

**STATE OF NORTH DAKOTA
BEFORE THE
PUBLIC SERVICE COMMISSION**

Foxtail Wind, LLC

**Foxtail Wind Energy Center - Dickey
County**

Case No. PU-17-284

AFFIDAVIT OF

1. My name is Daryl Hart. I am the Director, Business Development for NextEra Energy Resources, LLC ("NextEra"), which is developing the Foxtail Wind Energy Center through its indirect wholly-owned subsidiary, Foxtail Wind, LLC.
2. I submit this affidavit to briefly describe the circumstances under which two landowners participating in the Foxtail Project agreed to waive potential impacts associated with noise and shadow flicker from the Project.

Noise

3. The Commission's rules specify that sound levels from a wind facility may not exceed 50 dBA within 100 feet of an inhabited residence or a community building, unless waived in writing by the owner. The noise modeling results for the Foxtail Project indicated that the received sound levels at 22 of the 24 occupied receptors are below the North Dakota acoustic requirement of 50 dBA within 100 feet of an inhabited residence. Two occupied receptors exceeded the acoustic requirement, but have signed a written waiver of the Commission's 50 dBA acoustic limit.
4. In particular, the predictive acoustic assessment conducted for the Project indicated that Receiver R07 (Kevin and Tammy Strobel) could experience sound levels from operation

of the facility ranging from 53 to 56 dBA and receiver R32 (Jonathan and Sarah Wilmshurst) could experience sound levels ranging from 51 to 54 dBA.

5. As set forth in Section 2(b) of the attached Participation Agreements (Exhibit A), both the Strobels and Wilmshursts are Project participants and have signed a written waiver of the Commission's 50 dBA acoustic limit.
6. To ensure that both the Strobels and Wilmshursts fully understood the waiver they were granting, Foxtail explained the specific (and technical) modeling results and what the results mean from a practical perspective. The specific "talking points" used by Foxtail in discussions with the Strobels and Wilmshursts are attached to my affidavit as Exhibit B. A copy of the talking points was provided to the Strobels and the Wilmshursts.

Shadow Flicker Discussions

7. The Commission's rules do not regulate shadow flicker, but the Commission has evaluated shadow flicker at 30 hours per year or less at a currently occupied residence, unless waived by the landowner. This is the standard that Foxtail used in evaluating this Project. A total of 50 structures were identified within and near the Project area; of these, 24 were determined to be occupied residences and are considered potential shadow flicker receptors for the purpose of Foxtail's analysis.
8. The assessments show that the potential shadow flicker impacts of the Foxtail Project are less than 30 hours per year at all but one identified occupied receptor. This receptor is a residence owned by landowners that are participating in the Project (the Strobels) and have granted a waiver for shadow flicker impacts on their property.
9. Similar to Foxtail's approach with respect to potential noise impacts, to ensure that the Strobels fully understood the waiver they were granting, Foxtail explained shadow flicker

in concept and the specific (and technical) shadow flicker modeling results with the Strobels. The “talking points” used by Foxtail in discussions with the Strobels are attached to my affidavit as Exhibit C. A copy of the talking points was provided to the Strobels.

10. This concludes my affidavit.

STATE OF NORTH DAKOTA
BEFORE THE
PUBLIC SERVICE COMMISSION

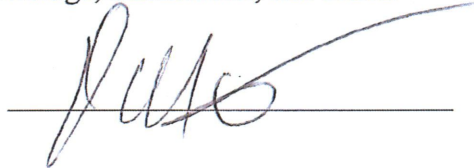
Foxtail Wind, LLC

Foxtail Wind Energy Center - Dickey
County

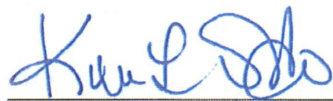
Case No. PU-17-284

AFFIDAVIT OF

I, Daryl Hart, being duly sworn, depose and state that the contents of the foregoing Affidavit and appended Exhibits submitted on behalf of Foxtail Wind LLC are true, correct, accurate, and complete to the best of my knowledge, information, and belief.



Subscribed and sworn to before me
this 4th day of December, 2017.



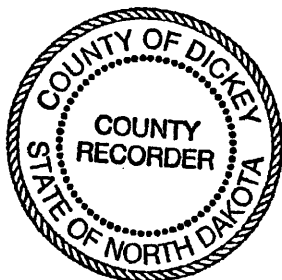
Notary



DOC #: 188027

(1 of 6)

STATE OF NORTH DAKOTA - DICKEY COUNTY
RECORDED: 11/28/2017 12:40 PM
RETURN TO: NEXTERA ENERGY RESOURCES LLC
700 UNIVERSE BLVD
JUNO BEACH, FL 33408



Recorded ☒
Indexed ☒
Compared ☒

DOC #: 188027

Fee: \$20.00

STATE OF NORTH DAKOTA - DICKEY COUNTY
RECORDED: 11/28/2017 12:40 PM

I certify that this instrument was recorded this date

Deborah D. Anderson, County Recorder

By: Deborah D. Anderson

PARTICIPATION AGREEMENT

THIS PARTICIPATION AGEEMENT ("Agreement") is dated this 18 day of September, 2017 ("Effective Date") by and between Kevin Strobel and Tammy Strobel, husband and wife, with an address of 8832 70th Avenue SE, Kulm, ND 58456 ("Owner"), and Foxtail Wind, LLC, a Delaware limited liability company, with an address of 700 Universe Blvd., Juno Beach, FL 33408, Attn: Land Services, and its successors in interests ("Operator"). Owner and Operator are collectively referred to as the "Parties".

