**Reviewer Name M.Arrington, J.Velante, Kim Jamgochian, R.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Grade:\_\_\_\_\_\_\_\_\_6\_\_\_\_\_\_\_\_\_ Lesson/Unit Title:\_\_Wind\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**I. Alignment to the NGSS**

The lesson or unit aligns with the conceptual shifts of the NGSS:

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| Criteria | Specific evidence from materials and reviewers’ reasoning | Suggestions for improvement |
| A. Grade‐appropriate elements of the science and engineering practice(s),  disciplinary core idea(s), and crosscutting concept(s), work together to  support students in three‐dimensional learning to make sense of  phenomena and/or to design solutions to problems.  i. Provides opportunities to develop and use specific elements of the  practice(s) to make sense of phenomena and/or to design solutions to  problems.  ii. Provides opportunities to develop and use specific elements of the  disciplinary core idea(s) to make sense of phenomena and/or to design  solutions to problems.  iii.Provides opportunities to develop and use specific elements of the  crosscutting concept(s) to make sense of phenomena and/or to design  solutions to problems.  iv.The three dimensions work together to support students to make sense  of phenomena and/or to design solutions to problems. | The lesson or unit supports instruction and learning for all students:  Wind is a form of energy in nature and has relevance throughout the KidWind curriculum. KidWind begins by defining types of energy. This leads to the storage of energy, and eventual creation/evaluation of wind turbines.    **Evidence of opportunities for students to develop and use the practices include**:  Student projects will culminate to the design of a model turbine. Important features will include the blade shape design, material, and placement of turbine.  **Lesson 1** Having students describe the relationship between energy by demonstrating the different forms and their transfer of energy [i.e. electricity to light from a lamp, battery vs. hand generated (mechanical) energy, and potential and kinesthetic energy].  **Lesson 2** This includes utilizing a battery-operated flashlight and comparing it to a hand-generator flashlight.    **Lesson 4** students will observe models that demonstrate the relationship between temperature pressure and wind speed.  **Lesson 5** Students will analyze wind speed and data using topographic maps.  **Lesson 6** students will use a balloon or kite to simulate the effects of wind shear and turbulence.  **Lesson 7** Students will use the turbulence model to argue the best location for a wind turbine above the ground surface.  Lesson 8 and 10  Students will convert wind energy to electricity by collecting, evaluating, and presenting data to determine which blade design in best (Windwise Education-Turbine Lesson 10, pgs 179 - 185).  **Ask Questions**:  How does movement transfer from nature (i.e. wind, hydro, sun)/ generators to batteries/machines?  What causes wind? P77  Where is it windy? P 97  What are wind shear and turbulence? p111  Can wind power your classroom? P121  What’s the difference between power and energy?      **Evidence of opportunities for students to develop and use the DCI’s include**: | The lesson or unit supports monitoring student progress:  Engage: Begin the lesson with a short video about the transfer of mechanical energy to electrical energy.    Strengthen how this lesson provides opportunities to develop and use DCI the core ideas of **energy transfer and its different forms** needs to be made explicit, though not told, to students. Requiring the use of the language in the diagrams for redesigns and how that would increase the likelihood of students making sense of these concepts.  Build in some student work around the idea of energy transfer. Also, changing the designing a solution process to include DCI as reasons for changing a given design.  Improve the use of the CCC of **energy** by including more questions about how the model is demonstrating that energy can *be transferred in various ways and between objects* (NGSS, Appendix G) and by including energy transfer as a criterion in the explanation.  Using the language of cause and effect will help students recognize when they are using this concept and may support them in applying it in other contexts. Give students explicit opportunities to reflect on each of the three dimensions.  The crosscutting concept of systems might nicely support the idea of circuits( how energy would transfer in a circuit) and, more importantly, energy transfer.  Engage the students with the question: Why might the bad bulb in a light string be a problem people would want solved? earlier in the lesson to provide students with a purpose. Additionally, generalizing the problem of not having light beyond a string of lights might be more relevant to students. However, students may have experienced not having light (when bills have not been paid ) so it may be better to bring up hurricane sandy how and why people lost power whether it be because of down cables or power outages.   1. Elicits direct, observable evidence of three- dimensional learning by students using practices with core ideas and crosscutting concepts to make sense of phenomena and/or to design solutions. 2. Assessing student proficiency using methods, vocabulary, representations, and examples that are accessible and unbiased for all students. .   Assessment questions and worksheets are not specifically coded by the types of three- dimensional learning they assess. A key could be useful.  A rubric helping teachers assess students’ use of the three dimensions would be useful. |

A unit or longer lesson will also:

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| Criteria | Specific evidence from materials and reviewers’ reasoning | Suggestions for improvement |
| B. Lessons fit together coherently targeting a set of performance expectations.  i. Each lesson links to previous lessons and provides a need to engage in  the current lesson.  ii. The lessons help students develop proficiency on a targeted set of  performance expectations.  C. Where appropriate, disciplinary core ideas from different disciplines are  used together to explain phenomena.    D.Where appropriate, crosscutting concepts are used in the explanation of  phenomena from a variety of disciplines.  E. Provides grade‐appropriate connection(s) to the Common Core State  Standards in Mathematics and/or English Language Arts & Literacy in  History/Social Studies, Science and Technical Subjects. | The Wind unit is made up of four lessons that are designed to build upon each other to scaffold student learning.  ● **Lesson 4** guides students examine the relationship between temperature, pressure, and wind speed in the context of gases in the atmosphere.  **Lesson 5** **students will analyze wind speed data and topographic maps.**  **Lesson 6** **students will use a balloon or kite to simulate the effects of wind shear and turbulence. Students will use the turbulence model to argue the best location for a wind turbine.**  **Lesson 7 students will analyze wind data and interpret wind speed and power output graphs.**  This unit focuses on developing proficiency in developing possible solutions under the Engineering Design domain.  This unit incorporates use of three DCI’s from the Physical Sciences (Matter and Its Interactions) with Engineering, Technology, and Applications of Science.  Several crosscutting concepts appear throughout this unit, including Cause and Effect (wind energy interacts with materials in a variety of ways, causing specific motion), Structure and Function (the shape and makeup of a material impacts how well it can perform a specific task - in this case, harnessing the energy of the wind), and Scale, Proportion, and Quantity (changing the size and/or number of windmill blades has a direct impact on the ability of the windmill to harness the wind’s energy).  This unit includes cross-curricular connections, particularly to English Language Arts and Literacy and in and applied mathematics and science throughout the unit where appropriate. | This unit should include aligned rubrics and scoring guidelines that provide guidance for interpreting student performance along the three dimensions to support teachers in (a) planning instruction and (b) providing ongoing feedback to students.  Students should investigate the pros and cons of wind energy.  Pros for Wind Energy  It is renewable  Wind is free  Wind turbines do not produce pollutants or greenhouse gases  Eventually, it can be cost effective  Cons for Wind Energy  Turbines can be damaged during storms  Can be harmful to wildlife  Noise can be disturbing  Low wind speed can impact efficiency |

**Reviewer Name\_\_Marla Arrington\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Grade:\_\_\_\_\_6\_\_\_\_\_\_\_\_\_\_\_\_\_ Lesson/Unit Title:\_\_ KidWind\_\_**

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| **Disciplinary Core Ideas (DCIs)** | **Element** | **Evidence** |
| **MS- ESS2.D Weather and Climate**            **MS-PS1 Matter and Its Interactions**          **MS-PS-3-5 Energy**                    **MS-PS2 Motion and Stability: Forces and Interactions**              **MS-PS3 Relationship Between Energy and Forces**  **ETS1.B Developing Possible solutions** | **Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6)**      MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.      **MS-PS2-2. Plan an investigation to provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object.**          **Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. (MS-PS3-3)**  **A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. (secondary to MS-PS3-3)** | **Lesson 4 Examine the relationship between temperature, pressure, and wind speed in the context of gases in the atmosphere.**  **On the molecular level students describe what causes pressure and the change in pressure.**  **Lesson 5**  **Students relate concepts to topography and large scale weather patterns.**  **Students will explain how topography and elevation affect wind speed.**  **Students will identify optimal locations for wind farms based on wind speed.**  **Lesson 6**  **Students will interpret topographic and wind speed maps.**  **Students will be able to explain the concepts of wind shear and wind turbulence.**  **Students will know how wind shear and turbulence affect wind turbine performance.**  **Lesson 7**  **Students will analyze real wind turbine data and interpret wind speed and turbine power output graphs.**  **Students can assess the potential and economic feasibility of powering their classroom or school with a wind turbine.**  **Lesson 7-Students conduct an energy audit of their classroom.**  **Lesson 7- Students estimate what size turbine would power their classroom under local wind.** |

**Evidence that Disciplinary Core Ideas (DCIs), Science and Engineering Practice (SEP) and Crosscutting Concepts (CCCs) were included in this lesson**

**Reviewer Name\_\_\_\_\_Marla Arrington\_\_\_\_\_\_\_\_\_\_\_ Grade:\_\_\_\_\_\_\_\_6\_\_\_\_\_\_\_\_\_\_ Lesson/Unit Title:\_\_\_Wind\_\_\_\_\_\_\_\_\_\_\_**

