	1505	1079	298	54	3	1	1	4589	7.4	1,056,972 2.61
30	359	1326	1540	841	178	31	3	0	0	4278	7.0	886,454 2.19
40	410	1464	1313	471	70	10	1	1	0	3740	6.2	606,174 1.50
50	472	1479	1059	262	32	4	2	0	0	3309	5.6	434,439 1.07
60	445	1284	867	228	33	5	1	1	0	2865	5.6	367,553 0.91
70	425	1045	793	139	36	7	3	0	0	2448	5.5	304,982 0.75
80	447	922	821	116	13	1	0	0	0	2320	5.3	280,817 0.69
90	451	1033	721	175	12	1	1	0	0	2393	5.3	286,664 0.71
100	374	1145	773	274	11	2	1	1	2	2582	5.7	349,065 0.86
110	389	1168	818	266	15	1	1	0	0	2658	5.6	360,507 0.89
120	348	1200	1096	393	59	2	0	0	0	3097	6.1	505,593 1.25
130	364	1248	1236	595	100	7	1	0	0	3549	6.5	654,687 1.62
140	378	1323	1758	859	155	28	2	0	0	4504	6.9	939,211 2.32
150	352	1551	2695	2024	535	49	6	0	0	7212	7.9	1,887,981 4.67
160	391	1635	3498	3989	1263	102	7	1	0	10886	8.7	3,349,273 8.28
170	361	1569	3890	5086	1887	290	20	3	0	13104	9.2	4,323,987 10.69
180	329	1316	3541	4259	1917	478	33	5	0	11877	9.4	3,972,111 9.82
190	341	1095	2801	3229	1716	453	48	2	0	9686	9.5	3,220,904 7.97
200	317	997	2227	2266	1167	353	72	6	0	7405	9.3	2,346,529 5.80
210	283	822	1786	1527	563	144	12	1	0	5137	8.5	1,485,629 3.67
220	273	757	1276	1056	383	81	13	3	0	3842	8.1	1,027,002 2.54
230	208	661	817	552	111	18	6	1	0	2374	7.2	527,763 1.31
240	218	592	517	364	104	22	6	5	0	1827	6.9	373,303 0.92
250	221	502	435	285	93	20	3	0	0	1559	6.7	303,173 0.75
260	217	424	357	288	125	14	2	0	0	1425	6.9	294,509 0.73
270	189	421	344	256	117	21	4	0	0	1353	7.0	279,780 0.69
280	179	443	315	249	107	54	10	0	0	1357	7.2	282,907 0.70
290	173	374	382	330	104	64	14	0	0	1441	7.6	340,005 0.84
300	195	377	460	468	105	49	6	0	1	1659	7.6	407,461 1.01
310	218	462	702	939	294	89	22	1	0	2727	8.6	799,752 1.98
320	241	611	843	1032	358	99	67	3	0	3252	8.6	936,116 2.32
330	236	731	1160	1176	398	127	75	12	0	3915	8.7	1,119,984 2.77
340	290	885	1480	1308	565	224	63	9	1	4826	8.7	1,380,069 3.41
350	330	1083	1942	1622	620	165	37	4	0	5801	8.4	1,616,121 4.00
Calms	0									0		
Totals	11465	35827	49511	41231	14657	3337	605	61	6	156699	8.0	40,430,795 100.00

99 3% Data Recovery

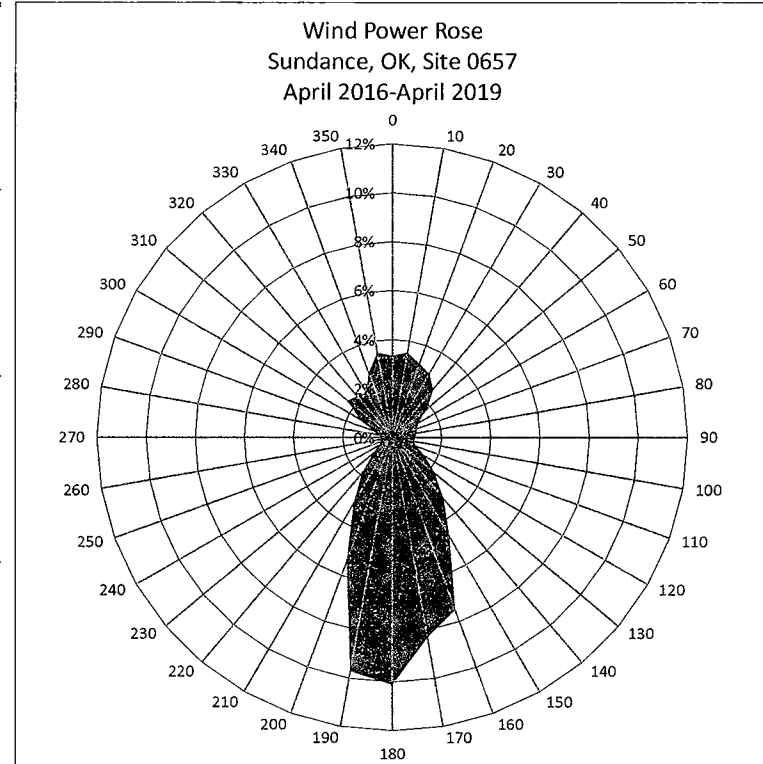


Extrapolated 80-m Wind Rose
Sundance Project, Oklahoma, Site 0657
April 2016-April 2019

Joint Frequency of 10-Minute Samples

Wind Speed (mps).										GE-2.82/127 Energy.			
Direction	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-25	26+	Row Total	Mean Speed	kWh	Percent
0	241	962	1528	1187	561	134	34	3	0	4650	8.4	1,278,633	3.36
10	287	1099	1662	1307	503	135	33	4	1	5031	8.2	1,340,047	3.52
20	281	1169	1697	1148	434	109	7	1	0	4847	7.9	1,221,985	3.21
30	272	1282	1586	995	464	118	16	0	2	4734	7.8	1,148,217	3.02
40	363	1451	1549	814	318	93	6	1	0	4593	7.2	977,536	2.57
50	454	1542	1587	474	117	19	5	1	0	4199	6.3	699,162	1.84
60	342	1276	1021	319	60	7	0	2	0	3027	6.0	457,954	1.20
70	300	1096	965	272	29	7	1	1	0	2670	6.0	401,024	1.05
80	301	1048	914	246	27	2	0	0	0	2538	5.9	371,218	0.98
90	371	1041	765	266	27	4	2	0	0	2476	5.8	350,782	0.92
100	343	1113	731	231	26	3	0	0	0	2446	5.7	331,093	0.87
110	403	1154	862	286	24	2	0	0	0	2729	5.7	382,381	1.00
120	467	1212	1156	493	54	10	4	0	0	3397	6.1	566,085	1.49
130	412	1387	1651	805	94	15	5	0	0	4369	6.7	853,427	2.24
140	455	1440	2130	1279	206	10	2	1	0	5522	7.2	1,236,692	3.25
150	411	1410	2531	2095	338	35	2	0	0	6821	7.8	1,768,750	4.65
160	442	1733	3392	3390	841	105	10	1	0	9913	8.3	2,853,661	7.50
170	455	1827	3712	3426	1143	229	26	1	0	10820	8.5	3,156,916	8.29
180	385	1647	3657	4049	1885	379	27	3	0	12031	9.2	3,846,024	10.11
190	398	1407	3566	3660	1960	417	33	3	0	11443	9.3	3,694,084	9.71
200	392	1247	2511	1946	882	182	23	14	0	7196	8.5	2,033,137	5.34
210	393	1159	1854	1128	347	52	6	16	0	4954	7.6	1,185,030	3.11
220	357	960	1313	641	158	22	7	0	0	3458	7.0	718,093	1.89
230	363	882	787	321	43	10	5	1	0	2411	6.0	383,255	1.01
240	350	668	487	178	38	11	0	0	0	1733	5.6	239,234	0.63
250	277	497	332	161	40	17	2	1	0	1326	5.8	196,198	0.52
260	277	545	307	120	30	22	10	0	0	1309	5.6	172,537	0.45
270	262	564	289	86	39	20	6	2	0	1268	5.5	156,360	0.41
280	275	588	390	147	55	42	7	1	0	1505	6.0	228,338	0.60
290	230	592	426	230	87	52	23	0	0	1640	6.7	300,694	0.79
300	256	681	735	558	157	62	16	2	0	2466	7.4	562,283	1.48
310	234	723	895	1035	291	74	29	2	0	3282	8.2	893,089	2.35
320	231	669	885	820	290	158	64	2	0	3117	8.5	846,604	2.22
330	219	646	1009	739	294	92	50	7	0	3057	8.2	803,511	2.11
340	207	735	1205	1050	419	141	29	11	0	3795	8.5	1,065,744	2.80
350	240	825	1412	1293	588	188	40	5	0	4591	8.8	1,338,611	3.52
Calms	0									0			
Totals	11945	38276	51498	37193	12871	2975	524	78	3	155364	7.7	38,058,388	100.00

98.5% Data Recovery

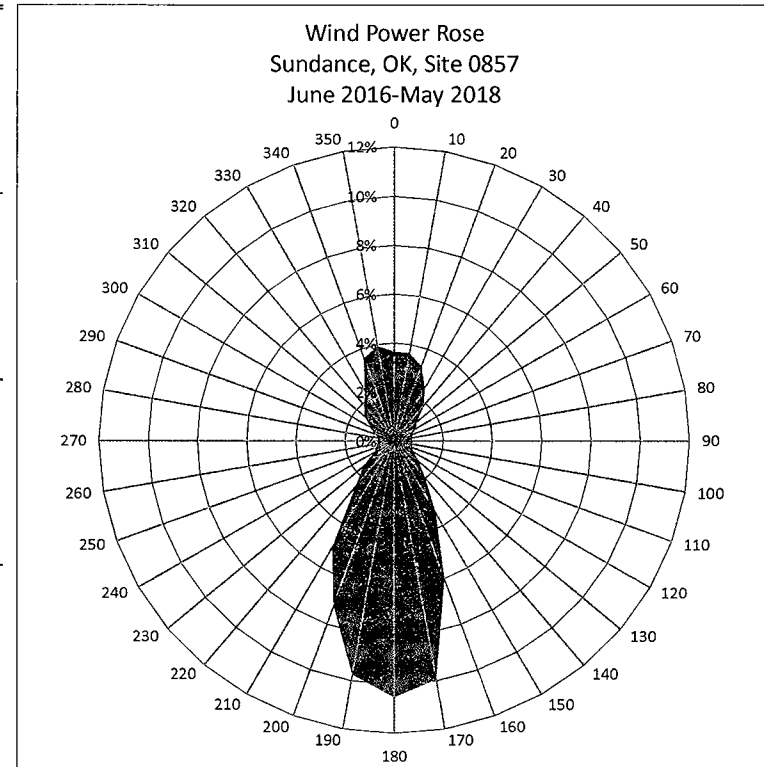


Extrapolated 80-m Wind Rose
Sundance Project, Oklahoma, Site 0857
June 2016-May 2018

Joint Frequency of 10-Minute Samples

Wind Speed (mps)...										GE-2 82/127 Energy		
Direction	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-25	26+	Row Total	Mean Speed	kWh Percent
0	200	747	1139	1044	316	72	4	0	0	3521	8.1	955,798 3.64
10	210	802	1192	997	346	59	8	1	0	3614	8.1	959,382 3.65
20	236	788	1115	928	261	33	1	0	1	3364	7.8	854,444 3.25
30	200	824	1133	645	138	17	0	1	0	2958	7.2	656,743 2.50
40	246	878	999	432	81	13	1	0	0	2650	6.6	496,809 1.89
50	304	964	786	210	15	2	3	0	0	2283	5.7	317,154 1.21
60	259	1035	674	150	13	0	0	0	0	2130	5.5	267,095 1.02
70	263	824	583	78	14	1	0	0	0	1763	5.4	205,077 0.78
80	300	691	606	66	6	2	0	0	0	1671	5.3	197,255 0.75
90	283	705	510	95	6	1	1	0	0	1599	5.3	187,637 0.71
100	276	683	507	128	5	1	0	2	0	1602	5.4	201,404 0.77
110	292	729	473	139	6	0	0	1	0	1640	5.4	201,245 0.77
120	298	715	616	162	3	1	0	0	0	1794	5.6	243,358 0.93
130	276	741	717	295	16	5	0	0	0	2051	6.1	340,921 1.30
140	240	883	1097	460	29	2	0	0	0	2711	6.6	513,809 1.95
150	205	988	1472	951	143	11	0	0	0	3769	7.4	889,936 3.39
160	215	1108	2148	1875	365	20	2	0	0	5732	8.1	1,583,626 6.02
170	213	1191	2933	3080	828	167	11	3	0	8426	8.8	2,613,462 9.94
180	247	1100	2758	2996	1258	238	20	3	0	8620	9.1	2,768,911 10.53
190	228	907	2459	2659	1323	230	12	0	0	7818	9.3	2,560,034 9.74
200	216	859	2100	1916	840	180	29	0	0	6140	8.9	1,891,603 7.20
210	192	728	1552	1436	484	101	2	0	0	4496	8.6	1,321,042 5.03
220	194	563	1019	648	138	36	4	0	0	2602	7.6	636,565 2.42
230	201	551	741	442	56	13	1	0	0	2006	6.9	423,978 1.61
240	183	424	420	218	41	11	2	0	0	1298	6.5	237,269 0.90
250	141	346	306	189	73	9	0	0	0	1064	6.7	208,327 0.79
260	164	317	222	170	59	16	3	0	0	952	6.6	176,745 0.67
270	161	266	250	174	62	9	2	1	0	925	6.7	180,535 0.69
280	177	319	225	144	63	23	4	0	0	955	6.5	171,680 0.65
290	147	291	251	194	97	49	4	0	0	1033	7.4	227,811 0.87
300	132	273	316	287	114	30	3	0	1	1155	7.7	284,192 1.08
310	121	259	354	495	141	51	6	0	0	1427	8.4	409,727 1.56
320	119	260	397	513	205	82	43	1	0	1621	9.1	493,777 1.88
330	123	362	619	687	222	73	42	4	0	2130	8.8	633,295 2.41
340	139	488	950	1040	363	108	15	4	0	3106	8.8	941,716 3.58
350	199	618	1109	1135	369	118	14	3	0	3565	8.6	1,036,585 3.94
Calms	0									0		
Totals	7600	24226	34750	27078	8501	1780	232	22	2	104191	7.8	26,288,946 100.00

99.1% Data Recovery



Off-Axis. Off-Axis Wake Losses (%)

Sundance, Oklahoma, Site **0157**

American Electric Power

Turbine: GE-2.82/127

Data from April 2008-December 2010; January 2016-March 2019

Spacing (Rotor Diameters)...						
Row Orientation	1.5 RD	2.0 RD	2.5 RD	3.0 RD	3.5 RD	4.0 RD
360/180	34.22	22.20	15.63	11.88	9.36	7.72
010/190	33.23	21.47	15.07	11.42	8.97	7.37
020/200	29.11	18.33	12.58	9.40	7.28	5.94
030/210	23.26	13.94	9.28	6.89	5.31	4.31
040/220	17.04	9.78	6.34	4.63	3.52	2.83
050/230	12.02	6.63	4.18	3.03	2.28	1.82
060/240	8.53	4.67	2.95	2.14	1.62	1.30
070/250	6.57	3.65	2.36	1.74	1.33	1.08
080/260	5.81	3.27	2.12	1.56	1.20	0.97
090/270	5.97	3.38	2.17	1.58	1.20	0.96
100/280	6.84	3.93	2.55	1.87	1.42	1.14
110/290	8.33	4.89	3.24	2.41	1.86	1.51
120/300	10.40	6.15	4.11	3.06	2.37	1.92
130/310	13.27	7.74	5.10	3.78	2.91	2.36
140/320	17.11	9.91	6.47	4.75	3.62	2.92
150/330	22.13	12.95	8.48	6.25	4.78	3.86
160/340	27.45	16.78	11.27	8.33	6.40	5.18
170/350	32.03	20.33	14.10	10.62	8.30	6.80

Off-Axis Wake Losses (%)

Sundance, Oklahoma, Site **0357**

American Electric Power

Turbine: GE-2.82/127

Data from January 2016-December 2018

Spacing (Rotor Diameters)...						
Row Orientation	1.5 RD	2.0 RD	2.5 RD	3.0 RD	3.5 RD	4.0 RD
360/180	35.94	23.32	16.39	12.42	9.76	8.03
010/190	32.73	20.67	14.22	10.65	8.28	6.76
020/200	27.07	16.47	11.06	8.20	6.31	5.12
030/210	20.65	12.11	7.98	5.89	4.52	3.66
040/220	14.87	8.48	5.49	4.03	3.07	2.48
050/230	10.49	5.84	3.72	2.71	2.05	1.64
060/240	7.56	4.17	2.64	1.91	1.45	1.16
070/250	5.87	3.27	2.10	1.54	1.18	0.95
080/260	5.10	2.92	1.91	1.41	1.08	0.87
090/270	5.05	2.90	1.91	1.41	1.08	0.88
100/280	5.65	3.20	2.07	1.53	1.17	0.95
110/290	6.98	3.92	2.52	1.84	1.39	1.12
120/300	9.43	5.24	3.36	2.46	1.87	1.51
130/310	13.46	7.47	4.76	3.48	2.65	2.13
140/320	19.16	10.99	7.07	5.15	3.90	3.13
150/330	25.80	15.61	10.41	7.67	5.87	4.74
160/340	31.88	20.23	14.01	10.55	8.24	6.76
170/350	35.64	23.19	16.39	12.48	9.84	8.12

Off-Axis Wake Losses (%)
Sundance, Oklahoma, Site 0657
American Electric Power
Turbine: GE-2.82/127
Data from April 2016-April 2019

