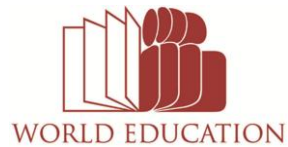


ABE Clean Energy Ambassadors Curriculum Resource Guide



Funded by the Massachusetts Clean Energy Center and World Education, Inc.



Project Co-Directors:

Sandy Goodman
National College Transition Network



Alex Risley Schroeder
Finding Earth Works



Finding Earth Works

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Introduction

The Adult Basic Education (ABE) system has had very limited exposure to clean energy concepts and career pathways. Yet, adult education is a crucial component of the workforce development pipeline with largely untapped potential to motivate and prepare low-skilled, low-income adults to pursue training for clean energy-related jobs, while also building clean energy awareness in adults who, as consumers, tend to be outside of such education efforts.

The ***Clean Energy Ambassadors Curriculum Resource Guide*** is a collection of materials, lessons and activities that adult educators can use to integrate clean energy concepts into their curricula. The guide was initially developed for adult educators from eight Massachusetts ABE programs participating in the ABE Clean Energy Ambassadors Project, funded with a Workforce Capacity Grant from the Massachusetts Clean Energy Center and additional support from World Education, Inc.

The ABE Clean Energy Ambassadors project was designed to strengthen the on-ramp to clean energy occupations for Massachusetts ABE students. Increasing the expertise of ABE teachers and counselors who work with ABE learners so that clean energy industries can be presented and investigated in the context of ABE instruction and counseling gives learners essential information about job prospects and requirements, training, and career pathways. The value of this on-ramp can't be underestimated: the shift that clean energy will create in our economy will require all citizens to know and understand these changes.

How to Use this Guide

While there are myriad websites, teacher resources, and other materials dedicated to teaching about clean energy concepts, applications and occupations, very few of them are geared specifically for adult ESOL and Basic Education learners. This guide gathers relevant resources, some of which were used by participating teachers and counselors to develop lesson sequences suitable in ABE/ESOL/GED classrooms. Following these annotated resources are examples of the ways the clean energy materials

Teaching about the challenge of our current energy use and global warming lends itself beautifully to curriculum integration; you can teach math, science, GED skills, vocabulary. And students are keenly interested. – Clean Energy Ambassador.

might be used to teach a variety of subjects: Career Exploration; Math, Science and Language Arts; and GED Preparation, and issues related to home and work. Next comes a collection of lessons, activities and approaches developed by participating ABE Clean Energy Ambassadors, teachers and counselors involved in this project.

These lessons incorporate a variety of online, multi-media, and teacher-created resources and span a wide range of clean energy topics, approaches and student

"Clean Energy," as defined by the Massachusetts Green Jobs Act of 2008 and for the purposes of this project, means "advanced and applied technologies that significantly reduce or eliminate the use of energy from non-renewable sources, including, but not limited to: energy efficiency; demand response; energy conservation and those technologies powered in whole or in part by the sun, wind, water, biomass, alcohol, wood, fuel cells, [and] any renewable, non-depletable or recyclable fuel [or] an alternative energy-generating source."

populations – there are infinite combinations and sequences that can be developed once one becomes familiar with the resources and gives thought to curricular objectives and student levels and interest.

With input from the adult educators, clean energy training providers, industry and employer project partners an organizing framework for this guide was developed: teaching about cleaning energy through the lenses of academic skill building, work, home, and community. This framework addresses the reality that adult students' interest may be sparked in any/all of these arenas and that not all are interested in clean energy work, or physically able to do it, but all are energy consumers or conservers. Furthermore clean energy industry partners and organizations, like the Massachusetts Clean Energy Center, share an interest in building a consumer and advocacy base among citizens necessary to grow and sustain the clean energy economy.



The framework provides flexibility to integrate clean energy concepts and materials as they connect to broader curricular plans based on class focus, level, student background knowledge and areas of interest – as learners (academic skills), workers (work), consumers (home), and citizens (community). For example, some teachers may draw predominately from the section on clean energy and work. It introduces students to clean energy occupations and career exploration. Others may be interested in integrating clean energy concepts into core academic instruction. Others may start with the basic clean energy concepts and use or develop math lessons to apply the concepts to build students awareness of themselves as energy consumers and their energy use at home.

The ABE Clean Energy Ambassadors Project

Eight Massachusetts ABE programs participated in the ABE Clean Energy Ambassadors Project. During the project, participating educators attended a series of face-to-face and online training events to identify clean energy and academic learning objectives and to develop strategies for incorporating clean energy concepts into instruction and advising. They learned about the clean energy industry, and employment and training opportunities in Massachusetts, attended a clean energy industry conference (NESEA's Building Energy 13) and visited two examples of clean energy companies. Simultaneously, they developed a sequence of at least three adult education lessons using the annotated resources of the Curriculum Resource Guide, additional resources they identified, and teacher-created materials. These lesson sequences were piloted in their classrooms and advising sessions and many are featured in this Guide.

The ABE Clean Energy Ambassadors Project was co-directed by Sandy Goodman, Director of Career Pathways, World Education, Inc. (sgoodman@worlded.org) and Alex Risley Schroeder, Principal, Finding Earth Works (alex@findingearthworks.org) both of whom also compiled and edited this Curriculum Resource Guide.

ABE Clean Energy Ambassadors Project Partners

Workforce Development and Clean Energy Industry

- Franklin Hampshire Regional Employment Board, Patricia Crosby
- New England Clean Energy Council, Kevin Doyle
- Northeast Sustainable Energy Association, Jennifer Marrapese

Training Providers

- Center for Eco Technology, Mark Newey, Beth Paulson
- MassGREEN Initiative, Leslie Hoffman

Clean Energy Employers

- Beyond Green Construction, Sean Jeffords
- FastCap Systems, Jamie Beard
- National Fiber, Chris Hoch
- Spirit Solar, Mike Kocsmiersky

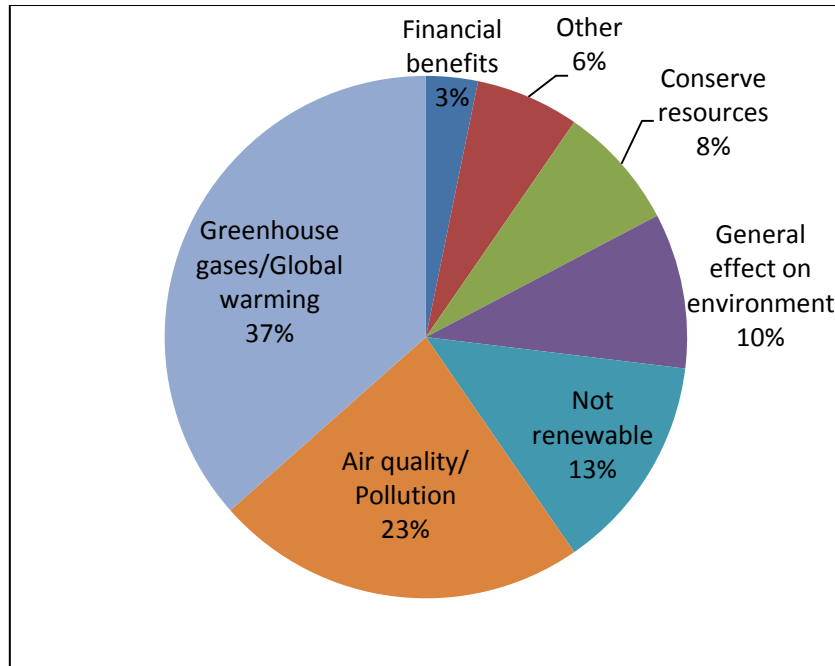
Adult Basic Education Programs

- Bristol Community College ABE Program , Dorothy Hayes, Meri Holden, Cathleen Desimone
- Cape Code Community College ACCCESS, George Carras, Roxanne Heller, Helen Rowell, Phyllis Whitney, Karen Zappula
- Clinton Adult Education Program, Holly Bullard, Christine Cordio, Diane Tenen
- Greenfield Community College, Virginia Goodale, Leo Hwang-Carlos, Wade Lavigne
- Holyoke Works, Angelika Bay, Larry Bay
- The Literacy Project, Amber Houghton, Kristi Kaeppel, Judith Roberts
- Quinsigamond Community College Adult Community Learning Center, Maria Kefallinou, Pat LaRochelle, Dayle Reynolds
- X-Cel, Inc. Adult Education, Kelly Folsom, Edell Howard, Don Sands

Annotated Resources for Teaching Clean Energy

Learning about Clean Energy

Students who participated in the lessons taught by the ABE Clean Energy Ambassadors completed an online survey at the end of the project. These are their responses, categorized by theme, to the question: ***Why is it important to reduce the use of fossil fuels?***



National Energy Education Development Project (NEED)

<http://cms.need.org/>

Energy information books, particularly secondary book sections on: energy efficiency, climate change, introduction to energy, solar, provide background information with accompanying worksheets.