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| **Science and Engineering Practice (SEP)** | **Element** | **Evidence** |
| **Asking Questions and Defining Problems**  **Analyzing and Interpreting Data**  **Developing and Using Models**  **Planning and Carrying Out Investigations**  **Engagement in Argument from evidence** | **Ask questions to identify and clarify evidence in an argument. MS-ESS-3-5**  [Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5)](http://www.nap.edu/openbook.php?record_id=13165&page=59)  **Develop and use a model to describe phenomena. (MS-PS1-4)**    **Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS2-2)**    **Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. (MS-PS3-5)** | **What causes wind? P77**  **Where is it windy? P 97**  **What are wind shear and turbulence? p111**  **Can wind power your classroom? P121**  **What’s the difference between power and energy?**  **Lesson 5 students will analyze wind speed data and topographic maps.**  **Lesson 4 students will observe models that demonstrate the relationship between temperature pressure and wind speed.**  **Lesson 6 students will use a balloon or kite to simulate the effects of wind shear and turbulence.**  **Lesson 6 Students will use the turbulence model to argue the best location for a wind turbine above the ground surface.** |

**Evidence that Disciplinary Core Ideas (DCIs), Science and Engineering Practice (SEP) and Crosscutting Concepts (CCCs) were included in this lesson**

**Reviewer Name\_\_Marla Arrington\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Grade:\_\_\_\_\_6\_\_\_\_\_\_\_\_\_\_\_\_\_ Lesson/Unit Title:\_Kid Wind\_\_\_\_\_**

**Evidence that Disciplinary Core Ideas (DCIs), Science and Engineering Practice (SEP) and Crosscutting Concepts (CCCs) were included in this lesson**

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| **Crosscutting Concepts (CCCs)** | **Element** | **Evidence** |
| Cause and effect  Stability and Change  Energy and Matter  **Influence of Science, Engineering, and Technology on Society and the Natural World** | [**Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)**](http://www.nap.edu/openbook.php?record_id=13165&page=96)  Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. (MS-PS2-2)    Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion).MS-PS3-5      [All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)](http://www.nap.edu/openbook.php?record_id=13165&page=96)  [The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)](http://www.nap.edu/openbook.php?record_id=13165&page=96) | **Students will estimate classroom power consumption by adding the average power draw of all electronic appliances in the room**  **Students can assess the potential and economic feasibility of powering their classroom or school with a wind turbine.**  **Student will analyze wind speed and energy output.**  **Students analyze their use of energy within the classroom to determine if the energy generated by their turbines has the potential to meet the classroom energy use.** |

**Reviewer Name\_\_\_\_Jason Velante and Kim\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Grade:\_\_\_\_\_\_6-8\_\_\_\_\_\_\_\_\_\_ Lesson/Unit Title: Energy**

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| **Disciplinary Core Ideas (DCIs)** | **Element** | **Evidence** |
| |  |  | | --- | --- | | **Students who demonstrate understanding can:** | | | **M S-PS3-3.** | **Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.\* [Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.] [*Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.*]** | | [**PS3.A: Definitions of Energy**](http://www.nap.edu/openbook.php?record_id=13165&page=120)  **·**  [**Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present.**](http://www.nap.edu/openbook.php?record_id=13165&page=120) | **Students demonstrate transfer from electrical energy to radiant (visible) and thermal (heat) energy by presenting with a lamp with a 40-watt light bulb.**  **(Windwise Education- Energy Lesson 1, pgs. 19-20)**  **Students will generate electricity (Battery operated flashlight vs. a hand generator flashlight).**  **(Windwise Education- Energy Lesson 1, pgs. 20-22)** |

**Evidence that Disciplinary Core Ideas (DCIs), Science and Engineering Practice (SEP) and Crosscutting Concepts (CCCs) were included in this lesson**

**Reviewer Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Grade:\_\_\_\_\_\_6-8\_\_\_\_\_\_\_\_\_\_ Lesson/Unit Title: Energy**

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| **Science and Engineering Practice (SEP)** | **Element** | **Evidence** |
| |  |  |  |  | | --- | --- | --- | --- | | **Students who demonstrate understanding can:**   |  |  | | --- | --- | | **MS-PS3-2.** | **Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. [Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate’s hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.] [*Assessment Boundary: Assessment is limited to two objects and electric, magnetic, and gravitational interactions.*]** | |  | | [**Developing and Using Models**](http://www.nap.edu/openbook.php?record_id=13165&page=56)  [**Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.**](http://www.nap.edu/openbook.php?record_id=13165&page=56)  **·**  [**Develop a model to describe unobservable mechanisms.**](http://www.nap.edu/openbook.php?record_id=13165&page=56) | **Students will create a model to demonstrate how much carbon dioxide Americans generate. (Windwise Education-Energy Lesson 2, pgs 42-43)**  **Students will demonstrate concepts of *power* by lifting an apple 1 meter (Windwise Education-Energy Lesson 3, pgs 56-57).** |