RECITALS

A. Owner is the owner of a certain tract of real property located in Dickey County, North Dakota and more particularly described on **Exhibit A** attached hereto and made a part hereof ("Property").

B. Operator is the holder of certain easement and other related rights covering real property located adjacent to and/or in the vicinity of the Property because it is constructing a wind energy conversion system with wind turbines, collection lines, and roads in Dickey County, North Dakota (collectively "Wind Farm").

C. Operator desires to have certain landowners participate in the benefit of the Wind Farm and Owner agrees to grant and convey to Operator an option to acquire an easement for wind non-obstruction and an easement for effects on the Property attributable to the Wind Farm.

For good and valuable consideration set forth herein, the adequacy and receipt of which is hereby acknowledged, the Parties agree as follows:

1. **Option.** Owner grants to Operator an exclusive option ("Option") to acquire the easements in accordance with the following terms and conditions.

(a) The initial term of the Option shall be for three (3) years, commencing on the Effective Date ("Initial Option Term"). Operator shall have the right to extend the Initial Option Term for an additional two (2) years ("Extended Option Term") after notifying Owner at least thirty (30) days prior to the expiration date of the Initial Option Term. The Initial Option Term and Extended Option Term shall collectively be referred to as the "Option Term".

(b) Operator may exercise the Option by giving written notice to Owner ("Option Notice") at any time during the Option Term. Operator shall specify in the Option Notice the

date on which the Easements (as defined in Section 2) will become effective ("**Commencement Date**").

(c) If Operator fails to exercise the Option within the Option Term, the Option and the rights of Operator as provided herein shall automatically terminate.

2. **Easements.** The easements described in this paragraph shall collectively be referred to as "**Easements**".

(a) On the Commencement Date, Owner grants Operator an exclusive easement for the right and privilege to use, maintain and capture the free and unobstructed flow of wind currents over and across the Property as described in **Exhibit A**. Owner shall not engage in any activity on the Property that might interfere with wind speed or wind direction over the Property; cause a decrease in the output or efficiency of any wind turbine or accuracy of any meteorological equipment; or otherwise interfere with Operator's operation of the Wind Farm or exercise of any rights granted in this Agreement.

(b) Owner grants to Operator an easement for sounds, visual, light, flicker, shadow, vibration, wake, electromagnetic, electrical and radio frequency interference, and any other effects (collectively "**Effects**") on the Property caused or alleged to be caused by the Wind Farm. By signing this Agreement, you, as the owner of the inhabited residence on the Property, acknowledge and confirm that you have no objection to the construction and operation of the Wind Farm. Execution of this Agreement confirms your understanding that operation of the Wind Farm may result in sound levels that exceed 50 dBA within one hundred (100) feet of your residence and with that understanding you waive the sound level avoidance criteria requirements in N.D. Admin. Code §69-06-08-01(4).

3. **Term.** The term of the Agreement ("**Term**") shall commence on the Commencement Date and end ninety-nine (99) years after the Commencement Date, subject to the rights of termination as provided in this Agreement. Operator, at its option, shall have the right to terminate this Agreement at any time during the Term of the Agreement. Termination shall be effective thirty (30) days after written notice of such termination to Owner.

4. **Authority.** Owner is the holder of fee simple title to all of the Property, and has the right, without the joinder of any other party, to enter into this Agreement and grant Operator the Easements. Owner agrees to warrant and defend its ownership of the Property and Operator's interest in this Agreement against any other party claiming to have any ownership interest in or other claim to the Property.

5. **Assignment.** This Agreement, and its rights and obligations, may be assigned by either party to its respective heirs, successors and assigns. The Easements shall run with the Property and shall be binding on Owner and Operator, together with their mortgagees, assignees, and respective successors and assigns, heirs, personal representatives, tenants or persons claiming through them.

6. **Reserved Uses.** Owner reserves the right to use the Property for all other purposes not granted to Operator under this Agreement, including ranching and agricultural uses, and all recreational uses, provided that no such other use interferes with the Easements.

7. **Release.** Owner hereby releases Operator from any and all claims for damages arising from any injury or harm or conditions related to the Property, including but not limited to, any harm or loss due to nuisance, trespass, disturbance, Effects, diminishment of the value of the Property, proximity of the Wind Farm to Owner's Property and/or residence, diminishment or interference with the ability to use or enjoy the Property, and any other injury or harm, of whatever kind or character, to persons or property, whether now known or unknown, or which may appear or develop in the future, caused or alleged to be caused by the Wind Farm or by Operator, its parent companies, affiliates, successors, assigns, whether claimed or not claimed, or which hereafter might be brought by Owner or any of their successors and assigns.