Spacing (Rotor Diameters)...						
Row Orientation	1.5 RD	2.0 RD	2.5 RD	3.0 RD	3.5 RD	4.0 RD
360/180	34.33	22.23	15.64	11.86	9.32	7.67
010/190	32.41	20.73	14.47	10.98	8.63	7.11
020/200	27.77	17.26	11.76	8.76	6.77	5.51
030/210	21.84	12.99	8.56	6.27	4.78	3.85
040/220	16.03	9.13	5.91	4.36	3.34	2.70
050/230	11.27	6.33	4.08	2.99	2.27	1.83
060/240	8.08	4.50	2.86	2.07	1.56	1.25
070/250	6.15	3.41	2.18	1.59	1.21	0.97
080/260	5.21	2.92	1.90	1.40	1.07	0.87
090/270	5.20	2.90	1.87	1.37	1.05	0.85
100/280	6.12	3.37	2.12	1.54	1.16	0.93
110/290	7.91	4.47	2.85	2.07	1.56	1.24
120/300	10.61	6.17	4.06	3.00	2.30	1.87
130/310	14.38	8.39	5.56	4.15	3.22	2.63
140/320	19.00	11.23	7.42	5.46	4.18	3.38
150/330	24.32	14.60	9.72	7.18	5.51	4.46
160/340	29.52	18.20	12.34	9.21	7.14	5.83
170/350	33.19	21.18	14.71	11.06	8.63	7.06

Off-Axis Wake Losses (%)
Sundance, Oklahoma, Site 0857
American Electric Power
Turbine: GE-2.82/127
Data from June 2016-May 2018

Spacing (Rotor Diameters)...						
Row Orientation	1.5 RD	2.0 RD	2.5 RD	3.0 RD	3.5 RD	4.0 RD
360/180	36.63	23.82	16.77	12.72	10.00	8.22
010/190	35.21	22.65	15.79	11.89	9.29	7.61
020/200	30.59	19.09	13.08	9.81	7.63	6.24
030/210	24.09	14.49	9.68	7.17	5.52	4.48
040/220	17.59	10.09	6.53	4.77	3.62	2.91
050/230	12.18	6.71	4.22	3.05	2.29	1.83
060/240	8.44	4.57	2.87	2.09	1.58	1.26
070/250	6.22	3.45	2.21	1.62	1.23	0.99
080/260	5.19	2.95	1.92	1.42	1.09	0.88
090/270	4.91	2.83	1.86	1.37	1.05	0.85
100/280	5.23	2.99	1.95	1.44	1.10	0.89
110/290	6.16	3.50	2.26	1.66	1.26	1.02
120/300	7.97	4.46	2.87	2.11	1.61	1.30
130/310	11.15	6.14	3.91	2.86	2.18	1.76
140/320	16.08	9.00	5.71	4.15	3.13	2.51
150/330	22.37	13.20	8.64	6.31	4.78	3.84
160/340	29.04	18.02	12.29	9.20	7.14	5.82
170/350	34.30	22.05	15.44	11.71	9.20	7.57

Max V. Maximum 10-Minute Mean Wind Speeds (mps)
Sundance Project, Oklahoma
American Electric Power

YEAR: 2008

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w			14.9	16.1	17.1	15.9	11.6	10.4	10.7	12.1	13.0	15.7	17.1
	31-e			18.5	19.7	21.1	19.3	16.0	14.1	13.5	15.8	16.3	21.1	21.1
	31-w			18.5	19.7	21.5	19.3	15.8	14.3	13.5	15.6	16.3	20.9	21.5
	47-w			19.6	20.9	23.8	20.4	18.1	15.2	14.3	16.6	17.3	22.2	23.8
	57-e			19.9	21.5	25.0	21.1	19.5	15.4	14.6	17.1	17.8	22.5	25.0
	57-w			20.0	21.5	25.1	21.1	19.3	15.4	14.7	17.0	17.7	22.3	25.1

YEAR: 2009

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	14.0	16.6	13.9	17.2	12.1	13.8	11.6	14.1	12.8	12.9	11.7	14.6	17.2
	31-e	17.3	20.4	17.0	21.6	15.3	17.4	13.4	18.3	15.6	16.8	15.4	18.8	21.6
	31-w	17.3	20.8	16.8	20.7	15.4	16.8	13.6	17.4	15.7	16.8	14.5	18.2	20.8
	47-w	18.4	22.2	17.7	22.0	16.9	18.3	14.2	18.6	16.4	18.4	15.6	19.7	22.2
	57-e	19.1	22.8	17.8	x	x	x	x	x	x	x	x	x	22.8
	57-w	19.1	23.0	18.2	22.4	17.6	18.8	14.6	19.4	16.7	18.8	16.2	20.3	23.0

YEAR: 2010

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	13.0	11.6	15.1	15.8	18.3	16.4	13.1	12.9	12.7	10.8	13.3	11.5	18.3
	31-e	16.4	14.4	17.0	19.1	23.2	22.4	15.3	16.3	17.1	14.8	16.4	15.0	23.2
	31-w	16.2	14.5	17.6	19.1	22.1	22.2	15.9	16.3	16.9	14.5	16.4	15.0	22.2
	47-w	17.4	15.6	18.1	20.7	23.8	24.6	17.0	17.6	18.2	16.2	18.0	16.3	24.6
	57-e	x	x	x	x	x	x	x	x	x	x	x	x	
	57-w	17.9	16.2	18.4	21.1	24.7	25.2	17.6	18.3	18.8	16.8	18.7	17.1	25.2

YEAR: 2015

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w											16.7	13.2	16.7

	31-e		20.5	17.4	20.5
	31-w		20.6	17.5	20.6
	47-e		21.9	18.6	21.9
	47-w		22.0	18.6	22.0
	57-e		21.7	19.2	21.7
	57-w		22.6	19.1	22.6
0257	30-ne		19.8	15.9	19.8
	30-sw		19.8	15.6	19.8
	45-ne		21.2	16.8	21.2
	45-sw		21.4	16.3	21.4
	60-ne		22.0	17.7	22.0
	60-sw		22.2	17.5	22.2
0357	30-ne		19.8	17.3	19.8
	30-sw		19.9	17.2	19.9
	45-ne		21.0	18.0	21.0
	45-sw		20.7	18.0	20.7
	60-ne		21.9	18.8	21.9
	60-sw		22.0	18.5	22.0

YEAR: 2016

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	9.9		x	x	x	16.1	14.2	11.4	12.3	12.8	12.5	15.5	16.1
	31-e	12.8	17.0	20.7	19.6	20.3	21.3	17.4	15.4	15.9	16.0	15.9	18.7	21.3
	31-w	12.8	17.1	20.5	19.7	20.2	21.2	17.5	15.4	15.7	16.0	15.9	18.8	21.2
	47-e	14.0	18.1	21.8	21.2	21.7	23.6	19.0	16.5	17.1	17.0	16.6	19.7	23.6
	47-w	14.1	18.0	21.8	21.3	22.0	23.7	19.0	16.6	17.0	17.1	16.7	19.9	23.7
	57-e	14.9	18.6	22.2	22.0	22.5	24.3	19.6	17.0	17.6	17.7	17.3	20.3	24.3
	57-w	15.0	18.6	22.1	21.9	22.6	24.7	19.7	17.1	17.7	17.8	17.4	20.5	24.7
0257	30-ne	13.6	19.3	19.3	19.7	18.9	22.0	16.4	19.1	13.2	16.8	15.4	17.8	22.0
	30-sw	13.5	19.5	20.1	19.6	19.1	22.0	16.3	19.9	13.2	16.6	15.3	17.7	22.0
	45-ne	14.1	20.2	20.3	20.8	20.2	23.4	17.7	20.3	14.1	17.5	16.4	18.9	23.4
	45-sw	14.2	20.5	21.1	20.6	20.4	23.4	17.6	21.4	14.2	17.3	16.2	18.7	23.4
	60-ne	14.7	21.2	21.1	21.9	21.6	24.7	18.5	22.0	14.9	18.0	17.2	19.6	24.7
	60-sw	14.5	21.1	22.0	21.7	21.4	24.6	18.1	22.5	14.7	17.8	17.2	19.5	24.6
0357	30-ne	13.6	19.6	22.1	24.5	19.8	24.9	17.5	14.9	16.3	16.2	16.2	20.9	24.9
	30-sw	13.7	19.7	22.3	24.5	19.6	25.0	17.3	15.0	16.4	16.2	16.1	20.6	25.0
	45-ne	14.5	20.7	22.3	26.0	21.6	26.7	18.0	15.6	17.8	16.8	16.7	21.4	26.7
	45-sw	14.5	20.7	23.6	26.1	21.7	27.0	18.0	15.9	18.0	16.8	16.8	21.5	27.0
	60-ne	15.4	21.7	24.4	27.5	23.5	28.7	18.9	16.4	19.0	17.4	17.7	22.5	28.7
	60-sw	15.4	21.8	24.4	27.4	23.2	29.0	18.6	16.6	19.0	17.2	17.3	22.2	29.0
0457	30-ne				20.1	22.0	19.7	16.2	14.0	14.4	16.5	15.9	19.6	22.0
	30-sw				20.1	22.2	19.9	16.5	14.0	14.5	16.5	15.9	19.6	22.2
	45-ne				21.2	23.4	20.5	17.3	14.7	15.0	17.2	17.5	20.6	23.4
	45-sw				21.2	23.4	20.7	17.5	14.7	15.1	17.2	17.3	20.4	23.4
	60-ne				22.2	24.1	21.8	18.3	15.5	15.3	17.8	18.5	21.4	24.1
	60-sw				22.1	24.0	21.8	18.2	15.4	15.3	17.6	18.3	21.4	24.0
0557	30-ne				18.1	21.1	22.8	16.9	16.7	14.8	17.8	16.6	18.7	22.8
	30-sw				18.3	21.3	22.4	17.0	16.7	14.8	17.6	16.5	18.5	22.4
	45-ne				19.0	22.6	24.4	17.9	17.4	15.6	19.0	17.5	19.8	24.4
	45-sw				19.3	22.4	24.0	17.8	17.7	15.5	18.9	17.5	19.8	24.0
	60-ne				19.8	23.4	25.5	18.5	18.3	15.7	19.8	18.1	20.4	25.5
	60-sw				19.6	23.4	25.6	18.4	18.2	15.8	19.7	18.1	20.5	25.6
0657	30-ne				16.0	19.4	23.4	15.5	17.2	15.2	15.7	15.9	20.3	23.4
	30-sw				15.7	19.4	23.4	15.3	17.1	15.3	15.5	15.7	20.1	23.4
	45-ne				16.6	21.3	25.3	16.7	18.7	16.8	16.2	16.9	21.0	25.3
	45-sw				16.9	21.2	25.5	16.7	18.7	17.0	16.4	16.9	21.0	25.5
	60-ne				17.7	22.2	26.8	17.7	19.8	17.8	17.1	18.0	21.8	26.8
	60-sw				17.4	22.3	26.8	17.5	19.7	18.2	17.0	17.7	21.6	26.8

0757	30-ne	17.0	18.3	22.9	15.7	14.9	14.1	15.9	15.4	19.2	22.9
	30-sw	16.8	18.2	23.0	15.4	15.4	14.2	15.8	15.2	19.0	23.0
	45-ne	18.1	19.4	24.6	16.6	16.8	14.7	17.0	15.9	20.0	24.6
	45-sw	18.0	19.8	24.5	16.7	16.9	15.0	16.8	15.9	19.9	24.5
	60-ne	18.7	20.9	26.5	17.4	18.1	15.8	17.5	16.9	20.3	26.5
	60-sw	18.7	20.9	26.6	17.3	18.2	15.8	17.5	17.1	20.4	26.6
0857	30-ne	14.7	16.5	20.8	15.2	14.1	12.5	15.6	15.9	18.2	20.8
	30-sw	14.5	16.7	20.9	15.0	14.0	12.5	15.5	15.8	18.1	20.9
	45-ne	16.2	18.9	22.6	16.5	15.7	14.6	17.1	17.8	20.1	22.6
	45-sw	15.9	19.1	23.0	16.3	15.8	14.6	16.9	17.6	19.6	23.0
	60-ne	16.9	20.7	24.0	17.2	17.4	15.6	18.2	18.6	20.9	24.0
	60-sw	17.0	20.7	24.2	17.0	17.4	15.6	18.1	18.5	20.9	24.2

YEAR: 2017

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	13.5	12.5	15.8	15.0	13.4	12.2	9.6	10.5	11.5	14.4	12.8	12.1	15.8
	31-e	16.3	15.4	19.7	18.2	17.2	15.5	12.7	13.4	13.8	18.0	16.3	16.0	19.7
	31-w	16.7	15.1	19.6	18.3	16.9	15.6	12.7	13.3	13.9	18.0	16.2	16.2	19.6
	47-e	17.3	16.4	20.8	18.9	18.4	16.3	14.3	14.7	14.6	19.2	17.4	17.2	20.8
	47-w	18.1	16.3	20.8	19.1	18.3	16.3	14.2	14.7	14.8	19.2	17.4	17.2	20.8
	57-e	18.4	16.8	21.1	19.6	18.4	16.7	14.8	15.2	15.1	19.7	18.0	17.8	21.1
	57-w	18.8	16.7	21.1	19.8	18.7	16.8	15.0	15.4	15.1	19.8	17.9	17.8	21.1
0257	30-ne	17.8	15.8	19.3	16.9	19.2	20.4	13.2	14.2	13.4	20.7	18.8	15.0	20.7
	30-sw	17.5	15.9	20.0	16.7	18.9	20.4	13.3	14.1	13.5	20.7	18.8	14.9	20.7
	45-ne	18.9	17.1	20.7	18.4	20.6	21.8	14.4	15.5	14.2	21.8	19.7	15.8	21.8
	45-sw	18.8	16.9	21.0	18.0	20.3	21.7	14.5	15.4	14.4	21.9	19.8	15.7	21.9
	60-ne	19.7	18.1	21.3	19.6	21.8	23.3	15.4	16.2	15.0	22.5	21.0	16.6	23.3
	60-sw	19.5	17.9	22.0	19.4	21.6	23.3	15.2	16.3	15.1	22.4	20.7	16.3	23.3
0357	30-ne	15.6	16.4	18.8	18.5	17.0	17.3	17.0	14.3	15.2	17.7	16.9	15.9	18.8
	30-sw	15.7	16.4	18.5	18.3	17.2	17.2	17.0	14.5	15.0	17.9	17.0	15.6	18.5
	45-ne	16.5	17.3	19.4	20.1	17.5	18.3	17.5	15.5	15.3	18.5	18.0	16.5	20.1
	45-sw	16.5	17.4	19.4	18.2	17.9	18.4	17.6	15.7	15.3	18.4	18.2	16.4	19.4
	60-ne	17.6	18.0	20.3	21.5	18.3	19.2	18.4	16.4	15.9	19.2	18.7	17.4	21.5
	60-sw	17.6	18.0	19.9	20.6	18.3	19.0	18.4	16.4	15.6	19.3	18.7	17.2	20.6
0457	30-ne	14.6	15.9	19.0	18.8	18.6	22.4	18.3	15.4	13.9	18.2	18.7	14.7	22.4
	30-sw	14.6	16.1	19.0	18.9	18.7	22.7	18.3	15.6	13.8	18.3	18.8	14.6	22.7
	45-ne	15.2	16.6	20.3	20.6	20.0	23.7	19.2	16.2	14.9	19.3	19.7	15.5	23.7
	45-sw	15.2	16.8	20.1	20.6	20.1	23.7	19.2	16.2	14.7	19.3	19.7	15.5	23.7
	60-ne	15.6	17.1	21.2	22.1	21.0	24.4	19.9	17.5	15.5	20.3	20.2	17.1	24.4
	60-sw	15.7	17.0	21.0	22.1	21.0	24.3	19.8	17.3	15.4	20.2	20.1	17.2	24.3
0557	30-ne	19.0	16.0	19.9	19.4	20.3	19.6	17.6	15.9	14.7	18.2	19.0	15.8	20.3
	30-sw	18.8	16.6	20.1	19.3	20.2	19.6	17.7	15.8	14.6	18.4	19.4	15.9	20.2
	45-ne	20.2	16.9	20.3	20.5	21.7	21.4	18.7	17.0	15.5	19.2	20.0	16.7	21.7
	45-sw	19.9	17.3	20.8	20.6	21.7	21.4	18.9	16.8	15.5	19.3	20.3	16.8	21.7
	60-ne	20.6	17.3	21.4	21.2	22.7	22.6	19.6	17.6	15.7	19.8	20.6	17.3	22.7
	60-sw	20.6	18.0	21.4	21.3	22.8	22.7	19.5	17.7	15.8	20.2	20.8	17.4	22.8
0657	30-ne	17.9	14.2	18.2	20.3	19.4	17.1	16.0	13.5	15.2	16.4	15.9	16.1	20.3
	30-sw	17.8	14.6	18.1	18.7	19.6	17.4	16.0	13.7	14.9	16.2	16.2	15.9	19.6
	45-ne	18.7	15.5	19.1	21.6	20.6	18.4	16.4	14.6	15.4	17.3	17.1	16.7	21.6
	45-sw	18.7	15.5	19.0	20.5	20.6	18.5	16.5	14.7	15.5	17.4	17.2	16.8	20.6
	60-ne	19.8	16.0	19.9	23.2	21.1	19.5	16.2	15.6	16.0	18.4	17.7	17.7	23.2
	60-sw	19.5	16.4	19.6	21.7	21.4	19.4	16.3	15.7	15.7	18.9	17.8	17.4	21.7

0757	30-ne	16.4	16.0	17.7	18.9	17.1	16.8	21.7	14.0	14.0	16.8	16.2	15.3	21.7
	30-sw	16.3	16.1	18.0	19.0	17.1	16.8	21.6	14.1	13.7	17.0	16.0	15.1	21.6
	45-ne	17.2	17.0	19.1	20.7	18.8	17.8	23.0	15.3	14.7	18.3	17.3	16.2	23.0
	45-sw	17.3	17.4	19.2	20.7	18.9	18.2	23.3	15.4	14.7	18.5	17.6	16.0	23.3
	60-ne	18.3	17.9	20.1	21.9	20.5	18.7	23.6	16.4	15.2	19.4	18.4	17.3	23.6
	60-sw	18.3	18.1	20.0	22.0	20.5	18.9	23.8	16.4	15.1	19.4	18.6	17.3	23.8
0857	30-ne	16.4	16.0	17.7	18.9	17.1	16.8	21.7	14.0	14.0	16.8	16.2	15.3	21.7
	30-sw	16.3	16.1	18.0	19.0	17.1	16.8	21.6	14.1	13.7	17.0	16.0	15.1	21.6
	45-ne	17.2	17.0	19.1	20.7	18.8	17.8	23.0	15.3	14.7	18.3	17.3	16.2	23.0
	45-sw	17.3	17.4	19.2	20.7	18.9	18.2	23.3	15.4	14.7	18.5	17.6	16.0	23.3
	60-ne	18.3	17.9	20.1	21.9	20.5	18.7	23.6	16.4	15.2	19.4	18.4	17.3	23.6
	60-sw	18.3	18.1	20.0	22.0	20.5	18.9	23.8	16.4	15.1	19.4	18.6	17.3	23.8

