

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

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5700	25-ssw						7.0	4.3	5.4	5.0	4.9	5.3	5.8	
	40-ese						7.7	4.8	6.0	5.6	5.6	6.1	6.6	
	40-ssw						7.7	4.8	6.0	5.6	5.5	6.0	6.6	
	50-ssw						7.9	5.2	6.4	5.9	5.9	6.5	7.0	
	58-ese						8.2	5.4	6.7	6.3	6.2	6.8	7.3	
	58-ssw						8.3	5.4	6.7	6.2	6.1	6.8	7.3	
5701	25-ssw						7.1	4.5	5.6	5.6	5.4	5.8	6.4	
	40-ese						7.8	5.2	6.4	6.3	6.1	6.6	7.3	
	40-ssw						8.0	5.5	6.7	6.5	6.3	6.9	7.5	
	50-ssw						7.8	5.2	6.4	6.2	6.0	6.5	7.2	
	58-ese						8.3	5.7	6.9	6.7	6.5	7.1	7.7	
	58-ssw						8.3	5.7	6.9	6.8	6.5	7.1	7.8	
4308	25-sw												6.2	
	25-nw												6.2	
	40-sw												6.9	
	40-nw												6.9	
	50-sw												7.3	
	50-nw												7.3	
	59-sw												7.6	
	59-nw												7.6	
4310	25-sw												6.0	
	25-nw												6.0	
	40-sw												6.8	
	40-nw												6.7	
	50-sw												7.2	
	50-nw												7.2	
	59-sw												7.5	
	59-nw												7.5	
4311	25-sw												6.1	
	25-nw												6.1	
	40-sw												6.8	
	40-nw												6.8	
	50-sw												7.2	
	50-nw												7.2	
	59-sw												7.5	
	59-nw												7.5	
Clinton	10						6.9	4.3	5.7	5.6	5.4	5.6	6.2	
Putnam	10						6.3	3.7	4.9	4.9	4.6	4.9	5.4	
MERRA-2 SW	50						7.9	5.2	6.5	6.5	6.8	7.0	7.5	
MERRA-2 S	50						7.7	5.0	6.5	6.3	6.7	6.9	7.4	

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5700	25-ssw	5.6	6.0	6.0										
	40-ese	6.4	6.7	6.7										
	40-ssw	6.4	6.6	6.7										
	50-ssw	6.7	7.0	7.0										
	58-ese	7.1	7.2	7.4										
	58-ssw	7.1	7.2	7.3										
5701	25-ssw	6.2	6.2	6.3										
	40-ese	7.0	6.9	7.1										
	40-ssw	7.2	7.1	7.4										
	50-ssw	6.9	6.8	7.0										
	58-ese	7.5	7.4	7.7										
	58-ssw	7.5	7.4	7.7										
4308	25-sw	6.1	6.1	6.3										
	25-nw	6.0	6.1	6.2										
	40-sw	6.6	6.6	6.9										
	40-nw	6.7	6.6	6.9										
	50-sw	7.1	7.0	7.3										
	50-nw	7.0	6.9	7.2										
	59-sw	7.4	7.2	7.6										
	59-nw	7.3	7.2	7.5										
4310	25-sw	6.0	6.3	6.2										
	25-nw	6.0	6.3	6.2										
	40-sw	6.7	6.8	6.9										
	40-nw	6.7	6.8	6.9										
	50-sw	7.1	7.1	7.3										
	50-nw	7.1	7.2	7.2										
	59-sw	7.4	7.4	7.6										
	59-nw	7.4	7.4	7.5										
4311	25-sw	6.1	6.4	6.3										
	25-nw	6.1	6.5	x										
	40-sw	6.8	6.9	7.0										
	40-nw	6.7	6.9	7.0										
	50-sw	7.1	7.1	7.3										
	50-nw	7.1	7.2	7.3										
	59-sw	7.3	7.3	7.6										
	59-nw	7.4	7.4	7.6										
Clinton	10	6.3	6.5	6.2										
Putnam	10	5.3	5.5	5.5										
MERRA-2 SW	50	7.2	7.0	7.4										
MERRA-2 S	50	7.1	7.0	7.4										

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

All values represent the estimate for the full month when data recovery is less than 100%.

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

Estimates for Sites 5700 and 5701 Based on Their Overall Mean Wind Speed Ratios to the Reference Stations...

Site	Level (m)	Overall Mean Jun 2018 to Mar 2019	Estimated Long-Term Based on...					Seasonal Adjustment	Shears		Extrapolated to...		
			Clinton	Putnam	MERRA-2 SW	MERRA-2 S	Combined*		Levels (m)	Exponent	80 m	88.6 m	90 m
5700	25-ssw	5.53	5.63	5.68	5.82	5.89	5.82	5.94					
	40-ese	6.22	6.33	6.38	6.54	6.62	6.54	6.67					
	40-ssw	6.19	6.30	6.35	6.51	6.59	6.51	6.64	40-58	0.266			
	50-ssw	6.54	6.66	6.71	6.88	6.97	6.88	7.02					
	58-ese	6.86	6.99	7.04	7.22	7.31	7.22	7.36	25-58	0.254	7.98	8.18	8.22
	58-ssw	6.83	6.96	7.02	7.19	7.28	7.19	7.34					
5701	25-ssw	5.91	6.02	6.07	6.22	6.30	6.22	6.27					
	40-ese	6.65	6.78	6.83	7.00	7.09	7.00	7.06					
	wiring switched 40-ssw	6.89	7.02	7.08	7.25	7.35	7.26	7.31	40-58	0.207	8.11	8.28	8.31
	50-ssw	6.59	6.71	6.76	6.93	7.02	6.93	6.99					
	58-ese	7.14	7.28	7.34	7.52	7.61	7.52	7.58	25-58	0.226			
	58-ssw	7.16	7.29	7.35	7.53	7.63	7.53	7.59					
Clinton	10	5.86	5.97										
Putnam	10	5.11		5.25									
MERRA-2 SW	50	6.90			7.26								
MERRA-2 S	50	6.80				7.25							

* weighting Putnam 20% and each MERRA-2 data points 40%

Estimates for Sites 4803, 4310 and 4311 Based on Their Overall Mean Wind Speed Ratios to Site 5700

Site	Level (m)	Overall Mean Dec 2018 to Mar 2019	Very Preliminary, 3+ months of data					Estimated Long-Term	Shears		Extrapolated to...		
									Levels (m)	Exponent	80 m	88.6 m	90 m
4308	25-sw	6.17					6.27						
	25-nw	6.12					6.22						
	40-sw	6.75					6.86						
	40-nw	6.78					6.89		40-59	0.235			
	50-sw	7.15					7.26						
	50-nw	7.12					7.23						
	59-sw	7.42					7.54		25-59	0.218	8.05	8.23	8.26
	59-nw	7.41					7.52						
4310	25-sw	6.13					6.22						

	25-nw	6.13	6.22					
	40-sw	6.79	6.90					
	40-nw	6.77	6.87	40-59	0.239			
	50-sw	7.19	7.30					
	50-nw	7.16	7.27					
	59-sw	7.46	7.58	25-59	0.226	8.10	8.28	8.31
	59-nw	7.42	7.53					
4311	25-sw	6.24	6.34					
	25-nw	6.21	6.30					
	40-sw	6.87	6.98					
	40-nw	6.83	6.94	40-59	0.214			
	50-sw	7.19	7.31					
	50-nw	7.22	7.33					
	59-sw	7.41	7.52	25-59	0.209	8.06	8.23	8.26
	59-nw	7.48	7.60					
5700	58-ssw	7.22	7.34					

Sodar. Diurnal Sodar Analysis, Triton #417-398
Traverse, Oklahoma
American Electric Power

Latitude (WGS84): 35° 44.332'N
Longitude (WGS84): 98° 55.232'W
This is 74 m southeast of Site 4308

23 January-17 April 2019

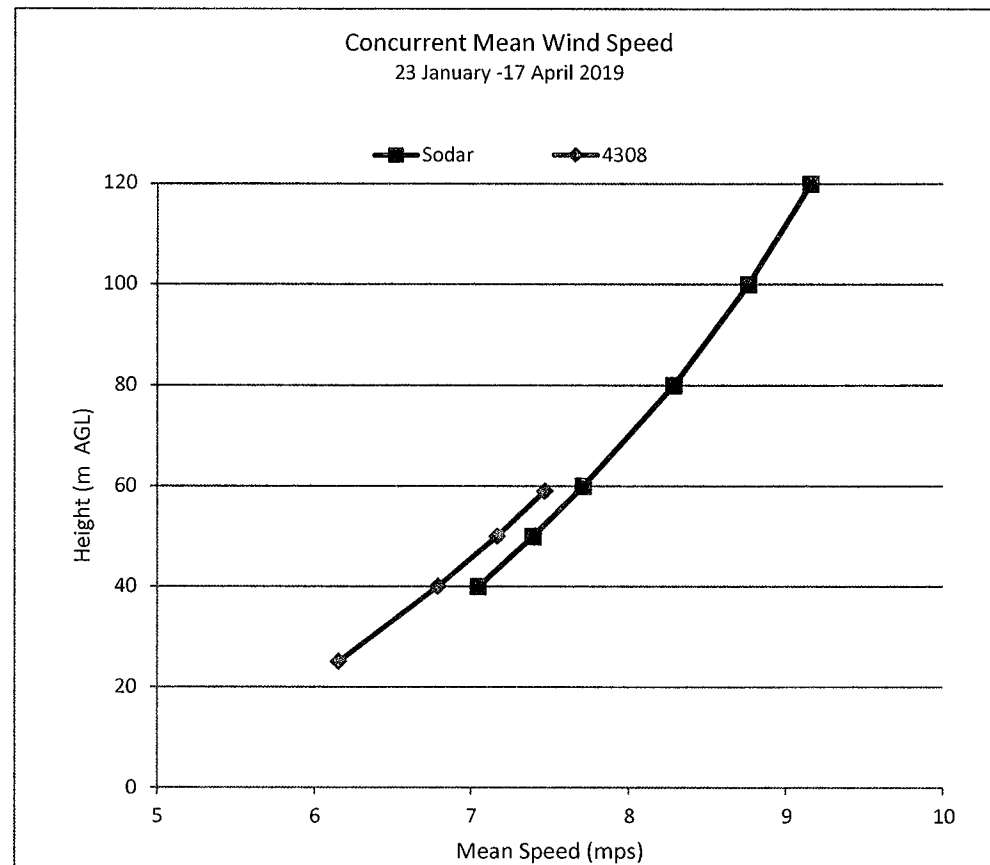
Concurrent Mean Wind Speeds (mps)*...

Site	Level (m)	% Data Recovery	Mean Speed
Sodar	40	89	7.05
	50	88	7.40
	60	87	7.71
	80	85	8.29
	100	79	8.76
	120	71	9.16
	140	61	
4308	160	50	
	25		6.15
	40		6.79
	50		7.17
	59		7.47

Mean Shear Exponents*...

Site	Levels (m)	Mean Shear
Sodar	40-50	0.216
	50-60	0.230
	60-80	0.250
	80-100	0.249
	100-120	0.244
4308	25-59	0.226
	40-59	0.247

* to be incorporated into these tables, there must be valid data at all sodar levels up to 120 m



En Sims. Gross Annual Energy Simulations

Traverse, Oklahoma Site 5700

American Electric Power

Using Extrapolated 88.6-m Data: April 2018-March 2019 (first two months from Maverick 0376)

Turbine: GE-2.82/127

Air Density: 1.14 kg/m³

Speed (mps)	Hours/Year at Mean Speed of:				Power (kW)	Energy (kWh) at Mean Speed of:			
	7 mps	8 mps	9 mps	10 mps		7 mps	8 mps	9 mps	10 mps
0	38.9	31.2	22.7	17.8	0	0	0	0	0
1	185.8	147.5	123.4	103.8	0	0	0	0	0
2	396.6	286.0	220.1	176.9	0	0	0	0	0
3	612.3	485.8	381.3	295.3	26	15,920	12,631	9,914	7,678
4	832.6	623.6	486.0	411.0	177	147,367	110,383	86,017	72,740
5	998.9	778.1	626.5	504.8	397	396,549	308,890	248,726	200,392
6	1032.6	904.4	736.7	605.0	706	728,988	638,492	520,142	427,136
7	987.0	905.1	816.5	676.3	1128	1,113,349	1,020,904	921,010	762,861
8	944.0	865.3	800.2	742.7	1651	1,558,547	1,428,552	1,321,201	1,226,150
9	843.1	831.7	765.2	721.0	2179	1,837,077	1,812,356	1,667,353	1,571,053
10	679.2	774.0	749.4	687.6	2570	1,745,476	1,989,172	1,926,072	1,767,234
11	430.1	641.6	698.0	676.6	2767	1,190,066	1,775,259	1,931,280	1,872,245
12	305.1	491.6	611.1	640.2	2819	860,157	1,385,703	1,722,701	1,804,803
13	205.4	318.2	513.6	573.7	2820	579,212	897,230	1,448,270	1,617,784
14	122.8	244.5	345.4	495.1	2820	346,191	689,516	974,108	1,396,222
15	72.3	173.2	264.7	401.0	2820	203,894	488,487	746,339	1,130,730
16	36.9	105.7	203.9	268.0	2820	104,096	297,963	574,915	755,889
17	15.6	67.9	143.6	218.8	2820	43,930	191,479	404,924	616,935
18	6.8	37.9	93.3	172.7	2820	19,100	106,961	263,105	487,054
19	4.2	22.4	65.4	126.0	2820	11,938	63,031	184,317	355,263
20	4.9	6.9	36.9	83.3	2820	13,848	19,578	104,096	234,932
21	2.7	4.4	25.2	60.3	2820	7,640	12,415	71,148	169,992
22	2.0	3.9	9.8	39.1	2820	5,730	10,982	27,695	110,303
23	0.2	4.7	5.9	24.0	1200	203	5,689	7,112	28,853
24	0	2.0	3.2	14.9	1200	0	2,438	3,861	17,881
25	0.2	2.0	3.2	6.4	1200	203	2,438	3,861	7,721
26	0	0.3	4.2	3.9	1200	0	406	5,080	4,673
27	0	0	1.7	3.2	1200	0	0	2,032	3,861
28	0	0	2.0	2.5	1200	0	0	2,438	3,048
29	0	0.2	0.3	3.6	1200	0	203	406	4,267
30+	0	0	0.3	4.4	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		10,929,480	13,271,160	15,178,123	16,657,701
Gross Capacity Factor (%):						44.24	53.72	61.44	67.43

Gross Annual Energy Simulations

Traverse, Oklahoma **Site 5701**

American Electric Power

Using Extrapolated 88.6-m Data: April 2018-March 2019 (first two months from Maverick 0376)

Turbine: **GE-2.82/127**

Air Density: 1.14 kg/m³

Speed (mps)	Hours/Year at Mean Speed of:				Power (kW)	Energy (kWh) at Mean Speed of:			
	7 mps	8 mps	9 mps	10 mps		7 mps	8 mps	9 mps	10 mps
0	26.9	20.4	15.1	10.9	0	0	0	0	0
1	152.6	115.1	92.0	79.6	0	0	0	0	0
2	379.4	273.1	205.1	162.2	0	0	0	0	0
3	595.5	462.7	369.0	282.0	26	15,483	12,031	9,594	7,332
4	799.9	609.6	473.2	388.2	177	141,590	107,905	83,751	68,710
5	987.1	764.6	602.4	490.8	397	391,861	303,549	239,152	194,862
6	1029.6	889.1	735.3	584.2	706	726,918	627,722	519,142	412,462
7	1039.7	901.7	792.7	688.7	1128	1,172,809	1,017,168	894,174	776,874
8	1017.3	911.0	795.7	713.8	1651	1,679,636	1,504,060	1,313,761	1,178,468
9	911.8	897.9	815.1	720.9	2179	1,986,901	1,956,469	1,776,075	1,570,748
10	740.9	825.4	803.8	733.8	2570	1,904,065	2,121,153	2,065,800	1,885,902
11	445.1	722.5	748.8	721.5	2767	1,231,501	1,999,269	2,071,902	1,996,475
12	287.7	510.2	680.0	696.6	2819	811,131	1,438,216	1,916,831	1,963,792
13	151.9	331.3	552.6	624.4	2820	428,486	934,318	1,558,304	1,760,921
14	98.3	214.7	366.5	554.3	2820	277,116	605,480	1,033,492	1,563,049
15	42.1	124.9	256.6	405.9	2820	118,628	352,089	723,634	1,144,528
16	22.9	83.6	169.6	288.4	2820	64,534	235,833	478,310	813,317
17	10.8	42.9	104.3	206.8	2820	30,369	121,001	294,199	583,178
18	7.4	22.5	76.1	141.2	2820	20,879	63,585	214,480	398,117
19	4.7	11.1	39.9	89.2	2820	13,286	31,318	112,460	251,492
20	4.2	8.9	25.2	66.5	2820	11,863	25,149	71,177	187,433
21	2.2	5.9	12.3	39.7	2820	6,169	16,608	34,639	111,985
22	0.7	3.7	8.2	24.6	2820	1,898	10,439	23,251	69,279
23	0.7	3.2	6.4	13.8	1200	808	3,837	7,673	16,557
24	0.5	2.0	3.9	7.6	1200	606	2,423	4,644	9,086
25	0	0.5	4.0	7.2	1200	0	606	4,846	8,683
26	0	0.8	2.4	4.7	1200	0	1,010	2,827	5,654
27	0	0.3	1.7	3.0	1200	0	404	2,019	3,635
28	0	0.2	0.7	3.5	1200	0	202	808	4,240
29	0	0	0.8	2.2	1200	0	0	1,010	2,625
30+	0	0	0.5	3.7	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		11,036,537	13,491,846	15,457,955	16,989,406
Gross Capacity Factor (%):						44.68	54.62	62.57	68.77

Gross Annual Energy Simulations

Traverse, Oklahoma Site 5700

American Electric Power

Using Extrapolated 90-m Data: April 2018-March 2019 (first two months from Maverick 0376)

Turbine: GE-2.5/116

Air Density: 1.14 kg/m³

Speed (mps)	Hours/Year at Mean Speed of:				Power (kW)	Energy (kWh) at Mean Speed of:			
	7 mps	8 mps	9 mps	10 mps		7 mps	8 mps	9 mps	10 mps
0	38.9	31.2	22.7	17.8	0	0	0	0	0
1	185.8	147.5	123.4	103.8	0	0	0	0	0
2	396.6	286.0	220.1	176.9	0	0	0	0	0
3	612.3	485.8	381.3	295.3	18	11,021	8,744	6,864	5,316
4	832.6	623.6	486.0	411.0	144	119,892	89,803	69,980	59,178
5	998.9	778.1	626.5	504.8	328	327,627	255,204	205,496	165,563
6	1032.6	904.4	736.7	605.0	589	608,178	532,679	433,943	356,350
7	987.0	905.1	816.5	676.3	945	932,726	855,278	771,591	639,099
8	944.0	865.3	800.2	742.7	1411	1,331,987	1,220,888	1,129,143	1,047,909
9	843.1	831.7	765.2	721.0	1947	1,641,482	1,619,393	1,489,829	1,403,782
10	679.2	774.0	749.4	687.6	2377	1,614,395	1,839,791	1,781,430	1,634,520
11	430.1	641.6	698.0	676.6	2500	1,075,231	1,603,957	1,744,922	1,691,584
12	305.1	491.6	611.1	640.2	2500	762,821	1,228,896	1,527,759	1,600,570
13	205.4	318.2	513.6	573.7	2500	513,486	795,417	1,283,928	1,434,206
14	122.8	244.5	345.4	495.1	2500	306,907	611,273	863,571	1,237,786
15	72.3	173.2	264.7	401.0	2500	180,757	433,056	661,648	1,002,420
16	36.9	105.7	203.9	268.0	2500	92,284	264,151	509,677	670,115
17	15.6	67.9	143.6	218.8	2500	38,945	169,751	358,975	546,929
18	6.8	37.9	93.3	172.7	2500	16,933	94,824	233,249	431,786
19	4.2	22.4	65.4	126.0	2500	10,583	55,878	163,401	314,950
20	4.9	6.9	36.9	83.3	2500	12,276	17,356	92,284	208,273
21	2.7	4.4	25.2	60.3	2500	6,773	11,006	63,075	150,702
22	2.0	3.9	9.8	39.1	2500	5,080	9,736	24,553	97,787
23	0.2	4.7	5.9	24.0	2500	423	11,853	14,816	60,111
24	0	2.0	3.2	14.9	2500	0	5,080	8,043	37,252
25	0.2	2.0	3.2	6.4	2500	423	5,080	8,043	16,086
26	0	0.3	4.2	3.9	1200	0	406	5,080	4,673
27	0	0	1.7	3.2	1200	0	0	2,032	3,861
28	0	0	2.0	2.5	1200	0	0	2,438	3,048
29	0	0.2	0.3	3.6	1200	0	203	406	4,267
30+	0	0	0.3	4.4	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		9,610,231	11,739,705	13,456,173	14,828,120
Gross Capacity Factor (%):						43.88	53.61	61.44	67.71

Gross Annual Energy Simulations

Traverse, Oklahoma **Site 5701**

American Electric Power

Using Extrapolated 90-m Data: April 2018-March 2019 (first two months from Maverick 0376)

Turbine: **GE-2.5/116**

Air Density: 1.14 kg/m³

Speed (mps)	Hours/Year at Mean Speed of:				Power (kW)	Energy (kWh) at Mean Speed of:			
	7 mps	8 mps	9 mps	10 mps		7 mps	8 mps	9 mps	10 mps
0	26.9	20.4	15.1	10.9	0	0	0	0	0
1	152.6	115.1	92.0	79.6	0	0	0	0	0
2	379.4	273.1	205.1	162.2	0	0	0	0	0
3	595.5	462.7	369.0	282.0	18	10,719	8,329	6,642	5,076
4	799.9	609.6	473.2	388.2	144	115,192	87,787	68,136	55,900
5	987.1	764.6	602.4	490.8	328	323,755	250,791	197,586	160,994
6	1029.6	889.1	735.3	584.2	589	606,451	523,695	433,108	344,108
7	1039.7	901.7	792.7	688.7	945	982,539	852,149	749,109	650,839
8	1017.3	911.0	795.7	713.8	1411	1,435,473	1,285,420	1,122,784	1,007,158
9	911.8	897.9	815.1	720.9	1947	1,775,354	1,748,162	1,586,975	1,403,510
10	740.9	825.4	803.8	733.8	2377	1,761,075	1,961,861	1,910,664	1,744,276
11	445.1	722.5	748.8	721.5	2500	1,112,668	1,806,351	1,871,975	1,803,826
12	287.7	510.2	680.0	696.6	2500	719,343	1,275,467	1,699,921	1,741,568
13	151.9	331.3	552.6	624.4	2500	379,864	828,296	1,381,475	1,561,101
14	98.3	214.7	366.5	554.3	2500	245,671	536,773	916,216	1,385,682
15	42.1	124.9	256.6	405.9	2500	105,167	312,136	641,520	1,014,652
16	22.9	83.6	169.6	288.4	2500	57,211	209,072	424,034	721,026
17	10.8	42.9	104.3	206.8	2500	26,923	107,271	260,815	517,002
18	7.4	22.5	76.1	141.2	2500	18,510	56,370	190,142	352,941
19	4.7	11.1	39.9	89.2	2500	11,779	27,764	99,699	222,954
20	4.2	8.9	25.2	66.5	2500	10,517	22,296	63,100	166,164
21	2.2	5.9	12.3	39.7	2500	5,469	14,724	30,709	99,278
22	0.7	3.7	8.2	24.6	2500	1,683	9,255	20,613	61,418
23	0.7	3.2	6.4	13.8	2500	1,683	7,993	15,986	34,495
24	0.5	2.0	3.9	7.6	2500	1,262	5,048	9,675	18,930
25	0	0.5	4.0	7.2	2500	0	1,262	10,096	18,089
26	0	0.8	2.4	4.7	1200	0	1,010	2,827	5,654
27	0	0.3	1.7	3.0	1200	0	404	2,019	3,635
28	0	0.2	0.7	3.5	1200	0	202	808	4,240
29	0	0	0.8	2.2	1200	0	0	1,010	2,625
30	0	0	0.5	3.7	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		9,708,305	11,939,885	13,717,643	15,107,138
Gross Capacity Factor (%):						44.33	54.52	62.64	68.98

Rose Extrapolated 88.6-m Wind Rose
Traverse, Oklahoma, Site 5700
April 2018-March 2019

Data from Maverick Site 0376: 1 April-8 June 2018

Joint Frequency of 10-Minute Samples

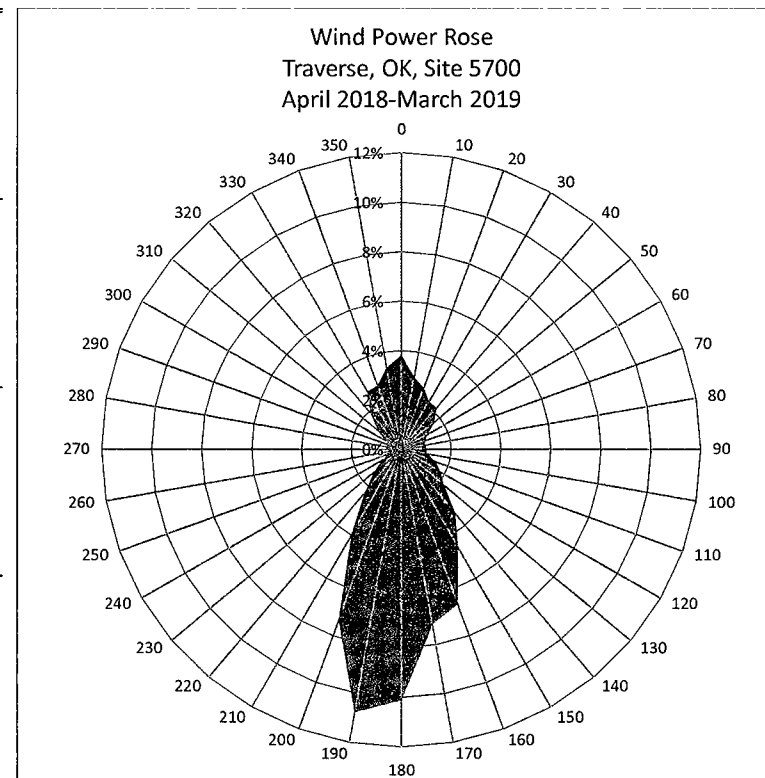
Wind Speed (mps) .										GE-2.82/127 Energy .		
Direction	0-3	3-6	6-9	9-12	12-15	15-18	18-21	21-25	26+	Row Total	Mean Speed	kWh Percent
0	99	394	558	389	214	95	45	7	0	1800	8.7	486,433 3.81
10	105	451	512	340	144	33	11	6	0	1601	7.8	380,017 2.98
20	152	552	568	319	81	13	3	2	0	1688	6.9	338,311 2.65
30	171	535	533	247	47	24	3	0	0	1560	6.6	284,637 2.23
40	146	489	547	230	69	14	0	0	0	1494	6.7	282,096 2.21
50	126	499	407	197	32	3	1	0	0	1266	6.4	219,964 1.72
60	135	424	338	123	12	2	0	0	0	1033	5.9	156,329 1.22
70	128	363	348	67	6	1	0	0	0	912	5.7	126,411 0.99
80	123	403	317	77	4	3	0	0	0	925	5.7	124,739 0.98
90	148	462	333	66	6	0	1	1	0	1016	5.5	125,517 0.98
100	171	508	372	69	4	1	0	0	0	1125	5.4	135,976 1.06
110	186	526	469	107	18	1	0	0	0	1307	5.8	184,126 1.44
120	166	392	510	201	21	0	0	0	0	1290	6.4	231,582 1.81
130	136	375	515	289	46	3	1	0	0	1364	6.9	285,649 2.24
140	129	399	662	506	69	6	2	0	0	1773	7.5	432,367 3.39
150	137	479	845	649	142	11	0	0	0	2264	7.8	585,271 4.58
160	122	469	906	1090	240	27	2	0	0	2855	8.5	849,387 6.65
170	120	437	905	1155	315	34	2	0	0	2968	8.7	915,416 7.17
180	110	406	968	1352	736	167	25	0	0	3763	9.7	1,291,367 10.11
190	109	399	940	1233	869	321	34	5	0	3911	10.2	1,373,504 10.76
200	93	363	599	804	628	236	16	15	0	2753	10.1	935,692 7.33
210	81	248	461	508	278	46	5	24	1	1652	9.2	507,674 3.98
220	85	254	389	262	112	28	3	8	0	1142	8.0	286,225 2.24
230	97	180	263	172	48	11	10	4	0	785	7.5	178,008 1.39
240	90	168	142	60	36	29	10	1	0	536	7.0	101,684 0.80
250	99	179	112	62	17	8	5	0	0	480	6.0	74,318 0.58
260	97	188	80	40	14	6	2	0	0	427	5.5	53,549 0.42
270	101	158	83	41	50	8	5	0	0	446	6.3	72,309 0.57
280	105	144	84	63	42	22	3	0	0	463	6.6	84,403 0.66
290	92	167	84	41	26	13	1	0	0	424	5.9	62,785 0.49
300	106	182	128	58	32	24	3	0	0	532	6.3	88,552 0.69
310	109	190	214	105	70	28	4	3	0	723	7.3	152,025 1.19
320	95	222	219	196	102	71	17	4	0	926	8.4	238,670 1.87
330	99	272	314	313	178	60	14	2	0	1252	8.5	343,364 2.69
340	92	281	357	358	136	62	5	0	0	1291	8.4	351,384 2.75
350	94	323	525	306	199	111	23	3	0	1584	8.7	428,458 3.36
Calms	0									0		
Totals	4255	12480	15606	12093	5042	1519	252	82	1	51331	7.9	12,768,195 100.00

97.7% Data Recovery

Extrapolated 88 6-m Wind Rose
Traverse, Oklahoma, Site 5701
April 2018-March 2019

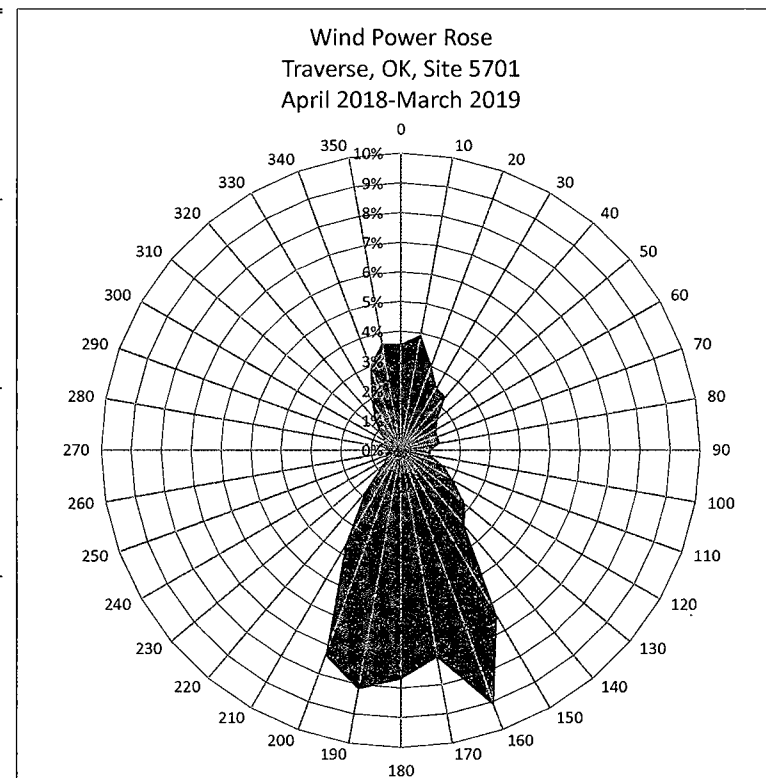
Data from Site 0367: 1 April-15 June 2018