<http://cms.need.org/node/30>

Variety of teacher resources, maps, lessons for teaching energy concepts, science, and math, such as:

Energy Around the World, uses math applications and cross cultural inquiry

<http://www.need.org/needpdf/Energy%20around%20the%20World.pdf>.

Energy Carnival <http://www.need.org/needpdf/Energy%20Carnival.pdf>

Subject Areas

Science, math, energy concepts

Target Audience

K12 students



Used in GED lesson on pages 55-56 and ESOL lessons on pages 97-99.

Energy Math Challenge offers math activities related to specific energy usage, global energy usage exploring energy, the greenhouse effect

<http://www.need.org/needpdf/Energy%20Math%20Challenge.pdf>

Exploring Energy uses hands-on activities to teach energy concepts

<http://www.need.org/needpdf/Exploring%20Energy.pdf>

Tennessee Valley Authority, TVAKids website

<http://www.tvakids.com/teachers/sourcebooks.htm>

The [Energy Sourcebooks](#) are teaching guides and energy education activities to help students better understand electricity, energy, and the environment. There are three source books: elementary, junior high and high school. (Junior high and high school require more lab equipment).

<http://www.tvakids.com/teachers/sourcebooks.htm>

Elementary Sourcebook:

Chapter 1 contains Simple activities to teach energy concepts

http://www.tvakids.com/teachers/pdf/elementary_ch1.pdf

Chapter 2 focuses on electricity. For example, Links in a Chain activity describes 8 forms of energy and Where Does it All Come From activity describes sources of energy.

http://www.tvakids.com/teachers/pdf/elementary_ch2.pdf

Chapter 3 offers simple activities to teach about different forms of renewable energy, including solar, wood, wind, water http://www.tvakids.com/teachers/pdf/elementary_ch3.pdf

Chapter 5 offers simple activities to teach about energy conservation around home and school.

http://www.tvakids.com/teachers/pdf/elementary_ch5.pdf

The Renewable Energy Curriculum includes also include lessons, readings, activities, fact sheets and glossaries on energy consumption, wind resource, landfill gas, solar resources

<http://www.tvakids.com/teachers/resources.htm>

Subject Areas

Science, basic energy concepts and vocabulary

Target Audience

Elementary, middle and high school. Accessible to high level ESOL and GED students.



Used in GED lesson on page 55.

Facing the Future

<https://www.facingthefuture.org/Curriculum/PreviewandBuyCurriculum/tabid/550/List/1/CategoryID/16/Level/a/Default.aspx>

Provides 2 versions of a free downloadable curriculum that contain solid overview and interactive activities to teach climate change

Subject Areas

Science, basic energy concepts and vocabulary

Target Audience

Elementary, middle and high school. Accessible to high level ESOL and GED students.

and energy issues. Lessons also address implications for economic equity and justice. Interactive activities. Curriculum is tied to national standards and includes assessment rubrics.

Franklin Hampshire Regional Employment Board Green Jobs Curricula

<http://franklinhampshirereb.org/adult-basic-education-green-curricula>

Clean energy curriculum developed through a collaboration of ABE/ESOL teachers, Regional Employment Board staff. Lesson topics include: understanding energy use; taking steps to reduce energy use; navigating utility bills; peak oil and its implications; the carbon cycle.

Subject Areas

Science concepts and vocabulary, career exploration

Target Audience

Advanced ESOL, GED



Used in GED lesson on pg 40 and Counseling lesson on pgs 107-108.

National Renewable Energy Lab (NREL)

<http://www.nrel.gov/docs/gen/fy01/30927.pdf>

Renewable Energy Activities – Choices for Tomorrow is a teacher’s activity guide that includes topics such as energy basics; source of renewable energy. Activity 1 and 2 require no special equipment, though some activities do. Lessons aligned with Colorado curriculum standards.

Subject Areas

Science and energy concepts, math, interpreting charts and graphs

Target Audience

Grades 6-8

Climate Literacy and Energy Awareness Network (CLEAN)

<http://cleanet.org/clean/literacy/index.html>

Teaching Climate Literacy and Energy Awareness is organized around 7 principles of climate literacy that provide a framework for teaching the science concepts.

The most direct way to get to the activities is to search the Educational Resources using terms like “clean energy” or renewable energy” http://cleanet.org/clean/educational_resources/index.html.

Then you can refine the results and select based on grade level, specific topic, and type of resource (e.g. video, lab experiment). Each lesson is annotated with reviewers’ comments: teaching tips, science involved, pedagogy, additional materials; ease of use.

Energy Awareness Quiz could be used as a pre and post student assessment

<http://cleanet.org/clean/literacy/energyquiz.html>

Subject Areas

Science and clean energy concepts

Target Audience

K-12 and lessons can be sorted by grade level

Infinite Power

<http://www.infinitepower.org/lessonplans.htm>

Lesson Plans on Renewable Energy developed by the Texas State Energy Conservation Office. They include teacher instructions, reading passages, handouts and worksheets. Everything needed for the lesson content is embedded in the lesson plan.

Subject Areas

Science and energy concepts

Target Audience

K12, the lessons for high school may be too advanced

Some lessons may be too specific to TX climate, conditions (e.g. "Roping the TX Breezes"). The teacher guides are mostly about how lessons align with Texas curriculum standards. Resources also include Fact Sheets for kids and adults.

Florida Solar Energy Center

<http://www.fsec.ucf.edu/en/education/k-12/curricula/index.htm>

Full curricula on topics, such as understanding solar energy, energy efficiency, and building performance. Lessons are aligned with Florida content standards and include teacher background information, instructions, handouts and worksheets.

Subject Areas

Science and energy concepts

Target Audience

K-12

Energy Ed and Workforce Development

<http://www1.eere.energy.gov/education/lessonplans/default.aspx>

Searchable data base of lessons and teaching materials organized by clean energy topic and grade level from the US Department of Energy, Energy Efficiency, Renewable Energy. Lessons are aligned with national education standards.

Background information and short readings on clean energy concepts can be found at Energy Basics

<http://www.eere.energy.gov/basics/>

Examples of lessons:

Energy Awareness Quiz guides students through process of identifying their level of knowledge about energy issues and calculating the CO₂ emissions caused by their lifestyles <http://www1.eere.energy.gov/education/lessonplans/plans.aspx?id=250>

Energy Analysis Lesson teaches students how to use graphs of historical data and research historical and societal events to determine and analyze energy trends in the United States over the past 50 years. <http://www1.eere.energy.gov/education/lessonplans/plans.aspx?id=207>

Subject Areas

Clean energy concepts addressed within a variety of subjects - math, social studies, history, science.

Target Audience

K12, the lessons for grades 9-12 may presume too much science background.



Used in GED lessons on pgs 48 and 59.

Teachers' Domain

<http://www.teachersdomain.org/>

Teachers Domain is a resource of WGBH and provides digital resources for teachers. Free registration is required to view the full set of resources and users can save searches in personal folders on the site. Lessons aligned with common core state standards.

Search data base using filters such as grade level, type of media (lesson plan, activity, video, professional development, document) and topics, such as clean energy, renewable energy, consumption or conservation.

Resources include full lesson plans with handouts and teacher notes as well as a Professional Development section for teachers to learn more about energy concepts and teaching about energy and general science.

Subject Areas

The majority of energy-related lessons are found under Science, Technology and Engineering.

Target Audience

K12, lesson can be filtered by grade level.

Energy For Educators

<http://www.energyforeducators.org/index.shtml>

Lesson plans are organized by STEM topics (science, technology, engineering, math) and then listed by grade level and topic. The majority of the CE/RE lessons are under Science (solar, wind, hydro, biomass, nuclear, conservation and consumption) and Math (wind power growth, cost, height, etc. teaching ratios, scatter plots).

Printable background readings are 2-5 pages at an intermediate reading level. The Energy Myths could be used as a pre-test/warm-up to lessons.

