

1 A. As Vice President – Energy Marketing and Renewables, I am responsible for managing
2 AEP’s portfolio of REPAs. I direct the team that (1) structures and issues the renewable
3 energy requests for proposals (RFPs); (2) reviews and evaluates proposals received in
4 response; and (3) negotiates and finalizes the agreements with the winning bidder(s).

5 I am also responsible for the development or acquisition of potential wind,
6 solar, and other renewable project development opportunities within AEP’s service
7 territory. Additionally, I oversee the commercial activities related to AEP’s wholesale
8 energy customers in AEP’s eastern footprint (Indiana, Kentucky, Michigan, Ohio,
9 Virginia, and West Virginia).

10 Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE ANY REGULATORY
11 COMMISSIONS?

12 A. Yes. I have presented testimony or testified in Arkansas, Indiana, Kentucky, Louisiana,
13 Michigan, Ohio, Oklahoma, Texas, and Virginia on behalf of AEP affiliates.

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15 II. PURPOSE OF TESTIMONY

16 Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

17 A. The purpose of my direct testimony is to support the Companies’ 2019 RFP for Wind
18 Energy Resources and the Purchase and Sale Agreements (PSAs) with affiliates of
19 Invenergy LLC (Invenergy) for three wind facilities located in North Central Oklahoma
20 totaling 1,485 MW:

- 21 (1) the Traverse (999 MW) wind project (Traverse) with Traverse Wind
22 Energy LLC,
23 (2) the Maverick (287 MW) wind project (Maverick) with Maverick Wind
24 Project, LLC, and

1 (3) the Sundance (199 MW) wind project (Sundance) with Sundance Wind
2 Project, LLC.

3 Collectively, I will refer to the three projects as the “Selected Wind Facilities”.

4 SWEPCO will acquire 54.5% of the Selected Wind Facilities and PSO will acquire
5 45.5%, subject to regulatory approvals.

6 Specifically, my testimony will:

- 7 • Provide an overview of the RFP, which resulted in the Selected Wind Facilities
8 presented in the Company’s Application;
- 9 • Discuss the RFP evaluation process and the Companies’ due diligence that
10 resulted in the Selected Wind Facilities;
- 11 • Discuss the results of the RFP process;
- 12 • Present the Companies’ independent consultant’s wind energy resource
13 assessment (WERA) of each of the Selected Wind Facilities; and
- 14 • Provide an overview of the PSAs negotiated as a result.

15 Q. DO YOU SPONSOR ANY EXHIBITS?

16 A. Yes. I sponsor the following exhibits:

<u>EXHIBIT</u>	<u>DESCRIPTION</u>
EXHIBIT JFG-1	Wind Energy Resources RFP
HIGHLY SENSITIVE CONFIDENTIAL EXHIBIT JFG-2	Congestion and Line Losses Cost
HIGHLY SENSITIVE CONFIDENTIAL EXHIBIT JFG-3	Selected Wind Facilities’ Purchase and Sale Agreements - REDACTED
EXHIBIT JFG-4	Simon Wind Resume
HIGHLY SENSITIVE CONFIDENTIAL EXHIBIT JFG-5	Bidder Wind Resource Assessment Review
EXHIBIT JFG-6	Wind Energy Resource Assessments

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1 Please see the testimony of Company witness Multer for detailed discussion on the
2 PTC and its value. Under the Company's proposal, the PTC helps to significantly
3 increase the net savings to customers as discussed further by Company witness Torpey.

4 Q. WHY ARE THERE MULTIPLE IN-SERVICE DATES FOR THE SELECTED
5 WIND FACILITIES?

6 A. The Companies optimized their selection of bids to bring the greatest value to
7 customers, which resulted in a selection of bids with multiple in-service dates. The
8 Companies solicited bids for projects that would be placed into service on or before
9 December 15, 2021 and qualify for at least 80% of the PTC value. This allowed
10 developers to submit different types of bids for the same project that met these
11 requirements, including those that could qualify for the full 100% of the PTC if placed
12 in-service prior to 2021, as is the case with the selected Sundance proposal. Given the
13 additional value the 100% PTC qualification brings to customers vis-à-vis the purchase
14 price, the Companies selected this bid option to be part of the Selected Wind Facilities.

15 Q. ARE THE COMPANIES OBLIGATED TO PAY INVENERGY ANY TYPE OF
16 PAYMENT OR FEE IF REGULATORY APPROVALS ARE NOT RECEIVED?

17 A. No.

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19 IV. RFP PREPARATION ACTIVITIES

20 Q. PURSUANT TO APPLICABLE REGULATORY REQUIREMENTS, WHAT STEPS
21 DID THE COMPANY TAKE PRIOR TO THE ISSUANCE OF THE RFP ON
22 JANUARY 7, 2019?

1 A. The Louisiana Public Service Commission (LPSC) Market Based Mechanism (MBM)
2 Order requires the Company to take the following steps prior to the issuance of the
3 RFP:

- 4 • Drafting the RFP and filing it with the LPSC
- 5 • Coordination with LPSC Staff and its consultant, United Professionals
6 Company (UPC)
- 7 • Bidders Technical Conference

8 I explain these steps further below.

9 Draft RFP Filing: The Company drafted and subsequently filed the draft RFP with the
10 LPSC on October 30, 2018. LPSC Staff and UPC provided feedback to the Company
11 regarding the draft RFP. The Company posted the draft RFP on SWEPCO's website
12 on November 2, 2018.

13 LPSC Staff's Consultant: In accordance with the Louisiana MBM, LPSC Staff and
14 UPC reviewed and provided comments that were incorporated into the final RFP prior
15 to issuance. In addition, both parties participated in the SWEPCO Bidders Technical
16 Conference.

17 Bidders Technical Conference: The Company held a webinar and technical conference
18 on December 10, 2018. During the webinar and teleconference, the Company
19 discussed the background associated with the Company and the RFP, the details
20 required with bid submissions, the RFP evaluation process, and the timeline associated
21 with the RFP processes.

1 V. THE WIND RFP PROCESS

2 A. RFP

3 Q. PLEASE PROVIDE AN OVERVIEW OF THE OBJECTIVE OF THE RFP.

4 A. As identified by the results of the Company's most recent IRP and further discussed by
5 Company witness Torpey, the Company's resource planning continues to show that
6 additional wind resources will be an economic resource for addition to its generation
7 portfolio. The Company's latest IRP shows customers would benefit by adding up to
8 1,200 MW of wind generation, with 600 MW to be added by 2022, and an additional
9 600 MW to be added by 2023.

10 Consistent with the IRP, the Company issued the RFP for up to 1,200 MW of
11 wind generation resources on January 7, 2019. The Company elected to pursue projects
12 on a turnkey basis in which it individually, or together with PSO, would acquire via a
13 PSA all of the equity interests in the project company whose assets consist solely of
14 the selected project.

15 The Company sought projects that: (1) are physically located in, and
16 interconnected to the Southwest Power Pool (SPP) in Arkansas, Louisiana, Texas, or
17 Oklahoma; (2) are not currently experiencing, or anticipated to experience, significant
18 congestion or deliverability constraints; and (3) balance project performance and
19 deliverability to the AEP West load zone in the Tulsa area. In addition, the Company
20 sought projects that are either in service or that would be placed in service by December
21 15, 2021, and qualify for at least 80% of the PTC value. Bidders submitting proposals
22 into the Company's RFP were also required to submit identical proposals into the PSO
23 RFP.

1 Q. WHY WERE BIDDERS THAT SUBMITTED PROPOSALS FOR THE
2 COMPANY'S RFP REQUIRED TO SUBMIT AN IDENTICAL PROPOSAL IN
3 RESPONSE TO PSO'S RFP?

4 A. Identical proposals in both RFPs were required because the proposed wind projects will
5 be jointly owned assets whose benefits and costs PSO and SWEPCO will both share.

6 Q. PLEASE DESCRIBE THE COMPANIES' EFFORTS TO PUBLICIZE THE RFP
7 AND REACH OUT TO THE POOL OF POTENTIAL BIDDERS.

8 A. On January 7, 2019, the Companies published the RFP on their respective websites¹
9 including a news release, RFP Schedule, and the RFP document. AEPSC distributed
10 the news release and RFP links to the Companies' websites to a mass distribution list
11 of known wind project developers. AEPSC Corporate Communications also provided
12 notice to major industry trade publications and organizations (e.g., S&P Global Market
13 Intelligence, AWEA, etc.). This approach was effective in reaching out to potential
14 wind project developers in the SPP region, as demonstrated by the robust participation
15 in the RFP discussed below.

16 Q. WERE THERE ANY REVISIONS TO THE RFP?

17 A. Yes, the Companies revised their RFPs on January 22, 2019. The Companies posted
18 the revised RFPs (EXHIBIT JFG-1) and included the details associated with the
19 revisions to each of the respective websites on that same day. The changes made to the
20 RFP were associated with requesting additional information from the Bidders to

¹ www.psoklahoma.com/rfp and www.swepco.com/rfp

1 support the Companies' due diligence efforts and a revision to the RFP's Requirements
2 for Connection of Facilities.

3 Q. DID THE COMPANIES FOLLOW THE PROCESS ESTABLISHED IN THE RFP
4 FROM THE TIME IT WAS ISSUED THROUGH THE IDENTIFICATION OF THE
5 SELECTED WIND FACILITIES?

6 A. Yes.

7 Q. DID THE COMPANIES PROVIDE OPPORTUNITIES TO POTENTIAL BIDDERS
8 AND OTHER STAKEHOLDERS TO HAVE INPUT INTO THE RFP PROCESS?

9 A. Yes. The Companies held a transparent and open process that afforded bidders and
10 stakeholders opportunities to ask questions about the RFP. The Companies held two
11 technical conferences, on December 6, 2018, and December 10, 2018, that were open
12 to all bidders and were well attended, including by the staffs of several of the
13 Companies' state commissions. In addition to the presentations made by the
14 Companies at these conferences, bidders and Staff had the opportunity to ask questions
15 or provide comments regarding the RFP, which was subsequently issued on January
16 7, 2019. Bidders also had the opportunity to submit questions concerning the RFP
17 process after the technical conferences and prior to the submission of bids. All
18 questions and answers were publicly posted to the RFP website for all to view and are
19 currently still available for all to view. Responses were timely made to all questions
20 received from bidders, whether the questions were received during or after the
21 technical conferences.

1 Q. PLEASE DESCRIBE THE STEPS IN EXECUTING THE RFP PROCESS.

2 A. The RFP outlined six main steps in the process:

3 Step 1: Notice of Intent

4 Step 2: Submission of Proposals

5 Step 3: Eligibility & Threshold Review

6 Step 4: Detailed Analysis

7 - Economic Analysis, 90%

8 - Non-Price Factor Analysis, 10%

9 Step 5: Identification of Selected Wind Facilities and Bidder Notification

10 Step 6: Negotiations /Execution of PSAs

11 Q. PLEASE DESCRIBE THE NOTICE OF INTENT REQUIREMENT IN THE RFP.

12 A. Notices of Intent (NOI) to bid into the RFP were due by January 30, 2019. The purpose
13 of the NOI was to determine the potential robustness of the RFP response and allow
14 the Companies to begin the process of evaluating potential congestion and
15 deliverability issues. Bidders representing 28 wind projects totaling approximately
16 7,252 MW submitted NOIs to the Companies. Following receipt of the NOIs, each
17 project notice was reviewed to ensure that each project had in fact obtained a completed
18 Definitive Interconnection System Impact Study (DISIS) from SPP, which is an
19 Eligibility and Threshold Requirement in RFP §9.1.4. Four of the NOI projects totaling
20 860 MW did not have a completed DISIS. The developers of those projects were
21 informed that the projects would not be able to participate in the RFP. In summary, of
22 the NOIs submitted, 24 wind projects totaling 6,392 MW had completed System Impact
23 Studies.

1 Q. PLEASE DESCRIBE THE BIDS RECEIVED IN RESPONSE TO THE RFP.

2 A. The Companies received 35 bids representing 19 unique wind projects totaling 5,896

3 MW in response to the RFP on March 1, 2019. Fifteen projects were located in

4 Oklahoma and four projects were located in Texas. Several bidders of the 19 unique

5 wind projects provided alternative project proposals with variations such as project

6 size, turbine manufacturer or models, and target commercial operation dates (COD),

7 which resulted in the 35 total bids.

8 Q. PLEASE RECONCILE THE PROJECTS THAT WERE SUBMITTED VIA THE NOI

9 PROCESS AND THE ACTUAL BID SUBMISSIONS.

10 A. Table 1 summarizes the reconciliation of the NOI projects and the actual projects

11 submitted into the RFP. As described above, 24 projects that submitted NOIs (totaling

12 6,392 MW) had a completed SPP DISIS. Of these 24 projects, six projects (totaling

13 1,016 MW) were not submitted as bids into the RFP on March 1. In addition, the bid

14 size of many of the projects changed, which resulted in an additional 320 MW that

15 were bid into the RFP, but were not included in the NOIs. One new project (200 MW)

16 was bid into the RFP that did not submit a NOI.

Table 1

Date	Activity	Projects	MW
Jan 31	NOI	28	7,252
Jan 31	NOI (no DISIS)	(4)	(860)
	Net NOI	24	6,392
Mar 1	NOI Projects Not Bid	(6)	(1,016)
Mar 1	NOI Project Size Change, net		320
Mar 1	New Projects (No NOI)	1	200
	Net RFP Participation	19	5,896

1 Q. WERE ANY BIDS SUBMITTED BY THE COMPANY OR AN AEP AFFILIATE?

2 A. No. The RFP specifically prohibited submission of proposals from the Company or an
3 AEP affiliate.

4 B. ELIGIBILITY AND THRESHOLD REQUIREMENTS

5 Q. PLEASE DESCRIBE THE ELIGIBILITY AND THRESHOLD REQUIREMENTS.

6 A. Each proposed project was required to meet the Eligibility and Threshold Requirements
7 listed in RFP §9.1 including (1) being located in Arkansas, Louisiana, Texas or
8 Oklahoma; (2) submittal of an identical proposal in the PSO RFP; (3) qualifying for at
9 least 80% of the PTC; (4) being interconnected to the SPP with a completed DISIS and
10 ability to achieve timely commercial operation of any necessary interconnection; (5)
11 turbines from a specified set of manufacturers; (6) appropriate previous experience with
12 similar wind projects; (7) a minimum project nameplate rating of 100 MW; (8)
13 substantial site control; (9) ability to achieve commercial operation by the deadline;
14 (10) inclusion of an independent wind report; (11) inclusion of the Turbine Specific
15 Site Suitability Report; (12) location in an area in which deliverability to the AEP West

1 load zone is not severely limited; (13) constructability requirements; and (14)
2 acceptable exceptions to the PSA Term Sheet.

3 Q. WHAT WERE THE RESULTS OF THE ELIGIBILITY AND THRESHOLD
4 REVIEW?

5 A. At the conclusion of the Companies' review, 11 of the 19 wind projects, totaling 3,265
6 MW, passed the Eligibility and Threshold requirements outlined in the RFP. Eight of
7 the wind projects, constituting 2,631 MW, failed to meet all of the Eligibility and
8 Threshold requirements and were removed from further consideration:

- 9 • Three projects failed to satisfy the requirements of having a completed SPP
10 DISIS with a demonstrated ability to achieve the COD on or before December
11 15, 2021 (RFP §9.1.4). Of the three projects, one project did not have an SPP
12 DISIS. The other two projects had obtained a completed DISIS, but the
13 associated network upgrades were not expected to be completed by the COD;
- 14 • Four projects failed to satisfy the requirements of deliverability (RFP §9.1.12).
15 Please refer to Company witness Ali's testimony for further discussion on
16 deliverability; and
- 17 • One project failed to provide an independent wind report as required in RFP
18 §9.1.10.

19 C. DETAILED ANALYSIS

20 Q. PLEASE SUMMARIZE THE DETAILED ANALYSIS PERFORMED ON EACH
21 QUALIFYING PROPOSAL.

22 A. After completion of the Eligibility and Threshold Requirements review, a Detailed
23 Analysis was conducted on each of the 11 proposals as described in RFP §9.2. The
24 purpose of the Detailed Analysis was to determine a numerical scoring of both
25 quantitative ("economic") and qualitative ("non-price") merits of each bid. The
26 Detailed Analysis was comprised of two parts: (1) the Economic Analysis constituting
27 90 percent of the overall evaluated value of each proposal; and, (2) the Non-Price

1 Factor Analysis constituting 10 percent of the overall evaluated value of each proposal.
2 These two scores were then combined to determine an overall score for each bid. The
3 Detailed Analysis process allowed the Companies to objectively evaluate and rank each
4 eligible bid to inform the decision to move forward with the Selected Wind Facilities.

5 Q. WHAT WAS THE PURPOSE OF THE RFP ECONOMIC ANALYSIS?

6 A. As discussed in more detail by Company witness Torpey, the purpose of the Economic
7 Analysis was to determine the risk-adjusted cost effectiveness of delivering the energy
8 generated at each of the 11 qualifying wind farms to the AEP West load zone.

9 Q. WHAT WERE THE COMPONENTS OF THE ECONOMIC ANALYSIS?

10 A. As described in RFP §9.2, the Economic Analysis consists of two components:

11 1) the Levelized Cost of Energy (LCOE, \$/MWh) associated with each
12 proposal calculated by the Companies, as further described by Company
13 witness Torpey, and

14 2) the cost of Transmission Congestion (\$/MWh) as determined by the
15 Companies' Transmission Congestion Screening Analysis, as further
16 described by Company witnesses Ali, Sheilendranath and Pfeifenberger.

17 The two components were added together to determine the Levelized Adjusted Cost of
18 Energy (LACOE) \$/MWh for each bid.

19 Q. HOW DID THE COMPANIES DETERMINE THE COST OF TRANSMISSION
20 CONGESTION?

21 A. As described in the RFP in §9.2.1.1, the Transmission Congestion value was
22 determined by considering (1) the cost of transmission congestion and losses from a
23 given project to the AEP West load zone and (2) the cost of mitigating this potential
24 future congestion, if necessary, through a gen-tie line, as further discussed by Company
25 witnesses Ali, Sheilendranath, and Pfeifenberger. The two costs were assigned a

1 weighting of 50 percent each, and then added together to determine the total evaluated
2 congestion cost.

3 Q. HAVE WIND FACILITIES LOCATED IN THE SPP EXPERIENCED
4 CONGESTION IN ACTUAL OPERATIONS?

5 A. Yes, Highly Sensitive Confidential EXHIBIT JFG-2, which was prepared by internal
6 AEP experts at my request, shows the congestion and line losses cost that PSO and
7 SWEPCO experienced over 2018 net of hedging activities. As shown on this exhibit,
8 congestion and line losses are an actual cost to customers to receive energy from wind
9 facilities in the SPP.

10 Q. WHY DID THE COMPANIES EVALUATE THE COST OF A POTENTIAL GEN-
11 TIE LINE IN THEIR DETAILED ANALYSIS?

12 A. As discussed further by Company witnesses Pfeifenberger and Ali, the Companies
13 believed it prudent to analyze the cost of directly connecting the wind generators to the
14 AEP West load zone in Tulsa via a gen-tie line as a possible scenario for mitigating
15 potential future congestion given the uncertainty in forecasting congestion values.

16 Q. WHY DID THE COMPANIES ASSIGN A WEIGHTING OF 50 PERCENT TO
17 BOTH THE COST OF CONGESTION AND THE COST OF A POTENTIAL GEN-
18 TIE LINE IN THEIR TRANSMISSION CONGESTION ANALYSIS?

19 A. As discussed further by Company witnesses Pfeifenberger and Ali, there is uncertainty
20 about both future congestion costs and the potential need to mitigate these costs through
21 a generation-tie line. The Companies determined that assigning a 50 percent weighting
22 to each cost strikes a reasonable risk-adjusted balance for the customer in their
23 assessment of congestion cost risk.

1 Q. PLEASE DESCRIBE THE INPUTS REQUIRED FOR THE ECONOMIC
2 ANALYSIS OF EACH QUALIFYING PROPOSAL.

3 A. Inputs required for the Economic Analysis of each qualifying proposal included the (1)
4 bid price; 2) adjusted expected energy output; (3) O&M expense; (4) cost of
5 transmission congestion; and (5) financing assumptions. The source of each of these
6 assumptions, which Company witness Torpey used for his economic analysis, is as in
7 Table 2 below:

Table 2

Inputs	Source
Bid Price from RFP Proposals	Godfrey
Expected Energy Output	Godfrey
O&M Expense and Owner's Cost	DeRuntz
Transmission Congestion	Ali and Sheilendranath
Financing Assumptions	Hollis

8 Q. WHAT WERE THE RESULTS OF THE ECONOMIC ANALYSIS PROVIDED BY
9 COMPANY WITNESS TORPEY?

10 A. As discussed further by Company witness Torpey, the Economic Analysis determined
11 the levelized adjusted cost of energy (LACOE) of each of the 11 eligible bids, which
12 were then sorted lowest to the highest cost, placing the projects expected to deliver the
13 lowest cost of energy to customers on a risk-adjusted basis at the top of the stack. The
14 ranking of the 11 qualifying projects is presented in Table 3 below.

15 Based on Table 3, the Companies were able to identify the most cost-effective
16 bids that met the level of procurement interest of 2,200 MW in the Companies'
17 combined RFPs. The six projects identified as being collectively able to meet the

1 Companies' solicitation were bid numbers 21, 15, 17, 12, 1, and 6 and totaled
2 approximately 2,166 MW.

3 Q. WHAT WERE THE FACTORS THAT COMPRISED THE NON-PRICE
4 COMPONENT OF THE DETAILED RFP ANALYSIS?

5 A. The non-price factors detailed in RFP §9.2.2 included: (1) impact on wildlife, the
6 environment and identified cultural resources; (2) proximity to tribal or government
7 lands; (3) exceptions to AEP Wind Generation Facility Standards; (4) exceptions to
8 Requirements for the Connection of Facilities; (5) exceptions to the PSA Term Sheet;
9 (6) the scope and terms of proposed O&M services; (7) development status of the
10 project; (8) operating history of other wind facilities developed by the bidder; and, (9)
11 the credentials of the bidder's independent wind resource consultant.

12 Q. PLEASE DESCRIBE THE EFFECT THE NON-PRICE EVALUATION FACTORS
13 HAD ON THE FINAL BID SELECTION.

14 A. The Company's Non-Price Factor Analysis, which constituted 10% of the overall
15 evaluated value in the detailed analysis, was completed using a 0-10 scale, with 10 being
16 an excellent or perfect score. The final Non-Price Factor Analysis scores for each of
17 the 11 projects ranked resulted in a range of 8.3 to 8.8. Due to the narrow range of this
18 scoring, these results had no impact on the top projects considered for the Selected Wind
19 Facilities as further described below.

20 Q. WHAT WERE THE RESULTS OF THE DETAILED ANALYSIS?

21 A. On April 18, 2019, the Companies concluded the Detailed Analysis. Table 3
22 summarizes the overall ranking of the 11 eligible project bids using the results of the

1 Economic Analysis (90%) and Non-Price Factor Analysis (10%). The ranking was
 2 based on a 0-100 Score, with 100 being the most favorable score.

