Climate Literacy and Energy Awareness Network (CLEAN)

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Introduction

To provide students with accurate information about climate and energy science, educators require scientifically and pedagogically robust teaching materials. This is especially important for topics in which scientific understanding is rapidly evolving like climate science.

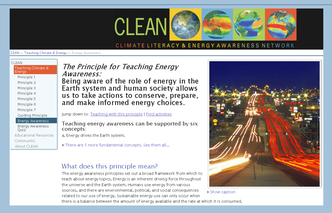
To address this need, the CLEAN Pathway (http://cleanet.org) is building and stewarding a **collection teaching materials in climate and energy science appropriate for grades 6-16**. Review criteria and a rigorous review process have been developed to vet **classroom activities, lab demonstrations, visualizations, videos, and modules/units**. We are offering an iterative peer review process to resource developers, to include their educational resources in our collection.

The CLEAN collection currently contains **360+ vetted** climate and energy science **educational resources aligned with the AAAS Project 2061 Benchmarks for Science Literacy**. The effort also includes **guidance for teaching about climate and energy**, and **professional development opportunities** for secondary teachers and undergraduate faculty.

Teaching Climate and Energy Topics Webpages

http://cleanet.org/clean/literacy

The CLEAN website offers background information and teaching tips for educators of students in grades 6-16 about how to teach climate and energy. We follow a **literacy-based approach** by using the framework provided by the Climate Literacy Principles and the Energy Literacy Principles. For each of the principles we summarize the relevant **scientific concepts** and provide a more detailed discussion of what makes the **topic important**, and why it can be **challenging to teach.** We offer suggestions for grade-level specific **teaching strategies** and links to **relevant teaching materials** and **reference materials**.

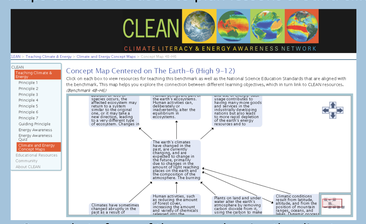


Two examples of "Teaching Climate and Energy" Pages on the CLEAN Website (cleanet.org).

Maps of Climate and Energy Concepts

http://cleanet.org/clean/literacy/concept_maps.html

To help educators explore how climate and energy topics can be organized into a **logical scope and sequence**, we present the CLEAN collection in a tool that visually connects CLEAN resources with relevant benchmarks from the **AAAS Project 2061 Benchmarks for Science Literacy.** These maps can also be used to plan lessons around climate science and energy awareness..



Screenshot of one of the maps showing the climate related concepts for the high school benchmark "The Earth"

Accessing the maps in the CLEAN collection is easy.

From each Teaching Climate and Energy Web Page

From the CLEAN description of each Resource

The CLEAN Review Process

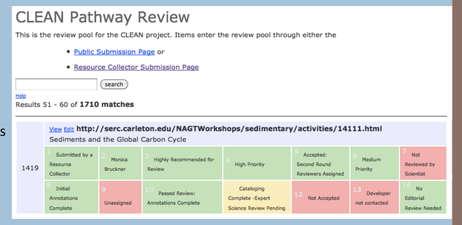
http://cleanet.org/clean/about/review.html

We have designed a **rigorous and transparent peer-review process** for the CLEAN collection. A peer-review process is desirable for curriculum developer as well as collection builder to ensure quality of the collection, its implementation is non-trivial. Our experiences provide general guidelines that can be used to judge the quality of digital teaching materials across disciplines.

We have instituted a multi-stage review process. The steps in this process include:

1. Identification of teaching materials

Our team of CLEAN resource collectors searches educational websites to find existing digital teaching resources that are a) **relevant to CLEAN** given the above defined framework of climate science, climate change, and energy awareness, b) of **appropriate granularity**, and c) for the **appropriate grade level**. We are evolving this process to include direct interactions with resource developers who will submit their resources to CLEAN for a peer-review. This will involved an iterative process with authors much like a peer-reviewed journal.



2. Formal Triage/Vetting

Any teaching activity that seems relevant to the collection, with a promising pedagogic design and seemingly solid science, is entered in our **online review tool** for further consideration by the review team. The initial set of questions in our initial vetting form addresses **the relevance of the resource to the collection (topic, type of educational material, grade level)** and concludes with a qualitative recommendation of the overall quality of the resource.

3. Reviews

General Reviews: Review criteria have been developed for **activities, videos, visualizations, modules/units and demo/short investigations**. These include criteria for a) **scientific accuracy**, b) **pedagogic effectiveness**, and c) **technical quality/ease of use**. Two general reviews are conducted for each resource, with the reviewers providing an overall qualitative assessment.

Panel Review: Resources that pass the two general reviews are presented to a **panel review**. This team of four specialists **(educators and scientists)** discusses each resource, based on the prior reviews, and makes final decision about inclusion in the CLEAN collection.

Expert Science Review: Climate and energy science encompasses a wide range of disciplines exceeding the scientific expertise of the CLEAN team. Therefore an expert science review is conducted for resources that pass the panel review.