Subject Areas

STEM

Target Audience

K12, sorted by K-6, 7-9, 10-12

CT Energy Education

<http://www.ctenergyeducation.com/index.htm>

Curriculum resource for educators featuring the energy topics funded by CT Energy Efficiency Fund. The materials are free but you have to register with name and email address to access them.

Lessons are organized by topics such as Fundamentals of Energy, Climate Change, Energy Efficiency, Green Jobs, Green Schools and contain full lesson plans, power point presentations, handouts, worksheets, assessments, games and video clips. Lessons are aligned with CT standards.

Subject Areas

Science, clean energy concepts

Target Audience

K-12, targeted grade range provided for each lesson, but lessons can't be searched by level.

Kidwind Project

<http://learn.kidwind.org/movement>

Site features Windwise, a curriculum for middle schoolers focused primarily on wind power, and secondarily on solar. It also provides basic information about electricity and renewable energy – focused primarily on wind power and secondarily on solar.

Teacher Lessons and Resources include: Power point presentations on a variety of topics accompanied by “quick lessons” and additional readings. These are available without registration. Examples of quick math lesson topics are:

Estimate the Height of Wind Turbine <http://learn.kidwind.org/sites/default/files/triangles2.pdf> and Economics (of renewable energy) Word Problems http://learn.kidwind.org/sites/default/files/word_problems2.pdf

Registration on the site is free, but required, in order to access the full curriculum, which appear to be very comprehensive and interdisciplinary.

Subject Areas

Science of wind and solar power, Math such as measuring turbine heights and calculating costs

Target Audience

Middle School

US Energy Information Agency

<http://www.eia.gov/kids/energy.cfm?page=1>

The Energy Kids website contains basic energy and renewable energy information, games, quizzes, and energy calculators geared towards kids, and the reading and science levels may be appropriate for adult learners. The Teacher Resources contain lesson plans and teaching guides categorized by primary, elementary, intermediate, and secondary education levels.

Subject Areas

Science, math, some interdisciplinary lessons

Target Audience

K12 sortable by grade level ranges



Used in GED lesson on pg 56.

Quiz Tree Energy Quizzes

http://www.quiz-tree.com/Energy_main.html

Contains 5 online multiple choice quizzes that review basic concepts such as *What is energy?* *What is Renewable Energy?* The quizzes aren't accompanied by lessons or other instructional materials, but could guide be the foundation for prior knowledge assessment, formulating student research questions, and lesson planning.

Subject Areas

Energy concepts

Target Audience

Kids and adults

Climate Change, Energy, and Action

http://www.youtube.com/watch?v=s9dxc_jVIY&feature=related

This short video is graphically interesting, easy to understand and may provide a good opening for discussion and to assess learners' ideas and opinions and knowledge. It has no dialogue or narration.

Subject Areas

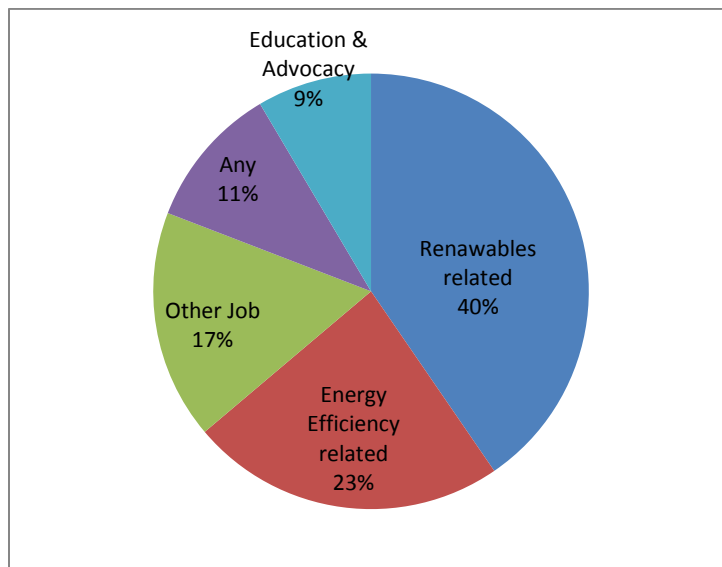
Climate change

Target Audience

All

Learning about Clean Energy Work

Students who participated in the lessons taught by the ABE Clean Energy Ambassadors completed an online survey at the end of the project. These are their responses, categorized by theme, to the question: ***What types of training and jobs are you interested in learning more about in the clean energy field?***



MN Energy Careers - ISeek

<http://www.iseek.org/industry/energy/index.html>

Site helps explore successful paths in energy, including 'green' energy. Focuses on MN, but broadly applicable as well. Background reading, interactive exploration for students, including industry profiles, career pathway descriptions, energy ed quizzes, videos, competencies and teacher resources. Also links to Center for Energy Workforce Development and postsecondary training.

Subject Areas

Careers and postsecondary training in Clean Energy Industries

Target Audience

Job seekers and educators

Explore Energy Careers

<http://www.iseek.org/industry/energy/careers/index.html>

Energy Career Paths

<http://www.iseek.org/industry/energy/education/pathway-tools.html>

Career paths for 8 energy careers including: Commercial Energy Efficiency; Residential Energy Efficiency; Solar Electric; Solar Heating and Cooling; Wind

Energy Skills to Teach in High School

<http://www.iseek.org/industry/energy/education/high-school-skills.html>

List of energy core fundamentals, trade specialization and industry specialization to teach; heavy on technical but gives solid overview of skills, competencies needed.

US Department of Energy, Energy Efficiency, Renewable Energy, Energy Ed and Workforce Development

http://www1.eere.energy.gov/education/clean_energy_jobs.html

The Office of Energy Efficiency and Renewable Energy's (EERE) workforce development and education activities support the further development and enhancement of critical workforce skills.

Green jobs fact sheets have good details on skills/competencies needed

http://www1.eere.energy.gov/education/clean_energy_jobs.html

Subject Areas

Clean energy jobs

Target Audience

Job seekers, students, teachers



Used in GED lessons on pgs 48 and 59.

Solar Career Map – fully interactive solar career exploration tool

<http://www1.eere.energy.gov/solar/careemap/>

Franklin Hampshire Regional Employment Board Green Careers
<http://www.franklinhampshirereb.org/adult-basic-education-green-curricula>

Career pathways created using actual job postings and job seekers tools.

Energy Efficiency Career Pathway Diagram

<http://www.franklinhampshirereb.org/green-careers-sectors-energy-efficiency>

Energy efficiency pathway with links to examples of occupations/job descriptions

Solar Career Pathway Diagram

<http://www.franklinhampshirereb.org/green-career-sectors-solar-power>

Solar energy pathway with links to examples of occupations/job descriptions

Subject Areas

clean energy career pathways

Target Audience

Job seekers, appropriate for GED and ESOL learners



Used in GED lesson on pg 40 and Counseling lesson on pgs 107-108.

Bureau of Labor Statistics green careers resources

<http://www.bls.gov/green/greencareers.htm>

Articles on different green occupations, including energy efficiency and green construction and solar, as well as others.

Subject Areas

Careers

Target Audience

Job seekers, career counselors and students

ONET online green careers resource

<http://www.onetcenter.org/green.html>

Green careers information and tools on 12 green economy sectors (ranging from renewable energy generation to manufacturing to transportation and energy efficiency) and occupations coded as new and emerging, enhanced skill and increased demand. From this site, use On-Line search tab to navigate to database (<http://www.onetonline.org/find/green>) to get detailed information on occupations.

Subject Areas

Careers

Target Audience

Job seekers, career counselors and students



Used in GED lesson on pg 34.

Career One Stop green careers resource

<http://www.careeronestop.org/greencareers/greencareers.aspx>

CareerOneStop's Green Careers section provides an outline of green careers including an overview of three different types of green careers, details on skills and education needed, and career growth rates.

Subject Areas

Careers

Target Audience

Job seekers, career counselors and students

Renewable Energy video

<http://www.youtube.com/watch?v=p5CJpxHQwHw>

Broad overview focused on solar, wind and ocean energy; moves at a good pace.

Subject Areas

Careers, renewable energy jobs/careers

Target Audience

General public



Used in GED lesson on pg 59.

Green Careers video trailer for Phoenix Learning green careers video

<http://tinyurl.com/9kkmr2h>

This is a short clip on the work of a solar installer. This is a clip from a longer video that is available for purchase from Phoenix Learning Group, Inc.

