Wind Turbines
Curriculum Chart

Lesson#	**Lesson Question**	**Days**	**Description**	**Concepts/ Subconcepts**	**What Will Students Figure Out?**	**Materials/ Resources**
1	Why did William build a wind turbine in *The Boy Who Harnessed the Wind?*	2	Students will read *The Boy Who Harnessed the Wind* and watch a video from the author to identify what problem he was trying to solve and the impact it had on his life.	Engineers collect qualitative and quantitative data when researching the problem they are trying to solve and what other solutions already exist.	Engineers identify problems in their community and through research can adapt pre-existing solutions to solve that problem.	-student notebook -*The Boy Who Harnessed the Wind* (picture book) -*https://www.youtube.com/watch?v=BzlgyDAMupw*
2	Why is not having electricity a problem for people?	1	Students will analyze interview evidence of how not having electricity affects people across the world.	Engineers collect qualitative and quantitative data when researching the problem they are trying to solve.	-Engineers interview affected people to understand the experience of the problem.	-student notebook https://www.youtube.com/watch?v=DSCiPFoCAX8
3	Who else around the	1	Students will analyze an interactive map to	Engineers collect qualitative and	-Engineers look to data and experts to	-student notebook

	world doesn't have electricity?		establish patterns of where electricity access is most limited as well as where the world's electricity comes from.	quantitative data when researching the problem they are trying to solve.	understand the scope of a problem.	https://energyeducation.ca/encyclopedia/Access_to_electricity
4	How do different places in the world produce electricity and what impact do these energy sources have on the environment?	2	Students will compare renewable vs. nonrenewable forms of energy to reason about what it means to be renewable and what forms of energy have the greatest harm on the environment. Students will then analyze an interactive map on what forms of electricity different countries use.	Engineers collect qualitative and quantitative data when researching the problem they are trying to solve.	-Engineers research the impact of problems from multiple angles (i.e. human impact vs. environmental impact).	-student notebook https://www.gocompare.com/gas-and-electricity/what-powers-the-world/ -Energy cards (appendix)
5	What evidence do scientists have that fossil fuels cause	1-2	Students will perform an experiment on whether or not increased CO2 in the air raises temperature.	Engineers collect qualitative and quantitative data when researching the problem they are	Engineers use math and science to back up their claims when they say something is a problem.	-student notebooks -2 mason jars + lids per group (filled halfway

	global warming?		They will then analyze graphs on carbon dioxide levels and temperature throughout history. Using the experiment and historical data they will make a claim regarding the human impact on climate change.	trying to solve.		with room temperature water) -1 alka-seltzer per group -1-2 thermometers per group -optional post-assessment
6	What do we need to know about our clients needs when designing wind turbines for them? (criteria and constraints)	1	Students will be introduced to the design challenge of building a wind turbine to power a small community. They will evaluate their design briefs (as well as calculate how much energy each community member needs) to develop a list of criteria and constraints.	Engineers collect information regarding their clients' needs in order to define the criteria and constraints of their design problem.	Engineers learn as much about their clients and their needs to understand the criteria and constraints of their challenge.	-student notebooks -post-it notes
7	What do blades need to spin?	2	Students will study different designs of pinwheels as well as	Engineers research existing solutions while brainstorming	Engineers research existing solutions to reason about what works	-student notebook -Wind turbine

			close up pictures of different designs of wind turbines to determine what blades need to spin.	their own solutions.	and to inspire their own designs. Blades need to be designed at an angle (with a curve) in order to catch the wind.	comparison photos (appendix) -Close-up photos of different wind turbine blades (appendix) -Different style pinwheels -1-3 fans
8	What design features (size, weight, shape) do you want to test? What materials will work best for your design?	1	Students will work with partner teams to brainstorm and draw their designs. They will then investigate the available materials and reason about which material will best suit their design function.	-When selecting materials, engineers reason about how a material's properties will serve the function of the design. -Engineers use visual representations to design and communicate their solutions.	Engineers choose their materials based on which properties will best suit their design.	-Student notebooks -A variety of cups (differing in height, width, weight, material, ect)
9	How can we test different design features (size,	3	Students will build and test their prototypes. After testing they'll adjust	-Engineers use visual representations to design and communicate their	Engineers have to redesign several times to determine what design will best meet their	-Student notebooks -Wine corks (2-3 per team)

	weight, shape) to make the most efficient wind turbine possible?		the features or materials of their design to determine the most efficient design features.	solutions. -Engineers use their criteria and constraints to test the successes and limitations of their prototypes.	criteria given their constraints.	-Craft sticks -1-2 fans set up -1-2 multimeters -1-2 low resistant motors -A large array of diverse cups students can use for building -Scissors -Masking tape -rulers
10	Did you meet your criteria under the given constraints? How can you communicate your final design to the client?	1	Students will make a scale drawing of their prototype and determine how much energy the full scale wind turbine would produce. They will then communicate the successes and limitations of their designs to their clients.	-Engineers use visual representations to design and communicate their solutions. -Engineers use their criteria and constraints to test the successes and limitations of their prototypes.	Engineers reflect on what they have learned from the tests of their prototypes and evaluate how well they'll met their criteria and constraints.	-student notebook -ruler -colored pencils