8. **Governing Law.** Operator shall comply with valid laws applicable to the Property and Owner shall not be liable in the event that Operator violates a law relating to the Easements on the Property. This Agreement shall be governed by and interpreted in accordance with the laws of the State of North Dakota. The Parties agree to first attempt to settle any dispute arising out of or in connection with this Agreement by good faith negotiation. If the Parties are unable to resolve amicably any dispute arising out of or in connection with this Agreement, each shall have all remedies available at law or in equity. **Each party waives all right to trial by jury and specifically agrees that trial of suits or causes of action arising out of this Agreement shall be to the court of competent jurisdiction.**

9. **Compensation.** Operator shall pay Owner the amounts set forth in a separate Compensation Agreement as the consideration for this Agreement. The Parties acknowledge and agree that the Compensation Agreement shall not be recorded with the County Recorder, and that by separating the Compensation Agreement from this Agreement prior to recording does not in any way affect the validity of this Agreement. If Operator fails to operate the Wind Farm for a period of three (3) years, then Owner may terminate this Agreement unless Operator continues to pay to Owner the Annual Installment Payment, which is the amount set forth in Compensation Agreement entered into contemporaneously with this Agreement.

[Signatures on Next Pages]

EXECUTED effective the day and year set forth below.

Owner:

Kevin Strobel
Kevin Strobel

Tammy Strobel
Tammy Strobel

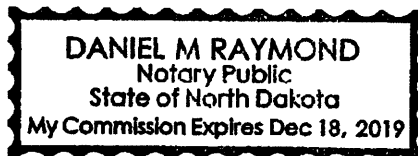
ACKNOWLEDGEMENT

STATE OF NORTH DAKOTA)
) ss:
COUNTY OF LAMOURE)

The forgoing instrument was acknowledged before me this 31 day of August, 2017,
by Kevin Strobel and Tammy Strobel, husband and wife.

My Commission expires: 12-18-19

[Signature]
Notary Public



DOC #: 188027

(4 of 6)

STATE OF NORTH DAKOTA - DICKEY COUNTY

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RETURN TO: NEXTERA ENERGY RESOURCES LLC

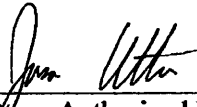
700 UNIVERSE BLVD

JUNO BEACH, FL 33408

EXECUTED effective the day and year set forth below.

Operator:

Foxtail Wind, LLC
A Delaware limited liability company

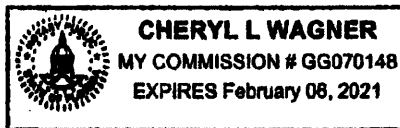
By: 
Jason Utton, Authorized Representative

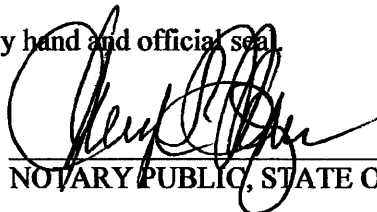
STATE OF FLORIDA)
) ss:
COUNTY OF PALM BEACH)

On this 18 day of September, 2017, before me, the undersigned notary public, personally appeared Jason Utton, personally known to me to be the person who subscribed to the foregoing instrument and acknowledged that he executed the same on behalf of said limited liability company and that he was duly authorized so to do.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

(notary seal)




NOTARY PUBLIC, STATE OF FLORIDA

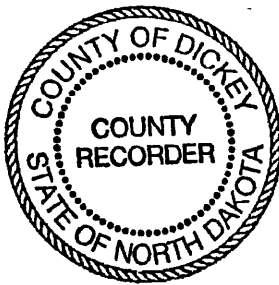
AFTER RECORDING RETURN TO

Orin Shakerdge, Esq.
NextEra Energy Resources, LLC
700 Universe Blvd.
Juno Beach, FL 33408
(561) 694-4678

EXHIBIT A

Legal Description of Property

South Half of the Northwest Quarter (S½NW¼) of Section 26, Township 131 North, Range 66 West, Dickey County, North Dakota.



Recorded ☒
Indexed ☒
Compared ☒

DOC #: 188028 (1 of 6)
STATE OF NORTH DAKOTA - DICKEY COUNTY
RECORDED: 11/28/2017 12:45 PM
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700 UNIVERSE BLVD
JUNO BEACH, FL 33408

DOC #: 188028 Fee: \$20.00
STATE OF NORTH DAKOTA - DICKEY COUNTY
RECORDED: 11/28/2017 12:45 PM
I certify that this instrument was recorded this date
Deborah D. Anderson, County Recorder
By: Deborah D. Anderson

PARTICIPATION AGREEMENT

THIS PARTICIPATION AGREEMENT ("**Agreement**") is dated this 29th day of September, 2017 ("**Effective Date**") by and between Jonathan Wilmschurst and Sarah Wilmschurst, husband and wife, with an address of 12741 Shannon Parkway, Rosemount, MN 55068 ("**Owner**"), and Foxtail Wind, LLC, a Delaware limited liability company, with an address of 700 Universe Blvd., Juno Beach, FL 33408, Attn: Land Services, and its successors in interests ("**Operator**"). Owner and Operator are collectively referred to as the "**Parties**".