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	14.0	13.5	13.6	15.1	16.2	20.3	11.9	16.9	10.0	12.7	14.9	14.7	20.3
	31-e	18.3	16.4	17.3	17.7	20.1	25.3	15.9	21.4	13.8	16.1	19.3	17.5	25.3
	31-w	18.2	16.5	17.2	17.8	20.2	25.2	15.7	21.3	13.8	15.8	19.2	17.6	25.2
	47-e	19.7	17.5	18.6	18.9	21.4	27.6	17.5	22.1	15.4	17.2	21.0	18.8	27.6
	47-w	19.8	17.6	18.6	19.0	21.7	27.7	17.7	22.0	15.7	17.0	21.0	18.7	27.7
	57-e	20.4	18.1	19.1	19.4	22.2	28.7	18.3	22.0	15.9	17.5	21.5	19.1	28.7
	57-w	20.6	18.1	19.3	19.8	22.5	29.0	18.6	22.1	16.5	17.5	21.9	19.2	29.0
0257	30-ne	19.7	15.0	20.7	19.9	19.1	25.1	18.4	15.0	14.2	15.4	21.2	18.6	25.1
	30-sw	19.4	14.9	20.5	19.7	19.1	25.2	19.4	15.0	14.3	15.5	21.0	18.7	25.2
	45-ne	21.0	16.1	21.6	20.6	20.6	26.6	19.8	16.6	15.5	16.5	22.3	19.7	26.6
	45-sw	21.0	15.8	21.6	20.7	20.4	26.9	21.1	16.8	15.7	16.7	22.2	19.9	26.9
	60-ne	21.7	16.9	22.3	21.5	21.8	28.5	22.1	18.0	16.4	17.4	23.4	20.8	28.5
	60-sw	21.3	16.7	21.9	21.2	21.6	28.3	19.7	x	14.0	17.4	23.1	20.8	28.3
0357	30-ne	19.7	17.2	18.5	18.6	22.7	21.4	17.9	14.3	13.9	15.6	21.8	18.0	22.7
	30-sw	19.9	16.9	18.5	18.6	22.7	21.6	17.9	14.4	14.0	15.7	21.9	18.3	22.7
	45-ne	20.8	17.3	19.3	19.8	25.0	23.1	19.6	14.9	14.6	16.4	22.8	19.1	25.0
	45-sw	21.0	17.5	19.2	19.8	24.8	23.2	19.9	15.0	14.7	16.7	22.8	19.3	24.8
	60-ne	21.8	17.8	19.9	20.8	26.6	24.1	20.7	16.4	15.2	x	x	x	26.6
	60-sw	21.8	17.9	19.9	20.7	26.9	24.5	21.1	16.1	15.0	17.2	23.4	20.0	26.9
0457	30-ne	20.6	16.6	20.9	21.6	23.2	22.9	19.4	19.2	13.2	16.4	21.2	19.0	23.2
	30-sw	20.7	16.6	21.0	21.9	23.4	23.1	19.3	19.2	13.0	16.5	21.3	19.1	23.4
	45-ne	21.5	17.4	21.7	22.8	23.5	24.5	20.4	20.6	14.0	17.3	21.9	19.7	24.5
	45-sw	21.5	17.2	21.8	22.9	23.6	24.6	20.4	20.8	13.6	17.4	22.1	19.8	24.6
	60-ne	22.1	17.9	22.1	23.5	23.5	25.6	21.3	21.8	14.3	18.0	22.5	20.2	25.6
	60-sw	22.0	17.7	22.0	23.4	23.5	25.5	21.4	21.8	13.9	18.0	22.5	20.2	25.5
0557	30-ne	19.4	17.9	19.7	19.4	23.4	25.3	20.6	21.0					25.3
	30-sw	19.2	18.0	19.6	19.3	23.1	15.3	20.5	20.6					23.1
	45-ne	20.4	18.8	20.5	20.9	24.9	26.2	21.9	21.4					26.2
	45-sw	20.2	18.9	20.4	20.9	24.8	26.2	21.7	21.1					26.2
	60-ne	20.9	19.2	20.9	21.9	25.5	27.0	22.6	21.1					27.0
	60-sw	20.8	19.1	20.9	22.1	25.5	27.1	22.6	20.6					27.1
0657	30-ne	18.6	16.5	17.6	18.9	19.1	21.3	17.9	23.3	14.7	16.2	22.0	17.9	23.3
	30-sw	18.8	16.3	17.6	18.8	19.3	21.5	18.1	23.5	14.7	16.3	22.3	18.0	23.5
	45-ne	20.3	17.0	18.5	19.7	21.2	22.8	19.4	25.4	15.4	17.9	22.7	19.4	25.4
	45-sw	20.5	17.3	18.7	19.9	21.0	22.8	19.3	25.1	15.6	17.8	22.9	19.3	25.1
	60-ne	21.2	17.8	19.3	20.7	22.6	23.5	20.3	26.2	15.9	18.8	23.0	20.3	26.2
	60-sw	21.7	17.6	19.2	20.7	22.7	23.9	20.8	26.6	16.1	19.2	23.4	20.8	26.6

0757	30-ne	19.9	15.7	18.1	18.5	18.4	22.1	17.6	18.3	11.8	22.1
	30-sw	20.0	15.5	18.3	18.5	18.4	22.0	17.7	18.4	11.9	22.0
	45-ne	21.3	16.6	19.2	19.5	19.8	23.9	19.0	20.1	12.7	23.9
	45-sw	21.6	16.5	19.7	20.0	20.2	24.2	19.1	20.4	12.8	24.2
	60-ne	22.1	17.3	20.4	20.6	21.1	25.4	20.0	21.6	13.4	25.4
	60-sw	22.1	17.3	20.6	20.8	21.2	25.4	20.1	21.8	13.3	25.4
0857	30-ne	19.9	15.7	18.1	18.5	18.4	22.1	17.6	18.3	11.8	22.1
	30-sw	20.0	15.5	18.3	18.5	18.4	22.0	17.7	18.4	11.9	22.0
	45-ne	21.3	16.6	19.2	19.5	19.8	23.9	19.0	20.1	12.7	23.9
	45-sw	21.6	16.5	19.7	20.0	20.2	24.2	19.1	20.4	12.8	24.2
	60-ne	22.1	17.3	20.4	20.6	21.1	25.4	20.0	21.6	13.4	25.4
	60-sw	22.1	17.3	20.6	20.8	21.2	25.4	20.1	21.8	13.3	25.4

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	14.1	11.7	16.8										16.8
	31-e	17.5	15.1	22.0										22.0
	31-w	17.7	14.9	22.1										22.1
	47-e	18.5	15.8	23.9										23.9
	47-w	18.7	16.0	24.1										24.1
	57-e	19.1	16.2	24.6										24.6
	57-w	19.5	16.4	24.6										24.6
0257	30-ne	17.2	16.5	20.9										20.9
	30-sw	17.1	16.4	20.8										20.8
	45-ne	18.4	17.1	22.1										22.1
	45-sw	18.5	17.1	22.0										22.0
	60-ne	19.8	17.7	23.0										23.0
	60-sw	19.7	17.3	22.8										22.8
0357	30-ne	17.3	16.2	23.7										23.7
	30-sw	17.5	16.1	23.3										23.3
	45-ne	18.4	16.9	24.5										24.5
	45-sw	18.6	16.8	24.4										24.4
	60-ne	x	x	x										x
	60-sw	19.4	17.3	25.1										25.1
0457	30-ne	17.6	16.2	22.0										22.0
	30-sw	17.8	16.2	21.8										21.8
	45-ne	18.7	16.6	23.1										23.1
	45-sw	18.9	16.9	22.9										22.9
	60-ne	19.5	17.1	23.8										23.8
	60-sw	19.5	17.1	23.7										23.7
0657	30-ne	17.7	15.9	22.3										22.3
	30-sw	17.3	15.9	21.9										21.9
	45-ne	18.7	16.8	23.6										23.6
	45-sw	18.5	16.7	23.4										23.4
	60-ne	19.8	17.4	24.6										24.6
	60-sw	19.4	17.3	24.2										24.2

Overall Maximum:	29.0
------------------	------

Data Recovery: black = 90-100%; green = 75-90%; blue = 50-75%; orange = 25-50%; purple = 10-25%; "x" = 0-10%.

Peak 1-Second Gusts (mps)
Sundance Project, Oklahoma
American Electric Power

YEAR: 2008

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w			21	23	24	26	17	20	17	20	20	23	26
	31-e			24	25	30	31	20	21	18	23	23	26	31
	31-w			24	25	30	31	20	21	18	22	23	26	31
	47-w			24	26	29	31	22	23	18	23	23	28	31
	57-e			25	28	29	31	23	23	18	24	25	28	31
	57-w			25	28	30	32	23	24	19	24	24	28	32

YEAR: 2009

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	21	24	22	26	20	20	18	22	18	19	18	22	26
	31-e	24	27	26	29	23	25	24	29	22	24	21	26	29
	31-w	24	27	24	28	22	26	23	27	21	23	20	26	28
	47-w	26	28	26	30	21	25	23	28	21	24	21	26	30
	57-e	25	29	23	x	x	x	x	x	x	x	x	x	29
	57-w	25	28	25	30	22	27	22	29	20	24	21	28	30

YEAR: 2010

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	20	18	20	24	28	28	24	20	19	18	20	21	28
	31-e	23	20	22	28	31	31	26	24	22	22	22	24	31
	31-w	23	20	23	27	30	31	28	23	22	21	22	23	31
	47-w	23	20	22	27	31	33	28	24	24	24	23	25	33
	57-e	x	x	x	x	x	x	x	x	x	x	x	x	
	57-w	23	22	23	29	31	33	28	24	24	23	23	25	33

YEAR: 2015

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w											23.7	19.1	24

	31-e		27.5	22.9	28
	31-w		28.3	22.9	28
	47-e		30.6	22.9	31
	47-w		29.4	22.9	29
	57-e		30.2	23.3	30
	57-w		29.4	23.3	29
0257	30-ne		26.3	21.4	26
	30-sw		26.8	21.8	27
	45-ne		27.9	22.6	28
	45-sw		27.9	22.2	28
	60-ne		27.5	22.2	28
	60-sw		27.5	22.2	28
0357	30-ne		25.6	22.6	26
	30-sw		25.6	22.6	26
	45-ne		26.3	22.6	26
	45-sw		29.0	23.7	29
	60-ne		27.5	23.3	28
	60-sw		28.3	23.7	28

YEAR: 2016

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	16		x	x	x	27	20	21	22	20	20	23	27
	31-e	17	24	28	28	32	32	25	24	24	21	21	28	32
	31-w	18	24	28	28	31	32	25	24	24	22	21	28	32
	47-e	20	25	29	27	33	33	26	27	24	22	23	28	33
	47-w	18	25	29	28	33	33	25	27	24	22	22	28	33
	57-e	18	25	29	27	33	33	26	27	23	23	22	28	33
	57-w	19	25	29	27	33	33	26	27	23	23	23	29	33
0257	30-ne	17	26	28	27	28	35	23	26	20	23	21	26	35
	30-sw	18	26	29	26	29	35	22	28	20	22	21	26	35
	45-ne	19	26	29	28	29	35	24	28	20	23	23	28	35
	45-sw	19	26	30	28	29	34	23	28	20	22	22	27	34
	60-ne	18	26	31	28	29	34	24	31	20	23	23	29	34
	60-sw	18	26	31	28	30	34	24	32	20	23	22	29	34
0357	30-ne	18	26	29	38	30	35	23	18	23	21	24	28	38
	30-sw	19	26	28	40	29	36	23	18	23	21	23	27	40
	45-ne	18	27	31	39	31	37	23	19	25	22	24	28	39
	45-sw	19	27	31	42	31	37	23	20	26	22	23	28	42
	60-ne	20	28	31	41	32	38	23	21	26	23	24	29	41
	60-sw	20	28	30	42	31	39	23	21	26	23	24	28	42
0457	30-ne				26	30	33	22	20	22	23	23	27	33
	30-sw				26	30	34	22	20	22	22	23	26	34
	45-ne				29	33	33	23	20	21	23	24	29	33
	45-sw				28	34	33	23	20	21	22	23	28	34
	60-ne				29	33	33	24	20	21	24	25	29	33
	60-sw				29	33	33	24	20	21	24	25	29	33
0557	30-ne				24	29	31	23	21	26	24	22	26	31
	30-sw				24	29	32	23	20	26	24	22	26	32
	45-ne				25	29	32	24	22	26	24	23	27	32
	45-sw				25	29	33	24	21	27	25	23	27	33
	60-ne				25	31	34	25	22	26	26	24	29	34
	60-sw				25	30	35	25	21	26	26	23	29	35
0657	30-ne				23	29	34	23	24	23	23	23	28	34
	30-sw				22	29	35	23	23	23	22	24	27	35
	45-ne				22	33	36	25	26	24	23	23	28	36
	45-sw				22	32	36	24	26	24	23	23	27	36
	60-ne				23	32	37	26	26	24	23	24	28	37
	60-sw				23	33	37	26	26	24	23	23	28	37

0757	30-ne	24	25	33	24	21	22	23	23	29	33
	30-sw	26	26	33	24	21	22	23	23	28	33
	45-ne	26	27	36	26	24	23	25	23	29	36
	45-sw	26	28	34	26	24	23	24	23	29	34
	60-ne	26	27	37	26	24	23	25	24	30	37
	60-sw	26	29	38	26	24	23	25	23	30	38
0857	30-ne	23	36	31	22	23	20	22	22	26	36
	30-sw	24	36	30	22	23	20	21	22	26	36
	45-ne	25	33	33	23	24	23	23	24	29	33
	45-sw	23	33	33	23	24	23	22	24	28	33
	60-ne	27	32	35	25	24	21	23	23	28	35
	60-sw	26	32	36	24	24	22	23	23	27	36

YEAR: 2017

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	21	20	22	21	25	26	23	17	18	23	19	20	26
	31-e	27	21	25	24	29	29	26	20	18	24	23	22	29
	31-w	26	21	24	24	29	29	26	20	19	24	23	22	29
	47-e	28	22	26	24	28	29	25	21	19	24	24	23	29
	47-w	29	22	26	24	28	29	26	21	19	24	25	23	29
	57-e	29	23	28	25	29	28	27	21	20	25	24	24	29
	57-w	29	23	28	26	29	29	27	21	20	25	25	24	29
0257	30-ne	26	21	26	23	27	31	29	21	20	28	24	20	31
	30-sw	26	22	26	24	27	30	34	21	18	28	24	20	34
	45-ne	26	22	26	24	28	30	26	22	21	29	24	22	30
	45-sw	26	22	27	23	28	31	31	22	20	29	26	21	31
	60-ne	29	23	28	24	29	31	29	21	21	30	25	21	31
	60-sw	28	24	28	24	29	31	29	22	21	29	26	21	31
0357	30-ne	22	22	25	24	24	26	30	19	20	23	22	22	30
	30-sw	22	22	25	24	24	26	29	19	20	24	22	21	29
	45-ne	23	23	25	25	25	26	29	20	19	24	23	22	29
	45-sw	23	23	25	24	25	26	29	20	20	24	23	22	29
	60-ne	25	23	26	26	25	26	29	20	20	24	24	24	29
	60-sw	25	23	26	25	25	26	29	20	20	25	24	23	29
0457	30-ne	21	22	26	26	39	35	23	22	20	26	26	20	39
	30-sw	21	23	26	26	38	37	23	21	19	26	26	20	38
	45-ne	20	23	27	28	36	37	24	21	20	26	27	20	37
	45-sw	20	23	27	27	34	37	24	22	20	27	27	20	37
	60-ne	20	23	28	27	35	38	25	22	23	26	27	22	38
	60-sw	20	23	29	28	36	39	25	22	23	26	26	21	39
0557	30-ne	26	23	27	25	26	33	26	23	20	25	24	22	33
	30-sw	26	22	27	25	27	33	26	23	20	24	24	22	33
	45-ne	26	23	28	26	29	33	26	23	21	25	25	23	33
	45-sw	26	23	27	26	29	33	26	23	20	25	25	23	33
	60-ne	26	23	29	26	30	36	26	23	21	26	25	23	36
	60-sw	26	23	28	26	29	35	26	24	20	26	26	23	35
0657	30-ne	24	21	27	27	36	26	25	21	20	23	22	21	36
	30-sw	25	22	29	26	36	26	25	20	20	23	22	21	36
	45-ne	26	22	29	27	38	26	24	23	20	25	23	22	38
	45-sw	26	22	28	27	38	26	25	23	20	25	23	22	38
	60-ne	27	23	30	28	37	28	24	23	20	24	23	23	37
	60-sw	26	23	29	27	36	28	24	23	20	25	23	23	36

0757	30-ne	16	16	18	19	17	17	22	14	14	17	16	15	22
	30-sw	24	22	25	26	24	28	27	21	20	23	22	23	28
	45-ne	26	22	26	27	25	26	28	22	21	24	23	23	28
	45-sw	26	22	26	27	25	26	29	22	21	24	24	23	29
	60-ne	26	23	27	27	26	29	29	23	22	25	25	24	29
	60-sw	26	23	26	27	26	30	29	23	22	25	24	24	30
0857	30-ne	25	22	26	26	24	28	28	22	20	23	23	23	28
	30-sw	24	22	25	26	24	28	27	21	20	23	22	23	28
	45-ne	26	22	26	27	25	26	28	22	21	24	23	23	28
	45-sw	26	22	26	27	25	26	29	22	21	24	24	23	29
	60-ne	26	23	27	27	26	29	29	23	22	25	25	24	29
	60-sw	26	23	26	27	26	30	29	23	22	25	24	24	30

