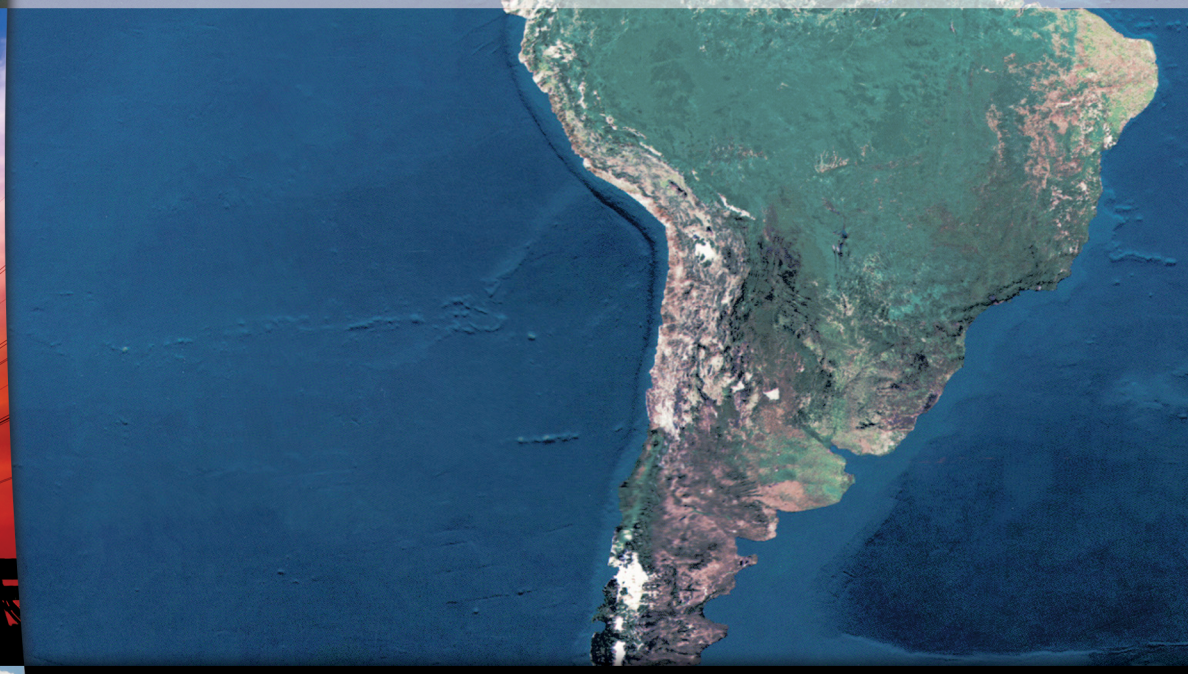



Fueling Our Future:
Exploring Sustainable Energy Use

An Interdisciplinary Curriculum
Recommended for Grades 9–12

9–Lesson Curriculum Unit

Facing THE Future™

Fueling Our Future:

Exploring Sustainable Energy Use

An Interdisciplinary Curriculum
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Facing THE Future™

Fueling Our Future:
Exploring Sustainable Energy Use

Facing the Future is a nonprofit organization whose mission is to create tools for educators that equip and motivate students to develop critical thinking skills, build global awareness, and engage in positive solutions for a sustainable future.

We develop and deliver standards-based hands-on lessons, student textbooks, curriculum units, and professional development opportunities for educators. Facing the Future curriculum is in use in all 50 U.S. states and over 140 countries by teachers and students in grades K-12, in undergraduate and graduate classes, and across multiple subject areas. Facing the Future reaches over 1,500,000 students through its programming.