Subject Areas

Solar job

Target Audience

Job seekers, students

Mass Clean Energy Center Industry Report on MA jobs in clean energy

<http://masscec.com/index.cfm/page/2012-Massachusetts-Clean-Energy-Industry-Report/cdid/13909/pid/11170>

Massachusetts industry and occupation information. Background reading for teachers, counselors to prep them for discussion of MA clean energy industry and occupations; address concerns. Math can be applied in interpreting charts and graphs.

Subject Areas

Clean energy industry/occupations, math

Target Audience

Job seekers, Teachers and counselors

Green Jobs: Where Are They? Greenways Conference Report, Jobs for the Future

http://www.jff.org/sites/default/files/GreenJobs-WhereAreThey_042312.pdf

Subject Areas
Career and jobs

Target Audience
Teachers

Report on green jobs including section on MA clean energy economy. Background reading.

Insider's Guide to Clean Energy Credentials, Heatspring Learning Institute

<http://tinyurl.com/pgg3utv>

Offers information on certifications in solar, energy efficiency and geothermal.

Subject Areas
Clean energy certification guide

Target Audience
Job seekers and students

Web directory of training opportunities sponsored by Mass CEC

<http://cleanenergyeducation.org/category/training-type/career-training/curriculum-development/>

Provides information on content of MA skill training as well as links to programs.

Subject Areas
MA clean energy career / training information

Target Audience
Job seekers and students

Mass GREEN

<http://massgreentcc.com/>

A training partner for the ABE Clean Energy Ambassadors Project. Mass GREEN is a consortium of MA community colleges offering energy efficiency training across the state and a training partner. Background information on organization and programming. Includes information on current and future training courses, certifications, employment and career pathways as well as job openings.

Subject Areas
Training opportunities

Target Audience
Job seekers, students, career counselors

Center for Eco Technology website

<http://www.cetonline.org/>

A training partner for the ABE Clean Energy Ambassadors Project. CET is a non-profit educating the public about energy efficiency, renewable energy, waste and recycling. Information on some clean energy issues aimed at individuals, businesses and communities.

Subject Areas

Training opportunities

Target Audience

General public

National Fiber

<http://www.nationalfiber.com/>

An employer partner for the ABE Clean Energy Ambassadors Project. A cellulose insulation manufacturer. Includes information on cellulose insulation, glossary of industry terms, installer training syllabus.

Subject Areas

Cellulose installation
manufacturing

Target Audience

Customers, trades people,
general public

Spirit Solar

<http://spiritsolar.net/>

An employer partner for the ABE Clean Energy Ambassadors Project. Includes information on the range of solar services offered.

Subject Areas

Solar power installation

Target Audience

Customers

Beyond Green Construction

<http://beyondgreen.biz/>

An employer partner for the ABE Clean Energy Ambassadors Project. Includes information on Project Retrofit, Architecture 2030 Challenge, both major building sector initiatives to increase energy efficiency and information on Deep Energy Retrofits and good pictures of energy efficiency work being done.

Subject Areas

Energy efficiency and green
building

Target Audience

Customers

Fast Cap Systems

<http://www.fastcapsystems.com/>

An employer partner for the ABE Clean Energy Ambassadors Project. Includes information on energy storage technology.

Subject Areas

Energy storage company

Target Audience

Customers, provides general
education as well

Why Green is Your Color: A Woman's Guide to a Sustainable Career

http://www.dol.gov/wb/Green_Jobs_Guide/

This is a comprehensive manual produced by the US Department of Labor's Women's Bureau. The guide was created to help women at all stages of their careers ... identify and take advantage of opportunities in the clean energy economy." The manual includes sections on 'Why Is Green Good for Women', 'Green Occupations: A Look at What's Out There', 'Educating Yourself for a Green Career', 'Finding Your Green Job', 'Green Entrepreneurship', 'Women Succeeding in Green Jobs', 'Overcoming Challenges on Your Career Path', 'Planning Your Green Career' as well as a 'Glossary of Terms'. Chapters include tools, occupation examples, worksheets and links to other resources.

Useful both for learners/job seekers as well as teachers and counselors; can be used independently or in a group setting.

Subject Areas

Career and occupation information, job search techniques

Target Audience

written for women, suitable for men

Integrating Career Awareness into the ABE & ESOL Classroom

<http://www.sabes.org/workforce/integrating-career-awareness.pdf>

A flexible curriculum that covers in-depth self exploration, occupational exploration and career and education planning. Well structured, interconnected lessons geared specifically for ESOL and ABE learners. Lessons are correlated with both the MA Curriculum Standards and the SCANS standards.

All of the student handouts are available individually to be downloaded and modified

<http://www.sabes.org/workforce/ica-worksheets/index.htm>

Subject Areas

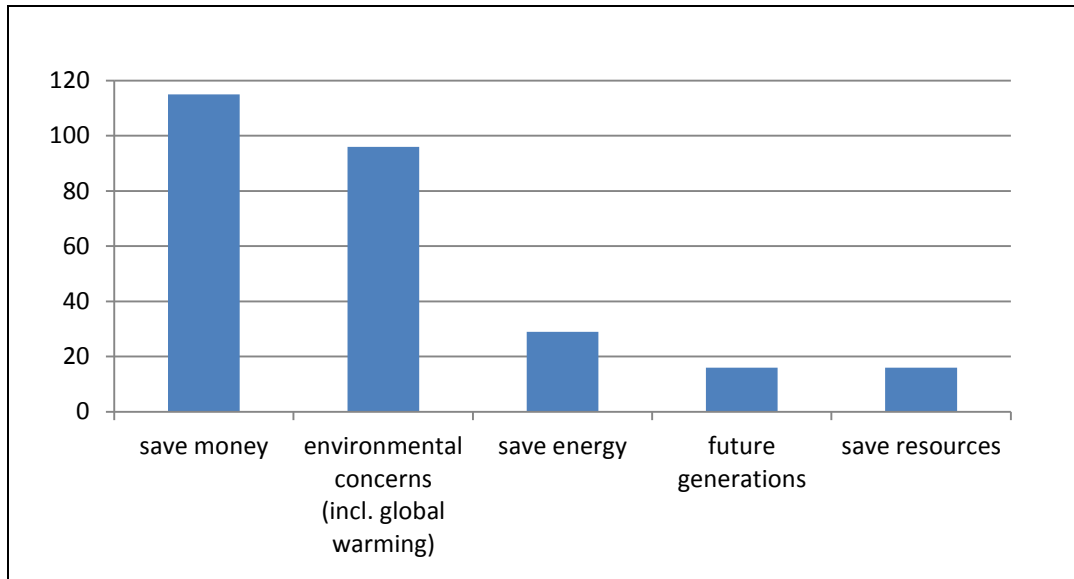
Jobs, careers – what are they, finding them

Target Audience

ABE/ESOL teachers, counselors, and learners

Learning About Clean Energy at Home

Students who participated in the lessons taught by the ABE Clean Energy Ambassadors completed an online survey at the end of the project. These are their responses, categorized by theme, to the question: ***Why do you try to reduce your use of energy? Write the 2 most important reasons for you.***



Mass SAVE program

<http://www.masssave.com/>

Official website of the Mass SAVE program to encourage energy efficiency; Walks tenants and homeowners through the program, identifies contractors and incentive programs.

Mass SAVE learning center

<http://www.masssave.com/residential/learning-center/be-a-masssaver/using-the-masssave-website>

Describes how to use the mass save website

Home energy assessment home page

http://www.masssave.com/residential/learning-center/be-a-masssaver/~/_link.aspx?id=EE54AEA72F104F3ABB58F9C7D8125512&z=z

Gets tenants, homeowners started on path to energy assessment and incentives

Virtual home tour

<http://www.masssave.com/residential/learning-center>

“home tour” gives short facts and information on energy usage/efficiency

Subject Areas

Science, energy savings, navigating web resources

Target Audience

Massachusetts residents and utility customers



Used in GED lessons on pgs 45-46, 64-67, and ABE lesson on pg 82.

Environmental Protection Agency

<http://www.epa.gov/climatechange/>

EPA's climate change resources Background information on climate change, greenhouse gas emissions, climate change science; includes map of US with information about impacts of climate change on different regions

Things you can do to save energy at home

<http://www.epa.gov/climatechange/wycd/home.html>

Calculator to figure out household greenhouse gas emissions

<http://www.epa.gov/climatechange/ghgemissions/ind-calculator.html>

Subject Areas

Science, energy savings, navigating web resources

Target Audience

Massachusetts residents and utility customers



Used in GED lesson on pg 59.