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	22	20	23	23	25	31	19	29	20	19	23	21	31
	31-e	26	21	26	26	27	35	22	32	20	21	29	24	35
	31-w	26	21	25	26	27	36	22	32	20	21	28	23	36
	47-e	26	22	27	27	29	38	23	34	19	21	28	24	38
	47-w	26	22	27	26	29	38	23	34	19	21	28	24	38
	57-e	27	23	28	26	31	38	24	34	21	21	29	24	38
0257	57-w	27	23	28	26	30	39	24	35	22	21	29	24	39
	30-ne	26	21	28	27	31	32	25	20	21	22	29	26	32
	30-sw	26	20	27	27	30	33	25	20	21	22	30	26	33
	45-ne	27	22	28	28	30	35	27	21	21	22	30	26	35
	45-sw	27	21	28	27	29	35	26	21	22	22	31	26	35
	60-ne	28	22	29	30	32	36	27	21	21	23	32	27	36
0357	60-sw	27	23	28	29	32	36	26	x	18	23	32	27	36
	30-ne	26	22	26	26	30	29	24	21	19	20	28	25	30
	30-sw	25	21	26	25	30	29	24	21	18	21	28	24	30
	45-ne	26	21	27	26	31	31	25	21	20	22	28	25	31
	45-sw	26	21	27	26	31	32	26	22	19	22	28	26	32
	60-ne	27	22	28	27	32	32	26	21	18	x	x	x	32
0457	60-sw	27	21	28	27	32	32	26	21	19	21	29	25	32
	30-ne	27	22	27	29	33	31	28	25	18	22	29	26	33
	30-sw	27	22	28	29	33	31	28	24	18	22	29	26	33
	45-ne	27	23	28	29	36	32	29	26	19	22	30	27	36
	45-sw	27	22	27	29	35	32	29	26	19	22	30	26	35
	60-ne	28	23	28	29	34	33	29	27	19	23	30	27	34
0557	60-sw	28	23	28	29	33	33	29	26	19	23	30	27	33
	30-ne	26	23	27	26	31	36	28	34					36
	30-sw	26	23	28	26	31	19	29	35					35
	45-ne	27	23	29	26	31	38	29	35					38
	45-sw	26	23	28	27	31	38	29	36					38
	60-ne	28	23	29	27	30	38	30	36					38
0657	60-sw	29	23	29	26	31	39	30	36					39
	30-ne	27	22	26	26	29	36	26	33	20	22	29	23	36
	30-sw	26	21	26	26	30	35	26	33	20	23	28	23	35
	45-ne	27	23	27	27	33	36	26	33	20	23	29	25	36
	45-sw	27	23	26	27	32	36	27	34	19	23	29	25	36
	60-ne	27	23	29	26	33	36	29	34	20	23	29	25	36
	60-sw	27	22	28	26	33	35	28	35	20	23	30	25	35

0757	30-ne	20	16	18	19	18	22	18	18	12	22
	30-sw	26	21	26	28	29	33	29	31	19	33
	45-ne	27	22	26	28	29	33	30	31	20	33
	45-sw	28	22	27	29	29	33	31	32	20	33
	60-ne	27	22	27	29	29	36	31	32	20	36
	60-sw	27	22	27	30	30	36	31	33	20	36
0857	30-ne	26	21	26	28	29	33	29	30	20	33
	30-sw	26	21	26	28	29	33	29	31	19	33
	45-ne	27	22	26	28	29	33	30	31	20	33
	45-sw	28	22	27	29	29	33	31	32	20	33
	60-ne	27	22	27	29	29	36	31	32	20	36
	60-sw	27	22	27	30	30	36	31	33	20	36

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	10-w	21	18	26										26
	31-e	23	20	31										31
	31-w	24	20	30										30
	47-e	25	21	31										31
	47-w	25	20	32										32
	57-e	26	22	32										32
	57-w	26	22	32										32
0257	30-ne	24	22	29										29
	30-sw	24	22	29										29
	45-ne	24	21	30										30
	45-sw	24	21	30										30
	60-ne	24	23	30										30
	60-sw	24	23	30										30
0357	30-ne	23	22	30										30
	30-sw	24	22	29										29
	45-ne	24	22	31										31
	45-sw	25	22	33										33
	60-ne	x	x	x										x
	60-sw	25	22	34										34
0457	30-ne	23	22	29										29
	30-sw	24	22	29										29
	45-ne	24	23	30										30
	45-sw	25	23	31										31
	60-ne	25	23	32										32
	60-sw	25	23	31										31
0657	30-ne	25	22	31										31
	30-sw	24	21	31										31
	45-ne	24	23	32										32
	45-sw	24	22	33										33
	60-ne	24	23	34										34
	60-sw	25	22	33										33

Overall Maximum:	42
------------------	----

Data Recovery: black = 90-100%; green = 75-90%; blue = 50-75%; orange = 25-50%; purple = 10-25%; "x" = 0-10%.

TI. Turbulence Intensity Analysis
Sundance Project, Oklahoma
American Electric Power
Site 0157, 56.5-m Level, West Boom
Using 10-Minute Data from March 2008-April 2019

Speed (mps)	Number of Samples	Mean T. I.	Standard Deviation of T. I.	Mean + 1 Std. Dev.	Mean + 1.28 Std. Dev.	Maximum T. I.
0	792	0.230	0.209	0.439	0.498	0.814
1	4167	0.441	0.176	0.617	0.666	1.503
2	10928	0.263	0.135	0.398	0.436	1.022
3	18761	0.186	0.099	0.285	0.313	1.044
4	26001	0.148	0.078	0.226	0.248	0.969
5	31093	0.125	0.065	0.190	0.208	0.690
6	34294	0.108	0.056	0.164	0.180	0.784
7	36480	0.096	0.050	0.146	0.160	0.703
8	37586	0.087	0.046	0.133	0.146	0.667
9	35851	0.084	0.043	0.127	0.139	0.829
10	29113	0.086	0.041	0.127	0.138	0.718
11	21158	0.090	0.039	0.129	0.140	0.604
12	14601	0.097	0.037	0.134	0.144	0.588
13	9674	0.103	0.032	0.135	0.144	0.752
14	6357	0.107	0.027	0.134	0.142	0.528
15	4046	0.110	0.025	0.135	0.142	0.292
16	2495	0.112	0.026	0.138	0.145	0.444
17	1355	0.113	0.022	0.135	0.141	0.296
18	589	0.114	0.024	0.138	0.145	0.307
19	337	0.115	0.029	0.144	0.152	0.488
20	146	0.117	0.031	0.148	0.157	0.341
21	58	0.114	0.027	0.141	0.149	0.245
22	35	0.130	0.027	0.157	0.165	0.196
23	12	0.138	0.041	0.179	0.190	0.238
24	10	0.128	0.032	0.160	0.169	0.191
25	5	0.104	0.026	0.130	0.137	0.145
26+	2	0.143	0.009	0.152	0.155	0.149
Total	325946					

Shear: 0.257
89/57 m Speed Ratio: 1.124

89-m TI Statistics at 15 mps:	Mean	Std. Dev.	Mean + 1 Std. Dev.	Mean + 1.28 Std. Dev.
	0.098	0.022	0.120	0.126

Turbulence Intensity Analysis
Sundance Project, Oklahoma
American Electric Power
Site 0357, 60-m Level, Southwest Boom
Using 10-Minute Data from October 2015-April 2019

Speed (mps)	Number of Samples	Mean T. I.	Standard Deviation of T. I.	Mean + 1 Std. Dev.	Mean + 1.28 Std. Dev.	Maximum T. I.
0	648	0.185	0.207	0.392	0.450	0.750
1	2938	0.435	0.176	0.611	0.660	1.097
2	6261	0.260	0.141	0.401	0.440	1.127
3	10353	0.178	0.101	0.279	0.307	1.104
4	14464	0.135	0.075	0.210	0.231	1.108
5	16936	0.111	0.062	0.173	0.190	0.745
6	19583	0.096	0.053	0.149	0.164	0.801
7	21888	0.085	0.048	0.133	0.146	0.752
8	21167	0.079	0.042	0.121	0.133	0.570
9	19527	0.079	0.040	0.119	0.130	0.632
10	15443	0.082	0.038	0.120	0.131	0.718
11	10567	0.088	0.035	0.123	0.133	0.650
12	7143	0.095	0.031	0.126	0.135	0.412
13	4590	0.101	0.028	0.129	0.137	0.557
14	2921	0.105	0.026	0.131	0.138	0.386
15	1799	0.106	0.025	0.131	0.138	0.406
16	1035	0.108	0.024	0.132	0.139	0.357
17	625	0.109	0.024	0.133	0.140	0.265
18	354	0.111	0.033	0.144	0.153	0.575
19	194	0.112	0.022	0.134	0.140	0.179
20	81	0.117	0.047	0.164	0.177	0.436
21	38	0.110	0.013	0.123	0.127	0.147
22	26	0.111	0.012	0.123	0.126	0.138
23	15	0.123	0.031	0.154	0.163	0.192
24	8	0.108	0.017	0.125	0.130	0.136
25	3	0.117	0.009	0.126	0.129	0.126
26+	5	0.104	0.035	0.139	0.149	0.136
Total	178612					

Shear: 0.210
89/60 m Speed Ratio: 1.086

89-m TI Statistics at 15 mps:	Mean	Std. Dev.	Mean + 1 Std. Dev.	Mean + 1.28 Std. Dev.
	0.098	0.023	0.121	0.127

Turbulence Intensity Analysis
Sundance Project, Oklahoma
American Electric Power
Site 0657, 60-m Level, Southwest Boom
Using 10-Minute Data from April 2016-April 2019

Speed (mps)	Number of Samples	Mean T. I.	Standard Deviation of T. I.	Mean + 1 Std. Dev.	Mean + 1.28 Std. Dev.	Maximum T. I.
0	539	0.264	0.261	0.525	0.598	0.785
1	2417	0.524	0.163	0.687	0.733	1.177
2	5841	0.304	0.129	0.433	0.469	1.166
3	10104	0.211	0.096	0.307	0.334	1.031
4	14284	0.160	0.070	0.230	0.250	0.915
5	16743	0.132	0.059	0.191	0.208	1.148
6	19250	0.113	0.051	0.164	0.178	0.718
7	20033	0.102	0.044	0.146	0.158	0.640
8	18462	0.096	0.041	0.137	0.148	0.591
9	15833	0.094	0.040	0.134	0.145	0.928
10	11527	0.100	0.037	0.137	0.147	0.435
11	7911	0.106	0.032	0.138	0.147	0.571
12	5447	0.109	0.029	0.138	0.146	0.337
13	3834	0.113	0.027	0.140	0.148	0.449
14	2367	0.114	0.025	0.139	0.146	0.315
15	1386	0.115	0.026	0.141	0.148	0.320
16	784	0.116	0.025	0.141	0.148	0.211
17	409	0.119	0.034	0.153	0.163	0.531
18	238	0.121	0.031	0.152	0.161	0.260
19	132	0.118	0.031	0.149	0.158	0.353
20	42	0.125	0.030	0.155	0.163	0.202
21	22	0.130	0.049	0.179	0.193	0.330
22	22	0.134	0.043	0.177	0.189	0.253
23	11	0.119	0.025	0.144	0.151	0.160
24	4	0.139	0.037	0.176	0.186	0.191
25	0					
26+	3	0.194	0.097	0.291	0.318	0.273
Total		157645				

Shear: 0.230
89/60 m Speed Ratio: 1.095

89-m TI Statistics at 15 mps:	Mean	Std. Dev.	Mean + 1 Std. Dev.	Mean + 1.28 Std. Dev.
	0.105	0.024	0.129	0.135

Turbulence Intensity Analysis
Sundance Project, Oklahoma
American Electric Power
Site 0857, 60-m Level, Southwest Boom
Using 10-Minute Data from April 2016-September 2018

Speed (mps)	Number of Samples	Mean T. I.	Standard Deviation of T. I.	Mean + 1 Std. Dev.	Mean + 1.28 Std. Dev.	Maximum T. I.
0	531	0.268	0.265	0.533	0.607	0.848
1	2117	0.547	0.168	0.715	0.762	1.180
2	4642	0.325	0.137	0.462	0.500	1.006
3	8225	0.221	0.102	0.323	0.352	1.079
4	11090	0.168	0.074	0.242	0.263	0.756
5	13806	0.140	0.062	0.202	0.219	0.816
6	16063	0.121	0.055	0.176	0.191	0.931
7	17140	0.109	0.048	0.157	0.170	0.752
8	16084	0.106	0.046	0.152	0.165	0.764
9	13206	0.108	0.044	0.152	0.164	0.951
10	9126	0.114	0.040	0.154	0.165	0.577
11	5919	0.121	0.036	0.157	0.167	0.479
12	3700	0.128	0.030	0.158	0.166	0.450
13	2354	0.132	0.028	0.160	0.168	0.589
14	1355	0.133	0.030	0.163	0.171	0.570
15	778	0.132	0.027	0.159	0.167	0.431
16	394	0.138	0.027	0.165	0.173	0.331
17	198	0.142	0.026	0.168	0.175	0.315
18	81	0.138	0.031	0.169	0.178	0.330
19	26	0.135	0.017	0.152	0.157	0.160
20	12	0.147	0.064	0.211	0.229	0.305
21	11	0.152	0.032	0.184	0.193	0.211
22	1	0.134				0.134
23	1	0.175				0.175
24	1	0.136				0.136
25	1	0.230				0.230
26+	0					
Total		126862				

Shear: 0.303
89/60 m Speed Ratio: 1.127

89-m TI Statistics at 15 mps:	Mean	Std. Dev.	Mean + 1 Std. Dev.	Mean + 1.28 Std. Dev.
	0.117	0.024	0.141	0.148

Temps. Summary of Ambient Air Temperature Data
Sundance Project, Oklahoma
American Electric Power

Monthly Mean Temperatures (°C)...

YEAR: 2008

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2			9.4	13.6	20.6	26.1	28.4	26.3	21.1	15.3	9.2	2.3	

YEAR: 2009

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	2.2	7.3	10.0	14.4	19.0	26.8	28.2	26.4	20.7	11.4	11.1	0.0	14.8

YEAR: 2010

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	0.3	1.2	8.9	16.5	19.6	27.8	27.9	28.2	23.8	16.9	8.4	2.5	15.2

YEAR: 2011

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2													

YEAR: 2015

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2											10.2	4.1	
	55											11.6	4.8	
0257	10											9.8	5.0	
	55											9.9	5.6	
0357	10											10.6	6.0	
	55											11.2	7.1	

YEAR: 2016

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	1.2	7.1	11.6	15.2	18.3	26.0	28.1	25.8	22.6	18.1	11.4	1.0	15.5
	55	2.1	8.0	12.0	15.2	18.4	26.1	27.9	25.9	22.9	18.7	12.4	2.0	16.0
0257	10	1.9	7.8	12.2	15.6	18.8	26.5	28.5	26.1	23.4	19.0	12.2	1.7	16.1
	55	2.3	8.3	12.4	15.6	18.6	26.4	28.2	26.1	23.3	19.0	12.6	2.2	16.3
0357	10	2.7	8.2	12.4	15.9	19.1	26.9	28.8	26.8	23.6	19.0	12.5	2.1	16.5
	55	3.4	9.1	13.0	16.3	19.4	27.1	29.0	27.1	23.9	19.7	13.4	3.0	17.0
0457	10				16.0	18.8	26.4	28.5	26.1	23.3	18.8	12.0	1.7	
	55				16.2	19.0	26.7	28.6	26.5	23.6	19.2	12.8	2.5	
0557	10				15.9	18.9	26.7	28.7	26.4	23.5	18.9	12.1	1.8	
	55				16.1	19.2	26.9	28.8	26.7	23.7	19.4	13.0	2.7	
0657	10				16.0	19.0	26.5	28.5	26.4	23.3	19.0	12.3	2.0	
	55				16.0	19.2	26.9	28.7	26.7	23.7	19.5	13.1	2.8	
0757	10				16.1	19.2	26.6	28.6	26.6	23.5	19.1	12.6	2.4	
	55				15.4	18.6	26.2	28.1	26.2	23.1	18.9	12.7	2.3	
0857	10				15.8	18.9	26.3	28.3	26.4	23.2	18.8	12.3	2.0	
	55				16.0	19.0	26.6	28.4	26.5	23.4	19.2	12.9	2.6	

YEAR: 2017

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	2.3	8.2	11.2	14.2	18.8	25.2	27.9	23.8	22.4	15.7	9.5	2.4	15.1
	55	3.1	8.8	11.2	14.1	19.0	25.0	27.8	24.0	22.9	16.3	10.3	3.2	15.5
0257	10	2.7	8.6	11.6	14.6	19.3	25.6	28.3	24.4	23.1	16.2	10.2	2.7	15.6
	55	3.0	8.9	11.4	14.2	19.2	25.2	28.0	24.2	23.0	16.3	10.4	3.0	15.6
0357	10	3.4	8.9	12.0	14.9	19.6	25.9	28.5	24.6	23.3	16.6	10.4	3.4	16.0
	55	4.1	9.7	12.3	15.1	20.0	26.0	28.8	25.1	23.8	17.3	11.3	4.2	16.5
0457	10	2.9	8.6	11.6	14.6	19.2	25.5	28.2	24.2	22.9	16.0	10.1	2.8	15.6
	55	3.5	9.3	11.9	14.8	19.6	25.6	28.4	24.6	23.3	16.8	10.8	3.6	16.0
0557	10	3.1	8.7	11.8	14.9	19.4	25.8	28.6	24.5	23.1	16.3	10.2	3.0	15.8
	55	3.7	9.5	12.1	15.0	19.8	25.8	28.7	24.8	23.6	16.9	10.9	3.7	16.2
0657	10	3.2	8.9	11.9	14.9	19.4	25.6	28.2	24.3	22.9	16.3	10.3	3.1	15.8
	55	3.8	9.5	12.1	15.0	19.8	25.8	28.6	24.8	23.6	17.0	11.0	3.8	16.2
0757	10	3.5	9.2	12.1	15.0	19.6	25.7	28.3	24.5	23.1	16.6	10.6	3.6	16.0
	55	3.4	9.0	11.5	14.4	19.3	25.2	28.0	24.2	23.1	16.6	10.6	3.6	15.7
0857	10	3.2	8.8	11.8	14.7	19.3	25.4	28.0	24.2	22.8	16.3	10.3	3.2	15.7
	55	3.7	9.3	11.9	14.7	19.5	25.4	28.2	24.5	23.2	16.7	10.8	3.8	16.0