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Table of Contents

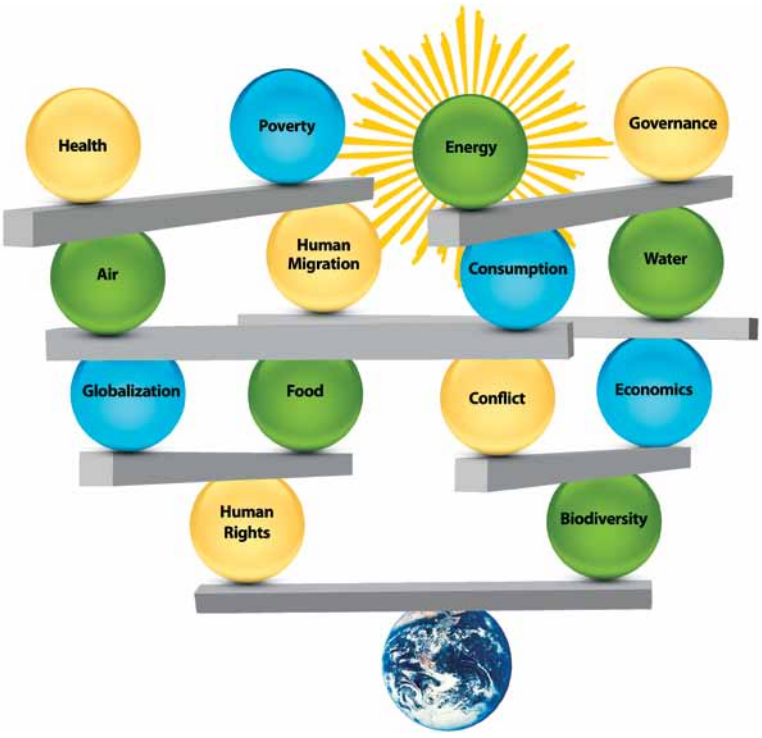
Introduction

Energy fuels our lives. It sustains our bodies, powers our industries, lights our cities, charges our cell phones, and moves our cars. Energy is interconnected with a range of global issues from climate change to economic development and resource scarcity. Taking a close look at human energy use is a key part of working toward sustainable societies, economies, and environments.

The world's energy needs are currently supplied primarily by fossil fuels. As we deplete the planet's supply of these nonrenewable natural resources, we can expect competition for fossil fuels to increase and the cost of energy to rise, creating a cascade of impacts across global markets. This will touch us all, from the farmer whose machinery runs on fuel to the parent trying to put food on the table. At the same time, our dependence on fossil fuels has an environmental impact that grows larger every day. The Intergovernmental Panel on Climate Change has stated that the burning of fossil fuels is the main contributor to increased atmospheric concentrations of carbon dioxide in the past century,[1] leading to global climate change. In the 21st century, challenges posed by the rapid depletion of fossil fuels and the contribution of carbon dioxide emissions to climate change have already begun to spur the development of alternative energy sources and new technologies and impel us to reexamine how we use energy.

Because energy consumption is deeply rooted in many local and global issues, the choices we make about energy can be part of sustainable solutions to critical challenges facing the world today. Such solutions can range from promoting home energy efficiency and conservation in order to lower household energy bills to using leapfrog technology to help developing communities access energy through the use of renewable resources. *Fueling Our Future: Exploring Sustainable Energy Use* presents an opportunity for you to engage your students in a relevant and authentic exploration of sustainable energy use. The unit asks students to reflect on how energy is connected to their own lives and to investigate paths toward energy systems that ensure access to energy for all people for generations to come.

Just as energy is an interdisciplinary topic, so too is this unit. During the first week, students review basic energy science, calculate their daily electricity use, read nonfiction text to identify the pros and cons of renewable and nonrenewable sources of energy, and analyze statistics on energy



use around the world. During the second week, students embark on an in-depth study of transportation fuels. Using Facing the Future's global sustainability framework, students explore the social, economic, and environmental impacts of petroleum-based fuels and various biofuels. They do this by comparing the impacts of fuels throughout their supply chain, taking multiple perspectives, and proposing sustainable solutions. The lessons presented in this unit are student-centered, support critical thinking, and foster collaboration among students.

In addition to nine fully planned lessons, this curricular unit includes readings, formative and summative assessments, extensions, and service learning ideas. Readings include vocabulary, youth profiles, career profiles, case studies, and questions that check for student understanding. While formative assessments vary throughout the unit, each lesson is guided by inquiry and critical thinking questions and concludes with discussion questions. The unit also includes a pre and post assessment designed to show student growth in content knowledge, ability to analyze complex energy issues, and personal attitude toward energy consumption and energy resources. The last three lessons of this curriculum are designed as a context-specific performance-based assessment in which students conduct research on the timely real world issue of aviation biofuels. Students are authentically assessed on products such as posters, papers, and negotiations that help them to answer the performance-based assessment's driving question: What are the most sustainable biofuels that can be produced in the Pacific Northwest for aviation?

By engaging youth with authentic and relevant activities to explore energy issues, we foster the understanding and critical thinking skills needed to make thoughtful personal and collective decisions about energy. We hope that *Fueling Our Future: Exploring Sustainable Energy Use* helps prepare students to navigate the complex real world issues of energy resources and consumption and motivates students to participate in positive energy solutions for a sustainable world.

Unit Overview

Fueling Our Future: Exploring Sustainable Energy Use begins with lessons that introduce students to foundational energy concepts. The lessons then begin to focus more specifically on topics like energy access and transportation fuels. The unit culminates with an aviation-focused performance-based assessment that is integrated into the final three lessons.