Cape Light Compact Home Energy Detective Kit

<http://www.capelightcompact.org/library/2010/06/killawatt-project-for-web.pdf>

Step by step guide to determine and reduce home energy usage

Subject Areas

Science, math

Target Audience

General public

Energy Information Administration, Energy Kids website

<http://www.eia.gov/kids/index.cfm>

Lessons plans for teachers

<http://www.eia.gov/kids/energy.cfm?page=Plans>

Subject Areas

Science, reading charts

Target Audience

Students and teachers



Used in GED lesson on pg 56.

Alliance to Save Energy

<http://ase.org/about-us>

The Alliance to Save Energy is a nonprofit organization that promotes energy efficiency worldwide through research, education and advocacy.

Subject Areas

Social studies, math.

Target Audience

Grades 5 - 8

Clear lessons plans (pdfs) that can be downloaded to calculate energy use at home and school, which light bulb is cheaper, assess appliances, etc. Calculating trade-offs social and personal costs.

Conscientious Consumption

<http://ase.org/resources/lesson-plan-conscientious-consumer>

Understanding window treatments for energy savings

<http://ase.org/resources/window-treatments-energy-savings>

Climate Literacy and Energy Awareness Network (CLEAN)

<http://cleanet.org>

Teaching and learning resources organized around 7 principles of climate literacy. Each activity is annotated with reviewers' comments: teaching tips, science involved, pedagogy, ease of use.

Need to probe a few layers to find the lessons/activities

Home – The Big Energy Gamble, Energy Audit Lesson

<http://cleanet.org/resources/41864.html>

Plugged into CO2 – measuring appliance uses.

<http://cleanet.org/resources/41859.html>

Home/Community – The Lifestyle Project, 3 week lesson.

<http://cleanet.org/resources/41895.html>

Subject Areas

Science

Target Audience

Sorted by Grade Level

CT Energy Education

<http://www.ctenergyeducation.com/lessons.htm?cat=qwv6u0ax>

Energy Efficiency lessons provide activities for students to make their own solutions to energy issues.

Subject Areas

Energy efficiency (as well as green jobs and climate change)

Target Audience

Diverse grades

Energy Hog

<http://energyhog.org/adult/home/>

Website with info on energy audits for kids and adults.

Energy Scavenger Hunt

<http://energyhog.org/pdf/ScavengerHunt.pdf>

Subject Areas

Energy savings

Target Audience

Kids and adults

Saving Electricity

<http://michaelbluejay.com/electricity/cost.html>

This interactive website is a how-to guide about saving electricity in the home. It has a variety of tools and learning activities for calculating home energy use and comparing costs and savings.

Subject Areas

Home energy use

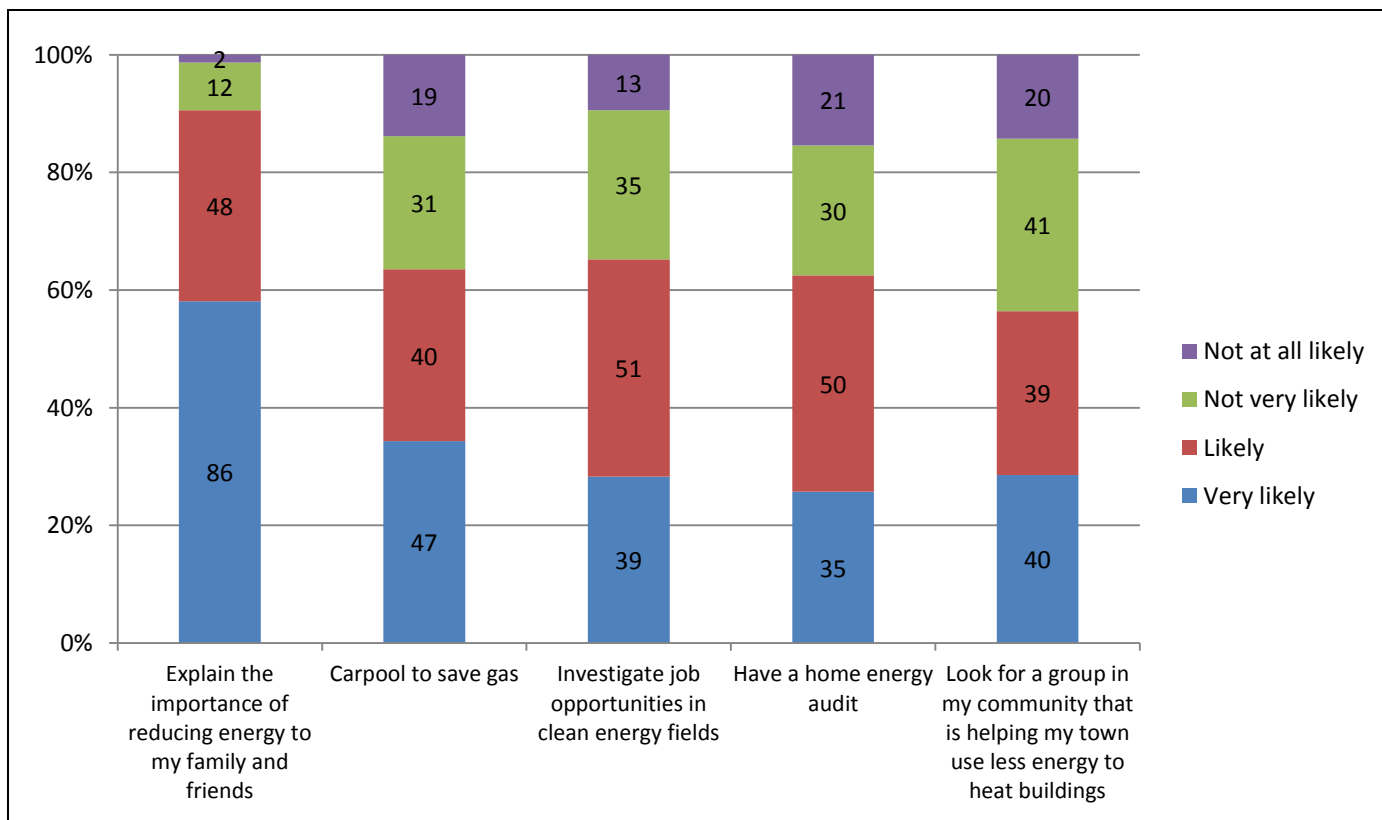
Math concepts and formulas

Target Audience

General public and electricity consumers

Learning About Clean Energy in Your Community

Students who participated in the lessons taught by the ABE Clean Energy Ambassadors completed an online survey at the end of the project. These are their responses to the question: **How likely is it that you will do any of these actions in the next 3 months?**



Alliance to Save Energy
<http://ase.org/about-us>

The Alliance to Save Energy is a nonprofit organization that promotes energy efficiency worldwide through research, education and advocacy. It provides lesson plans that can be filtered by topic and grade level. Lessons for grades 9-12 include one on charting the energy used on campus, and discuss energy use and potential ways to save.
<http://ase.org/lessonplans>. The site also provides other resources, including videos.

Subject Areas

Energy concepts, science, map

Target Audience

K-12

Tax Incentives Assistance Project (TIAP)
<http://energytaxincentives.org/>

Information for consumers to make use of the federal income tax incentives for energy efficient products and technologies.
Consumer page available in Spanish
<http://www.energytaxincentives.org/consumers/>

Subject Areas

Clean energy tax incentives

Target Audience

Consumers and businesses

Coop Power
<http://www.cooppower.coop/>

Information on community owned sustainable energy that can be used as a resource to develop lessons or projects.

Subject Areas

Clean and renewable energy

Target Audience

Residents, community groups

Examples of How Clean Energy Resources Can be Used to Teach a Variety of Subjects

There are a variety of ways to incorporate clean energy while simultaneously meeting broader curricular goals. The following are four examples of how to combine resources identified in the Curriculum Resource Guide to support learning in the following areas: Career Exploration, Math, Science and Language Arts, Adult Secondary Education/GED and Relating to Home and Work Concerns. While not lesson plans, these examples illustrate how resources not already in lesson format can be used productively to teach across subject areas, develop skills and enhance student knowledge.

Example of Resources used to Teach Career Exploration

This sequence combines real world data on the Massachusetts clean energy economy, detailed occupational information on clean energy occupations and two tools to support student career investigations. The sequence contains the:

- **MA Clean Energy Industry Report** (2012) (<http://masscec.com/index.cfm/page/2012-Massachusetts-Clean-Energy-Industry-Report/cdid/13909/pid/11170>),
- **ONET Online** database (www.onetonline.org),
- **Integrating Career Awareness into ABE and ESOL Classrooms** curriculum, and (<http://www.sabes.org/workforce/integrating-career-awareness.pdf>)
- **Why Green Is Your Color: A Woman's Guide to a Sustainable Career** (http://www.dol.gov/wb/Green_Jobs_Guide/).