Comments from all reviewers along with teaching tips are compiled in annotations (notes to the user) that are included when cataloging the resource in the collection. Resources that include cutting edge science are flagged and will be re-reviewed in as science evolves.

4) Cataloging and alignment with benchmarks/standards/guidelines

CLEAN resources are aligned with the Climate Literacy Essential Principles of Climate Science as well as with the new Energy Literacy Principles. The CLEAN collection is also aligned with the Benchmarks for Science Literacy (AAAS Project 2026). For easier search functionality , the CLEAN team developed a set of terms ("vocabularies") that define relevant topics of climate science, climate change, and energy.

CLEAN Selected resources are **cataloged into the collection by tagging with the climate and energy principles, benchmarks, vocabularies, and include comments from all reviewers**. Resources will also be aligned with the National Science Education Standards and the NAAEE Excellence in Environmental Education Guidelines.

Logo provided to CLEAN selected resources

Bringing CLEAN Resources to Your Website: The CLEAN "Widget"

http://cleanet.org/clean/about/widget.html

Would visitors to your website benefit from direct access to a collection of reviewed climate and energy related teaching materials?

With the CLEAN widget you can embed access to CLEAN's collection of resources directly into your website.

The CLEAN widget is a simple piece of javascript code that presents a self contained search of the CLEAN collection from any website.

Catalog record: teaching tips, reviewers comments, relevant essential principles & benchmarks.

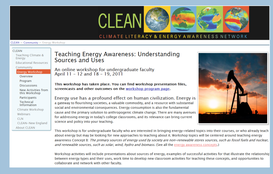
Educator Professional Development

Interactive Online Workshops for College Faculty

http://cleanet.org/clean/community/workshops

CLEAN offers online workshops focused on **teaching climate and energy topics** for **undergraduate faculty**. Each workshops runs over 4 days with a blend of synchronous sessions and asynchronous work time. Workshop activities include **presentations about the science**, examples of **teaching resources from the CLEAN collection** proven to be successful in the classroom, work time to **develop new classroom activities** for teaching the science concepts, and opportunities to **collaborate and network** with other faculty.

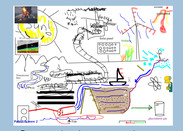
Teaching Energy Awareness: Understanding Sources and Uses



Navigating Climate Complexities in the Classroom

These two online workshops were designed to help college science faculty strengthen their teaching of climate and energy topics by:

- building content knowledge of climate and energy topics
- demonstrating exemplary teaching materials in the CLEAN collection
- collaborating with other faculty to develop new classroom materials



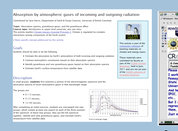
Concept sketching activity drawn on the Elluminate whiteboard. Participants sketched the sources of energy that feed into their electrical outlets.

Outcomes

- 12 new activities were completed and peer-reviewed by participants
- A new model emerged for teaching a principle of climate literacy with an integrated suite of activities
- Faculty networking and collaboration was fostered across the science disciplines.

2012 Workshops

Communicating Climate Change - April 2 -11, 2012
Interactions within the Climate System - May 7-16, 2012



Example of an activity produced at the workshop

Screen casts of workshop presentations, such as this one from Richard Alley's keynote are available on the web site.

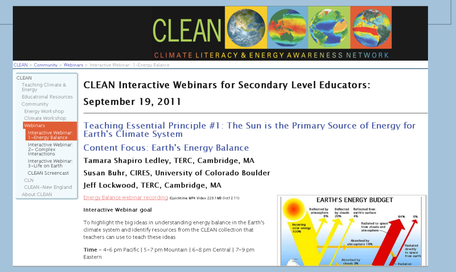
Interactive Webinars (iWebinars) for Secondary Level Educators

http://cleanet.org/community/webinars

CLEAN offers monthly interactive 2-hour webinars for **middle and high school educators**. Each webinar focuses on one of the **Climate Literacy Essential Principles**. The webinar presenters explore **misconceptions** that exist around the content, present the **scientific background** and suggest **how to teach** the content of the respective principle from an educator perspective. Participants discuss in **interactive breakout sessions** how the **CLEAN collection can support them in their teaching**. Presenters are scientists and educators with an expertise in the respective topic covered.

Examples of Topics Covered in iWebinars

- Overview of Climate Literacy Essential Principle or Energy Literacy principle that is the focus of the iWebinar
- Big ideas and student misconceptions
- Discussion of effective strategies for teaching these ideas
- Identification of selected teaching activities from CLEAN collection that address the topic



2012 iWebinar Series

7 iWebinars conducted September 2011-March 2012

Remaining

Apr 17, 2012: Humans can take actions to reduce climate change and its impacts, CLEP Guiding Principle
May 15, 2012: Being aware of the role of energy in the Earth system and human society allows us to take actions to conserve, prepare, and make informed energy choices, Energy Awareness

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