Table 3

Bid Number	Size, MW	Cumulative MW	Rank	% Difference from Best Bid	Score (0-100)
21	999	999	1	-	98.3
15	287	1,285	2	4.3 %	94.1
17	199	1,485	3	11.8 %	86.7
12	177	1,662	4	28.0 %	70.8
1	302	1,964	5	33.3 %	65.6
6	202	2,166	6	46.3 %	52.8
4	248	2,414	7	63.4 %	36.0
30	150	2,565	8	70.7 %	28.8
32	155	2,719	9	91.1 %	8.8
31	248	2,967	10	91.3 %	8.6
2	299	3,266	11	91.5 %	8.3

3 VI. SELECTED WIND FACILITIES

4 Q. WHAT PROJECTS WERE INCLUDED IN THE SELECTED WIND FACILITIES?

5 A. Based on the proposal scoring, the following projects in Table 4 were included in the
 6 Selected Wind Facilities, and moved forward for additional due diligence and PSA
 7 negotiations:

Table 4

Bid #	Project Name	MW
21	Traverse	999
15	Maverick	287
17	Sundance	199
Total =		1,485

1 All Bidders were promptly notified whether their project(s) were part of the
2 Selected Wind Facilities or no longer being considered in the RFP.

3 Q. WHY DID THE COMPANIES DECIDE NOT TO PROCURE 2,200 MW, THE
4 COMBINED AMOUNT THAT WAS SOLICITED IN THE COMPANIES' RFPs?

5 A. The Companies elected not to procure additional resources beyond the 1,485 MW of
6 the Selected Wind Facilities based upon the bid economics (see Table 3 above, with
7 the fourth ranked bid having a score of just 70.8), geographic locations, and
8 deliverability relative to the Companies' load. The Companies concluded that 1,485
9 MW provide customers the best combination of price, performance, and risk for all
10 bids received in response to the RFPs.

11 Q. WHAT STEPS DID THE COMPANIES TAKE ONCE THE SELECTED WIND
12 FACILITIES WERE IDENTIFIED?

13 A. Once the Selected Wind Facilities were identified, the Companies: (1) continued with
14 due diligence activities as described by Company witness DeRuntz; (2) released their
15 consulting meteorologist to develop the bottom-up wind energy resource assessment
16 discussed below; and (3) initiated formal contract negotiations.

1 Q. DESCRIBE THE CONTRACT NEGOTIATION ACTIVITIES WITH THE
2 DEVELOPER OF THE SELECTED WIND FACILITIES.

3 A. Upon identification of the Selected Wind Facilities, the Bidders were sent the
4 Companies' Form Purchase and Sale Agreement. The Companies then went through
5 an iterative process of contract negotiations and were successful in negotiating
6 executable PSAs, which are included in EXHIBIT JFG-3, with Traverse, Maverick,
7 and Sundance, all affiliates of Invenergy.

8 Included in the PSAs, the Companies also negotiated a 10-year fixed price Form
9 O&M agreement with an affiliate of Invenergy. The O&M activities and costs for the
10 Selected Wind Facilities are discussed in more detail by Company witness DeRuntz.

11

12 VII. DUE DILIGENCE DURING THE RFP PROCESS

13 Q. WHAT DUE DILIGENCE DID THE COMPANIES UNDERTAKE WITH REGARD
14 TO THE SELECTED WIND FACILITIES?

15 A. The Companies completed a thorough due diligence review of the Selected Wind
16 Facilities including technology, overall project design, land leases, transmission and
17 interconnection, steps taken to qualify the wind facility for at least 80% of the PTC,
18 environmental/wildlife impact assessment, and the expected energy output (MWh). I
19 will discuss the Selected Wind Facilities' expected energy output later in my testimony.
20 Due diligence items are described in more detail in the direct testimony of Company
21 witness DeRuntz.

1 Q. WHAT STEPS DID THE COMPANIES TAKE TO IDENTIFY ANY SIGNIFICANT
2 ISSUES THAT WOULD PREVENT THE DEVELOPMENT OF THE SELECTED
3 WIND FACILITIES?

4 A. The structure of the PSAs that I discuss later in my testimony includes fixed prices
5 payable at Closing and no pre-Closing progress payments. This structure mitigates
6 schedule risk since closing (the actual purchase of the project) does not occur until on
7 or about timely completion of the project. The PSAs also contain additional risk
8 mitigation including pass-through warranties from the wind turbine manufacturer
9 (General Electric), construction vendors, and other equipment suppliers. The
10 development status of the Selected Wind Facilities is on target, assuming timely
11 regulatory approvals, for achieving the expected commercial operation dates for the
12 projects. As discussed in Company witness DeRuntz's testimony, the Companies will
13 continue to provide oversight and monitoring of the Seller's progress to ensure that
14 adequate planning and scheduling processes are in place.

15 Q. WILL THE COMPANIES CONTINUE TO MONITOR THE DEVELOPMENT AND
16 CONSTRUCTION OF THE SELECTED WIND FACILITIES?

17 A. Yes. There are a series of requirements that are detailed in the PSAs. For example, the
18 Companies will monitor the Sellers' progress towards completing all of the
19 environmental assessments. The Sellers are further required to use good faith efforts
20 to site the wind turbine-generators (WTGs) consistent with industry best practices as
21 set forth by U.S. Fish and Wildlife Service Land-Based Wind Energy Guidelines
22 (2012). In accordance with the PSAs, the Sellers are also required to coordinate with

1 AEPSC's Projects and Engineering team as detailed project engineering continues
2 following Commission approvals.

3

4 VIII. WIND ENERGY RESOURCE ANALYSIS

5 Q. PLEASE DESCRIBE THE WIND ENERGY RESOURCE ANALYSIS RFP
6 REQUIREMENT.

7 A. Of the many areas reviewed during the Companies' due diligence process, the expected
8 energy output is one of the most impactful to the Companies' economic analysis. As
9 part of the RFP process, each developer was required to submit, as part of its proposal,
10 an independent assessment of the wind resource and expected energy output (see RFP
11 §3.7 and §9.1.10). The independent analyses were required to include one-year, five-
12 year, 10-year, 20-year and 30-year production forecast estimates for the various
13 probability of exceedance values (P50, P75, P90, P95, and P99).²

14 Q. DID THE COMPANIES VERIFY THE WIND RESOURCE ANALYSES
15 SUBMITTED BY THE BIDDERS?

16 A. Yes. The Companies hired Simon Wind Inc. (Simon Wind), an experienced consulting
17 firm, to (1) independently review wind resource assessments and the expected energy
18 output included in each of the RFP proposals; and (2) develop a wind energy resource
19 assessment (WERA) for each of the Selected Wind Facilities. Please see EXHIBIT
20 JFG-4 for Simon Wind's resume.

² Probability exceedance value (e.g. P90) is the probability (i.e. confidence) that a forecasted value is exceeded. For a P99 forecast, the probability of the forecast being exceeded is 99%.

1 Simon Wind independently reviewed the inputs and methodology used by each
2 of the Bidders' consultants and either confirmed that the conclusions were appropriate
3 or recommended an adjustment to the bidder's expected annual energy output for use
4 in the Companies' Detailed Analysis (RFP §9.2). The results of this Bidders wind
5 resource assessment review are presented in Highly Sensitive Confidential EXHIBIT
6 JFG-5. The adjustments to the Bidder's expected annual energy projection for the
7 proposals ranged from -8.2% to +2.1%.

8 In addition, Simon Wind developed a bottom-up WERA for the Selected Wind
9 Facilities based upon the raw site meteorological data, site layout and air density
10 adjusted turbine power curve correlated to long-term reference meteorological stations
11 in the area. The results of the WERA indicate that on a combined basis, the Selected
12 Wind Facilities are expected to produce 5,724 GWh per year (P50). SWEPCO's share
13 of the generation is expected to be 3,122 GWh per year. The full Simon Wind Energy
14 Resource Assessments for each of the Selected Wind Facilities are available in
15 EXHIBIT JFG-6. The WERA provided the expected energy output assumption for use
16 in the final net revenue requirements and customer savings analysis presented by
17 Company witness Torpey.

18 Q. ARE THE COMPANIES CONFIDENT THAT THE SELECTED WIND
19 FACILITIES WILL ACHIEVE THE EXPECTED ENERGY OUTPUT OVER THE
20 LIVES OF THE FACILITIES?

21 A. Yes. Through their extensive due diligence efforts, by using Simon Wind to 1) validate
22 the Seller's expected energy output; and, 2) subsequently develop a bottom-up wind
23 energy resource assessment, the Companies are confident of the expected energy

1 output. Company witness DeRuntz discusses the engineered design life of the facilities
2 in his testimony.

3
4 IX. SELECTED WIND FACILITIES PSAs

5 Q. PLEASE PROVIDE AN OVERVIEW OF THE PSAs FOR THE SELECTED WIND
6 FACILITIES.

7 A. The Companies entered into three PSAs with affiliates of Invenenergy LLC (Sellers) for
8 the Selected Wind Facilities. The PSAs govern the construction of the Selected Wind
9 Facilities by the Sellers and the Companies' purchase of 100% of the equity interests
10 of each of the project holding companies that own the rights and assets associated with
11 each of the Selected Wind Facilities. The PSAs are presented in Highly Sensitive
12 Confidential EXHIBIT JFG-3. Subject to regulatory approval, SWEPCO and PSO will
13 share the benefit and the cost of the Selected Wind Facilities consistent with their
14 ownership shares of 54.5% and 45.5%, respectively.

15 Q. PLEASE DESCRIBE THE GENERAL TERMS OF THE PSAs.

16 A. The PSAs include the covenants (e.g., development, construction timing, pre-closing
17 activities), representations and warranties, indemnifications, termination rights and
18 conditions precedent (including regulatory approvals) that are typical in such
19 transactions. The PSAs also include details regarding the purchase of the equity
20 interests, pricing, timing of payment by the Companies and the associated conditions
21 precedent for such payment. Finally, the PSAs contain requirements for the provision
22 of project supplier warranties and credit support for same.

1 Q. WHAT IS THE TOTAL PURCHASE PRICE OF THE SELECTED WIND
2 FACILITIES?

3 A. The total purchase price for the Selected Wind Facilities is approximately \$1.86 billion
4 or approximately \$1,253/kW, which includes all costs associated with interconnecting
5 the facilities to the SPP transmission system and any assigned network upgrade costs.
6 The purchase price of each facility is included in the PSAs in Highly Sensitive
7 Confidential EXHIBIT JFG-3. This purchase price does not include associated
8 owner's costs, Allowance for Funds Used During Construction (AFUDC), PSA price
9 adjustments, or any contingency for risk mitigation as further described by Company
10 witness DeRuntz.

11 Q. WHEN IS THE PURCHASE PRICE PAID BY THE COMPANIES TO THE
12 SELLERS?

13 A. The purchase price is payable to the Sellers at Closing of each individual project. Note
14 that there are no pre-Closing progress or other payments. Closing for each individual
15 project will occur when the wind facility has reached Project Substantial Completion
16 or Interim Project Substantial Completion as defined in the PSAs and all Closing
17 conditions precedent provided for in each of the respective PSAs have been satisfied
18 or waived.

19 Q. PLEASE EXPLAIN THE EXPERIENCE AND VALUE THE SELLER HAS AS A
20 RENEWABLE ENERGY DEVELOPER.

21 A. Invenergy LLC affiliates for Traverse, Maverick, and Sundance are the developers and
22 Sellers of the Selected Wind Facilities. Invenergy is North America's largest
23 independent, privately held renewable energy provider and develops, owns, and

1 operates renewable energy facilities worldwide. Invenenergy has successfully developed
2 146 wind, solar, natural gas and storage projects totaling more than 22,600 MW.
3 Invenenergy has developed 13,288 MW of wind energy projects across the Americas,
4 Europe, and Asia, and currently owns and operates almost 4,850 MW of wind
5 generation globally, mostly in North America. Invenenergy has also developed and/or
6 constructed and sold renewable energy projects to various other U.S. utilities including
7 Black Hills Energy, Detroit Edison, Dominion Energy, Liberty Utilities, MidAmerican
8 Energy / Berkshire Hathaway, Oklahoma Gas & Electric Company and Xcel Energy.

9 AEP, through its regulated affiliate Appalachian Power Company, has long-
10 term Renewable Energy Purchase Agreements with Invenenergy for the output from the
11 Beech Ridge I (100 MW) wind farm located in West Virginia, and the Grand Ridge II
12 (51 MW) and Grand Ridge III wind farms (49 MW) located in Illinois. Additionally,
13 AEP through its competitive wholesale affiliate, AEP Renewables, has partnered with
14 affiliates of Invenenergy on two recently repowered wind projects in Texas totaling 310
15 MW and has recently contracted to purchase 75% of Invenenergy's 302 MW Santa Rita
16 East Wind Project in west Texas.

17 Q. ARE THERE STATE COMMISSION REGULATORY APPROVAL
18 REQUIREMENTS IN THE PSAs?

19 A. Yes. The Companies' purchase obligations are conditioned on regulatory approval by
20 the Commissions in Texas, Arkansas, Louisiana, and Oklahoma, although it is possible
21 that some or all of the transactions may proceed even if one or more regulatory
22 approvals is not received as discussed by Company witness Brice. Company witness

1 Brice discusses the regulatory approvals and the timing needed to ensure the PTC
2 benefits for the projects.

3 Q. WHAT IS THE NOTICE TO PROCEED PROVISION OF THE PSAs?

4 A. A Notice to Proceed (NTP) is issued to the Seller after certain Buyer (Company)
5 conditions precedent or requirements have been satisfied. The NTP gives each of the
6 PSA counterparties a signal to advance construction activities into the major
7 construction phase of the wind facility and commits the Companies to future payment
8 and receipt of the projects once each of the projects are completed subject to certain
9 closing conditions. The NTP date for the PSAs is August 15, 2020.

10 Q. WHAT ARE THE CONDITIONS PRECEDENT FOR THE NTP?

11 A. The conditions precedent required prior to the NTP issuance consist of a variety of
12 obligations for the Companies and each of the Sellers. The major requirements include,
13 but are not limited to, the following:

- 14 • The issuance of state regulatory approvals acceptable to SWEPCO
15 and PSO;
- 16 • All major project contracts shall have been executed and in full force
17 and in effect;
- 18 • The Companies received an updated wind report and mechanical
19 loads analysis (MLA) from the Seller's turbine supplier, as necessary;

20 Q. DO THE PSAs CONTAIN TERMS IN REGARDS TO SCALABILITY AND
21 MINIMUM CAPACITY?

22 A. Yes. Per Section 3.18 of the PSAs, the Company has the right prior to the NTP date to
23 reduce the Selected Wind Facilities' nameplate capacity to the contractual aggregate
24 minimum of 810 MW (Traverse). This provision provides the Companies with

1 flexibility to ensure that their purchase of the Selected Wind Facilities is approximately
2 sized to align with regulatory approvals and to maximize customer benefits.

3 Q. PLEASE SUMMARIZE THE CLOSING PROCESS AS DESCRIBED IN THE PSAs.

4 A. The closing of each PSA will occur when certain closing conditions have been met by
5 each of the Sellers or waived. The closing conditions in the PSAs include, but are not
6 limited to, the Sellers having:

- 7 • Achieved Project Substantial Completion;
- 8 • Obtained, or have caused their respective project entity to obtain, all
9 permits;
- 10 • Confirmed the representations and warranties are true and correct in
11 all material respects; and
- 12 • Met the other closing conditions as set forth in the PSAs including
13 matters related to Real Property, required Consents, required
14 Estoppels, and that all construction loans have either been paid off or
15 retired.

16 Q. PLEASE DESCRIBE THE TERMINATION RIGHTS INCLUDED IN THE
17 PSAs.

18 A. The Companies have the right to terminate the PSA's if timely regulatory approvals
19 are not obtained or closing conditions have not been met.

20

21 X. OTHER ITEMS

22 Q. WHAT WILL BE THE COMPANIES' APPROACH TOWARDS OPERATING AND
23 MAINTAINING THE SELECTED WIND FACILITIES?

24 A. As discussed earlier, the Companies are entering into a fixed price 10-year Form O&M
25 agreement with Invenergy Services, an experienced operations and maintenance
26 service provider, and an affiliate of Invenergy LLC. The third-party O&M service

1 provider will conduct the day-to-day operations, routine maintenance and performance
2 monitoring of each project. In addition, Invenergy Services will be responsible for
3 remote operations of the projects to comply with SPP operations instructions. AEPSC,
4 on behalf of the Companies, will be the SPP Market Participant responsible for
5 activities such as day-ahead forecasting, scheduling and SPP settlement activities. The
6 O&M activities and budget for the costs for maintaining the assets for the life of the
7 Selected Wind Facilities are discussed in more detail in the testimony of Company
8 witness DeRuntz.

9 Q. PLEASE DESCRIBE THE STATUS OF THE LAND LEASES NEEDED TO
10 CONSTRUCT THE WIND FACILITIES.

11 A. A significant portion of the wind farm land leases that cover the lands needed for the
12 various projects have been executed. Securing the remaining land still needs to be
13 completed over the next two years. The terms of the land leases in each of the three
14 projects are substantially similar. The Sellers will each assign the leases to the Project
15 Company prior to NTP. The Companies will ultimately acquire the leases at closing
16 when the Selected Wind Facilities are completed.

17 Q. PLEASE DESCRIBE ANY END OF LIFE LEASE OBLIGATIONS FOR THE WIND
18 FACILITIES.

19 A. It is not uncommon for wind projects similar to the proposed facilities to be a viable
20 energy option beyond the 30-year design life. In the event that the wind facilities are
21 not repowered, they will need to be dismantled as defined in the land lease agreements.
22 Estimates of these dismantling costs have been included in the economic analysis of
23 Company witness Torpey and are also discussed by Company witness DeRuntz.

1 Q. BASED ON YOUR EXPERIENCE AND EXPERTISE WITH RECENT WIND
2 PURCHASE EVALUATIONS, ARE THE PSAs FOR THE PURCHASE OF THE
3 SELECTED WIND FACILITIES REASONABLE AND CONSISTENT WITH
4 INDUSTRY PRACTICE?

5 A. Yes.

6 Q. DO THE PSAs PROVIDE REASONABLE ASSURANCE OF THE COSTS
7 ASSOCIATED WITH THE PROJECTS?

8 A. Yes. The PSAs contains terms, covenants, and price provisions for reasonable
9 assurance of the costs for the Selected Wind Facilities.

10

11 XI. CONCLUSION

12 Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

13 A. Yes, it does.



American Electric Power Service Corporation
as agent for
Southwestern Electric Power Company

**Request for Proposals for up to 1,200 MW
of Wind Energy Resources**

RFP Issue Date: January 7, 2019

RFP Proposals Due: March 1, 2019

RFP Web Address: www.swepco.com/rfp

Revision 1 (01/22/19)

2019 SWEPCO Wind
Energy Resources RFP



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1. Introduction

American Electric Power Service Corporation ("AEPSC") and Southwestern Electric Power Company ("SWEPCO" or the "Company") are subsidiaries of American Electric Power Company, Inc. ("AEP"). AEPSC is administering this Request for Proposals ("RFP") on behalf of SWEPCO who is seeking competitively priced wind energy resources solely on a turnkey basis through its acquisition of the ownership interests in one or more wind projects totaling up to 1,200 MW. Projects must have a 100 MW minimum nameplate capacity that are either currently in commercial operation or that will achieve commercial operation by December 15, 2021 (each a "Project" and collectively the ("Projects"), all as further described in this RFP. Affiliates of the Company will not participate as Bidders in this RFP.

Contemporaneous with this RFP, AEPSC is administering a Request for Proposals on behalf of Public Service Company of Oklahoma ("PSO") (such RFP, the "PSO RFP") who is seeking the same wind energy resources in the same geographical area as SWEPCO in this RFP through the acquisition of one or more wind projects. SWEPCO and PSO are affiliates and anticipate that one or more of the wind projects for which they are seeking proposals through their respective RFPs may be jointly owned by them as further described in Section 2.6.

A Bidder that submits a Proposal in response to this RFP will also be required to submit an identical proposal in response to the PSO RFP.

AEP is one of the largest electric utilities in the United States, delivering electricity and custom energy solutions to nearly 5.4 million regulated retail customers in 11 states. AEP owns the nation's largest electricity transmission system, a more than 40,000-mile network that includes more 765-kilovolt extra-high voltage transmission lines than all other U.S. transmission systems combined. AEP also operates 224,000 miles of distribution lines. AEP ranks among the nation's largest generators of electricity, owning approximately 26,000 megawatts of generating capacity in the U.S. AEP also supplies approximately 4,300 megawatts of renewable energy to customers. AEP's utility units operate as AEP Ohio, AEP Texas, Appalachian Power (in Virginia and West Virginia), AEP Appalachian Power (in Tennessee), Indiana Michigan Power, Kentucky Power, PSO and SWEPCO (in Arkansas, Louisiana and east Texas). AEP's headquarters is in Columbus, Ohio. More information about AEP can be accessed by visiting www.aep.com.

SWEPCO serves 535,000 customers in northwestern and central Louisiana, western Arkansas, East Texas and the panhandle of North Texas. Its headquarters is in Shreveport, with regulatory and external affairs offices in Shreveport and Baton Rouge, Louisiana, Little Rock, Arkansas, and Austin, Texas.

SWEPCO has 5,240 MW of generating capacity and has executed long-term renewable energy purchase agreements ("REPA") with wind generation resources totaling 469 MW. In addition, SWEPCO has over 4,000 miles of transmission and 25,000 miles of distribution lines. Additional information regarding SWEPCo can be accessed by visiting www.SWEPCO.com.



2. RFP Overview

- 2.1. Additional Wind Resources. As identified by the results of the Company's most recent Integrated Resource Plan which was filed in December 2018 with the Arkansas Public Service Commission in Case No. 07-011-U and its draft Integrated Resource Plan filed with the Louisiana Public Service Commission in Case # I-34715, additional wind resources continue to be determined by the Company to be a selected economic resource for addition to its generation portfolio. The Company's latest IRP shows a need for up to 1,200 MW of wind generation, with 600 MW to be added by 2022, and an additional 600 MW to be added by 2023.
- 2.2. Project Acquisition and Ownership. SWEPCO is only seeking Projects on a turnkey basis in which it individually, or together with PSO, will acquire all of the equity interests in the project company whose assets are comprised solely of the Project. Proposals that do not meet these criteria, including proposals for renewable energy power purchase agreements, will not be considered by the Company.
- 2.3. Project Location. The Company is seeking Projects that are physically located in, and interconnected to, the SPP in Arkansas, Louisiana, Texas or Oklahoma and (a) that are not currently experiencing, or anticipated by the Company to experience, significant congestion or deliverability constraints which are likely to result in adverse Project economics and (b) which balance (i) Project performance and (ii) deliverability to the AEP West load zone in the Tulsa area via a potential generation-tie line that may be constructed by the Company in the future to avoid or alleviate anticipated transmission congestion, if necessary.
- 2.4. PTC Value. The Company is seeking Projects that are either in service or that will be placed in service by December 15, 2021, and which will qualify for at least 80% of the federal Production Tax Credit ("PTC").
- 2.5. Timing. The time period between the receipt of Proposals and the time required for the Company's evaluation, due diligence, negotiation and the execution of definitive agreements is anticipated to be five months (see Section 6.1). The Company anticipates filing for regulatory approval in each of its operating jurisdictions (Louisiana, Arkansas and Texas) in Q3-2019 and receiving regulatory approvals by Q3-2020. Due to these timing considerations and the deadline for 80% PTC qualification, only Proposals conforming to the requirements of this RFP will be accepted by the Company for evaluation.
- 2.6. Co-Owned Projects. As described in Section 1 - Introduction, SWEPCO and PSO are conducting contemporaneous RFPs for the same wind resources in the same geographic area. A Bidder that submits a Proposal in response to this RFP is required to submit an identical proposal in response to the PSO RFP. The PSO



RFP contains a reciprocal proposal submission requirement for the SWEPCO RFP. SWEPCO and PSO anticipate selecting the same Projects through their respective RFP processes and jointly acquiring the selected Projects if they obtain their respective state regulatory approvals for the selected projects. However, SWEPCO reserves the right to proceed with any Project if it does not receive all of its state regulatory approvals as described in Section 2.8 or if PSO does not receive state regulatory approval.