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	1.7	2.2	10.2	11.5	24.2	26.9	27.2	25.7	21.5	13.4	4.9	2.8	14.4
	55	2.3	2.3	10.4	11.3	24.1	26.7	27.2	26.0	21.5	13.8	5.8	3.7	14.6
0257	10	2.0	2.6	10.7	11.8	24.5	27.3	27.4	26.3	22.1	14.0	5.5	3.2	14.8
	55	2.3	2.4	10.5	11.4	24.2	26.9	27.3	26.1	21.7	13.9	5.7	3.5	14.7
0357	10	2.5	2.9	10.9	12.2	24.8	27.5	27.7	26.6	22.3	14.3	5.9	3.8	15.1
	55	3.3	3.3	11.3	12.4	25.0	27.7	28.2	27.0	22.5	14.8	6.7	4.6	15.6
0457	10	2.2	2.7	10.7	11.8	24.4	27.2	27.4	26.1	21.9	13.9	5.4	3.2	14.7
	55	2.9	3.0	11.1	12.0	24.6	27.4	27.7	26.6	22.1	14.3	6.2	4.1	15.2
0557	10	2.4	2.9	10.8	12.0	24.7	27.5	27.8	26.4					
	55	3.0	3.2	11.2	12.2	24.8	27.6	27.9	26.7					
0657	10	2.4	2.9	10.9	12.1	24.6	27.4	27.7	26.3	22.0	14.1	5.7	3.5	15.0
	55	3.0	3.2	11.2	12.2	24.8	27.5	28.0	26.7	22.2	14.5	6.4	4.3	15.3
0757	10	2.7	3.2	11.1	12.3	24.7	27.4	27.6	26.5	22.3				
	55	2.6	2.7	10.7	11.7	24.3	26.9	27.4	26.2	21.7				
0857	10	2.4	2.9	10.8	12.1	24.5	27.2	27.4	26.2	22.1				
	55	2.9	3.0	10.9	12.0	24.5	27.1	27.6	26.4	22.0				

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	1.7	0.5	6.5										
	55	2.5	0.4	6.7										
0257	10	2.1	0.7	6.9										
	55	2.3	0.4	6.6										
0357	10	2.6	1.4	7.4										
	55	3.4	1.6	7.8										
0457	10	2.2	1.0	6.9										
	55	2.9	1.1	7.3										
0657	10	2.4	1.2	7.3										
	55	3.0	1.3	7.5										

Composite Ambient Air Temperature (°C), March 2008-January 2011 and October 2015-March 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	1.0	4.4	9.7	14.2	20.1	26.5	28.0	26.0	22.0	15.1	9.2	2.2	14.9

Composite Ambient Air Temperature (°C), October 2015-March 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	55	2.4	1.4	8.6	13.7	21.7	26.8	28.0	26.4	22.6	15.0	10.2	3.8	15.0
0257	10	2.1	1.7	8.8	14.0	21.9	27.0	28.0	26.5	22.8	14.6	9.3	3.5	15.0
	55	2.3	1.4	8.6	13.4	21.4	26.6	27.7	26.2	22.4	14.5	9.4	3.8	14.8
0357	10	2.6	2.2	9.2	14.0	21.9	26.9	28.0	26.5	22.8	15.1	9.6	3.9	15.2
	55	3.4	2.5	9.6	14.2	22.0	27.2	28.3	26.8	23.0	15.7	10.3	4.8	15.6

Composite Ambient Air Temperature (°C), April 2016-March 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0457	10	2.4	4.1	9.7	14.1	20.8	26.4	28.0	25.5	22.7	16.2	9.2	2.6	15.1
	55	3.1	4.5	10.1	14.3	21.1	26.6	28.2	25.9	23.0	16.8	9.9	3.4	15.6
0657	10	2.7	4.3	10.0	14.3	21.0	26.5	28.1	25.7	22.7	16.5	9.4	2.9	15.3
	55	3.3	4.7	10.3	14.4	21.3	26.7	28.4	26.1	23.2	17.0	10.2	3.6	15.8

Composite Ambient Air Temperature (°C), April 2016-August 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0557	10	2.8	5.8	11.3	14.3	21.0	26.7	28.4	25.8	23.0	17.6	11.2	2.4	15.8
	55	3.4	6.4	11.7	14.4	21.3	26.8	28.5	26.1	23.2	18.2	12.0	3.2	16.2
0757	10	3.1	6.2	11.6	14.5	21.2	26.6	28.2	25.9	23.3	17.9	11.6	3.0	16.1
	55	3.0	5.9	11.1	13.8	20.7	26.1	27.8	25.5	23.1	17.8	11.7	3.0	15.8
0857	10	2.8	5.8	11.3	14.2	20.9	26.3	27.9	25.6	23.0	17.5	11.3	2.6	15.8
	55	3.3	6.1	11.4	14.2	21.0	26.4	28.0	25.8	23.3	18.0	11.8	3.2	16.0

Extreme Maximum Temperatures (°C)...

YEAR: 2008

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2			29.5	33.6	36.6	39.3	42.4	43.8	34.9	32.0	29.8	23.7	43.8

YEAR: 2009

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	22.8	26.4	33.9	34.3	35.3	40.6	47.0	42.0	35.9	27.0	30.1	20.1	47.0

YEAR: 2010

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	20.1	18.1	35.9	33.3	34.3	39.3	39.3	41.3	38.6	33.0	26.7	22.2	41.3

YEAR: 2011

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	7.9												x

YEAR: 2015

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2										21.9	26.4	24.6	26.4
	55										21.3	25.5	23.1	25.5
0257	10										22.2	26.4	23.7	26.4
	55										21.0	25.2	23.1	25.2
0357	10										22.2	26.4	23.7	26.4
	55										21.9	25.8	23.1	25.8

YEAR: 2016

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	23.7	27.3	28.8	32.6	34.9	38.6	41.3	39.6	36.9	34.3	29.8	19.6	41.3
	55	22.8	25.5	26.7	30.1	33.3	36.6	39.3	37.6	35.3	33.3	28.5	20.1	39.3
0257	10	23.4	28.2	28.2	32.3	35.3	38.3	40.0	38.6	37.9	35.6	30.4	21.9	40.0
	55	23.4	27.3	28.5	33.3	34.3	36.9	39.3	37.6	36.6	34.6	29.5	21.9	39.3
0357	10	23.1	27.6	27.3	32.0	34.9	39.3	41.0	39.6	37.6	34.6	30.1	22.5	41.0
	55	23.1	27.0	27.3	31.4	33.9	37.9	40.0	38.6	36.6	34.3	29.2	23.1	40.0
0457	10				31.2	34.3	38.1	40.2	38.8	37.1	34.5	29.8	21.2	40.2
	55				30.5	34.2	37.2	39.7	37.9	36.5	34.4	29.2	21.3	39.7
0557	10				31.6	34.9	38.5	40.4	39.1	37.1	34.1	29.6	20.3	40.4
	55				30.7	34.2	37.3	39.8	38.4	36.2	34.0	29.3	20.8	39.8
0657	10				32.0	34.3	38.5	40.8	39.1	36.9	34.5	29.9	20.6	40.8
	55				30.9	33.9	37.6	40.0	38.2	36.2	33.8	29.4	21.1	40.0
0757	10				31.9	34.2	38.2	40.1	38.9	37.2	34.3	30.1	20.8	40.1
	55				30.3	33.1	36.6	38.6	37.5	35.6	33.1	28.8	20.7	38.6
0857	10				31.7	34.0	38.0	40.5	38.8	36.8	34.1	29.9	20.7	40.5
	55				30.8	33.5	37.2	39.3	37.9	36.2	33.3	28.9	20.9	39.3

YEAR: 2017

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	24.6	33.3	33.6	32.0	33.0	37.9	42.0	37.2	38.6	30.7	29.8	23.7	42.0
	55	23.1	31.4	30.7	30.7	30.4	36.6	39.6	35.6	36.6	29.2	29.2	22.5	39.6
0257	10	24.3	32.3	33.6	32.6	32.6	38.3	41.7	37.2	37.2	30.7	30.4	23.7	41.7
	55	23.4	31.4	31.7	31.4	31.0	36.9	40.6	35.9	36.2	29.8	29.5	23.1	40.6
0357	10	24.6	32.6	32.3	30.7	33.0	37.9	41.3	37.9	37.2	31.0	30.4	23.1	41.3
	55	24.3	32.0	31.4	29.8	31.7	36.6	40.3	37.2	36.6	30.7	30.4	22.5	40.3
0457	10	24.2	33.2	32.5	31.7	32.2	38.0	41.0	36.7	37.6	29.9	29.7	23.6	41.0
	55	23.6	32.1	32.0	31.4	31.5	37.5	40.2	36.3	37.0	29.7	29.6	23.4	40.2
0557	10	24.2	32.3	32.9	31.6	32.2	38.0	41.3	37.1	37.9	30.2	29.7	23.8	41.3
	55	23.8	31.4	32.1	31.4	31.6	36.9	40.6	36.5	37.2	29.6	29.6	23.3	40.6
0657	10	24.8	32.5	32.5	32.4	32.4	37.3	41.5	36.7	37.2	30.1	30.2	23.9	41.5
	55	24.0	31.8	31.3	31.7	31.5	36.9	40.5	36.4	36.8	29.8	29.9	23.4	40.5
0757	10	24.7	32.2	32.4	32.1	32.2	37.0	40.6	36.8	36.7	30.3	30.2	23.8	40.6
	55	23.4	31.1	30.9	31.1	30.8	35.7	39.5	35.7	36.1	29.3	29.4	22.4	39.5
0857	10	24.6	32.1	32.4	31.6	32.0	36.9	40.3	37.0	36.1	30.2	30.0	23.4	40.3
	55	23.7	31.5	31.3	31.1	31.2	35.9	39.4	36.3	35.9	29.6	29.6	22.7	39.4

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	19.9	27.6	27.6	38.9	37.2	38.6	44.8	37.6	36.2	33.0	21.3	15.9	44.8
	55	18.4	26.1	25.2	36.9	34.9	36.9	42.7	35.9	34.3	31.4	19.3	14.8	42.7
0257	10	20.1	29.2	27.6	38.3	36.9	37.9	43.1	37.2	36.2	33.3	20.4	17.0	43.1
	55	19.3	27.9	26.1	37.2	35.3	36.9	42.4	36.2	34.9	32.0	19.6	16.2	42.4
0357	10	20.1	26.4	26.4	35.9	36.2	38.9	43.4	38.3	36.9	32.6	21.0	15.3	43.4
	55	19.6	26.1	25.5	34.9	34.9	37.9	43.4	37.2	35.6	31.7	21.0	14.8	43.4
0457	10	19.7	28.5	26.7	37.8	35.8	37.7	43.4	37.4	36.4	32.9	20.6	16.3	43.4
	55	19.4	28.1	26.4	37.7	35.3	37.5	43.2	36.7	35.3	32.3	20.0	15.9	43.2
0557	10	19.9	28.1	26.8	38.4	36.3	38.2	44.1	37.2	36.1				44.1
	55	19.4	28.0	26.2	37.8	35.5	37.6	43.4	36.7	35.4				43.4
0657	10	19.4	27.0	27.0	37.9	36.1	38.3	44.1	36.9	35.8	32.6	20.8	16.0	44.1
	55	18.8	26.2	26.1	37.2	35.3	37.8	43.5	36.4	35.1	31.9	20.0	15.3	43.5
0757	10	19.7	26.7	26.6	37.2	36.4	38.3	43.3	36.9	35.6				43.3
	55	18.6	25.3	25.2	36.0	34.8	37.3	42.6	36.0	34.4				42.6
0857	10	19.4	26.4	26.1	36.6	35.5	38.1	43.2	36.8	35.5				43.2
	55	18.8	25.7	25.5	35.8	35.0	37.4	42.7	36.2	34.8				42.7

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	20.1	23.7	26.4										26.4
	55	19.6	23.4	24.9										24.9
0257	10	20.7	24.6	27.6										27.6
	55	19.6	23.7	26.4										26.4
0357	10	19.9	24.0	25.5										25.5
	55	19.3	23.7	24.6										24.6
0457	10	20.5	24.3	26.2										26.2
	55	20.1	24.2	25.8										25.8
0657	10	20.7	24.4	26.2										26.2
	55	20.1	24.0	25.2										25.2

Overall Maximum: 47.0

Extreme Minimum Temperatures (°C)...

YEAR: 2008

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2			-13.5	-1.8	3.0	14.3	15.9	15.3	7.7	-2.2	-10.9	-14.3	-14.3

YEAR: 2009

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	-16.0	-8.2	-8.6	-6.7	4.2	11.3	14.8	12.4	4.9	0.1	-3.8	-15.0	-16.0

YEAR: 2010

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	-16.9	-10.7	-5.4	-1.8	3.9	17.0	18.4	10.0	7.4	2.2	-6.4	-13.5	-16.9

YEAR: 2011

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	-13.7												-13.7

YEAR: 2015

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2										3.7	-4.5	-9.8	-9.8
	55										5.2	-4.3	-6.2	-6.2
0257	10										6.2	-4.0	-7.3	-7.3
	55										5.9	-4.5	-6.7	-6.7
0357	10										5.9	-2.7	-6.7	-6.7
	55										6.4	-3.1	-4.5	-4.5

YEAR: 2016

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	-12.9	-7.5	-7.9	-1.3	4.7	13.4	16.7	13.7	6.4	3.4	-7.7	-23.2	-23.2
	55	-11.3	-5.8	-3.6	3.2	4.7	16.2	16.7	17.9	10.8	4.4	-2.7	-18.4	-18.4
0257	10	-11.3	-7.7	-7.3	-1.8	4.7	13.2	16.7	15.9	9.7	4.2	-6.2	-22.2	-22.2
	55	-10.9	-6.2	-5.6	0.3	4.7	16.5	16.2	17.6	11.8	4.4	-5.1	-21.3	-21.3
0357	10	-10.2	-7.3	-4.0	-0.6	6.4	16.2	17.3	15.9	9.7	5.2	-5.8	-19.5	-19.5
	55	-9.6	-4.5	-2.5	3.7	6.4	17.3	17.3	18.1	11.6	6.2	-1.8	-18.2	-18.2
0457	10				5.7	5.2	13.7	16.9	13.9	8.8	4.2	-5.7	-21.2	-21.2
	55				5.4	5.5	15.5	16.9	17.3	12.1	5.1	-3.4	-19.1	-19.1
0557	10				4.2	5.4	14.0	17.4	13.4	9.0	3.1	-6.0	-21.3	-21.3
	55				5.6	5.7	17.1	17.2	17.3	12.2	5.4	-4.3	-20.5	-20.5
0657	10				5.9	5.8	14.0	18.0	15.0	9.4	4.7	-6.2	-21.5	-21.5
	55				5.5	5.8	17.0	17.7	17.7	11.9	5.5	-3.3	-19.6	-19.6
0757	10				6.0	6.2	16.7	17.5	16.2	10.1	5.4	-5.0	-20.0	-20.0
	55				4.9	5.3	16.0	16.6	17.5	10.9	4.9	-2.2	-18.4	-18.4
0857	10				5.6	6.2	16.4	17.1	15.5	9.6	5.0	-6.1	-21.4	-21.4
	55				5.5	5.9	16.8	16.8	17.6	11.3	5.5	-2.4	-18.1	-18.1

YEAR: 2017

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	-15.6	-10.7	-5.1	1.5	1.5	13.7	14.5	11.3	6.2	-6.9	-7.1	-16.0	-16.0
	55	-13.3	-7.3	-4.3	1.3	3.4	15.1	16.2	15.9	12.1	-1.5	-3.1	-15.6	-15.6
0257	10	-16.2	-9.6	-4.3	1.7	1.5	14.5	17.0	15.9	10.0	-5.6	-3.8	-16.0	-16.2
	55	-14.5	-8.4	-4.0	1.0	2.5	15.3	17.6	16.2	12.4	-2.9	-2.9	-15.6	-15.6
0357	10	-14.8	-7.9	-3.6	2.2	3.2	14.5	17.3	15.3	13.2	-5.1	-4.0	-14.7	-14.8
	55	-12.1	-6.4	-2.9	2.7	3.7	15.9	18.4	17.3	13.4	-1.1	-2.5	-14.3	-14.3
0457	10	-17.8	-9.0	-3.5	2.0	2.1	14.8	17.0	14.9	11.4	-5.0	-4.5	-15.2	-17.8
	55	-13.9	-7.4	-3.2	1.7	4.2	15.2	17.9	16.3	13.0	-1.6	-2.5	-14.8	-14.8
0557	10	-16.8	-9.0	-4.8	1.1	2.9	14.4	16.9	14.4	9.9	-5.5	-5.2	-14.9	-16.8
	55	-12.7	-7.7	-3.0	2.3	3.9	15.3	18.3	16.5	13.3	-3.6	-2.1	-14.5	-14.5
0657	10	-16.7	-9.0	-3.7	1.8	1.9	14.9	15.1	15.0	11.5	-4.8	-5.2	-14.5	-16.7
	55	-14.1	-7.5	-3.2	2.1	4.3	15.4	15.9	16.6	13.3	-2.7	-2.3	-14.5	-14.5
0757	10	-14.4	-7.6	-3.3	2.8	2.3	14.6	16.3	16.2	13.3	-4.6	-3.2	-14.6	-14.6
	55	-12.8	-7.1	-3.7	1.7	2.8	15.1	16.3	16.6	12.8	-0.7	-2.9	-15.2	-15.2
0857	10	-15.3	-8.9	-4.0	2.4	2.8	14.5	16.4	15.1	11.2	-4.9	-5.0	-15.2	-15.3
	55	-12.4	-6.8	-3.4	2.1	3.3	15.7	16.6	16.8	13.1	-3.0	-2.5	-14.9	-14.9