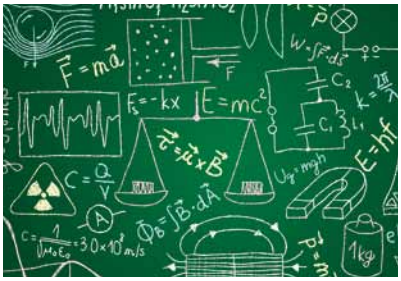
This unit was designed to contribute to the educational mission of the Northwest Advanced Renewables Alliance to strengthen the overall scientific literacy of students with respect to biofuels. The pre and post assessment can be administered before and after this unit to measure knowledge and personal attitudes about energy consumption.

Suggested Scope and Sequence

Introduction to Energy

Lesson 1: Energy 101

Students diagram energy transformations that take place with energy technology to demonstrate the law of conservation of energy.



Reading 1:
Introduction to Energy

Personal Energy Use

Lesson 2: Power to the People!

Students identify pros and cons of different nonrenewable and renewable energy sources used to generate electricity.

Reading 2:
Energy Today

Lesson 3: Lighten Up: A Personal Energy Audit

Students calculate their daily electricity use and identify behaviors and technology that can reduce their energy use.

Performance-based Assessment

Lesson 7: The Sky's the Limit

Students critically assess information from different multimedia resources to identify the motivation to shift from petroleum-based aviation fuels to alternative fuels.

Lesson 8: The Life of a Fuel

Students research the steps required to produce different biofuels and consider possible environmental impacts on the region.

Lesson 9: Sustainable Flight: A Stakeholder Meeting

Students represent stakeholder interests to negotiate a sustainable aviation biofuel mix for the Pacific Northwest.

Global Energy Use		Transportation Fuels
Lesson 4: Toil for Oil Students simulate the extraction of oil and analyze graphs depicting global oil consumption and reserves. Students then use an interactive timeline to examine the role of oil in U.S. history.	**Lesson 5:** Energizing the World Students examine graphs and statistics to learn of the diverse energy needs of people around the world and propose sustainable energy solutions.	**Lesson 6:** Fueling the Future Students use multiple perspectives to evaluate the sustainability of extracting or growing different transportation fuel feedstocks.
		
Reading 3: Background on Energy	**Reading 4:** Pathways to Progress: Energy	

Standards Correlations

- *Fueling Our Future: Exploring Sustainable Energy Use* correlates to standards in all 50 U.S. states, including Common Core State Standards and the Next Generation Science Standards.
- Educators can visit our standards correlation tool at **www.facingthefuture.org** to see how this unit correlates to state standards.
- Each lesson has also been aligned to the fundamental concepts presented in *Energy Literacy: Essential Principles and Fundamental Concepts for Energy Education* (**http://www1.eere.energy.gov/education/energy_literacy.html**), created through collaboration between the U.S. Department of Energy, the American Association for the Advancement of Science, and thousands of experts.

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Teacher Notes

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Fueling Our Future:
Exploring Sustainable Energy Use

Student Engagement
Fueling Our Future offers educators and students hands-on activities, real-world case studies, and readings that showcase youth around the world who have made positive impacts in their communities. Lessons and assessments are aligned to NSES, NCSS, Common Core Standards, and energy concepts outlined by the U.S. Department of Energy and American Association for the Advancement of Science in *Energy Literacy: Essential Principles and Fundamental Concepts for Energy Education.*

Global Knowledge and Competency
Fueling Our Future presents students with multiple perspectives on important energy issues facing our world today. Topics range from personal energy use to global oil consumption and lack of energy access to developing sustainable biofuels. Lessons allow students to grapple with these real-world issues and to formulate their own perspectives on how to positively respond.

Interdisciplinary Connections
Energy use is a generative topic that spans many disciplines. *Fueling Our Future* engages students in an authentically interdisciplinary study of sustainable energy. Interdisciplinary connections are woven throughout the entire unit via social studies, science, math, and language arts.

Application and Assessment
Fueling Our Future contains multiple opportunities for formative and summative assessments such as discussion questions, drawings, and class presentations. The unit includes a pre and post assessment designed to measure analysis of complex energy issues, understanding of content knowledge, and personal attitudes toward energy consumption as well as a performance-based assessment where students engage in an exploration of sustainable aviation fuels.

What Educators Say:

"The lesson enables students to see that all sources of energy have positive and negative considerations and to discuss the real world dilemmas that include global concerns, costs, and environmental impacts."

—**Mary Smith**, Science teacher, Louisiana

"[The lessons] are well planned for the time recommended; they are engaging and give students many opportunities for discussion. The background materials and support is helpful and detailed. The lessons were easy to adapt for IEP students and gave them many opportunities for success."

—**Elise Cooksley**, Social Studies teacher, Washington

"[Before introducing these lessons] students didn't understand that energy just changes from one form to another and I think these lessons helped with gaining this knowledge."

—**Lori Lawton**, Science teacher, Idaho

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