- 2.7. Wind Turbines (New Technology). The Company anticipates that Bidders of new Projects will collaborate with the three major wind turbine suppliers (GE, Vestas and Siemens-Gamesa) to bring new wind turbine project solutions (higher output, improved technology, lower pricing and lower operating and maintenance expenses) that offer cost advantages over their wind projects and which are in commercial operation by December 15, 2021 (the "Commercial Operation Deadline").
- 2.8. Regulatory Approvals. The Company's decisions regarding the results of this RFP will be subject to its receipt of regulatory approvals from the Arkansas Public Service Commission, the Louisiana Public Service Commission and the Public Utility Commission of Texas and the Federal Energy Regulatory Commission. Definitive agreements between the Company and Bidders for selected Projects will be conditioned upon (a) the Company receiving the regulatory approvals described in the preceding sentence that are in form and substance satisfactory to the Company in its sole discretion and (b) PSO receiving its regulatory approvals for the same projects.
- 2.9. Notice to Proceed. Upon obtaining regulatory approvals for the Projects selected by the Company as described in Section 2.8, the Company would issue a notice to proceed ("NTP") for the Bidders to proceed with the construction of selected Projects that are not already in commercial operation. The Purchase Sale Agreement (PSA) Term Sheet (Appendix D) contains additional information regarding the conditions and timing for NTP issuance. The Company may issue NTP for selected Projects that it prefers over other selected Projects if some, but not all, of its or PSO's regulatory approvals are received.
- 2.10. Reservation of Rights. The Company reserves the right, without qualification, to select or reject any or all Proposals and to waive any formality, technicality, requirement, or irregularity in the Proposals. In addition, the Company reserves the right to utilize a Bidder's completed Appendices and any supplemental information submitted by the Bidder in any its regulatory filings.
- 2.11. Non-Binding. This RFP is not a commitment by the Company to acquire any Project and it does not bind the Company or its affiliates in any manner. The Company in its sole discretion will determine which Bidders, if any, it wishes to



engage in negotiations with that may lead to definitive agreements for the acquisition of a selected Project.

- 2.12. RFP Questions. All questions regarding this RFP should be submitted by email. Questions and answers that are determined to be pertinent to Bidders will be posted to the RFP webpage. Questions should be submitted to:

SWEPCOWindRFP2019@aeep.com

3. Project Description and Requirements

- 3.1. Completed Project. Each Project must be a complete, commercially operable, integrated wind-powered electric generating plant, including all facilities that are necessary to generate and deliver energy into SPP by the Commercial Operation Deadline.
- 3.2. Project Location. All Projects must be physically located in, and interconnected to, the SPP in Arkansas, Louisiana, Texas or Oklahoma.
- 3.3. Minimum Project Size. Each Project must have a minimum nameplate rating of 100 MW.
- 3.4. Interconnection. Each Project must be interconnected to the SPP with the demonstrated ability to achieve commercial operation of the Project by the Commercial Operation Deadline.
- 3.5. Existing Projects. Bidders may submit Proposals for wind projects that either are already in service or that are an expansion of an existing Project provided that such expansion has separate metering and a metering protocol that is acceptable to the Company.
- 3.6. PTC Qualification. Each Project must qualify for at least 80% of the PTC in accordance with Section 45 of the Internal Revenue Code of 1986, as amended.
- 3.7. Wind Resource Analysis/Study. Each Project must have a robust wind resource analysis/study prepared by an independent consultant which shows the expected energy output from the Project utilizing the turbines that will be used for the Project. Such analysis should include P50, P75, P90, P95 and P99 output with 1-year, 5-year, 10-year, 20-year and 30-year estimates. During the Company's evaluation process, Bidders will be required to provide additional site information including raw meteorological data to the Company for use by the Company's independent consultant.
- 3.8. Turbine Specific Site Suitability Report. Each Project must have a Turbine Specific Site Suitability Report from the turbine manufacturer.



GE: Mechanical Load Analysis (MLA)
Siemens: Site Assessment Report (SAR)
Vestas: Wind Power Plant Assessment (WPPA)

- 3.9. AEP Wind Generation Facility Standards. Each Project must satisfy the AEP Wind Generation Facility Standards (see Appendix E). The AEP Wind Generation Facility Standards (Appendix E) includes the following:

- 3.9.1. Wind Farm Technical Specification and Design Criteria (GEN-4560), and
- 3.9.2. Wind Facility – O&M Building Specification and Design Criteria (GEN-4561).

- 3.10. AEP Requirements for Connection of Facilities. Project substation and interconnection facilities must conform to the AEP Requirements for Connection of Facilities (Appendix F). These requirements also apply to New Facilities interconnecting to non-AEP utilities and are in addition to any requirements of the non-AEP transmission service provider. Projects with substations and interconnection line facilities operating at voltages above 100 kV shall provide sufficient design information, including but not limited to electrical, mechanical and civil design criteria and major material manufacturers (See Appendix A-2, "Generation Collection System" for additional details).

4. Bid Price and Structure

- 4.1. Proposal pricing must be for the Company's acquisition of a turnkey Project that is complete, commercially operable, integrated wind-powered electric generating plant designed for a minimum of a 30-year life; including, but not limited to, wind turbine generators, balance of plant equipment, operations and maintenance ("O&M") facilities, SCADA and all facilities required to deliver energy into SPP. In addition, pricing must include costs associated with ALTA/title insurance and construction financing.
- 4.2. In addition to Section 4.1, Proposal pricing must include the costs associated with the following:
 - 4.2.1. a minimum of two-year comprehensive warranty from a creditworthy entity for all non-turbine balance of plant equipment including design, labor and materials, and fitness for purpose;
 - 4.2.2. post-commercial operation power curve testing activities and associated costs, including the installation and removal of any temporary test met towers; and



4.2.3. transmission and interconnection facilities required for the Project, including system or network upgrades, as required by SPP for the Project to interconnect to SPP.

4.3. Projects should be proposed at both (a) maximum nameplate rating and (b) if possible, in 50-100 MW increments above the 100 MW minimum and up to maximum nameplate rating.

5. Interconnection/Delivery Point

5.1. The Proposal must identify the Project's proposed transmission interconnection point(s) within SPP, including any studies, applications, line extensions and system upgrades identified as part of the interconnection approval process.

5.2. The Bidder is responsible during Project start-up period for following the established SPP, NERC, and transmission operator policies and procedures that are in effect regarding facility interconnection and operation associated with a utility's transmission system.

5.3. Each Project must have a completed SPP System Impact Study with the demonstrated ability to achieve commercial operation of any interconnection for the full output of the Project by the Commercial Operation Deadline. An electronic copy of all completed SPP studies must be included with Bidder's Proposal.

6. RFP Schedule and Proposal Submission

6.1. The following schedule and deadlines apply to this RFP. The Company reserves the right to revise this schedule at any time in its sole discretion.

RFP Timeline	
Draft RFP Filed with LPSC	October 30, 2018
Bidders Technical Conference	December 10, 2018
RFP Issued	January 7, 2019
Notice of Intent	January 30, 2019
Q&A Deadline	February 22, 2019
Proposal Due Date	March 1, 2019
Final Project Selection and Negotiation	March – July, 2019
Execute Definitive Agreements	July 30, 2019
File for Regulatory Approvals	August 1, 2019
Required Regulatory Approvals	No later than August 1, 2020
Notice to Proceed	No later than August 15, 2020
Commercial Operation Date	No later than December 15, 2021



- 6.2. By the Notice of Intent date, Bidders should send a written notice to SWEPCO via email at SWEPCOWindRFP2019@aep.com indicating their intention to submit a Proposal and describing (a) the Project size and location and (b) the SPP interconnection location and the SPP queue unique identifier for the interconnection request.
- 6.3. Bidders may execute a Confidentiality Agreement with SWEPCO prior to the submission of their Proposals. Bidders should request the Confidentiality Agreement from SWEPCO via email at SWEPCOWindRFP2019@aep.com.
- 6.4. Proposals must be complete in all material respects and be received no later than 4:00 p.m. EST on the Proposal Due Date at AEPSC's Columbus, Ohio location as defined in Section 7 of this RFP.
- 6.5. The Company reserves the right to solicit additional information or Proposals and the right to request additional information from Bidders during the Proposal evaluation process.
- 6.6. Proposals and bid pricing must be valid for at least 180 days after the Proposal Due Date at which time Proposals shall expire unless the Bidder has been notified that its Proposal has been included in Final Project Selection.
- 6.7. A Proposal should be as comprehensive as possible to enable the Company to make a definitive and final evaluation of the Proposal's benefits to its customers without further contact with the Bidder.

7. Proposal Submittal

Two hard copies and two electronic thumb drive copies of the Bidder's Proposal shall be submitted by the Proposal Due Date to:

American Electric Power Service Corporation
Attn: SWEPCO Wind Energy 2019 RFP Manager
1 Riverside Plaza (14th Floor)
Columbus, OH 43215

8. Proposal Content

- 8.1. New Build Projects. Bidders must submit the following information for Proposals for new Projects or expansion of existing projects. All electronic versions of the Appendices shall be individual files.
 - 8.1.1. A completed Appendix I (Proposal Content Check Sheet).



- 8.1.2. An executive summary of the Project's characteristics and timeline, including any unique aspects and benefits.
- 8.1.3. Summary documentation demonstrating the Project will qualify for at least 80% of the PTCs under Section 45 of the Internal Revenue Code of 1986, as amended.
- 8.1.4. A completed Appendix A (Wind Project Summary).
- 8.1.5. Detailed information regarding the turbine manufacturer's warranty offering including parts and labor coverage, warranted turbine availability levels, power curve warranty, liquidated damages and other key terms.
- 8.1.6. The identity of all persons and entities that have a direct or indirect ownership interest in the Project.
- 8.1.7. A completed Appendix B (Bidder's Credit-Related Information).
- 8.1.8. A completed Appendix C (Bidder Profile). Bidders must provide a general description of its (including its affiliates) background and experience in the development and construction of at least three large-scale wind projects similar to the Projects sought by the Company in this RFP. In addition, Bidders should provide at least three third-party references for such projects.
- 8.1.9. Any exceptions to the terms and conditions contained in the PSA Term Sheet (Appendix D).
- 8.1.10. Any exceptions to the AEP Wind Generation Facility Standards (Appendix E).
- 8.1.11. Any exceptions to AEP Requirements for Connection of Facilities (Appendix F)
- 8.1.12. Expected land lease payments and property tax costs over a 30-year period.
- 8.1.13. OPTIONAL: Bidders may provide a separate O&M services proposal for a full 10-year warranty from the Project's turbine manufacturer (Appendix H).
- 8.2. Existing Projects: In addition to the information required in Section 8.1, Bidders must submit the following information for Proposals for existing Projects:
 - 8.2.1. Audited financial statements (two years, last quarterly-unaudited) and FERC Form 1 if applicable.



- 8.2.2. Documentation supporting PTC qualification and remaining PTC life including any supporting documentation.
- 8.2.3. Historical production data (annual MWh) from initial commercial operation date through July 1, 2018.
- 8.2.4. Hourly production (MWh) for the period January 1, 2016 through July 1, 2018.
- 8.2.5. Historical operations and maintenance expenses for the period from commercial operation through July 1, 2018.
- 8.2.6. Forecasted operations and maintenance costs for the period from January 1, 2019 through the end of the expected life of the asset.
- 8.2.7. A summary of all outages for the period of January 1, 2013 through July 1, 2018, including the reasons for such outages.
- 8.2.8. A summary of all turbine and balance of plant warranty issues experienced to date.
- 8.2.9. Forecasted annual production of the facility for the remainder of the facility's design life.
- 8.2.10. Independent report from a nationally recognized third party engineering consultant (e.g. DNV-GL, UL (AWS Truepower), Black & Veatch, Leidos, or their equivalents) that will include 1) confirmation that the information provided in Sections 8.2.3 – 8.2.9 is accurate and 2) a summary of the facility's condition, remaining useful life and any known or anticipated reliability issues with the Project.

9. RFP Proposal Evaluation

The evaluation process will be conducted in three phases:

- Section 9.1 Eligibility and Threshold Requirements
- Section 9.2 Detailed Analysis
- Section 9.3 Final Project Selection

- 9.1. Eligibility and Threshold Requirements. A preliminary screening of each Proposal will be undertaken by the Company to determine if the Proposal is eligible to proceed to the Detailed Analysis phase. Bidders and their associated Proposals Projects must satisfy the following Eligibility and Threshold Requirements:



- 9.1.1. the Project must be physically located in, and interconnected to the SPP, in Arkansas, Louisiana, Texas or Oklahoma;
- 9.1.2. the Bidder must have submitted an identical proposal in the PSO RFP;
- 9.1.3. the Project will qualify for at least 80% of the PTC;
- 9.1.4. the Project must be interconnected to SPP and have a completed System Impact Study which remains active in the SPP queue process with the demonstrated ability to achieve commercial operation of any interconnection for the full output of the Project by the Commercial Operation Deadline;
- 9.1.5. the turbines for the Project must be manufactured by GE, Vestas or Siemens-Gamesa;
- 9.1.6. the Bidder must have completed the development, construction, financing, and commissioning of a similar-sized wind project in the United States or Canada and/or otherwise have demonstrated appropriate experience;
- 9.1.7. the Project's minimum name-plate rating is 100 MW;
- 9.1.8. the Bidder has substantial Project site control;
- 9.1.9. the Project must be capable of achieving commercial operation by the Commercial Operation Deadline (December 15, 2021);
- 9.1.10. the Bidder must include an independent wind report as required in Section 3.7;
- 9.1.11. the Bidder must include the Turbine Specific Site Suitability Report as required in Section 3.8;
- 9.1.12. the Project must not be located in an area in which deliverability is determined by the Company to be either severely limited or non-deliverable to the AEP West load zone, based upon (a) its analysis of various groupings of Proposals of dependence on existing transmission lines as determined through a current distribution factor method ("DFAX")¹ analysis performed by the Company, and (b) a First Contingency Incremental Transfer Capability ("FCITC")² analysis performed by the Company on each area;

¹ DFAX analysis is an analysis of each generator to determine individual responses to transmission lines across SPP. Based on the response factors, generators will be aggregated into generator clusters

² A FCITC analysis is an analysis on the generator clusters which Bidders plan to interconnect which will measure the amount which could



- 9.1.13. the Project, and a potential generation-tie line that may be constructed by the Company in the future to avoid or alleviate anticipated transmission congestion, if necessary, must be constructible taking into account (a) the impact on wildlife, the environment and identified cultural resources, (b) its location on or proximity to tribal or government lands and (c) other factors that would materially impact Project constructability; and
- 9.1.14. the Bidder's exceptions to the PSA Term Sheet, considered individually or in the aggregate, are minimally acceptable to the Company as a basis for further discussions.

The Company reserves the right to reject any Proposal which proceeded to the Detailed Analysis phase but which is subsequently determined by the Company not to satisfy the Eligibility and Threshold Requirements.

9.2. Detailed Analysis. Proposals meeting the Eligibility and Threshold Requirements in Section 9.1 will move to the Detailed Analysis phase which is comprised of the Economic Analysis and the Non-Price Factor Analysis set forth below. The Economic Analysis will constitute 90% and the Non-Price Factor Analysis 10% of the overall evaluated value of each Proposal.

9.2.1. Economic Analysis. The Economic Analysis will result in a Levelized Net Revenue Requirement, which will constitute 90% of the overall evaluated value of the Proposal in its Final Project Selection. The Levelized Net Revenue Requirement will be calculated as follows:

9.2.1.1. The Company will first determine a Levelized Adjusted Cost of Energy ("LACOE") by adding together (a) the Levelized Cost of Energy ("LCOE") associated with each Proposal as calculated by the Company and (b) the value of Transmission Congestion as determined by the Company's Transmission Congestion Screening Analysis. The Transmission Congestion Screening Analysis will evaluate (a) cost of transmission congestion and losses to the AEP West load zone using PROMOD and (b) the risk-adjusted cost effectiveness of various Project groupings including the cost of mitigating potential future congestion.

9.2.1.2. The Company will then calculate the Levelized Net Revenue Requirement by taking the difference between (a) the levelized expected SPP revenues for the Proposal's energy in the SPP market and (b) the LACOE for each Proposal.

be transferred from the Bidder's interconnection area to the AEP West load zone while ensuring that the system is operated respecting operating limits that will not be exceeded in the event of certain outages (or contingency)



9.2.2. Non-Price Factor Analysis. The Non-Price Factor Analysis, which will constitute 10% of the overall evaluated value of the Proposal will be comprised of the following factors:

- 9.2.2.1. the Project's, including associated transmission and interconnection facilities, impact on wildlife, the environment and identified cultural resources;
- 9.2.2.2. the Project's, including associated transmission and interconnection facilities, location on or proximity to tribal or government lands;
- 9.2.2.3. the Bidder's exceptions to the AEP Wind Generation Facility Standards (Appendix E);
- 9.2.2.4. the Bidder's exceptions to the AEP Requirements for Connection of Facilities (Appendix F);
- 9.2.2.5. the Bidder's exceptions to the PSA Term Sheet (Appendix D);
- 9.2.2.6. if applicable, the scope and terms of the O&M services proposal described in Section 8.1.12;
- 9.2.2.7. the development status of the Project including, but not limited to, permitting, transmission and interconnection facilities;
- 9.2.2.8. the operating history of other similar wind generation facilities that were developed and constructed by the Bidder or its affiliates; and
- 9.2.2.9. the credentials of the Bidder's independent consultant who prepared the Wind Resource Analysis/Study (Appendix G) for the Project as described in Section 3.7.

9.3. Final Project Selection. Based upon the results of the Economic Analysis and the Non-Price Factor Analysis described above, the Company will determine which Projects will be included in the final selection. The Company will notify Bidders whether or not their Proposal has been selected and negotiation of definitive agreements will commence with Bidders whose Proposals have been selected.

10. Confidentiality

The Company will take reasonable precautions and use reasonable efforts to maintain the confidentiality of the Proposals. Bidders should clearly identify each page of



information considered to be confidential or proprietary. The Company reserves the right to release any Proposals to agents or consultants for purposes of Proposal evaluation. The Company's disclosure policies and standards will be binding upon its agents and consultants. Regardless of such confidentiality, all such information may be subject to review by the appropriate state authority or any other governmental authority or judicial body with jurisdiction relating to these matters and may be subject to legal discovery. Under such circumstances, the Company will make all reasonable efforts to protect Bidder's confidential information.

11. Bidder's Responsibilities

- 11.1. It is the Bidder's responsibility to comply with the deadlines specified in this RFP.
- 11.2. Bidders are responsible for the timely completion of the Project by the Commercial Operation Deadline and are required to submit proof of their financial and technical wherewithal to ensure the successful completion of the Project.
- 11.3. Bidders are responsible for costs incurred by them in the preparation of their Proposal.

12. Reservation of Rights

A Proposal will be deemed accepted only when the Company and the successful Bidder have executed definitive agreements for the Company's acquisition of the Project. The Company has no obligation to accept any Proposal, whether or not the stated price in such Proposal is the lowest price offered, and the Company may reject any Proposal in its sole discretion and without any obligation to disclose the reason or reasons for rejection.

BY PARTICIPATING IN THE RFP PROCESS, EACH BIDDER AGREES THAT ANY AND ALL INFORMATION FURNISHED BY OR ON BEHALF OF THE COMPANY IN CONNECTION WITH THE RFP IS PROVIDED WITHOUT ANY REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, AS TO THE USEFULNESS, ACCURACY, OR COMPLETENESS OF SUCH INFORMATION, AND NEITHER THE COMPANY NOR ITS AFFILIATES NOR ANY OF THEIR PERSONNEL OR REPRESENTATIVES SHALL HAVE ANY LIABILITY TO ANY BIDDER OR ITS PERSONNEL OR REPRESENTATIVES RELATING TO OR ARISING FROM THE USE OF OR RELIANCE UPON ANY SUCH INFORMATION OR ANY ERRORS OR OMISSIONS THEREIN.

The Company reserves the right to modify or withdraw this RFP, to negotiate with any and all qualified Bidders to resolve any and all technical or contractual issues, or to reject any or all Proposals and to terminate negotiations with any Bidder at any time in its sole



discretion. The Company reserves the right, at any time and from time to time, without prior notice and without specifying any reason and, in its sole discretion, to (a) cancel, modify or withdraw this RFP, reject any and all Proposals, and terminate negotiations at any time during the RFP process; (b) discuss with a Bidder and its advisors the terms of any Proposal and obtain clarification from the Bidder and its advisors concerning the Proposal; (c) consider all Proposals to be the property of the Company, subject to the provisions of this RFP relating to confidentiality and any confidentiality agreement executed in connection with this RFP, and destroy or archive any information or materials developed by or submitted to the Company in this RFP; (d) request from a Bidder information that is not explicitly detailed in this RFP, but which may be useful for evaluation of that Bidder's Proposal; (e) determine which Proposals to accept, favor, pursue or reject; (f) reject any Proposals that are not complete or contain irregularities, or waive irregularities in any Proposal that is submitted; (g) accept Proposals that do not provide the lowest evaluated cost; (h) determine which Bidders are allowed to participate in the RFP, including disqualifying a Bidder due to a change in the qualifications of the Bidder or in the event that the Company determines that the Bidder's participation in the RFP has failed to conform to the requirements of the RFP; (i) conduct negotiations with any or all Bidders or other persons or with no Bidders or other persons; and (j) execute one or more definitive agreements with any Bidder.

13. Contacts

All correspondence and questions regarding this RFP should be directed to:

SWEPCOWindRFP2019@aep.com

Appendix A Wind Project Summary

Company Information

Bidder (Company):		
Contact Name (Title):		
Address:		
City:	State:	Zip Code:
Work Phone:	Cell Phone:	
Email Address:		
Is the Proposal being submitted through a partnership, joint venture, consortium, or other association? <u> </u> If so, please identify all partners, joint ventures, members, or other		

General Project Information

Project Name:	
Project Location: [] County, []	
Bidder submitted same proposal and pricing into the PSO RFP	(Y/N):
Percentage of Federal Production Tax Credit that the Project will qualify for:	%
Turbine Specific Site Suitability Report completed & included in proposal?	(Y/N):
Bidder confirms that it has substantial Project site control	(Y/N):
Independent wind report / analysis completed and included in proposal?	(Y/N):
Source of wind energy forecast:	
SPP Queue #:	SPP Study Status:

Proposal Bid Pricing¹

Size, MW	Expected COD by	Turbine Manufacturer	Bid Price (\$)
	12/15/2021		
	12/15/2021		

Note 1: Optional size(s) provided cannot be contingent on Bidder selling the remaining portion of the Project to another party via a sale of a portion of the project company or a power purchase agreement.