RECITALS

A. Owner is the owner of a certain tract of real property located in Dickey County, North Dakota and more particularly described on **Exhibit A** attached hereto and made a part hereof ("**Property**").

B. Operator is the holder of certain easement and other related rights covering real property located adjacent to and/or in the vicinity of the Property because it is constructing a wind energy conversion system with wind turbines, collection lines, and roads in Dickey County, North Dakota (collectively "**Wind Farm**").

C. Operator desires to have certain landowners participate in the benefit of the Wind Farm and Owner agrees to grant and convey to Operator an option to acquire an easement for wind non-obstruction and an easement for effects on the Property attributable to the Wind Farm.

For good and valuable consideration set forth herein, the adequacy and receipt of which is hereby acknowledged, the Parties agree as follows:

1. **Option**. Owner grants to Operator an exclusive option ("**Option**") to acquire the easements in accordance with the following terms and conditions.

(a) The initial term of the Option shall be for three (3) years, commencing on the Effective Date ("**Initial Option Term**"). Operator shall have the right to extend the Initial

Option Term for an additional two (2) years ("**Extended Option Term**") after notifying Owner at least thirty (30) days prior to the expiration date of the Initial Option Term. The Initial Option Term and Extended Option Term shall collectively be referred to as the "**Option Term**".

(b) Operator may exercise the Option by giving written notice to Owner ("**Option Notice**") at any time during the Option Term. Operator shall specify in the Option Notice the date on which the Easements (as defined in Section 2) will become effective ("**Commencement Date**").

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(a) On the Commencement Date, Owner grants Operator an exclusive easement for the right and privilege to use, maintain and capture the free and unobstructed flow of wind currents over and across the Property as described in **Exhibit A**. Owner shall not engage in any activity on the Property that might interfere with wind speed or wind direction over the Property; cause a decrease in the output or efficiency of any wind turbine or accuracy of any meteorological equipment; or otherwise interfere with Operator's operation of the Wind Farm or exercise of any rights granted in this Agreement.

(b) Owner grants to Operator an easement for sounds, visual, light, flicker, shadow, vibration, wake, electromagnetic, electrical and radio frequency interference, and any other effects (collectively "**Effects**") on the Property caused or alleged to be caused by the Wind Farm. By signing this Agreement, you, as the owner of the inhabited residence on the Property, acknowledge and confirm that you have no objection to the construction and operation of the Wind Farm. Execution of this Agreement confirms your understanding that operation of the Wind Farm may result in sound levels that exceed 50 dBA within one hundred (100) feet of your residence and with that understanding you waive the sound level avoidance criteria requirements in N.D. Admin. Code §69-06-08-01(4).

3. **Term.** The term of the Agreement ("**Term**") shall commence on the Commencement Date and end ninety-nine (99) years after the Commencement Date, subject to the rights of termination as provided in this Agreement. Operator, at its option, shall have the right to terminate this Agreement at any time during the Term of the Agreement. Termination shall be effective thirty (30) days after written notice of such termination to Owner.

4. **Authority.** Owner is the holder of fee simple title to all of the Property, and has the right, without the joinder of any other party, to enter into this Agreement and grant Operator the Easements. Owner agrees to warrant and defend its ownership of the Property and Operator's interest in this Agreement against any other party claiming to have any ownership interest in or other claim to the Property.

5. **Assignment.** This Agreement, and its rights and obligations, may be assigned by either party to its respective heirs, successors and assigns. The Easements shall run with the

DOC #: 188028

STATE OF NORTH DAKOTA - DICKEY COUNTY

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700 UNIVERSE BLVD

JUNO BEACH, FL 33408

(2 of 6)

Property and shall be binding on Owner and Operator, together with their mortgagees, assignees, and respective successors and assigns, heirs, personal representatives, tenants or persons claiming through them.

6. **Reserved Uses.** Owner reserves the right to use the Property for all other purposes not granted to Operator under this Agreement, including ranching and agricultural uses, and all recreational uses, provided that no such other use interferes with the Easements.

7. **Release.** Owner hereby releases Operator from any and all claims for damages arising from any injury or harm or conditions related to the Property, including but not limited to, any harm or loss due to nuisance, trespass, disturbance, Effects, diminishment of the value of the Property, proximity of the Wind Farm to Owner's Property and/or residence, diminishment or interference with the ability to use or enjoy the Property, and any other injury or harm, of whatever kind or character, to persons or property, whether now known or unknown, or which may appear or develop in the future, caused or alleged to be caused by the Wind Farm or by Operator, its parent companies, affiliates, successors, assigns, whether claimed or not claimed, or which hereafter might be brought by Owner or any of their successors and assigns.