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	95	370	583	313	207	139	48	24	0	1779	9.0	481,479	3.57
10	119	401	674	467	221	65	25	11	0	1982	8.4	530,906	3.94
20	121	521	652	391	116	15	4	0	0	1819	7.4	410,076	3.04
30	149	465	549	319	64	23	4	1	0	1574	7.0	327,706	2.43
40	133	497	604	249	86	14	1	0	0	1584	6.9	316,517	2.35
50	120	490	442	170	49	3	0	0	0	1273	6.4	220,998	1.64
60	114	382	317	184	32	3	1	0	0	1033	6.5	187,815	1.39
70	97	369	368	140	27	2	2	0	0	1004	6.4	176,159	1.31
80	94	392	384	164	19	0	0	0	0	1053	6.4	185,130	1.37
90	82	413	312	106	8	0	1	1	0	923	6.0	137,504	1.02
100	109	399	303	113	6	1	0	0	0	930	5.9	137,885	1.02
110	119	383	451	176	19	2	0	0	0	1150	6.4	208,137	1.54
120	119	399	513	270	35	1	0	0	0	1337	6.8	273,578	2.03
130	130	457	666	399	47	6	2	0	0	1706	7.1	379,900	2.82
140	137	426	609	528	104	16	0	0	0	1821	7.6	451,640	3.35
150	129	467	1004	1072	255	19	0	0	0	2946	8.4	870,172	6.46
160	102	420	1021	1650	437	39	4	0	0	3672	9.2	1,231,000	9.14
170	78	342	791	1120	456	53	4	0	0	2843	9.3	952,395	7.07
180	80	323	716	1041	689	109	19	0	0	2978	9.9	1,037,515	7.70
190	82	367	617	1092	776	157	12	2	0	3104	10.1	1,099,436	8.16
200	80	367	733	943	630	152	17	7	0	2929	9.8	990,252	7.35
210	94	293	543	519	234	30	0	4	2	1719	8.6	499,025	3.70
220	67	221	316	273	80	10	4	24	6	1001	8.4	254,206	1.89
230	71	116	172	99	30	5	4	2	1	498	7.2	107,259	0.80
240	62	114	124	45	19	21	3	2	0	390	6.9	73,678	0.55
250	84	158	144	53	8	19	5	0	0	471	6.4	78,567	0.58
260	80	172	115	39	11	11	2	0	0	430	5.9	62,216	0.46
270	94	144	125	33	10	1	1	1	0	409	5.5	54,581	0.41
280	120	232	125	70	56	18	2	0	0	623	6.4	104,080	0.77
290	104	171	105	64	34	21	1	0	0	499	6.4	84,642	0.63
300	108	175	122	44	31	16	3	0	0	500	6.1	77,919	0.58
310	100	149	161	86	78	25	4	1	0	604	7.4	131,141	0.97
320	62	131	155	110	91	89	14	2	0	654	9.2	181,640	1.35
330	66	192	215	246	104	71	20	2	0	915	8.9	261,273	1.94
340	69	240	298	413	225	55	13	2	0	1314	9.1	404,144	3.00
350	93	349	478	406	232	132	24	4	0	1717	9.0	491,120	3.65
Calms	0									0			
Totals	3562	11508	15505	13405	5529	1340	239	87	9	51184	8.2	13,471,692	100.00

97.4% Data Recovery



Off-Axis. Off-Axis Wake Losses (%)
Traverse, Oklahoma, Site 5700
American Electric Power
Turbine: GE-2.82/127
Data from April 2018-March 2019
Data from Maverick 0376 used to flesh out a full year

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	34.50	22.28	15.64	11.85	9.31	7.67
010/190	33.22	21.45	15.12	11.53	9.11	7.53
020/200	29.00	18.27	12.57	9.41	7.31	5.96
030/210	23.13	13.84	9.13	6.69	5.10	4.11
040/220	16.99	9.67	6.21	4.54	3.45	2.78
050/230	11.91	6.63	4.26	3.13	2.39	1.93
060/240	8.47	4.71	3.02	2.20	1.67	1.34
070/250	6.50	3.60	2.29	1.66	1.26	1.01
080/260	5.57	3.12	2.01	1.47	1.12	0.90
090/270	5.45	3.12	2.04	1.51	1.16	0.94
100/280	6.06	3.47	2.28	1.68	1.29	1.05
110/290	7.47	4.22	2.73	2.00	1.53	1.23
120/300	9.84	5.55	3.56	2.60	1.97	1.59
130/310	13.29	7.65	4.97	3.64	2.77	2.23
140/320	17.72	10.48	6.96	5.15	3.95	3.20
150/330	23.06	13.82	9.27	6.92	5.37	4.37
160/340	28.45	17.45	11.76	8.74	6.74	5.48
170/350	32.69	20.65	14.19	10.59	8.21	6.68

Off-Axis Wake Losses (%)
Traverse, Oklahoma, Site 5701
American Electric Power
Turbine: GE-2.82/127
Data from April 2018-March 2019
Data from Maverick 0376 used to flesh out a full year

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	33.32	21.13	14.51	10.81	8.36	6.81
010/190	31.41	19.85	13.78	10.45	8.21	6.76
020/200	27.13	17.08	11.84	8.95	7.01	5.76
030/210	21.73	13.22	8.88	6.58	5.05	4.09
040/220	16.19	9.26	5.93	4.31	3.25	2.61
050/230	11.51	6.27	3.92	2.84	2.14	1.71
060/240	8.27	4.56	2.90	2.10	1.58	1.26
070/250	6.58	3.72	2.43	1.81	1.40	1.13
080/260	5.87	3.40	2.25	1.67	1.29	1.04
090/270	5.88	3.40	2.22	1.63	1.24	1.00
100/280	6.52	3.72	2.41	1.77	1.35	1.09
110/290	7.85	4.46	2.91	2.14	1.64	1.32
120/300	10.40	5.80	3.73	2.75	2.11	1.70
130/310	14.40	8.10	5.14	3.74	2.83	2.27
140/320	19.35	11.51	7.56	5.51	4.17	3.34
150/330	24.73	15.30	10.48	7.87	6.13	5.02
160/340	29.54	18.57	12.88	9.77	7.69	6.34
170/350	32.65	20.66	14.23	10.65	8.26	6.74

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

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5700	25-ssw						21.4	16.3	19.1	13.1	13.7	19.0	16.9	21.4
	40-ese						21.8	19.3	20.2	14.3	14.8	19.9	18.7	21.8
	40-ssw						22.5	18.7	20.7	14.4	14.6	20.0	18.8	22.5
	50-ssw						22.7	19.4	21.1	15.0	14.9	20.7	19.5	22.7
	58-ese						22.4	20.8	20.7	15.6	15.3	20.9	20.2	22.4
	58-ssw						23.3	20.2	21.6	15.6	15.3	21.3	20.3	23.3
5701	25-ssw						20.9	16.3	21.1	15.6	14.9	18.7	19.9	21.1
	40-ese						22.0	18.2	21.2	17.0	15.7	19.6	20.8	22.0
	40-ssw						22.2	18.1	21.3	16.9	15.8	19.9	21.0	22.2
	50-ssw						22.7	18.8	21.2	17.2	16.1	20.2	21.5	22.7
	58-ese						23.0	19.2	21.1	17.5	16.3	20.1	21.8	23.0
	58-ssw						23.2	19.3	21.3	17.9	16.4	20.5	21.9	23.2
4308	25-sw												19.6	19.6
	25-nw												19.6	19.6
	40-sw												20.6	20.6
	40-nw												20.8	20.8
	50-sw												21.2	21.2
	50-nw												21.3	21.3
	59-sw												22.0	22.0
	59-nw												21.8	21.8
4310	25-sw												17.7	17.7
	25-nw												17.6	17.6
	40-sw												19.1	19.1
	40-nw												18.9	18.9
	50-sw												19.8	19.8
	50-nw												19.8	19.8
	59-sw												20.5	20.5
	59-nw												20.4	20.4
4311	25-sw												18.6	18.6
	25-nw												18.5	18.5
	40-sw												19.6	19.6
	40-nw												19.4	19.4
	50-sw												20.1	20.1
	50-nw												20.2	20.2
	59-sw												20.4	20.4
	59-nw												20.6	20.6

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5700	25-ssw	15.9	17.4	21.7										21.7
	40-ese	17.2	18.5	23.4										23.4
	40-ssw	17.2	18.4	23.1										23.1
	50-ssw	18.0	18.8	23.9										23.9
	58-ese	18.5	19.0	24.5										24.5
	58-ssw	18.7	19.1	24.4										24.4
5701	25-ssw	19.6	17.6	23.2										23.2
	40-ese	20.8	18.4	25.0										25.0
	40-ssw	20.9	18.7	25.1										25.1
	50-ssw	28.6	22.5	25.5										28.6
	58-ese	21.7	18.8	25.7										25.7
	58-ssw	21.8	19.1	26.2										26.2
4308	25-sw	19.3	18.2	22.5										22.5
	25-nw	19.2	17.8	22.6										22.6
	40-sw	20.3	18.7	23.3										23.3
	40-nw	20.5	18.4	23.6										23.6
	50-sw	20.8	19.0	23.8										23.8
	50-nw	20.8	18.7	23.9										23.9
	59-sw	21.4	19.4	24.3										24.3
	59-nw	21.3	19.0	24.3										24.3
4310	25-sw	18.3	16.2	22.9										22.9
	25-nw	18.0	16.3	23.2										23.2
	40-sw	19.1	17.2	24.6										24.6
	40-nw	19.0	17.2	24.8										24.8
	50-sw	19.7	17.5	25.1										25.1
	50-nw	19.5	17.7	25.3										25.3
	59-sw	20.1	18.0	25.7										25.7
	59-nw	19.9	18.0	25.7										25.7
4311	25-sw	18.8	15.1	23.2										23.2
	25-nw	18.7	15.2	x										18.7
	40-sw	19.6	16.2	24.0										24.0
	40-nw	19.7	16.3	24.4										24.4
	50-sw	20.2	16.9	24.5										24.5
	50-nw	20.4	17.2	25.1										25.1
	59-sw	20.4	17.5	25.0										25.0
	59-nw	20.7	17.7	25.3										25.3

Overall Maximum:	28.6
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Data Recovery: black = 90-100%; green = 75-90%; blue = 50-75%; orange = 25-50%; purple = 10-25%; "x" = 0-10%.

Peak 2-Second Gusts (mps)*
Traverse, Oklahoma
American Electric Power

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5700	25-ssw						30	30	26	22	22	28	26	30
	40-ese						32	32	27	22	21	28	26	32
	40-ssw						33	32	27	23	21	28	26	33
	50-ssw						32	32	27	22	21	28	27	32
	58-ese						31	34	27	22	20	28	28	34
	58-ssw						32	32	27	23	20	29	28	32
5701	25-ssw						31	26	32	22	21	26	26	32
	40-ese						31	26	33	23	21	25	27	33
	40-ssw						31	27	34	24	21	26	27	34
	50-ssw						31	26	33	23	22	26	26	33
	58-ese						31	25	34	23	21	26	27	34
	58-ssw						31	25	34	23	21	27	27	34
4308	25-sw												28	28
	25-nw												27	27
	40-sw												27	27
	40-nw												28	28
	50-sw												29	29
	50-nw												28	28
	59-sw												29	29
	59-nw												28	28
4310	25-sw												25	25
	25-nw												24	24
	40-sw												26	26
	40-nw												26	26
	50-sw												26	26
	50-nw												26	26
	59-sw												26	26
	59-nw												26	26
4311	25-sw												25	25
	25-nw												25	25
	40-sw												26	26
	40-nw												25	25
	50-sw												27	27
	50-nw												26	26
	59-sw												27	27
	59-nw												26	26

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5700	25-ssw	24	24	29										29
	40-ese	25	24	31										31
	40-ssw	25	23	31										31
	50-ssw	26	24	32										32
	58-ese	27	25	32										32
	58-ssw	27	25	33										33
5701	25-ssw	28	22	31										31
	40-ese	29	22	32										32
	40-ssw	29	22	33										33
	50-ssw	29	23	33										33
	58-ese	28	22	33										33
	58-ssw	29	22	34										34
4308	25-sw	27	22	32										32
	25-nw	27	22	32										32
	40-sw	27	22	34										34
	40-nw	27	22	34										34
	50-sw	28	22	34										34
	50-nw	28	22	34										34
	59-sw	29	23	36										36
	59-nw	28	24	36										36
4310	25-sw	25	22	31										31
	25-nw	25	22	32										32
	40-sw	26	23	32										32
	40-nw	26	23	32										32
	50-sw	25	23	32										32
	50-nw	26	24	32										32
	59-sw	27	23	32										32
	59-nw	27	24	32										32
4311	25-sw	26	20	31										31
	25-nw	25	20	x										25
	40-sw	26	22	35										35
	40-nw	26	22	34										34
	50-sw	27	22	34										34
	50-nw	28	22	36										36
	59-sw	26	22	35										35
	59-nw	27	23	37										37

Overall Maximum:	37
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Data Recovery: black = 90-100%; green = 75-90%; blue = 50-75%; orange = 25-50%; purple = 10-25%; "x" = 0-10%.

TI. Turbulence Intensity Analysis
Traverse, Oklahoma
American Electric Power
Site 5700, 58-m Level, South-southwest Boom
Using 10-Minute Data from June 2018-March 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	226	0.386	0.325	0.711	0.802	0.965
1	833	0.522	0.174	0.696	0.745	1.166
2	1938	0.280	0.113	0.393	0.425	1.147
3	3152	0.198	0.085	0.283	0.307	0.854
4	4342	0.157	0.063	0.220	0.238	0.728
5	5403	0.137	0.055	0.192	0.207	0.759
6	5511	0.119	0.047	0.166	0.179	0.620
7	4767	0.109	0.043	0.152	0.164	0.654
8	4082	0.105	0.039	0.144	0.155	0.702
9	3485	0.105	0.040	0.145	0.156	0.730
10	2797	0.110	0.040	0.150	0.161	0.643
11	1915	0.111	0.038	0.149	0.160	0.480
12	1299	0.117	0.034	0.151	0.161	0.308
13	886	0.119	0.031	0.150	0.159	0.362
14	587	0.118	0.032	0.150	0.159	0.348
15	316	0.117	0.028	0.145	0.153	0.285
16	195	0.116	0.032	0.148	0.157	0.215
17	107	0.132	0.041	0.173	0.184	0.407
18	61	0.128	0.034	0.162	0.172	0.295
19	35	0.128	0.026	0.154	0.161	0.196
20	25	0.145	0.042	0.187	0.199	0.276
21	20	0.128	0.018	0.146	0.151	0.171
22	13	0.137	0.031	0.168	0.177	0.216
23	14	0.122	0.012	0.134	0.137	0.148
24	1	0.097				0.097
25	0					
26+	0					
Total	42010					

Shear: 0.254
88.6/58 m Speed Ratio: 1.114

88.6-m TI Statistics	Mean	Std. Dev.	Mean + 1 Std. Dev.	Mean + 1.28 Std. Dev.
at 15 mps:	0.105	0.025	0.130	0.137

Turbulence Intensity Analysis
Traverse, Oklahoma
American Electric Power
Site 5701, 58-m Level, South-southwest Boom
Using 10-Minute Data from June 2018-March 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	190	0.397	0.329	0.726	0.818	0.980
1	677	0.539	0.181	0.720	0.771	1.410
2	1605	0.289	0.118	0.407	0.440	0.986
3	2636	0.197	0.089	0.286	0.311	1.061
4	3547	0.154	0.066	0.220	0.238	0.710
5	4719	0.130	0.056	0.186	0.202	0.734
6	5241	0.111	0.045	0.156	0.169	0.408
7	5068	0.097	0.041	0.138	0.149	0.538
8	4564	0.091	0.038	0.129	0.140	0.450
9	3881	0.089	0.036	0.125	0.135	0.622
10	3096	0.093	0.035	0.128	0.138	0.416
11	2239	0.098	0.033	0.131	0.140	0.374
12	1308	0.107	0.030	0.137	0.145	0.483
13	819	0.111	0.023	0.134	0.140	0.206
14	497	0.114	0.025	0.139	0.146	0.362
15	330	0.112	0.034	0.146	0.156	0.555
16	188	0.111	0.024	0.135	0.142	0.249
17	104	0.115	0.026	0.141	0.148	0.274
18	45	0.120	0.022	0.142	0.148	0.180
19	52	0.117	0.027	0.144	0.152	0.231
20	35	0.118	0.022	0.140	0.146	0.202
21	29	0.116	0.037	0.153	0.163	0.294
22	22	0.118	0.021	0.139	0.145	0.173
23	11	0.123	0.025	0.148	0.155	0.159
24	1	0.105				0.105
25	5	0.100	0.007	0.107	0.109	0.105
26+	2	0.094	0.005	0.099	0.100	0.098
Total	40911					

Shear: 0.000
88.6/58 m Speed Ratio: 1.000

88.6-m TI Statistics	Mean	Std. Dev.	Mean + 1 Std. Dev.	Mean + 1.28 Std. Dev.
at 15 mps:	0.102	0.031	0.133	0.141

Climate. Summary of Ambient Air Temperature Data
Traverse, Oklahoma
American Electric Power

Monthly Mean Temperatures (°C)...

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5700	5						27.3	28.0	26.3	21.7	14.2	5.7	3.6	
5701	3						26.6	27.7	26.1	21.7	14.0	5.5	3.3	
4308	2												3.9	
4310	2												3.6	
4311	2												4.1	

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5700	5	2.5	2.2	7.5										
5701	3	2.2	1.8	7.1										
4308	2	2.1	1.8	6.9										
4310	2	1.9	1.6	7.1										
4311	2	2.3	2.0	8.8										

Extreme Maximum Temperatures (°C)...

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5700	5						37.7	43.1	36.8	35.2	30.4	21.0	16.8	43.1
5701	3						37.6	43.0	36.7	35.6	31.3	20.4	16.4	43.0
4308	2												14.4	14.4
4310	2												14.9	14.9
4311	2												15.1	15.1

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5700	5	18.3	23.2	24.2										24.2
5701	3	18.1	23.8	24.6										24.6
4308	2	17.4	23.0	23.1										23.1
4310	2	17.1	22.6	22.9										22.9
4311	2	18.0	23.3	24.2										24.2

Overall Maximum: 43.1

Extreme Minimum Temperatures (°C)...

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5700	5						16.1	15.5	15.6	5.9	-0.8	-10.8	-7.8	-10.8
5701	3						15.8	15.2	15.8	7.3	-1.0	-11.4	-7.8	-11.4
4308	2												-5.7	-5.7
4310	2												-7.0	-7.0
4311	2												-7.7	-7.7

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
5700	5	-9.1	-12.1	-13.2										-13.2
5701	3	-9.6	-13.4	-13.6										-13.6
4308	2	-9.3	-12.7	-13.3										-13.3
4310	2	-9.2	-12.0	-13.4										-13.4
4311	2	-9.1	-11.5	-11.4										-11.5

Overall Minimum: -13.6

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

Summary of Barometric Pressure Data
Traverse, Oklahoma
American Electric Power

Monthly Mean Barometric Pressure (mb)...

Site 5700, 4-m Level...

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018						952	957	955	955	955	953	953	
2019	954	951	955										

Site 5701, 2-m Level...

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018						944	949	947	947	947	945	944	
2019	945	943	947										

Extreme Maximum Barometric Pressure (mb)...

Site 5700, 4-m Level...

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018						958	968	964	964	968	969	964	969
2019	970	971	967										971

Site 5701, 2-m Level...

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018						949	960	957	955	960	961	956	961
2019	963	963	959										963

Overall Maximum: 971

Extreme Minimum Barometric Pressure (mb)...

Site 5700, 4-m Level...

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018						946	948	949	949	942	930	928	928
2019	938	935	925										925

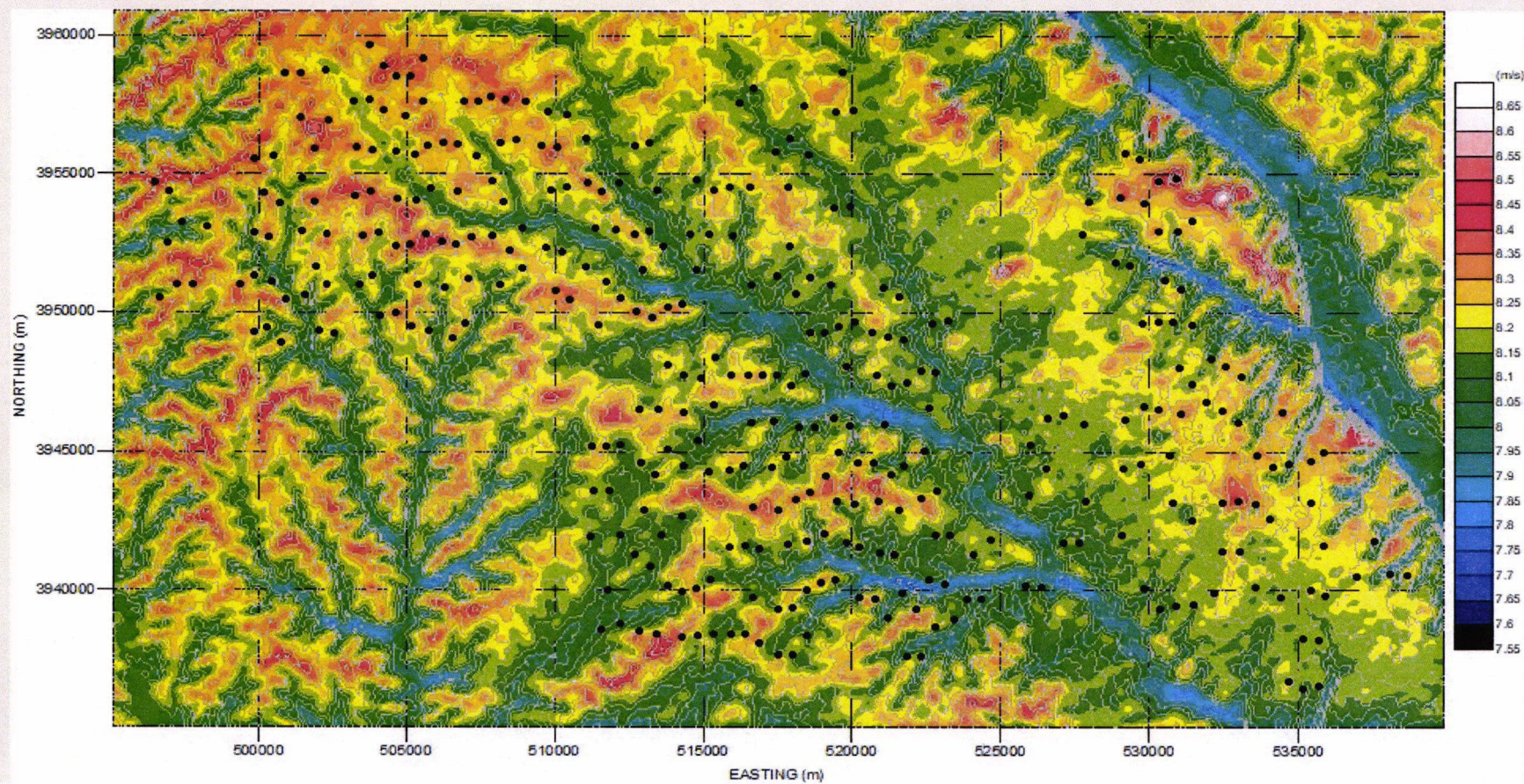
Site 5701, 2-m Level...

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2018						938	940	940	941	934	923	920	920
2019	930	928	917										917

Overall Minimum: 917

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

Model Results. Traverse Wind Speed Map
Annual Mean 88.6-m Winds (mps)
Created by O. Galaviz, Deriva Energia



WERA. Wind Energy Resource Assessment
Traverse Array, Oklahoma
GE-2.82/127 and GE-2.5/116 Turbines

Summary Statistics, 359 Turbines
Weighted by Nameplate Rating

8.12 55.06 4816.54

Turbine	Model	Hub Ht (m)	Mean Hub- Ht Wind Speed (mps)	Gross Capacity Factor (%)	Gross Annual GWh	Turbine	Model	Hub Ht (m)	Mean Hub- Ht Wind Speed (mps)	Gross Capacity Factor (%)	Gross Annual GWh
1	2.5-116	90	8.10	54.9	12.02	61	2.82-127	88.6	8.09	54.9	13.55
2	2.5-116	90	8.16	55.3	12.11	62	2.82-127	88.6	8.20	55.7	13.77
3	2.5-116	90	7.99	54.0	11.82	63	2.82-127	88.6	8.28	56.3	13.91
4	2.5-116	90	8.20	55.6	12.18	64	2.82-127	88.6	8.23	56.0	13.83
5	2.5-116	90	8.22	55.8	12.23	65	2.82-127	88.6	8.28	56.4	13.93
6	2.5-116	90	8.21	55.8	12.21	66	2.82-127	88.6	8.16	55.4	13.69
7	2.5-116	90	8.13	55.1	12.07	67	2.82-127	88.6	8.22	55.9	13.82
8	2.5-116	90	8.13	55.1	12.07	68	2.82-127	88.6	8.12	55.1	13.62
9	2.5-116	90	8.09	54.8	12.00	69	2.82-127	88.6	8.09	54.9	13.56
10	2.5-116	90	8.14	55.2	12.09	70	2.82-127	88.6	8.19	55.7	13.75
11	2.5-116	90	8.11	54.9	12.02	71	2.82-127	88.6	8.31	56.6	13.98
12	2.5-116	90	8.03	54.3	11.90	72	2.82-127	88.6	8.39	57.2	14.13
13	2.5-116	90	8.17	55.5	12.14	73	2.82-127	88.6	8.17	55.5	13.72
14	2.5-116	90	8.12	55.0	12.05	74	2.82-127	88.6	8.22	55.9	13.80
15	2.5-116	90	8.05	54.5	11.94	75	2.82-127	88.6	8.25	56.1	13.87
16	2.5-116	90	8.04	54.4	11.91	76	2.82-127	88.6	8.17	55.5	13.71
17	2.5-116	90	8.05	54.5	11.93	77	2.82-127	88.6	8.23	55.9	13.82
18	2.5-116	90	8.10	54.8	12.01	78	2.82-127	88.6	8.25	56.1	13.86
19	2.5-116	90	8.13	55.1	12.06	79	2.82-127	88.6	8.16	55.4	13.70
20	2.5-116	90	8.08	54.7	11.98	80	2.82-127	88.6	8.10	55.0	13.58
21	2.5-116	90	8.15	55.2	12.10	81	2.82-127	88.6	8.15	55.4	13.67
22	2.5-116	90	8.30	56.5	12.37	82	2.82-127	88.6	8.22	55.9	13.80
23	2.5-116	90	8.23	55.9	12.25	83	2.82-127	88.6	8.01	54.2	13.40
24	2.5-116	90	8.11	54.9	12.02	84	2.82-127	88.6	8.13	55.2	13.64
25	2.5-116	90	8.11	55.0	12.04	85	2.82-127	88.6	8.05	54.5	13.47
26	2.5-116	90	8.14	55.2	12.09	86	2.82-127	88.6	8.09	54.8	13.55
27	2.5-116	90	8.15	55.3	12.11	87	2.82-127	88.6	8.02	54.3	13.43
28	2.5-116	90	8.08	54.7	11.98	88	2.82-127	88.6	8.06	54.7	13.50
29	2.5-116	90	8.08	54.7	11.98	89	2.82-127	88.6	8.07	54.7	13.52
30	2.5-116	90	8.11	54.9	12.03	90	2.82-127	88.6	8.18	55.6	13.73
31	2.5-116	90	8.11	54.9	12.03	91	2.82-127	88.6	8.11	55.0	13.59
32	2.5-116	90	8.07	54.7	11.97	92	2.82-127	88.6	8.06	54.6	13.49
33	2.5-116	90	8.09	54.8	12.00	93	2.82-127	88.6	7.95	53.7	13.26
34	2.5-116	90	8.11	55.0	12.04	94	2.82-127	88.6	8.01	54.3	13.41
35	2.5-116	90	8.03	54.3	11.89	95	2.82-127	88.6	8.17	55.5	13.71
36	2.5-116	90	8.07	54.6	11.97	96	2.82-127	88.6	7.94	53.6	13.23
37	2.5-116	90	8.14	55.1	12.08	97	2.82-127	88.6	8.04	54.5	13.45
38	2.5-116	90	8.12	55.0	12.05	98	2.82-127	88.6	8.14	55.3	13.66
39	2.5-116	90	8.02	54.2	11.87	99	2.82-127	88.6	8.17	55.5	13.72
40	2.5-116	90	8.16	55.3	12.12	100	2.82-127	88.6	8.04	54.5	13.46
41	2.5-116	90	8.10	54.9	12.02	101	2.82-127	88.6	8.13	55.2	13.63
42	2.5-116	90	8.19	55.6	12.18	102	2.82-127	88.6	8.22	55.9	13.81
43	2.5-116	90	8.16	55.3	12.11	103	2.82-127	88.6	8.10	54.9	13.57
44	2.82-127	88.6	8.03	54.4	13.44	104	2.82-127	88.6	8.11	55.0	13.59
45	2.82-127	88.6	8.05	54.6	13.48	105	2.82-127	88.6	8.20	55.7	13.76
46	2.82-127	88.6	8.07	54.7	13.52	106	2.82-127	88.6	8.24	56.0	13.84
47	2.82-127	88.6	8.07	54.7	13.51	107	2.82-127	88.6	8.18	55.6	13.73
48	2.82-127	88.6	8.12	55.1	13.62	108	2.82-127	88.6	8.21	55.8	13.79
49	2.82-127	88.6	8.07	54.8	13.53	109	2.82-127	88.6	8.09	54.9	13.55
50	2.82-127	88.6	8.06	54.7	13.50	110	2.82-127	88.6	8.10	55.0	13.58
51	2.82-127	88.6	8.06	54.7	13.50	111	2.82-127	88.6	8.23	56.0	13.82
52	2.82-127	88.6	8.34	56.8	14.03	112	2.82-127	88.6	8.23	56.0	13.83
53	2.82-127	88.6	8.22	55.9	13.82	113	2.82-127	88.6	8.15	55.3	13.66
54	2.82-127	88.6	8.11	55.1	13.60	114	2.82-127	88.6	8.12	55.1	13.62
55	2.82-127	88.6	7.97	53.8	13.30	115	2.82-127	88.6	8.28	56.3	13.92
56	2.82-127	88.6	8.00	54.1	13.37	116	2.82-127	88.6	8.07	54.7	13.52
57	2.82-127	88.6	8.16	55.4	13.69	117	2.82-127	88.6	8.13	55.2	13.63
58	2.82-127	88.6	8.01	54.2	13.40	118	2.82-127	88.6	8.23	56.0	13.83
59	2.82-127	88.6	8.04	54.5	13.47	119	2.82-127	88.6	8.10	55.0	13.58
60	2.82-127	88.6	8.12	55.1	13.62	120	2.82-127	88.6	8.04	54.5	13.47

Turbine	Model	Hub Ht (m)	Mean Hub- Ht Wind Speed (mps)	Gross Capacity Factor (%)	Gross Annual GWh	Turbine	Model	Hub Ht (m)	Mean Hub- Ht Wind Speed (mps)	Gross Capacity Factor (%)	Gross Annual GWh
121	2.82-127	88.6	8.05	54.6	13.48	181	2.82-127	88.6	8.11	55.0	13.59
122	2.82-127	88.6	8.01	54.2	13.40	182	2.82-127	88.6	8.09	54.9	13.56
123	2.82-127	88.6	8.02	54.4	13.43	183	2.82-127	88.6	8.04	54.5	13.46
124	2.82-127	88.6	8.08	54.8	13.54	184	2.82-127	88.6	8.07	54.7	13.52
125	2.82-127	88.6	7.97	53.8	13.30	185	2.82-127	88.6	8.02	54.3	13.42
126	2.82-127	88.6	8.13	55.2	13.64	186	2.82-127	88.6	8.24	56.0	13.84
127	2.82-127	88.6	8.08	54.8	13.54	187	2.82-127	88.6	8.20	55.8	13.77
128	2.82-127	88.6	8.16	55.5	13.70	188	2.82-127	88.6	8.11	55.0	13.59
129	2.82-127	88.6	8.11	55.1	13.60	189	2.82-127	88.6	8.09	54.9	13.55
130	2.82-127	88.6	8.06	54.6	13.49	190	2.82-127	88.6	7.95	53.6	13.25
131	2.82-127	88.6	8.05	54.6	13.48	191	2.82-127	88.6	8.22	55.9	13.81
132	2.82-127	88.6	8.06	54.7	13.50	192	2.82-127	88.6	8.11	55.0	13.59
133	2.82-127	88.6	8.05	54.6	13.48	193	2.82-127	88.6	8.01	54.2	13.40
134	2.82-127	88.6	8.11	55.0	13.59	194	2.82-127	88.6	8.10	54.9	13.57
135	2.82-127	88.6	8.06	54.7	13.50	195	2.82-127	88.6	8.03	54.4	13.44
136	2.82-127	88.6	8.09	54.9	13.56	196	2.82-127	88.6	8.02	54.3	13.42
137	2.82-127	88.6	8.19	55.6	13.75	197	2.82-127	88.6	7.98	54.0	13.34
138	2.82-127	88.6	8.11	55.0	13.59	198	2.82-127	88.6	8.21	55.8	13.78
139	2.82-127	88.6	8.18	55.6	13.73	199	2.82-127	88.6	8.10	55.0	13.58
140	2.82-127	88.6	8.13	55.2	13.64	200	2.82-127	88.6	8.10	54.9	13.57
141	2.82-127	88.6	8.04	54.5	13.46	201	2.82-127	88.6	8.11	55.1	13.60
142	2.82-127	88.6	8.07	54.7	13.51	202	2.82-127	88.6	8.02	54.4	13.43
143	2.82-127	88.6	8.19	55.7	13.76	203	2.82-127	88.6	8.00	54.2	13.38
144	2.82-127	88.6	8.11	55.0	13.60	204	2.82-127	88.6	8.08	54.8	13.53
145	2.82-127	88.6	8.07	54.7	13.51	205	2.82-127	88.6	8.07	54.7	13.51
146	2.82-127	88.6	7.88	53.3	13.16	206	2.82-127	88.6	8.22	55.9	13.81
147	2.82-127	88.6	8.13	55.2	13.63	207	2.82-127	88.6	8.03	54.4	13.43
148	2.82-127	88.6	8.18	55.6	13.73	208	2.82-127	88.6	8.15	55.3	13.67
149	2.82-127	88.6	8.11	55.0	13.59	209	2.82-127	88.6	8.18	55.6	13.73
150	2.82-127	88.6	8.12	55.1	13.61	210	2.82-127	88.6	8.11	55.0	13.59
151	2.82-127	88.6	8.12	55.1	13.62	211	2.82-127	88.6	8.11	55.0	13.59
152	2.82-127	88.6	8.03	54.4	13.45	212	2.82-127	88.6	7.98	54.0	13.34
153	2.82-127	88.6	8.00	54.2	13.38	213	2.82-127	88.6	8.08	54.8	13.53
154	2.82-127	88.6	8.12	55.1	13.62	214	2.82-127	88.6	7.98	54.0	13.33
155	2.82-127	88.6	8.01	54.2	13.40	215	2.82-127	88.6	8.01	54.2	13.39
156	2.82-127	88.6	8.03	54.4	13.45	216	2.82-127	88.6	8.00	54.2	13.39
157	2.82-127	88.6	8.07	54.7	13.51	217	2.82-127	88.6	8.20	55.7	13.77
158	2.82-127	88.6	8.03	54.4	13.44	218	2.82-127	88.6	8.05	54.6	13.48
159	2.82-127	88.6	8.02	54.3	13.42	219	2.82-127	88.6	8.02	54.4	13.43
160	2.82-127	88.6	8.07	54.7	13.51	220	2.82-127	88.6	8.05	54.6	13.48
161	2.82-127	88.6	8.09	54.8	13.55	221	2.82-127	88.6	8.01	54.2	13.40
162	2.82-127	88.6	8.10	54.9	13.57	222	2.82-127	88.6	8.17	55.5	13.70
163	2.82-127	88.6	8.12	55.1	13.61	223	2.82-127	88.6	8.32	56.7	14.00
164	2.82-127	88.6	8.19	55.7	13.75	224	2.82-127	88.6	8.18	55.6	13.72
165	2.82-127	88.6	8.29	56.4	13.93	225	2.82-127	88.6	8.32	56.7	14.01
166	2.82-127	88.6	8.19	55.6	13.75	226	2.82-127	88.6	8.32	56.7	14.00
167	2.82-127	88.6	8.08	54.8	13.55	227	2.82-127	88.6	8.18	55.6	13.72
168	2.82-127	88.6	8.27	56.3	13.90	228	2.82-127	88.6	8.08	54.8	13.54
169	2.82-127	88.6	8.09	54.9	13.55	229	2.82-127	88.6	7.97	53.8	13.30
170	2.82-127	88.6	8.23	56.0	13.84	230	2.82-127	88.6	8.21	55.8	13.78
171	2.82-127	88.6	8.19	55.6	13.74	231	2.82-127	88.6	8.14	55.3	13.65
172	2.82-127	88.6	8.12	55.1	13.61	232	2.82-127	88.6	8.04	54.5	13.46
173	2.82-127	88.6	8.19	55.6	13.74	233	2.82-127	88.6	8.05	54.6	13.48
174	2.82-127	88.6	8.17	55.5	13.70	234	2.82-127	88.6	8.17	55.5	13.71
175	2.82-127	88.6	8.15	55.3	13.66	235	2.82-127	88.6	8.30	56.5	13.95
176	2.82-127	88.6	8.11	55.0	13.59	236	2.82-127	88.6	8.20	55.8	13.77
177	2.82-127	88.6	8.20	55.7	13.77	237	2.82-127	88.6	8.23	56.0	13.83
178	2.82-127	88.6	8.27	56.3	13.90	238	2.82-127	88.6	8.07	54.7	13.52
179	2.82-127	88.6	8.23	56.0	13.83	239	2.82-127	88.6	8.16	55.4	13.69
180	2.82-127	88.6	8.16	55.4	13.70	240	2.82-127	88.6	8.24	56.0	13.84