The table below shall be replicated for each size option listed above.

Turbine Manufacturer Options¹

Turbine Manufacturer	GE	Siemens/Gamesa	Vestas
Nameplate (MW)			
# of Turbines			
Model #			
Expected Capacity Factor (%)			
Expected Annual Energy (MWh)			
Year 1 Capacity Factor (%) ²			
Year 1 Expected Annual Energy ²			

Note 1: Bidder is required to identify the Turbine Manufacturer and associated data above for their bid.
The additional columns are available IF multiple turbine manufacturers are available.

Note 2: Year 1 production data is required to account for potential lower Year 1 production due to routine maintenance associated with the break-in period.

Bidder MUST include a Turbine Specific Site Suitability Report with its proposal.

Interconnection and Point of Delivery

SPP Queue #:	Substation Name / Voltage:
System Impact Study Complete (Y/N):	System Impact Study Report Date:
Feasibility Study Complete (Y/N):	Feasibility Study Report Date:
Point of Interconnection with :	
SPP Interconnection Status (describe):	
Attach electronic copies of all interconnection studies and/or the expected completion date(s).	

Generation Collector System

Proposals for Projects with substations and interconnection line facilities that operate at voltages above 100 kV as part of a generation collector system shall provide sufficient design information for the electrical, mechanical, and civil design and any associated design criteria and major manufacturers used for these facilities. At a minimum, this shall include design criteria on items such as lightning performance, insulation design, grounding design and conductor motion. In addition, any structural, foundation and clearance criteria that will be incorporated beyond the levels outlined in NESC, IEEE or other applicable standards and code, as well as any associated material design specifications, shall be identified in the proposal response. All designs should include cascading containment and allow for future live line maintenance. SWEPCO reserves the right to review all manufacturers to ensure alignment with its approved major suppliers.

Wind Projects Completed

Provide a summary of all wind projects (> 100 MW) that Bidder has successfully developed and completed in the United States or Canada. For each project, describe the Bidder's specific role in the project.

[illegible]

Site Information / Permits

Site Legal Description:		
Address:		
City:	State:	Zip Code:
County	Longitude:	Latitude:
Site Control (lease, own, site purchase pending, etc.):		
Site Acres:		
Is there potential for expansion (Y / N):	If Yes; acres available:	

Preliminary Site Questions¹ (Y / N)

Has the site been assessed for any environmental contamination? Describe any known environmental issues. If necessary, please describe on a separate attachments	
Are there any Tribal Lands or Tribal mineral ownership rights within Project boundary or vicinity?	
Is Bidder adhering to the United States Fish & Wildlife Service Land-Based Wind Energy Guidelines?	
Are there any Federally or State owned or controlled lands within Project boundary or vicinity?	
Has TNC, WAFWA or any other non-governmental organizations been engaged?	
Are there CRP, WRP or other conservation easements within the Project boundary or vicinity?	

Attachments Required

- **Site Layout:** Attach a diagram identifying anticipated placement of major equipment and other project facilities, including transmission layouts and Point of Delivery.
- **Leases:** Attach (electronic version only) a copy of all leases, easements or other ownership documentation.
- **Permit Matrix:** Attach a comprehensive permit matrix and status of all required permits, including, but not limited to Federal (USF&W, FAA), State, County, City, etc.
- **Environmental Report Summary:** The initial Proposals shall include a summary of all environmental and other reports associated with the site. (See Note 1 for reports to summarize)
- **Decommissioning Studies:** Attach copies of any completed decommissioning studies.

Note 1: As applicable, the following reports will be requested: Tier I / II Site Characterization Report, Environmental Work / Survey Plan, Bat Acoustic Survey Report, Avian Use Survey Report, Raptor Nest Survey Report, Prey-base Survey Report, Wetland, Waters and Playa Survey / Assessment Report, Whooping Crane Habitat Assessment Report, Lesser Prairie Chicken Survey / Assessment Report, Phase I Environmental Site Assessment Report, Historical and Cultural Resource Survey / Assessment Report, All Other Species and Environmental Resource Survey and Study Reports, Record and Notes of all Federal or State Resource Agency Correspondence and Meetings, Turbine and Environmental Resource Shapefiles (.kmz format), and Bird and Bat Conservation Strategy and Eagle Conservation Plan (if available).

Appendix B

Bidder's Credit-Related Information

Full Legal Name of the Bidder:
Type Bidder Entity (corporation, partnership, etc.):
Bidder's Percentage Ownership in Project:
Full Legal Name(s) of Parent Corporation: 1. 2. 3.
Entity Providing Credit Support on Behalf of Bidder (if applicable): Name: Address: City: Zip Code:
Type of Relationship:
Current Senior Unsecured Debt Rating: 1. S&P: 2. Moodys:
Bank References & Name of Institution:
Bank Contact: Name: Title: Address: City: Zip Code: Phone Number:
Legal Proceedings: As a separate attachment, please list all lawsuits, regulatory proceedings, or arbitration in which the Bidder or its affiliates or predecessors have been or are engaged that could affect the Bidder's performance of its bid. Identify the parties involved in such lawsuits, proceedings, or arbitration, and the final resolution or present status of such matters.
Financial Statements: Please provide copies of the Annual Reports for the three most recent fiscal years and quarterly reports for the most recent quarter ended, if available. If available electronically, please provide link:

Appendix C

Bidder Profile

Please list Bidder's affiliate companies:

- 1.
- 2.
- 3.
- 4.

Please attach a summary of Bidder's background and experience in Wind Energy projects.

References

1. Company
 - a. Contact Name:
 - b. Contact Number:
 - c. Project:
2. Company
 - a. Contact Name:
 - b. Contact Number:
 - c. Project:
3. Company
 - a. Contact Name:
 - b. Contact Number:
 - c. Project:
4. Company
 - a. Contact Name:
 - b. Contact Number:
 - c. Project:

Appendix D

TERM SHEET FOR PURCHASE AGREEMENT FOR BUILD TRANSFER OF WIND ENERGY PROJECT

Confidential

This Term Sheet is part of that Request for Proposals for Wind Energy Resources (the “RFP”), issued by American Electric Power Service Corporation (“AEPSC”), as agent for Southwestern Electric Power Company (“SWEPCO”).

Capitalized terms used but not defined in this Term Sheet shall have the meaning specified in the RFP. References in this Term Sheet to Appendix A are to Appendix A of Bidder’s Proposal.

By submitting its Proposal, Bidder will be deemed to have accepted the terms and conditions set forth in this Term Sheet except for the specific exceptions noted in the Bidder’s Proposal.

This Term Sheet does not constitute an offer or otherwise create a binding agreement or obligation to consummate any contemplated transaction. Any such obligation or agreement will be created only by the execution of definitive agreements, the provisions of which, if so executed, will supersede this Term Sheet and all other agreements, if any, related to this Term Sheet.

1.	Parties	The Bidder (herein referred to as the “ Seller ”) and AEPSC as agent for SWEPCO (provided that SWEPCO’s affiliate and Public Service Company of Oklahoma (“ PSO ”) may participate as a co-buyer in such undivided percentage as SWEPCO and PSO determine) (“ Buyer ”). Seller and Buyer are hereinafter called a “ Party ” or collectively, the “ Parties .”
2.	Project; Assets	<p>The wind electric generating facility Project described in Appendix A with the nameplate capacity set forth in Appendix A (the “Project”).</p> <p>The “Assets” shall consist of all property, contracts and assets, real, personal or mixed, tangible and intangible, of every kind and description, wherever located, related to the Project held by Seller, the Project Company or their affiliates.</p> <p>The provisions in this Term Sheet assume that the Project is not in commercial operation. If Bidder’s Proposal is for a Project that is in commercial operation the provisions of this Term Sheet would apply with appropriate modifications.</p>
3.	Project Company	The wholly owned direct subsidiary of Seller that owns and is developing the Project and whose sole assets consist of the Project and the Assets, and which does not have any liabilities other than liabilities related to its ownership, development and construction of the Project.
4.	Transaction	The transaction shall be structured as a build-transfer arrangement pursuant to which following Substantial Completion of the Project Buyer will either (a) purchase all of the equity interests in the Project Company from Seller for the Purchase Price, or (b) purchase the Project and all of the Assets from the Project Company for the Purchase Price, such election by buyer between

		alternative “(a)” and alternative “(b)” to be made prior to execution of the Definitive Agreements (the “ Transaction ”).
5.	Purchase Price; Holdbacks	<p>The purchase price for the purchase of the equity interests in the Project Company (or for the purchase of the Project and all the Assets from the Project Company, if applicable) (the “Purchase Price”) shall be the amount set forth under “Proposal Bid Pricing” in Appendix A, payable at closing under the PSA (“Closing”) without any pre-Closing progress or other payments.</p> <p>Prior to Closing, the Parties will obtain (a) a final wind report from a wind consultant acceptable to the Parties reflecting final micro-siting of turbines, any other changes in turbine locations of the turbines and any wildlife curtailment, and (b) an updated mechanical load analysis from the turbine supplier, with a Purchase Price reduction for any adverse changes from the wind report furnished to Buyer by Seller pursuant to Section 3.7 of the RFP and any loss of energy production compared to the Proposal.</p> <p>Buyer shall hold back amounts necessary to complete punch list items and rectify any known breaches of representations or covenants of Seller, which amounts shall be payable upon final completion or cure of such breaches, respectively.</p> <p>Buyer shall holdback a specified amount per Post-Closing Turbine reflecting the value thereof. To the extent Seller completes the installation and commissioning of Post-Closing Turbines on or before the earlier of 90 days after Closing and December 15, 2021, Buyer will release such amount to Seller. Buyer will have the right to require that Seller remove any Post-Closing Turbines not installed and commissioned within such period.</p> <p>Buyer shall be entitled to the benefit of all test power proceeds net of payments to landowners based on such proceeds.</p>
6.	Seller Credit Support	If Seller’s credit is not satisfactory to Buyer, Seller will furnish credit support satisfactory to Buyer as security for the obligations of Seller and its affiliates under the Definitive Agreements in accordance with the Credit and Collateral Requirements (see Attachment 1).
7.	Project Level Credit Support	Except as set forth in Seller’s Proposal, Buyer shall not be required to replace any deposits, guarantees, letters of credit, bonds or other security posted by Seller or its affiliates under the interconnection agreements or otherwise with respect to the Project.
8.	No Buyer Parent Guarantee; Several Liability of Buyer	Buyer will not furnish a parent guarantee or other credit support for Buyer’s obligations under the Definitive Agreements. If PSO is a co-buyer with SWEPCO, their respective obligations under the Definitive Agreement shall be several as to the interests being acquired, not joint.
9.	Scope of Work	Seller shall design, develop, engineer, procure, construct, commission and start up the Project (including sufficient temporary meteorological towers for post-completion power curve / performance testing), which shall be a fully complete, commercially operable, integrated wind-powered electric

		<p>generating facility, including all facilities necessary to generate and deliver energy to the point of delivery specified in Seller's Proposal.</p> <p>Prior to NTP, Seller shall deliver to Buyer a site plan and final scope of work for Buyer's review. The site plan will include the layout and location for the turbines, permanent meteorological towers, O&M building, access roads, electrical collector system, substation, communication lines, and setbacks of the turbines from roads and other structures, the location of areas subject to crossing agreements, the boundaries of each tract or parcel of real property included in the Project, wetlands (if any), and areas of concern (if any) as identified in the then current environmental site assessment for the Project. In addition, Seller shall deliver an updated mechanical load analysis from the turbine supplier and an updated wind resource report from a wind engineering consultant acceptable to the Parties showing no loss of energy production compared to the Proposal. Buyer shall provide any comments it may have thereon within 30 days after receipt.</p> <p>The Project shall satisfy Buyer's technical specifications in Appendix E of the RFP. Buyer shall have the right to approve the specifications for major electrical equipment such as main power transformer(s), breakers, cabling, and pad mount transformers prior to execution of the Definitive Agreements. Buyer shall have full access and inspection rights during construction.</p>
10.	TSA	<p>The Project Company will enter into a turbine supply agreement ("TSA") acceptable to Buyer from a Tier 1 turbine supplier described under "Proposal Bid Pricing" in Appendix A.</p>
11.	BOP Contract	<p>The Project Company will enter into a balance of plant construction contract ("BOP Contract") with Seller or an affiliate of Seller (whose obligations under the BOP Contract will be guaranteed by Seller), or a recognized third party contractor experienced in the constructing similar projects that is acceptable to Buyer and whose credit is acceptable to Buyer, ("Contractor"), covering the entire scope of work for the Project other than the procurement of turbines under the TSA and the services provided by the turbine supplier thereunder (the "TSA Work").</p> <p><i>Commissioning, Start-Up and Testing.</i> Contractor will conduct all calibration, functional testing and start-up, commissioning and testing of the Work in accordance with the BOP Contract and the TSA other than the TSA Work. Contractor will coordinate its calibration, functional testing and start-up testing for the Work with the Project Company, turbine supplier, any independent engineer, interconnection utility and transmission system operator. Prior to, and as a condition to, Substantial Completion, Contractor will have performed the Work such that the Project satisfies the performance criteria with respect to the acceptance tests described in the BOP Contract ("Acceptance Tests"). If the Project fails to pass an Acceptance Test, Contractor will, at Contractor's sole cost and expense, take such corrective actions as are necessary or appropriate to address such failure.</p> <p><i>Substantial Completion.</i> Substantial completion for the Work ("Substantial Completion") will be deemed to have occurred when the following have been completed (or waived in writing by Project Company with the prior</p>

		<p>written consent of Buyer), except with regard to punch list items related thereto:</p> <ul style="list-style-type: none"> (a) completion of infrastructure including the roads, foundations and collection systems; (b) completion of the substation(s) and any transmission line(s) included in the Project; (c) completion of all of the turbines (other than the Post-Closing Turbines, if any); (d) satisfaction of the Acceptance Tests; (e) all quality assurance documentation has been provided in accordance with the quality assurance plan and all non-conforming quality assurance issues have been resolved in accordance with the quality assurance plan; (f) delivery of all required lien waivers and no claims, security interests or other encumbrances; (g) delivery of preliminary as-built drawings; (h) Contractor shall have delivered, and Project Company (with the prior written consent of Buyer) shall have approved, a punch list with respect to all the Work; and (i) Project Company (with the prior written consent of Buyer) shall have accepted a substantial completion certificate. <p><i>Safety.</i> Contractor shall have, and shall use only subcontractors that are qualified prior to bidding with, an “EMR” no greater than 1.0 and a “TRIR” less than 2.7. Seller shall develop a site specific safety plan which will serve as minimum requirements for the site safety plans implemented by contractors which is reasonably acceptable to Buyer.</p> <p>Notwithstanding any force majeure provisions in the BOP Contract, in no event will a delay in Contractor’s completion of the work under the BOP Contract due to force majeure or otherwise extend the December 15, 2021 termination deadline in Section 21(a).</p>
12.	Project Warranty	<p>Contractor shall warrant that, for the duration of the applicable Warranty period, the Project and all equipment and materials and other Work furnished by the Project Company or any subcontractor, including installation (but excluding the TSA Work) will be free from improper workmanship; defects in design, engineering, construction, fabrication, workmanship, materials and operations; will be new and unused, be of good quality, undamaged and in good condition, and conform to the requirements of the BOP Contract (the “Warranty”).</p> <p>Contractor shall remedy all defects arising or discovered before Substantial Completion. Contractor shall remedy at its cost all defects and deficiencies covered by the Warranty (including any necessary uncovering and recovering) arising or discovered until 2 years following Substantial Completion, and 12 months for all other portions of the Work. The Warranty period will be extended for any parts or equipment replaced or work done as Warranty work for 12 months after completion of such work. The Warranty period also will be extended by the period during which the Project cannot be fully used because of such defect.</p> <p>Contractor shall be responsible for making good any latent or serial defect</p>

		(and damage caused by or resulting from such defect, and including uncovering and recovering) that subsisted at the end of the Warranty period but was not revealed through normal Project operations, and that is discovered within 5 years after Substantial Completion.
13.	PTC Qualification	Buyer will have the benefit of that percentage of the federal production tax credit (“PTC”) set forth in “Wind Turbine Selection & Federal Tax Credit” of Appendix A (but not less than 80%). Seller shall confirm that it has qualified the Project for such percentage of the PTC by “beginning construction”, either by performing physical work of a significant nature or by satisfying the 5% safe harbor before the applicable date (i.e., January 1, 2017 for 100% of the PTC or January 1, 2018 for 80% of the PTC). Seller shall provide factual evidence of performance of physical work of a significant nature in the form of a report issued by a qualified third party, or factual evidence of satisfaction of the 5% safe harbor, as applicable, and factual representations by Seller of the work that has been performed, or the costs paid or incurred, as applicable. Seller shall be responsible for meeting the applicable continuous construction or continuous effort requirement.
14.	PUC Approvals	Following execution of the PSA, Buyer will file for the necessary regulatory approvals from the applicable public utility commissions (“PUC Approvals”). Seller shall reasonably cooperate with Buyer in such proceedings, including without limitation, providing information concerning the Project and the Assets.
15.	FERC Approval	Following execution of the PSA, the Parties shall use commercially reasonable efforts to seek any necessary approvals of the Transaction from the Federal Energy Regulatory Commission (including approval under Section 203 of the Federal Power Act) (the “FERC Approval”), if required, in order to obtain such approval reasonably in advance of the expected Closing date. The FERC Approval shall be acceptable to Buyer in its sole discretion. Seller shall reasonably cooperate with Buyer in such proceeding, including without limitation, providing information concerning the Project and the Assets.
16.	NTP	<p>Buyer will issue the notice to proceed (“NTP”) with construction of the Project within 30 days after satisfaction (or waiver by Buyer in its sole discretion) of the following conditions:</p> <ul style="list-style-type: none"> (a) Buyer shall have received PUC Approvals that are acceptable to Buyer in its sole discretion and that have become final and non-appealable; (b) all of the major Project contracts shall have been executed, shall be in full force and effect, and Buyer shall have received estoppel certificates from the counterparties thereto; (c) Buyer shall have received the updated wind report and mechanical loads analysis described in Section 9; and (d) there shall have been no material adverse change to the PTCs or other federal or state tax benefits to Buyer. <p>If the NTP is not issued on or before August 15, 2020, each Party shall have the right to terminate the Transaction.</p>
17.	Seller Covenants	The PSA will include customary covenants, including the following covenants of Seller:

		<ul style="list-style-type: none"> (a) develop and construct the Project in accordance with applicable contracts, laws and prudent industry practices and achieve Substantial Completion of the Project by December 15, 2021; (b) pay all costs of developing and constructing the Project through final completion; (c) not cause or permit the Project Company to: <ul style="list-style-type: none"> (i) make any material change in the accounting methods except as required by GAAP; (ii) merge, combine or consolidate with any other entity; (iii) issue, sell or transfer any equity interest in the Project Company except (A) pursuant to, or in connection with, the pledge of any such equity interests to Seller's lenders under the construction loan for the Project as collateral with respect to the construction financing for the Project and (B) pursuant to, or in connection with, the exercise of remedies by all or any of the lenders with respect to the construction financing; (iv) acquire (by merger, consolidation or acquisition of stock or assets or otherwise) any corporation, partnership or other business organization or division thereof or collection of assets constituting all or substantially all of a business or business unit; (v) make or change any method of accounting with respect to taxes, make or change any income or other material tax election, file any amended tax return (other than sales and use or personal property tax returns), enter into any closing or similar agreement, consent to any extension or waiver of the limitation period applicable to any tax claim or assessment against the Project Company or the Assets; (vi) change the governing documents of the Project Company (other than in connection with the construction loan agreement for the Project); (vii) hire any employee or adopt any benefit plan or incur any liability under any benefit plan; (viii) undertake any recapitalization, reorganization, liquidation, dissolution or winding up, or not maintain the Project Company's existence; (ix) engage in any line of business or activity other than the continued construction, development, operation and maintenance of the Project; (x) terminate any material contract or amend, modify or waive any material right under any material contract in a way that would reasonably be expected to have an adverse effect; (xi) settle or initiate any action in a manner that would be contrary to prudent industry practices; or (xii) commit or agree orally or in writing to do any of the foregoing.
18.	Seller Representations and Warranties	<p>Seller shall make the following representations with respect to itself and the Project Company:</p> <ul style="list-style-type: none"> (a) existence and good standing; (b) authorization, execution and enforceability of transaction documents; (c) organization and qualification; (d) no conflicts or violation; (e) no brokers;

—

	<p>(f) governmental approvals and filings and third party consents (including any consents or approvals required to enable the Project Company to be merged into Buyer, or distribute the Project and the Assets to Buyer, immediately following Closing);</p> <p>(g) legal proceedings and claims;</p> <p>(h) regulatory status;</p> <p>(i) Project developed for re-sale;</p> <p>(j) bankruptcy and solvency</p> <p>(Items (a)-(e), (i) and (j) above, and items (a), (b), (e), (h), (q), (r), (v) and (x) below, are herein called the “Fundamental Representations” and the other representations and warranties of Seller are herein called the “Non-Fundamental Representations”)</p> <p>With respect to the Project Company and the Project:</p> <p>(a) special purpose entity status;</p> <p>(b) capitalization and ownership of the equity interests in the Project Company including no liens on the equity interests other than liens to be released at or prior to Closing by the construction lenders to the Project Company;</p> <p>(c) no subsidiaries;</p> <p>(d) financial statements, changes subsequent to the date of the financial statements, and no undisclosed liabilities;</p> <p>(e) Project Company real property and other assets and title thereto, validity and enforceability and no breach or default under real property documents; no liens except for agreed permitted liens; schedule of rents and royalties payable under each lease or parcel and in the aggregate as to the Project as a whole;</p> <p>(f) contracts and project documents; in full force and effect, validity and enforceability, no breach or defaults under by Project Company and, to Project Company’s and Seller’s knowledge, as to the counterparties thereto;</p> <p>(g) required permits;</p> <p>(h) factual matters supporting “beginning of construction”, “continuous construction or “continuous efforts”, as applicable, with respect to PTC qualification;</p> <p>(i) reports and studies related to the Project including wildlife, wetland, archaeological and other customary studies and surveys having been obtained for the Project;</p> <p>(j) guaranties and other existing credit support (to include all items to be replaced by Buyer that are listed in Seller’s Proposal);</p> <p>(k) wind data;</p> <p>(l) intellectual property;</p> <p>(m) sufficiency of real property interests, permits, contract rights and intellectual property for construction and operation of the Project;</p> <p>(n) compliance with laws;</p> <p>(o) environmental matters including compliance with environmental laws</p> <p>(p) litigation and claims affecting the Project Company or the Project;</p> <p>(q) no existing or former employees, no labor matters, no benefit plan liabilities;</p> <p>(r) taxes;</p> <p>(s) insurance;</p>
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		<ul style="list-style-type: none"> (t) related party transactions; (u) bank accounts and powers of attorney; (v) not an “investment company”; (w) no willful exclusion of material information; and (x) no illegal payments.
19.	Buyer Representations and Warranties	<p>Buyer shall make the following representations:</p> <ul style="list-style-type: none"> (a) existence and good standing; (b) authorization, execution and enforceability of transaction documents; (c) organization and qualification; (d) no conflicts or violation; (e) no brokers; (f) governmental approvals and filings and third party consents; and (g) legal proceedings and claims.
20.	Conditions to Closing	<p>The PSA will include the following conditions to Closing:</p> <ul style="list-style-type: none"> (a) achievement of Substantial Completion of the Project such that Buyer will be able to place the Project in service in commercial operation in its business, and of agreed-upon testing requirements for purposes of the TSA and the BOP Contract, and satisfactory completion NERC or other required testing, in each case, for all turbines constituting the Project; provided that this condition will be satisfied if no more than 10% of the turbines (the “Post-Closing Turbines”) included in the Project have not achieved substantial completion but the remaining turbines and the remainder of the Project have achieved Substantial Completion; (b) as of the Closing date, as a condition to each Party’s obligation to close, each of the representations and warranties of the other Party shall be true and correct in all material respects (other than representations and warranties that are qualified by materiality or material adverse effect, in which case such representations and warranties shall be true and correct in all respects); (c) performance by the other Party in all material respects of its respective closing actions and covenants; (d) receipt of all required regulatory, and other approvals, including all required third party consents, upon terms reasonably satisfactory to both Parties; (e) Seller’s delivery to Buyer of a permitting opinion; (f) the Project Company will have obtained all permits required for the construction, completion, ownership and operation of the Project and such permits will be in full force and effect; (g) the Parties’ receipt of customary Closing deliveries (e.g., assignment of membership interest agreement, officers’ resignations, release of Seller claims against the Project Company, etc.); (h) delivery of a commitment to issue a title policy from a recognized title insurance company in a form reasonably acceptable to Buyer, subject only to “permitted encumbrances” and an ALTA survey; (i) delivery of landowner estoppels, dated not earlier than 60 days prior to the Closing date, for real property constituting the Project to cover at least a certain percentage of both turbine and non-turbine locations (with such thresholds to be agreed in the definitive PSA); and estoppels from the counterparties to certain of the major Project agreements to be agreed upon by the Parties;