8. **Governing Law.** Operator shall comply with valid laws applicable to the Property and Owner shall not be liable in the event that Operator violates a law relating to the Easements on the Property. This Agreement shall be governed by and interpreted in accordance with the laws of the State of North Dakota. The Parties agree to first attempt to settle any dispute arising out of or in connection with this Agreement by good faith negotiation. If the Parties are unable to resolve amicably any dispute arising out of or in connection with this Agreement, each shall have all remedies available at law or in equity. **Each party waives all right to trial by jury and specifically agrees that trial of suits or causes of action arising out of this Agreement shall be to the court of competent jurisdiction.**

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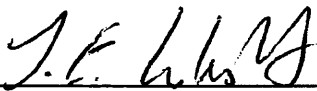
[Signatures on Next Pages]

EXECUTED effective the day and year set forth below.

Owner:



Jonathan Wilmschurst



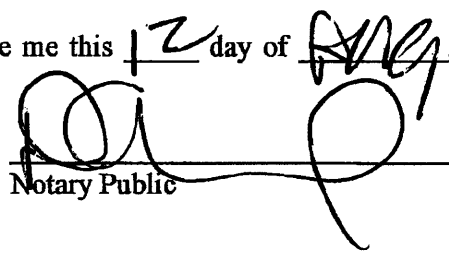
Sarah Wilmschurst

ACKNOWLEDGEMENT

STATE OF MINNESOTA)
) ss.
COUNTY OF DAKOTA)

The forgoing instrument was acknowledged before me this 12 day of Aug, 2017, by Jonathan Wilmschurst and Sarah Wilmschurst.

My Commission expires: 1-31-19



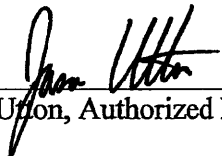
Notary Public



EXECUTED effective the day and year set forth below.

Operator:

Foxtail Wind, LLC
a Delaware limited liability company

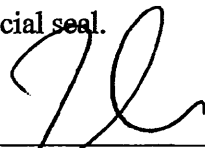
By: 
Jason Utton, Authorized Representative

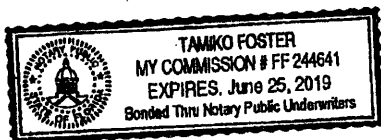
STATE OF FLORIDA)
) ss:
COUNTY OF PALM BEACH)

On this 29 day of September, 2017, before me, the undersigned notary public, personally appeared Jason Utton, personally known to me to be the person who subscribed to the foregoing instrument and acknowledged that he executed the same on behalf of said limited liability company and that he was duly authorized so to do.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

(notary seal)


NOTARY PUBLIC, STATE OF FLORIDA



AFTER RECORDING RETURN TO

Orin Shakerdge, Esq.
NextEra Energy Resources, LLC
700 Universe Blvd.
Juno Beach, FL 33408
(561) 694-4678

DOC #: 188028

(5 of 6)

STATE OF NORTH DAKOTA - DICKEY COUNTY

RECORDED: 11/28/2017 12:45 PM

RETURN TO: NEXTERA ENERGY RESOURCES LLC

700 UNIVERSE BLVD
JUNO BEACH, FL 33408

EXHIBIT A

Legal Description of Property

A tract of land located within the Northwest Quarter (NW¼) of Section 7, Township 130 North, Range 65 West, Dickey County, North Dakota, more particularly described as follows: Commencing at the NW corner of the NW¼ of said Section 7, thence N 90°00'00" (assumed bearing) along the north line of the NW¼ of said Section 7, 943.79 feet to the point of beginning; thence continuing N 90°00'00" E along the north line of the NW¼ of said Section 7, 451.69 feet; then S 12°52'20" E, 659.42 feet; thence S 84°00'29" W, 464.85 feet; thence N 11°09'01" W, 704.68 feet to the point of beginning. Said tract of land contains 7.08 acres, more or less.

DOC #: 188028

(6 of 6)

STATE OF NORTH DAKOTA - DICKEY COUNTY

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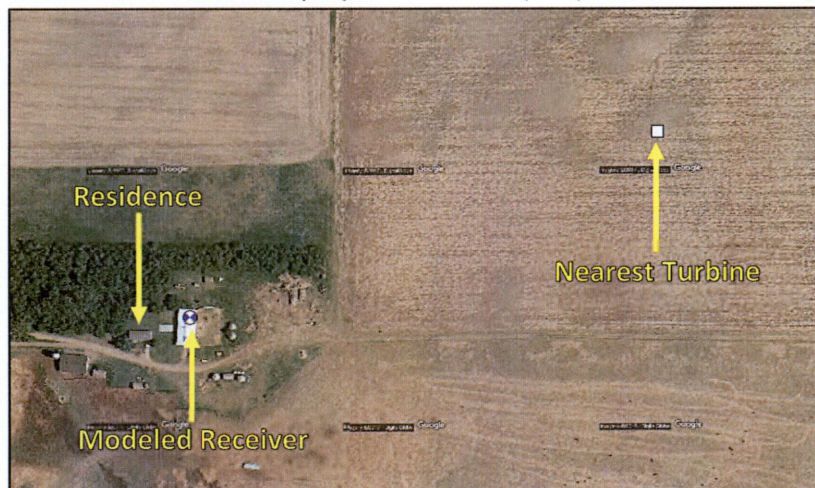
RETURN TO: NEXTERA ENERGY RESOURCES LLC

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How does the model calculate wind turbine noise?