**Evidence that Disciplinary Core Ideas (DCIs), Science and Engineering Practice (SEP) and Crosscutting Concepts (CCCs) were included in this lesson**

**Reviewer Name\_Jason Velante and Kim J\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Grade:\_\_\_\_\_\_6-8\_\_\_\_\_\_\_\_\_\_ Lesson/Unit Title: Energy**

**Evidence that Disciplinary Core Ideas (DCIs), Science and Engineering Practice (SEP) and Crosscutting Concepts (CCCs) were included in this lesson**

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| **Crosscutting Concepts (CCCs)** | **Element** | **Evidence** |
| **Students who demonstrate understanding can:**  **MS-PS3-3.**  **Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.\* [Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.] [*Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.*]**   |  |  | | --- | --- | |  |  | | [Constructing Explanations and Designing Solutions](http://www.nap.edu/openbook.php?record_id=13165&page=67) [**Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.**](http://www.nap.edu/openbook.php?record_id=13165&page=67)  **·**  [**Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system.**](http://www.nap.edu/openbook.php?record_id=13165&page=67) | **Students will be contractors who present proposals demonstrating efficiency of heir energy saving methods.**  **(Windwise Education-Energy Lesson 3, pg 67, worksheets pgs. 68-73)** |

**Reviewer Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Grade:\_\_\_\_\_\_6-8\_\_\_\_\_\_\_\_\_\_ Lesson/Unit Title: \_ Turbine**

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| **Disciplinary Core Ideas (DCIs)** | **Element** | **Evidence** |
| **Students who demonstrate understanding can:**  **MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.**   |  |  | | --- | --- | |  |  | | [ETS1.A: Defining and Delimiting Engineering Problems](http://www.nap.edu/openbook.php?record_id=13165&page=204) **●**  [**The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions.**](http://www.nap.edu/openbook.php?record_id=13165&page=204) | **Students will design techniques to optimize wind turbine blands by designing advanced wind turbine blades (Windwise Education-Energy Lesson 11, pg 206)**    **Students will optimize the power output of a model wind turbine by analyzing data to come up with their own individual designs.**  **(Windwise Education-Energy Lesson 11, pgs 192-193, wrkshts pgs. 195-199)** |

**Evidence that Disciplinary Core Ideas (DCIs), Science and Engineering Practice (SEP) and Crosscutting Concepts (CCCs) were included in this lesson**

**Reviewer Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Grade:\_\_\_\_\_\_6-8\_\_\_\_\_\_\_\_\_\_ Lesson/Unit Title: \_ Turbine**

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| **Science and Engineering Practice (SEP)** | **Element** | **Evidence** |
| **Students who demonstrate understanding can:**  **MS-ETS1-3**  **Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.** | [Analyzing and Interpreting Data](http://www.nap.edu/openbook.php?record_id=13165&page=61) [**Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.**](http://www.nap.edu/openbook.php?record_id=13165&page=61)  **●**  [**Analyze and interpret data to determine similarities and differences in findings.**](http://www.nap.edu/openbook.php?record_id=13165&page=61) | **Students will create airfoil shapes to make turbine blades more efficient (Windwise Education-Energy Lesson 11, pgs 201-205)** |

**Evidence that Disciplinary Core Ideas (DCIs), Science and Engineering Practice (SEP) and Crosscutting Concepts (CCCs) were included in this lesson**

**Reviewer Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Grade:\_\_\_\_\_\_6-8\_\_\_\_\_\_\_\_\_\_ Lesson/Unit Title: \_ Turbine**

**Evidence that Disciplinary Core Ideas (DCIs), Science and Engineering Practice (SEP) and Crosscutting Concepts (CCCs) were included in this lesson**

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| **Crosscutting Concepts (CCCs)** | **Element** | **Evidence** |
| **Students who demonstrate understanding can:**  **MS-PS3-4.**  **Plan an investigation to determine** Planning and Carrying Out Investigations **Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.**   * **Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.**   **the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. [Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.] [*Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.*]** | **Scale, Proportion, and Quantity**  [**· Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes.**](http://www.nap.edu/openbook.php?record_id=13165&page=89) | **Students will convert wind energy to electricity by collecting, evaluating, and presenting data to determine which blade design in beset**  **(Windwise Education-Turbine Lesson 10, pgs 179 - 185)** |