		<ul style="list-style-type: none"> (j) delivery of lien waivers; (k) no litigation seeking to enjoin the transaction or litigation that would reasonably be expected to have a material adverse effect on the Project or Project Company; and (l) Seller shall provide customary evidence to Buyer that, upon Buyer's payment of the Purchase Price, the construction loan financing arrangements affecting the equity interests in the Project Company or the Project shall be paid in full and that liens related thereto shall be released or otherwise extinguished.
21. Termination		<ul style="list-style-type: none"> (a) By the applicable Party if its conditions to Closing have not been satisfied (or waived by it) on or before December 15, 2021 (such date will not be extended for force majeure events under the BOP Contract or otherwise, or interconnection or transmission line delays); (b) by either Party upon the occurrence of a bankruptcy event with respect to the other Party; (c) as provided in Section 16; and (d) by Buyer if there is an adverse change in the PTC or other material federal or state tax benefits prior to issuance of the NTP.
22. Seller Retained Obligations		<p>Seller will retain and indemnify Buyer and the Project Company for:</p> <ul style="list-style-type: none"> (a) any liabilities incurred or accruing prior to the Closing date; (b) any liability of the Project Company, Seller or its affiliates for taxes with respect to any taxable period, or portion thereof, prior to the Closing date; (c) any liability under the Project documents, the leases and land contracts, permits, permit applications, interconnection agreements or other contracts to which the Project Company is a party or by which the Project is bound to the extent such liability (but for a breach or default by the Project Company, Seller or any of its affiliates or a waiver or extension given to or by the Project Company, Seller or any of its affiliates) would have been paid, performed or otherwise discharged, or was or would have been incurred or accrued, on or prior to the Closing date; (d) any liability (i) relating to the Project or any present or former developer, owner, lessee or operator of the Project or (ii) of the Project Company to Seller or its affiliates, in either case, incurred or accrued prior to the Closing date, whether or not associated with or arising from the Assets; (e) any liabilities for violations of law, or for remediation of releases of hazardous substances, occurring prior to the Closing date; (f) any claims by any prior employees of the Company relating to their employment and any liability of the Project Company with respect to any benefit plan that any entity maintains or in the past maintained (or to which such entity ever contributed or was required to contribute); and (g) any liabilities associated with the construction loan agreement.
23. Indemnification:		<ul style="list-style-type: none"> (a) Seller's indemnification for breach (i) of the Non-Fundamental Representations shall be capped at 20% of the Purchase Price and (ii) of the Fundamental Representations shall be capped at the Purchase Price; such caps shall not be applicable to fraud, bad faith, gross negligence or

		<p>willful misconduct;</p> <p>(b) deductible of 0.1% of the Purchase Price before Seller is required to make indemnification payments for aggregate losses to Buyer for breach of the Non-Fundamental Representations (other than for claims related to fraud, bad faith, gross negligence or willful misconduct);</p> <p>(c) survival periods:</p> <p>(i) Non-Fundamental Representations--24 months (except as provided in clause (iii) below);</p> <p>(ii) Fundamental Representations-- 90 days after the expiration of the statute of limitations; and</p> <p>(iii) breach of representations with respect to environmental matters, zoning, permits, and real property—3 years;</p> <p>(d) materiality qualifiers in representations shall be disregarded for indemnification-related purposes (i.e., determining whether a breach has occurred and calculating damages);</p> <p>(e) Buyer's knowledge of breach at Closing shall not be deemed to waive right to claim breach; and</p> <p>(f) damages will include lost revenues and lost PTCs and other lost tax benefits.</p>
24.	Documentation	<p>If Seller's Proposal is included in the Final Project Selection described in Section 9.3 of the RFP, then the Parties will attempt to negotiate definitive, legally binding, written agreements reflecting the structure, final configuration, and binding terms and conditions applicable to the Transaction, including without limitation: a purchase and sale agreement ("PSA") for the purchase of the equity interests in the Project Company (or for the purchase of the Project and the Assets if Buyer elects to purchase the Project and the Assets directly), the form of BOP Contract and any other related agreements necessary to address the other matters described in this Term Sheet (collectively, the "Definitive Agreements").</p>
25.	Buyer Access to Project, Information and Personnel	<p>Seller shall furnish access to relevant records in response to requests from Buyer in connection with Buyer's review of the Transaction. Seller shall make its personnel reasonably available to Buyer representatives, and upon reasonable advance notice, Seller shall permit Buyer representatives to conduct on-site reviews and to be present on site continuously through construction and testing of the Project.</p>
26.	No Liability Under Term Sheet	<p>Neither Party shall be liable to the other in contract, tort, or otherwise, for any claims, liabilities or losses alleged to result from the failure to enter into any of the Definitive Agreements. In no event shall either Party be liable to the other Party pursuant to this Term Sheet (including without limitation for any incidental, indirect, special, punitive or consequential damages for lost profits).</p>
27.	Expenses	<p>Except as may otherwise be provided in the Definitive Agreements, each of the Parties hereto will be responsible for its own expenses in connection with the proposed Transaction, including fees and expenses of legal, accounting and financial advisors.</p>
28.	Governing Law	<p>New York; customary waiver of jury trial.</p>

ATTACHMENT 1

CREDIT AND COLLATERAL REQUIREMENTS

For any wind resource selected under this RFP, PSO/SWEPCO and its ratepayers are exposed to credit risk in the event a selected Bidder is unable to fulfill its obligations pursuant to the executed definitive agreement. PSO/SWEPCO views the credit risk as the cost it would incur to replace the contract at then-prevailing market prices in the event that the Bidder defaulted. In order to mitigate credit exposure, PSO/SWEPCO requires credit assurances in the form of collateral in the amount of \$200/kw based upon nameplate project size from any winning Bidder(s). For example, the amount of collateral required for a nameplate project size of 100MWs equates to \$20,000,000 (\$200/kw x 1,000kw/MW x 100MWs).

Bidders can satisfy the collateral requirement with cash, a Letter of Credit, or a Guaranty. A Letter of Credit must be in an acceptable format and from a major U.S. commercial bank and have at all times a Credit Rating of at least 'A' and 'A2' from S&P and Moody's, respectively, and have assets of at least \$10,000,000,000. Credit Rating means the lower of the most recently published senior, unsecured, unenhanced, long term debt rating (or corporate issuer rating if a long term debt rating is unavailable) from S&P or Moody's Investor Services. A Guaranty must be in a format acceptable to PSO/SWEPCO. Foreign Guarantees may be considered based on acceptable country risk and format.

Based on the Credit Rating of the Bidder or its Guarantor, the value in the Credit Matrix below represents the Unsecured Credit Limit and the corresponding Collateral Requirement. If a Bidder, or its Guarantor, does not have a Credit Rating, the Unsecured Credit Limit would be \$0 and the maximum amount of collateral will be required, or row 6. PSO/SWEPCO's internal credit risk tolerance specific to this RFP has been applied to the Unsecured Credit Limit and corresponding Collateral Requirement.

Using the Credit Matrix below for illustration, the Collateral Requirement for a 500MW nameplate project size and an 'A/A2' rated Bidder/Guarantor would be \$0 (row 1). For a Bidder/Guarantor with a BB+/Ba1 or below Credit Rating, the maximum amount of collateral is required, or \$100,000,000 (row 6). If a Guaranty is provided, the Credit Rating for the Bidder/Guarantor and the corresponding Unsecured Credit Limit will be used to determine the maximum Guaranty amount. For instance, if the Guarantor was rated 'BBB/Baa2', a Guaranty can be provided up to a maximum amount of \$30,000,000 (row 4) while the remaining Collateral Requirement of \$70,000,000 must be satisfied with either cash or a Letter of Credit.

Credit Rating (Bidder/Guarantor)	Unsecured Credit Limit (\$)	Collateral Requirement (\$)	
A/A2 and above	100,000,000	\$0	row 1
A-/A3	75,000,000	25,000,000	row 2
BBB+	50,000,000	50,000,000	row 3
BBB/Baa2	30,000,000	70,000,000	row 4
BBB-/Baa3	20,000,000	80,000,000	row 5

BB+/Ba1 and below	\$0	100,000,000	row 6
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In the event that the financial condition of a Bidder or its Guarantor changes over the term of the definitive agreement, PSO/SWEPCO reserves the right to request updated information to reevaluate the Bidder and its collateral requirements, which may be adjusted accordingly.

Each Bidder must provide a statement in good faith describing the manner in which it will comply with the credit requirements, if applicable. Upon receiving notification, a Bidder selected for the short list must provide specific evidence of its ability to meet the collateral requirements to be set forth in a definitive agreement. Evidence of Bidder's ability to post sufficient collateral or a Guaranty may include, but not be limited to, a comfort letter from a financial institution that would be issuing a letter of credit, evidence of available cash on financial statements, a comfort letter from a proposed Guarantor, or other evidence acceptable to PSO/SWEPCO based on commercially reasonable credit standards. Any bidder failing to provide sufficient evidence of the foregoing may be dismissed from further consideration.

Collateral Requirements must be posted by the Bidder in accordance with the following schedule: a) 50% due upon execution of the definitive agreement; and b) 100% due at Notice To Proceed.

In the event that Bidder's financial condition or Credit Rating changes at any time after submission of its bid and before consummation of definitive agreement, the Bidder will provide notice to PSO/SWEPCO and will update information concerning this change. PSO/SWEPCO reserves the right to request any updated pertinent information and to reevaluate and adjust the Bidder's and collateral requirement based on such change. Any Bidder failing to provide evidence in sufficient detail of changes in financial condition or Credit Rating and the ability to meet any adjusted collateral requirement, may be dismissed from further consideration.

If Bidder, its Guarantor, or other affiliates have existing exposure under transactions with PSO/SWEPCO, or their affiliates, PSO/SWEPCO reserves the right to require additional collateral as a means to mitigate the incremental exposure from the potential transaction under this RFP.

Appendix E

AEP Wind Generation Facility Standards

The AEP Wind Generation Facility Standards includes the following:

1. Wind Farm Technical Specification and Design Criteria (Specification Number: GEN-4560)
2. Wind Facility – O&M Building Specification and Design Criteria (Specification Number: GEN-4561)

Bidders may request the AEP Wind Generation Standards via email at
SWEPWindRFP2019@aep.com

Appendix F

AEP Requirements for Connection of Facilities

Please follow the link below to access the AEP Requirements for Connection of Facilities (“Requirements for Connection of New Facilities or Changes to Existing Facilities Connected to the AEP Transmission System”).

~~https://aep.com/assets/docs/requiredpostings/TransmissionStudies/Requirements/AEP-Interconnection_Requirements_Rev1.pdf~~

[https://aep.com/assets/docs/requiredpostings/TransmissionStudies/Requirements/AEP Interconnection_Requirements_Rev2.pdf](https://aep.com/assets/docs/requiredpostings/TransmissionStudies/Requirements/AEP_Interconnection_Requirements_Rev2.pdf)

Appendix G

Wind Resource Analysis / Study

Required Information

- Attach the independent wind energy report
 - Wind report shall also include P50, P75, P90, P95 and P99 production estimates with 1, 5, 10, 20 and 30 year timeframes
 - Independent consultant information (resume, contact information) if not included in the wind energy report.
- Describe on-site meteorological campaign including:
 - Number of met towers
 - Height of met towers
 - Remote sensing (lidar and/or sodar)
 - Number of years of data for each tower / remote sensing device.
- Identify any wind direction sector management or other operation restriction requirements.
- Experience of developer in OK, AR, LA and TX. Identify the number of projects, years each project has been operating, turbine models and capacity rating.
- Source and basis of the wind speed data used in the development of energy projections for the project. Explain all assumptions for wake losses, line losses, etc. and the location where the data was measured.
- Wind turbine power curve adjusted for the site's specific air density.
- Provide a description of the system intended to provide real-time telemetry data.
- Attach an 8760 calendar year hourly energy forecast, net of all losses (See attached Excel spreadsheet (*Energy Input Sheet*)).
- Bidders shall provide a summary of representative wind data with measurement height referenced and any extrapolations used to estimate the wind speeds at the proposed hub height. (This item shall be provided in the electronic (CD, flash drive, etc.) version of the Proposal only.)

The following information should be available upon request; however, is not required with the submission of the Proposal.

- Project boundary (shape files, kmz files, or pdf on USGS topographic map)
- Land control, broken down by leased land, likely to be leased land, likely NOT to be leased land, and indeterminate status (shape files, kmz are best)
- Setbacks/exclusions (shape files preferred),
- Met tower installation commissioning sheets and all subsequent maintenance documents
- Raw data files for all on-site met towers
- If applicable, sodar or lidar documentation and raw data files
- Proposed turbine locations (shape file, kmz file, Excel file with coordinates, including map datum (e.g., WGS84, NAD83))
- All documents related to turbine availability, electrical system design with losses
- Any other materials the developer has in terms of turbine siting

Appendix H

O&M Services Scope of Work (OPTIONAL)

Bidders may request the O&M Services Scope of Work via email at:
SWEPCOWindRFP2019@aep.com

Appendix I

Proposal Content Check Sheet

New Build Projects

Section	Item	Completed
8.1.2	Executive Summary	
8.1.3	Documentation demonstrating Project will qualify for 80% PTC	
8.1.4	Appendix A (Wind Project Summary) <ul style="list-style-type: none"> - Company information - General Project Information - Proposal Bid Pricing - Turbine Manufacturer Options - Interconnection & Point of Delivery - Generation Collection System (>100 kV) - Wind Projects Completed - Site Information / Permits 	
8.1.5	Manufacturer's warranty offerings	
8.1.6	Identity of all person and entities that have a direct or indirect ownership interest in the project.	
8.1.7	Appendix B (Bidder's Credit-Related Information	
8.1.8	Appendix C (Bidder Profile)	
8.1.9	Appendix D (Term Sheet - including exceptions)	
8.1.10	Appendix E (exceptions to the AEP Wind Generation Facility Standard)	
8.1.11	Appendix F (exceptions to the AEP Requirements for Connection of Facilities)	
8.1.12	Land lease payments & property tax cost for 30-year period.	
8.1.13	O&M Services Proposal (optional)	

Existing Projects (in addition to above, as applicable)

Section	Item	Completed
8.2.1	Audited financial statements and FERC Form 1	
8.2.2	PTC documentation and remaining PTC life	
8.2.3	Production data (annual MWh) COD – 7/1/18	
8.2.4	Production data (hourly MWh) 1/1/16 – 7/1/18	
8.2.5	O&M Expenses (COD – 12/31/17)	
8.2.6	Forecasted O&M (1/1/19 – end of life)	
8.2.7	Outage details (1/1/13 – 1/1/18)	
8.2.8	Warranty claims	
8.2.9	Forecasted annual production for remainder of facility's life	
8.2.10	Independent report from nationally recognized third party	

This information is HIGHLY SENSITIVE under the terms of the Protective Order. The HIGHLY SENSITIVE information is available for review at the Austin offices of American Electric Power Company (AEP), 400 West 15th Street, Suite 1520, Austin, Texas, 78701, (512) 481-4562, during normal business hours.

This information is Voluminous and HIGHLY SENSITIVE under the terms of the Protective Order. The HIGHLY SENSITIVE information is available for review at the Austin offices of American Electric Power Company (AEP), 400 West 15th Street, Suite 1520, Austin, Texas, 78701, (512) 481-4562, during normal business hours.



COMPANY OVERVIEW

Richard Simon is the President of Simon Wind, Inc. He is a consulting meteorologist with 42 years of professional experience. His career has focused on wind energy, starting in 1977 when he co-authored the first study of wind power potential for California's Energy Commission. Mr. Simon has personally sited 25,000 megawatts of operating wind turbines around the world and approximately 15% of all installed wind capacity in the United States.

Simon Wind performs all meteorological aspects of wind energy, including identification of windy lands, designing and implementing on-site wind measurement campaigns, processing wind data, siting turbines and optimizing their wind resource potential, due diligence reports for financing, and operational analysis of existing wind farms.

The company is composed of three meteorologists with more than 30 years of experience, and two data analysts with engineering degrees and solid meteorological backgrounds.

AEP (through its Central and Southwest Services Company) first hired Mr. Simon in 1993 to plan and conduct a wind energy study across its subsidiaries' service areas over four states (Texas, Oklahoma, Arkansas and Louisiana).

His support to AEP over the years has included:

- Siting the first wind farm in Texas, a 12-MW project near Fort Davis, 1994-1997
- Siting AEP's Trent Mesa wind farm, 1994-2001
- Identifying the Southwest Mesa land, which AEP purchased in 1996 and had developed by a third party. Annual royalties from this project are double the original purchase price.
- Participated in reviews of RFP's for third-party developer projects (ongoing)
- Identified and studied the Bluff Point, Indiana project, 2006-2011
- Identified potential projects in Ohio for wind development, 2006-2008
- Toured and reviewed project opportunities in Virginia and West Virginia, 2006
- Worked with wind farm owners to develop curtailment protocols (2013-2015)
- Review of Hardin (OH) and Beech Ridge II (WV) potential wind farm acquisitions, 2016-2018
- Reviewed Hog Creek, Ohio, wind farm for potential acquisition, 2017
- Helping plan and evaluate the proposed Windcatcher project in western Oklahoma, 2016-2017
- Independent evaluation of a proposed wind farm for acquisition during the SWEPCO RFP, 2017
- Formal due diligence review for the Santa Rita East wind farm purchased by AEP in 2018
- Support for the SWEPCO-PSO RFP for wind farm acquisitions, 2018-present, including helping write parts of the RFP, designing a scoring matrix, and formal due diligence with complete wind resource assessments for short-listed projects

Thus Mr. Simon has a long track record working with AEP on wind energy projects. More information can be found at www.simonwind.com

17 June 2019

This information is **HIGHLY SENSITIVE** under the terms of the Protective Order. The **HIGHLY SENSITIVE** information is available for review at the Austin offices of American Electric Power Company (AEP), 400 West 15th Street, Suite 1520, Austin, Texas, 78701, (512) 481-4562, during normal business hours.



**WIND ENERGY RESOURCE ASSESSMENTS FOR SELECTED WIND FACILITIES
FROM THE SWEPCO-PSO 2019 RFP**

**Submitted to
American Electric Power**

**Prepared by
Simon Wind, Inc.
Richard L. Simon, President
59-215 Maki Way
Kamuela, HI 96743**

30 May 2019

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INTRODUCTION

American Electric Power issued a Request for Proposal (RFP) to purchase wind energy projects located in Arkansas, Louisiana, Texas or Oklahoma interconnected to the Southwest Power Pool. 35 bids were received by the 1 March 2019 due date, and they were vetted to a short list of three projects:

Project Name	Sponsor	Nameplate MW	Location	Turbine Models
Maverick	Invenergy, LLC	286.62	Oklahoma	GE-2.82/127; GE-2.5/116
Sundance	Invenergy, LLC	199.40	Oklahoma	GE-2.82/127; GE-2.3/116
Traverse	Invenergy, LLC	998.62	Oklahoma	GE-2.82/127; GE-2.5/116

Simon Wind was contracted by AEP in on 15 November 2018 (PSA NO. 03023677x198) to assist with several aspects of the RFP process:

Task 1: support writing RFP Appendices, including specific language for bidders to respond with information, formats and content of Independent Engineer (IE) wind resource reports, etc. This work was completed in December 2018.

Task 2: review of bidder wind reports. Bidder wind reports were received in early March 2019, and Simon Wind reviewed all 35 of the associated IE wind resource assessment reports. Simon Wind developed a scoring matrix to address the quality of the on-site meteorological data collection, the duration of such campaigns, and other factors pertinent to evaluating the reasonableness of the long-term mean annual energy projections. This work was completed in mid-April 2019.

Task 3: full wind energy resource assessments for the Selected Wind Facilities. Simon Wind acquired raw data from the sponsors (e.g., met data, turbine locations, turbine characteristics, engineering reports), made a site visit to check on-site meteorological towers in person, and created its own independent wind energy resource projections for the three projects. Once completed, Simon Wind also compared its projections to those of the IE's submitted with the respective bids.

This document presents highlights of our independent wind energy resource assessments associated with Task 3, the original reports prepared in Excel files with complete sets of wind resource statistics. Below is a summary of the three projects, focusing on both the IE and Simon Wind long-term mean annual net energy projections. Differences between the analysts are discussed in the following chapters.

Project Name	Independent Engineer	NCF (%) IE/Simon Wind	Net GWh, IE/Simon Wind	Ratio: Simon Wind/IE
Maverick	DNV-GL	46.3 / 44.89	1163.4 / 1127.0	0.969
Sundance	Arcvera	47.03 / 45.95	821.5 / 802.6	0.977
Traverse	Vaisala	45.60 / 43.37	3988.7 / 3794.0	0.951

Simon Wind's projections ranged from 2.3 - 4.9% less than the IE projections. In the case of Traverse, the IE report used a likely incorrect electrical loss (2.5% versus the 3.5% estimated by the sponsor), and the IE did not consider sub-optimal operations (which other analysts routinely do). Also, there were effectively only two met towers for Traverse, neither of which had a full year of on-site data.