The model space is a 3-dimensional acoustical propagation model that considers terrain, noise source heights and characteristics, receiver heights, ground-cover types, meteorological conditions (e.g. humidity, temperature, wind speed/direction), and other various parameters that have potential to affect outdoor sound propagation across long distances.

- Input of sources
 - Turbine locations
 - Turbine hub height
 - Turbine sound level data
 - Provided by the manufacturer (collected via standardized methods). This data not only includes a single sound level value, but also provides spectral information (e.g. sound levels specific to each octave-band frequency), this allows the model to consider the varying propagation characteristics of different frequencies generated by the turbine.
- Input of Receptor R07/Stobel's residence
 - The relevant state regulation (NDAC Section 69-06-08-01[4]), requires noise levels to be assessed at approximately 100' from the residence, thus, the receiver location was placed approximately 100' from the residence in the direction of the nearest proposed turbine (#10), northeast of the property.



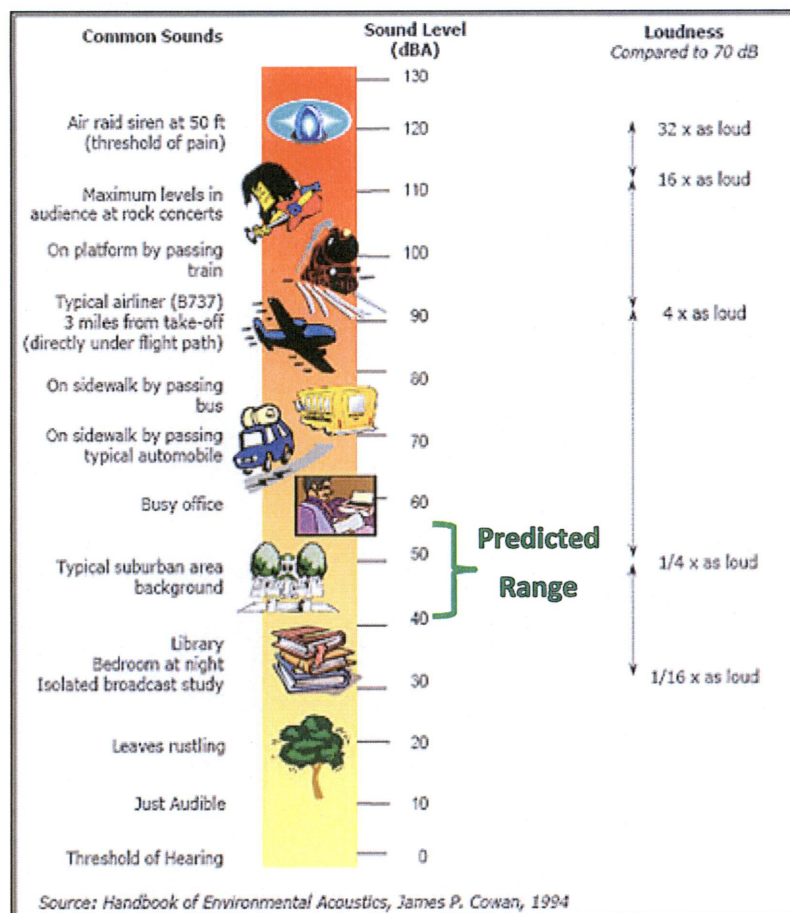
- Though receivers are typically modeled at a typical listener height (5 feet above ground) for other types of acoustic studies, wind turbine noise assessments will conservatively elevate the receiver off the ground to a height of approximately 13 feet to reduce benefits from groundcover absorption, intervening terrain/structures, and other features to provide a more-conservative estimate for noise levels. The result of this increased height at R07 is a predicted sound level that is 1-2 dB higher than what would be expected at typical listener height.

- Model Notes

- The model relies on an industry standard (ISO 9613-2) which assumes that all receivers are downwind of the modeled noise sources, thus, predicted noise levels presented in the report are considered to be worst-case (as it relates to receiver/noise source location and wind direction) for all scenarios.
- Scenario Review
 - “Cut-In” - The dominant noise generated by the wind turbine will be during energy generation. Energy generation occurs when wind speeds at the hub height reach the necessary “cut-in” speed. The cut-in speed for the proposed turbines is 3 m/s or 6.7 mph.
 - “Maximum Rotational” - The highest noise levels are generated by the turbine when it reaches its maximum rotational capabilities at wind speeds of 20 m/s or 44.7 mph. Wind surpassing these speeds will no longer accelerate rotor/blade rotational speed. It is important to note that during periods of these wind speeds, ambient noise levels in the immediate occupied house/receptor vicinity are expected to be significantly higher due to wind-generated noise from nearby structures and foliage.
 - “Anomalous” – In addition to the maximum rotational scenario, the levels reported for anomalous conditions present a worst-case scenario wherein the presence of atypical meteorological conditions would provide an environment favorable to sound propagation, resulting in higher levels at greater distances.