Turbine	Model	Hub Ht (m)	Mean Hub- Ht Wind Speed (mps)	Gross Capacity Factor (%)	Gross Annual GWh	Turbine	Model	Hub Ht (m)	Mean Hub- Ht Wind Speed (mps)	Gross Capacity Factor (%)	Gross Annual GWh
241	2.82-127	88.6	8.16	55.4	13.69	301	2.82-127	88.6	8.05	54.6	13.48
242	2.82-127	88.6	8.20	55.8	13.78	302	2.82-127	88.6	8.10	55.0	13.58
243	2.82-127	88.6	8.09	54.8	13.55	303	2.82-127	88.6	8.02	54.3	13.42
244	2.82-127	88.6	8.11	55.1	13.60	304	2.82-127	88.6	8.10	54.9	13.57
245	2.82-127	88.6	8.12	55.1	13.61	305	2.82-127	88.6	8.09	54.9	13.55
246	2.82-127	88.6	8.24	56.1	13.85	306	2.82-127	88.6	7.84	52.6	12.99
247	2.82-127	88.6	8.05	54.6	13.49	307	2.82-127	88.6	8.07	54.7	13.52
248	2.82-127	88.6	8.02	54.3	13.42	308	2.82-127	88.6	8.09	54.9	13.56
249	2.82-127	88.6	8.00	54.2	13.38	309	2.82-127	88.6	8.05	54.6	13.49
250	2.82-127	88.6	7.94	53.6	13.24	310	2.82-127	88.6	8.15	55.3	13.67
251	2.82-127	88.6	7.80	52.2	12.89	311	2.82-127	88.6	8.08	54.8	13.53
252	2.82-127	88.6	8.03	54.4	13.44	312	2.82-127	88.6	8.09	54.9	13.56
253	2.82-127	88.6	8.07	54.7	13.51	313	2.82-127	88.6	8.18	55.6	13.73
254	2.82-127	88.6	7.94	53.6	13.25	314	2.82-127	88.6	8.25	56.1	13.87
255	2.82-127	88.6	8.14	55.2	13.64	315	2.82-127	88.6	8.09	54.9	13.56
256	2.82-127	88.6	8.03	54.4	13.44	316	2.82-127	88.6	8.10	54.9	13.57
257	2.82-127	88.6	8.27	56.3	13.90	317	2.82-127	88.6	8.07	54.7	13.52
258	2.82-127	88.6	8.25	56.1	13.87	318	2.82-127	88.6	8.12	55.1	13.60
259	2.82-127	88.6	8.27	56.3	13.91	319	2.82-127	88.6	8.06	54.7	13.51
260	2.82-127	88.6	8.05	54.5	13.47	320	2.82-127	88.6	8.13	55.2	13.62
261	2.82-127	88.6	8.07	54.7	13.52	321	2.82-127	88.6	8.04	54.5	13.46
262	2.82-127	88.6	8.11	55.0	13.60	322	2.82-127	88.6	8.02	54.3	13.43
263	2.82-127	88.6	8.03	54.4	13.45	323	2.82-127	88.6	8.04	54.5	13.46
264	2.82-127	88.6	8.06	54.6	13.49	324	2.82-127	88.6	8.08	54.8	13.53
265	2.82-127	88.6	8.15	55.3	13.67	325	2.82-127	88.6	8.35	56.9	14.05
266	2.82-127	88.6	8.11	55.1	13.60	326	2.82-127	88.6	8.44	57.6	14.24
267	2.82-127	88.6	8.01	54.3	13.41	327	2.82-127	88.6	8.40	57.3	14.15
268	2.82-127	88.6	7.97	53.9	13.32	328	2.82-127	88.6	8.20	55.7	13.76
269	2.82-127	88.6	7.93	53.5	13.21	329	2.82-127	88.6	8.23	55.9	13.82
270	2.82-127	88.6	8.02	54.3	13.42	330	2.82-127	88.6	8.13	55.2	13.63
271	2.82-127	88.6	8.03	54.4	13.43	331	2.82-127	88.6	8.08	54.8	13.53
272	2.82-127	88.6	8.08	54.8	13.54	332	2.82-127	88.6	7.95	53.6	13.25
273	2.82-127	88.6	8.16	55.4	13.68	333	2.82-127	88.6	8.13	55.2	13.63
274	2.82-127	88.6	8.04	54.4	13.45	334	2.82-127	88.6	7.96	53.8	13.29
275	2.82-127	88.6	8.05	54.6	13.48	335	2.82-127	88.6	8.09	54.9	13.56
276	2.82-127	88.6	8.08	54.8	13.54	336	2.82-127	88.6	7.96	53.8	13.30
277	2.82-127	88.6	8.04	54.5	13.46	337	2.82-127	88.6	8.04	54.5	13.45
278	2.82-127	88.6	7.98	53.9	13.32	338	2.82-127	88.6	8.10	55.0	13.58
279	2.82-127	88.6	7.98	53.9	13.32	339	2.82-127	88.6	8.13	55.2	13.64
280	2.82-127	88.6	8.09	54.9	13.55	340	2.82-127	88.6	8.17	55.5	13.71
281	2.82-127	88.6	8.09	54.9	13.56	341	2.82-127	88.6	8.22	55.9	13.82
282	2.82-127	88.6	8.09	54.8	13.55	342	2.82-127	88.6	8.23	56.0	13.82
283	2.82-127	88.6	8.05	54.5	13.47	343	2.82-127	88.6	8.23	55.9	13.82
284	2.82-127	88.6	8.07	54.7	13.52	344	2.82-127	88.6	8.31	56.6	13.98
285	2.82-127	88.6	8.06	54.6	13.49	345	2.82-127	88.6	8.25	56.2	13.87
286	2.82-127	88.6	8.24	56.1	13.85	346	2.82-127	88.6	8.26	56.2	13.88
287	2.82-127	88.6	7.99	54.1	13.37	347	2.82-127	88.6	8.25	56.1	13.86
288	2.82-127	88.6	8.01	54.3	13.41	348	2.82-127	88.6	8.21	55.8	13.79
289	2.82-127	88.6	8.07	54.7	13.51	349	2.82-127	88.6	8.22	55.9	13.80
290	2.82-127	88.6	7.95	53.7	13.25	350	2.82-127	88.6	8.27	56.3	13.90
291	2.82-127	88.6	7.93	53.5	13.22	351	2.82-127	88.6	8.31	56.6	13.98
292	2.82-127	88.6	8.21	55.8	13.79	352	2.82-127	88.6	8.25	56.1	13.87
293	2.82-127	88.6	8.10	55.0	13.58	353	2.82-127	88.6	8.28	56.4	13.92
294	2.82-127	88.6	8.13	55.2	13.64	354	2.82-127	88.6	8.24	56.1	13.85
295	2.82-127	88.6	8.13	55.2	13.63	355	2.82-127	88.6	8.24	56.1	13.85
296	2.82-127	88.6	8.08	54.8	13.54	356	2.82-127	88.6	8.22	55.9	13.80
297	2.82-127	88.6	8.03	54.4	13.44	357	2.82-127	88.6	8.14	55.3	13.65
298	2.82-127	88.6	8.03	54.4	13.43	358	2.82-127	88.6	8.27	56.3	13.91
299	2.82-127	88.6	8.06	54.6	13.49	359	2.82-127	88.6	8.09	54.9	13.56
300	2.82-127	88.6	8.04	54.5	13.47						

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

GE-2.82/127; 2.5/116

	Loss (%)	Efficiency
Total Discount	21.23	0.7877

Detail by Category

	Loss (%)	Efficiency	Description
Turbine Availability	4.00	0.9600	
Turbine	4	0.96	Assuming 97% performance-based guarantee for the warranty period, then lower availability in the future. Check TSA and warranty documentation.
High-wind downtime correlation	0	1	Downtime correlated with high-wind events, assumed zero
Electrical	3.50	0.9650	from turbines to high-side of interconnect point, J. Williams 5-15-19 email
Wake Effects	8.68	0.9132	
Internal wake losses	7.9	0.921	Evaluated with Simon Wind and DAWM Fast Eddy Viscosity wake models
Wakes from pre-existing turbines	0.8	0.992	Taken from Vaisala report, seems reasonable
Wakes from future turbines	0	1	None expected at this time
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	None expected
High-wind hysteresis	0	1.000	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 the AWEA 2012 wind resource assessment workshop
Environmental	2.09	0.9791	
Blade degradation and soiling	1	0.99	Industry standard value
Icing	0.6	0.994	Based on climate and observed anemometer icing
High/low temperature shutdowns	0.2	0.998	Allowing for occasional temperatures above 40C
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	Assumed zero
Curtailement	0.00	1.0000	
Wind direction sector management	0	1	Assumed zero, needs vendor's site suitability assessment
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 Monthly/Diurnal Mean Net Capacity Factor (%)
 Traverse Project, Oklahoma
 American Electric Power
 Turbines: 316 GE-2.82/127; 43 GE-2.5/116

Hour (CST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	51.6	54.0	64.8	54.7	54.8	50.6	53.6	39.7	46.4	45.7	59.7	51.8
1	49.7	52.0	60.6	55.7	57.4	46.7	49.1	37.2	40.5	45.8	59.2	51.5
2	47.7	50.7	60.5	56.2	48.0	43.2	48.6	36.6	37.9	47.0	55.5	49.5
3	48.0	43.4	56.7	54.9	45.4	40.4	43.3	38.1	36.6	41.2	54.2	50.7
4	49.8	40.9	59.4	54.2	45.8	40.0	36.5	37.8	35.4	39.8	54.3	52.6
5	47.1	40.7	60.4	52.7	45.9	40.5	35.0	35.5	33.0	42.3	53.4	49.3
6	47.0	41.3	56.2	52.7	40.9	34.2	27.6	31.7	28.9	44.9	52.4	48.0
7	45.4	44.7	54.8	46.0	38.7	33.3	24.5	29.6	24.5	43.0	47.6	48.4
8	44.5	42.4	48.2	48.9	36.1	37.4	17.4	25.5	23.8	40.2	38.0	45.6
9	40.2	41.9	41.6	50.3	38.1	40.1	11.5	26.0	24.8	37.0	28.6	41.9
10	39.6	40.6	41.3	49.1	38.5	40.9	9.6	26.7	29.1	33.9	24.6	38.3
11	40.6	39.1	39.4	45.5	32.9	44.1	10.6	26.9	30.8	33.6	28.1	38.1
12	39.5	38.4	40.2	48.5	34.6	45.5	10.6	26.7	33.4	38.1	30.3	39.5
13	39.1	37.8	40.7	49.8	34.5	45.9	12.3	28.2	34.7	40.0	32.6	41.1
14	38.9	35.9	40.5	51.4	39.3	46.7	16.7	29.3	37.4	40.3	34.4	41.3
15	38.6	34.2	40.0	52.0	45.5	46.0	19.5	31.7	43.2	40.7	35.7	42.3
16	36.5	34.7	40.0	54.7	49.8	45.5	20.8	31.9	45.6	38.3	37.2	43.4
17	36.4	34.4	40.6	53.1	54.8	47.7	27.0	33.0	46.3	38.0	39.8	43.5
18	41.9	38.2	41.0	51.8	54.3	50.4	30.5	31.2	43.9	38.2	44.6	44.1
19	49.8	44.9	45.7	53.6	57.8	48.7	42.4	32.8	45.3	39.4	52.5	51.1
20	52.8	52.2	51.3	58.8	64.8	48.8	53.1	37.8	49.8	38.9	55.0	52.6
21	51.8	55.0	55.1	58.8	68.5	51.7	59.4	42.8	51.9	40.7	56.2	52.9
22	49.2	58.3	54.0	54.3	66.9	54.6	59.9	44.5	51.2	40.7	57.2	51.4
23	48.5	57.4	58.4	55.6	59.0	53.2	57.6	42.7	50.1	42.3	60.1	52.2
Month	44.8	43.9	49.6	52.6	48.0	44.8	32.4	33.5	38.5	40.4	45.5	46.7

Year: 43.37

Simulated Long-Term Monthly/Diurnal Mean Net Capacity Factor (%)
 Traverse 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	515.6	538.8	647.5	546.1	547.1	505.0	535.1	396.3	463.2	456.1	595.7	517.2
1	496.6	518.8	605.4	555.8	573.1	466.2	490.5	371.9	404.9	457.1	590.7	514.7
2	476.8	505.9	604.6	561.3	478.9	431.7	485.5	365.6	378.0	468.9	554.1	493.9
3	479.5	433.8	565.7	548.7	453.1	403.8	432.7	380.1	365.5	411.4	541.6	506.5
4	497.5	408.8	593.0	540.8	457.5	399.2	364.5	377.2	353.2	397.8	542.4	525.3
5	470.8	406.2	602.9	525.9	458.0	404.1	349.8	354.1	329.1	422.1	533.7	492.2
6	468.9	412.5	560.9	526.3	408.1	341.0	275.2	317.0	288.7	448.2	523.8	479.8
7	453.4	446.2	547.5	459.7	386.7	332.2	244.9	295.2	244.2	429.5	475.1	483.4
8	444.1	423.7	481.8	488.3	360.0	373.3	174.1	254.3	238.1	401.8	379.2	455.6
9	401.8	418.0	415.3	502.5	380.7	400.5	114.5	260.1	248.0	369.6	285.9	418.1
10	395.2	405.5	412.4	489.9	384.7	408.9	95.4	266.8	290.9	338.7	245.4	382.7
11	405.2	390.6	393.3	454.3	328.4	440.8	106.3	268.6	307.7	335.8	280.2	380.8
12	394.9	383.1	401.8	484.7	345.6	454.0	105.5	266.7	333.9	380.4	302.9	394.1
13	390.2	377.5	406.6	497.3	344.5	458.8	123.0	281.4	346.3	399.7	325.8	410.8
14	388.2	358.9	404.0	513.2	392.0	466.1	167.2	292.6	373.6	402.2	343.5	412.4
15	385.7	341.7	399.3	519.6	454.3	458.9	194.6	316.9	431.6	406.3	356.9	422.9
16	364.3	346.2	399.0	546.3	497.4	454.3	208.0	318.5	455.4	382.5	371.7	433.1
17	363.9	343.8	405.8	530.0	546.8	475.9	270.0	329.3	462.5	379.9	397.3	434.2
18	418.5	381.3	409.5	517.6	541.8	503.4	304.8	311.2	438.5	381.7	445.6	439.9
19	497.6	448.6	456.2	535.3	577.2	486.4	423.2	327.3	452.3	393.0	523.9	510.2
20	527.2	520.9	511.8	587.4	647.2	487.5	530.7	377.7	497.6	388.9	549.4	525.6
21	517.1	549.0	549.8	587.2	683.8	516.5	593.1	427.2	517.9	406.4	561.3	528.4
22	491.0	582.0	539.7	542.1	667.8	545.7	598.5	444.2	511.4	406.1	570.8	513.3
23	484.1	572.8	583.4	555.4	589.6	531.2	575.3	426.1	500.6	422.3	599.7	521.4
Month (GWh)	332.57	294.40	368.82	378.47	356.64	322.36	240.64	248.82	276.99	300.28	326.90	347.09

GWh for Year: 3793.991

P-Values. Probability Analysis, Traverse 998.62-MW Array
316 GE-2.82/127 and 43 GE-2.5/116 Turbines

95% Confidence Limits in

1) Weighted Long-Term Mean Speeds at Reference Stations	
Standard Deviation (%) of Annual Means	2.84
Average Years of Data	18.6
Equivalent Long-Term Uncertainty (1 sigma)	0.66
95% Confidence Limits	1.29
2) Weighted Correlation between Reference Stations and Sites 5700/5701	
Standard Deviation (%) of Monthly Speed Ratios	3.75
Average Months of Data	10
Equivalent Long-Term Uncertainty (1 sigma)	1.19
95% Confidence Limits	2.32
3) Shear Uncertainties, 58-89 m	
Base Shear	0.24
89/58 m Speed Ratio, Base Shear	1.099
Minimum Likely Shear	0.19
89/58 m Speed Ratio, Minimum Shear	1.078
Shortfall in Mean with Minimum Shear	1.95
4) Micrositing Uncertainty	
based on array layout, terrain, met tower coverage, site visit	7.00
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	9.55

Equivalent 95% Confidence Limits in Gross Capacity Factor:

Case	Mean Speed (mps)	Gross Cap. Factor (%)	% Deviation from Base
Base	8.12	55.07	0
Lower	7.34	47.74	13.30
Upper	8.89	61.15	11.05
7 mps	8 mps	9 mps	10 mps
44 42	54 16	62 01	68 13

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

Case	% Deviation from Base
Lower	15.46
Upper	12.55

95% Confidence Limits in...

	Low	High
wind speed frequency distribution	-5	5
turbine availability	-2	1
electrical loss	-1	1
wake loss	-4	2.5
turbine performance	-2	1
environmental factors	-2	1
curtailment	-2	0
balance of plant	-2	0.5
Combined	-7.87	5.96

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 2.84%, per cell E7 above. This is equivalent to a gross energy standard deviation of 3.7%. Allowing for possible different conditions at Traverse plus the interannual variability of the loss factors brings the total interannual standard deviation of energy potential to 7.1%.

For a 10-year period, the equivalent standard deviation increment for interannual variability is 7.1% divided by the square root of 10, or 2.3%. This is equivalent to a 95% confidence limit of 2.3% x 1.96, or 4.5%. The 10-year confidence limits are computed from the root-sum-square of the values in lines 55/56 and 4.5%.

Case	% Deviation from Base
Lower	16.10
Upper	13.34

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	35.11	8.21	2.32	19.06	80.94
P95	37.49	8.21	1.65	13.55	86.45
P90	38.81	8.21	1.28	10.51	89.49
P75	40.95	8.21	0.68	5.59	94.41
P50	43.37	from Summary tab			
P25	45.38	6.80	0.68	4.63	104.63
P10	47.15	6.80	1.28	8.71	108.71
P05	48.24	6.80	1.65	11.23	111.23
P01	50.22	6.80	2.32	15.79	115.79

For one-year P-values, we incorporate the one-year 95% confidence limits in interannual variability (7.1% x 1.96, or 13.9%) with the values from lines 55/56, with these resulting 95% confidence limits:

Case	% Deviation from Base
Lower	20.79
Upper	18.73

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	32.70	10.61	2.32	24.61	75.39
P95	35.78	10.61	1.65	17.50	82.50
P90	37.48	10.61	1.28	13.58	86.42
P75	40.24	10.61	0.68	7.21	92.79
P50	43.37 from Summary tab				
P25	46.19	9.56	0.68	6.50	106.50
P10	48.68	9.56	1.28	12.23	112.23
P05	50.21	9.56	1.65	15.77	115.77
P01	52.99	9.56	2.32	22.17	122.17

Maverick Wind Farm



Wind Energy Resource Assessment, Maverick Project, Oklahoma

Submitted to Jay Godfrey, Joe Karrasch and Zachary Yetzer
American Electric Power

Prepared by Richard Simon, Rob Lowrance and Matt Christy
29 May 2019

This report evaluates the wind resource potential for Invenergy's proposed Maverick wind farm in northwestern Oklahoma, which would consist of 91 GE-2.82/127 turbines (88.6-m hub heights) and 12 GE-2.5/116 turbines (90-m hub heights), for a nameplate rating of 286.62 MW. Two 60-m met towers (Sites 0276 and 0376) were installed in August 2017. Four more met towers (Sites 0176, 0476, 0576, and 0676) were installed in August 2018.

This is Bid 15 from the SWEPCO-PSO RFP.

We have also compared our results to the brief IE Excel summary report by DNV-GL dated 12 March 2019.

Our analyses are presented as a series of topics, discussed below in sequential order. All tables and charts follow the text of this report. The same bold blue font in the text below is used to divide the topics into their respective tables and charts.

Tower Info. Documentation of the Maverick meteorological towers is furnished: their location, exposure, sensor types and measurement heights, boom lengths and orientations, and sensor calibration data.

All met towers measure wind speed at 30, 45, and 60 m above ground. KB Energy visited the site on behalf of Simon Wind with AEP personnel on 23 April 2019; their field notes are given in the Tower Info table. Besides some minor discrepancies in boom orientations, the met towers matched the furnished documentation well.

Site 0476 had numerous small data gaps from late October to November 2018. Otherwise, data recovery has been excellent for the Maverick meteorological data network.

Maps. There is a regional map showing the Maverick project and reference stations we use to evaluate long-term winds at the project met towers. The second map shows the turbine array and met towers. GE-2.82/127 turbines are shown with black numbers; GE-2.5/116 with brown numbers.

Coords. Latitudes, longitudes and elevations for the Maverick array are given in WGS84/NAD83 datum. There are two versions, the one used in the DNV-GL report (which is shown on the Maps tab), and the subsequent one furnished by Invenergy. The arrays are identical, just with different turbine labels.

Ref V. Monthly mean wind speed histories are given for six long-term reference stations: the Oklahoma City Will Rogers (OKC) and Ponca City airports, the Fairview and Lahoma Oklahoma Mesonet stations, and the two nearest MERRA-2 data points north and south of the Maverick project. OKC, Ponca City, Fairview and Lahoma measure winds at 10 m above ground; MERRA-2 winds are at 50 m above ground.

Will Rogers and Ponca City were converted from cup to sonic anemometry in 2009.

MERRA is an acronym for Modern Era Retrospective Analysis for Research and Applications) data. This data set is created with ground, radiosonde and satellite meteorological data re-analyzed by NASA. MERRA data are widely accepted as surrogate long-term reference "stations."

NASA switched to Version 2 (MERRA-2) in February 2016, which uses more advanced analysis methods and incorporates additional data sets. We have incorporated MERRA-2 data in this report from 2002-2019, which is a homogeneous data set.

Daily V Daily mean wind speeds have been tabulated for the Maverick met towers and reference stations. Daily correlation coefficients of all Maverick met towers to all reference stations are summarized below; the individual data points being too voluminous for effective presentation in this report. Note that correlations between Maverick and the airports average 0.86-0.87, and they average 0.95-0.97 to the Mesonet stations and MERRA-2 data points:

Daily Correlation Coefficient Matrix...

Site	0176	0276	0376	0476	0576	0676	Overall
OKC	0.865	0.901	0.870	0.842	0.869	0.885	0.872
Ponca City	0.858	0.897	0.866	0.840	0.861	0.857	0.863
Fairview	0.958	0.956	0.958	0.953	0.956	0.965	0.958
Lahoma	0.969	0.967	0.970	0.960	0.966	0.975	0.968
MERRA-2 South	0.951	0.951	0.951	0.948	0.952	0.949	0.950
MERRA-2 North	0.952	0.951	0.956	0.956	0.952	0.950	0.953

Mo Speeds. Monthly mean wind speeds are given for the Maverick met towers and reference stations through March 2019.

Composite mean monthly and annual wind speeds for concurrent periods of record for Sites 0276/0376 and the reference stations are computed at the bottom of the tab.

Sodar. A Triton sodar was deployed by Site 0276 for one month in fall 2018. Wind shears increased slightly with height, but there are too little data to draw annual conclusions about shears above 60 m. Historical shear data in central Oklahoma suggest shears are typically constant with height, and we accept that for Maverick.

L-T Speeds. Long-term mean annual wind speeds at Sites 0276 and 0376 are estimated from their composite mean annual wind speed ratios to the reference stations. The individual estimates based on the six reference stations agree within 4%, and we have combined them into single estimates using the weighting scheme described in the tab.

Preliminary long-term mean annual wind speeds at the four newer Maverick met towers are estimated from their overall mean wind speed ratios to Site 0276.

Here are the long-term mean annual wind speed estimates in meters per second with extrapolations to 80, 88.6 and 90 m using site-specific shears. We also present DNV-GL's estimated long-term 90-m winds:

Level (m)	0176	0276	0376	0476	0576	0676
30	6.64	6.35	6.71	6.51	6.43	6.13
45	7.23	6.92	7.25	7.07	7.06	6.82
60	7.71	7.37	7.68	7.58	7.62	7.28
80	8.21	7.85	8.12	8.07	8.17	7.81
88.6	8.40	8.03	8.28	8.25	8.38	8.01
90	8.42	8.05	8.31	8.28	8.41	8.04
DNV-90	8.4	8.0	8.3	8.3	8.3	7.9

DNV-GL speeds agree exactly with us at four met towers and differ by only 0.1 mps at the other two met towers.

En Sims. 10-minute mean wind speed data from Sites 0276 and 0376 have been scaled to 80 m using time-specific shears and compiled into separate wind speed frequency distributions. These distributions have

been scaled to integer annual mean wind speeds of 6-9 mps (bracketing the wind resource) and normalized to single, 8760-hour years. Gross annual energy simulations are performed for the two turbine models at a mean annual air density of 1.15 kg/m³, derived from regional climate data.

Relationships between gross annual capacity factor in percent and annual mean wind speed are as follows:

GE-2.82/127...

Site	6 mps	7 mps	8 mps	9 mps
0276	33.64	45.08	54.79	62.47
0376	33.63	45.25	55.07	62.84
Averaged	33.63	45.17	54.93	62.65

GE-2.5/116...

Site	6 mps	7 mps	8 mps	9 mps
0276	32.52	44.13	54.02	61.92
0376	32.49	44.29	54.31	62.24
Averaged	32.51	44.21	54.17	62.08

Rose. Joint frequency distributions of wind speed and wind direction for Sites 0276 and 0376 are furnished in tabular and graphical format for annual periods. Prevailing winds are southerly, with a secondary contribution from the north.

Off-Axis. Wake losses in annual energy between two turbines are given as a function of their azimuth orientation and spacing. These tables are prepared for the two met towers (0276, 0376) with at least one full year of data. The optimal turbine row orientations to minimize these wake losses are W/E and WSW/ENE. These tables have been incorporated into our wake modeling for Maverick.

Max V. Monthly maximum 10-minute mean wind speeds and peak gusts are summarized for the Maverick met towers. Through March 2019, the observed maximum 10-minute mean wind speed has been 27.1 mps; the peak gust 39 mps.

TI. 60-m turbulence statistics are summarized for Maverick met towers 0276 and 0376. Characteristic turbulence [mean TI plus 1.0 or 1.28 standard deviations (depending on the turbine vendor) in a 15-mps wind] is 0.11-0.13, when scaled to the 88.6/90-m hub heights for the turbines.

Temps. Monthly summaries of temperature are given, with mean and extreme values. There are no barometric pressure data, which we would need to calculate annual mean air density from on-site data.

WERA. We have informally modeled long-term mean annual hub-height winds at individual turbines at Maverick. The simplicity of the terrain warrants this decision, and the range of predicted winds is a narrow 7.9-8.5 mps. Here are the aggregate gross energy projections, along with those from DNV-GL:

Analyst	Aggregate Speed	Gross GWh	Gross Cap. Factor (%)	Ratio: SW/DNV
Simon Wind	8.22	1419.2	56.53	0.985
DNV-GL	8.25	1440.6	57.38	

Losses. Gross-to-net discounts are computed or estimated based on known information.

Analyst	Turbine Count	Gross Cap. Factor (%)	Total % Discount	Net Cap. Factor (%)	Total MW Rating	Net GWh, Full Array	Ratio: SW/DNV
Simon Wind	103	56.53	20.59	44.89	286.62	1,127.0	0.969
DNV-GL	DNV-GL	57.38	19.2	46.3	286.62	1,163.4	

12x24. Long-term simulated monthly/diurnal net energy projections are given, both as capacity factors and net MW power delivery. Given the short period of on-site data, we have extrapolated those data to reflect long-term mean monthly and annual energy expectations.

P-Values. We have calculated probability of exceedance values for the standard 10-year and 1-year periods. Values below are expressed as annual net capacity factors in percent:

P-Value	10-Year	1-Year
P99	37.79	34.93
P95	39.84	37.80
P90	40.97	39.39
P75	42.81	41.97
P50	44.89	44.89
P25	46.63	47.58
P10	48.17	49.95
P05	49.12	51.42
P01	50.84	54.07

P99/P50 ratios are 0.842 for ten years and 0.778 for one-year.

Comparison to DNV-GL Report.

We note excellent agreement for long-term winds at the met masts, plus our aggregate long-term mean annual hub-height wind speeds agree within 0.03 mps.

The conversion of mean winds to gross energy results in a 1.5% variance between the two consultants, which breaks down as follows:

- 0.3% due to the difference in aggregate speeds
- 0.3% due to DNV air density of 1.16, versus our 1.15 (no on-site pressure data)
- 0.3% due to DNV creating a long-term frequency distribution, we relied just on the existing data

Our total estimated gross-to-net discount is 1.4% greater than DNV-GL. All due to minor differences in wakes, turbine availability, etc. We note they assume a long-term 96.6% turbine availability. From the white paper they furnished AEP, availability for the first 10 years should be 96.8%, declining in subsequent years, so it strikes us a bit optimistic that long-term availability will average 96.6%.

Our long-term mean annual net energy projections are 3.1% less than DNV-GL.

This concludes our report.