This combination offers multiple foci for teaching and learning that combine career and job seeking strategies with industry information and labor market data.

This sequence presumes learners are interested in exploring different possible careers, including clean energy. It also assumes teachers and counselors have comfort with career investigation tools already and have some experience weaving them into classroom activities and lessons, enough to discern what parts of SABES and DOL Women's Bureau Guide resources are most applicable to their students' educational and occupational goals.

The **MA Clean Energy Industry Report** (<http://masscec.com/index.cfm/page/2012-Massachusetts-Clean-Energy-Industry-Report/cdid/13909/pid/11170>) contains text, chart and graphics that illustrate the state of the MA clean energy economy. There are no formal lessons; instead, this report is a rich resource for building lessons around the clean energy industry and occupations, as well as lessons that focus on interpreting charts and graphs.

The 13 page report is divided into nine research categories (including 'Clean Energy Employers in MA are Growing Rapidly', 'Clean Energy Firms are Distributed Throughout the Commonwealth but Growth is Uneven', etc.). The organization of the report, as well as the short length of the sections, lends itself to the development of one or two lessons and then to build out in combination with any of the following resources.

The **ONET online** database (www.onetonline.org) is an interactive tool for exploring and searching occupations. Regularly updated with current industry information, the database has levels of coding, including 'green' (green occupations, including clean energy occupations) and 'bright outlook' (occupations projected to grow). The database lends itself to multiple lessons (how to use the tool, how to research occupations or industries, etc.); in particular, the database can serve as a substantial resource for information about green occupations in 12 industry sectors (including energy efficiency, renewable energy generation, green construction, and manufacturing), offering detailed job information (tasks, tools, knowledge, education required, certifications, wage information, etc.). A lesson sequence that pairs the MA Clean Energy Industry Report and the ONET online database could offer students tools and information to discover their own suitability for clean energy occupations.

Both the ***Integrating Career Awareness into ABE and ESOL Classrooms*** curriculum (<http://www.sabes.org/workforce/integrating-career-awareness.pdf>) and the ***Why Green Is Your Color: A Woman's Guide to a Sustainable Career*** (http://www.dol.gov/wb/Green_Jobs_Guide/) offer lessons or activities that support student exploration of their skills and the process of job searching. (ONET includes job and career search resources as well.)

Integrating Career Awareness into ABE and ESOL Classrooms offers a whole curriculum geared specifically for ABE and ESOL learners. Of particular value in this All Career sequence might be the Lesson 7: Identifying Skills, Lesson 8: Things I Am Good At, Lesson 10: Identifying Job Values, Lesson 11: Prioritizing Job Values and Lesson 12, Part 1: Putting It All Together: Interests, Skills and Values and Lesson 12, Part 2: Matching Skills, Interests and Values to Occupations. The lessons used will depend on the prior experience and knowledge that learners have. (Alternatively, or additionally, Section III: Occupational Exploration could be used to support the research of clean energy occupations identified in the MA Clean Energy Industry Report.)

Why Green Is Your Color: A Woman's Guide to a Sustainable Career, (written for women, but suitable for both women and me) published by the US Department of Labor's Women's Bureau, is an online "comprehensive manual designed to assist women with job training and career development as they enter into innovative and nontraditional jobs. ... The guide was created to help women at all stages of their careers ... identify and take advantage of opportunities in the clean energy economy." The manual includes sections on 'Why Is Green Good for Women', 'Green Occupations: A Look at What's Out There', 'Educating Yourself for a Green Career', 'Finding Your Green Job', 'Green Entrepreneurship', 'Women Succeeding in Green Jobs', 'Overcoming Challenges on Your Career Path', 'Planning Your Green Career' as well as a 'Glossary of Terms'.

The section on 'Green Occupations: A Look at What's Out There', offers short summaries of occupations as well as techniques for research. The Planning Your Green Career section provides activities designed to support use of the ONET online database. The Guide also lends itself to some extension activities. One could focus on the section on Educating Yourself for a Green Career to support student investigation into the education, training and credentials needed for the clean energy occupations of interest to them; another could focus on resume and cover letter writing, finding job leads and preparing for interviews. Throughout the Guide there are additional resources identified and hot linked.

Example of Resources used to Teach Math, Science and Language Arts

This selection consists of lessons from a well-developed climate change unit and lessons and activities from the National Energy Education Development Project. Selected lessons and activities from these two resources can be used to build a sequence engaging diverse academic areas with a focus on energy and climate change. The sequence includes the following resources:

- **Facing the Future** units (<https://www.facingthefuture.org/Curriculum/PreviewandBuyCurriculum/tabid/550/List/1/CatagoryID/16/Level/a/Default.aspx>). There are two two-week units, one for grades 6-8 and one for grades 9-12. Content covered doesn't differ significantly, but the depth of investigation and critical thinking is greater in the 9-12. These units were developed by Facing the Future, a nonprofit, nonpartisan organization providing resources and community action opportunities on global issues and sustainability for teachers, students, and the public. Each lesson/activity includes the subject areas and national standards alignment (k-12). In addition, each lesson/activity includes extension activity suggestions as well as action activity suggestions.
- **NEED** <http://cms.need.org/>. These lessons were developed by the National Energy Education Development Project. The main focus is increasing energy awareness and understanding across energy sources, including fossil fuels, nuclear and renewable energy. Considerations of impact and implications are included.

This sequence presumes that learners have a basic understanding of climate changes and the causes and consequences.

Suggested lesson selection and sequences:

Greenhouse Gas Investigations (Facing the Future, grades 9 – 12)

A low-tech science experiment to illustrate greenhouse gases, identify sources and impacts and to set the context for exploration of implications. The activity requires simple materials (glass containers or jars and thermometers). Students conduct the experiment and then graph the results.

Energy Exploration (Facing the Future, grades 9 – 12)

In small groups, students read about various sources of energy used for electricity production. Students identify the pros and cons of these energy sources and take a position, either encouraging or discouraging the class to use particular energy sources. Groups of students investigate seven different energy sources, describing the energy source and answering four questions:

1. What are the benefits?
2. What are the negative consequences?
3. Does the use of the energy source contribute to climate change?
4. Should the energy source be a major source for future electricity production?

Groups share their findings and have a discussion. This lesson can be tailored so that only a small bit of research is needed (each energy source question sheet has information that could suffice for answering the questions) or students can do more significant research about the energy source. This lessons touches on social studies, science and communication.

From the NEED resources, the **Energy Around the World** activity (<http://www.need.org/needpdf/Energy%20around%20the%20World.pdf>) The purpose of this unit is to introduce students to the different ways that people in other countries produce and consume energy by providing information on a representative sample of countries throughout the world. This unit is designed for use with upper elementary and middle school students.

Making Climate Connections (Facing the Future, grades 6-8)

In pairs, students read about the impacts of climate change experienced by people living in different environments around the world. As a class, students discuss how these climate change impacts are connected. The climate accounts come from different environments as well as different countries, including Pohnpei (an island community), Switzerland, USA, Nepal, Argentina, Antarctica, Spain, China, Germany, Australia, Japan, Tanzania and Kenya. This activity supports analysis and synthesis of information and developing connections.

From the NEED resources, the **Energy Carnival** activity (<http://www.need.org/needpdf/Energy%20Carnival.pdf>) is a collection of 10 carnival games that tap science and math skills. Energy Equations uses charts and graphs representing energy usage and supply data and provides good practice and working with different units as well as math calculations. Energy Sleuth and Energy Taboo are refreshers for different sources of energy. Top Five and Wheel of Energy get at facts about global energy use and production. Some revisions to these carnival activities to better dovetail with the Facing the Future lessons will be necessary. This could be a fun closing activity, but does presume some knowledge that is not part of the earlier lessons in this sequence.

Example of Resources used to Teach Adult Secondary Education/GED Preparation

This sequence uses selected chapters from the US Department of Energy Info Book for Secondary Education (grades 9-12) <http://www1.eere.energy.gov/education/> to teach basic energy concepts integrating the type of reading, interpretation, math, social studies skills needed for the GED.