- Results

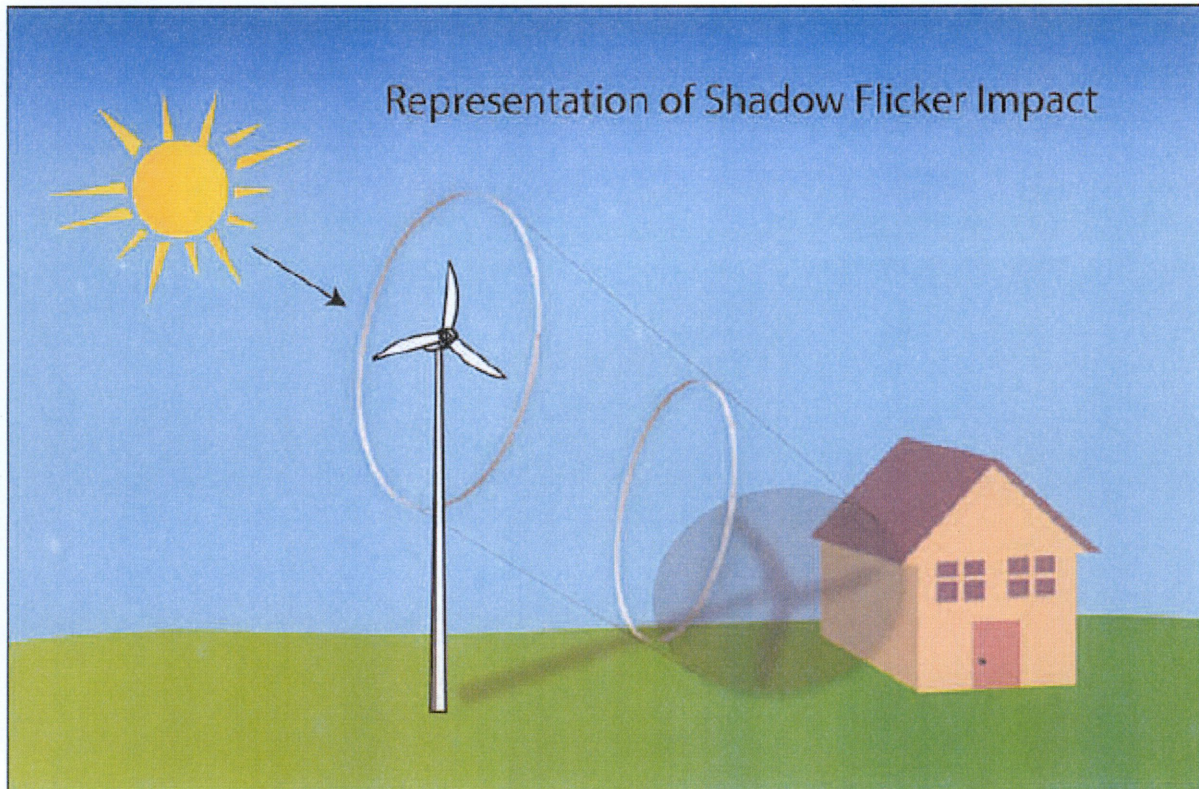
- The predicted noise levels for R07 remain identical across both the “No Alternates” and “With Alternates” proposed Project scenarios and are as follows:
 - Operation Noise Levels During Cut-In: **40.9 dBA**
 - Operation Noise Levels During Maximum Rotation: **52.9 dBA**
 - Operation Noise Levels During Anomalous Conditions: **55.7 dBA**
- The figure below provides a scale of common noise sources at various decibel levels:



Source: Handbook of Environmental Acoustics, James P. Cowan, 1994

What is shadow flicker?

- Shadow flicker occurs when the blades of a turbine pass in front of the sun to create a repeating shadow on a window of a house.
- Shadow flicker would not occur when:
 - The wind speeds are less than 6.7 mph (3 m/s) as the turbines are not operating.
 - Clouds are blocking the sun.
 - During precipitation (rain/snow) events.
 - At night.