Tower Info. Meteorological Tower Information
Maverick Project, Oklahoma
American Electric Power

values confirmed by KB Energy
red text KB Energy values different from furnished tower documentation

Time Zone	Central Standard Time							Boom			
Magnetic Declination	4° East (true north = 356° magnetic)							Orientation	Calibration Constants**		
		Sensor Type	Model	Serial Number*	Channel	Sensor Height (m)	Boom Length (in)	Relative to True North	Slope	Offset	Units
Site Number	0176	Anemometer	NRG 1st Class	009366	1	60.0	95	229°/225°	0.761	0.23	mps
Installation Date	30 August 2018	Anemometer	NRG #40C	309910	2	60.0	95	049°	0.773	0.29	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG 1st Class	009348	3	45.0	95	229°/225°	0.762	0.22	mps
Logger Serial Number	820602270	Anemometer	NRG #40C	309911	4	45.0	95	049°	0.773	0.33	mps
Property Owner	Ott	Anemometer	NRG 1st Class	009349	5	30.0	95	229°/225°	0.761	0.22	mps
Tower Height (m)	60	Anemometer	NRG #40C	309900	6	30.0	95	049°	0.771	0.30	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Drummond, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	229°/225°	1	0	degrees
Latitude (WGS84)	36° 13.379'N	Wind Vane	NRG 200P	N/A	14	43.0	95	229°/225°	1	0	degrees
Longitude (WGS84)	98° 03.553'W	Wind Vane	NRG 200P	N/A	15	28.0	95	229°/225°	1	0	degrees
Elevation (m)	378	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
		Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C
Site Exposure	open, flat pasture										
Site Number	0276	Anemometer	NRG #40C	277663	1	60.0	95	229°	0.761	0.35	mps
Installation Date	29 August 2017	Anemometer	NRG #40C	260360	2	60.0	95	049°	0.771	0.27	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	277664	3	45.0	95	229°	0.763	0.33	mps
Logger Serial Number	820601056	Anemometer	NRG #40C	260365	4	45.0	95	049°	0.771	0.27	mps
Property Owner	Kirchner	Anemometer	NRG #40C	277685	5	30.0	95	229°	0.759	0.39	mps
Tower Height (m)	60	Anemometer	NRG #40C	260359	6	30.0	95	049°	0.769	0.21	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Ames, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	229°	1	0	degrees
Latitude (WGS84)	36° 10.906'N	Wind Vane	NRG 200P	N/A	14	43.0	95	229°	1	0	degrees
Longitude (WGS84)	98° 06.909'W	Wind Vane	NRG 200P	N/A	15	28.0	95	229°	1	0	degrees
Elevation (m)	367	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
		Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C

Site Exposure		open, flat wheat field									
Site Number	0276	Anemometer	NRG #40C	297563	1	60.0	95	229°	0.761	0.35	mps
Maintenance Date	29 November 2017	Anemometer	NRG #40C	260360	2	60.0	95	049°	0.771	0.27	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	297561	3	45.0	95	229°	0.762	0.33	mps
Logger Serial Number	820601056	Anemometer	NRG #40C	260365	4	45.0	95	049°	0.771	0.27	mps
Property Owner	Kirchner	Anemometer	NRG #40C	277685	5	30.0	95	229°	0.759	0.39	mps
Tower Height (m)	60	Anemometer	NRG #40C	260359	6	30.0	95	049°	0.769	0.21	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Ames, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	229°	1	0	degrees
Latitude (WGS84)	36° 10.906'N	Wind Vane	NRG 200P	N/A	14	43.0	95	229°	1	0	degrees
Longitude (WGS84)	98° 06.909'W	Wind Vane	NRG 200P	N/A	15	28.0	95	229°	1	0	degrees
Elevation (m)	367	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
		Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C
Site Exposure		open, flat wheat field									
Site Number	0276	Anemometer	NRG #40C	297563	1	60.0	95	229°	0.761	0.35	mps
Maintenance Date	10 January 2018	Anemometer	NRG #40C	260360	2	60.0	95	049°	0.771	0.27	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	297561	3	45.0	95	229°	0.762	0.33	mps
Logger Serial Number	820601056	Anemometer	NRG #40C	260365	4	45.0	95	049°	0.771	0.27	mps
Property Owner	Kirchner	Anemometer	NRG #40C	277685	5	30.0	95	229°	0.759	0.39	mps
Tower Height (m)	60	Anemometer	NRG #40C	259672	6	30.0	95	049°	0.767	0.30	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Ames, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	229°	1	0	degrees
Latitude (WGS84)	36° 10.906'N	Wind Vane	NRG 200P	N/A	14	43.0	95	229°	1	0	degrees
Longitude (WGS84)	98° 06.909'W	Wind Vane	NRG 200P	N/A	15	28.0	95	229°	1	0	degrees
Elevation (m)	367	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
		Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C
Site Exposure		open, flat wheat field									
Site Number	0276	Anemometer	NRG #40C	297563	1	60.0	95	229°/230°	0.761	0.35	mps
Maintenance Date	13 February 2018	Anemometer	NRG #40C	260360	2	60.0	95	049°/052°	0.771	0.27	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	303636	3	45.0	95	229°/230°	0.760	0.35	mps
Logger Serial Number	820601056	Anemometer	NRG #40C	260365	4	45.0	95	049°/052°	0.771	0.27	mps
Property Owner	Kirchner	Anemometer	NRG #40C	277685	5	30.0	95	229°/230°	0.759	0.39	mps
Tower Height (m)	60	Anemometer	NRG #40C	259672	6	30.0	95	049°/052°	0.767	0.30	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Ames, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	229°/230°	1	0	degrees
Latitude (WGS84)	36° 10.906'N	Wind Vane	NRG 200P	N/A	14	43.0	95	229°/230°	1	0	degrees
Longitude (WGS84)	98° 06.909'W	Wind Vane	NRG 200P	N/A	15	28.0	95	229°/230°	1	0	degrees
Elevation (m)	367	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
		Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C

Site Exposure		open, flat wheat field									
Site Number	0376	Anemometer	NRG #40C	277687	1	60.0	95	229°	0.763	0.34	mps
Installation Date	24 August 2017	Anemometer	NRG #40C	260361	2	60.0	95	049°	0.767	0.27	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	277683	3	45.0	95	229°	0.763	0.32	mps
Logger Serial Number	820601057	Anemometer	NRG #40C	260354	4	45.0	95	049°	0.768	0.28	mps
Property Owner	DeHaas	Anemometer	NRG #40C	277684	5	30.0	95	229°	0.766	0.33	mps
Tower Height (m)	60	Anemometer	NRG #40C	260357	6	30.0	95	049°	0.773	0.24	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Meno, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	229°	1	0	degrees
Latitude (WGS84)	36° 19.859'N	Wind Vane	NRG 200P	N/A	14	43.0	95	229°	1	0	degrees
Longitude (WGS84)	98° 09.066'W	Wind Vane	NRG 200P	N/A	15	28.0	95	229°	1	0	degrees
Elevation (m)	398	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
		Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C
Site Exposure		open, flat pasture									
Site Number	0376	Anemometer	NRG #40C	277687	1	60.0	95	229°	0.763	0.34	mps
Maintenance Date	30 November 2017	Anemometer	NRG #40C	260361	2	60.0	95	049°	0.767	0.27	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	297576	3	45.0	95	229°	0.765	0.34	mps
Logger Serial Number	820601057	Anemometer	NRG #40C	260354	4	45.0	95	049°	0.768	0.28	mps
Property Owner	DeHaas	Anemometer	NRG #40C	297575	5	30.0	95	229°	0.762	0.36	mps
Tower Height (m)	60	Anemometer	NRG #40C	260357	6	30.0	95	049°	0.773	0.24	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Meno, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	229°	1	0	degrees
Latitude (WGS84)	36° 19.859'N	Wind Vane	NRG 200P	N/A	14	43.0	95	229°	1	0	degrees
Longitude (WGS84)	98° 09.066'W	Wind Vane	NRG 200P	N/A	15	28.0	95	229°	1	0	degrees
Elevation (m)	398	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
		Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C
Site Exposure		open, flat pasture									
Site Number	0376	Anemometer	NRG #40C	277687	1	60.0	95	229°/225°	0.763	0.34	mps
Maintenance Date	6 December 2017	Anemometer	NRG #40C	260361	2	60.0	95	049°/045°	0.767	0.27	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	297576	3	45.0	95	229°/225°	0.765	0.34	mps
Logger Serial Number	820601057	Anemometer	NRG #40C	297978	4	45.0	95	049°/045°	0.763	0.33	mps
Property Owner	DeHaas	Anemometer	NRG #40C	297575	5	30.0	95	229°/225°	0.762	0.36	mps
Tower Height (m)	60	Anemometer	NRG #40C	297975	6	30.0	95	049°/045°	0.761	0.34	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Meno, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	229°/225°	1	0	degrees
Latitude (WGS84)	36° 19.859'N	Wind Vane	NRG 200P	N/A	14	43.0	95	229°/225°	1	0	degrees
Longitude (WGS84)	98° 09.066'W	Wind Vane	NRG 200P	N/A	15	28.0	95	229°/225°	1	0	degrees
Elevation (m)	398	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
		Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C

Site Exposure		open, flat pasture									
Site Number	0476	Anemometer	NRG 1st Class	009345	1	60.0	95	229°/227°	0.761	0.23	mps
Installation Date	30 August 2018	Anemometer	NRG #40C	309909	2	60.0	95	049°/053°	0.773	0.30	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG 1st Class	008255	3	45.0	95	229°/227°	0.757	0.26	mps
Logger Serial Number	820602371	Anemometer	NRG #40C	306545	4	45.0	95	049°/053°	0.773	0.29	mps
Property Owner	Gregory	Anemometer	NRG 1st Class	008263	5	30.0	95	229°/227°	0.755	0.28	mps
Tower Height (m)	60	Anemometer	NRG #40C	306541	6	30.0	95	049°/053°	0.770	0.30	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Ames, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	229°/227°	1	0	degrees
Latitude (WGS84)	36° 16.144'N	Wind Vane	NRG 200P	N/A	14	43.0	95	229°/227°	1	0	degrees
Longitude (WGS84)	98° 07.655'W	Wind Vane	NRG 200P	N/A	15	28.0	95	229°/227°	1	0	degrees
Elevation (m)	388	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
		Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C

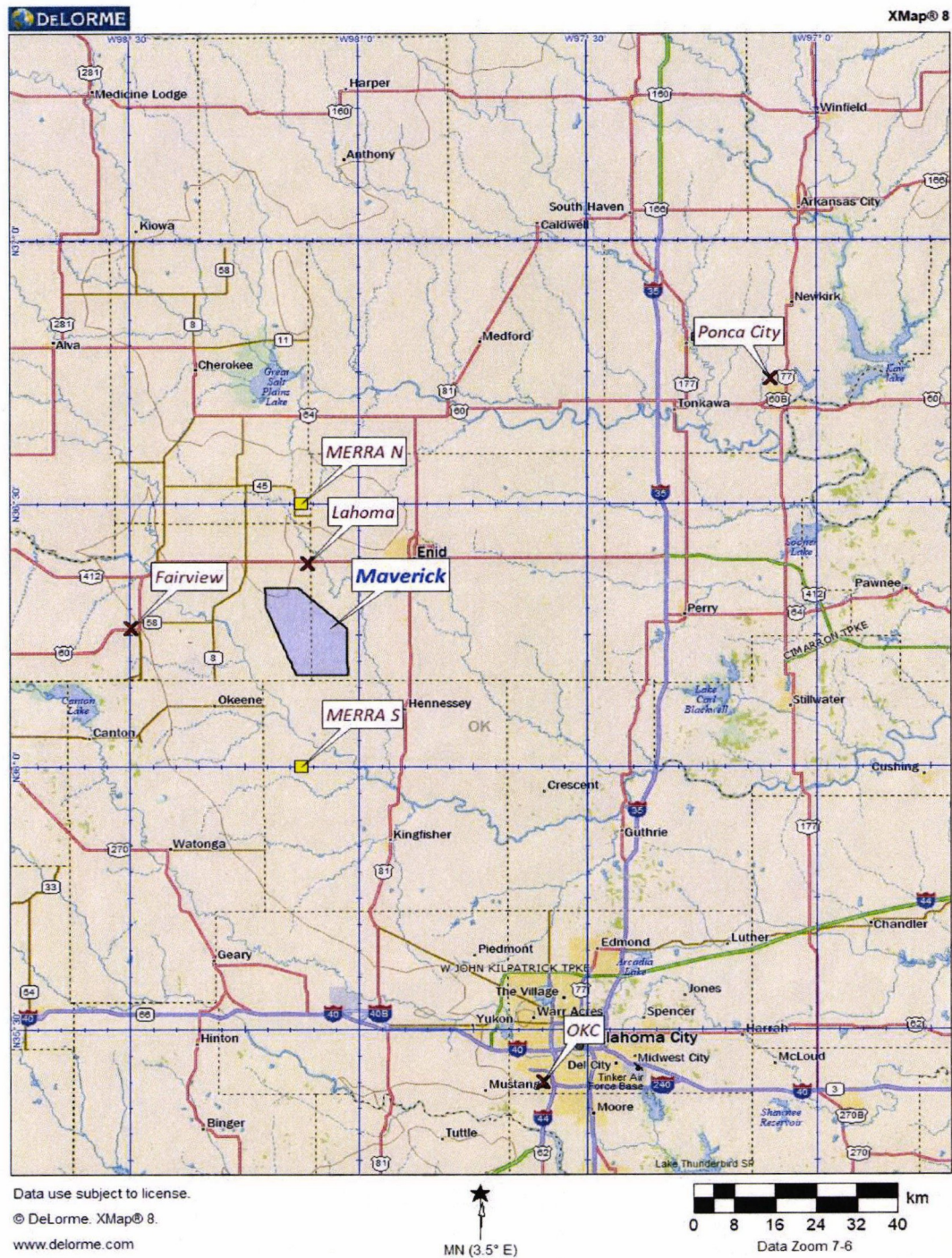
Site Exposure		open, flat pasture									
Site Number	0576	Anemometer	NRG 1st Class	009008	1	60.0	95	229°/230°	0.760	0.23	mps
Installation Date	29 August 2018	Anemometer	NRG #40C	306528	2	60.0	95	049°/054°	0.775	0.29	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG 1st Class	009011	3	45.0	95	229°/230°	0.759	0.23	mps
Logger Serial Number	820602271	Anemometer	NRG #40C	306529	4	45.0	95	049°/054°	0.774	0.28	mps
Property Owner	Kirchner	Anemometer	NRG 1st Class	009012	5	30.0	95	229°/230°	0.759	0.24	mps
Tower Height (m)	60	Anemometer	NRG #40C	306524	6	30.0	95	049°/054°	0.773	0.26	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Ames, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	229°/230°	1	0	degrees
Latitude (WGS84)	36° 11.190'N	Wind Vane	NRG 200P	N/A	14	43.0	95	229°/230°	1	0	degrees
Longitude (WGS84)	98° 02.641'W	Wind Vane	NRG 200P	N/A	15	28.0	95	229°/230°	1	0	degrees
Elevation (m)	381	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
		Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C

Site Exposure		open, flat pasture									
Site Number	0676	Anemometer	NRG 1st Class	009007	1	60.0	95	229°	0.762	0.23	mps
Installation Date	29 August 2018	Anemometer	NRG #40C	306544	2	60.0	95	049°/053°	0.774	0.28	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG 1st Class	009005	3	45.0	95	229°	0.759	0.24	mps
Logger Serial Number	820602372	Anemometer	NRG #40C	306531	4	45.0	95	049°/053°	0.772	0.29	mps
Property Owner	Gungoll	Anemometer	NRG 1st Class	009006	5	30.0	95	229°	0.760	0.23	mps
Tower Height (m)	60	Anemometer	NRG #40C	306543	6	30.0	95	49°	0.775	0.26	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Bison, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	229°	1	0	degrees
Latitude (WGS84)	36° 11.514'N	Wind Vane	NRG 200P	N/A	14	43.0	95	229°	1	0	degrees
Longitude (WGS84)	97° 59.961'W	Wind Vane	NRG 200P	N/A	15	28.0	95	229°	1	0	degrees
Elevation (m)	354	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
		Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C

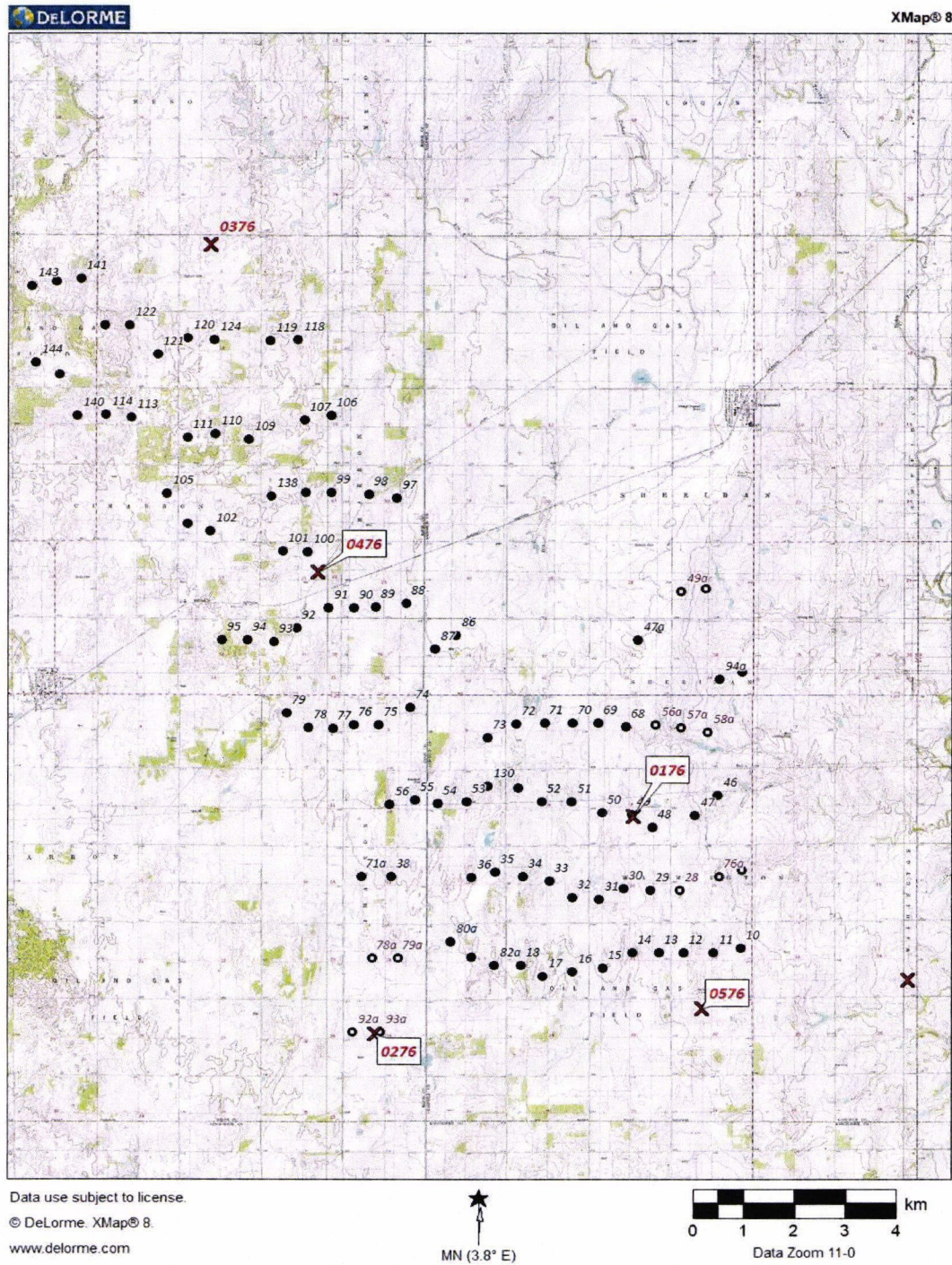
Site Exposure lower-lying area halfway down into Turkey Creek

** the full serial numbers for all NRG #40C anemometers have a prefix of 179500. Thus a listed serial number of 257052 is actually 179500257052.
The full serial numbers for all NRG 1st Class anemometers have a prefix of 596600. Thus a listed serial number of 009366 is actually 596600009366.
** all RNRG #40C anemometers use NREL default calibration constants (slope 0.765 mps/Hz, offset 0.35 mps) in our analyses*

Maps. Regional Map with the Maverick Project and Long-Term Reference Stations



Maverick Met Towers and Proposed Turbine Array (black labels GE-2.82/127, brown GE-2.5/116)



Coords. Prospective Array for GE Turbines
Maverick Project, Oklahoma
American Electric Power
Furnished by Invenenergy
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	36.182053	-98.113839	373	2.5/116	53	36.240185	-98.119685	385	2.82/127
2	36.181971	-98.119826	371	2.5/116	54	36.239516	-98.124134	384	2.82/127
3	36.197973	-98.035465	382	2.82/127	55	36.239701	-98.129581	385	2.82/127
4	36.197066	-98.041531	386	2.82/127	56	36.242452	-98.134340	387	2.82/127
5	36.196992	-98.048000	385	2.82/127	57	36.265456	-98.048639	385	2.5/116
6	36.196999	-98.053354	383	2.82/127	58	36.258500	-98.053306	383	2.82/127
7	36.197025	-98.059229	381	2.82/127	59	36.256260	-98.058105	381	2.82/127
8	36.194064	-98.065644	380	2.82/127	60	36.257086	-98.097497	379	2.82/127
9	36.193462	-98.072342	379	2.82/127	61	36.254490	-98.102064	382	2.82/127
10	36.192565	-98.078651	381	2.82/127	62	36.263160	-98.108295	383	2.82/127
11	36.194618	-98.083292	381	2.82/127	63	36.262503	-98.115046	387	2.82/127
12	36.194726	-98.089123	385	2.82/127	64	36.262329	-98.119687	388	2.82/127
13	36.196150	-98.094084	383	2.82/127	65	36.262317	-98.125242	392	2.82/127
14	36.199146	-98.098559	379	2.82/127	66	36.258539	-98.132007	391	2.82/127
15	36.195954	-98.109949	376	2.5/116	67	36.255859	-98.137007	389	2.82/127
16	36.195996	-98.115625	375	2.5/116	68	36.256240	-98.142812	385	2.82/127
17	36.212583	-98.035411	376	2.5/116	69	36.256280	-98.148445	382	2.82/127
18	36.211411	-98.040349	381	2.5/116	70	36.283079	-98.110426	382	2.82/127
19	36.208845	-98.048750	384	2.5/116	71	36.283708	-98.116467	387	2.82/127
20	36.208898	-98.055360	383	2.82/127	72	36.284046	-98.124619	394	2.82/127
21	36.209196	-98.061190	384	2.82/127	73	36.272860	-98.129839	392	2.82/127
22	36.207030	-98.066349	383	2.82/127	74	36.273066	-98.135126	392	2.82/127
23	36.207392	-98.072333	383	2.82/127	75	36.276748	-98.151038	389	2.82/127
24	36.210644	-98.077195	384	2.82/127	76	36.278298	-98.155990	389	2.82/127
25	36.211357	-98.082942	384	2.82/127	77	36.283885	-98.160465	388	2.82/127
26	36.212373	-98.089014	383	2.82/127	78	36.298666	-98.124623	393	2.82/127
27	36.211214	-98.094071	380	2.82/127	79	36.297770	-98.130402	387	2.82/127
28	36.211427	-98.111563	380	2.82/127	80	36.294092	-98.142633	401	2.82/127
29	36.211499	-98.117934	380	2.82/127	81	36.295199	-98.149975	398	2.82/127
30	36.226746	-98.040796	373	2.82/127	82	36.294465	-98.155878	394	2.82/127
31	36.223028	-98.045531	381	2.82/127	83	36.298375	-98.168117	392	2.82/127
32	36.220713	-98.054757	386	2.82/127	84	36.298851	-98.173804	390	2.82/127
33	36.223130	-98.059393	384	2.82/127	85	36.313056	-98.131882	393	2.82/127
34	36.223626	-98.065756	383	2.82/127	86	36.312760	-98.137879	398	2.82/127
35	36.225627	-98.072550	383	2.82/127	87	36.313294	-98.155834	398	2.82/127
36	36.225632	-98.078930	385	2.82/127	88	36.310155	-98.162274	395	2.82/127
37	36.225623	-98.095182	389	2.82/127	89	36.315696	-98.168538	398	2.82/127
38	36.225231	-98.101474	385	2.82/127	90	36.315683	-98.173986	399	2.82/127
39	36.225886	-98.106385	384	2.82/127	91	36.312994	-98.150222	399	2.82/127
40	36.225033	-98.111920	382	2.82/127	92	36.228205	-98.083998	384	2.82/127
41	36.248863	-98.040317	376	2.82/127	93	36.228492	-98.090640	387	2.82/127
42	36.238699	-98.042834	373	2.5/116	94	36.250162	-98.035244	373	2.82/127
43	36.239716	-98.048689	380	2.5/116	95	36.265954	-98.043171	376	2.5/116
44	36.240122	-98.054144	380	2.5/116	96	36.284042	-98.130270	396	2.82/127
45	36.239888	-98.060674	383	2.82/127	97	36.283414	-98.137771	397	2.82/127
46	36.240527	-98.066739	384	2.82/127	98	36.298589	-98.179999	391	2.82/127
47	36.240448	-98.072279	383	2.82/127	99	36.324599	-98.179009	404	2.82/127
48	36.240420	-98.078354	382	2.82/127	100	36.324132	-98.184411	401	2.82/127
49	36.240370	-98.084386	382	2.82/127	101	36.323182	-98.189818	396	2.82/127
50	36.237759	-98.097696	386	2.82/127	102	36.308736	-98.188966	389	2.82/127
51	36.243515	-98.107521	386	2.82/127	103	36.306414	-98.183739	390	2.82/127
52	36.240097	-98.114393	387	2.82/127					

Prospective Array for GE Turbines
Maverick Project, Oklahoma
American Electric Power
from DNV-GL Report
WGS84 Datum, Not Field Checked by Simon Wind

Turbine	Latitude	Longitude	Turbine Model	Turbine	Latitude	Longitude	Turbine Model
10	36.197973	-98.035462	2.82/127	97	36.283081	-98.110422	2.82/127
11	36.197066	-98.041535	2.82/127	98	36.283711	-98.116472	2.82/127
12	36.196992	-98.047998	2.82/127	99	36.284042	-98.124619	2.82/127
13	36.196998	-98.053359	2.82/127	100	36.272856	-98.129843	2.82/127
14	36.197026	-98.059231	2.82/127	101	36.273066	-98.135130	2.82/127
15	36.194065	-98.065640	2.82/127	102	36.276750	-98.151033	2.82/127
16	36.193459	-98.072343	2.82/127	103	36.278299	-98.155993	2.82/127
17	36.192562	-98.078648	2.82/127	105	36.283884	-98.160465	2.82/127
18	36.194617	-98.083295	2.82/127	106	36.298664	-98.124623	2.82/127
28	36.208844	-98.048755	2.5/116	107	36.297769	-98.130402	2.82/127
29	36.208896	-98.055363	2.82/127	109	36.294089	-98.142637	2.82/127
30	36.209194	-98.061188	2.82/127	110	36.295196	-98.149976	2.82/127
31	36.207026	-98.066353	2.82/127	111	36.294463	-98.155875	2.82/127
32	36.207388	-98.072334	2.82/127	113	36.298371	-98.168117	2.82/127
33	36.210644	-98.077190	2.82/127	114	36.298852	-98.173803	2.82/127
34	36.211355	-98.082945	2.82/127	118	36.313061	-98.131881	2.82/127
35	36.212375	-98.089018	2.82/127	119	36.312761	-98.137877	2.82/127
36	36.211215	-98.094071	2.82/127	120	36.313295	-98.155839	2.82/127
38	36.211427	-98.111568	2.82/127	121	36.310158	-98.162277	2.82/127
46	36.226747	-98.040794	2.82/127	122	36.315692	-98.168534	2.82/127
47	36.223026	-98.045535	2.82/127	123	36.315685	-98.173982	2.82/127
48	36.220710	-98.054753	2.82/127	124	36.312994	-98.150217	2.82/127
49	36.223127	-98.059397	2.82/127	129	36.228204	-98.083994	2.82/127
50	36.223627	-98.065755	2.82/127	130	36.228489	-98.090645	2.82/127
51	36.225628	-98.072552	2.82/127	137	36.284038	-98.130265	2.82/127
52	36.225632	-98.078928	2.82/127	138	36.283416	-98.137766	2.82/127
53	36.225621	-98.095184	2.82/127	140	36.298588	-98.179998	2.82/127
54	36.225235	-98.101475	2.82/127	141	36.324599	-98.179012	2.82/127
55	36.225885	-98.106386	2.82/127	142	36.324131	-98.184409	2.82/127
56	36.225034	-98.111925	2.82/127	143	36.323186	-98.189823	2.82/127
68	36.239887	-98.060677	2.82/127	144	36.308738	-98.188970	2.82/127
69	36.240530	-98.066734	2.82/127	145	36.306412	-98.183736	2.82/127
70	36.240446	-98.072277	2.82/127	47a	36.256257	-98.058110	2.82/127
71	36.240421	-98.078354	2.82/127	48a	36.258500	-98.053307	2.82/127
72	36.240368	-98.084386	2.82/127	49a	36.265458	-98.048637	2.5/116
73	36.237703	-98.090683	2.82/127	50a	36.265956	-98.043176	2.5/116
74	36.243518	-98.107521	2.82/127	56a	36.240124	-98.054141	2.5/116
75	36.240098	-98.114393	2.82/127	57a	36.239720	-98.048693	2.5/116
76	36.240183	-98.119689	2.82/127	58a	36.238700	-98.042829	2.5/116
77	36.239512	-98.124137	2.82/127	71a	36.211501	-98.117930	2.82/127
78	36.239705	-98.129577	2.82/127	76a	36.211409	-98.040347	2.5/116
79	36.242453	-98.134343	2.82/127	77a	36.212586	-98.035416	2.5/116
86	36.257083	-98.097493	2.82/127	78a	36.195996	-98.115624	2.5/116
87	36.254494	-98.102064	2.82/127	79a	36.195954	-98.109952	2.5/116
88	36.263159	-98.108299	2.82/127	80a	36.199150	-98.098559	2.82/127
89	36.262506	-98.115041	2.82/127	81a	36.196150	-98.094089	2.82/127
90	36.262333	-98.119685	2.82/127	82a	36.194724	-98.089122	2.82/127
91	36.262320	-98.125240	2.82/127	92a	36.181972	-98.119829	2.5/116
92	36.258538	-98.132006	2.82/127	93a	36.182054	-98.113834	2.5/116
93	36.255860	-98.137011	2.82/127	94a	36.248867	-98.040313	2.82/127
94	36.256235	-98.142817	2.82/127	95a	36.250160	-98.035244	2.82/127
95	36.256276	-98.148449	2.82/127				

Ref V. Monthly Mean 10-m Wind Speeds (mps)
Will Rogers OKC Airport, Oklahoma
ASOS and Sonic Period Only
Sonic Conversion Date: 14 January 2009

Latitude: 35° 23.3'N
Longitude: 97° 36.0'W
Elevation: 392 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009		6.1	6.6	6.6	4.5	4.6	4.4	4.5	4.1	5.4	4.6	5.3	5.15
2010	4.6	4.6	6.5	6.1	4.7	4.9	4.0	4.4	4.6	3.8	5.8	4.8	4.90
2011	4.5	5.8	6.0	6.9	6.5	6.4	4.1	4.4	4.3	4.6	6.1	4.6	5.34
2012	5.4	5.2	5.7	5.2	5.4	4.7	4.2	4.4	3.9	5.1	4.7	5.4	4.94
2013	4.8	5.3	5.7	6.4	5.7	4.9	4.0	3.5	3.8	5.1	5.6	4.6	4.94
2014	5.9	5.2	6.2	6.3	5.5	5.4	3.9	4.0	4.4	4.5	5.8	4.6	5.15
2015	4.5	5.3	4.2	5.4	5.0	4.6	4.4	4.0	4.6	4.2	5.8	5.1	4.76
2016	5.0	5.8	6.2	5.4	5.0	4.0	4.8	4.1	4.4	5.2	4.8	5.1	4.98
2017	5.3	5.7	6.4	6.2	5.2	5.2	4.0	3.7	4.2	5.3	5.0	4.8	5.08
2018	5.7	5.6	6.0	6.6	5.0	5.2	3.7	4.3	3.9	4.2	4.8	5.1	5.01
2019	5.2	5.7	5.4										
Overall	5.08	5.49	5.89	6.11	5.25	4.99	4.15	4.11	4.23	4.74	5.29	4.94	5.02

Monthly Mean 10-m Wind Speeds (mps)
Ponca City Airport, Oklahoma
ASOS and Sonic Period Only
Sonic Conversion Date: 6 February 2009

Latitude: 36° 44.2'N
Longitude: 97° 06.1'W
Elevation: 305 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2009			5.3	5.1	3.7	3.7	3.4	3.6	3.4	4.1	3.4	4.0	3.97
2010	3.7	3.4	4.9	4.3	3.8	4.1	3.2	3.5	3.6	2.8	4.3	3.7	3.78
2011	3.2	4.1	4.8	5.1	5.2	5.1	3.9	3.5	3.2	3.6	4.2	3.3	4.09
2012	3.8	3.9	4.1	4.3	4.6	4.0	3.3	3.2	3.4	4.0	3.7	4.0	3.85
2013	3.5	4.1	4.7	5.1	4.4	4.1	3.4	3.3	3.3	3.9	4.1	3.4	3.94
2014	4.4	4.3	5.1	5.0	4.1	4.1	3.2	3.3	4.1	3.5	4.4	4.0	4.13
2015	3.5	4.4	3.6	4.6	4.2	3.7	3.6	3.4	4.0	3.3	4.6	4.1	3.91
2016	3.9	4.4	4.8	4.4	4.1	3.5	4.7	3.4	3.7	4.0	3.6	3.7	4.01
2017	4.2	4.3	5.1	4.9	4.3	4.4	3.6	3.0	3.7	4.4	3.9	3.9	4.13
2018	4.2	4.6	4.9	5.3	3.9	4.5	3.0	3.5	3.5	3.1	3.9	4.1	4.05
2019	3.9	4.6	4.4										
Overall	3.82	4.21	4.71	4.81	4.23	4.11	3.53	3.37	3.59	3.67	3.99	3.81	3.99