Other differences between the two analysts are relatively minor, and these are discussed fully in the main body of the text.

Traverse Wind Farm



Wind Energy Resource Assessment, Traverse Project, Oklahoma

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

Prepared by Richard Simon, Peter Stamus, and Omar Galaviz
29 May 2019

This report evaluates the wind resource potential for Invenenergy's proposed Traverse wind farm in central Oklahoma, which would consist of 316 GE-2.82/127 turbines (88.6-m hub heights) and 43 GE-2.5/116 turbines (90-m hub heights), for a nameplate rating of 998.62 MW. Two 60-m met towers (Sites 5700 and 5701) were installed in June 2018. Four more met towers (Sites 4308, 4310, 4311) were installed in December 2018.

This is Bid 21 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 have also compared our results to the IE report by Vaisala dated 8 April 2019.

Tower Info. Documentation of the Traverse meteorological towers is furnished: their location, exposure, data loggers, sensor types and measurement heights, boom lengths and orientations, and sensor calibration data. Two towers were installed in June 2018 and three in December 2018. They are all 60-m towers, with wind speeds measured at 4 levels from 25 to 59 m above ground. KB Energy visited met towers 5700 and 5701 with AEP on 24 April 2019; their notes are incorporated in the table.

The towers are operating normally, with the exception of the following issues:

- Site 5701: wiring is switched between the 40-ssw and 50-ssw anemometers. We have accounted for this in our analyses.
- Site 4310: The 57-m wind vane has never given valid data.
- Site 4311: The 25-m anemometer on the northwest boom was damaged on 5 March 2019.

The important item is that there are less than 10 months of data at these met towers.

Maps. There is a regional map showing the Traverse project footprint and reference stations we use to evaluate long-term winds at the on-site met towers. There are also topographic maps showing the met tower locations and the turbine array.

Coords. Coordinates and turbine models for the Traverse array are given in WGS84 datum, and were furnished by Invenenergy through the Vaisala report. This array has not been field checked; many turbines are in non-optimal topographic settings.

Ref V. Monthly mean wind speed histories are given for four long-term reference stations: the Clinton-Sherman airport (55 km southwest of the project), the Putnam Oklahoma Mesonet site (25 km northwest of the project), and two MERRA-2 data point (south and southwest of the project).

The Clinton-Sherman airport station is an ASOS station, which were converted from cup to sonic anemometers in 2009. Cup and sonic anemometers have different response characteristics, and one should not combine their

data to determine long-term mean annual wind speeds without addressing this difference. Since there are more than 10 years of sonic observations, we use only the sonic data in our analyses.

MERRA stands for Modern Era Retrospective-analysis for Research and Applications. MERRA data are comprised of climate data re-analyzed by NASA, which are calculated for specific latitudes and longitudes on a world-wide grid. NASA updated these data sets in early 2016, and they are now called MERRA-2. We have downloaded and processed MERRA-2 data at 50 m above ground going back to 2002.

Daily V. Daily mean wind speeds are tabulated for the Traverse 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 to all reference stations average better than 0.94.

Daily Correlation Coefficient Matrix...

Site	5700	5701	4308	4310	4311	Overall
Clinton	0.951	0.958	0.950	0.962	0.971	0.958
Putnam	0.975	0.975	0.977	0.983	0.966	0.975
MERRA-2 SW	0.931	0.935	0.962	0.941	0.955	0.945
MERRA-2 S	0.938	0.936	0.961	0.951	0.963	0.950

Mo Speeds. Monthly mean wind speeds are given for the Traverse met towers and reference stations.

L-T Speeds. Long-term mean annual wind speeds were estimated for the Traverse towers from their overall mean annual wind speed ratios to the reference stations. With less than one full year of on-site data, we developed an adjustment factor based on comparative data from the Maverick project.

Here are the resulting long-term mean annual wind speed estimates in meters per second with extrapolations to 80, 88.6 and 90 m using site-specific shears:

Level (m)	5700	5701*	4308	4310	4311	
25	5.94	6.27	6.24	6.22	6.32	very, very preliminary estimates for latter 3 sites, only 4 months of data
40	6.66	7.06	6.87	6.89	6.96	
50	7.02	7.31	7.24	7.29	7.32	
58/59	7.35	7.59	7.53	7.56	7.56	
80	7.98	8.11	8.05	8.10	8.06	
88.6	8.18	8.28	8.23	8.28	8.23	
90	8.22	8.31	8.26	8.31	8.26	

* correcting for miswiring of sensors

Sodar. Sodar data are analyzed diurnally for the period January-April 2019. We have compared the sodar to concurrent data at Site 4308, located nearby.

Data recovery is sufficiently high to evaluate data at all levels up to 120 m. Here are the resulting wind shears:

Sodar Shears, Concurrent Measurement Periods...

Site	Shears...				
	25-59 m 40-50 m	40-59 m 50-60 m	60-80 m	80-100 m	100-120 m
4308	0.226	0.247			
Sodar	0.216	0.230	0.250	0.249	0.244

Sodar shears are fairly consistent with height up to 120 m, and similar to those observed at the towers. Although only 4 months of data, this supports using met tower shears to extrapolate to hub height.

En Sims. 10-minute mean wind speed data from Sites 5700 and 5701 have been scaled to hub-height using time-specific shears and compiled into separate wind speed frequency distributions. These distributions have been scaled to integer annual mean wind speeds of 7-10 mps (bracketing the wind resource) and expanded to full 8760-hour years. Gross annual energy simulations are performed for the GE-2.82/127 and GE-2.5/116 turbines at a mean annual air density of 1.14 kg/m³, derived from regional climate data.

Relationships between gross annual capacity factor in percent and annual mean wind speed are shown in the tables below.

GE-2.82/127...

Site	7 mps	8 mps	9 mps	10 mps
5700	44.24	53.72	61.44	67.43
5701	44.68	54.62	62.57	68.77
Averaged	44.46	54.17	62.01	68.10

GE-2.5/116...

Site	7 mps	8 mps	9 mps	10 mps
5700	43.88	53.61	61.44	67.71
5701	44.33	54.52	62.64	68.98
Averaged	44.11	54.06	62.04	68.35

Rose. Joint frequency distributions of wind speed and wind direction for the Traverse met towers are given in tabular and graphical format. Prevailing winds are basically north-south, consistent with the region.

Off-Axis. Wake losses in annual energy between two turbines are given as a function of their azimuth orientation and spacing. There are individual tables for each met tower, and a combined off-axis table averaging Sites 5700 and 5701. We incorporate this information into wake modeling.

Max V. Monthly 10-minute maximum mean wind speeds and peak gusts are summarized for the Traverse met towers. Through March 2019, the maximum observed mean wind speed has been 28.6 mps; the peak gust 37 mps.

TI. 58/59-m turbulence statistics are summarized for the Traverse towers. Characteristic turbulence [mean TI plus 1.0 or 1.28 standard deviations (depending on the turbine vendor) in a 15-mps wind] averages 0.13-0.14 when scaled to the 88.6/90-m hub heights of the turbines, as calculated at the bottom of this tab.

Climate. Monthly summaries of temperature and pressure are given for the Traverse met towers. There is not a full year of data, so we can't compute annual mean air density from these records.

WIND ENERGY RESOURCE ASSESSMENT

Model Results. Wind flow modeling was carried out by Omar Galaviz (Deriva Energia) in two stages:

1) A low 3-km resolution wind resource grid was obtained for an extended area, using VORTEX technology. This is based on the non-linear model WRF (Weather Research and Forecasting model), developed through a joint effort of various atmospheric research centers and supported by a community of scientific users. This model incorporates the most advanced physics parameterizations. WRF was run over an extended area with a fixed resolution and with the last 30 years of CFSR reanalysis data as input. Simulations for met towers 5700 and 5701 were executed; the results are used as input in subsequent simulations. Consecutive simulations improve the resolution. Results from in this initial phase were then used to perform a more accurate wind flow model for the specific area of the Traverse project.

2) Microscale (non-linear) modeling was then performed in OpenWind with 100-m spatial resolution. There were 16 wind direction sectors, the grid being 44.8 km east/west and 35.8 km north/south. Since most of the turbines have 88.6-m hub heights, the resulting wind speed map (see the tab) is for that level.

The microscale model adapts the mesoscale wind flow to local topographic and terrain roughness effects. For this process, a Wind Resource Grid derived (WRG) by means Vortex has been used. The WRG grid is designed to cover wind turbine positions at hub height, plus any surroundings that could affect the free-stream wind speeds.

Full model results are available on request. Our focus is the mean annual hub-height winds and the waked gross energy versus unwaked gross energy.

Traverse is larger than any existing wind farm in the world, and wake modeling may not accurately capture the true wake scenario. We ran five wake models (DAWM eddy viscosity conserving momentum, DAWM fast eddy viscosity, DAWM Park variant, and standard eddy viscosity), with DAWM standing for Deep Array Wake Model. Wake predictions were 14.34%, 7.96%, 7.92%, and 6.54%, respectively. In addition, the Simon Wind wake model predicts an internal loss of 7.94%. Ignoring the 14.34% value, we conclude that a reasonable wake loss is 7.9-8.0%.

The model's predicted wind speed map (88.6 m) and turbine locations are shown in the figure.

WERA. Long-term mean annual hub-height wind speeds and gross annual capacity factors have been evaluated for individual turbines in the array, using the WRF model described above. We combined predicted wind speeds from the model with our annualized wind speed frequency distributions to evaluate gross annual energy projections for the individual turbines.

Aggregate long-term mean annual projections are given below, weighted by nameplate rating, with equivalent Vaisala projections from their IE report:

	Mean Analyst Speed (mps)	Total MW Rating	Gross Cap. Factor (%)	Gross GWh
Simon Wind	8.12	998.62	55.06	4816.54
Vaisala	8.18	998.62	55.16	4825.60

Losses. We have quantified gross-to-net discount factors as best as possible. Some are calculated from the on-site met data, others are based on site documentation, and some are typical industry values.

Here are the long-term mean annual net energy projections for the Traverse project:

Analyst	Turbine Models	Turbine Count	Gross Cap. Factor (%)	Total % Discount	Net Cap. Factor (%)	Net GWh, Full Array	Ratio: SW/Vais
Simon Wind	2.82/127; 2.5/116	359	55.06	21.23	43.37	3,794.0	0.951
Vaisala	same	359	55.16	17.3	45.60	3,988.7	

Thus our long-term mean annual net energy projection for the Traverse project is 4.9% less than that from Vaisala.

12x24. Monthly/diurnal mean net capacity factors and energy values are given for Traverse. 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	35.11	32.70
P95	37.49	35.78
P90	38.81	37.48
P75	40.95	40.24
P50	43.37	43.37
P25	45.38	46.19
P10	47.15	48.68
P05	48.24	50.21
P01	50.22	52.99

P99/P50 ratios are 0.809 for ten years and 0.754 for one year. Equivalent Vaisala ratio are 0.796 and 0.784, respectively. That's a very small difference in the two Vaisala values and seems to underplay the interannual variability in winds.

Comparison with Vaisala Report. Our gross projections agree very closely, but our discount factors are substantially greater. Here is a direct comparison, along with our thoughts. Items highlighted with yellow fill indicate where one analyst differs by more than 0.5%:

Discount Factor	Vaisala Loss (%)	Simon Loss (%)	Remarks
Turbine Availability	96.6	96.0	DNV projects 96.8% for first ten years, then declining. That suggests a 25/30-year availability less than 96.6%.
BOP/Grid Availability	99.2	99.0	reasonable agreement, no one really knows
Sector Management	100.0	100.0	agreement
High Wind Hysteresis	100.0	100.0	agreement
Extreme Temperature	100.0	99.8	temperatures >40C occur with some regularity
Total Icing	99.3	99.4	close agreement
Internal Wakes	94.1	92.1	Vaisala wake model seems to consistently predict less than others; we ran four wake models.
External Wakes	99.2	99.2	we accept the Vaisala calculations
Electrical Efficiency	97.5	96.75	this is a large wind farm, and consensus with AEP suggests the 97.5% placeholder value is too optimistic. A formal engineering study is needed.
Power Curve	98.0	98.0	agreement
Sub-Optimal Ops.	100.0	99.0	Vaisala does not address this
Turbulence	99.4	99.0	reasonable agreement, no one really knows
Site Access, Weather	100.0	99.6	Vaisala does not address these
Blade Soiling/Degrade	98.0	99.0	Vaisala more aggressive on this factor
Total Efficiency (%)	82.7	78.77	

This completes our report.

Tower Info. Meteorological Tower Information
Traverse Project, Oklahoma

values confirmed by KB Energy
red text KB Energy values changed with KB Energy field notes

Time Zone	Central Standard Time										
Magnetic Declination	5° East (true north = 355° magnetic)										
		Sensor Type	Model	Serial Number*	Channel	Sensor Height (m)	Boom Length (in)	Boom Orientation Relative to True North	Calibration Constants**		Units
Site Number	4308	Anemometer	NRG #40C	317090	1	59.2	95	312°	0.759	0.35	mps
Installation Date	9 December 2018	Anemometer	NRG #40C	314797	2	59.2	95	222°	0.767	0.30	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	317089	3	50.1	95	312°	0.757	0.33	mps
Logger Serial Number	820604308	Anemometer	NRG #40C	314796	4	50.1	95	221°	0.761	0.34	mps
Property Owner	Mannerling	Anemometer	NRG #40C	317088	5	40.1	95	312°	0.761	0.31	mps
Tower Height (m)	60	Anemometer	NRG #40C	314795	6	40.1	95	222°	0.762	0.32	mps
Tower Diameter	10" to 30 m, 8" above	Anemometer	NRG #40C	317084	7	25.1	95	312°	0.759	0.31	mps
Closest Town	Thomas, OK	Anemometer	NRG #40C	314794	8	25.1	95	222°	0.765	0.31	mps
Latitude (WGS84)	35° 44.360'N										
Longitude (WGS84)	98° 55.266'W	Wind Vane	NRG 200P	027755	13	57.3	95	357°	0	4	degrees
Elevation (m)	549	Wind Vane	NRG 200P	027760	14	27.7	95	357°	0	4	degrees
		Thermometer	NRG #110S	N/A	16	2.0	N/A	North side	55.55	-86.38	°C
Site Exposure	hilltop in cropland, oil equipment 200 m NW.										
Site Number	4310	Anemometer	NRG #40C	317094	1	59.2	95	314°	0.756	0.35	mps
Installation Date	9 December 2018	Anemometer	NRG #40C	314852	2	59.2	95	224°	0.765	0.31	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	317093	3	50.1	95	314°	0.760	0.33	mps
Logger Serial Number	820601161	Anemometer	NRG #40C	314851	4	50.1	95	223°	0.758	0.37	mps
Property Owner	Johnston	Anemometer	NRG #40C	317092	5	40.1	95	315°	0.758	0.32	mps
Tower Height (m)	60	Anemometer	NRG #40C	314799	6	40.1	95	225°	0.763	0.34	mps
Tower Diameter	10" to 30 m, 8" above	Anemometer	NRG #40C	317091	7	25.1	95	314°	0.761	0.33	mps
Closest Town	Custer City, OK	Anemometer	NRG #40C	314798	8	25.1	95	225°	0.759	0.35	mps
Latitude (WGS84)	35° 40.100'N										
Longitude (WGS84)	98° 50.407'W	Wind Vane	NRG 200P	027768	13	57.3	95	359°	0	4	degrees
Elevation (m)	496	Wind Vane	NRG 200P	027761	14	27.8	95	359°	0	4	degrees
		Thermometer	NRG #110S	N/A	16	2.0	N/A	North side	55.55	-86.38	°C
Notes	Logger replaced 1 February 2019, new serial number 820603955										
Site Exposure	in rolling cropland just above small drainage, farm buildings 50 m N and NE, 70 m ESE										
Site Number	4311	Anemometer	NRG #40C	317098	1	59.3	95	321°	0.759	0.36	mps
Installation Date	8 December 2018	Anemometer	NRG #40C	314862	2	59.3	95	230°	0.760	0.35	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	317097	3	50.1	95	321°	0.760	0.33	mps
Logger Serial Number	820604311	Anemometer	NRG #40C	314861	4	50.1	95	230°	0.757	0.36	mps
Property Owner	Stutzman	Anemometer	NRG #40C	317096	5	40.1	95	321°	0.758	0.33	mps
Tower Height (m)	60	Anemometer	NRG #40C	314860	6	40.1	95	230°	0.759	0.38	mps
Tower Diameter	10" to 30 m, 8" above	Anemometer	NRG #40C	317095	7	25.1	95	322°	0.760	0.33	mps

Closest Town	Weatherford, OK	Anemometer	NRG #40C	314853	8	25.1	95	230°	0.763	0.31	mps
Latitude (WGS84)	35° 36.094'N										
Longitude (WGS84)	98° 38.499'W	Wind Vane	NRG 200P	027785	13	57.3	95	006°	0	4	degrees
Elevation (m)	512	Wind Vane	NRG 200P	027762	14	27.8	95	005°	0	4	degrees
		Thermometer	NRG #110S	N/A	16	2.0	N/A	North side	55.55	-86.38	°C

Site Exposure open, somewhat elevated area, no obstructions

Site Number	5700	Anemometer	NRG #40C	306532	1	58.0	95	200°	0.773	0.28	mps
Installation Date	7 June 2018	Anemometer	NRG #40C	308215	2	58.0	95	110°/107°	0.755	0.40	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	308216	3	50.0	95	200°	0.763	0.32	mps
Logger Serial Number	820602898	Anemometer	NRG #40C	306533	4	40.0	95	200°	0.772	0.29	mps
Property Owner	---	Anemometer	NRG #40C	308223	5	40.0	95	110°/107°	0.761	0.32	mps
Tower Height (m)	60	Anemometer	NRG #40C	308228	6	25.0	95	200°	0.760	0.33	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Custer, OK	Wind Vane	NRG 200M	000430	13	52.0	95	360°/004°	147.911	-1.46	degrees
Latitude (WGS84)	35° 40.205'N	Wind Vane	NRG 200M	000431	14	47.5	95	360°/004°	147.911	-1.46	degrees
Longitude (WGS84)	98° 47.826'W	Thermometer	NRG #110S	N/A	15	5/3	N/A	North side	55.55	-86.38	°C
Elevation (m)	526	Baramometer	NRG BP20	180534646	16	4/3	N/A	North side	217.9	106.5	mb

Site Exposure small hilltop, but in low-lying area between creeks

Site Number	5701	Anemometer	NRG #40C	306534	1	58.0	95	200°/199°	0.772	0.27	mps
Installation Date	15 June 2018	Anemometer	NRG #40C	308217	2	58.0	95	110°/107°	0.755	0.37	mps
Logger Type	NRG SymphoniePRO	Anemometer	NRG #40C	308218	3	50.0	95	200°/199°	0.764	0.31	mps
Logger Serial Number	820602897	Anemometer	NRG #40C	306535	4	40.0	95	200°/199°	0.774	0.27	mps
Property Owner	---	Anemometer	NRG #40C	308219	5	40.0	95	110°/107°	0.756	0.38	mps
Tower Height (m)	60	Anemometer	NRG #40C	308222	6	25.0	95	200°/199°	0.763	0.31	mps
Tower Diameter	10" to 30 m, 8" above										
Closest Town	Putnam, OK	Wind Vane	NRG 200M	000417	13	52.0	95	360°/002°	147.911	-1.46	degrees
Latitude (WGS84)	35° 45.572'N	Wind Vane	NRG 200M	000418	14	47.5	95	360°/002°	147.911	-1.46	degrees
Longitude (WGS84)	98° 58.654'W	Thermometer	NRG #110S	N/A	15	3	N/A	North side	55.55	-86.38	°C
Elevation (m)	578	Baramometer	NRG BP20	180534646	16	2/3	N/A	North side	217.9	105.5	mb

Site Exposure slightly down E side of N/S oriented ridgeline

* 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.

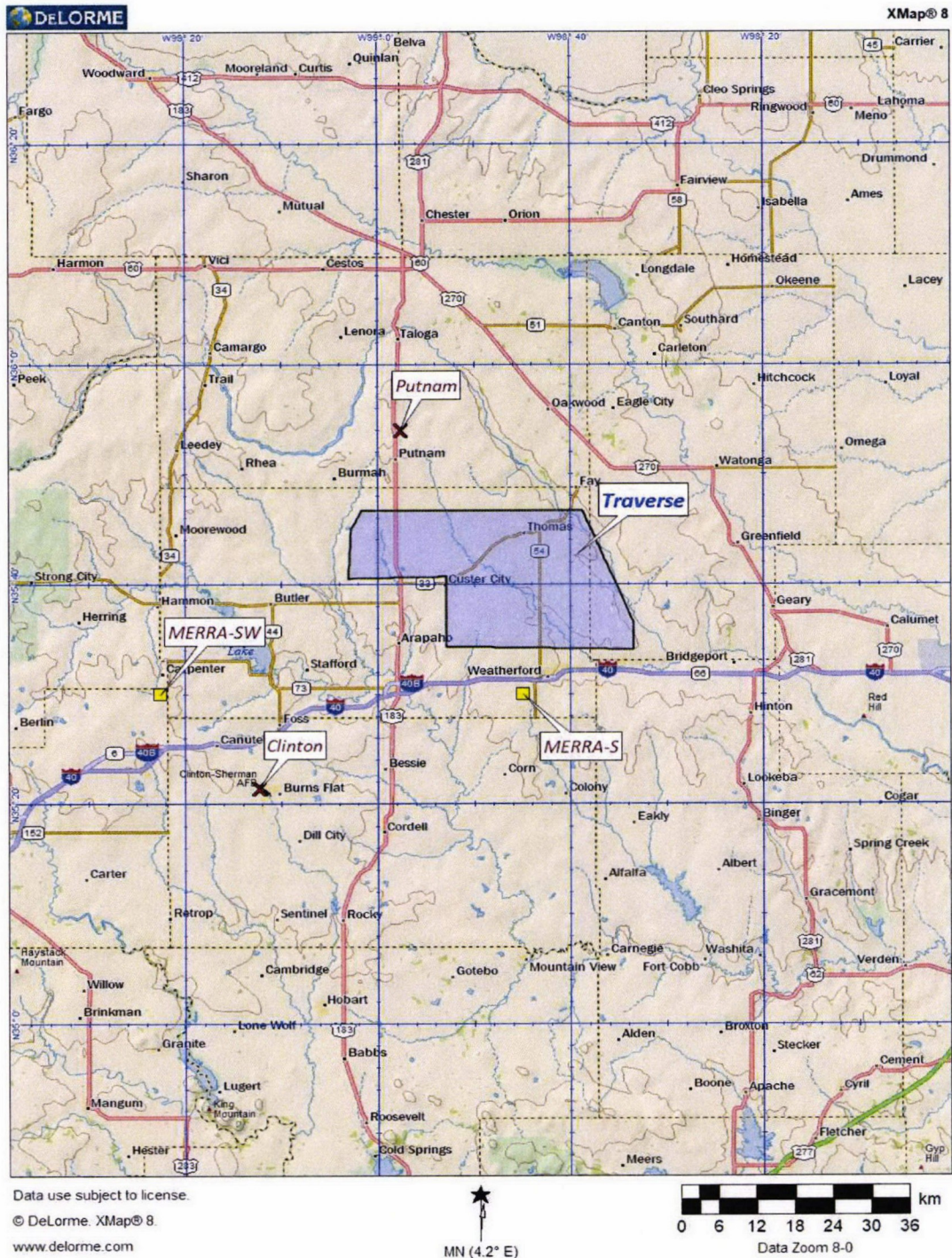
The full serial number for all NRG #200P vanes have a prefix of 179900. Thus a listed serial number of 027755 is actually 179900027755.