The Info Book http://www1.eere.energy.gov/education/pdfs/basics_secondaryenergyinfobook.pdf contains a collection of readings about a variety of energy related topics (@3-5 pages per chapter) , but does not contain formal lesson plans. Instead, the readings are accompanied by an Activity Book http://www1.eere.energy.gov/education/pdfs/basics_secondaryenergyactivities.pdf that includes a variety of worksheets designed to reinforce the vocabulary, concepts, and information contained in the Info Books.

The activities do not include any hands on activities or lab experiments which means that they don't require additional materials, equipment, space, or extensive preparation. The readings are 3-5 pages

and perhaps dense for GED students, and might require multiple class sessions to thoroughly cover them.

Suggested Chapter selection and sequences:

Introduction to Energy (pgs 9-12) offers an introduction to the definition of energy and types of energy. The reading contains headings, graphs, charts and lends itself way to using multiple strategies for reading and understanding complex texts.

Examples of accompanying worksheets:

- reading comprehension worksheet (Forms of Energy, pg. 10)
- worksheet for converting quads into percentages and pie charts (p 16)
- table for charting how we use energy sources (pg. 17).

To lighten up the reading and engage kinesthetic learners, you might incorporate Acting Out Energy Forms, from Green Teacher http://energyteachers.org/download-doc.php?media_id=9

This booklet on Energy Flow is full of diagrams and pictorials that might be used to supplement the Introduction to Energy, or if you choose to continue reading about specific forms of energy that follow the intro chapter. In addition to illustrating the science concepts, the diagrams may be useful for teaching and reinforcing vocabulary. <http://www.need.org/needpdf/Energy%20Flows.pdf>

Measuring Electricity (pgs. 65, 66) – Gets into some more math and science, such as calculating power and energy, and Ohm’s Law, and accompanying worksheets on pgs. 19-26.

Energy Consumption (66-69) – Gets into the issues related to residential and commercial consumption, such as heating, cooling, lighting, building design, appliances, and efficiency ratings.

If you wanted to follow up with a hands-on activity that did not require additional equipment or materials, consider one of the following:

- Energy Action Challenge to give students opportunity to apply the information by assessing energy usage in their home. Students increase awareness of how they use energy at work or home, but do not get into calculating usage or waste in this activity.

http://www1.eere.energy.gov/education/pdfs/efficiency_energyactionchallenge.pdf

- Or a cost-benefit analysis of fluorescent and LED light bulbs, which would reinforce math computation as well as comparison and evaluation skills.

<http://www.ctenergyeducation.com/lesson.htm?id=2f549jbd>

- Plugged into CO2 has students measure the energy used by variety of home appliances but does require a Kill-O-Watt meter. <http://cleanet.org/resources/41859.html>

Example of Resources used to Teach about Clean Energy Related to Home and Work

The following selection and sequence of lessons/materials might be used if you want to teach students the basics of clean energy in order to raise their awareness of home energy consumption and conservation and the types of jobs and careers one might consider if they're interested in addressing energy concerns.

Basic Energy Concepts:

Lesson from CT Energy Education on Introduction to Energy Use

<http://www.ctenergyeducation.com/lesson.htm?id=px6e4sxx>. Without getting too deeply into the science and math, it uses this article from the Union of Concerned Scientists on a Short History of Energy to provide some background to the issues .

http://www.easternct.edu/sustainenergy/education/documents/PuttingEnergyinPerspectiveStudentsheet_new.pdf . The lesson continues with two activities that raise students awareness about how regional energy sources vary and about transportation and fuel consumption.

In addition to teaching basic energy concepts, students will be reading, drawing historical and regional comparisons and interpreting data from charts and graphs and creating timelines to document past, present, future events.

Home/Community Energy Consumption

The Lifestyle Project <http://cleanet.org/resources/41895.html> is a multi—week project that begins with a measurement of baseline consumptive behavior followed by three weeks of working to reduce the use of water, energy, high-impact foods, and other materials. The activity can be pared down to focus on just one area of consumption, such as energy. The assignment uses an Excel spreadsheet that calculates direct energy and water use. Students are asked to keep a journal throughout the project.

In addition to raising awareness of patterns of consumption, the project can be used to practice and reinforce Excel spreadsheet skills, writing, and collecting and using data to make comparisons (e.g. concept of “baseline”).

If the Lifestyle Project is more extensive than you have time for, then there are numerous short lessons that get students thinking about their home and community energy use. These lessons also draw on collecting and/or interpreting data and drawing comparisons:

- How does the electricity I use compare to the National Average?
<http://www.ctenergyeducation.com/lesson.htm?id=vcwcjkgd>
- Energy Use Around the World
<http://www.need.org/needpdf/Energy%20around%20the%20World.pdf>

Work – Learning about Green Jobs

You can introduce students to descriptions of some types of jobs in the Green Economy sector using a variety of career information websites and materials. The job profiles are short readings with which

you can teach vocabulary, reading strategies, test comprehension, etc. You can reinforce and practice internet navigation and research skills, you can use the videos to practice listening and note taking skills. The labor market data contained in each profile can be used for math lessons and lessons on interpreting and comparing data, charting and graphing.

Mass Career Info Systems (CIS) has a section dedicated to Green Jobs Green Jobs organized by occupation. <http://masscis.intocareers.org/ViewHtmlWithNav.aspx?File=Green/Green300.htm> .

Click on the occupation and explore the profile, to find information about:

- Skills
- Demand and labor market information
- Wages
- Preparation (training needed)
- License and certification
- Video - some profiles include videos (in English and Spanish) of people on the job
- Interviews – some profiles include written interview transcripts with people in the field
- Related Occupations
- Programs of Study in MA

There are a number of activities, worksheets, lessons you can use or develop to help students explore and process the information gathered here.

- Integrating Career Awareness – Lessons and worksheets on Using the Internet to Learn about Occupations pgs. 70-79 <http://collegetransition.org/publications.icacurriculum.html>
- Alliance to Save Energy has some lesson plans to introduce (kids) to Green Jobs
Green Jobs Trading Cards <http://ase.org/e-jobs%20trading%20card%20lesson%20plan>
A Green Future for You <http://ase.org/resources/green-future-you-lesson-plan>
Green Careers Webquest <http://ase.org/resources/green-careers-web-quest>

If you were to engage in an actual career planning process, then you would want to add many more lessons to guide students through a process of self-exploration and assessment of their own interests, skills, values, as well as help them find opportunities to speak with people in these occupations and industries (e.g. Informational Interviews). Lessons and worksheets for the entire career planning process can be found in the ICA.

You can download the full set of career planning lessons contained in the Integrating Career Awareness (ICA) curriculum guide here, <http://collegetransition.org/publications.icacurriculum.html>.

GED Lesson Sequence Examples

Class: GED (8th and above reading level) & College and Career Planning

Program: The Literacy Project

Introductory Summary

The sequence represents the initial lessons used to introduce classes to the field and topics of clean energy. The lessons were designed to inspire motivated learning in the GED subject areas by raising student awareness of and a deeper understanding of the issues at the core of climate change – the problem and potential solutions – and to help students become better-informed citizens and critical thinkers.

The GED preparation course focused heavily on reading, writing, and math. Science and social studies concepts are explored through readings and activities. Therefore, the instructor sought to interweave clean energy topics with relevant GED science knowledge, focusing on reading skills for science passages and science vocabulary that was found both in the clean energy field and that's likely found in GED-style science passages. Maps, graphs, reading passages, and video were used to reach GED academic goals, such as identifying implications from graphs, drawing inferences, etc.

For the College and Career Planning students, the aim was to give them an overview of the field without overwhelming them with details or specific concepts. A presentation on the clean energy industry in Massachusetts was given highlighting its rate of growth, required skills, types of jobs and training opportunities available. Students used what they learned about the field to talk about work values, and whether the clean energy field aligns with them. As a result, one student signed up for an intersession course on renewable energy solutions at Greenfield Community College!

Lessons:

1. Our World 4 Degrees Warmer
2. Green Careers—Could They Be For You?
3. The Carbon Cycle and Climate
4. Should We Really Be Concerned about Global Warming?

Incorporating clean energy lessons has made me more aware of the need to get students invested in important and controversial topics. It got me to reflect on the ways that students form beliefs about the world and how tenuous the foundations for those beliefs can be. I see civic engagement as a primary objective and need of adult education.

I learned that I can incorporate the clean energy content into all GED subject areas which allows the class to go into greater depth with one topic, explore the issues and read critically, form opinions.