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 10-m Wind Speeds (mps)
Lahoma Mesonet Station, Oklahoma

Latitude: 36° 23.1'N
Longitude: 98° 06.7'W
Elevation: 396 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1994	4.9	5.5	5.1	5.9	3.5	5.3	4.9	5.0	5.0	4.1	5.2	4.0	4.86
1995	4.5	5.3	5.3	5.1	4.2	4.5	4.3	4.3	4.2	5.3	5.4	4.2	4.73
1996	6.4	4.9	6.2	6.1	5.9	4.4	4.1	3.8	4.3	5.8	5.5	5.0	5.20
1997	5.1	4.7	5.3	4.9	4.2	4.2	4.7	4.0	4.5	4.9	4.4	4.8	4.65
1998	4.9	4.5	6.2	4.9	4.0	6.1	4.4	3.7	4.2	5.0	5.0	4.3	4.76
1999	5.0	5.2	5.3	5.1	4.5	4.7	5.3	4.0	4.5	4.6	4.4	5.0	4.81
2000	4.1	5.3	4.8	4.6	4.7	4.9	4.9	5.0	5.6	5.1	4.4	4.7	4.82
2001	4.4	5.2	4.2	5.6	4.3	5.4	5.3	3.9	4.1	5.8	4.8	4.8	4.82
2002	5.1	6.2	6.2	5.6	5.1	5.2	4.7	4.7	4.3	4.2	4.4	4.5	5.01
2003	4.9	4.5	4.8	5.4	4.1	4.1	5.1	4.0	4.6	4.1	5.1	5.7	4.69
2004	4.7	5.3	5.0	4.8	5.6	4.5	4.4	4.4	4.7	4.2	4.5	4.6	4.72
2005	4.3	4.4	4.9	5.4	4.0	4.9	4.2	3.9	4.7	4.5	5.4	4.9	4.63
2006	5.4	5.1	5.5	5.4	4.6	4.8	4.8	4.2	4.8	5.2	5.1	5.1	5.01
2007	5.2	5.4	5.2	4.9	4.2	4.2	3.5	5.0	4.7	5.5	4.4	4.8	4.75
2008	5.9	5.3	5.6	5.7	4.8	5.5	4.4	3.8	4.0	5.1	5.1	6.0	5.10
2009	5.3	5.7	5.6	5.6	4.1	4.7	4.5	4.7	4.2	5.3	4.9	5.2	4.98
2010	4.7	4.7	5.9	5.6	4.1	4.8	4.4	4.2	4.9	4.0	5.4	4.2	4.73
2011	4.4	5.3	5.3	5.9	5.6	6.4	4.3	4.3	4.4	4.9	5.7	4.5	5.09
2012	5.2	4.9	5.2	4.5	4.9	5.2	4.5	4.1	4.3	5.5	5.0	5.2	4.88
2013	4.7	5.3	5.2	5.6	4.9	5.1	4.4	3.8	4.3	5.1	5.1	4.8	4.87
2014	5.9	5.0	6.2	6.1	5.1	5.5	4.5	4.4	5.2	4.7	5.5	4.7	5.22
2015	4.7	5.3	4.3	4.9	4.2	4.4	4.4	3.9	4.8	3.8	5.5	5.0	4.59
2016	4.6	5.4	5.6	4.9	4.2	4.1	4.7	4.0	4.5	5.1	4.6	4.7	4.70
2017	5.1	5.0	5.7	5.3	4.3	4.9	3.9	3.3	4.1	5.3	4.7	5.0	4.71
2018	5.4	5.4	5.4	6.0	4.6	5.2	3.3	4.0	3.8	4.2	4.6	5.1	4.75
2019	4.8	5.1	5.1										
Overall	4.99	5.15	5.35	5.35	4.55	4.91	4.47	4.18	4.50	4.84	4.96	4.82	4.84

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

Latitude: 36° 00.0'N
Longitude: 98° 07.5'W

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2002	7.5	7.8	8.5	8.1	7.9	7.5	6.3	6.5	6.6	6.0	7.0	6.9	7.20
2003	6.9	6.3	7.2	8.7	6.6	6.1	7.2	5.7	7.0	6.6	7.4	8.1	6.98
2004	6.7	7.2	7.8	7.5	9.1	6.5	6.2	6.3	7.0	6.9	6.7	7.5	7.12
2005	6.1	6.4	7.7	8.5	6.6	7.5	6.1	5.5	7.0	7.0	8.5	7.1	7.00
2006	8.2	7.2	8.0	8.5	7.1	6.7	7.0	5.8	6.8	7.3	7.5	7.4	7.29
2007	6.9	7.5	7.7	7.4	6.5	6.4	5.2	7.3	6.6	7.9	6.9	6.8	6.91
2008	8.2	7.0	7.8	8.5	8.2	8.1	7.0	5.6	6.2	7.6	7.8	8.4	7.53
2009	7.6	8.4	8.5	8.9	6.4	7.4	6.1	6.5	6.2	7.5	7.4	7.2	7.35
2010	6.3	6.0	8.2	9.2	7.2	7.5	6.5	6.6	7.4	6.8	8.2	6.3	7.17
2011	6.5	7.5	7.8	9.0	9.0	9.4	6.2	6.3	6.6	7.4	8.3	6.5	7.54
2012	8.0	7.0	8.1	7.5	8.1	7.3	6.8	6.4	6.1	7.9	7.5	7.6	7.35
2013	6.7	7.4	7.6	8.1	8.0	7.7	6.4	6.0	6.7	7.9	7.8	6.8	7.25
2014	8.4	6.8	8.5	8.9	8.0	8.1	6.3	6.5	6.8	7.1	7.8	6.4	7.45
2015	6.7	6.9	6.0	7.6	7.2	7.1	6.7	6.1	7.1	6.3	8.2	7.5	6.94
2016	6.8	8.2	8.5	7.6	7.1	6.2	7.1	6.0	6.8	8.0	7.3	7.1	7.23
2017	7.2	7.5	8.4	8.2	7.4	7.2	5.7	5.3	6.6	8.4	7.1	7.0	7.18
2018	7.8	7.4	7.7	8.6	7.3	7.6	4.9	6.4	6.2	6.5	6.9	7.2	7.04
2019	7.1	7.0	7.2										
Overall	7.20	7.18	7.85	8.29	7.50	7.30	6.34	6.16	6.68	7.24	7.55	7.16	7.20

Monthly Mean 50-m Wind Speeds (mps)
MERRA-2 North 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)
Maverick Project, Oklahoma
American Electric Power
YEAR: 2017

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0276	30-ne									5.7	7.0	6.1	6.0	
	30-sw									5.7	7.0	6.1	6.1	
	45-ne									6.3	7.8	6.8	6.6	
	45-sw									6.2	7.7	6.7	6.6	
	60-ne									6.8	8.3	7.2	7.1	
	60-sw									6.7	8.3	7.1	7.0	
0376	30-ne									6.1	7.5	6.5	6.6	
	30-sw									6.0	7.5	6.5	6.6	
	45-ne									6.7	8.3	7.1	7.2	
	45-sw									6.6	8.2	7.1	7.2	
	60-ne									7.0	8.8	7.4	7.6	
	60-sw									7.0	8.8	7.5	7.6	
OKC	10									4.2	5.3	5.0	4.8	
Ponca City	10									3.7	4.4	3.9	3.9	
Fairview	10									3.7	4.6	3.9	4.3	
Lahoma	10									4.1	5.3	4.7	5.0	
MERRA-2 South	50									6.6	8.4	7.1	7.0	
MERRA-2 North	50									6.6	8.2	7.0	6.8	

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0176	30-ne									5.5	5.6	6.2	6.7	
	30-sw									5.5	5.7	6.2	6.7	
	45-ne									6.0	6.2	6.8	7.4	
	45-sw									6.0	6.3	6.9	7.4	
	60-ne									6.4	6.6	7.2	7.8	
	60-sw									6.5	6.6	7.3	7.9	
0276	30-ne	7.0	6.6	7.0	7.8	6.7	7.2	4.5	5.5	5.3	5.4	5.9	6.3	6.27
	30-sw	6.9	6.6	7.1	7.9	6.6	7.1	4.4	5.5	5.3	5.4	5.9	6.4	6.25
	45-ne	7.7	7.2	7.6	8.4	7.3	7.8	5.0	6.1	5.8	5.9	6.5	7.0	6.85
	45-sw	7.6	7.2	7.6	8.4	7.2	7.6	4.9	6.0	5.8	5.9	6.5	6.9	6.79
	60-ne	8.2	7.6	8.0	8.9	7.7	8.2	5.4	6.5	6.2	6.4	7.0	7.5	7.29
	60-sw	8.2	7.6	8.0	8.9	7.7	8.2	5.4	6.5	6.2	6.3	6.9	7.5	7.26
0376	30-ne	7.5	7.1	7.4	8.1	6.9	7.5	4.8	5.9	5.7	5.8	6.3	6.9	6.65
	30-sw	7.5	7.0	7.3	8.1	6.9	7.4	4.8	5.8	5.6	5.7	6.3	6.8	6.59
	45-ne	8.1	7.6	7.9	8.6	7.4	8.0	5.3	6.4	6.1	6.2	6.8	7.5	7.15
	45-sw	8.1	7.6	7.9	8.6	7.4	8.0	5.3	6.4	6.1	6.2	6.8	7.5	7.15

	60-ne	8.5	8.0	8.3	9.0	7.8	8.4	5.6	6.8	6.5	6.5	7.2	7.8	7.55
	60-sw	8.6	8.0	8.3	9.1	7.9	8.4	5.6	6.9	6.5	6.6	7.3	7.9	7.59
0476	30-ne									5.5	5.6	6.1	6.5	
	30-sw									5.5	5.6	6.1	6.5	
	45-ne									6.0	6.1	6.6	7.1	
	45-sw									6.0	6.1	6.7	7.2	
	60-ne									6.4	6.5	7.2	7.7	
	60-sw									6.4	6.5	7.1	7.7	
0576	30-ne									5.4	5.5	6.0	6.5	
	30-sw									5.3	5.5	6.0	6.4	
	45-ne									5.9	6.0	6.7	7.2	
	45-sw									5.8	6.1	6.6	7.2	
	60-ne									6.3	6.5	7.2	7.8	
	60-sw									6.3	6.5	7.2	7.7	
0676	30-ne									4.8	5.1	5.6	6.3	
	30-sw									4.9	5.2	5.7	6.2	
	45-ne									5.4	5.7	6.3	7.0	
	45-sw									5.5	5.9	6.4	7.1	
	60-ne									5.9	6.2	6.8	7.4	
	60-sw									5.9	6.2	6.8	7.4	
OKC	10	5.7	5.6	6.0	6.6	5.0	5.2	3.7	4.3	3.9	4.2	4.8	5.1	5.01
Ponca City	10	4.2	4.6	4.9	5.3	3.9	4.5	3.0	3.5	3.5	3.1	3.9	4.1	4.05
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
Lahoma	10	5.4	5.4	5.4	6.0	4.6	5.2	3.3	4.0	3.8	4.2	4.6	5.1	4.75
MERRA-2 South	50	7.8	7.4	7.7	8.6	7.3	7.6	4.9	6.4	6.2	6.5	6.9	7.2	7.04
MERRA-2 North	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
0176	10-w	6.5	6.6	6.8										
	31-e	6.5	6.5	6.7										
	47-e	7.0	7.1	7.3										
	47-w	7.1	7.0	7.3										
	56.5-e	7.5	7.5	7.7										
	56.5-w	7.5	7.5	7.8										
0276	30-ne	6.1	6.4	6.4										
	30-sw	6.1	6.4	6.4										
	45-ne	6.7	6.8	7.0										
	45-sw	6.7	6.8	7.0										
	60-ne	7.2	7.3	7.4										
	60-sw	7.1	7.2	7.4										
0376	30-ne	6.4	6.7	6.8										
	30-sw	6.5	6.6	6.8										
	45-ne	6.9	7.0	7.3										
	45-sw	7.1	7.0	7.3										
	60-ne	7.4	7.4	7.7										
	60-sw	7.4	7.4	7.7										
0476	30-ne	6.2	6.4	6.6										
	30-sw	6.3	6.5	6.6										
	45-ne	6.8	7.0	7.1										
	45-sw	6.8	7.0	7.1										
	60-ne	7.2	7.5	7.6										
	60-sw	7.2	7.5	7.5										
0576	30-ne	6.2	6.4	6.5										
	30-sw	6.3	6.5	6.5										
	45-ne	6.9	7.0	7.1										
	45-sw	6.9	7.1	7.1										
	60-ne	7.4	7.6	7.6										
	60-sw	7.4	7.5	7.6										
0676	30-ne	6.0	6.3	6.3										
	30-sw	6.1	6.3	6.3										
	45-ne	6.6	6.8	6.9										
	45-sw	6.8	6.9	7.0										
	60-ne	7.1	7.3	7.3										
	60-sw	7.2	7.3	7.3										

OKC	10	5.2	5.7	5.4
Ponca City	10	3.9	4.6	4.4
Fairview	10	4.1	4.6	4.4
Lahoma	10	4.8	5.1	5.1
MERRA-2 South	50	7.1	7.0	7.2
MERRA-2 North	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), September 2017-March 2019														
Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0276	30-ne	6.5	6.5	6.7	7.8	6.7	7.2	4.5	5.5	5.5	6.2	6.0	6.2	6.28
	30-sw	6.5	6.5	6.7	7.9	6.6	7.1	4.4	5.5	5.5	6.2	6.0	6.2	6.26
	45-ne	7.2	7.0	7.3	8.4	7.3	7.8	5.0	6.1	6.1	6.9	6.6	6.8	6.87
	45-sw	7.1	7.0	7.3	8.4	7.2	7.6	4.9	6.0	6.0	6.8	6.6	6.7	6.81
	60-ne	7.7	7.4	7.7	8.9	7.7	8.2	5.4	6.5	6.5	7.4	7.1	7.3	7.31
0376	60-sw	7.6	7.4	7.7	8.9	7.7	8.2	5.4	6.5	6.4	7.3	7.0	7.3	7.27
	30-ne	7.0	6.9	7.1	8.1	6.9	7.5	4.8	5.9	5.9	6.6	6.4	6.7	6.65
	30-sw	7.0	6.8	7.1	8.1	6.9	7.4	4.8	5.8	5.8	6.6	6.4	6.7	6.60
	45-ne	7.5	7.3	7.6	8.6	7.4	8.0	5.3	6.4	6.4	7.2	7.0	7.3	7.16
	45-sw	7.6	7.3	7.6	8.6	7.4	8.0	5.3	6.4	6.3	7.2	6.9	7.3	7.16
OKC	60-ne	7.9	7.7	8.0	9.0	7.8	8.4	5.6	6.8	6.7	7.6	7.3	7.7	7.56
	60-sw	8.0	7.7	8.0	9.1	7.9	8.4	5.6	6.9	6.8	7.7	7.4	7.8	7.61
	10	5.4	5.7	5.7	6.6	5.0	5.2	3.7	4.3	4.0	4.8	4.9	4.9	5.02
	Ponca City	10	4.1	4.6	4.7	5.3	3.9	4.5	3.0	3.5	3.6	3.7	4.0	4.06
	Fairview	10	4.4	4.5	4.6	5.6	4.6	5.0	3.1	3.8	3.7	4.0	4.2	4.27
Lahoma	10	5.1	5.2	5.3	6.0	4.6	5.2	3.3	4.0	4.0	4.7	4.6	5.0	4.76
	MERRA-2 South	50	7.5	7.2	7.5	8.6	7.3	7.6	4.9	6.4	6.4	7.5	7.0	7.07
	MERRA-2 North	50	7.2	7.0	7.4	8.4	7.2	7.6	4.9	6.7	6.5	7.4	6.9	7.01

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

Estimates for Sites 0276 and 0376 Based on Their Composite Mean Annual Speed Ratios to the Reference Stations...

Site	Level (m)	Composite Mean Sep 2017 to Mar 2019	Estimated Long-Term Based on...							Shears		Extrapolated to		
			OKC	Ponca City	Fairview	Lahoma	MERRA-2 South	MERRA-2 North	Combined*	Levels (m)	Exponent	80 m	88.6 m	90 m
0276	30-ne	6.28	6.28	6.16	6.33	6.39	6.40	6.37	6.35					
	30-sw	6.26	6.26	6.14	6.31	6.37	6.38	6.35	6.34	30-45	0.213			
	45-ne	6.87	6.87	6.74	6.92	6.98	6.99	6.96	6.95	45-60	0.223			
	45-sw	6.81	6.81	6.68	6.86	6.92	6.93	6.90	6.89					
	60-ne	7.31	7.31	7.17	7.36	7.43	7.44	7.41	7.39	30-60	0.217	7.85	8.03	8.05
	60-sw	7.27	7.27	7.13	7.32	7.39	7.40	7.37	7.36					
0376	30-ne	6.65	6.65	6.52	6.70	6.76	6.77	6.74	6.73					
	30-sw	6.60	6.61	6.48	6.65	6.72	6.73	6.69	6.68	30-45	0.191			
	45-ne	7.16	7.17	7.03	7.22	7.28	7.30	7.26	7.25	45-60	0.201			
	45-sw	7.16	7.16	7.02	7.21	7.28	7.29	7.25	7.24					
	60-ne	7.56	7.57	7.42	7.62	7.69	7.70	7.67	7.65	30-60	0.195	8.12	8.28	8.31
	60-sw	7.61	7.61	7.46	7.66	7.74	7.75	7.71	7.70					
OKC	10	5.02	5.02											
Ponca City	10	4.06		3.99										
Fairview	10	4.27			4.30									
Lahoma	10	4.76				4.84								
MERRA-2 South	50	7.07					7.20							
MERRA-2 North	50	7.01						7.11						

* weighting OKC 5%, Ponca City 5%, Fairview 20%, Lahoma 20%, MERRA-2 points each 25%

Estimates for Other Maverick Towers Based on Their Overall Mean Wind Speed Ratios to Site 0276...

		Overall Mean Sep 2018 to Mar 2019	Preliminary, based on 7+ months of data					Shears		Extrapolated to		
Site	Level (m)						Estimated Long-Term	Levels (m)	Exponent	80 m	88.6 m	90 m
0176	30-ne	6.28					6.66					
	30-sw	6.24					6.62	30-45	0.212			
	45-ne	6.83					7.23	45-60	0.225			
	45-sw	6.84					7.24					
	60-ne	7.24					7.68	30-60	0.217	8.21	8.40	8.42
	60-sw	7.30					7.75					

0476	30-ne	6.13	6.50						
	30-sw	6.16	6.53	30-45	0.201				
	45-ne	6.65	7.04	45-60	0.243				
	45-sw	6.70	7.09						
	60-ne	7.15	7.59	30-60	0.218	8.07	8.25	8.28	
	60-sw	7.13	7.57						
0576	30-ne	6.07	6.43						
	30-sw	6.07	6.44	30-45	0.230				
	45-ne	6.68	7.07	45-60	0.263				
	45-sw	6.66	7.05						
	60-ne	7.18	7.62	30-60	0.244	8.17	8.38	8.41	
	60-sw	7.17	7.61						
0676	30-ne	5.77	6.11						
	30-sw	5.81	6.15	30-45	0.260				
	45-ne	6.38	6.75	45-60	0.226				
	45-sw	6.50	6.89						
	60-ne	6.84	7.26	30-60	0.246	7.81	8.01	8.04	
	60-sw	6.86	7.29						
0276	30-sw	5.98	6.34						
	45-sw	6.51	6.89						
	60-sw	6.93	7.36						

Sodar. Sodar Data Analysis, Triton near Site 0276
Maverick Project, OK
American Electric Power

Latitude (WGS84): 36° 10.903'N
Longitude (WGS84): 98° 06.855'W
This is 80 m east of Site 0276

Data Period: 13 September-16 October 2018

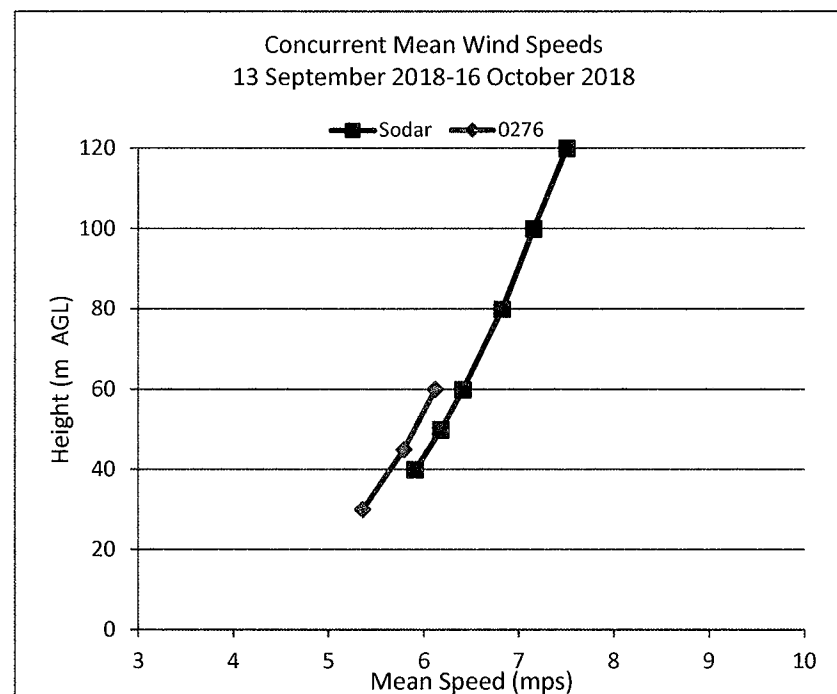
Mean Wind Speeds (mps)*...

Site	Level (m)	% Data Recovery	Mean Speed
Sodar	40	90	5.91
	50	90	6.18
	60	90	6.41
	80	90	6.83
	100	90	7.16
	120	84	7.51
	140	79	7.78
	160	74	8.04
	180	68	8.29
	200	61	8.50
0276	30	90	5.36
	45	90	5.79
	60	90	6.12

Mean Shear Exponents*...

Site	Levels (m)	Mean Shear
Sodar	40-50	0.201
	50-60	0.201
	60-80	0.219
	80-100	0.211
	100-120	0.264
	120-140	0.227
	140-160	0.251
	160-180	0.257
	180-200	0.238
0276	30-45	0.191
	45-60	0.192
	30-60	0.191

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



This is only five weeks of data.

En Sims. Gross Annual Energy Simulations
Maverick Project, Oklahoma, Site 0276
American Electric Power
Using Extrapolated 80-m Data, January-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	32.6	22.0	15.6	13.4	0	0	0	0	0
1	296.3	214.0	165.6	128.7	0	0	0	0	0
2	588.3	433.0	326.6	257.0	0	0	0	0	0
3	817.2	634.3	507.1	394.7	27	22,073	17,133	13,697	10,660
4	995.5	770.1	603.4	509.5	179	178,401	138,010	108,131	91,294
5	1124.3	884.9	723.6	585.8	401	450,277	354,419	289,796	234,597
6	1190.3	983.1	797.5	663.9	712	847,882	700,263	568,088	472,908
7	1167.7	1018.2	862.9	733.5	1138	1,328,789	1,158,745	982,007	834,725
8	982.4	1026.3	894.9	762.7	1663	1,633,778	1,706,732	1,488,150	1,268,449
9	732.5	875.2	909.1	799.2	2189	1,603,428	1,915,798	1,990,119	1,749,495
10	376.0	743.3	792.0	813.5	2575	968,188	1,913,870	2,039,383	2,094,783
11	214.5	483.2	697.7	723.6	2768	593,654	1,337,581	1,931,235	2,002,883
12	115.8	266.9	564.1	657.7	2819	326,460	752,423	1,590,133	1,854,049
13	63.4	173.5	330.4	561.2	2820	178,693	489,154	931,856	1,582,639
14	38.5	99.0	199.3	400.0	2820	108,543	279,178	562,147	1,128,087
15	15.3	59.3	144.5	257.5	2820	43,133	167,317	407,628	726,146
16	5.5	38.7	87.2	154.8	2820	15,641	109,017	245,999	436,541
17	2.2	21.3	55.3	123.4	2820	6,162	60,196	155,941	347,906
18	1.0	7.1	38.2	76.5	2820	2,844	19,908	107,595	215,664
19	0.3	3.7	23.4	52.8	2820	948	10,428	65,884	148,832
20	0.2	1.5	11.3	36.3	2820	474	4,266	31,757	102,381
21	0.2	0.7	5.4	25.2	2820	474	1,896	15,168	71,098
22	0	0.2	2.7	15.5	2820	0	474	7,584	43,607
23	0	0.2	0.8	5.5	1200	0	202	1,008	6,656
24	0	0.3	0.7	3.7	1200	0	403	807	4,437
25	0	0	0	2.4	1200	0	0	0	2,824
26	0	0	0.3	0.8	1200	0	0	403	1,008
27	0	0	0.2	0.5	1200	0	0	202	605
28	0	0	0.2	0	1200	0	0	202	0
29	0	0	0	0.3	1200	0	0	0	403
30+	0	0	0	0.3	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		8,309,840	11,137,411	13,534,919	15,432,674
Gross Capacity Factor (%):						33.64	45.08	54.79	62.47

Gross Annual Energy Simulations
Maverick Project, Oklahoma, Site 0376
American Electric Power
Using Extrapolated 80-m Data, November 2017-October 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	33.0	23.4	16.0	11.8	0	0	0	0	0
1	239.3	179.5	138.6	110.5	0	0	0	0	0
2	563.2	393.6	294.8	215.4	0	0	0	0	0
3	846.5	642.9	479.7	383.8	27	22,864	17,365	12,957	10,366
4	1039.2	803.8	641.4	517.9	179	186,217	144,035	114,939	92,807
5	1117.2	915.3	757.3	611.8	401	447,451	366,586	303,310	245,020
6	1182.7	966.0	807.3	692.5	712	842,425	688,059	575,040	493,302
7	1172.4	1010.2	850.0	724.5	1138	1,334,214	1,149,629	967,343	824,501
8	1035.5	1011.9	881.3	767.1	1663	1,721,966	1,682,793	1,465,658	1,275,665
9	730.7	939.7	900.9	783.6	2189	1,599,597	2,057,045	1,971,964	1,715,248
10	379.9	762.5	839.6	805.6	2575	978,309	1,963,550	2,161,985	2,074,466
11	217.9	468.1	738.7	757.7	2768	603,130	1,295,681	2,044,587	2,097,215
12	118.3	278.3	540.3	684.0	2819	333,446	784,523	1,523,037	1,928,104
13	51.2	172.1	331.6	582.7	2820	144,244	485,400	935,213	1,643,147
14	22.5	103.0	218.1	388.0	2820	63,581	290,386	614,935	1,094,166
15	6.9	48.1	141.7	249.4	2820	19,454	135,703	399,518	703,189
16	1.7	26.2	86.7	179.4	2820	4,745	74,020	244,361	505,803
17	0.5	9.1	46.4	119.5	2820	1,424	25,622	130,958	336,886
18	0.7	3.4	27.8	74.2	2820	1,898	9,490	78,290	209,249
19	0.3	1.0	12.5	45.4	2820	949	2,847	35,112	128,111
20	0.2	0.3	5.0	27.8	2820	475	949	14,235	78,290
21	0.3	0.7	2.2	14.5	2820	949	1,898	6,168	40,806
22	0	0.3	0.5	6.9	2820	0	949	1,424	19,454
23	0	0.2	0.5	2.7	1200	0	202	606	3,231
24	0	0.3	0.3	1.3	1200	0	404	404	1,615
25	0	0	0.2	0.5	1200	0	0	202	606
26	0	0	0.3	0.7	1200	0	0	404	808
27	0	0	0	0.2	1200	0	0	0	202
28	0	0	0.3	0	1200	0	0	404	0
29	0	0	0	0.5	1200	0	0	0	606
30+	0	0	0	0.3	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		8,307,336	11,177,135	13,603,051	15,522,864
Gross Capacity Factor (%):						33.63	45.25	55.07	62.84

Gross Annual Energy Simulations
Maverick Project, Oklahoma, Site 0276

American Electric Power

Using Extrapolated 80-m Data, January-December 2018

Turbine: **GE-2.5/116** (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	32.6	22.0	15.6	13.4	0	0	0	0	0
1	296.3	214.0	165.6	128.7	0	0	0	0	0
2	588.3	433.0	326.6	257.0	0	0	0	0	0
3	817.2	634.3	507.1	394.7	11	8,581	6,661	5,325	4,144
4	995.5	770.1	603.4	509.5	145	143,855	111,286	87,192	73,616
5	1124.3	884.9	723.6	585.8	328	368,766	290,261	237,336	192,129
6	1190.3	983.1	797.5	663.9	594	706,469	583,470	473,340	394,034
7	1167.7	1018.2	862.9	733.5	950	1,108,686	966,809	819,346	696,460
8	982.4	1026.3	894.9	762.7	1411	1,385,715	1,447,592	1,262,198	1,075,855
9	732.5	875.2	909.1	799.2	1906	1,395,766	1,667,681	1,732,377	1,522,915
10	376.0	743.3	792.0	813.5	2304	866,105	1,712,077	1,824,357	1,873,915
11	214.5	483.2	697.7	723.6	2481	531,993	1,198,653	1,730,646	1,794,852
12	115.8	266.9	564.1	657.7	2500	289,518	667,278	1,410,192	1,644,244
13	63.4	173.5	330.4	561.2	2500	158,416	433,647	826,114	1,403,049
14	38.5	99.0	199.3	400.0	2500	96,226	247,498	498,358	1,000,077
15	15.3	59.3	144.5	257.5	2500	38,238	148,331	361,372	643,747
16	5.5	38.7	87.2	154.8	2500	13,867	96,646	218,084	387,005
17	2.2	21.3	55.3	123.4	2500	5,463	53,366	138,246	308,427
18	1.0	7.1	38.2	76.5	2500	2,521	17,649	95,386	191,191
19	0.3	3.7	23.4	52.8	2500	841	9,245	58,408	131,943
20	0.2	1.5	11.3	36.3	2500	420	3,782	28,154	90,763
21	0.2	0.7	5.4	25.2	2500	420	1,681	13,447	63,030
22	0	0.2	2.7	15.5	2500	0	420	6,723	38,659
23	0	0.2	0.8	5.5	2500	0	420	2,101	13,867
24	0	0.3	0.7	3.7	2500	0	841	1,681	9,245
25	0	0	0	2.4	2500	0	0	0	5,883
26	0	0	0.3	0.8	1200	0	0	403	1,008
27	0	0	0.2	0.5	1200	0	0	202	605
28	0	0	0.2	0	1200	0	0	202	0
29	0	0	0	0.3	1200	0	0	0	403
30+	0	0	0	0.3	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		7,121,865	9,665,290	11,831,187	13,561,065
Gross Capacity Factor (%):						32.52	44.13	54.02	61.92

Gross Annual Energy Simulations
Maverick Project, Oklahoma, Site 0376
American Electric Power
Using Extrapolated 80-m Data, November 2017-October 2018
Turbine: **GE-2.5/116** (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	33.0	23.4	16.0	11.8	0	0	0	0	0
1	239.3	179.5	138.6	110.5	0	0	0	0	0
2	563.2	393.6	294.8	215.4	0	0	0	0	0
3	846.5	642.9	479.7	383.8	11	8,888	6,751	5,037	4,030
4	1039.2	803.8	641.4	517.9	145	150,159	116,144	92,682	74,836
5	1117.2	915.3	757.3	611.8	328	366,452	300,226	248,404	200,665
6	1182.7	966.0	807.3	692.5	594	701,922	573,302	479,133	411,028
7	1172.4	1010.2	850.0	724.5	950	1,113,212	959,203	807,111	687,929
8	1035.5	1011.9	881.3	767.1	1411	1,460,513	1,427,287	1,243,121	1,081,976
9	730.7	939.7	900.9	783.6	1906	1,392,431	1,790,635	1,716,573	1,493,104
10	379.9	762.5	839.6	805.6	2304	875,159	1,756,520	1,934,032	1,855,741
11	217.9	468.1	738.7	757.7	2481	540,485	1,161,104	1,832,224	1,879,387
12	118.3	278.3	540.3	684.0	2500	295,713	695,746	1,350,689	1,709,919
13	51.2	172.1	331.6	582.7	2500	127,876	430,319	829,090	1,456,691
14	22.5	103.0	218.1	388.0	2500	56,366	257,434	545,155	970,006
15	6.9	48.1	141.7	249.4	2500	17,247	120,304	354,183	623,395
16	1.7	26.2	86.7	179.4	2500	4,207	65,621	216,632	448,407
17	0.5	9.1	46.4	119.5	2500	1,262	22,715	116,098	298,658
18	0.7	3.4	27.8	74.2	2500	1,683	8,413	69,406	185,504
19	0.3	1.0	12.5	45.4	2500	841	2,524	31,128	113,574
20	0.2	0.3	5.0	27.8	2500	421	841	12,619	69,406
21	0.3	0.7	2.2	14.5	2500	841	1,683	5,468	36,176
22	0	0.3	0.5	6.9	2500	0	841	1,262	17,247
23	0	0.2	0.5	2.7	2500	0	421	1,262	6,730
24	0	0.3	0.3	1.3	2500	0	841	841	3,365
25	0	0	0.2	0.5	2500	0	0	421	1,262
26	0	0	0.3	0.7	1200	0	0	404	808
27	0	0	0	0.2	1200	0	0	0	202
28	0	0	0.3	0	1200	0	0	404	0
29	0	0	0	0.5	1200	0	0	0	606
30+	0	0	0	0.3	0	0	0	0	0
Total	8760.0	8760.0	8760.0	8760.0		7,115,678	9,698,873	11,893,377	13,630,649
Gross Capacity Factor (%):						32.49	44.29	54.31	62.24