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	-21.3	-13.7	-6.7	-7.9	9.2	12.4	14.3	14.5	5.4	-2.2	-12.9	-9.6	-21.3
	55	-20.1	-13.7	-3.1	-8.6	10.0	15.3	15.3	15.9	8.2	-1.8	-9.2	-7.1	-20.1
0257	10	-19.7	-13.3	-6.7	-7.7	8.9	15.3	14.8	14.8	8.9	-1.8	-11.9	-7.9	-19.7
	55	-19.7	-13.3	-5.1	-8.4	9.5	15.3	15.1	16.5	8.2	-1.8	-10.2	-7.3	-19.7
0357	10	-19.0	-12.7	-4.7	-6.9	11.6	16.5	15.3	16.2	8.9	-0.8	-10.2	-6.9	-19.0
	55	-18.6	-12.3	-2.5	-7.3	11.6	16.5	15.9	17.9	9.7	-0.6	-9.2	-5.6	-18.6
0457	10	-19.5	-13.3	-6.4	-7.4	9.7	14.0	14.8	14.7	7.0	-1.2	-12.0	-7.7	-19.5
	55	-18.9	-12.6	-3.3	-7.6	10.3	16.0	14.9	16.8	8.9	-0.9	-10.3	-6.3	-18.9
0557	10	-18.8	-12.6	-5.9	-6.9	10.1	15.6	16.0	15.6					-18.8
	55	-18.5	-12.5	-4.0	-7.3	10.6	16.1	16.2	16.6					-18.5
0657	10	-19.4	-13.4	-5.9	-7.2	10.4	16.3	14.9	15.1	7.7	-1.2	-11.7	-8.0	-19.4
	55	-18.9	-12.8	-3.6	-7.6	10.8	16.3	15.5	17.2	9.3	-0.9	-9.2	-6.0	-18.9
0757	10	-19.0	-13.1	-3.5	-7.0	11.5	16.5	15.9	17.0	14.3				-19.0
	55	-19.4	-13.1	-2.6	-8.1	10.8	15.8	15.7	17.1	14.9				-19.4
0857	10	-19.4	-13.0	-3.7	-7.1	10.8	16.3	15.5	16.7	14.0				-19.4
	55	-19.0	-12.5	-2.9	-7.6	11.2	16.1	15.4	17.4	15.1				-19.0

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0157	2	-11.1	-16.0	-14.5										-16.0
	55	-10.5	-12.7	-15.0										-15.0
0257	10	-10.9	-13.9	-14.7										-14.7
	55	-10.5	-12.9	-14.7										-14.7

0357	10	-9.8	-13.9	-13.5	-13.9
	55	-9.0	-11.7	-13.7	-13.7
0457	10	-10.4	-14.2	-13.7	-14.2
	55	-9.5	-12.8	-13.9	-13.9
0657	10	-10.0	-14.1	-13.5	-14.1
	55	-9.4	-12.0	-13.9	-13.9
Overall Minimum:					-23.2

Data Recovery: black = 90-100%; green = 75-90%; blue = 50-75%; orange = 25-50%; purple = 10-25%; "x" = 0-10%.

WERA. Wind Energy Resource Assessment
Sundance Project, Oklahoma
GE Turbines

Turbine 1						Turbine 2						Turbine 3					
Turbine	Model	Hub Ht (m)	Mean Hub-Ht Speed	Gross Cap. Factor (%)	Gross Annual GWh	Turbine	Model	Hub Ht (m)	Mean Hub-Ht Speed	Gross Cap. Factor (%)	Gross Annual GWh	Turbine	Model	Hub Ht (m)	Mean Hub-Ht Speed	Gross Cap. Factor (%)	Gross Annual GWh
1	2.82-127	88.6	8.07	55.6	13.736	37	2.82-127	88.6	8.25	57.1	14.103	65	2.82-127	88.6	8.03	45.7	9.214
2	2.82-127	88.6	8.15	56.3	13.908	38	2.82-127	88.6	8.36	57.9	14.314	66	2.3-116	80	8.08	46.0	9.277
3	2.82-127	88.6	8.41	58.4	14.417	39	2.82-127	88.6	8.45	58.7	14.500	67	2.3-116	80	8.04	45.8	9.227
4	2.82-127	88.6	8.24	57.0	14.090	40	2.82-127	88.6	8.26	57.2	14.127	68	2.3-116	80	8.03	45.7	9.216
5	2.82-127	88.6	7.78	52.8	13.035	41	2.82-127	88.6	8.39	58.2	14.379	69	2.3-116	80	7.97	45.3	9.120
6	2.82-127	88.6	8.26	57.2	14.131	42	2.82-127	88.6	7.65	51.5	12.721	70	2.3-116	80	7.97	45.3	9.120
7	2.82-127	88.6	8.35	57.9	14.311	43	2.82-127	88.6	7.72	52.2	12.897	71	2.3-116	80	7.95	45.1	9.088
8	2.82-127	88.6	8.53	59.4	14.674	44	2.82-127	88.6	7.75	52.5	12.972	72	2.3-116	80			
9	2.82-127	88.6	8.57	59.7	14.744	45	2.82-127	88.6	7.78	52.8	13.048						
10	2.82-127	88.6	8.55	59.6	14.714	46	2.82-127	88.6	7.96	54.6	13.500						
11	2.82-127	88.6	8.67	60.5	14.942	47	2.82-127	88.6	7.92	54.2	13.399						
12	2.82-127	88.6	7.72	52.2	12.897	48	2.82-127	88.6	7.94	54.4	13.450						
13	2.82-127	88.6	7.80	53.0	13.098	49	2.82-127	88.6	7.94	54.4	13.450						
14	2.82-127	88.6	7.84	53.4	13.198	50	2.82-127	88.6	7.99	55.0	13.575						
15	2.82-127	88.6	8.02	55.2	13.640	51	2.82-127	88.6	8.06	55.5	13.721						
16	2.82-127	88.6	8.25	57.1	14.103	52	2.82-127	88.6	8.11	55.9	13.821						
17	2.82-127	88.6	8.45	58.7	14.505	53	2.82-127	88.6	8.13	56.1	13.861						
18	2.82-127	88.6	8.36	58.0	14.324	54	2.82-127	88.6	8.14	56.2	13.882						
19	2.82-127	88.6	8.50	59.1	14.605	55	2.82-127	88.6	8.18	56.5	13.957						
20	2.82-127	88.6	8.49	59.0	14.585	56	2.82-127	88.6	8.16	56.3	13.920						
21	2.82-127	88.6	8.28	57.3	14.163	57	2.82-127	88.6	8.10	55.9	13.806						
22	2.82-127	88.6	8.53	59.4	14.666	58	2.82-127	88.6	8.12	56.0	13.844						
23	2.82-127	88.6	8.54	59.4	14.686	59	2.82-127	88.6	8.08	55.7	13.767						
24	2.82-127	88.6	8.63	60.2	14.867	60	2.82-127	88.6	8.04	55.4	13.688						
25	2.82-127	88.6	8.54	59.4	14.686	61	2.82-127	88.6	8.04	55.4	13.688						
26	2.82-127	88.6	8.60	59.9	14.806	62	2.82-127	88.6	8.02	55.2	13.648						
27	2.82-127	88.6	8.65	60.3	14.907	63	2.82-127	88.6	8.02	55.2	13.648						
28	2.82-127	88.6	8.60	59.9	14.806	64	2.82-127	88.6	7.98	54.9	13.559						
29	2.82-127	88.6	8.35	57.9	14.304	65	2.82-127	88.6	7.92	54.2	13.399						
30	2.82-127	88.6	8.45	58.7	14.505	66	2.3-116	80	8.03	45.7	9.214						
31	2.82-127	88.6	8.24	57.0	14.083	67	2.3-116	80	8.08	46.0	9.277						
32	2.82-127	88.6	8.40	58.3	14.404	68	2.3-116	80	8.04	45.8	9.227						
33	2.82-127	88.6	8.45	58.7	14.505	69	2.3-116	80	8.03	45.7	9.216						
34	2.82-127	88.6	8.41	58.4	14.430	70	2.3-116	80	7.97	45.3	9.120						
35	2.82-127	88.6	8.37	58.0	14.335	71	2.3-116	80	7.97	45.3	9.120						
36	2.82-127	88.6	8.20	56.6	13.994	72	2.3-116	80	7.95	45.1	9.088						
						Overall				8.19	55.80	974.71					

Losses. Discount Factors to Convert Gross to Net Energy Projections
Sundance Project, Oklahoma
American Electric Power

Highlighted discounts need contractual or engineering inputs before finalizing them

GE-2.82/127; 2.3/116		
88.6/80-m Hub Heights		
	Loss (%)	Efficiency
Total Discount	17.66	0.8234

Detail by Category

	Loss (%)	Efficiency	Description
Turbine Availability	4.00	0.9600	
Turbine	4	0.96	Assumes 97.0% performance-based guarantee for warranty period, then generally decreasing availability after that, consistent with DNV report for AEP
High-wind/downtime correlation	0	1	Downtime correlated with high-wind events, assumed zero for this project
Electrical	2.50	0.9750	from turbines to high-side of interconnect point, placeholder value for now
Wake Effects	5.32	0.9468	
Internal wake losses	5.23	0.9477	Calculated with Simon Wind wake models, includes turbine blockage effect
Wakes from pre-existing turbines	0	1	No pre-existing turbines
Wakes from future turbines	0.1	0.999	Assuming the Freedom wind farm is built to the northwest
Turbine Performance	3.95	0.9605	
Turbulence	1	0.99	Standard value, aerodynamic inefficiency due to high turbulence or yaw error
Inclined flow, high shear	0	1	Not applicable due to simple terrain and standard Midwest shears
High-wind hysteresis	0	1	Calculated from "En Sims" tab and control algorithm near cut-out speed
Sub-optimal operations	1	0.99	Control software settings, hardware performance, O&M inefficiency
Power curve inaccuracy	2	0.98	Per presentations at AWEA 2012 wind resource assessment workshop
Environmental	2.28	0.9772	
Blade degradation and soiling	1	0.99	Industry standard average value over time; starts out near zero then increases over time
Icing	0.8	0.992	Based on climate and observed anemometer icing
High/low temperature shutdowns	0.2	0.998	Based on -30C to +40C operating temperature range with cold weather package
Other meteorological events	0.2	0.998	Lightning, severe weather, etc.
Site access, force majeure	0.1	0.999	Non-meteorological events that affect site access
Tree growth or felling	0	1	Minimal changes expected in tree cover
Curtailment	0.00	1.0000	
Wind direction sector management	0	1	Pending MLA
Off-taker curtails power delivery	0	1	Assumed zero, check with off-taker
Other causes	0	1	Noise, shadow flicker, animal activity/migration, military operations, etc.
Balance of Plant	1.00	0.9900	Plant downtime (substation, collection, etc., not turbine-related)

12x24. Simulated Long-Term Mean Monthly/Diurnal Net Capacity Factor (%)
Sundance Project, Oklahoma
American Electric Power
Based on Sites 0157/0357, 89-m Extrapolated Data, November 2015-April 2019
Turbine: GE-2.82/127 and GE-2.3/116

Hour (CST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	57.6	58.6	56.9	57.5	60.3	59.1	48.4	42.6	54.8	54.0	59.5	52.3
1	59.0	59.3	56.3	59.3	57.6	54.6	44.2	41.8	51.2	52.4	58.9	54.2
2	58.7	58.4	57.8	57.7	55.6	50.1	43.1	40.6	48.5	51.3	57.6	57.6
3	57.9	56.7	57.6	55.0	55.9	49.5	38.8	38.1	46.1	50.8	56.7	57.1
4	56.6	53.9	57.7	53.8	52.9	47.0	36.9	35.7	45.1	52.5	55.6	55.8
5	56.0	56.3	58.4	55.3	51.8	46.1	34.0	35.8	42.4	52.8	54.9	54.1
6	54.8	55.9	57.5	54.0	47.9	38.4	28.1	34.1	41.4	51.1	53.4	53.5
7	55.5	53.6	54.1	47.4	38.1	32.1	19.0	24.8	34.8	47.8	52.2	52.1
8	51.2	48.4	46.5	45.2	39.9	34.7	18.4	22.5	29.4	39.0	44.1	47.8
9	39.3	39.8	45.5	46.7	40.8	36.0	17.5	22.5	31.7	37.1	37.6	38.3
10	36.4	39.1	46.0	46.2	40.2	35.8	17.5	21.7	33.8	37.3	37.5	37.3
11	36.7	39.1	46.1	47.2	39.7	35.7	17.2	22.9	34.0	38.8	38.8	38.6
12	36.7	38.7	46.0	48.2	38.5	37.7	18.5	23.4	35.2	40.7	39.0	40.2
13	37.0	40.4	45.1	48.9	40.0	40.5	20.1	24.9	37.2	42.2	39.2	40.4
14	38.4	40.6	46.1	50.6	41.9	42.5	21.4	26.2	38.2	42.0	40.0	40.0
15	37.3	41.2	46.8	51.3	43.3	45.5	22.4	26.6	39.1	41.0	41.2	39.3
16	36.8	40.4	46.0	52.1	44.4	48.4	24.4	28.7	41.1	40.4	41.3	38.0
17	38.9	39.7	45.6	51.6	46.0	48.6	27.2	29.1	41.0	39.8	44.0	42.5
18	46.4	45.0	46.1	52.8	46.0	47.9	30.7	31.9	44.6	46.8	51.2	48.3
19	50.6	52.4	51.4	54.3	49.5	47.9	38.4	38.8	52.7	53.1	54.6	52.0
20	53.0	58.0	56.1	60.0	53.6	53.7	47.5	46.7	56.7	54.7	57.0	53.1
21	55.6	59.8	59.5	63.0	59.0	57.9	51.8	52.4	57.6	55.0	58.2	52.1
22	55.6	57.3	58.9	63.5	61.4	58.0	51.4	50.0	57.5	54.7	57.7	52.9
23	58.0	56.5	56.6	60.7	61.2	59.0	50.0	47.5	57.9	54.1	57.3	53.5
Month	48.50	49.55	51.85	53.43	48.56	46.10	31.96	33.72	43.83	47.06	49.48	47.97
Year:	45.95											

Simulated Long-Term Mean Monthly/Diurnal Net Power Delivery (MW)
Sundance Project, Oklahoma
American Electric Power
Monthly net GWh at bottom of table

Hour (CST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	114.9	116.8	113.4	114.7	120.3	117.9	96.4	84.9	109.3	107.7	118.7	104.3
1	117.6	118.3	112.3	118.2	114.9	108.8	88.1	83.4	102.1	104.5	117.5	108.1
2	117.0	116.4	115.3	115.1	110.8	100.0	85.9	81.0	96.7	102.3	114.9	114.8
3	115.5	113.0	114.8	109.6	111.4	98.7	77.4	76.0	91.9	101.3	113.0	113.9
4	112.9	107.4	115.0	107.4	105.4	93.7	73.6	71.1	89.9	104.8	110.8	111.3
5	111.6	112.2	116.4	110.3	103.2	91.9	67.8	71.5	84.6	105.2	109.5	107.9
6	109.2	111.5	114.6	107.6	95.5	76.5	56.1	67.9	82.5	101.9	106.6	106.6
7	110.6	107.0	107.8	94.5	76.0	64.1	37.9	49.4	69.5	95.2	104.1	103.8
8	102.1	96.4	92.8	90.2	79.6	69.2	36.7	44.9	58.5	77.8	87.9	95.3
9	78.4	79.4	90.7	93.0	81.3	71.8	34.9	44.8	63.2	73.9	74.9	76.5
10	72.6	77.9	91.8	92.2	80.1	71.3	34.9	43.3	67.4	74.3	74.9	74.4
11	73.2	77.9	92.0	94.0	79.2	71.1	34.2	45.6	67.8	77.4	77.4	77.1
12	73.2	77.2	91.7	96.1	76.8	75.2	36.9	46.6	70.2	81.2	77.7	80.2
13	73.8	80.6	89.9	97.5	79.7	80.7	40.1	49.6	74.2	84.1	78.2	80.6
14	76.5	80.9	91.9	100.9	83.6	84.8	42.7	52.2	76.2	83.7	79.9	79.7
15	74.4	82.1	93.4	102.3	86.3	90.7	44.7	53.1	77.9	81.8	82.1	78.4
16	73.4	80.6	91.7	103.8	88.6	96.4	48.7	57.1	81.9	80.6	82.3	75.9
17	77.5	79.1	90.9	102.8	91.7	96.9	54.3	58.0	81.8	79.3	87.7	84.8
18	92.6	89.8	91.9	105.2	91.6	95.4	61.1	63.7	88.9	93.4	102.1	96.3
19	101.0	104.5	102.4	108.4	98.7	95.5	76.6	77.4	105.1	105.9	108.8	103.7
20	105.6	115.7	111.9	119.6	107.0	107.0	94.7	93.2	113.1	109.1	113.8	105.9
21	110.8	119.3	118.6	125.7	117.6	115.5	103.3	104.6	114.9	109.6	116.0	103.9
22	110.8	114.2	117.5	126.7	122.5	115.7	102.5	99.7	114.6	109.1	115.1	105.6
23	115.7	112.7	112.9	121.1	122.1	117.6	99.8	94.8	115.4	107.8	114.3	106.8
Month (GWh)	71.94	66.39	76.93	76.71	72.05	66.19	47.41	50.03	62.92	69.81	71.04	71.16

GWh for Year: 802.589

P-Values. Probability Analysis, Sundance 199.4-MW Array
65 GE-2.82/127 and 7 GE-2.3/116 Turbines

95% Confidence Limits in

1) Weighted Long-Term Mean Speeds at Reference Stations			
Standard Deviation (%) of Annual Means		2.93	
Average Years of Data		18.92	
Equivalent Long-Term Uncertainty (1 sigma)		0.67	
95% Confidence Limits			1.32
2) Weighted Correlation between Reference Stations and Site 0157			
Standard Deviation (%) of Monthly Speed Ratios		3.01	
Average Months of Data		41	
Equivalent Long-Term Uncertainty (1 sigma)		0.47	
95% Confidence Limits			0.92
3) Correlation between Site 0157 and Key Other Sundance Towers			
Standard Deviation (%) of Monthly Speed Ratios		2.38	
Average Months of Data		34	
Equivalent Long-Term Uncertainty (1 sigma)		0.41	
95% Confidence Limits			0.80
4) Shear Uncertainties, 60-89 m			
Base Shear		0.23	
89/60 m Speed Ratio, Base Shear		1.095	
Minimum Likely Shear		0.19	
89/60 m Speed Ratio, Minimum Shear		1.078	
Shortfall in Mean with Minimum Shear			1.56
5) Micrositing Uncertainty			
based on array layout, terrain, met tower coverage, no site visit			6.00
6) Tower Configuration/Anemometer Accuracy			
			2.50
7) Changes to Reference Stations			
			3.00
8) Climate Change			
			4.00
Root-Sum-Square 95% Confidence Limits in Aggregate			
Long-Term Mean Annual Hub-Height Mean Wind Speed			8.54

Equivalent 95% Confidence Limits in Gross Capacity Factor:

Case	Mean Speed (mps)	Gross Cap. Factor (%)	% Deviation from Base
Base	8.19	55.66	0
Lower	7.49	49.06	11.86
Upper	8.89	61.25	10.04

7 mps	8 mps	9 mps
44.14	54.13	62.11

Adjustment to above 95% Confidence Limits to Convert from Gross to Net
Long-Term Capacity Factor (see table immediately below)...