The full serial number for all NRG #200M vanes have a prefix of 1007000. Thus a listed serial number of 000430 is actually 1007000000430.

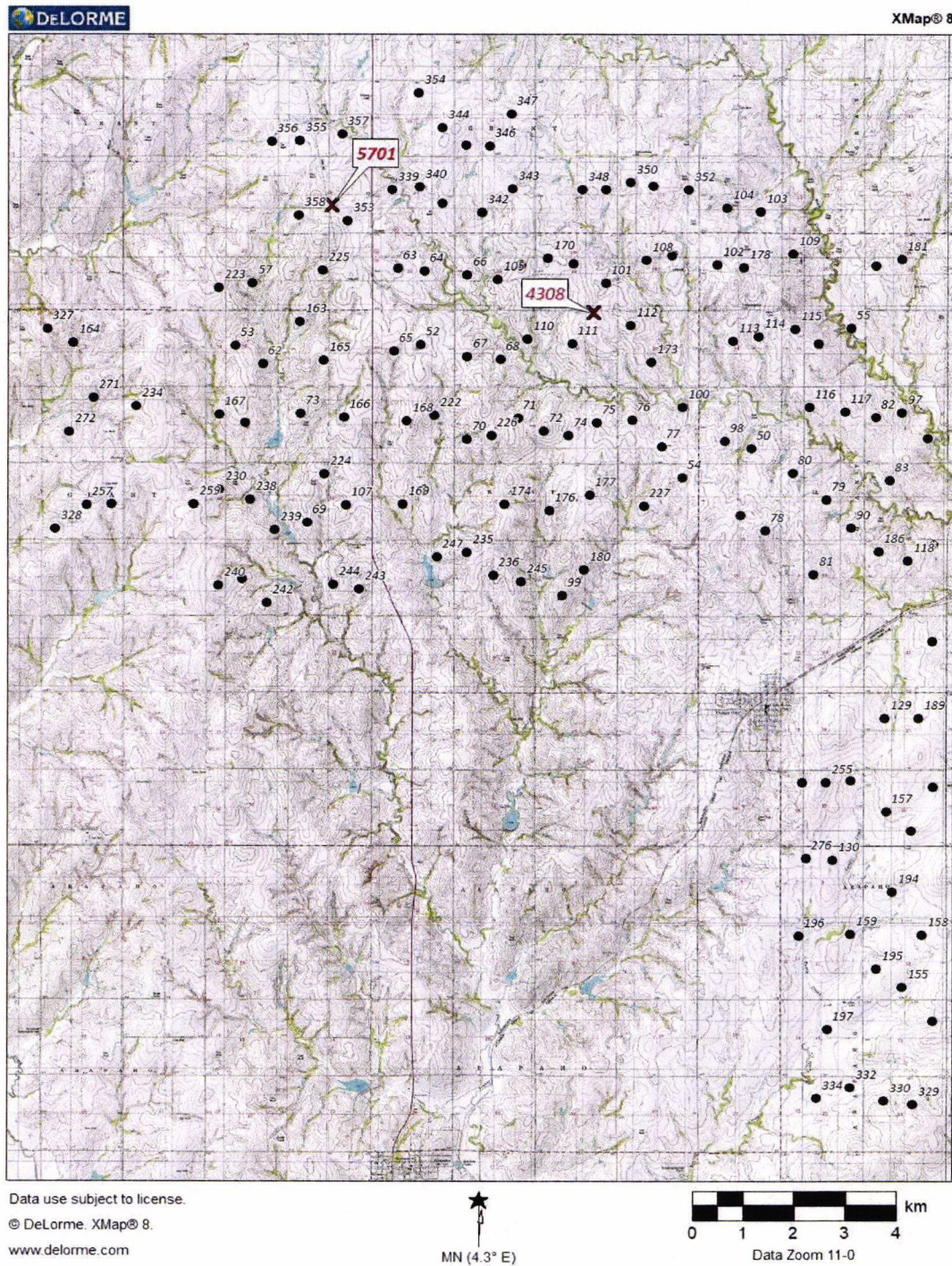
The full serial number for all NRG T-60 thermometers have a prefix of 9400. Thus a listed serial number of 000307 is actually 9400000307.

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

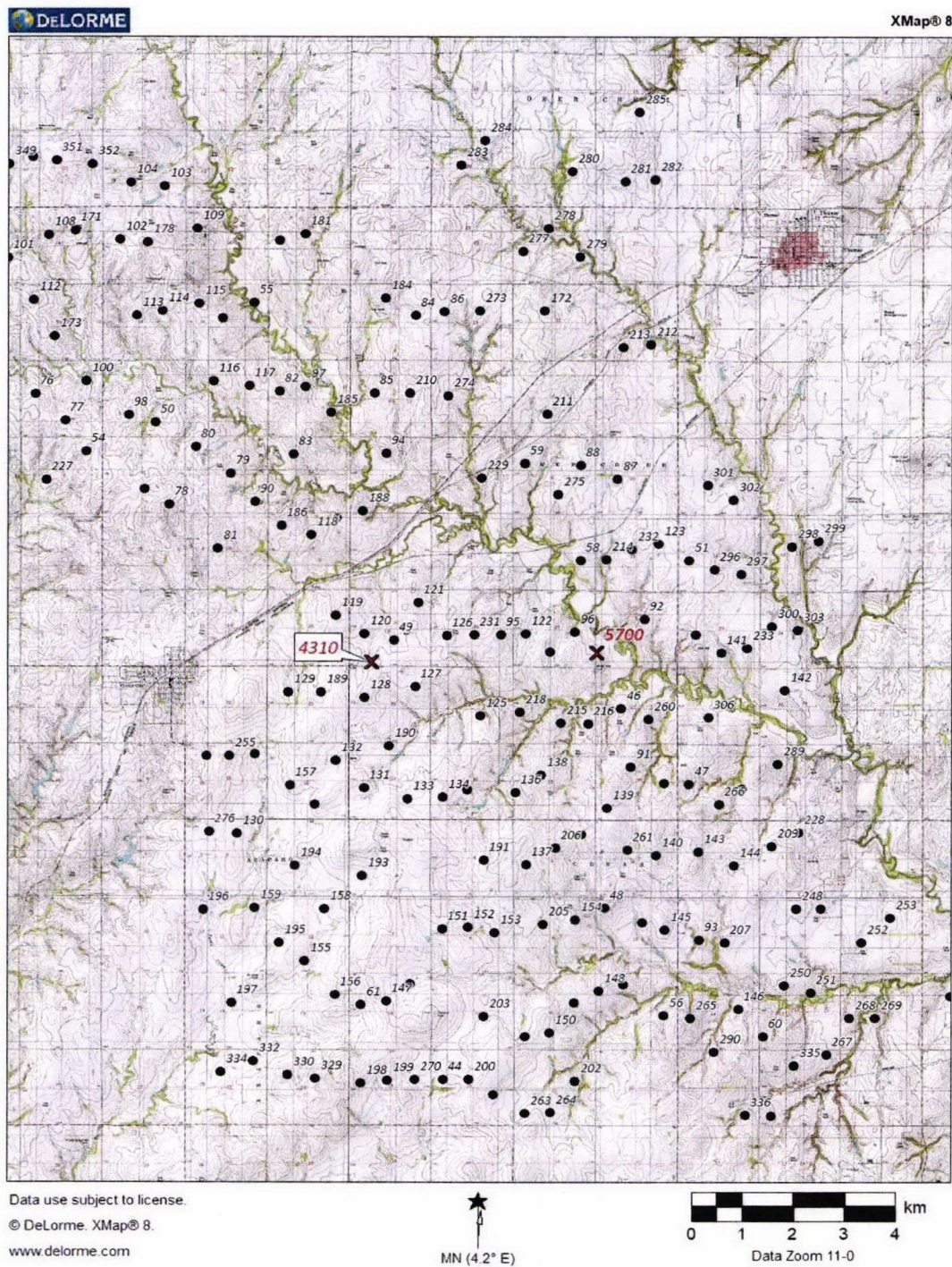
Maps. Regional Map of Traverse Project and Reference Stations



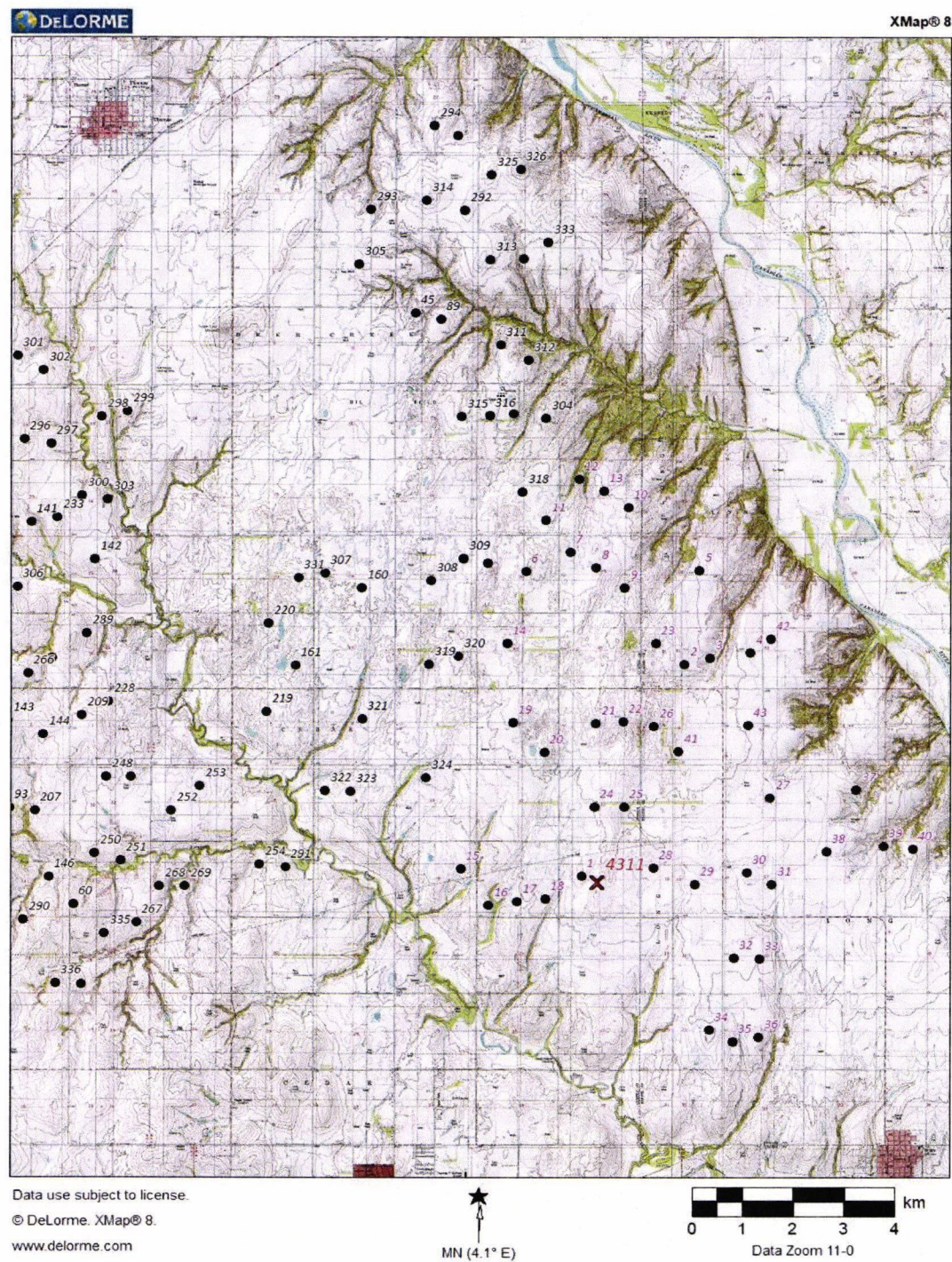
West Part of Traverse Project



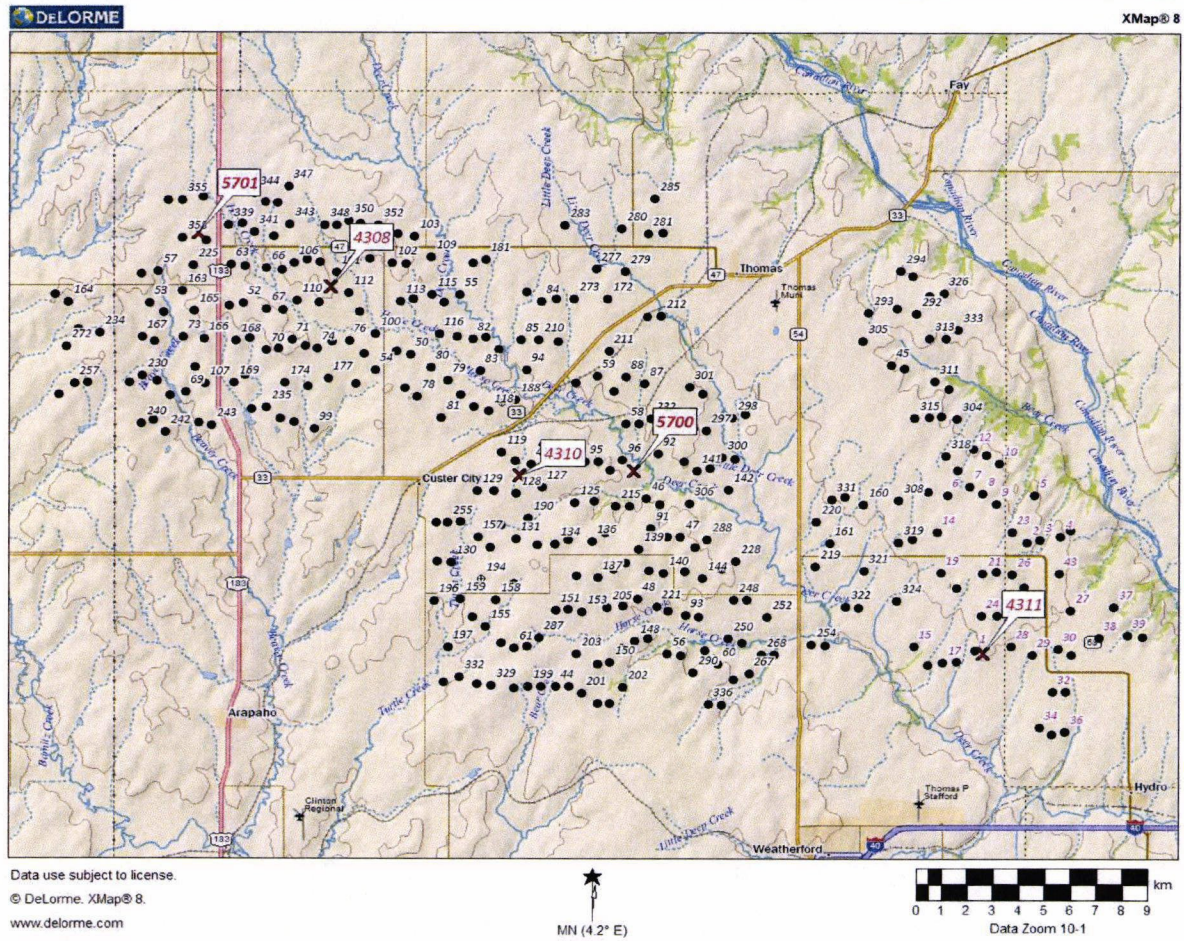
Central Part of Traverse Project



East Part of Traverse Project



Traverse Full Array Plan and Met Towers (GE-2.82/127 turbines with black numbers, GE-2.5/116 turbines with pink numbers)



Coords. Traverse, OK Array Plan
GE-2.82/127 and GE-2.5/116 Turbines
WGS84 Datum, Not Field Checked

Turbine	Latitude	Longitude	Model	Hub Height (m)
1	35.60271	-98.64481	2.5-116	90
2	35.64312	-98.62264	2.5-116	90
3	35.64438	-98.61704	2.5-116	90
4	35.64538	-98.60846	2.5-116	90
5	35.66094	-98.61943	2.5-116	90
6	35.66083	-98.65696	2.5-116	90
7	35.66434	-98.64726	2.5-116	90
8	35.66150	-98.64176	2.5-116	90
9	35.65768	-98.63572	2.5-116	90
10	35.67281	-98.63472	2.5-116	90
11	35.67038	-98.65259	2.5-116	90
12	35.67829	-98.64552	2.5-116	90
13	35.67599	-98.64009	2.5-116	90
14	35.64705	-98.66100	2.5-116	90
15	35.60424	-98.67090	2.5-116	90
16	35.59731	-98.66500	2.5-116	90
17	35.59802	-98.65895	2.5-116	90
18	35.59854	-98.65265	2.5-116	90
19	35.63197	-98.65975	2.5-116	90
20	35.62632	-98.65288	2.5-116	90
21	35.63182	-98.64178	2.5-116	90
22	35.63225	-98.63593	2.5-116	90
23	35.64703	-98.62890	2.5-116	90
24	35.61593	-98.64200	2.5-116	90
25	35.61591	-98.63555	2.5-116	90
26	35.63128	-98.62920	2.5-116	90
27	35.61773	-98.60413	2.5-116	90
28	35.60432	-98.62932	2.5-116	90
29	35.60120	-98.62033	2.5-116	90
30	35.60345	-98.60906	2.5-116	90
31	35.60120	-98.60369	2.5-116	90
32	35.58728	-98.61180	2.5-116	90
33	35.58712	-98.60622	2.5-116	90
34	35.57361	-98.61723	2.5-116	90
35	35.57122	-98.61193	2.5-116	90
36	35.57219	-98.60638	2.5-116	90
37	35.61920	-98.58540	2.5-116	90
38	35.60742	-98.59171	2.5-116	90
39	35.60843	-98.57949	2.5-116	90
40	35.60798	-98.57303	2.5-116	90
41	35.62642	-98.62390	2.5-116	90
42	35.64786	-98.60396	2.5-116	90
43	35.63154	-98.60887	2.5-116	90
44	35.58931	-98.82444	2.82-127	88.6
45	35.70984	-98.68096	2.82-127	88.6
46	35.65955	-98.78596	2.82-127	88.6
47	35.64515	-98.77132	2.82-127	88.6
48	35.62190	-98.78952	2.82-127	88.6
49	35.67250	-98.83525	2.82-127	88.6
50	35.71373	-98.88676	2.82-127	88.6
51	35.68751	-98.77136	2.82-127	88.6
52	35.73317	-98.95839	2.82-127	88.6
53	35.73299	-98.99822	2.82-127	88.6
54	35.70809	-98.90176	2.82-127	88.6
55	35.73635	-98.86539	2.82-127	88.6

56	35.60140	-98.77664	2.82-127	88.6
57	35.74489	-98.99464	2.82-127	88.6
58	35.68763	-98.79475	2.82-127	88.6
59	35.70590	-98.80686	2.82-127	88.6
60	35.59750	-98.75509	2.82-127	88.6
61	35.60353	-98.84220	2.82-127	88.6
62	35.72963	-98.99236	2.82-127	88.6
63	35.74758	-98.96329	2.82-127	88.6
64	35.74707	-98.95755	2.82-127	88.6
65	35.73210	-98.96417	2.82-127	88.6
66	35.74641	-98.94850	2.82-127	88.6
67	35.73100	-98.94834	2.82-127	88.6
68	35.73054	-98.94113	2.82-127	88.6
69	35.69975	-98.98278	2.82-127	88.6
70	35.71535	-98.94850	2.82-127	88.6
71	35.71936	-98.93728	2.82-127	88.6
72	35.71699	-98.93170	2.82-127	88.6
73	35.72018	-98.98422	2.82-127	88.6
74	35.71606	-98.92642	2.82-127	88.6
75	35.71852	-98.92018	2.82-127	88.6
76	35.71905	-98.91266	2.82-127	88.6
77	35.71404	-98.90620	2.82-127	88.6
78	35.69810	-98.88380	2.82-127	88.6
79	35.70403	-98.87060	2.82-127	88.6
80	35.70901	-98.87795	2.82-127	88.6
81	35.68986	-98.87334	2.82-127	88.6
82	35.71957	-98.85992	2.82-127	88.6
83	35.70764	-98.85702	2.82-127	88.6
84	35.73389	-98.83052	2.82-127	88.6
85	35.71916	-98.83942	2.82-127	88.6
86	35.73467	-98.82428	2.82-127	88.6
87	35.70292	-98.78688	2.82-127	88.6
88	35.70550	-98.79471	2.82-127	88.6
89	35.70867	-98.67544	2.82-127	88.6
90	35.69859	-98.86532	2.82-127	88.6
91	35.64839	-98.78398	2.82-127	88.6
92	35.67654	-98.78096	2.82-127	88.6
93	35.61583	-98.76892	2.82-127	88.6
94	35.70788	-98.83693	2.82-127	88.6
95	35.67347	-98.81209	2.82-127	88.6
96	35.67414	-98.79605	2.82-127	88.6
97	35.72038	-98.85446	2.82-127	88.6
98	35.71500	-98.89261	2.82-127	88.6
99	35.68583	-98.92781	2.82-127	88.6
100	35.72145	-98.90165	2.82-127	88.6
101	35.74475	-98.91844	2.82-127	88.6
102	35.74828	-98.89437	2.82-127	88.6
103	35.75826	-98.88489	2.82-127	88.6
104	35.75910	-98.89212	2.82-127	88.6
105	35.74558	-98.94171	2.82-127	88.6
106	35.74829	-98.93669	2.82-127	88.6
107	35.70291	-98.97442	2.82-127	88.6
108	35.74918	-98.90973	2.82-127	88.6
109	35.75041	-98.87781	2.82-127	88.6
110	35.73423	-98.93544	2.82-127	88.6
111	35.73342	-98.92566	2.82-127	88.6
112	35.73682	-98.91304	2.82-127	88.6
113	35.73385	-98.89086	2.82-127	88.6
114	35.73486	-98.88534	2.82-127	88.6
115	35.73626	-98.87747	2.82-127	88.6
116	35.72142	-98.87422	2.82-127	88.6