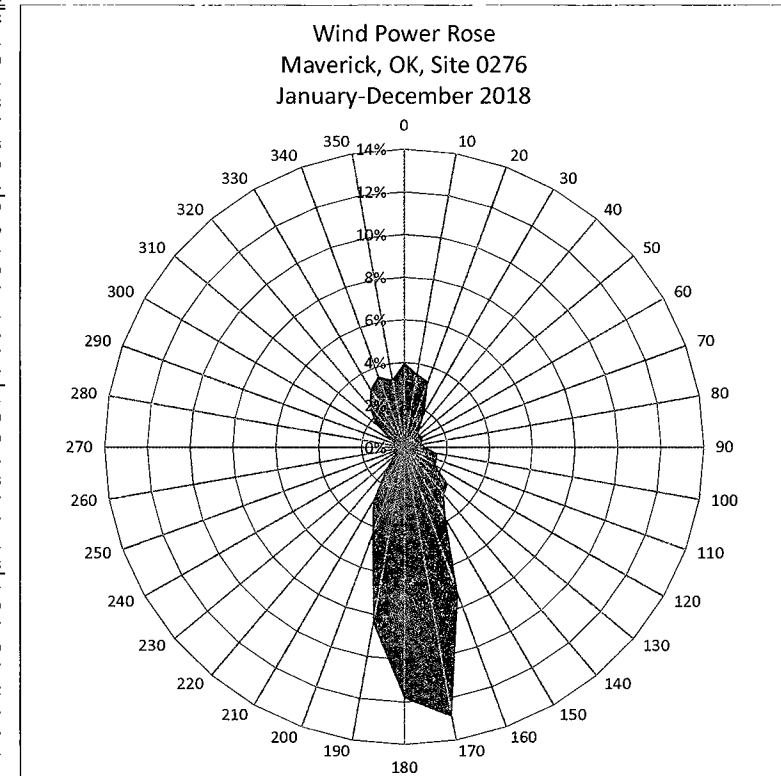
Rose. Extrapolated 80-m Wind Rose
Maverick Project, Oklahoma, Site 0276
January-December 2018
99.0% Data Recovery
Joint Frequency of 10-Minute Samples

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	149	364	545	445	228	113	23	1	0	1868	8.6	512,859 3.98
10	146	468	664	397	150	52	15	0	0	1890	7.7	452,940 3.51
20	141	535	619	384	144	37	1	1	0	1862	7.4	424,519 3.29
30	111	471	425	231	54	4	0	0	0	1295	6.7	250,792 1.94
40	118	452	286	96	22	2	0	0	0	976	5.9	138,726 1.08
50	167	431	222	88	7	2	0	0	0	917	5.4	112,132 0.87
60	120	402	310	87	11	2	2	0	0	934	5.8	132,991 1.03
70	95	368	292	61	11	1	0	0	0	828	5.8	114,761 0.89
80	114	336	282	61	9	1	1	0	0	803	5.7	109,072 0.85
90	165	395	317	82	11	2	0	0	0	970	5.6	128,192 0.99
100	164	451	436	149	28	3	1	0	0	1231	6.1	201,235 1.56
110	175	460	475	165	15	7	3	1	0	1301	6.1	212,789 1.65
120	151	518	499	154	24	3	1	2	0	1352	6.2	218,406 1.69
130	167	507	688	329	28	4	0	0	0	1723	6.7	343,867 2.67
140	152	474	719	388	25	2	1	0	0	1760	6.9	374,990 2.91
150	153	521	770	576	78	11	2	0	0	2109	7.4	506,848 3.93
160	167	576	979	1180	329	15	4	0	0	3249	8.4	950,519 7.37
170	185	655	1428	1942	760	95	22	1	0	5086	9.2	1,659,732 12.87
180	161	460	1182	1703	794	155	9	1	0	4464	9.5	1,523,767 11.81
190	145	359	915	1168	570	116	2	0	0	3275	9.3	1,083,838 8.40
200	134	333	568	678	198	38	4	0	1	1954	8.4	567,950 4.40
210	128	302	406	442	128	26	1	0	0	1433	7.9	379,330 2.94
220	127	220	233	196	39	4	0	0	0	819	6.8	171,580 1.33
230	125	140	150	50	19	4	2	0	0	490	5.8	73,197 0.57
240	119	119	113	38	13	10	6	3	1	421	5.9	61,251 0.47
250	128	105	92	41	13	4	2	0	0	384	5.4	52,311 0.41
260	110	89	60	30	10	2	0	0	0	300	5.0	35,478 0.28
270	106	90	69	42	12	1	0	0	0	319	5.3	43,667 0.34
280	108	94	64	35	41	23	1	0	0	366	6.5	64,107 0.50
290	96	112	72	43	16	25	4	0	0	367	6.3	60,840 0.47
300	80	151	118	95	29	18	10	0	0	501	7.1	102,583 0.80
310	70	191	215	223	86	45	16	1	0	847	8.4	228,361 1.77
320	91	227	296	294	131	80	28	3	0	1150	8.8	324,590 2.52
330	122	276	412	388	153	66	39	9	0	1463	8.7	406,847 3.15
340	136	350	579	367	171	94	30	5	0	1732	8.4	457,691 3.55
350	125	321	519	301	184	105	23	3	0	1581	8.5	417,432 3.24
Calms	0									0		
Totals	4751	12321	16015	12947	4536	1169	250	30	2	52020	7.8	12,900,189 100.00

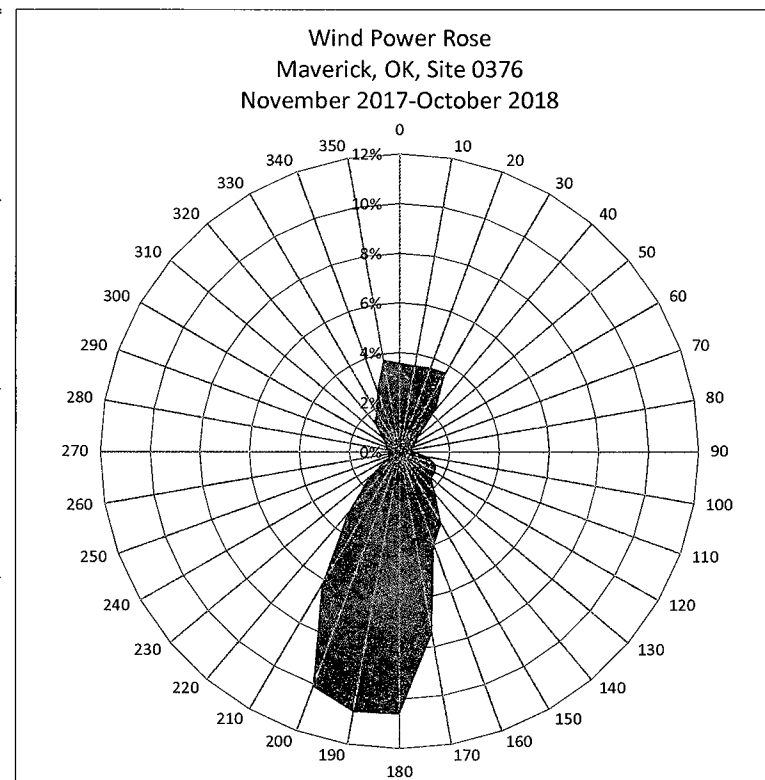
Extrapolated 80-m Wind Rose
Maverick Project, Oklahoma, Site 0376
November 2017-October 2018
99.0% Data Recovery
Joint Frequency of 10-Minute Samples

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	78	329	584	445	194	58	29	5	1	1723	8.7	488,257	3.60
10	106	379	528	464	213	53	3	1	0	1746	8.3	478,522	3.53
20	104	444	606	498	195	32	1	0	0	1879	8.0	491,333	3.62
30	119	429	646	514	169	45	2	0	0	1923	8.0	499,176	3.68
40	102	450	516	268	95	8	0	0	0	1438	7.1	305,254	2.25
50	151	499	262	86	28	0	0	0	0	1027	5.6	130,850	0.96
60	182	496	238	58	8	1	0	0	0	983	5.1	102,455	0.76
70	127	416	219	26	8	1	0	0	0	797	5.1	80,182	0.59
80	114	369	175	22	6	0	1	0	0	686	5.0	65,851	0.49
90	131	407	210	46	4	1	1	1	0	800	5.2	85,852	0.63
100	144	454	339	127	9	1	1	0	0	1075	5.9	159,415	1.18
110	149	471	435	178	28	2	0	0	0	1263	6.2	211,629	1.56
120	130	397	497	188	12	2	1	1	0	1227	6.4	221,985	1.64
130	140	492	539	160	15	4	0	0	0	1349	6.2	225,942	1.67
140	152	492	572	301	24	1	0	0	0	1542	6.6	301,119	2.22
150	137	498	801	473	53	7	0	0	0	1968	7.3	452,258	3.33
160	96	472	716	666	114	7	2	0	0	2073	7.9	544,971	4.02
170	121	470	1033	1258	348	27	3	1	0	3259	8.7	1,009,079	7.44
180	153	510	1137	1616	750	122	17	0	0	4305	9.4	1,438,065	10.60
190	147	462	1120	1628	739	161	5	0	0	4262	9.5	1,446,637	10.67
200	148	393	740	1363	893	282	13	1	0	3832	10.1	1,368,647	10.09
210	116	369	642	904	456	108	10	0	0	2605	9.3	846,571	6.24
220	103	275	435	431	219	57	4	3	0	1526	8.6	440,698	3.25
230	83	195	241	241	91	5	1	0	1	857	7.8	218,280	1.61
240	114	179	150	66	22	10	2	1	0	543	6.1	86,745	0.64
250	89	137	99	45	10	6	2	0	0	387	5.7	56,055	0.41
260	97	115	78	57	15	3	1	0	0	364	5.8	56,375	0.42
270	66	101	78	53	17	0	0	0	0	316	6.0	53,783	0.40
280	79	118	73	60	26	0	0	0	0	356	6.1	60,321	0.44
290	83	105	68	78	43	21	2	0	0	399	7.2	85,805	0.63
300	74	130	82	77	36	14	3	0	0	416	6.9	83,226	0.61
310	78	142	139	130	37	15	11	1	0	552	7.5	128,637	0.95
320	63	133	157	189	90	80	16	0	0	728	9.3	216,558	1.60
330	80	182	201	216	113	69	31	3	1	896	9.0	252,274	1.86
340	77	229	382	330	163	58	14	2	0	1254	8.7	358,885	2.65
350	79	252	532	444	224	104	35	1	1	1672	9.2	509,594	3.76
Calms	0									0			
Totals	4009	11993	15268	13705	5463	1362	205	18	4	52028	8.0	13,561,288	100.00



Off-Axis. Off-Axis Wake Losses (%)
Maverick, Oklahoma, Site 0276
American Electric Power
Turbine: GE-2.82/127
Data from January-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	37.26	24.52	17.46	13.34	10.56	8.72
010/190	33.24	21.30	14.78	11.09	8.63	7.05
020/200	26.40	15.96	10.64	7.86	6.03	4.88
030/210	18.77	10.62	6.80	4.97	3.77	3.03
040/220	12.36	6.64	4.10	2.95	2.20	1.75
050/230	8.04	4.23	2.58	1.84	1.36	1.07
060/240	5.67	3.03	1.91	1.40	1.07	0.87
070/250	4.71	2.62	1.70	1.26	0.97	0.79
080/260	4.64	2.67	1.72	1.25	0.94	0.75
090/270	5.18	2.99	1.96	1.45	1.11	0.89
100/280	6.30	3.60	2.37	1.77	1.37	1.12
110/290	8.07	4.63	3.00	2.20	1.67	1.34
120/300	10.70	6.15	4.00	2.92	2.22	1.78
130/310	14.63	8.31	5.42	4.02	3.09	2.51
140/320	20.21	11.55	7.47	5.50	4.20	3.40
150/330	26.85	16.04	10.54	7.69	5.83	4.68
160/340	33.19	20.88	14.32	10.70	8.29	6.76
170/350	37.14	24.28	17.22	13.15	10.40	8.60

Off-Axis Wake Losses (%)
Maverick, Oklahoma, Site 0376
American Electric Power
Turbine: GE-2.82/127
Data from November 2017-October 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	36.07	23.20	16.22	12.28	9.64	7.93
010/190	37.17	24.28	17.11	12.95	10.16	8.34
020/200	34.39	22.19	15.54	11.76	9.23	7.59
030/210	28.33	17.66	12.12	9.11	7.10	5.81
040/220	20.77	12.23	8.02	5.87	4.47	3.59
050/230	13.73	7.43	4.57	3.25	2.41	1.90
060/240	8.43	4.23	2.49	1.76	1.29	1.01
070/250	5.38	2.66	1.58	1.13	0.85	0.67
080/260	4.28	2.24	1.38	1.00	0.75	0.60
090/270	4.40	2.50	1.61	1.17	0.88	0.71
100/280	5.19	3.08	2.06	1.54	1.19	0.97
110/290	6.42	3.80	2.56	1.92	1.50	1.22
120/300	8.08	4.71	3.10	2.28	1.75	1.41
130/310	10.44	5.98	3.88	2.84	2.16	1.73
140/320	14.08	7.91	5.10	3.77	2.89	2.34
150/330	19.18	11.00	7.11	5.19	3.95	3.18
160/340	25.37	15.20	10.08	7.41	5.65	4.56
170/350	31.62	19.69	13.47	10.11	7.87	6.43

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

YEAR: 2017

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0257	30-ne									14.6	18.5	17.8	14.4	18.5
	30-sw									14.6	18.5	18.1	14.4	18.5
	45-ne									15.4	19.7	19.0	15.1	19.7
	45-sw									15.2	19.7	18.9	15.1	19.7
	60-ne									15.8	20.5	19.4	15.8	20.5
	60-sw									15.7	20.4	19.5	15.9	20.4
0357	30-ne									15.1	18.2	19.0	16.0	19.0
	30-sw									14.7	18.4	19.2	16.3	19.2
	45-ne									15.5	19.2	19.8	17.0	19.8
	45-sw									15.2	19.4	19.9	17.2	19.9
	60-ne									15.4	20.0	20.0	17.4	20.0
	60-sw									15.6	20.0	20.2	17.7	20.2

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0176	30-ne									14.1	15.9	20.6	18.8	20.6
	30-sw									14.0	15.9	20.4	18.8	20.4
	45-ne									14.7	16.6	21.4	19.7	21.4
	45-sw									14.9	16.8	21.6	19.6	21.6
	60-ne									15.5	17.4	22.6	20.5	22.6
	60-sw									15.2	16.9	22.3	20.0	22.3
0276	30-ne	19.0	16.1	19.7	18.1	21.3	24.0	18.5	19.2	13.5	15.5	20.1	18.6	24.0
	30-sw	19.0	16.2	19.7	19.0	23.7	24.0	18.7	19.3	13.8	15.7	20.3	18.6	24.0
	45-ne	20.3	16.9	20.2	18.8	23.5	25.3	19.7	20.1	14.4	16.2	21.3	19.2	25.3
	45-sw	20.2	16.9	20.2	19.6	24.8	25.2	19.7	19.8	14.4	16.1	21.3	19.3	25.2
	60-ne	20.8	17.3	20.5	19.5	24.9	25.8	20.4	20.5	14.9	16.4	22.1	20.1	25.8
	60-sw	20.8	17.3	20.6	20.2	26.0	25.6	20.5	20.4	14.9	16.5	22.2	20.1	26.0
0376	30-ne	19.8	17.8	20.3	18.5	23.6	25.0	18.4	15.8	16.0	16.6	21.8	18.4	25.0
	30-sw	20.0	17.6	20.2	18.8	24.2	25.2	18.7	15.4	15.7	16.1	21.9	18.7	25.2

	45-ne	20.8	19.0	20.9	19.3	25.7	26.4	19.5	15.8	16.7	16.8	22.6	19.4	26.4
	45-sw	20.8	18.8	20.8	19.5	25.5	26.4	19.7	16.0	16.5	16.8	22.7	19.5	26.4
	60-ne	21.5	19.9	21.2	19.8	26.7	27.1	20.4	16.3	17.1	17.4	22.9	19.9	27.1
	60-sw	21.3	19.7	21.2	20.1	26.8	27.0	20.4	16.5	17.4	17.3	23.0	20.0	27.0
0476	30-ne									13.8	15.1	19.7	17.7	19.7
	30-sw									13.8	14.9	19.5	17.9	19.5
	45-ne									14.9	15.5	20.5	18.7	20.5
	45-sw									14.9	15.4	20.6	18.7	20.6
	60-ne									15.6	15.9	21.2	19.5	21.2
	60-sw									15.4	15.7	21.4	19.4	21.4
0576	30-ne									13.4	15.3	19.5	18.8	19.5
	30-sw									13.3	14.9	19.4	18.7	19.4
	45-ne									14.4	15.8	21.4	19.6	21.4
	45-sw									14.2	15.7	21.1	19.5	21.1
	60-ne									15.2	16.4	22.4	20.5	22.4
	60-sw									14.9	16.2	22.3	20.4	22.3
0676	30-ne									13.4	16.3	20.7	18.0	20.7
	30-sw									13.4	16.0	20.6	18.1	20.6
	45-ne									14.3	17.0	22.1	19.2	22.1
	45-sw									14.4	17.0	22.3	19.5	22.3
	60-ne									14.6	17.2	22.7	19.8	22.7
	60-sw									14.6	17.2	22.8	19.6	22.8

YEAR: 2019 (maximum 10-minute means)

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0176	30-ne	19.6	18.3	21.7										21.7
	30-sw	19.6	18.0	21.4										21.4
	45-ne	20.7	18.7	22.8										22.8
	45-sw	20.7	18.7	22.6										22.6
	60-ne	21.5	19.1	23.4										23.4
	60-sw	21.2	19.0	23.4										23.4
0276	30-ne	19.2	17.9	22.3										22.3
	30-sw	19.4	17.7	22.2										22.2
	45-ne	20.1	18.9	23.2										23.2
	45-sw	20.0	18.8	23.0										23.0
	60-ne	20.3	19.7	23.7										23.7

	60-sw	20.6	19.7	23.7	23.7
0376	30-ne	19.6	17.2	22.2	22.2
	30-sw	19.9	17.0	21.7	21.7
	45-ne	20.5	17.7	23.0	23.0
	45-sw	20.7	17.4	22.9	22.9
	60-ne	21.0	18.1	23.8	23.8
	60-sw	21.1	18.1	23.9	23.9
0476	30-ne	18.5	18.1	21.9	21.9
	30-sw	18.3	17.9	21.6	21.6
	45-ne	19.2	18.7	22.8	22.8
	45-sw	18.8	18.6	22.4	22.4
	60-ne	20.1	19.0	23.3	23.3
	60-sw	20.0	19.1	23.4	23.4
0576	30-ne	18.5	18.4	22.6	22.6
	30-sw	18.3	18.0	22.1	22.1
	45-ne	19.5	19.8	23.4	23.4
	45-sw	19.5	19.4	23.4	23.4
	60-ne	21.0	20.4	24.5	24.5
	60-sw	20.9	20.4	24.1	24.1
0676	30-ne	19.0	17.9	21.4	21.4
	30-sw	19.2	17.6	21.1	21.1
	45-ne	19.9	18.6	22.2	22.2
	45-sw	20.3	18.6	22.4	22.4
	60-ne	20.3	18.9	22.8	22.8
	60-sw	20.1	18.8	22.9	22.9
Overall Maximum:					27.1

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)
Maverick Project, Oklahoma
American Electric Power

YEAR: 2017

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0257	30-ne									20	27	23	20	27
	30-sw									20	27	24	20	27
	45-ne									21	26	24	20	26
	45-sw									20	26	24	20	26
	60-ne									20	27	24	21	27
	60-sw									20	27	24	21	27
0357	30-ne									20	25	26	20	26
	30-sw									20	26	25	21	26
	45-ne									20	25	26	21	26
	45-sw									20	26	25	22	26
	60-ne									20	26	25	22	26
	60-sw									20	26	26	23	26

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0176	30-ne									20	20	28	24	28
	30-sw									19	20	28	24	28
	45-ne									20	21	28	25	28
	45-sw									21	21	29	25	29
	60-ne									21	22	29	25	29
	60-sw									21	21	28	24	28
0276	30-ne	26	20	26	26	30	37	28	33	20	20	27	23	37
	30-sw	25	21	26	27	32	38	28	33	20	20	27	24	38
	45-ne	25	21	26	27	33	39	29	33	20	20	28	24	39
	45-sw	26	21	26	27	33	39	29	32	20	20	29	24	39
	60-ne	26	22	26	27	33	38	29	32	22	20	29	25	38
	60-sw	26	21	26	28	34	38	29	31	21	21	29	25	38
0376	30-ne	26	22	28	25	32	33	23	20	21	22	29	24	33
	30-sw	25	22	27	26	33	33	23	21	20	21	29	25	33

	45-ne	26	23	27	26	35	33	25	21	22	22	29	25	35
	45-sw	26	23	27	26	34	33	25	21	21	22	29	26	34
	60-ne	26	23	28	26	36	33	26	21	21	21	29	25	36
	60-sw	26	23	27	26	34	34	25	21	22	21	29	25	34
0476	30-ne									21	20	28	24	28
	30-sw									21	19	27	24	27
	45-ne									21	20	28	24	28
	45-sw									21	20	28	25	28
	60-ne									22	20	29	25	29
	60-sw									22	21	28	25	28
0576	30-ne									23	20	29	25	29
	30-sw									22	21	28	25	28
	45-ne									23	20	29	25	29
	45-sw									23	20	28	25	28
	60-ne									24	21	28	25	28
	60-sw									23	21	28	25	28
0676	30-ne									19	21	29	26	29
	30-sw									19	20	28	26	28
	45-ne									20	21	29	26	29
	45-sw									20	21	28	26	28
	60-ne									20	21	29	26	29
	60-sw									21	22	28	26	28

YEAR: 2019 (peak 1-second gusts)

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0176	30-ne	26	25	33										33
	30-sw	25	24	32										32
	45-ne	26	24	33										33
	45-sw	26	24	32										32
	60-ne	26	25	30										30
	60-sw	28	24	31										31
0276	30-ne	25	24	30										30
	30-sw	26	24	30										30
	45-ne	26	25	30										30
	45-sw	26	25	30										30
	60-ne	26	25	32										32

	60-sw	26	25	33	33
0376	30-ne	24	22	32	32
	30-sw	25	22	31	31
	45-ne	25	22	33	33
	45-sw	26	22	32	32
	60-ne	26	22	33	33
	60-sw	25	23	33	33
0476	30-ne	25	23	29	29
	30-sw	24	22	28	28
	45-ne	26	23	31	31
	45-sw	25	22	30	30
	60-ne	26	23	30	30
	60-sw	26	22	31	31
0576	30-ne	25	24	32	32
	30-sw	25	23	31	31
	45-ne	26	24	33	33
	45-sw	26	24	33	33
	60-ne	26	26	34	34
	60-sw	27	25	34	34
0676	30-ne	25	23	31	31
	30-sw	25	23	30	30
	45-ne	26	25	31	31
	45-sw	27	25	31	31
	60-ne	26	24	32	32
	60-sw	26	24	32	32

Overall Maximum:	39
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Data Recovery: black = 90-100%; green = 75-90%; blue = 50-75%; orange = 25-50%; purple = 10-25%; "x" = 0-10%.

TI. Turbulence Intensity Analysis
Maverick Project, Oklahoma
American Electric Power
Site 0276, 60-m Level, Northeast Boom
Using 10-Minute Data from August 2017-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	281	0.297	0.263	0.560	0.634	0.848
1	1684	0.492	0.156	0.648	0.692	1.282
2	3513	0.283	0.116	0.399	0.431	0.988
3	5512	0.187	0.080	0.267	0.289	0.772
4	6958	0.145	0.062	0.207	0.224	0.756
5	8390	0.121	0.052	0.173	0.188	0.952
6	9686	0.103	0.045	0.148	0.161	0.787
7	10008	0.092	0.039	0.131	0.142	0.550
8	9444	0.087	0.037	0.124	0.134	0.560
9	8494	0.084	0.034	0.118	0.128	0.397
10	6590	0.087	0.034	0.121	0.131	0.468
11	5055	0.093	0.032	0.125	0.134	0.534
12	3381	0.100	0.030	0.130	0.138	0.435
13	2111	0.104	0.026	0.130	0.137	0.553
14	1518	0.108	0.024	0.132	0.139	0.277
15	913	0.106	0.023	0.129	0.135	0.214
16	512	0.109	0.025	0.134	0.141	0.367
17	336	0.108	0.020	0.128	0.134	0.196
18	202	0.109	0.020	0.129	0.135	0.171
19	104	0.113	0.025	0.138	0.145	0.206
20	50	0.119	0.030	0.149	0.157	0.265
21	25	0.132	0.038	0.170	0.181	0.243
22	14	0.134	0.029	0.163	0.171	0.184
23	2	0.130	0.004	0.134	0.135	0.133
24	3	0.196	0.147	0.343	0.384	0.366
25	1	0.117				0.117
26+	1	0.133				0.133
Total	84788					

Shear: 0.217
89/60 m Speed Ratio: 1.089

	Mean	Std. Dev.	Mean + 1 Std. Dev.	Mean + 1.28 Std. Dev.
89-m TI Statistics at 15 mps:	0.097	0.021	0.118	0.124

Turbulence Intensity Analysis
Maverick Project, Oklahoma
American Electric Power
Site 0376, 60-m Level, Northeast Boom
Using 10-Minute Data from August 2017-March 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	335	0.266	0.261	0.527	0.600	0.811
1	1349	0.506	0.163	0.669	0.715	1.265
2	2846	0.288	0.121	0.409	0.443	0.979
3	4754	0.191	0.085	0.276	0.300	0.799
4	6361	0.146	0.064	0.210	0.228	0.552
5	7753	0.121	0.053	0.174	0.189	0.832
6	8842	0.104	0.045	0.149	0.162	0.552
7	9288	0.094	0.040	0.134	0.145	0.608
8	9046	0.086	0.035	0.121	0.131	0.651
9	8459	0.083	0.034	0.117	0.127	0.616
10	7275	0.083	0.032	0.115	0.124	0.377
11	5244	0.088	0.031	0.119	0.128	0.519
12	3481	0.093	0.029	0.122	0.130	0.475
13	2148	0.098	0.026	0.124	0.131	0.341
14	1487	0.100	0.023	0.123	0.129	0.330
15	1052	0.102	0.022	0.124	0.130	0.211
16	635	0.103	0.030	0.133	0.141	0.632
17	374	0.107	0.029	0.136	0.144	0.469
18	209	0.106	0.025	0.131	0.138	0.300
19	105	0.103	0.019	0.122	0.127	0.159
20	69	0.099	0.021	0.120	0.126	0.156
21	38	0.108	0.024	0.132	0.139	0.196
22	18	0.106	0.014	0.120	0.124	0.133
23	12	0.102	0.021	0.123	0.129	0.157
24	1	0.128				0.128
25	2	0.122	0.058	0.180	0.196	0.163
26+	3	0.100	0.024	0.124	0.131	0.123
Total	81186					

Shear: 0.195
89/60 m Speed Ratio: 1.080

	Mean	Std. Dev.	Mean + 1 Std. Dev.	Mean + 1.28 Std. Dev.
89-m TI Statistics at 15 mps:	0.094	0.020	0.115	0.121

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

Monthly Mean Temperatures (*C)...

YEAR: 2017

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0276	10									23.5	16.8	10.8	3.9	
	55									23.5	16.8	10.9	4.0	
0376	10									23.2	16.3	10.2	3.4	
	55									23.4	16.8	10.9	4.0	

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0176	10								x	22.7	14.7	6.1	3.8	
	55								x	22.6	14.9	6.8	4.6	
0276	10	2.7	3.5	11.3	12.4	24.8	27.4	28.3	26.7	22.8	14.9	6.3	4.1	15.4
	55	2.7	3.1	11.1	12.0	24.4	27.0	28.1	26.5	22.4	14.7	6.5	4.2	15.2
0376	10	2.3	2.9	10.8	11.8	24.3	27.0	27.9	26.3	22.3	14.4	5.8	3.7	15.0
	55	2.7	3.0	11.0	11.8	24.4	26.9	28.0	26.4	22.2	14.5	6.4	4.3	15.1
0476	10								x	22.7	14.7	6.2	4.0	
	55								x	23.6	15.8	7.7	5.5	
0576	10								x	22.5	14.7	6.1	3.9	
	55								x	22.5	14.8	6.6	4.4	
0676	10								x	22.9	15.1	6.5	4.3	
	55								x	22.7	15.0	6.7	4.5	

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0176	10	2.7	2.1	7.6										
	55	3.2	2.0	7.9										
0276	10	3.0	2.5	8.1										
	55	2.9	1.8	7.8										
0376	10	2.5	1.7	7.4										
	55	2.9	1.6	7.7										
0476	10	2.8	2.1	7.9										
	55	4.2	2.9	9.0										
0576	10	2.7	2.1	7.8										
	55	3.0	1.9	7.9										
0676	10	3.2	2.6	8.2										
	55	3.2	2.2	8.1										

Composite Ambient Air Temperature (°C), August 2017-March 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0276	10	2.9	3.0	9.7	12.4	24.8	27.4	28.3	26.7	23.2	15.9	8.6	4.0	15.6
	55	2.8	2.5	9.5	12.0	24.4	27.0	28.1	26.5	23.0	15.8	8.7	4.1	15.4
0376	10	2.4	2.3	9.1	11.8	24.3	27.0	27.9	26.3	22.8	15.4	8.0	3.6	15.1
	55	2.8	2.3	9.4	11.8	24.4	26.9	28.0	26.4	22.8	15.7	8.7	4.2	15.3

Extreme Maximum Temperatures (°C)...

YEAR: 2017

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0276	10									36.8	31.7	27.5	22.4	36.8
	55									35.3	30.7	27.2	21.5	35.3
0376	10									36.0	31.2	27.3	21.7	36.0
	55									35.0	30.3	27.8	20.8	35.0

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0176	10									36.5	31.5	20.8	16.1	36.5
	55									35.0	30.5	20.1	16.0	35.0
0276	10	20.9	25.0	26.5	33.4	36.1	37.6	43.6	37.4	36.1	32.0	20.8	16.5	43.6
	55	19.8	24.1	25.2	32.1	34.9	37.1	43.2	36.1	34.6	30.7	20.0	15.9	43.2
0376	10	20.1	24.6	25.9	32.9	35.7	37.3	43.6	36.9	35.7	31.8	20.9	15.5	43.6
	55	19.4	23.9	25.1	32.0	34.5	36.8	42.9	36.0	34.6	30.6	19.9	15.2	42.9
0476	10									35.9	32.1	20.9	16.0	35.9
	55									35.9	31.9	21.2	16.8	35.9
0576	10									35.6	31.6	20.8	16.1	35.6
	55									34.6	30.7	20.1	15.8	34.6
0676	10									36.0	32.0	21.3	16.6	36.0
	55									35.0	30.7	20.3	16.1	35.0

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0176	10	18.2	21.9	23.8										23.8
	55	17.6	21.3	22.9										22.9
0276	10	18.6	22.4	24.0										24.0
	55	17.9	21.4	22.7										22.7
0376	10	18.8	22.0	20.9										22.0
	55	17.9	21.4	20.1										21.4
0476	10	18.9	22.1	23.8										23.8
	55	19.1	22.6	23.8										23.8
0576	10	18.8	22.0	24.1										24.1
	55	17.9	21.3	23.0										23.0
0676	10	19.1	22.3	24.3										24.3
	55	17.9	21.4	22.9										22.9

Overall Maximum: 43.6

Extreme Minimum Temperatures (°C)...