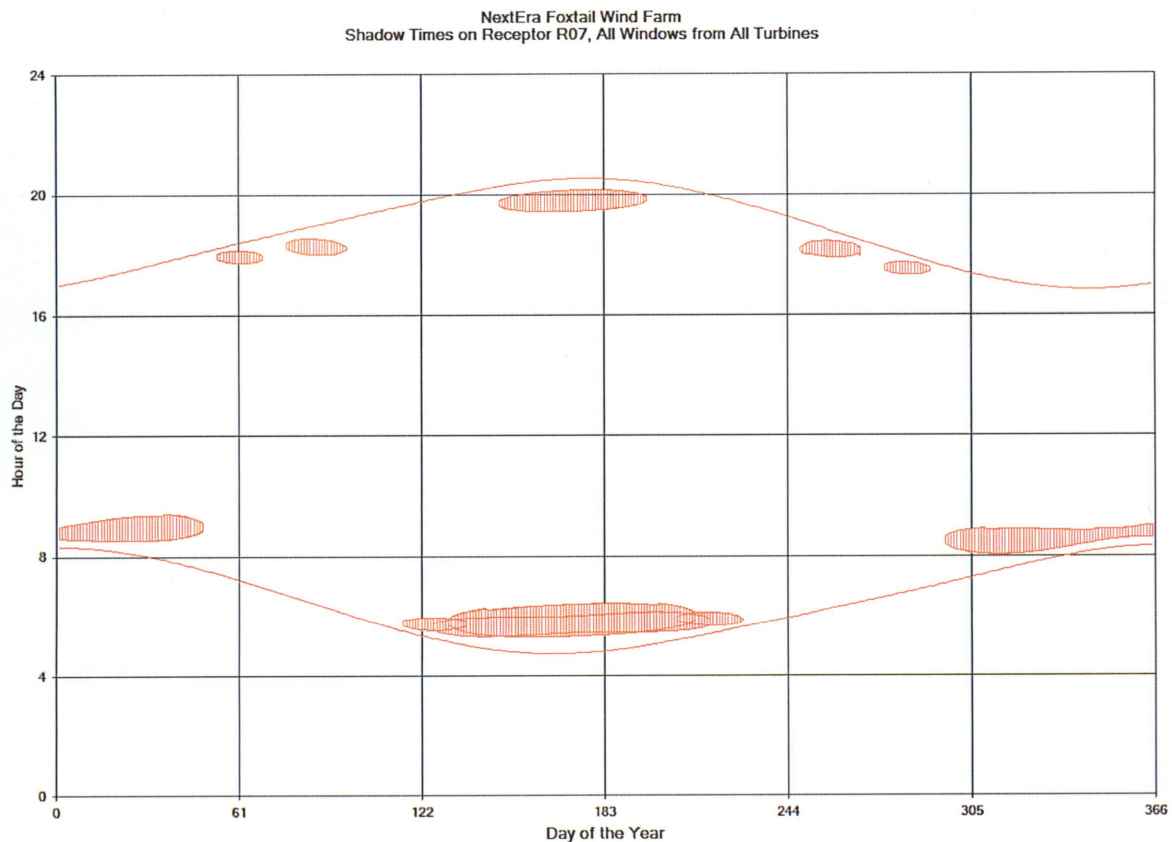
How does the model calculate shadow flicker?

- Input turbine locations, the height of the motor (hub height), rotor diameter (length of blades times two)
- Input the receptor (house) locations, assume that windows face eight different directions starting at North (0 degrees) and going clockwise such that there is a 3 foot (1 meter) by 3 foot (1 meter) window at a height of 6.5 feet (2 meters) above ground level at every 45 degrees.
- The model assumes that all daylight hours are sunny. We apply a scaling factor after the model runs based on the amount of time it is more than partly cloudy.
- The model assumes that the turbine is always operating. It does not account for when wind speeds are less than 6.7 mph.

- The model assumes there are no obstructions between the turbine and the window (i.e. it does not know if there are trees or bushes in between that would block the sun).
- The model uses the sun angle, time of sunrise and sunset to calculate when flicker would occur based on the items above. The shadows reach the furthest during sunrise and sunset when the sun angle is low. This is especially true in the winter months.
- The model calculates the length of time that a turbine or turbines could cause shadow flicker at any of the 8 windows at the house during the year.

Current results:

- Shadow flicker was modeled at 98 hrs/yr
- The model shows this house/receptor could be affected within 2 hours after sunrise from November through February and May through August, as well as within 2 hours before sunset to a lesser extent



This graph shows the days of the year and time of day when SF occurs at the Stobel's house (Receptor R07). The red areas of the graph represent the days of the year (X axis) and times of day (Y axis) when the nearby turbines could affect any of the eight windows at this receptor. Note that the curved red line on the lower half of the graph represents sunrise during the year and the curved red line on the upper half of the graph represents sunset. As shown on the graph, this receptor could be affected after 2 hours after sunrise from November through February and May through August as well as 2 hours before sunset to a

lesser extent. Shadow flicker is not expected once the sun rises sufficiently above the horizon. Where some of the hatched areas overlap during sunrise in the summer months, that means more than one turbine could affect this receptor on those dates.

How can we can refine the analysis:

- Use only the angles that each window faces.
- Change the size of the windows to match the home.
- Change the height of the windows to match the home. This should be the midpoint of the window height above ground level.
- Review weather data to determine the amount of wind speeds less than 6.7 mph during hours of predicted shadow flicker.