Case	% Deviation from Base
Lower	13.22
Upper	10.78

95% Confidence Limits in...

	Low	High
wind speed frequency distrib.	-3	3
turbine availability	-2	1
electrical loss	-1	1
wake loss	-2	1.5
turbine performance	-2	1
environmental factors	-2	1
curtailment	-2	0
balance of plant	-2	0.5
Combined	-5.83	3.94

To adjust long-term uncertainties to 1-year and 10-year uncertainties, one must incorporate the standard deviation of interannual winds. The weighted standard deviation in interannual wind speeds at the reference stations is 2.93%, per cell E7 above. This is equivalent to a gross energy standard deviation of 3.6%. Allowing for possible different conditions at Sundance plus the interannual variability of the loss factors brings the total interannual standard deviation of energy potential to 7.0%.

For a 10-year period, the equivalent standard deviation increment for interannual variability is 7.0% divided by the square root of 10, or 2.2%. This is equivalent to a 95% confidence limit of 2.2% x 1.96, or 4.3%. The 10-year confidence limits are computed from the root-sum-square of the values in lines 61/62 and 4.3%.

Case	% Deviation from Base
Lower	13.90
Upper	11.61

Here are the Associated P-Values for 10-Year Mean Net Capacity Factors
(assuming turbines operate according to the stated power curve including the 2.0% discount per the "Losses" tab, turbines are operated and maintained according to manufacturer specifications with no major mechanical defects, and all curtailment is reimbursed)...

P-Value	Net CF (%)	Tao	# Tao	Extension	Percent
P99	38.39	7.09	2.32	16.45	83.55
P95	40.57	7.09	1.65	11.70	88.30
P90	41.78	7.09	1.28	9.08	90.92
P75	43.73	7.09	0.68	4.82	95.18
P50	45.95 from Summary tab				
P25	47.80	5.92	0.68	4.03	104.03
P10	49.43	5.92	1.28	7.58	107.58

P05	50.44	5.92	1.65	9.77	109.77
P01	52.26	5.92	2.32	13.74	113.74

For one-year P-values, we incorporate the one-year 95% confidence limits in interannual variability (7.0% x 1.96, or 13.7%) with the values from lines 61/62, with these resulting 95% confidence limits:

Case	% Deviation from Base
Lower	19.04
Upper	17.43

Here are the Associated P-Values for One-Year Mean Net Capacity Factors
(assuming turbines operate according to the stated power curve including the 2.0% discount per the "Losses" tab, turbines are operated and maintained according to manufacturer specifications with no major mechanical defects, and all curtailment is reimbursed)...

P-Value	Net CF (%)	Tao	# Tao	Extension	Percent
P99	35.59	9.71	2.32	22.53	77.47
P95	38.58	9.71	1.65	16.03	83.97
P90	40.23	9.71	1.28	12.43	87.57
P75	42.91	9.71	0.68	6.61	93.39
P50	45.95 from Summary tab				
P25	48.73	8.89	0.68	6.05	106.05
P10	51.18	8.89	1.28	11.39	111.39
P05	52.69	8.89	1.65	14.68	114.68
P01	55.43	8.89	2.32	20.64	120.64

PUC DOCKET NO. _____

PUBLIC UTILITY COMMISSION OF TEXAS

APPLICATION OF
SOUTHWESTERN ELECTRIC POWER COMPANY
FOR CERTIFICATE OF CONVENIENCE AND NECESSITY
AUTHORIZATION AND RELATED RELIEF FOR
THE ACQUISITION OF WIND GENERATION FACILITIES

DIRECT TESTIMONY OF
JOSEPH G. DERUNTZ
FOR
SOUTHWESTERN ELECTRIC POWER COMPANY

JULY 15, 2019

<u>SECTION</u>	<u>TESTIMONY INDEX</u>	<u>PAGE</u>
I. INTRODUCTION		1
II. PURPOSE OF TESTIMONY		2
III. SELECTED WIND FACILITIES OVERVIEW		3
IV. CONSTRUCTION AND EXECUTION		5
V. SELECTED WIND FACILITIES PROJECTED COSTS.....		14
VI. SELECTED WIND FACILITIES PROJECTED O&M COST		16
VII. DESIGN LIFE OF THE SELECTED WIND FACILITIES		18
VIII. CONCLUSION		19

EXHIBITS

<u>EXHIBIT</u>	<u>DESCRIPTION</u>
EXHIBIT JGD-1	Selected Wind Facilities Overview
EXHIBIT JGD-2	Wind Resource Map
EXHIBIT JGD-3	Total Installed Capital Cost
EXHIBIT JGD-4	Permitting and Environmental Studies Status
EXHIBIT JGD-5	Ongoing O&M and Capital Forecast

1 I. INTRODUCTION

2 Q. PLEASE STATE YOUR NAME, POSITION IN THE COMPANY AND BUSINESS
3 ADDRESS.

4 A. My name is Joseph G. DeRuntz. My business address is 1 Riverside Plaza, Columbus,
5 Ohio 43215. I am employed by American Electric Power Service Corporation
6 (AEPSC), a wholly owned subsidiary of American Electric Power Company, Inc.
7 (AEP), as Project Director. AEP is the parent company of Southwestern Electric Power
8 Company (SWEPCO, or the Company) and Public Service Company of Oklahoma
9 (PSO). AEPSC supplies engineering, financing, accounting, and similar planning and
10 advisory services to AEP's regulated electric operating companies, including
11 SWEPCO and PSO (jointly referred to as the Companies).

12 Q. WOULD YOU BRIEFLY DESCRIBE YOUR EDUCATIONAL AND
13 PROFESSIONAL BACKGROUND?

14 A. I earned a Bachelor of Science Degree in Civil Engineering from the University of
15 Missouri-Rolla in 1984 and a Master of Business Administration degree from the
16 Fisher College of Business at The Ohio State University in 2001. My professional
17 experience includes 34 years working for AEP companies on the design, construction,
18 retrofit, and maintenance of coal, natural gas, nuclear, and renewable generating
19 facilities. I have held various positions including design engineer, construction
20 coordinator, project engineer, asset manager, and project manager. I am a registered
21 Professional Engineer in Ohio and a PMI certified Project Management Professional.
22 I assumed my current position as Project Director in 2017.

1 Q. WHAT ARE YOUR CURRENT RESPONSIBILITIES?

2 A. I directly supervise seven project managers. My responsibilities include direct
3 accountability for the successful completion of a wide range of projects varying in size,
4 technology, complexity and capital investment. I provide leadership to ensure capital
5 projects that serve the needs of the AEP generation fleet are initiated, planned,
6 executed, monitored, controlled, and closed in a safe, efficient, and effective manner.

7 Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE ANY REGULATORY
8 COMMISSIONS?

9 A. Yes. I filed testimony before the Louisiana Public Service Commission (LPSC) in
10 Docket No. U-33856, before the Kentucky Public Service Commission in Case No.
11 2015-00152, and the Indiana Utility Regulatory Commission in Cause No. 45245.

12

13 II. PURPOSE OF TESTIMONY

14 Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

15 A. The purpose of my testimony is to (1) provide an overview of the Traverse, Maverick,
16 and Sundance wind projects (collectively, the Selected Wind Facilities); (2) describe
17 the Companies' role in project management and the oversight of engineering,
18 procurement, and construction; (3) present milestones for construction activities and
19 the estimated commercial operation dates (COD); (4) present the total installed capital
20 cost; (5) describe the Companies' operation and maintenance (O&M) plans including
21 ongoing O&M and capital cost estimates for the Selected Wind Facilities; and (6)
22 describe the reasonableness of the 30-year design life.

1 III. SELECTED WIND FACILITIES OVERVIEW

2 Q. PLEASE PROVIDE AN OVERVIEW OF THE SELECTED WIND FACILITIES.

3 A. The Selected Wind Facilities are summarized in Table 1 below and described in more
4 detail in EXHIBIT JGD-1. The Selected Wind Facilities consist of three separate
5 projects totaling 1,485 MW of installed nameplate capacity. The Companies identified
6 the Selected Wind Facilities through a competitive Request for Proposal (RFP) process
7 as discussed in detail by Company witness Jay Godfrey.

Table 1 – Selected Wind Facilities Overview

	Traverse	Maverick	Sundance
Size (Nameplate)	999 MW	287 MW	199 MW
Planned COD	2021	2021	2020
Location (State)	Oklahoma	Oklahoma	Oklahoma
Location (Counties)	Custer, Blaine	Garfield, Kingfisher, Major	Woods, Alfalfa, Major

8 The Selected Wind Facilities will be engineered to have a design life of 30 years
9 and will consist of a selection of General Electric (GE) 2.3 MW, 2.5 MW, and 2.82
10 MW wind turbine generators (WTG). The energy from the turbines will flow into a
11 34.5 kV underground Collection System to a collector substation where the energy will
12 be transformed and transmitted via overhead line to match the voltage of the
13 interconnecting utility's substation. The Selected Wind Facilities will also have access
14 roads to the turbines and an O&M building on each of the sites.

15 Q. PLEASE PROVIDE A GENERAL DESCRIPTION OF THE SELECTED WIND
16 FACILITIES SITE LOCATIONS.

17 A. As shown in EXHIBIT JDG-2, the Selected Wind Facilities will be located to take
18 advantage of one of the best wind resources in North America within the western

1 portion of the Southwest Power Pool (SPP) in North Central Oklahoma. The Selected
2 Wind Facilities will cover large areas of land primarily used for agriculture and pasture.

3 Q. WHAT DUE DILIGENCE DID THE COMPANY COMPLETE ON THE SELECTED
4 WIND FACILITIES?

5 A. As further described by Company witness Godfrey, thorough due diligence was
6 completed on the Selected Wind Facilities prior to the execution of the Purchase and
7 Sale Agreements (PSAs). Included in the due diligence was a review of the technology,
8 site layout, wind analysis, permitting, environmental and wildlife impacts and site
9 visits. The Company will continue to monitor the Selected Wind Facilities as
10 engineering and construction progresses. These activities include, but are not limited
11 to, project and schedule oversight, review of all contracts and agreements entered into,
12 and continued evaluation of environmental impacts and wildlife studies that I discuss
13 in more detail below.

14 Q. WHAT IS THE STATUS OF EACH OF THE SELECTED WIND FACILITIES?

15 A. The sequence of development activities associated with wind farms generally starts
16 with land acquisition followed by environmental studies, turbine siting and layout,
17 engineering and design, major equipment procurement and construction. The sequence
18 of the development activities is not linear and is dependent on the status of leasing
19 arrangements. The detailed scope of wind projects are developed progressively so that
20 as land acquisition is finalized, the other development activities are completed within
21 a relatively short period afterward.

1 Sundance has complete all land acquisition and will finalize micro-siting¹ of
2 turbines in the third quarter of 2019. Major equipment procurement and engineering
3 work will follow to support a March 2020 construction start. Maverick and Traverse
4 are expected to complete land acquisition by October and December 2019, respectively.

5 Q. WHAT IS THE PLANNED COD FOR EACH OF THE SELECTED WIND
6 FACILITIES?

7 A. The estimated COD for Sundance is on or before December 15, 2020. The estimated
8 CODs for Traverse and Maverick are on or before December 15, 2021. Company
9 witness Godfrey discusses the multiple in-service dates for the Selected Wind Facilities
10 in his testimony.

11

12 IV. CONSTRUCTION AND EXECUTION

13 Q. HAVE THE COMPANIES ENTERED INTO ANY AGREEMENTS FOR THE
14 DEVELOPMENT AND CONSTRUCTION OF THE SELECTED WIND
15 FACILITIES?

16 A. Yes. The Companies have entered into PSAs for the purchase of 100% of the equity
17 interests of each of the project holding companies, which are affiliates of Invenergy
18 Wind Development, North America (Invenergy). The PSAs are discussed in the
19 testimony of Company witness Godfrey.

¹ Micro-siting is the process ensuring that each turbine location is verified and there are no impediments that would impact construction or operation.

1 Q. WHAT RESPONSIBILITIES WILL INVENERGY HAVE UNDER THE PSAS IN
2 THE DEVELOPMENT AND CONSTRUCTION OF THE SELECTED WIND
3 FACILITIES?

4 A. Invenergy will be responsible for the development, land acquisition, environmental
5 studies, permitting, engineering, and procurement of all necessary equipment and
6 materials, construction and commissioning of the Selected Wind Facilities. Invenergy
7 will procure all equipment for the Selected Wind Facilities including the WTGs, pad
8 mount transformers, generation step up transformers, cabling, and medium voltage
9 breakers. Invenergy is in the process of determining specifications and identifying
10 suppliers that are qualified and able to meet the construction timeline for the Selected
11 Wind Facilities. Invenergy is also responsible for securing the construction contracts
12 necessary for the Selected Wind Facilities as defined in the PSAs. A list of approved
13 suppliers is included in the PSAs.

14 Q. WHAT ROLE WILL THE COMPANIES HAVE IN THE ENGINEERING,
15 PROCUREMENT, AND CONSTRUCTION PROCESS OF THE SELECTED WIND
16 FACILITIES?

17 A. As set forth in the PSA, the Companies have (1) review rights of the engineering,
18 design, and procurement of equipment for the Selected Wind Facilities and (2)
19 oversight rights of all construction activities via provisions stipulated in the PSA.
20 AEPSC, on behalf of the Companies, has been involved in determining the scope of
21 the Selected Wind Facilities and reviewing their engineering and design elements
22 through its due diligence efforts in the development of the PSAs.

1 AEPSC and Invenergy have agreed to specifications for the major electrical
2 equipment, engineering and design reviews, construction quality oversight rights, and
3 scheduling and monitoring requirements. AEPSC's role will ensure the facilities are
4 engineered and constructed to the agreed-to design standards and that the Companies
5 are involved and informed of the construction activities influencing the Selected Wind
6 Facilities' timely completion by the COD. AEPSC has the right to perform power
7 curve tests on the completed facilities to verify the output performance of the GE
8 turbines.

9 Q. PLEASE DESCRIBE AEPSC'S PROJECT MANAGEMENT AND
10 CONSTRUCTION EXPERIENCE.

11 A. AEPSC has a long history of safe project management and construction of large-scale
12 complex utility projects, ranging from construction of power plants to environmental
13 retrofits and upgrades. Examples of power plant construction include the building of
14 the Riverside Units 3 and 4 and Southwestern Units 4 and 5 for PSO and the Turk,
15 Mattison, and Stall power-generating facilities for SWEPCO.

16 In addition, AEPSC has a long proven record of accomplishment of successful
17 environmental retrofits and upgrades. AEPSC installed in excess of 15,000 MW of
18 selective catalytic reduction technology as well as retrofitted approximately 9,000 MW
19 with flue gas desulfurization technology systems. AEPSC has executed major
20 environmental retrofits for compliance with the Clean Air Act including at PSO's
21 Northeastern and Oklaunion plants and SWEPCO's Welsh, Pirkey, and Flint Creek
22 Plants. AEPSC also recently executed the repowering of its Trent Mesa and Desert
23 Sky wind facilities in Texas.

1 This extensive project management and construction experience will be
2 invaluable to providing oversight and monitoring of the Selected Wind Facilities.

3 Q. WHAT ARE THE GENERAL COMPONENTS IN CONSTRUCTION OF A WIND
4 FACILITY?

5 A. The construction of a wind facility typically includes the following main components:

- 6 • Access Road Construction – Access roads will be constructed from the
7 public roads to the WTGs that will be suitable for use during
8 construction to facilitate equipment and material delivery and during
9 post-construction to support operation activities.
- 10 • Turbine Foundations – Foundations will be constructed at each tower
11 site location using a typical spread footer foundation design of
12 reinforced concrete, embedded electrical grounding and conduits, and
13 an anchor bolt cage design to support the WTG loading requirements.
- 14 • Collection System – The collection system will connect the WTGs to
15 the collector substation through 34.5kV underground electrical circuits
16 that run from the high side of the circuit breaker in the WTG switchgear
17 and terminate at the collector substations. This includes pad mount
18 transformers and junction boxes, fiber optic control cable and all other
19 electrical appurtenances required to electrically connect each WTG to a
20 substation.
- 21 • WTGs – General Electric 2.3 MW, 2.5 MW, and 2.83 MW WTGs will
22 be procured, delivered, and commissioned with Federal Aviation
23 Administration (FAA)-required lighting and personnel climb assist
24 systems to support future inspection and maintenance activities.
- 25 • Collector Substation – Substation(s) will be constructed, which consist
26 of the foundations, underground and overhead electrical lines, step-up
27 transformers, metering devices, switchgear and protective devices,
28 together with all other associated equipment and improvements.
29 Substation(s) are necessary to provide electrical protection for the wind
30 facility and convert the 34.5 kV output voltage of the collection system
31 to the transmission voltage of the interconnecting utility.
- 32 • Interconnection Lines – A single overhead line connecting the collector
33 substation to the dead end structures outside the interconnecting utility's
34 substation.
- 35 • Operations & Maintenance Building – An O&M building will be
36 constructed to support the O&M services for each facility. The O&M
37 buildings will be located to minimize travel between the WTGs. The

1 O&M building will be sized to provide adequate workspace for the
2 expected site staff and include garage bays and material storage areas.
3 The O&M for the Selected Wind Facilities is discussed later in my
4 testimony.