YEAR: 2017

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0276	10									10.9	-3.9	-4.7	-12.9	-12.9
	55									13.7	-2.8	-3.7	-13.8	-13.8
0376	10									11.9	-3.5	-4.7	-13.9	-13.9
	55									13.4	-1.9	-3.2	-14.1	-14.1

YEAR: 2018

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0176	10								x	8.6	0.1	-9.9	-6.8	-9.9
	55								x	11.2	-0.1	-9.5	-4.8	-9.5
0276	10	-17.6	-11.6	-3.8	-5.5	10.5	16.0	16.2	16.3	8.4	0.5	-9.7	-7.5	-17.6
	55	-18.4	-12.0	-3.0	-6.5	12.2	16.6	15.7	17.1	9.7	-0.2	-10.0	-6.1	-18.4
0376	10	-18.2	-12.4	-4.4	-6.3	10.3	15.6	15.8	16.7	8.2	0.1	-10.3	-7.2	-18.2
	55	-18.5	-11.9	-3.2	-6.8	11.9	16.5	15.8	17.4	10.9	-0.2	-9.8	-5.2	-18.5
0476	10									9.1	0.3	-9.5	-7.4	-9.5
	55									12.3	1.0	-8.4	-3.9	-8.4
0576	10									8.9	0.0	-9.9	-6.7	-9.9
	55									11.3	-0.3	-9.6	-5.0	-9.6
0676	10									8.3	0.4	-8.9	-5.8	-8.9
	55									10.7	-0.1	-9.4	-5.4	-9.4

YEAR: 2019

Site	Level (m)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0176	10	-8.9	-11.7	-13.3										-13.3
	55	-8.9	-10.8	-13.7										-13.7
0276	10	-8.8	-11.8	-12.7										-12.7
	55	-9.2	-11.7	-13.8										-13.8
0376	10	-9.1	-12.3	-13.6										-13.6
	55	-9.2	-11.2	-14.0										-14.0
0476	10	-8.7	-11.9	-13.1										-13.1
	55	-8.0	-10.6	-12.7										-12.7
0576	10	-9.0	-12.3	-13.3										-13.3
	55	-9.2	-11.2	-14.0										-14.0
0676	10	-8.1	-11.4	-12.7										-12.7
	55	-8.9	-11.3	-13.6										-13.6

Overall Minimum:	-18.5
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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
Maverick Project, Oklahoma

Turbine	Model	Hub Ht (m)	Long-Term Speed		Gross Capacity Factor (%)	Gross Annual MWh		Turbine	Model	Hub Ht (m)	Long-Term Speed		Gross Capacity Factor (%)	Gross Annual MWh
			Simon Wind	DNV-GL							Simon Wind	DNV-GL		
10	2.82/127	88.6	8.2	8.3	56.5	13,951		97	2.82/127	88.6	8.1	8.2	55.7	13,760
11	2.82/127	88.6	8.3	8.4	57.2	14,142		98	2.82/127	88.6	8.2	8.2	56.5	13,951
12	2.82/127	88.6	8.3	8.4	57.2	14,142		99	2.82/127	88.6	8.3	8.2	57.2	14,142
13	2.82/127	88.6	8.2	8.3	56.5	13,951		100	2.82/127	88.6	8.2	8.3	56.5	13,951
14	2.82/127	88.6	8.3	8.4	57.2	14,142		101	2.82/127	88.6	8.2	8.2	56.5	13,951
15	2.82/127	88.6	8.2	8.3	56.5	13,951		102	2.82/127	88.6	8.2	8.2	56.5	13,951
16	2.82/127	88.6	8.2	8.2	56.5	13,951		103	2.82/127	88.6	7.9	8.2	54.0	13,328
17	2.82/127	88.6	8.2	8.2	56.5	13,951		105	2.82/127	88.6	7.9	8.2	54.0	13,328
18	2.82/127	88.6	8.2	8.3	56.5	13,951		106	2.82/127	88.6	8.2	8.3	56.5	13,951
28	2.5/116	90	8.3	8.4	56.5	12,382		107	2.82/127	88.6	8.2	8.2	56.5	13,951
29	2.82/127	88.6	8.3	8.4	57.2	14,142		109	2.82/127	88.6	8.2	8.3	56.5	13,951
30	2.82/127	88.6	8.3	8.4	57.2	14,142		110	2.82/127	88.6	8.2	8.2	56.5	13,951
31	2.82/127	88.6	8.3	8.3	57.2	14,142		111	2.82/127	88.6	8.1	8.2	55.7	13,760
32	2.82/127	88.6	8.3	8.3	57.2	14,142		113	2.82/127	88.6	8.0	8.1	54.9	13,569
33	2.82/127	88.6	8.3	8.3	57.2	14,142		114	2.82/127	88.6	8.0	8.2	54.9	13,569
34	2.82/127	88.6	8.3	8.3	57.2	14,142		118	2.82/127	88.6	8.2	8.1	56.5	13,951
35	2.82/127	88.6	8.3	8.2	57.2	14,142		119	2.82/127	88.6	8.3	8.2	57.2	14,142
36	2.82/127	88.6	8.2	8.2	56.5	13,951		120	2.82/127	88.6	8.3	8.2	57.2	14,142
38	2.82/127	88.6	8.2	8.2	56.5	13,951		121	2.82/127	88.6	8.3	8.2	57.2	14,142
46	2.82/127	88.6	8.1	8.3	55.7	13,760		122	2.82/127	88.6	8.2	8.1	56.5	13,951
47	2.82/127	88.6	8.3	8.4	57.2	14,142		123	2.82/127	88.6	8.2	8.1	56.5	13,951
48	2.82/127	88.6	8.4	8.4	58.0	14,332		124	2.82/127	88.6	8.3	8.2	57.2	14,142
49	2.82/127	88.6	8.4	8.4	58.0	14,332		129	2.82/127	88.6	8.3	8.3	57.2	14,142
50	2.82/127	88.6	8.4	8.4	58.0	14,332		130	2.82/127	88.6	8.3	8.4	57.2	14,142
51	2.82/127	88.6	8.4	8.3	58.0	14,332		137	2.82/127	88.6	8.3	8.2	57.2	14,142
52	2.82/127	88.6	8.3	8.4	57.2	14,142		138	2.82/127	88.6	8.3	8.3	57.2	14,142
53	2.82/127	88.6	8.3	8.4	57.2	14,142		140	2.82/127	88.6	7.9	8.1	54.0	13,328
54	2.82/127	88.6	8.3	8.3	57.2	14,142		141	2.82/127	88.6	8.2	8.2	56.5	13,951
55	2.82/127	88.6	8.2	8.3	56.5	13,951		142	2.82/127	88.6	8.2	8.2	56.5	13,951
56	2.82/127	88.6	8.2	8.3	56.5	13,951		143	2.82/127	88.6	8.0	8.1	54.9	13,569
68	2.82/127	88.6	8.4	8.3	58.0	14,332		144	2.82/127	88.6	7.9	8.0	54.0	13,328
69	2.82/127	88.6	8.4	8.3	58.0	14,332		145	2.82/127	88.6	7.9	8.1	54.0	13,328
70	2.82/127	88.6	8.4	8.4	58.0	14,332		47a	2.82/127	88.6	8.3	8.3	57.2	14,142
71	2.82/127	88.6	8.4	8.4	58.0	14,332		48a	2.82/127	88.6	8.3	8.3	57.2	14,142
72	2.82/127	88.6	8.3	8.3	57.2	14,142		49a	2.5/116	90	8.5	8.3	58.1	12,729
73	2.82/127	88.6	8.4	8.3	58.0	14,332		50a	2.5/116	90	8.2	8.2	55.7	12,209
74	2.82/127	88.6	8.3	8.3	57.2	14,142		56a	2.5/116	90	8.3	8.3	56.5	12,382
75	2.82/127	88.6	8.3	8.3	57.2	14,142		57a	2.5/116	90	8.2	8.3	55.7	12,209
76	2.82/127	88.6	8.2	8.2	56.5	13,951		58a	2.5/116	90	8.1	8.2	55.0	12,036
77	2.82/127	88.6	8.2	8.3	56.5	13,951		71a	2.82/127	88.6	8.2	8.2	56.5	13,951
78	2.82/127	88.6	8.2	8.3	56.5	13,951		76a	2.5/116	90	8.2	8.4	55.7	12,209
79	2.82/127	88.6	8.3	8.3	57.2	14,142		77a	2.5/116	90	8.3	8.3	56.5	12,382
86	2.82/127	88.6	8.2	8.2	56.5	13,951		78a	2.5/116	90	8.1	8.1	55.0	12,036
87	2.82/127	88.6	8.2	8.2	56.5	13,951		79a	2.5/116	90	8.1	8.1	55.0	12,036
88	2.82/127	88.6	8.2	8.2	56.5	13,951		80a	2.82/127	88.6	8.1	8.1	55.7	13,760
89	2.82/127	88.6	8.2	8.2	56.5	13,951		81a	2.82/127	88.6	8.1	8.2	55.7	13,760
90	2.82/127	88.6	8.2	8.2	56.5	13,951		82a	2.82/127	88.6	8.1	8.2	55.7	13,760
91	2.82/127	88.6	8.3	8.2	57.2	14,142		92a	2.5/116	90	8.0	8.0	54.2	11,862
92	2.82/127	88.6	8.2	8.3	56.5	13,951		93a	2.5/116	90	8.0	8.0	54.2	11,862
93	2.82/127	88.6	8.1	8.3	55.7	13,760		94a	2.82/127	88.6	8.3	8.2	57.2	14,142
94	2.82/127	88.6	8.0	8.2	54.9	13,569		95a	2.82/127	88.6	8.4	8.2	58.0	14,332
95	2.82/127	88.6	8.0	8.2	54.9	13,569		Overall			8.22	8.25	56.53	1,419,227

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

GE-2.82/127; 2.5/116

	Loss (%)	Efficiency
Total Discount	20.59	0.7941

Detail by Category

	Loss (%)	Efficiency	Description
Turbine Availability	4.00	0.9600	
Turbine	4	0.96	Assuming 97% performance-based guarantee for the warranty period, then lower availability in the future. Check TSA and warranty documentation.
High-wind downtime correlation	0	1	Downtime correlated with high-wind events, assumed zero
Electrical	2.50	0.9750	from turbines to high-side of interconnect point, typical value
Wake Effects	8.70	0.9130	
Internal wake losses	7.7	0.923	Evaluated with Simon Wind wake model
Turbine blockage	1.1	0.989	Estimated
Wakes from pre-existing turbines	0	1	no turbines close to Maverick
Wakes from future turbines	0	1	None expected at this time
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	None expected
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 the AWEA 2012 wind resource assessment workshop
Environmental	2.28	0.9772	
Blade degradation and soiling	1	0.99	Industry standard value
Icing	0.8	0.992	Based on climate and observed anemometer icing
High/low temperature shutdowns	0.2	0.998	Allowing for occasional temperatures above 40C
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	Assumed zero
Curtailement	0.00	1.0000	
Wind direction sector management	0	1	Assumed zero, needs vendor's site suitability assessment
Bat curtailement	0	1	Assumed zero
Off-taker curtails power delivery	0	1	Assumed zero, check with off-taker
Other causes	0	1	Noise, shadow flicker, other 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 (%)
Maverick Project, Oklahoma
American Electric Power
Turbines: GE-2.82/127 and GE-2.5/116

Hour (CST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	54.6	56.3	53.2	57.4	57.1	50.7	51.4	42.4	51.1	50.3	57.5	53.7
1	54.8	55.0	54.2	59.3	58.5	49.7	50.2	41.7	44.5	50.7	57.7	55.3
2	56.8	53.8	56.3	57.6	50.5	46.2	51.8	39.9	39.3	51.2	56.0	53.2
3	54.1	52.1	56.6	56.6	47.4	41.0	44.5	38.1	37.3	50.0	54.2	51.6
4	54.0	50.1	59.5	55.4	45.7	37.5	36.4	36.0	35.6	51.9	53.5	52.5
5	54.4	54.0	59.0	52.1	46.1	35.6	37.4	33.4	34.4	53.6	51.5	52.9
6	52.2	54.0	61.2	50.2	41.1	31.5	26.2	31.0	28.5	50.1	48.5	52.4
7	49.1	49.4	54.9	44.9	39.7	29.5	14.4	24.5	22.1	45.3	44.2	50.3
8	47.6	43.6	46.0	46.8	37.3	34.7	8.5	23.2	20.4	37.2	38.0	45.1
9	36.7	40.8	44.9	48.5	39.6	37.6	9.2	24.8	28.4	36.8	31.9	35.5
10	36.7	40.9	44.6	47.6	40.5	39.8	10.9	25.1	31.0	37.4	33.2	34.5
11	36.7	40.5	44.8	46.9	35.6	43.1	11.9	25.9	32.5	39.4	35.1	35.1
12	36.4	42.0	44.5	48.2	36.9	45.2	13.2	30.0	34.2	39.8	36.1	38.1
13	37.4	41.2	43.6	49.5	36.8	45.2	13.7	30.8	36.6	40.7	37.0	37.3
14	36.8	41.4	42.1	50.0	41.6	46.7	18.2	28.6	38.7	41.6	39.5	38.5
15	37.7	41.2	40.9	51.2	47.3	48.7	20.3	31.1	38.9	42.6	39.5	39.3
16	37.6	38.4	42.3	54.5	52.7	48.3	19.3	32.1	40.9	41.1	37.6	37.1
17	39.0	38.3	43.9	53.5	56.0	50.1	27.8	31.2	42.7	38.9	39.9	37.6
18	48.7	39.9	42.3	53.8	58.0	49.6	39.8	30.7	41.9	45.5	47.9	47.5
19	54.5	46.5	48.5	56.3	62.4	48.1	51.3	37.5	47.4	50.9	53.8	52.3
20	55.1	55.8	54.1	62.2	67.3	51.1	61.7	44.7	54.1	53.3	57.0	54.5
21	55.4	56.9	57.7	62.3	69.7	55.0	60.8	44.6	56.2	55.0	56.9	54.2
22	55.1	56.0	54.3	58.9	69.9	55.5	54.6	46.2	56.0	54.4	55.1	53.4
23	55.0	56.6	51.3	60.8	59.2	55.1	52.9	46.7	54.9	52.5	57.5	53.7
Month	47.35	47.70	50.04	53.52	49.86	44.81	32.76	34.17	39.49	46.26	46.63	46.48

Year: 44.89

Simulated Long-Term Mean Monthly/Diurnal Net Power Delivery (MW)
Maverick Project, Oklahoma
American Electric Power
Turbines: GE-2.82/127 and GE-2.5/116
Monthly net GWh at bottom of table

Hour (CST)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	156.5	161.4	152.5	164.4	163.6	145.2	147.2	121.4	146.5	144.3	164.8	153.9
1	157.0	157.6	155.4	169.9	167.6	142.4	143.9	119.4	127.6	145.2	165.4	158.4
2	162.8	154.2	161.5	165.0	144.8	132.5	148.4	114.5	112.6	146.7	160.4	152.4
3	155.0	149.4	162.3	162.1	135.8	117.4	127.5	109.2	107.0	143.3	155.3	147.8
4	154.8	143.5	170.5	158.9	130.9	107.5	104.3	103.2	102.1	148.7	153.3	150.3
5	156.0	154.8	169.0	149.3	132.1	102.2	107.1	95.7	98.7	153.6	147.5	151.5
6	149.6	154.8	175.3	144.0	117.7	90.4	75.2	88.9	81.8	143.6	139.0	150.3
7	140.7	141.6	157.2	128.8	113.7	84.7	41.2	70.2	63.3	129.9	126.8	144.2
8	136.5	124.9	131.9	134.0	107.0	99.4	24.4	66.4	58.5	106.5	108.9	129.2
9	105.1	116.9	128.8	139.1	113.4	107.7	26.3	71.0	81.4	105.4	91.5	101.9
10	105.2	117.2	127.8	136.6	116.2	114.0	31.3	71.9	88.7	107.3	95.2	99.0
11	105.1	116.1	128.5	134.4	102.1	123.4	34.2	74.3	93.2	113.0	100.7	100.5
12	104.2	120.5	127.5	138.1	105.8	129.6	37.7	85.9	98.2	114.1	103.4	109.1
13	107.1	118.0	125.0	141.8	105.4	129.7	39.2	88.2	104.8	116.6	106.1	107.0
14	105.5	118.7	120.7	143.4	119.3	133.7	52.1	81.9	111.0	119.3	113.2	110.2
15	108.0	118.2	117.4	146.7	135.5	139.5	58.3	89.1	111.6	122.1	113.2	112.7
16	107.9	110.1	121.2	156.1	151.1	138.4	55.4	92.1	117.1	117.7	107.7	106.5
17	111.7	109.7	125.9	153.2	160.4	143.5	79.6	89.3	122.4	111.5	114.4	107.9
18	139.6	114.5	121.4	154.3	166.3	142.1	113.9	87.9	120.1	130.3	137.3	136.2
19	156.2	133.3	139.1	161.3	178.8	138.0	147.1	107.6	135.8	145.9	154.2	149.9
20	157.9	160.1	154.9	178.3	192.9	146.6	176.8	128.2	155.0	152.6	163.2	156.1
21	158.8	163.2	165.5	178.6	199.7	157.7	174.3	127.9	161.2	157.6	163.1	155.3
22	158.0	160.6	155.8	168.9	200.4	159.1	156.5	132.5	160.6	156.0	158.0	153.0
23	157.7	162.2	146.9	174.1	169.5	157.9	151.5	133.8	157.4	150.4	164.7	154.0
Month (GWh)	100.96	91.88	106.71	110.44	106.33	92.48	69.86	72.87	81.50	98.64	96.22	99.12

GWh for Year: 1127.00

P-Values. Probability Analysis, Maverick 286.62-MW Array
91 GE-2.82/127 and 12 GE-2.5/116 Turbines

95% Confidence Limits in

1) Weighted Long-Term Mean Speeds at Reference Stations			
Standard Deviation (%) of Annual Means		3.21	
Average Years of Data		19.5	
Equivalent Long-Term Uncertainty (1 sigma)		0.73	
95% Confidence Limits			1.42
2) Weighted Correlation between Reference Stations and Sites 0276/0376			
Standard Deviation (%) of Monthly Speed Ratios		2.37	
Average Months of Data		19	
Equivalent Long-Term Uncertainty (1 sigma)		0.54	
95% Confidence Limits			1.07
3) Correlation between Sites 0276/0376 and Other Maverick Towers			
Standard Deviation (%) of Monthly Speed Ratios		1.19	
Average Months of Data		7	
Equivalent Long-Term Uncertainty (1 sigma)		0.45	
95% Confidence Limits			0.88
4) Shear Uncertainties, 60-89 m			
Base Shear		0.22	
89/60 m Speed Ratio, Base Shear		1.091	
Minimum Likely Shear		0.17	
89/60 m Speed Ratio, Minimum Shear		1.069	
Shortfall in Mean with Minimum Shear			1.95
5) Micrositing Uncertainty			
based on array layout, terrain, met tower coverage, no site visit			5.00
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			
			8.00

Equivalent 95% Confidence Limits in Gross Capacity Factor:

Case	Mean Speed (mps)	Gross Cap. Factor (%)	% Deviation from Base
Base	8.22	56.52	0
Lower	7.56	50.53	10.60
Upper	8.87	61.62	9.01
7 mps	8 mps	9 mps	
45.05	54.84	62.59	

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	12.58
Upper	10.27

95% Confidence Limits in...

	Low	High
wind speed frequency distribution	-4	4
turbine availability	-2	1
electrical loss	-1	1
wake loss	-3	2
turbine performance	-2	1
environmental factors	-2	1
curtailment	-2	0
balance of plant	-2	0.5
Combined	-6.78	4.92

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 3.21%, per cell E7 above. This is equivalent to a gross energy standard deviation of 3.8%. Allowing for possible different conditions at Maverick plus the interannual variability of the loss factors brings the total interannual standard deviation of energy potential to 7.1%.

For a 10-year period, the equivalent standard deviation increment for interannual variability is 7.1% divided by the square root of 10, or 2.3%. This is equivalent to a 95% confidence limit of 2.3% x 1.96, or 4.5%. The 10-year confidence limits are computed from the root-sum-square of the values in lines 61/62 and 4.5%.

Case	% Deviation from Base
Lower	13.36
Upper	11.21

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	37.79	6.82	2.32	15.82	84.18
P95	39.84	6.82	1.65	11.25	88.75
P90	40.97	6.82	1.28	8.73	91.27
P75	42.81	6.82	0.68	4.64	95.36
P50	44.89	from Summary tab			
P25	46.63	5.72	0.68	3.89	103.89
P10	48.17	5.72	1.28	7.32	107.32
P05	49.12	5.72	1.65	9.44	109.44
P01	50.84	5.72	2.32	13.27	113.27

For one-year P-values, we incorporate the one-year 95% confidence limits in interannual variability (7.1% x 1.96, or 13.9%) with the values from lines 61/62, with these resulting 95% confidence limits:

Case	% Deviation from Base
Lower	18.75
Upper	17.28

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	34.93	9 57	2 32	22.19	77.81
P95	37.80	9 57	1.65	15 78	84.22
P90	39.39	9.57	1.28	12.24	87 76
P75	41.97	9 57	0.68	6 50	93.50
P50	44.89 from Summary tab				
P25	47.58	8.82	0.68	6.00	106.00
P10	49.95	8.82	1.28	11 29	111 29
P05	51.42	8.82	1.65	14.55	114.55
P01	54 07	8 82	2.32	20.46	120.46

Sundance Wind Farm



Wind Energy Resource Assessment, Sundance Project, Oklahoma

Submitted to Jay Godfrey, Joe Karrasch and Zachary Yetzer
American Electric Power

Prepared by Richard Simon, Rob Lowrance and Matt Christy
29 May 2019

This report evaluates the wind resource potential for Invenergy's proposed Sundance wind farm in northwestern Oklahoma, which would consist of 65 GE-2.82/127 turbines (88.6-m hub heights) and 7 GE-2.3/116 turbines (80-m hub heights), for a nameplate rating of 199.4 MW. One 60-m met towers (Site 0157) was operated initially from 2008-2011. This tower was reinstalled in October 2015 along with two additional 60-m towers. Five more towers were installed in April 2016.

Three more towers were installed northwest of Sundance in Fall 2017.

This is Bid 17/18 from the SWEPCO-PSO RFP.

Our analyses are presented as a series of topics, discussed below in sequential order. All tables and charts follow the text of this report. The same bold blue font in the text below is used to divide the topics into their respective tables and charts. We also make comparisons with the IE report prepared by Arcvera dated 21 February 2019.

Tower Info. Documentation of the Sundance meteorological towers is furnished: their location, exposure, sensor types and measurement heights, boom lengths and orientations, and sensor calibration data.

Site 0157 measured wind speed at 10, 31.5, 47, and 57 m above ground from 2008-2011. After its 2015 refurbishment, anemometer heights have been 10, 31, 47 and 56.5 m above ground. All other Sundance met towers measure wind speeds at 30, 45 and 60 m above ground.

KB Energy visited the site on behalf of Simon Wind with AEP personnel on 24 April 2019; their field notes are given in the Tower Info table.

There have been various sensor issues:

- Site 0157: there is a strong likelihood that all its anemometers were subject to the so-called "dry friction whip" problem from roughly November 2008 until the original data stopped being collected in January 2011. This phenomenon was experienced by many NRG #40C anemometers sold during that time period. In addition to this, the 57-e anemometer had clearly invalid data from 18 March 2009 to 5 January 2011, and its 10-w anemometer had invalid data from 7 February to 8 June 2016.
- Site 0257: the 45-ne anemometer had invalid data from 30 November to 9 December 2015
- Site 0357: the 60-ne anemometer has had invalid data since 14 September 2018
- Site 0657: the 43-m vane had invalid data from 7 April 2015 to 5 July 2016

As part of our independent review, KB Energy visited Sites 0157, 0357, 0457 and 0657 on 24 April 2019. The other met towers had been removed, although R. Simon checked them in early 2017 for AEP.

There are also three met towers nearby (Sites 0178, 0278, 0378) on the Freedom project, for which we

provide their information but present only minimal data summaries.

Maps. There is a regional map showing the Sundance project and reference stations used to evaluate long-term winds at the project met towers. The other two maps show detailed topography, met towers, and the 72-turbine array plan, which consists of northwest and southwest halves.

Coords. Latitudes, longitudes and elevations for the 72-turbine array are given in WGS84/NAD83 datum. This array was furnished by Invenenergy.

Ref V. Monthly mean wind speed histories are given for six long-term reference stations: the Medicine Lodge airport, the Woodward, Alva and Fairview Oklahoma Mesonet stations, and the two nearest MERRA-2 data points west and east of the Sundance project. Medicine Lodge, Woodward, Alva, and Fairview measure winds at 10 m above ground; MERRA-2 winds are calculated at 50 m above ground.

We use only the sonic anemometer period (starting 2005) for Medicine Lodge.

MERRA is an acronym for Modern Era Retrospective Analysis for Research and Applications) data. This data set is created with ground, radiosonde and satellite meteorological data re-analyzed by NASA. MERRA data are widely accepted as surrogate long-term reference "stations."

NASA switched to Version 2 (MERRA-2) in February 2016, which uses more advanced analysis methods and incorporates additional data sets. We have incorporated MERRA-2 data in this report from 2002-2016, which is a homogeneous data set.

Daily V. Daily mean wind speeds have been tabulated for the Sundance met towers and reference stations. Daily correlation coefficients of pertinent Sundance met towers to all reference stations are summarized below; the individual data points being too voluminous for effective presentation in this report. Note that correlation coefficients of the Sundance met towers average 0.88 to Medicine Lodge, and 0.93-0.95 to all other reference stations.

Daily Correlation Coefficient Matrix...

Site	0157	0357	0557	0657	0757	0857	Overall
Medicine Lodge	0.852	0.878	0.876	0.893	0.889	0.886	0.879
Woodward	0.954	0.940	0.949	0.937	0.934	0.937	0.942
Alva	0.922	0.935	0.941	0.946	0.944	0.943	0.938
Fairview	0.922	0.942	0.928	0.932	0.935	0.939	0.933
MERRA-2 West	0.943	0.954	0.945	0.945	0.950	0.951	0.948
MERRA-2 East	0.921	0.947	0.924	0.935	0.939	0.943	0.935

Mo Speeds. Monthly mean wind speeds are given for the Sundance met towers and reference stations through March 2019. We have flagged the 2008-2011 period with likely dry friction whip.

Composite mean monthly and annual wind speeds for concurrent periods of record at selected stations are computed at the bottom of the tab for selected groups of stations. The composite means for Site 0157 are calculated with and without the suspected dry friction whip data period.

Sodar. A Triton sodar operated near Site 0757 from October 2016 to November 2017. Concurrent mean wind speed data from these two measurement platforms are summarized. Wind shears are reasonably consistent with height: 0.23 (40-60 m), 0.22 (60-100 m), and 0.24 (100-140 m). This gives us confidence to use observed met tower shears to extrapolate wind speeds to hub height and above.

L-T Speeds. Long-term mean annual wind speeds at Site 0157 are estimated from its composite mean annual wind speed ratios to the reference stations. The individual estimates based on the six reference stations

agree within 2%, and we have combined them into single estimates using the weighting scheme described in the tab.

We've made two sets of long-term calculations for Site 0157 including its likely dry friction whip period (not shown) and excluding that period. By excluding the earlier data, resulting long-term winds are roughly 1% higher. This is consistent with past calculations for dry friction whip; therefore, we have relied solely on the current (starting 2015) period of data at Site 0157 to determine its long-term winds.

Long-term mean annual wind speeds at Sites 0257-0857 are estimated from their composite mean annual wind speed ratios to Site 0157.

Here are the long-term mean annual wind speed estimates in meters per second with extrapolations to 80 m and 88.6 m using site-specific shears. Site 0157 estimates exclude the 2008-2011 measurement period. The equivalent Arcvera 88.6-m long-term speeds are shown at the bottom of this table, adjusting their 88.9-m data down to the proper 88.6-m hub height for GE-2.82/127 turbines.

Level (m)	0157	0257	0357	0457	0557	0657	0757	0857
10	4.88	...	...	...	...	...	...	...
31/30	6.58	6.45	6.48	6.08	6.21	6.19	6.36	5.70
47/45	7.26	7.09	7.01	6.62	6.81	6.79	6.98	6.48
57/60	7.62	7.55	7.49	7.05	7.24	7.27	7.48	7.04
80	8.33	8.07	7.96	7.50	7.71	7.76	8.00	7.68
88.6	8.56	8.26	8.13	7.67	7.89	7.95	8.19	7.92
Arcv. 88.6	8.51	N/A	8.10	N/A	7.85	7.91	8.15	7.88

Our long-term hub-height winds are about 0.5% higher than Arcvera, which is excellent agreement.

En Sims. 10-minute mean wind speed data from the met towers have been scaled to 80 m using time-specific shears and compiled into separate wind speed frequency distributions. These distributions have been scaled to integer annual mean wind speeds of 6-9 mps (bracketing the wind resource) and normalized to single, 8760-hour years. Gross annual energy simulations are performed for the GE-2.82/127 turbine (GE-2.3/116 for Site 0357 only) at a mean annual air density of 1.15 kg/m³, derived from regional climate data.

Relationships between gross annual capacity factor in percent and annual mean wind speed are as follows:

GE-2.82/127...

Site	6 mps	7 mps	8 mps	9 mps
0157	33.17	44.89	55.00	63.09
0257	32.91	44.82	55.18	63.46
0357	33.21	45.08	55.30	63.43
0457	33.13	44.38	54.15	62.03
0557	33.38	44.63	54.31	62.12
0657	33.07	44.67	54.72	62.83
0757	33.08	45.17	55.68	64.02
0857	33.07	45.14	55.57	63.90

Combined* **33.13** **44.89** **55.05** **63.19** ** weighted by period of record and proximity to turbines*

GE-2.3/116...

Site	6 mps	7 mps	8 mps	9 mps
0357	27.39	37.16	45.51	52.09

Rose. Joint frequency distributions of wind speed and wind direction for representative met towers 0157, 0357, 0657 and 0857 are furnished in tabular and graphical format. The dominant winds have been from the south, with a secondary contribution from the north. We include the dry friction whip data for Site 0157,

since the slight decrease in wind speeds is of less concern versus the benefits of 2½ additional years of wind direction data.

Off-Axis. Wake losses in annual energy between two turbines are given as a function of their azimuth orientation and spacing. Tables are presented for the same met towers with the wind roses. The optimal turbine row orientation to minimize wake losses is W/E. We use these tables as part of our wake modeling.

Max V. Monthly maximum 10-minute mean wind speeds and peak gusts are summarized for the Sundance met towers. Through March 2019, the observed maximum 10-minute mean wind speed has been 29.0 mps; the peak gust 42 mps.

TI. 56.5-m and 60-m turbulence statistics are summarized for the four key Sundance met towers. Characteristic turbulence [mean TI plus 1.0 or 1.28 standard deviations (depending on the turbine vendor) in a 15-mps wind] is 0.12-0.15 when scaled to the 88.6-m hub height for the GE-2.82/127 turbine, as calculated at the bottom of the data tables.

Temps. Monthly summaries of temperature are given, with mean and extreme values. Temperatures exceed 40C with some regularity each year. There are no on-site barometric pressure data to compute mean annual air density directly.

WIND ENERGY RESOURCE ASSESSMENT

Long-term mean annual hub-height wind speeds have been modeled for individual turbines, taking into account their elevation, terrain, surface roughness and wind speed/direction patterns at the met towers. Some of this is very straightforward, but the northernmost turbines (#1-16) show a discontinuity based on met towers 0157 and 0557. Also the western end of the southern area (turbines 42-51) has different results based on met towers 0757, 0857, and 0357. We have smoothed the results and acknowledge these are areas of uncertain winds, which results in greater uncertainty of the aggregate wind resource.

Here are the predicted aggregate mean annual hub-height wind speeds and gross capacity factors for Sundance, weighting the capacity factor by nameplate rating. Comparison to the Arcvera projections are given:

Analyst	Turbine Count	Aggregate Hub-Ht Speed	Gross Capacity Factor (%)	Gross Annual GWh	Ratio: Simon/Arcvera
Simon Wind	72	8.19	55.80	974.71	0.984
Arcvera	72	8.20	56.69	990.15	

Losses. This tab lists the standard gross-to-net discount factors and our provisional values for them. Some discounts are meteorological in nature, and we have calculated their values from the on-site data or estimated them from our 25 years experience in the region. Other discounts are non-meteorological in nature, and we have supplied typical industry values pending formal contractual and engineering review.

The estimated total gross-to-net discount is 17.66%, which includes potential wakes from the Freedom wind farm if it is ever built. Here are the long-term mean annual net energy projections, based on the information available to date and two site visits:

Analyst	Turbine Count	Gross Cap. Factor (%)	Total % Discount	Net Cap. Factor (%)	Rated MW	Net MWh, Array	Ratio: SW/AV
Simon Wind	72	55.80	17.66	45.95	199.4	802,588	0.977
Arcvera	72	56.69	17.03	47.03	199.4	821,543	

12x24. Monthly/diurnal mean net capacity factors and energy values are given for Sundance. We have adjusted the results to reflect long-term conditions.

P-Values. We have calculated probability of exceedance values for the standard 10-year and 1-year periods. Values below are expressed as annual net capacity factors in percent:

P-Value	10-Year	1-Year
P99	38.39	35.59
P95	40.57	38.58
P90	41.78	40.23
P75	43.73	42.91
P50	45.95	45.95
P25	47.80	48.73
P10	49.43	51.18
P05	50.44	52.69
P01	52.26	55.43

P99/P50 ratios are 0.835 for ten years and 0.775 for one year.

Comparison to Arcvera Report. Arcvera evaluates the same turbine and same array as we have. Here are some pertinent comparative statistics:

• Long-Term 88.6-m Speed at Key Met Towers:

Analyst	0157	0357	0557	0657	0757	0857
Arcvera	8.51	8.10	7.85	7.91	8.15	7.88
Simon	8.56	8.13	7.89	7.95	8.19	7.92

We are about 0.5% windier at all met towers, so excellent agreement.

