Global Climate Change: Local Impact and Action is a place-based unit made for Hawai'i students. It covers Next Generation Science Standards required by the Hawaii Department of Education for 6th grade or 8th grade but the standards will change depending on whether the school has opted for integrated or disciplinary curriculum.

Disciplinary				Integrated		
Physical	Life	Earth/Space		Sixth	Seventh	Eighth
MS-PS1-1	MS-LS1-1	MS-ESS1-1		MS-PS3-3	MS-PS1-1	MS-PS2-1
MS-PS1-2	MS-LS1-2	MS-ESS1-2		MS-PS3-4	MS-PS1-2	MS-PS2-2
MS-PS1-3	MS-LS1-3	MS-ESS1-3		MS-PS3-5	MS-PS1-3	MS-PS2-3
MS-PS1-4	MS-LS1-4	MS-ESS1-4		MS-LS1-1	MS-PS1-4	MS-PS2-4
MS-PS1-5	MS-LS1-5	MS-ESS2-1		MS-LS1-2	MS-PS1-5	MS-PS2-5
MS-PS1-6	MS-LS1-6	MS-ESS2-2		MS-LS1-3	MS-PS1-6	MS-PS3-1
MS-PS2-1	MS-LS1-7	MS-ESS2-3		MS-LS1-4	MS-LS1-6	MS-PS3-2
MS-PS2-2	MS-LS1-8	MS-ESS2-4		MS-LS1-5	MS-LS1-7	MS-PS4-1
MS-PS2-3	MS-LS2-1	MS-ESS2-5		MS-LS1-8	MS-LS2-1	MS-PS4-2
MS-PS2-4	MS-LS2-2	MS-ESS2-6		MS-LS3-2	MS-LS2-2	MS-PS4-3
MS-PS2-5	MS-LS2-3	MS-ESS3-1		MS-ESS2-4	MS-LS2-3	MS-LS3-1
MS-PS3-1	MS-LS2-4	MS-ESS3-2		MS-ESS2-5	MS-LS2-4	MS-LS4-1
MS-PS3-2	MS-LS2-5	MS-ESS3-3		MS-ESS2-6	MS-LS2-5	MS-LS4-2
MS-PS3-3	MS-LS3-1	MS-ESS3-4		MS-ESS3-3	MS-ESS2-1	MS-LS4-3
MS-PS3-4	MS-LS3-2	MS-ESS3-5		MS-ESS3-5	MS-ESS2-2	MS-LS4-4
MS-PS3-5	MS-LS4-1				MS-ESS2-3	MS-LS4-5
MS-PS4-1	MS-LS4-2				MS-ESS3-1	MS-LS4-6
MS-PS4-2	MS-LS4-3				MS-ESS3-2	MS-ESS1-1
MS-PS4-3	MS-LS4-4					MS-ESS1-2
	MS-LS4-5					MS-ESS1-3
	MS-LS4-6					MS-ESS1-4
						MS-ESS3-4
MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4						

In the first two lessons, students consider phenomenon readily relatable to Hawai'i students: cars and pavement heating up in the sun. They explore these phenomenon through models and an outdoor lab investigation. They then engage in a graphing unit (with Common Core Math connections) to learn about changes in our climate over time. They consider the impacts of these changes on Hawai'i specifically and write an evidence-based letter using Common Core English Standards. Students finish by defining a problem in their own school that contributes to climate change and developing a solution to reduce their school's carbon footprint. The students who piloted this unit actually implemented some of their solutions in their school! Each lesson emphasizes or more Cross-Cutting Concepts and engages students in at least one Science and Engineering Practice.

NGSS Performance Expectations / Disciplinary Core Ideas

Lessons 1-3 Earth Science

ESS3.D: **Global Climate Change.** Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)

MS-ESS3-5. **Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.** [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.]

Lessons 1-2 Physical Science

PS4.B: **Electromagnetic Radiation.** When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media.

MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.]

Lessons 4 -5

ESS3.C: **Human Impacts on Earth Systems.** Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

MS-ESS3-3. **Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.** [Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]

Alternatively:

MS-ESS3-4. **Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.** [Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.]

Lesson 5

ETS1.A: **Defining and Delimiting Engineering Problems.** 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.

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.

ETSI.B: **Developing Possible Solutions.** There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

NGSS Cross-Cutting Concepts	Lesson
Systems and System Models A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems.	**1**
Energy and Matter Flows, Cycles, and Conservation: Tracking energy and matter flows, into, out of, and within systems helps one understand their system's behavior. • Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion).	1
Stability and Change For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand. • Small changes in one part of a system might cause large changes in another part.	1, 3
Cause and Effect Mechanism and Prediction: Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering. • Cause and effect relationships may be used to predict phenomena in natural or designed systems.	2, 4
Patterns Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them. • Patterns can be used to identify cause and effect relationships. • Graphs, charts, and images can be used to identify patterns in data.	3

Influence of Science, Engineering, and Technology on Society and the Natural World • 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. • 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.	5

NGSS Science and Engineering Practices	**Lesson**
Asking Questions and Defining Problems Asking questions and defining problems in grades 6–8 progresses to specifying relationships between variables, and clarifying arguments and models. • Ask questions to identify and clarify evidence of an argument.	**1**
• Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.	**5**
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model—based on evidence – to match what happens if a variable or component of a system is changed. • Develop and/or use a model to predict and/or describe phenomena. • Develop a model to describe unobservable mechanisms.	1, 2
Planning and Carrying Out Investigations Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions. • Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation • 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.	2
Analyzing and Interpreting Data 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 • Use graphical displays (e.g., maps, charts, graphs, and/or tables) of large data sets to identify temporal and spatial relationships. • Distinguish between causal and correlational relationships in data. • Analyze and interpret data to provide evidence for phenomena.	3
Constructing Explanations and Designing Solutions • Apply scientific reasoning to show why the data or evidence is adequate for the explanation or conclusion.	3

Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). • Construct, use, and/or present an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.	4
• Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.	5

Common Core Math – Lesson 3

Grade 6. Statistics & Probability
Summarize and describe distributions. 6.SP.B.5.C

Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.

Grade 8. Statistics and Probability
Investigate patterns of association in bivariate data. 8.SP.1

Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

Common Core English – Lesson 4

CCSS.ELA-LITERACY.W.6.1
Write arguments to support claims with clear reasons and relevant evidence.
CCSS.ELA-LITERACY.W.6.1.A
Introduce claim(s) and organize the reasons and evidence clearly.
CCSS.ELA-LITERACY.W.6.1.B
Support claim(s) with clear reasons and relevant evidence, using credible sources and demonstrating an understanding of the topic or text.
CCSS.ELA-LITERACY.W.6.1.C
Use words, phrases, and clauses to clarify the relationships among claim(s) and reasons.
CCSS.ELA-LITERACY.W.6.1.D
Establish and maintain a formal style.
CCSS.ELA-LITERACY.W.6.1.E
Provide a concluding statement or section that follows from the argument presented.

Common Core Social Studies – Lesson 4 & 5

Anchor Standard 5 – Taking Informed Action

SS.6-8.5.1 Identify local, regional and/or global problems or issues using interdisciplinary lenses
SS.6-8.5.2 Examine the origins of a problem or issue and explain the challenges and opportunities faced by those trying to address it
SS.6-8.5.3 Apply a range of deliberative strategies and procedures to make decisions and propose feasible solutions to address local, regional, and/or global concerns
SS.6-8.5.4 Create an action plan to address a solution to the problem or issue and demonstrate evidence of implementation