117	35.72060	-98.86658	2.82-127	88.6
118	35.69244	-98.85311	2.82-127	88.6
119	35.67710	-98.84777	2.82-127	88.6
120	35.67381	-98.84167	2.82-127	88.6
121	35.67955	-98.83002	2.82-127	88.6
122	35.67369	-98.80670	2.82-127	88.6
123	35.69071	-98.77800	2.82-127	88.6
124	35.67032	-98.80134	2.82-127	88.6
125	35.65808	-98.81657	2.82-127	88.6
126	35.67345	-98.82369	2.82-127	88.6
127	35.66377	-98.83049	2.82-127	88.6
128	35.66169	-98.84160	2.82-127	88.6
129	35.66262	-98.85812	2.82-127	88.6
130	35.63590	-98.86920	2.82-127	88.6
131	35.64450	-98.84158	2.82-127	88.6
132	35.64969	-98.84774	2.82-127	88.6
133	35.64237	-98.83227	2.82-127	88.6
134	35.64278	-98.82467	2.82-127	88.6
135	35.64416	-98.81927	2.82-127	88.6
136	35.64363	-98.80888	2.82-127	88.6
137	35.63002	-98.80644	2.82-127	88.6
138	35.64694	-98.80330	2.82-127	88.6
139	35.64067	-98.78903	2.82-127	88.6
140	35.63164	-98.77844	2.82-127	88.6
141	35.67008	-98.76433	2.82-127	88.6
142	35.66294	-98.75061	2.82-127	88.6
143	35.63244	-98.76929	2.82-127	88.6
144	35.62974	-98.76165	2.82-127	88.6
145	35.61763	-98.77636	2.82-127	88.6
146	35.60259	-98.76051	2.82-127	88.6
147	35.60425	-98.83679	2.82-127	88.6
148	35.60615	-98.79076	2.82-127	88.6
149	35.60377	-98.79612	2.82-127	88.6
150	35.59807	-98.80136	2.82-127	88.6
151	35.61776	-98.82452	2.82-127	88.6
152	35.61822	-98.81904	2.82-127	88.6
153	35.61713	-98.81340	2.82-127	88.6
154	35.61949	-98.79592	2.82-127	88.6
155	35.61179	-98.85434	2.82-127	88.6
156	35.60546	-98.84773	2.82-127	88.6
157	35.64507	-98.85758	2.82-127	88.6
158	35.62173	-98.85005	2.82-127	88.6
159	35.62188	-98.86535	2.82-127	88.6
160	35.65756	-98.69276	2.82-127	88.6
161	35.64298	-98.70697	2.82-127	88.6
162	35.67353	-98.76982	2.82-127	88.6
163	35.73752	-98.98430	2.82-127	88.6
164	35.73358	-99.03319	2.82-127	88.6
165	35.73025	-98.97919	2.82-127	88.6
166	35.71954	-98.97483	2.82-127	88.6
167	35.72015	-99.00162	2.82-127	88.6
168	35.71888	-98.96132	2.82-127	88.6
169	35.70312	-98.96228	2.82-127	88.6
170	35.74942	-98.93093	2.82-127	88.6
171	35.74997	-98.90408	2.82-127	88.6
172	35.73486	-98.80268	2.82-127	88.6
173	35.72997	-98.90850	2.82-127	88.6
174	35.70310	-98.94040	2.82-127	88.6
175	35.70596	-98.95755	2.82-127	88.6
176	35.70188	-98.93052	2.82-127	88.6
177	35.70488	-98.92185	2.82-127	88.6

178	35.74784	-98.88855	2.82-127	88.6
179	35.73348	-98.87236	2.82-127	88.6
180	35.69071	-98.92308	2.82-127	88.6
181	35.74940	-98.85445	2.82-127	88.6
182	35.74817	-98.86000	2.82-127	88.6
183	35.73367	-98.85152	2.82-127	88.6
184	35.73723	-98.83707	2.82-127	88.6
185	35.71557	-98.84896	2.82-127	88.6
186	35.69420	-98.85947	2.82-127	88.6
187	35.69577	-98.84761	2.82-127	88.6
188	35.69686	-98.84197	2.82-127	88.6
189	35.66273	-98.85095	2.82-127	88.6
190	35.65242	-98.83637	2.82-127	88.6
191	35.63075	-98.81564	2.82-127	88.6
192	35.64136	-98.85232	2.82-127	88.6
193	35.62788	-98.84212	2.82-127	88.6
194	35.62975	-98.85646	2.82-127	88.6
195	35.61522	-98.85988	2.82-127	88.6
196	35.62141	-98.87636	2.82-127	88.6
197	35.60386	-98.87024	2.82-127	88.6
198	35.58852	-98.84221	2.82-127	88.6
199	35.58912	-98.83644	2.82-127	88.6
200	35.58923	-98.81887	2.82-127	88.6
201	35.58644	-98.81342	2.82-127	88.6
202	35.58896	-98.79574	2.82-127	88.6
203	35.60125	-98.81568	2.82-127	88.6
204	35.59745	-98.80674	2.82-127	88.6
205	35.61870	-98.80277	2.82-127	88.6
206	35.63312	-98.80000	2.82-127	88.6
207	35.61530	-98.76346	2.82-127	88.6
208	35.64529	-98.77676	2.82-127	88.6
209	35.63333	-98.75349	2.82-127	88.6
210	35.71926	-98.83190	2.82-127	88.6
211	35.71519	-98.80191	2.82-127	88.6
212	35.72832	-98.77959	2.82-127	88.6
213	35.72780	-98.78557	2.82-127	88.6
214	35.68767	-98.78923	2.82-127	88.6
215	35.65671	-98.79894	2.82-127	88.6
216	35.65667	-98.79308	2.82-127	88.6
217	35.63563	-98.79455	2.82-127	88.6
218	35.65887	-98.80799	2.82-127	88.6
219	35.63419	-98.71327	2.82-127	88.6
220	35.65094	-98.71285	2.82-127	88.6
221	35.61912	-98.78132	2.82-127	88.6
222	35.71988	-98.95545	2.82-127	88.6
223	35.74397	-99.00195	2.82-127	88.6
224	35.70886	-98.97899	2.82-127	88.6
225	35.74729	-98.97951	2.82-127	88.6
226	35.71608	-98.94310	2.82-127	88.6
227	35.70285	-98.91014	2.82-127	88.6
228	35.63604	-98.74762	2.82-127	88.6
229	35.70314	-98.81618	2.82-127	88.6
230	35.70585	-99.00156	2.82-127	88.6
231	35.67353	-98.81774	2.82-127	88.6
232	35.68960	-98.78380	2.82-127	88.6
233	35.67102	-98.75876	2.82-127	88.6
234	35.72172	-99.01953	2.82-127	88.6
235	35.69390	-98.94842	2.82-127	88.6
236	35.68959	-98.94258	2.82-127	88.6
237	35.71854	-98.99616	2.82-127	88.6
238	35.70394	-98.99495	2.82-127	88.6

239	35.69825	-98.98963	2.82-127	88.6
240	35.68780	-99.00177	2.82-127	88.6
241	35.68894	-98.99671	2.82-127	88.6
242	35.68442	-98.99140	2.82-127	88.6
243	35.68704	-98.97164	2.82-127	88.6
244	35.68799	-98.97726	2.82-127	88.6
245	35.68838	-98.93663	2.82-127	88.6
246	35.74852	-98.92548	2.82-127	88.6
247	35.69310	-98.95478	2.82-127	88.6
248	35.62172	-98.74817	2.82-127	88.6
249	35.62163	-98.74276	2.82-127	88.6
250	35.60717	-98.75058	2.82-127	88.6
251	35.60571	-98.74490	2.82-127	88.6
252	35.61523	-98.73409	2.82-127	88.6
253	35.61996	-98.72781	2.82-127	88.6
254	35.60502	-98.71487	2.82-127	88.6
255	35.65058	-98.87075	2.82-127	88.6
256	35.65087	-98.86532	2.82-127	88.6
257	35.70299	-99.03029	2.82-127	88.6
258	35.70321	-99.02478	2.82-127	88.6
259	35.70316	-99.00715	2.82-127	88.6
260	35.65741	-98.78003	2.82-127	88.6
261	35.63271	-98.78458	2.82-127	88.6
262	35.60723	-98.78530	2.82-127	88.6
263	35.58264	-98.80669	2.82-127	88.6
264	35.58282	-98.80126	2.82-127	88.6
265	35.60089	-98.77083	2.82-127	88.6
266	35.64131	-98.76481	2.82-127	88.6
267	35.59389	-98.74143	2.82-127	88.6
268	35.60096	-98.73655	2.82-127	88.6
269	35.60094	-98.73099	2.82-127	88.6
270	35.58921	-98.83056	2.82-127	88.6
271	35.72323	-99.02869	2.82-127	88.6
272	35.71672	-99.03398	2.82-127	88.6
273	35.73482	-98.81678	2.82-127	88.6
274	35.71867	-98.82349	2.82-127	88.6
275	35.70002	-98.79976	2.82-127	88.6
276	35.63624	-98.87502	2.82-127	88.6
277	35.74606	-98.80729	2.82-127	88.6
278	35.75032	-98.80177	2.82-127	88.6
279	35.74501	-98.79493	2.82-127	88.6
280	35.76103	-98.79669	2.82-127	88.6
281	35.75919	-98.78516	2.82-127	88.6
282	35.75950	-98.77871	2.82-127	88.6
283	35.76233	-98.82086	2.82-127	88.6
284	35.76700	-98.81566	2.82-127	88.6
285	35.77234	-98.78229	2.82-127	88.6
286	35.70109	-98.88909	2.82-127	88.6
287	35.60738	-98.83161	2.82-127	88.6
288	35.64424	-98.75976	2.82-127	88.6
289	35.64895	-98.75227	2.82-127	88.6
290	35.59440	-98.76589	2.82-127	88.6
291	35.60458	-98.70906	2.82-127	88.6
292	35.72926	-98.67035	2.82-127	88.6
293	35.72944	-98.69072	2.82-127	88.6
294	35.74531	-98.67692	2.82-127	88.6
295	35.74351	-98.67180	2.82-127	88.6
296	35.68579	-98.76577	2.82-127	88.6
297	35.68502	-98.76001	2.82-127	88.6
298	35.69008	-98.74911	2.82-127	88.6
299	35.69116	-98.74352	2.82-127	88.6

300	35.67503	-98.75346	2.82-127	88.6
301	35.70170	-98.76730	2.82-127	88.6
302	35.69898	-98.76166	2.82-127	88.6
303	35.67450	-98.74782	2.82-127	88.6
304	35.68979	-98.65263	2.82-127	88.6
305	35.71907	-98.69327	2.82-127	88.6
306	35.65774	-98.76716	2.82-127	88.6
307	35.66034	-98.70066	2.82-127	88.6
308	35.65899	-98.67762	2.82-127	88.6
309	35.66313	-98.67048	2.82-127	88.6
310	35.66235	-98.66526	2.82-127	88.6
311	35.70381	-98.66242	2.82-127	88.6
312	35.70094	-98.65649	2.82-127	88.6
313	35.71999	-98.66473	2.82-127	88.6
314	35.73116	-98.67872	2.82-127	88.6
315	35.69008	-98.67100	2.82-127	88.6
316	35.69040	-98.66489	2.82-127	88.6
317	35.69063	-98.65964	2.82-127	88.6
318	35.67587	-98.65769	2.82-127	88.6
319	35.64311	-98.67794	2.82-127	88.6
320	35.64459	-98.67166	2.82-127	88.6
321	35.63267	-98.69247	2.82-127	88.6
322	35.61897	-98.70049	2.82-127	88.6
323	35.61895	-98.69497	2.82-127	88.6
324	35.62148	-98.67873	2.82-127	88.6
325	35.73605	-98.66470	2.82-127	88.6
326	35.73702	-98.65820	2.82-127	88.6
327	35.73619	-99.03879	2.82-127	88.6
328	35.69854	-99.03694	2.82-127	88.6
329	35.58943	-98.85201	2.82-127	88.6
330	35.59020	-98.85799	2.82-127	88.6
331	35.65952	-98.70637	2.82-127	88.6
332	35.59277	-98.86543	2.82-127	88.6
333	35.72314	-98.65228	2.82-127	88.6
334	35.59071	-98.87250	2.82-127	88.6
335	35.59184	-98.74850	2.82-127	88.6
336	35.58229	-98.75893	2.82-127	88.6
337	35.58213	-98.75335	2.82-127	88.6
338	35.72001	-98.65759	2.82-127	88.6
339	35.76253	-98.96452	2.82-127	88.6
340	35.76307	-98.95856	2.82-127	88.6
341	35.75982	-98.95366	2.82-127	88.6
342	35.75812	-98.94521	2.82-127	88.6
343	35.76260	-98.93866	2.82-127	88.6
344	35.77430	-98.95365	2.82-127	88.6
345	35.77098	-98.94867	2.82-127	88.6
346	35.77080	-98.94355	2.82-127	88.6
347	35.77684	-98.93882	2.82-127	88.6
348	35.76255	-98.92349	2.82-127	88.6
349	35.76249	-98.91829	2.82-127	88.6
350	35.76392	-98.91309	2.82-127	88.6
351	35.76312	-98.90808	2.82-127	88.6
352	35.76251	-98.90041	2.82-127	88.6
353	35.75657	-98.97417	2.82-127	88.6
354	35.78078	-98.95892	2.82-127	88.6
355	35.77183	-98.98441	2.82-127	88.6
356	35.77167	-98.99026	2.82-127	88.6
357	35.77302	-98.97524	2.82-127	88.6
358	35.75760	-98.98461	2.82-127	88.6
359	35.65060	-98.87568	2.82-127	88.6

Ref V. Monthly Mean 10-m Wind Speeds (mps)

Clinton-Sherman Airport, Oklahoma

ASOS Period Only

Sonic Conversion Date: 22 January 2009, Last Moved: 1 September 2010

Latitude: 35° 21.4'N

Longitude: 99° 12.3'W

Elevation: 586 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2010									6.2	5.1	6.6	5.1	
2011	5.3	6.4	6.6	6.9	7.0	8.3	5.2	5.1	5.0	5.9	7.0	5.6	6.19
2012	6.1	5.9	6.5	5.7	6.3	5.9	5.2	4.8	5.1	6.4	5.8	5.9	5.79
2013	5.2	5.9	6.1	7.3	6.6	6.6	5.3	5.1	5.2	6.5	6.4	5.6	5.98
2014	6.9	5.7	7.5	6.8	5.9	6.9	5.4	5.1	5.5	5.5	6.7	5.6	6.12
2015	5.5	6.3	5.2	6.1	5.4	5.7	5.8	5.1	5.9	5.1	6.8	6.1	5.74
2016	5.6	6.4	6.9	5.9	5.7	5.3	6.1	4.7	5.3	6.3	5.7	6.0	5.80
2017	5.9	6.1	7.0	6.9	6.0	6.6	5.3	4.3	5.5	7.0	6.2	5.9	6.05
2018	6.8	6.5	6.6	7.3	6.5	6.9	4.3	5.7	5.6	5.4	5.6	6.2	6.10
2019	6.3	6.5	6.2										
Overall	5.95	6.19	6.49	6.60	6.17	6.51	5.31	4.98	5.49	5.89	6.32	5.77	5.97

Monthly Mean 10-m Wind Speeds (mps)

Putnam Mesonet Station, Oklahoma

Latitude: 35° 53.9'N

Longitude: 98° 57.6'W

Elevation: 489 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1994	5.1	5.6	5.5	6.4	4.0	5.5	4.9	4.9	4.9	4.3	5.6	4.2	5.08
1995	4.8	5.6	5.7	5.7	4.9	5.0	4.2	4.6	4.2	5.4	5.6	4.0	4.98
1996	6.4	5.0	6.3	6.7	6.7	4.5	4.4	4.1	4.4	5.9	5.6	5.5	5.44
1997	5.4	4.8	6.0	5.5	4.9	4.7	4.8	4.1	4.7	5.2	4.7	5.2	5.01
1998	4.8	4.7	6.5	5.4	4.9	6.4	4.4	3.9	4.4	5.4	5.7	4.6	5.09
1999	5.4	5.7	5.9	6.0	5.7	5.5	5.6	4.3	4.8	4.8	5.3	5.5	5.36
2000	4.7	5.9	5.2	5.6	5.3	5.2	4.9	5.1	5.4	5.4	4.5	5.0	5.17
2001	4.6	5.0	4.4	6.6	4.9	5.9	5.4	4.3	4.4	6.1	5.4	5.3	5.18
2002	5.5	6.0	6.5	6.2	5.8	5.8	4.7	4.9	4.5	4.3	4.8	4.8	5.31
2003	5.1	4.7	5.4	6.1	4.7	4.4	5.3	4.1	5.0	4.5	5.3	6.0	5.06
2004	4.9	5.5	5.6	5.5	6.8	4.9	4.7	4.5	5.0	4.5	4.9	5.2	5.15
2005	4.3	4.8	5.6	6.1	4.7	5.3	4.5	4.1	4.8	4.7	5.7	5.0	4.97
2006	5.7	5.4	5.9	6.0	5.4	5.0	4.9	4.5	5.0	5.4	5.4	5.5	5.34
2007	5.3	5.6	5.7	5.4	4.8	4.5	3.7	5.0	4.8	5.6	4.8	5.2	5.03
2008	6.1	5.5	5.8	6.4	5.7	6.0	4.9	3.9	4.4	5.5	5.6	6.3	5.51
2009	5.8	6.0	6.3	6.5	4.7	5.1	4.6	4.7	4.4	5.5	5.1	5.3	5.34

2010	4.4	4.6	6.2	6.4	5.1	5.5	4.7	4.5	5.4	4.6	5.8	4.5	5.14
2011	4.7	5.7	5.8	6.8	6.8	7.5	4.7	4.7	4.8	5.5	6.4	5.1	5.70
2012	5.7	5.5	6.1	5.5	5.8	5.5	4.9	4.4	4.5	5.7	5.4	5.6	5.38
2013	4.9	5.4	5.5	6.4	6.0	6.0	5.0	4.6	4.8	5.8	5.9	5.4	5.46
2014	6.4	5.3	6.6	6.8	5.8	6.5	4.8	4.8	5.4	5.0	5.8	4.9	5.65
2015	4.8	5.4	4.7	5.6	4.9	5.1	4.9	4.3	5.2	4.2	6.0	5.1	5.02
2016	4.8	5.6	6.1	5.5	5.1	4.6	5.2	4.2	5.0	5.6	5.0	5.1	5.14
2017	5.3	5.3	6.3	6.3	5.1	5.6	4.4	3.7	4.9	6.0	5.1	5.1	5.26
2018	5.8	5.6	5.8	6.7	6.1	6.3	3.7	4.9	4.9	4.6	4.9	5.4	5.40
2019	5.3	5.5	5.5										
Overall	5.23	5.38	5.80	6.08	5.38	5.44	4.73	4.44	4.80	5.18	5.37	5.14	5.25

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

Latitude: 35° 30.0'N
Longitude: 99° 22.5'W

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2002	7.6	8.0	8.4	8.1	8.2	7.9	6.5	6.7	6.7	6.2	7.1	6.8	7.34
2003	6.8	6.5	7.3	8.5	7.0	6.1	7.2	6.1	7.2	6.6	7.5	8.1	7.06
2004	6.7	7.1	7.6	7.4	9.0	6.7	6.2	6.3	7.3	6.9	7.0	7.5	7.14
2005	6.1	6.6	7.6	8.6	6.4	7.8	6.3	5.6	6.8	7.1	8.3	7.1	7.01
2006	7.9	7.3	8.1	8.6	7.2	6.9	6.8	5.8	6.7	7.3	7.6	7.1	7.27
2007	6.9	7.5	7.6	7.4	6.7	6.3	5.4	7.3	6.8	8.1	6.8	7.0	6.97
2008	8.0	7.2	8.1	8.7	8.4	8.3	7.1	5.6	6.2	7.6	7.8	8.1	7.59
2009	7.7	8.2	8.4	8.9	6.5	7.2	6.2	6.7	6.4	7.6	7.1	7.1	7.32
2010	6.4	6.1	8.4	9.2	7.5	7.7	6.5	6.7	7.5	6.8	8.2	6.4	7.27
2011	6.5	7.2	7.7	9.0	8.9	9.6	6.3	6.3	6.7	7.5	8.1	6.5	7.54
2012	7.8	7.1	7.7	7.7	8.0	7.3	6.8	6.4	6.3	7.7	7.2	7.4	7.30
2013	6.7	7.5	7.5	8.2	8.2	8.1	6.7	6.2	6.8	8.0	7.6	6.8	7.36
2014	8.2	6.8	8.7	8.8	7.7	8.5	6.5	6.5	6.8	7.0	7.7	6.5	7.48
2015	6.9	7.1	6.3	7.8	7.3	6.9	6.6	6.2	7.1	6.6	8.1	7.4	7.02
2016	6.7	8.1	8.8	7.6	7.3	6.5	7.2	6.1	7.0	7.7	7.4	7.2	7.30
2017	7.1	7.6	8.5	8.5	7.4	7.3	5.7	5.4	6.8	8.4	7.2	7.1	7.26
2018	7.7	7.4	7.8	8.8	7.7	7.9	5.2	6.5	6.5	6.8	7.0	7.5	7.24
2019	7.2	7.0	7.4										
Overall	7.16	7.23	7.89	8.34	7.62	7.48	6.42	6.25	6.79	7.28	7.51	7.14	7.26

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

Latitude: 35° 30.0'N
Longitude: 98° 45.0'W

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2002	7.6	7.9	8.5	8.0	8.1	7.6	6.3	6.6	6.6	6.2	7.1	6.8	7.27
2003	6.9	6.5	7.3	8.6	6.8	6.1	7.2	5.9	7.1	6.7	7.5	8.2	7.06
2004	6.8	7.2	7.8	7.5	9.1	6.6	6.2	6.2	7.2	6.9	7.0	7.5	7.16
2005	6.2	6.5	7.7	8.6	6.5	7.6	6.2	5.4	6.8	7.1	8.4	7.1	7.00
2006	7.9	7.2	8.2	8.5	7.2	6.8	6.9	5.7	6.7	7.3	7.6	7.3	7.29
2007	6.8	7.6	7.6	7.4	6.5	6.3	5.2	7.2	6.7	7.9	6.9	6.8	6.91
2008	8.0	7.1	8.1	8.7	8.3	8.3	7.0	5.6	6.2	7.6	7.8	8.3	7.57
2009	7.7	8.5	8.5	9.1	6.5	7.2	6.2	6.8	6.4	7.7	7.2	7.1	7.39
2010	6.5	6.0	8.4	9.2	7.4	7.6	6.5	6.6	7.4	6.7	8.2	6.5	7.24
2011	6.5	7.4	7.8	9.1	9.0	9.8	6.2	6.4	6.8	7.4	8.3	6.5	7.58
2012	7.9	7.1	8.0	7.6	8.1	7.2	6.7	6.5	6.2	7.8	7.4	7.6	7.34
2013	6.7	7.5	7.7	8.2	8.2	8.0	6.5	6.1	6.8	8.0	7.8	6.8	7.36
2014	8.4	6.8	8.6	8.8	7.8	8.3	6.4	6.4	6.7	7.1	7.8	6.5	7.47
2015	6.8	7.2	6.1	7.8	7.3	7.0	6.7	6.2	7.0	6.6	8.2	7.5	7.03
2016	6.8	8.2	8.7	7.5	7.2	6.4	7.1	6.0	6.9	7.9	7.3	7.3	7.27
2017	7.2	7.6	8.4	8.3	7.4	7.1	5.7	5.4	6.7	8.4	7.2	7.0	7.20
2018	7.8	7.4	7.8	8.8	7.5	7.7	5.0	6.5	6.3	6.7	6.9	7.4	7.14
2019	7.1	7.0	7.4										
Overall	7.19	7.26	7.93	8.33	7.57	7.40	6.34	6.20	6.72	7.28	7.57	7.18	7.25