• Long-Term Aggregate Mean Hub-Height Wind Speed and Gross Capacity Projections for Array:

Analyst	Speed	GCF (%)	Gross MWh
Arcvera	8.20	56.69	990,150
Simon	8.19	55.80	974,710

Our wind speed frequency distributions produce less energy than theirs, no explanation why.

• Total Gross-to-Net Discount: Arcvera computes a total discount of 17.03%, versus our 17.66% discount. Our wake losses are somewhat higher; Arcvera does not address turbine blockage.

• Long-Term Aggregate Net Energy Projections for Array:

Analyst	NCF (%)	GWh
Arcvera	47.03	821,543
Simon	45.95	802,588

We are 2.3% less than Arcvera.

• P-Values

	10-Yr P99/ P50 Ratio	1-Yr P99/ P50 Ratio
Arcvera	0.886	0.834
Simon	0.835	0.775

Arcvera values are very aggressive compared to most analysts

Thus we agree closely with Arcvera on the aggregate long-term mean annual hub-height wind speed, but items like conversion of mean wind speed to gross energy and discount factors cause us to separate. Their P-values are very, very aggressive, and we've never seen P99 values so close to P50.

Tower Info. Meteorological Tower Information
Sundance Project, Oklahoma
American Electric Power

values confirmed by KB Energy
red text KB Energy values different from furnished tower documentation

Time Zone	Central Standard Time							Boom			
Magnetic Declination	5° East (true north = 355° magnetic)							Orientation	Calibration Constants**		
		Sensor Type	Model	Serial Number*	Channel	Sensor Height (m)	Boom Length (in)	Relative to True North	Slope	Offset	Units
Site Number	0157	Anemometer	NRG #40C	043244	1	57.0	60	275°	N/A	N/A	mps
Installation Date	1 March 2008	Anemometer	NRG #40C	043248	2	57.0	60	095°	N/A	N/A	mps
Logger Type	NRG Symphonie	Anemometer	NRG #40C	043245	3	47.0	60	275°	N/A	N/A	mps
Logger Serial Number	309015614	Anemometer	NRG #40C	043246	4	31.5	60	275°	N/A	N/A	mps
Property Owner	Johnny/Paula Fuqua	Anemometer	NRG #40C	043247	5	31.5	60	095°	N/A	N/A	mps
Tower Height (m)	60	Anemometer	NRG #40C	043249	6	10.0	60	275°	N/A	N/A	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Waynoka, OK	Wind Vane	NRG 200P	N/A	7	57.0	60	185°	0.351	0	degrees
Latitude (WGS84)	36° 36.682'N	Wind Vane	NRG 200P	N/A	8	47.0	60	185°	0.351	0	degrees
Longitude (WGS84)	98° 46.680'W	Thermometer	NRG #110S	N/A	12	2.0	N/A	North side	0.136	-86.38	°C
Elevation (m)	524										
Site Exposure	open, very gently rolling pasture land, bluff 800 m to the N through E, a few scattered bushes, no significant obstructions										
Sensors replaced October 2015											
Site Number	0157	Anemometer	NRG #40C	251018	1	56.5	60	275°	0.763	0.34	mps
Maintenance Date	28 October 2015	Anemometer	NRG #40C	250758	2	56.5	60	095°	0.762	0.34	mps
Logger Type	NRG SymphoniePLUS	Anemometer	NRG #40C	250763	3	47.0	60	275°	0.757	0.37	mps
Logger Serial Number	428004419	Anemometer	NRG #40C	251029	4	47.0	60	095°	0.758	0.38	mps
Property Owner	Johnny/Paula Fuqua	Anemometer	NRG #40C	250774	5	31.0	60	275°	0.763	0.32	mps
Tower Height (m)	60	Anemometer	NRG #40C	250766	6	31.0	60	095°	0.762	0.34	mps
Tower Diameter	10" to 30 m, 8" above	Anemometer	NRG #40C	252250	13	10.0	60	275°	0.759	0.38	mps
Closest Town	Waynoka, OK										
Latitude (WGS84)	36° 36.682'N	Wind Vane	NRG 200P	N/A	7	56.5	60	185°	0.351	180	degrees
Longitude (WGS84)	98° 46.680'W	Wind Vane	NRG 200P	N/A	8	47.0	60	185°	0.351	180	degrees
Elevation (m)	524	Thermometer	NRG #110S	N/A	9	55.0	N/A	North side	0.136	-86.38	°C
		Thermometer	NRG #110S	N/A	10	1.5	N/A	North side	0.136	-86.38	°C
Site Exposure	open, very gently rolling pasture land, bluff 800 m to the N through E, a few scattered bushes, no significant obstructions										
Sensors replaced December 2015 after an ice storm											
Site Number	0157	Anemometer	NRG #40C	252466	1	56.5	60	275°	0.762	0.31	mps
Maintenance Date	9 December 2015	Anemometer	NRG #40C	252467	2	56.5	60	095°	0.759	0.39	mps
Logger Type	NRG SymphoniePLUS	Anemometer	NRG #40C	252469	3	47.0	60	275°	0.759	0.39	mps
Logger Serial Number	428004419	Anemometer	NRG #40C	252461	4	47.0	60	095°	0.756	0.42	mps
Property Owner	Johnny/Paula Fuqua	Anemometer	NRG #40C	252463	5	31.0	60	275°	0.762	0.35	mps
Tower Height (m)	60	Anemometer	NRG #40C	252465	6	31.0	60	095°	0.760	0.37	mps
Tower Diameter	10" to 30 m, 8" above	Anemometer	NRG #40C	252459	13	10.0	60	275°	0.759	0.37	mps

Closest Town	Waynoka, OK										
Latitude (WGS84)	36° 36.682'N	Wind Vane	NRG 200P	N/A	7	56.5	60	185°	0.351	180	degrees
Longitude (WGS84)	98° 46.680'W	Wind Vane	NRG 200P	N/A	8	47.0	60	185°	0.351	180	degrees
Elevation (m)	524	Thermometer	NRG #110S	N/A	9	55.0	N/A	North side	0.136	-86.38	°C
		Thermometer	NRG #110S	N/A	10	1.5	N/A	North side	0.136	-86.38	°C

Site Exposure open, very gently rolling pasture land, bluff 800 m to the N through E, a few scattered bushes, no significant obstructions

10-m anemometer wiring repaired June 2016											
Site Number	0157	Anemometer	NRG #40C	252466	1	56.5/57.2	60	275°/263°	0.762	0.31	mps
Maintenance Date	8 June 2016	Anemometer	NRG #40C	252467	2	56.5/57.2	60	095°/108°	0.759	0.39	mps
Logger Type	NRG SymphoniePLUS	Anemometer	NRG #40C	252469	3	47.0/48.2	60	275°/263°	0.759	0.39	mps
Logger Serial Number	428004419	Anemometer	NRG #40C	252461	4	47.0/48.2	60	095°/108°	0.756	0.42	mps
Property Owner	Johnny/Paula Fuqua	Anemometer	NRG #40C	252463	5	31.0/31.7	60	275°/263°	0.762	0.35	mps
Tower Height (m)	60	Anemometer	NRG #40C	252465	6	31.0/31.7	60	095°/108°	0.760	0.37	mps
Tower Diameter	10" to 30 m, 8" above	Anemometer	NRG #40C	252459	13	10.0/10.2	60	275°/263°	0.759	0.37	mps
Closest Town	Waynoka, OK										
Latitude (WGS84)	36° 36.682'N	Wind Vane	NRG 200P	N/A	7	56.5/57.2	60	185°	0.351	180	degrees
Longitude (WGS84)	98° 46.680'W	Wind Vane	NRG 200P	N/A	8	47.0/48.2	60	185°	0.351	180	degrees
Elevation (m)	524	Thermometer	NRG #110S	N/A	9	55.0	N/A	North side	0.136	-86.38	°C
		Thermometer	NRG #110S	N/A	10	1.5	N/A	North side	0.136	-86.38	°C

Site Exposure open, very gently rolling pasture land, bluff 800 m to the N through E, a few scattered bushes, no significant obstructions

Site Number	0257	Anemometer	NRG #40C	251016	1	60.0	95	230°	0.764	0.33	mps
Installation Date	29 October 2015	Anemometer	NRG #40C	251019	2	60.0	95	050°	0.760	0.37	mps
Logger Type	NRG SymphoniePLUS	Anemometer	NRG #40C	251017	3	45.0	95	230°	0.759	0.37	mps
Logger Serial Number	428005479	Anemometer	NRG #40C	250764	4	45.0	95	050°	0.763	0.36	mps
Property Owner	Stan Bixler	Anemometer	NRG #40C	251015	5	30.0	95	230°	0.760	0.36	mps
Tower Height (m)	60	Anemometer	NRG #40C	250986	6	30.0	95	050°	0.758	0.37	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Waynoka, OK	Wind Vane	NRG 200P	N/A	7	58.0	95	230°	0.351	225	degrees
Latitude (WGS84)	36° 41.237'N	Wind Vane	NRG 200P	N/A	8	43.0	95	230°	0.351	225	degrees
Longitude (WGS84)	98° 55.823'W	Thermometer	NRG #110S	N/A	9	55.0	N/A	North side	0.136	-86.38	°C
Elevation (m)	539	Thermometer	NRG #110S	N/A	10	10.0	N/A	North side	0.136	-86.38	°C

Site Exposure open, gently rolling pasture land atop N/S oriented mesa, no obstructions

45-ne anemometer replaced December 2015

Site Number	0257	Anemometer	NRG #40C	251016	1	60.0	95	230°	0.764	0.33	mps
Maintenance Date	9 December 2015	Anemometer	NRG #40C	251019	2	60.0	95	050°	0.760	0.37	mps
Logger Type	NRG SymphoniePLUS	Anemometer	NRG #40C	251017	3	45.0	95	230°	0.759	0.37	mps
Logger Serial Number	428005479	Anemometer	NRG #40C	252470	4	45.0	95	050°	0.759	0.35	mps
Property Owner	Stan Bixler	Anemometer	NRG #40C	251015	5	30.0	95	230°	0.760	0.36	mps
Tower Height (m)	60	Anemometer	NRG #40C	250986	6	30.0	95	050°	0.758	0.37	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Waynoka, OK	Wind Vane	NRG 200P	N/A	7	58.0	95	230°	0.351	225	degrees
Latitude (WGS84)	36° 41.237'N	Wind Vane	NRG 200P	N/A	8	43.0	95	230°	0.351	225	degrees
Longitude (WGS84)	98° 55.823'W	Thermometer	NRG #110S	N/A	9	55.0	N/A	North side	0.136	-86.38	°C
Elevation (m)	539	Thermometer	NRG #110S	N/A	10	10.0	N/A	North side	0.136	-86.38	°C

Site Exposure open, gently rolling pasture land atop N/S oriented mesa, no obstructions

Anemometers replaced September 2018

Site Number	0257	Anemometer	NRG #40C	310749	1	60.0	95	230°	0.763	0.32	mps
Maintenance Date	13 September 2018	Anemometer	NRG #40C	303740	2	60.0	95	050°	0.761	0.35	mps
Logger Type	NRG SymphoniePLUS	Anemometer	NRG #40C	310939	3	45.0	95	230°	0.761	0.33	mps
Logger Serial Number	428005479	Anemometer	NRG #40C	303742	4	45.0	95	050°	0.762	0.30	mps
Property Owner	Stan Bixler	Anemometer	NRG #40C	310943	5	30.0	95	230°	0.762	0.33	mps
Tower Height (m)	60	Anemometer	NRG #40C	303604	6	30.0	95	050°	0.757	0.35	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Waynoka, OK	Wind Vane	NRG 200P	N/A	7	58.0	95	230°	0.351	225	degrees
Latitude (WGS84)	36° 41.237'N	Wind Vane	NRG 200P	N/A	8	43.0	95	230°	0.351	225	degrees
Longitude (WGS84)	98° 55.823'W	Thermometer	NRG #110S	N/A	9	55.0	N/A	North side	0.136	-86.38	°C
Elevation (m)	539	Thermometer	NRG #110S	N/A	10	10.0	N/A	North side	0.136	-86.38	°C

Site Exposure open, gently rolling pasture land atop N/S oriented mesa, no obstructions

Site Number	0357	Anemometer	NRG #40C	250771	1	60.0	95	230°	0.757	0.37	mps
Installation Date	28 October 2015	Anemometer	NRG #40C	251013	2	60.0	95	050°	0.761	0.36	mps
Logger Type	NRG SymphoniePLUS	Anemometer	NRG #40C	229729	3	45.0	95	230°	0.757	0.38	mps
Logger Serial Number	428009905	Anemometer	NRG #40C	251014	4	45.0	95	050°	0.760	0.35	mps
Property Owner	Jerry/Fonda Bloyd	Anemometer	NRG #40C	250769	5	30.0	95	230°	0.760	0.33	mps
Tower Height (m)	60	Anemometer	NRG #40C	250772	6	30.0	95	050°	0.762	0.33	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Aline, OK	Wind Vane	NRG 200P	N/A	7	58.0	95	230°	0.351	225	degrees
Latitude (WGS84)	36° 30.040'N	Wind Vane	NRG 200P	N/A	8	43.0	95	230°	0.351	225	degrees
Longitude (WGS84)	98° 35.290'W	Thermometer	NRG #110S	N/A	9	55.0	N/A	North side	0.136	-86.38	°C
Elevation (m)	455	Thermometer	NRG #110S	N/A	10	10.0	N/A	North side	0.136	-86.38	°C

Site Exposure open, flat cultivated land, no obstructions

Anemometers replaced December 2015											
Site Number	0357	Anemometer	NRG #40C	252450	1	60.0	95	230°	0.761	0.34	mps
Maintenance Date	9 December 2015	Anemometer	NRG #40C	251013	2	60.0	95	050°	0.761	0.36	mps
Logger Type	NRG SymphoniePLUS	Anemometer	NRG #40C	229729	3	45.0	95	230°	0.757	0.38	mps
Logger Serial Number	428009905	Anemometer	NRG #40C	251014	4	45.0	95	050°	0.760	0.35	mps
Property Owner	Jerry/Fonda Bloyd	Anemometer	NRG #40C	252462	5	30.0	95	230°	0.765	0.31	mps
Tower Height (m)	60	Anemometer	NRG #40C	252479	6	30.0	95	050°	0.757	0.37	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Aline, OK	Wind Vane	NRG 200P	N/A	7	58.0	95	230°	0.351	225	degrees
Latitude (WGS84)	36° 30.040'N	Wind Vane	NRG 200P	N/A	8	43.0	95	230°	0.351	225	degrees
Longitude (WGS84)	98° 35.290'W	Thermometer	NRG #110S	N/A	9	55.0	N/A	North side	0.136	-86.38	°C
Elevation (m)	455	Thermometer	NRG #110S	N/A	10	10.0	N/A	North side	0.136	-86.38	°C
Site Exposure open, flat cultivated land, no obstructions											
Logger replaced January 2016											
Site Number	0357	Anemometer	NRG #40C	252450	1	60.0	95	230°	0.761	0.34	mps
Maintenance Date	21 January 2016	Anemometer	NRG #40C	251013	2	60.0	95	050°	0.761	0.36	mps
Logger Type	NRG SymphoniePLUS	Anemometer	NRG #40C	229729	3	45.0	95	230°	0.757	0.38	mps
Logger Serial Number	428007782	Anemometer	NRG #40C	251014	4	45.0	95	050°	0.760	0.35	mps
Property Owner	Jerry/Fonda Bloyd	Anemometer	NRG #40C	252462	5	30.0	95	230°	0.765	0.31	mps
Tower Height (m)	60	Anemometer	NRG #40C	252479	6	30.0	95	050°	0.757	0.37	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Aline, OK	Wind Vane	NRG 200P	N/A	7	58.0	95	230°	0.351	225	degrees
Latitude (WGS84)	36° 30.040'N	Wind Vane	NRG 200P	N/A	8	43.0	95	230°	0.351	225	degrees
Longitude (WGS84)	98° 35.290'W	Thermometer	NRG #110S	N/A	9	55.0	N/A	North side	0.136	-86.38	°C
Elevation (m)	455	Thermometer	NRG #110S	N/A	10	10.0	N/A	North side	0.136	-86.38	°C
Site Exposure open, flat cultivated land, no obstructions											

60-sw anemometer replaced September 2016

Site Number	0357	Anemometer	NRG #40C	273369	1	60.0/60.4	95	230°/223°	0.762	0.34	mps
Maintenance Date	21 September 2016	Anemometer	NRG #40C	251013	2	60.0/60.4	95	050°/047°	0.761	0.36	mps
Logger Type	NRG SymphoniePLUS	Anemometer	NRG #40C	229729	3	45.0/45.4	95	050°/046°	0.757	0.38	mps
Logger Serial Number	428007782	Anemometer	NRG #40C	251014	4	45.0/45.4	95	050°/046°	0.760	0.35	mps
Property Owner	Jerry/Fonda Bloyd	Anemometer	NRG #40C	252462	5	30.0/30.4	95	230°/223°	0.765	0.31	mps
Tower Height (m)	60	Anemometer	NRG #40C	252479	6	30.0/30.4	95	050°/046°	0.757	0.37	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Aline, OK	Wind Vane	NRG 200P	N/A	7	58.0/58.4	95	050°/046°	0.351	225	degrees
Latitude (WGS84)	36° 30.040'N	Wind Vane	NRG 200P	N/A	8	43.0/43.4	95	050°/046°	0.351	225	degrees
Longitude (WGS84)	98° 35.290'W	Thermometer	NRG #110S	N/A	9	55.0	N/A	North side	0.136	-86.38	°C
Elevation (m)	455	Thermometer	NRG #110S	N/A	10	10.0	N/A	North side	0.136	-86.38	°C

Site Exposure open, flat cultivated land, no obstructions

Site Number	0457	Anemometer	NRG #40C	263520	1	60.0	95	230°	0.764	0.31	mps
Installation Date	5 April 2016	Anemometer	NRG #40C	263533	2	60.0	95	050°	0.760	0.33	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	263524	3	45.0	95	230°	0.758	0.34	mps
Logger Serial Number	820600222	Anemometer	NRG #40C	263515	4	45.0	95	050°	0.764	0.31	mps
Property Owner	Stan Bixler	Anemometer	NRG #40C	263521	5	30.0	95	230°	0.762	0.34	mps
Tower Height (m)	60	Anemometer	NRG #40C	263523	6	30.0	95	050°	0.760	0.37	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Waynoka, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	230°	0	0	degrees
Latitude (WGS84)	36° 38.351'N	Wind Vane	NRG 200P	N/A	14	43.0	95	230°	0	0	degrees
Longitude (WGS84)	98° 53.883'W	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
Elevation (m)	486	Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C

Site Exposure open, gently rolling, non-cultivated land, no significant obstructions

Anemometers replaced July 2018

Site Number	0457	Anemometer	NRG #40C	303704	1	60.0/60.5	95	230°/226°	0.765	0.32	mps
Maintenance Date	30 July 2018	Anemometer	NRG #40C	303600	2	60.0/60.5	95	050°/046°	0.770	0.30	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	303706	3	45.0/45.5	95	230°/226°	0.760	0.34	mps
Logger Serial Number	820600222	Anemometer	NRG #40C	303741	4	45.0/45.5	95	050°/046°	0.762	0.34	mps
Property Owner	Stan Bixler	Anemometer	NRG #40C	303717	5	30.0/30.5	95	230°/226°	0.757	0.37	mps
Tower Height (m)	60	Anemometer	NRG #40C	303605	6	30.0/30.5	95	050°/046°	0.759	0.35	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Waynoka, OK	Wind Vane	NRG 200P	N/A	13	58.0/58.5	95	230°/226°	0	0	degrees
Latitude (WGS84)	36° 38.351'N	Wind Vane	NRG 200P	N/A	14	43.0/43.5	95	230°/226°	0	0	degrees
Longitude (WGS84)	98° 53.883'W	Thermometer	NRG #110S	N/A	16	55/57	N/A	North side	55.55	-86.38	°C
Elevation (m)	486	Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C

Site Exposure open, gently rolling, non-cultivated land, no significant obstructions

Site Number	0557	Anemometer	NRG #40C	263514	1	60.0	95	230°	0.761	0.32	mps
Installation Date	5 April 2016	Anemometer	NRG #40C	263465	2	60.0	95	050°	0.761	0.35	mps

Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	263460	3	45.0	95	230°	0.761	0.32	mps
Logger Serial Number	820600224	Anemometer	NRG #40C	263461	4	45.0	95	050°	0.756	0.38	mps
Property Owner	Max Redgate	Anemometer	NRG #40C	263466	5	30.0	95	230°	0.757	0.35	mps
Tower Height (m)	60	Anemometer	NRG #40C	263530	6	30.0	95	050°	0.762	0.34	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Avard, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	230°	0	0	degrees
Latitude (WGS84)	36° 40.082'N	Wind Vane	NRG 200P	N/A	14	43.0	95	230°	0	0	degrees
Longitude (WGS84)	98° 49.784'W	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
Elevation (m)	470	Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C

Site Exposure open, gently rolling pasture and crop land, small bond with surrounding trees 40 m NE

30-sw anemometer replaced July 2018

Site Number	0557	Anemometer	NRG #40C	263514	1	60.0	95	230°	0.761	0.32	mps
Maintenance Date	10 July 2018	Anemometer	NRG #40C	263465	2	60.0	95	050°	0.761	0.35	mps
Removal Date	5 September 2018	Anemometer	NRG #40C	263460	3	45.0	95	230°	0.761	0.32	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	263461	4	45.0	95	050°	0.756	0.38	mps
Logger Serial Number	820600224	Anemometer	NRG #40C	303718	5	30.0	95	230°	0.763	0.33	mps
Property Owner	Max Redgate	Anemometer	NRG #40C	263530	6	30.0	95	050°	0.762	0.34	mps
Tower Height (m)	60										
Tower Diameter	10" to 30 m, 8" above	Wind Vane	NRG 200P	N/A	13	58.0	95	230°	0	0	degrees
Closest Town	Avard, OK	Wind Vane	NRG 200P	N/A	14	43.0	95	230°	0	0	degrees
Latitude (WGS84)	36° 40.082'N	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
Longitude (WGS84)	98° 49.784'W	Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C
Elevation (m)	470										

Site Exposure open, gently rolling pasture and crop land, small bond with surrounding trees 40 m NE

Site Number	0657	Anemometer	NRG #40C	263526	1	60.0	95	230°	0.761	0.33	mps
Installation Date	7 April 2016	Anemometer	NRG #40C	263525	2	60.0	95	050°	0.763	0.35	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	263535	3	45.0	95	230°	0.760	0.33	mps
Logger Serial Number	820600223	Anemometer	NRG #40C	263532	4	45.0	95	050°	0.763	0.33	mps
Property Owner	Steven Redgate	Anemometer	NRG #40C	263456	5	30.0	95	230°	0.757	0.35	mps
Tower Height (m)	60	Anemometer	NRG #40C	263459	6	30.0	95	050°	0.761	0.34	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Waynoka, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	230°	0	0	degrees
Latitude (WGS84)	36° 33.411'N	Wind Vane	NRG 200P	N/A	14	43.0	95	230°	0	0	degrees
Longitude (WGS84)	98° 45.818'W	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
Elevation (m)	486	Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C

Site Exposure open, rolling pasture land, scattered trees < 10 m tall, otherwise no significant obstructions

Vane shielding wires rerouted July 2016											
Site Number	0657	Anemometer	NRG #40C	263526	1	60.0/60.5	95	230°/227°	0.761	0.33	mps
Maintenance Date	5 July 2016	Anemometer	NRG #40C	263525	2	60.0/60.5	95	050°/052°	0.763	0.35	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	263535	3	45.0/45.5	95	230°/225°	0.760	0.33	mps
Logger Serial Number	820600223	Anemometer	NRG #40C	263532	4	45.0/45.5	95	050°/052°	0.763	0.33	mps
Property Owner	Steven Redgate	Anemometer	NRG #40C	263456	5	30.0/30.5	95	230°/227°	0.757	0.35	mps
Tower Height (m)	60	Anemometer	NRG #40C	263459	6	30.0/30.5	95	050°/052°	0.761	0.34	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Waynoka, OK	Wind Vane	NRG 200P	N/A	13	58.0/58.5	95	230°/227°	0	0	degrees
Latitude (WGS84)	36° 33.411'N	Wind Vane	NRG 200P	N/A	14	43.0/43.5	95	230°/227°	0	0	degrees
Longitude (WGS84)	98° 45.818'W	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
Elevation (m)	486	Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C
Site Exposure	open, rolling pasture land, scattered trees < 10 m tall, otherwise no significant obstructions										
Site Number	0757	Anemometer	NRG #40C	263513	1	60.0	95	230°	0.759	0.34	mps
Installation Date	7 April 2016	Anemometer	NRG #40C	263516	2	60.0	95	050°	0.759	0.36	mps
Removal Date	12 September 2018	Anemometer	NRG #40C	263457	3	45.0	95	230°	0.757	0.37	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	263545	4	45.0	95	050°	0.763	0.34	mps
Logger Serial Number	820600204	Anemometer	NRG #40C	263528	5	30.0	95	230°	0.759	0.36	mps
Property Owner	Percival	Anemometer	NRG #40C	263522	6	30.0	95	050°	0.761	0.32	mps
Tower Height (m)	60										
Tower Diameter	10" to 30 m, 8" above	Wind Vane	NRG 200P	N/A	13	58.0	95	230°	0	0	degrees
Closest Town	Waynoka, OK	Wind Vane	NRG 200P	N/A	14	43.0	95	230°	0	0	degrees
Latitude (WGS84)	36° 32.686'N	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
Longitude (WGS84)	98° 42.269'W	Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C
Elevation (m)	498										
Site Exposure	open, rolling pasture land, no obstructions										
Site Number	0857	Anemometer	NRG #40C	263538	1	60.0	95	230°	0.761	0.32	mps
Installation Date	6 April 2016	Anemometer	NRG #40C	263458	2	60.0	95	050°	0.761	0.33	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	263462	3	45.0	95	230°	0.756	0.39	mps
Logger Serial Number	820600209	Anemometer	NRG #40C	263452	4	45.0	95	050°	0.757	0.37	mps
Property Owner	John Copenhaver	Anemometer	NRG #40C	263464	5	30.0	95	230°	0.764	0.30	mps
Tower Height (m)	60	Anemometer	NRG #40C	263463	6	30.0	95	050°	0.757	0.41	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Dacoma, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	230°	0	0	degrees
Latitude (WGS84)	36° 31.360'N	Wind Vane	NRG 200P	N/A	14	43.0	95	230°	0	0	degrees
Longitude (WGS84)	98° 40.077'W	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
Elevation (m)	476	Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C
Site Exposure	gently rolling pasture land, scatterd trees starting 180 m south, W/E tree break 230 m north										
45-sw anemometer replaced September 2016											
Site Number	0857	Anemometer	NRG #40C	263538	1	60.0	95	230°	0.761	0.32	mps

Maintenance Date	20 September 2016	Anemometer	NRG #40C	263458	2	60.0	95	050°	0.761	0.33	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	273394	3	45.0	95	230°	0.761	0.38	mps
Logger Serial Number	820600209	Anemometer	NRG #40C	263452	4	45.0	95	050°	0.757	0.37	mps
Property Owner	John Copenhaver	Anemometer	NRG #40C	263464	5	30.0	95	230°	0.764	0.30	mps
Tower Height (m)	60	Anemometer	NRG #40C	263463	6	30.0	95	050°	0.757	0.41	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Dacoma, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	230°	0	0	degrees
Latitude (WGS84)	36° 31.360'N	Wind Vane	NRG 200P	N/A	14	43.0	95	230°	0	0	degrees
Longitude (WGS84)	98° 40.077'W	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
Elevation (m)	476	Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C

Site Exposure gently rolling pasture land, scatterd trees starting 180 m south, W/E tree break 230 m north

60-sw, 45-ne and 30-sw anemometers replaced August 2017

Site Number	0857	Anemometer	NRG #40C	290413	1	60.0	95	230°	0.766	0.30	mps
Maintenance Date	24 August 2017	Anemometer	NRG #40C	263458	2	60.0	95	050°	0.761	0.33	mps
Removal Date	11 September 2018	Anemometer	NRG #40C	273394	3	45.0	95	230°	0.761	0.38	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	290412	4	45.0	95	050°	0.758	0.37	mps
Logger Serial Number	820600209	Anemometer	NRG #40C	290400	5	30.0	95	230°	0.765	0.32	mps
Property Owner	John Copenhaver	Anemometer	NRG #40C	263463	6	30.0	95	050°	0.757	0.41	mps
Tower Height (m)	60										
Tower Diameter	10" to 30 m, 8" above	Wind Vane	NRG 200P	N/A	13	58.0	95	230°	0	0	degrees
Closest Town	Dacoma, OK	Wind Vane	NRG 200P	N/A	14	43.0	95	230°	0	0	degrees
Latitude (WGS84)	36° 31.360'N	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
Longitude (WGS84)	98° 40.077'W	Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C
Elevation (m)	476										

Site Exposure gently rolling pasture land, scatterd trees starting 180 m south, W/E tree break 230 m north

Site Number	0178	Anemometer	NRG #40C	290132	1	60.0	95	230°	0.766	0.31	mps
Installation Date	4 October 2017	Anemometer	NRG #40C	259689	2	60.0	95	050°	0.771	0.31	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	290140	3	45.0	95	230°	0.764	0.32	mps
Logger Serial Number	820600466	Anemometer	NRG #40C	259496	4	45.0	95	050°	0.768	0.29	mps
Property Owner	Elvin Bates	Anemometer	NRG #40C	290139	5	30.0	95	230°	0.763	0.33	mps
Tower Height (m)	60	Anemometer	NRG #40C	259697	6	30.0	95	050°	0.769	0.29	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Freedom, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	230°	1	0	degrees
Latitude (WGS84)	36° 49.563'N	Wind Vane	NRG 200P	N/A	14	43.0	95	230°	1	0	degrees
Longitude (WGS84)	98° 58.105'W	Wind Vane	NRG 200P	N/A	15	28.0	N/A	230°	1	0	degrees
Elevation (m)	563	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
		Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C
Site Exposure	open, rolling cultivated land, scattered trees < 10 m tall and structure to east < 10 m tall, otherwise no significant obstructions										
Site Number	0278	Anemometer	NRG #40C	290145	1	60.0	95	230°	0.760	0.35	mps
Installation Date	20 September 2017	Anemometer	NRG #40C	260351	2	60.0	95	050°	0.768	0.28	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	290130	3	45.0	95	230°	0.769	0.30	mps
Logger Serial Number	820600920	Anemometer	NRG #40C	259698	4	45.0	95	050°	0.767	0.31	mps
Property Owner	Mike Mackey Farms LLC	Anemometer	NRG #40C	290141	5	30.0	95	230°	0.762	0.37	mps
Tower Height (m)	60	Anemometer	NRG #40C	259688	6	30.0	95	050°	0.769	0.30	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Alva, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	230°	1	0	degrees
Latitude (WGS84)	36° 49.563'N	Wind Vane	NRG 200P	N/A	14	43.0	95	230°	1	0	degrees
Longitude (WGS84)	98° 52.932'W	Wind Vane	NRG 200P	N/A	15	28.0	N/A	230°	1	0	degrees
Elevation (m)	538	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
		Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C
Site Exposure	open, rolling cultivated land, scattered trees < 10 m tall, otherwise no significant obstructions										
Site Number	0378	Anemometer	NRG #40C	290131	1	60.0	95	230°	0.760	0.34	mps
Installation Date	21 September 2017	Anemometer	NRG #40C	259699	2	60.0	95	050°	0.768	0.30	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	290144	3	45.0	95	230°	0.768	0.30	mps
Logger Serial Number	820601053	Anemometer	NRG #40C	260355	4	45.0	95	050°	0.770	0.27	mps
Property Owner	Hughes Farms	Anemometer	NRG #40C	290405	5	30.0	95	230°	0.769	0.34	mps
Tower Height (m)	60	Anemometer	NRG #40C	260350	6	30.0	95	050°	0.770	0.28	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Avard, OK	Wind Vane	NRG 200P	N/A	13	58.0	95	230°	1	0	degrees
Latitude (WGS84)	36° 45.844'N	Wind Vane	NRG 200P	N/A	14	43.0	95	230°	1	0	degrees
Longitude (WGS84)	98° 51.128'W	Wind Vane	NRG 200P	N/A	15	28.0	N/A	230°	1	0	degrees
Elevation (m)	527	Thermometer	NRG #110S	N/A	16	55.0	N/A	North side	55.55	-86.38	°C
		Thermometer	NRG #110S	N/A	17	10.0	N/A	North side	55.55	-86.38	°C
Site Exposure	open, rolling pasture land, no significant obstructions										

Sodar Unit	Triton (84 m northeast of Site 0757)
Serial Number	162
Latitude (WGS84)	36° 32.717'N
Longitude (WGS84)	98° 42.227'W
Elevation (m ASL)	497
Deployment Date	5 October 2016

** the full serial numbers for all NRG #40C anemometers have a prefix of 179500. Thus a listed serial number of 257052 is actually 179500257052.*

*** all NRG #40C anemometers use NREL default calibration constants (slope 0.765 mps/Hz, offset 0.35 mps) in our analyses*

Maps. Regional Map of Sundance Project and Long-Term Reference Stations