- 5 • Meteorological Tower Construction – Lattice style meteorological
6 towers capable of measuring at least barometric pressure, ambient
7 temperature, wind speed, wind direction and relative humidity will be
8 constructed. Each meteorological tower will contain an anemometer
9 and wind vane, a rainfall indicator, and a data logger.

10 Further information on the Selected Wind Facilities' scope of work,
11 engineering, and design is included in the Scope of Work (SOW) and associated
12 attachments in the PSAs provided with the testimony of Company witness Godfrey.

13 Q. ARE THERE REQUIRED PERMITTING OR SITING APPROVALS FOR THE
14 SELECTED WIND FACILITIES AND, IF SO, WHAT IS THEIR STATUS?

15 A. Yes, there are such approvals. Invenergy is responsible for all required permitting and
16 siting approvals needed to support the Selected Wind Facilities. The general permitting
17 requirements associated with the Selected Wind Facilities are minimal. There are
18 county requirements related to road use and crossing permits that will be obtained prior
19 to construction. FAA Determinations of No Hazard have been issued for Sundance
20 and Maverick. These determinations will be updated and documentation sent to the
21 Oklahoma Corporation Commission (OCC) to comply with their notification process.
22 The OCC process will commence for Sundance and Maverick in August of 2019. For
23 Traverse, the OCC process will be initiated when the initial FAA filing is made in early
24 2020.

25 Additionally, Invenergy has proactively been in contact with the Oklahoma
26 Aeronautics Commission and Vance Air Force Base to make them aware of the projects
27 and their intent to move forward with submitting FAA filings and OCC notifications.

1 Invenergy's contractor will develop a Storm Water Pollution Prevention Plan and
2 obtain coverage under a National Pollution Discharge Elimination System Storm Water
3 Permit for construction activities.

4 Q. WHAT IS THE STATUS OF ENVIRONMENTAL IMPACT AND WILDLIFE
5 STUDIES?

6 A. Invenergy has and continues to conduct wildlife studies in accordance with all
7 applicable law and the United States Fish and Wildlife Service (USFWS) Land-Based
8 Wind Energy Guidelines and USFWS Eagle Conservation Plan Guidance (collectively,
9 Guidelines) for siting turbines to minimize potential adverse impacts to wildlife and
10 other environmental resources. The Guidelines are an iterative decision making
11 process consisting of five tiers or analogous stages (collectively, Tiers).

12 Invenergy has completed the Tier I and Tier II Site Characterization Studies for
13 Traverse and Sundance, and is in the process of completing the Tier I and Tier II studies
14 for Maverick, which are expected to be finalized by the summer of 2019. These studies
15 provide a preliminary characterization of environmental factors (potential wildlife and
16 habitat presence, land use, etc.) for the Selected Wind Facilities. Invenergy has
17 completed Tier III studies for Sundance, and Tier III studies for Traverse and Maverick
18 are ongoing with an expected completion of winter 2020 and spring 2020, respectively.
19 Invenergy also anticipates completing a delineation for wetlands and other
20 jurisdictional waters at the Selected Wind Facilities in the summer of 2019. Please see
21 EXHIBIT JGD-4 for the status of the environmental studies for the Selected Wind
22 Facilities.

1 The information obtained from the studies will support micro-siting of turbines
2 and inform implementation of potential wildlife avoidance and minimization measures
3 per the Guidelines. To date, the only species federally protected under the Endangered
4 Species Act observed during Tier III studies was a single whooping crane at Traverse.
5 Additionally, bald eagles, which are federally protected by the Bald and Golden Eagle
6 Protection Act, have been observed during Tier III studies at the Selected Wind
7 Facilities. A Bird and Bat Conservation Strategy, Eagle Conservation Plan, Whooping
8 Crane Management Plan, and any other wildlife protection plans will be developed to
9 manage potential adverse impacts to federally protected species and other wildlife.
10 Post-construction environmental studies are planned per Tier IV of the Guidelines, and
11 the Companies are committed to implementing reasonable and appropriate
12 conservation measures (Tier V), if necessary.

13 Q. WHAT IS THE SCHEDULE FOR THE CONSTRUCTION OF THE WIND
14 FACILITIES?

15 A. Please see Table 2 below for construction milestones for the Wind Facilities.

Table 2 – Selected Wind Facility Construction Milestones

Milestone Description	Traverse	Maverick	Sundance
Execute Generator Interconnection Agreement	6/1/19	11/29/19	5/1/19
Purchase Order Issued for GSU Transformers	3/2/20	6/22/20	7/29/19
Electrical Engineering 70% complete	5/22/20	8/28/20	12/13/19
Contractor Mobilization	7/13/20	9/14/20	3/9/20
Start Underground Cable Installation	9/7/20	1/18/21	3/16/20
Start Turbine Delivery	11/16/20	2/1/21	8/3/20
Turbine Foundations Complete	1/29/21	1/22/21	6/19/20
Collection Energization/Electrical Backfeed	4/12/21	7/12/21	8/3/20
Start Turbine Commissioning	4/12/21	7/12/21	9/28/20
Turbine Mechanical Completion	8/27/21	9/10/21	11/13/20
COD	12/15/21	12/15/21	12/15/20

1 Q. DO THE SELECTED WIND FACILITIES' CONSTRUCTION SCHEDULES
2 SUPPORT QUALIFYING EACH OF THE PROJECTS FOR THE PLANNED
3 PRODUCTION TAX CREDIT (PTC) BENEFITS?

4 A. Yes, they do. As part of the due diligence of proposals, Invenergy's preliminary
5 schedules were reviewed for the Selected Wind Facilities. The schedules are included
6 in the PSA Scope of Work as the basis for further schedule development. AEPSC
7 reviewed the schedules and determined that they appear reasonable. The requirements
8 to qualify for PTC benefits are discussed in more detail in the testimony of Company
9 witness Multer.

10 Q. HOW DOES AEPSC PLAN TO MONITOR THE PROGRESS OF CONSTRUCTION
11 OF THE SELECTED WIND FACILITIES?

12 A. AEPSC will have experienced personnel on-site monitoring construction progress.
13 Invenergy is required to deliver completion certificates to AEPSC for (i) Foundation
14 Completion, (ii) Collection System Completion, (iii) Substation Completion, (iv)
15 Collector Line Completion, (v) Electrical Works Completion, (vi) Infrastructure
16 Completion, (vii) WTG Mechanical Completion, (viii) Commissioning Completion,
17 (ix) SCADA System Functionality & Completion, (x) WTG Substantial Completion,
18 (xi) Project Substantial Completion, and (xii) Final Completion.

19 Upon delivery, AEPSC will have an opportunity to review and (1) identify any
20 open issues or deficiencies for resolution or (2) accept the Milestone Certificate and the
21 work underlying the completion. AEPSC will be monitoring and overseeing the entire

1 construction of the facility to ensure that Invenergy adheres to the scope of work and
2 project schedule under the PSA.

3 Invenergy is required to develop a project schedule that logically ties the
4 relationships between the distinct scopes of work of Invenergy and its contractors and
5 suppliers. The project schedule will include the major project phases (engineering,
6 procurement, construction and commissioning) for the work and milestones. Invenergy
7 will be required to track deliverables from engineering and design activities,
8 commodities for major equipment procurement and delivery, and construction and
9 commissioning status including but not limited to access roads, underground collection
10 system, WTG foundations, WTG erection, and WTG commissioning. Appropriate
11 rules of credit and planned commodity production curves will be established with
12 Invenergy's contractors and shared with AEPSC. The commodities will be tracked on
13 a weekly basis and reported on a monthly basis as defined in the PSAs SOW.

14 Q. DO THE COMPANIES HAVE THE RIGHT TO REVIEW CONTRACTS
15 INVENERGY ENTERS INTO?

16 A. Yes. The Companies will retain review rights on all contracts above a dollar threshold
17 before they are executed. Maintaining the review rights will allow the Companies the
18 opportunity to review each agreement to ensure that safety, performance, appropriate
19 warranties and credit requirements are maintained and in place for the construction of
20 the Selected Wind Facilities.

1 V. SELECTED WIND FACILITIES PROJECTED COSTS

2 Q. WHAT IS THE SELECTED WIND FACILITIES ESTIMATED COST AT
3 COMPLETION?

4 A. The estimated total installed capital cost for the Selected Wind Facilities is
5 \$1,996,218,432, which includes each wind project's purchase price, PSA price
6 adjustments, and owner's costs. I discuss the PSA price adjustments, and owner's cost
7 below. Please see EXHIBIT JGD-3 for the total installed capital cost for each of the
8 Selected Wind Facilities. Company witness Godfrey discusses the purchase price as
9 set forth in the PSAs.

10 Q. WHAT IS THE COMPANIES' ESTIMATED OWNER'S COST?

11 A. The Companies' estimated owner's cost for the Selected Wind Facilities is
12 approximately \$124.2 million, as detailed further in EXHIBIT JGD-3. The owner's
13 cost includes the direct cost for project management, environmental, engineering and
14 construction, personnel and expenses, legal and regulatory costs, telecommunication,
15 IT support, and equipment. In addition to these direct costs, overheads, contingency,
16 and Allowance for Funds Used During Construction (AFUDC) are also included with
17 the owner's costs.

18 Q. WHAT ARE THE COMPANIES' ESTIMATED COSTS FOR PSA PRICE
19 ADJUSTMENTS?

20 A. There are three items identified for each of the projects that adjust the price of the
21 construction of the Selected Wind Facilities. The Companies' price adjustments and
22 estimated costs are as follows:

- 1 • O&M Mobilization – As part of the O&M Agreement with Invenergy , the
2 cost to train, mobilize, and equip the site staff with the proper tooling and
3 safety equipment to perform the safe operation and maintenance of the
4 facility will be added to the PSA price at closing. The price for O&M
5 mobilization is approximately \$4.0 million.
- 6 • Capital Spare Parts – An initial set of capital spare parts will be needed in
7 preparation for full operation at COD. In addition, spare pad mounted and
8 main power transformers will be purchased to minimize the impact to
9 generation of a transformer failure. The actual cost for the spare parts and
10 transformers will be determined later in the project so an allowance of \$6.3
11 million is included in the Companies' estimated costs.
- 12 • Power Curve Testing – To test the performance of the GE 2.82 X 127
13 turbines, a power curve test will be performed at Traverse. The requirement
14 to test and the division of costs are outlined in the PSA but the actual costs
15 will be determined later as the plan and costs are finalized so an allowance
16 of \$750,000 is included in the Companies' estimated costs.

17 Q. WHY IS THE INCLUSION OF CONTINGENCY NECESSARY AND
18 APPROPRIATE?

19 A. As with any complex generating facility project, there are risks that may impact the
20 overall cost. For the Selected Wind Facilities, these risks have been identified and
21 include potential changes to the owner's scope of work, potential changes to operations
22 oversight, possible changes to security requirements, and general estimating accuracy.
23 In addition, the current uncertainty associated with changes in law, specifically the
24 imposition of tariffs on imported goods, is an issue addressed in the PSA, which could
25 result in a significant price increase for the projects. It is a standard industry practice
26 to allocate contingency within an estimate at completion (EAC) to address identified
27 risks. The Companies have allocated approximately \$65.1 million or approximately
28 3.5% of the PSA purchase price in contingency beyond the items described above as
29 owner's cost adjustments.

1 Q. PLEASE SUMMARIZE THE INSTALLED CAPITAL COST FOR THE SELECTED
2 WIND FACILITIES.

3 A. The total installed capital cost for the Selected Wind Facilities is summarized in
4 EXHIBIT JGD-3 and estimated to be approximately \$2.0 billion, including AFUDC of
5 \$9.3 million.
6

7 VI. SELECTED WIND FACILITIES PROJECTED O&M COST

8 Q. WHO WILL OPERATE AND MAINTAIN THE SELECTED WIND FACILITIES?

9 A. The Companies will be responsible for the O&M of the Selected Wind Facilities. The
10 Companies will utilize their own employees, AEPSC, and Invenergy Services, LLC
11 (Invenergy Services) to support the Selected Wind Facilities, as follows:

12 On-Site O&M Support: On-Site O&M Support, consisting of local plant
13 staffing, will be responsible for daily O&M activities such as routine inspections,
14 equipment monitoring, preventive maintenance, minor maintenance repairs,
15 acknowledgement and troubleshooting of equipment alarms, and resetting of relays and
16 devices. A Form O&M Agreement (10-year term) with Invenergy Services to provide
17 On-Site O&M Support and Remote Operation / Monitoring (described below) is
18 included in the PSAs provided with Company witness Godfrey's testimony. Estimates
19 for expected site staff are included in EXHIBIT JGD-1.

20 Remote Operation / Monitoring: Remote Operation and Monitoring of
21 equipment will be performed by Invenergy Services. These activities will include
22 following facility dispatch instructions for facility output, removing or placing WTGs
23 in service, and monitoring of equipment performance and potential issues.

1 Major Maintenance Activities: Major Maintenance Activities such as blade
2 replacements, gearbox repairs, and switchgear repairs as well as the procurement of
3 replacement parts used under the O&M Agreement will be managed by AEP in
4 coordination with Invenergy Services, the O&M support service provider.

5 Q. WILL THE COMPANIES HAVE AN ON-SITE PRESENCE AT EACH OF THE
6 WIND FACILITIES?

7 A. Yes. The Companies plan to hire a full-time manager for the Traverse site and a
8 separate full-time manager will be responsible for both the Sundance and Maverick
9 sites. The managers will be responsible for the overall O&M of the Selected Wind
10 Facilities and directly manage and provide oversight of Invenergy Services.

11 Q. WHAT ARE THE ESTIMATED ONGOING O&M AND CAPITAL COSTS FOR
12 THE SELECTED WIND FACILITIES?

13 A. The ongoing O&M and capital forecast for years 1-10 are included in EXHIBIT JGD-
14 5 for each of the facilities.

15 Q. HOW DID THE COMPANIES DEVELOP THE ONGOING O&M AND CAPITAL
16 FORECAST?

17 A. For the period from Year 1 through Year 10, the Companies developed the ongoing
18 O&M and capital forecast using (1) actual O&M contract costs extracted from the
19 Invenergy Services agreement for the Selected Wind Facilities; (2) estimates of parts
20 and major maintenance repairs; and (3) other O&M costs specific to each of the wind
21 facilities including environmental programs (including avian and environmental
22 studies), insurance, land lease costs, forecasting services, AEPSC Support, Ongoing IT

1 and Telecom, Company site labor, etc. The Companies used a 2.0% annual escalation
2 factor to forecast O&M and capital costs for the period from Year 11 through Year 30.

3 Q. HAVE THE COMPANIES CONSIDERED THE COST OF DECOMMISSIONING
4 THE SELECTED WIND FACILITIES?

5 A. Yes, decommissioning cost estimates for the Selected Wind Facilities are considered
6 in the economic analysis of Company witness Torpey. AEPSC, as agent for the
7 Companies, has contracted with Burns and McDonald to perform detailed
8 decommissioning studies. These studies and costs will be finalized when the design of
9 each of the Selected Wind Facilities is further refined.

10

11 VII. DESIGN LIFE OF THE SELECTED WIND FACILITIES

12 Q. WHAT IS THE DESIGN LIFE OF THE SELECTED WIND FACILITIES?

13 A. As I stated earlier in my testimony, the Selected Wind Facilities will be engineered to
14 have a 30-year design life. A 30-year design life was a requirement to bid projects into
15 the RFP. From a technical perspective, GE has completed Mechanical Loads Analyses
16 (MLA) utilizing wind data and turbine siting provided by Invenenergy for each of the
17 Selected Wind Facilities to determine the wind turbine and hub height suitability for
18 each of the Selected Wind Facilities. The loads were found within the design loads
19 envelope of the turbine. The analysis also determined the loads are within the design
20 loads for the 30-year design life.

21 Q. DOES THE ONGOING CAPITAL INVESTMENT AND O&M SUPPORT A 30-
22 YEAR DESIGN LIFE?

1 A. Yes. The Selected Wind Facilities ongoing O&M and capital forecast is based on
2 maintaining the availability and performance of the turbines over 30 years of operation.
3 This will be achieved through condition monitoring systems, routine preventative
4 maintenance, planned corrective maintenance, and major maintenance and overhauls.
5 Q. IS A 30-YEAR DESIGN LIFE REASONABLE?
6 A. Yes it is. Given AEPSC's experience in the development, engineering, and design of
7 other large complex projects, the RFP bidder requirement, and the O&M commitment
8 discussed above, a 30-year design life for the Selected Wind Facilities is reasonable.
9 In addition, the MLAs support the 30-year design life of the Selected Wind Facilities
10 with proper inspections and maintenance.

11

12

VIII. CONCLUSION

13 Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

14 A. Yes, it does.

WIND PROJECTS OVERVIEW

	Traverse	Maverick	Sundance
General			
Capacity	999 MW	287 MW	199 MW
Planned COD	2021	2021	2020
PTC Qualification	80%	80%	100%
Location in Oklahoma	North of Weatherford in Custer and Blaine Counties	Southwest of Enid in Garfield, Kingfisher and Major Counties	Northwest of Cleo Springs in Woods, Alfalfa and Major Counties
Estimated Leased Area	165,000 acres	55,000 acres	74,000 acres
O&M Building	1 @ 12,000 ft. ²	1 @ 10,000 ft. ²	1 @ 8,000ft. ²
Expected Site Staff	38	12	9
Turbines			
Model: GE 2.3 x 116	0	0	7
Model: GE 2.5 x 116	43	12	0
Model: GE 2.82 x 127	316	91	65
Total Turbines	359	103	72
Electrical Interconnection			
Collector Substations	2	1	1
Approx. Length of Interconnection Line(s)	55 miles	20 miles	20 miles
Interconnection Voltage	345 kV	138 kV	138 kV
Interconnection Utility	OG&E	WFEC	OG&E
Interconnection Location	Mathewson Substation	Dover Substation	Cleo Corner Substation

Turbine Information:

GE 2.3 x 116: Capacity of 2.3 MW, Rotor Diameter of 116 m, and Hub height: 80 m

GE 2.5 x 116: Capacity of 2.5 MW, Rotor Diameter of 116 m, and Hub height: 90 m

GE 2.82 x 127: Capacity of 2.8 MW, Rotor Diameter of 127 m, and Hub height: 88.6 m