Lesson # 1 - Our World 4 Degrees Warmer

Academic Learning Goals –

Students will restate and interpret information from maps and graphs, develop written responses to an important issue, and use peer-editing for punctuation, correct verb tenses, verb-subject agreement, commas, etc.

Clean Energy Learning Goals –

Prompt student reflection on the causes of global warming, solutions for improving it, and understanding of the importance of the clean energy field.

Materials :

- Video - National Geographic on *Earth 4 Degrees Warmer* (Celsius)
<http://www.youtube.com/watch?v=skFrR3g4BRQ>
- Projector, screen and internet connection
- Map of the world 4 degrees warmer (originally published in New Scientist magazine)
<http://blog.comparemysolar.co.uk/wp-content/uploads/2012/11/climate-change-map-new-scientist-2009.jpg>
- Map of World Energy Consumption
<http://www.wrsc.org/sites/default/files/images/2010/energy%201.png>

Time to teach lesson: 1.5 hours

Teaching Instructions

Introduction

1. Start by eliciting responses from the students on what the Earth would be like if the global temperature rose by a few degrees to see what they already know and what sense of importance they assign to global warming. Discuss questions such as:
 - What is global warming?
 - Do you think it's an important topic? Why or why not?
 - Do you know how our energy use affects global warming? If so, or if you just have some idea, say what you know about how they are related.
 - What would a warmer world mean for us?
 - What aren't you sure of about global warming or what would you like to know more about?
2. Show video from National Geographic on what the world would be like if the temperature increased by 4 degrees Celsius.
3. Discuss some of the implications raised in the video, touching upon the need to make changes in energy consumption.
4. Discuss questions such as:
 - What did you watch that surprised you?
 - What would happen to the people living in the coastal areas that would be submerged?
 - How would the economy be affected?

Activities:

1. Hand out map of the world 4 degrees (Celsius) warmer.
2. Have students write:
 - Three true statements that can be made based on the map.
 - Two implications gleaned from the map.
3. Handout the map of energy consumption around the world.
4. Have students write:
 - Three true statements that can be made based on the map.
 - Two implications gleaned from the map.
5. Ask students to read their statements and discuss connections between the information found on the two maps.

Now that students have reviewed and discussed data, they will process what they've learned through a three paragraph written reflection that will be the source of a lesson or review on writing mechanics and peer editing activities to improve writing.

Ask each student to choose one of the following three topics:

- As we saw on the map and in the video, a warmer world would mean radical changes. These changes wouldn't be easy to adjust to. Why do you think we have been so slow and unable to reduce our energy consumption?
- The U.S. is one of the largest users of energy in the world. Do we have an obligation to reduce our energy consumption to help slow global warming? Why or why not?
- What are some things we can do to reduce our energy consumption here in the U.S. at a national and personal level?

Demonstration of Learning:

Students will read their essays aloud and discuss after they have completed the peer-editing and revision activities of a follow-up writing lesson.

Wrap-up

Final discussion and reflection on essays and issues raised, such as US rate of energy consumption compared to other countries.

Lesson # 2 - Green Careers: Could They Be for You?

Clean Energy Learning Goals –

This lesson will inform students of increasing job opportunities and training programs in local industry/field and guide them through process of reflecting on their own work values and whether they match up with green careers.

Materials:

- Green Careers Presentation (the content is specific to Western Massachusetts, but can serve as a guide for developing a local presentation).
- Considering Work Values handout
- Computer and projector
- Lesson on Identifying Job Values <http://collegetransition.org/publications.icacurriculum.html> (pg 58) or similar work values assessment activity such as, <http://www.onetcenter.org/WIL.html?p=3>

Time to teach lesson: 1 hour

Teaching Instructions

Introduction

Prior to Green Careers presentation, present a lesson the career planning concept of work values and ask students to discuss what types of things are important to them in a job and work environment. When students bring an awareness of their own work values to a Green Careers lesson like this one, they are better prepared to discuss which jobs do or don't match their values.

Activities:

1. Present information on Green Careers, stopping throughout to address questions.
2. With students working in pairs, assign each pair one of the four scenarios from the Considering Work Values handout.
3. Referring back to the slides outlining types of green jobs and skills in demand, have pairs read a scenario and discuss whether the person might be a good fit for a specific job in the clean energy field, given the description of their personality, demographic background, interests, and values. Why or why not? Which jobs in the field might be good for them?
4. Ask pairs to describe their scenario to the full group and explain the conclusions they came to in their discussion.
5. Now students review their own work values and discuss with their partner whether any of the jobs presented would be a good fit for them. Why or why not?
6. Come back as a group and ask pairs to describe the results of their discussion.

Demonstration of Learning:

Students will demonstrate the concept of aligning work values to occupations by working with the scenarios and then their own work values and discussing how they do or don't match up with the types of jobs presented in the lesson.

Considering Work Values handout

Directions: Read the following paragraphs and decide what the author's thesis is. What are they arguing for? After that, decide what their **values** are. Values are what the author prizes as important above other things. For example, a mother who doesn't let her child go out late with friends values her child's safety over her freedom to hang out with friends. After you determine what the author values, look for **unstated assumptions**. What things are they assuming to be true without directly stating it? For example, if I say "He looks so much better now that he's stopped smoking", I am assuming that quitting smoking affects one's physical appearance.

1. It's common to hear people gripe about global warming. When a big storm comes or there's an unseasonably warm day, people get worked up about global warming. However, there's not enough information to say if this is the fault of global warming or not. Therefore, we should continue to use our cars and electricity until we know more. Without these things, the economy would suffer and jobs would be impacted. Whether or not global warming is real, the economic problems are. Let's not make them worse by regulating companies to keep track of their energy use.

Thesis:

Values of the author:

Unstated assumptions:

2. Riding your bike is a great way to cut down on your fuel use, which saves the environment. It also makes you healthy which is another reason you should do it. We should all ride bikes more! Riding bikes is more fun than sitting in your boring car too. You'll get muscular legs if you ride a bike—another great reason to bike!

Thesis:

Values of author:

Unstated assumptions:

3. People will never make the necessary changes in their habits to really reduce their energy use enough to stabilize global warming. Therefore, the government should encourage energy saving by taxing people heavily for their energy use. They should tax people heavily who drive non-fuel efficient cars. Unnecessary items like plastic water bottles and Styrofoam should also be heavily taxed, as well as using more than your allotted energy. Only when there's an economic cost will people make changes. We need to pull together and do the right thing for our planet.

Thesis:

Values:

Unstated assumptions:

Growing Job Fields

PLAN YOUR CAREER TO MEET JOB DEMANDS

Four Growing Fields

- **Green Careers:** any occupation that is affected by activities such as conserving energy, developing alternative energy, reducing pollution, or recycling
- **Manufacturing:** production of goods for use or sale
- **STEM Careers:** jobs requiring knowledge of science, technology, engineering, and math.
- **Healthcare:** any job in the medical field.

Reasons to Choose Green Careers

- **Fast growing field** Since 2011, clean energy employment has grown by 11.2%, about 10 times faster than the overall job growth rate of 1.2% in Massachusetts (Mass Clean Energy Council).
- **Competitive Pay** Median wages are 13% higher in green energy careers than the economy average (Franklin Hampshire Employment Board).
- **Contribute to helping the world** Green jobs are mainly aimed at increasing energy efficiency, recycling, and renewable energies and decreasing our reliance on fossil fuels, decreasing pollution and harmful emissions. This is becoming increasingly important to help keep our climate in tact.
- **New field with lots of training opportunities** especially in Massachusetts. College degree often not required. Good advancement opportunities.

Types of Green Jobs

- Weatherization technicians, contractors, installers (air sealing, insulation)
- Solar panel installers, solar project managers
- Building inspectors
- Construction workers
- Energy auditors
- Office jobs for green companies
- Sales and marketing for green companies
- HVAC technicians
- Bus drivers (any public transportation job)
- Carpenters
- Wind energy engineers
- Sustainability officers (oversee sustainability at their organizations/companies)
- Renewable energy engineers
- Etc- the list goes on!

Skills In Demand for Green Jobs

- Reading blueprints
- Carpentry skills
- Hand and power tools
- Desire to learn
- Be flexible and open to changes in routine
- Be physically fit and able to work long hours
- Small stature, able to climb into small spaces
- Math and measurements
- Office skills
- Communication skills (be able to communicate your work to clients)
- Like challenges, accept dynamic conditions

Local Training Opportunities

- **STCC:** Weatherization installer course, weatherization crew chief course, starting and running a successful weatherization course.
- **Greenfield Community College:** 28-credit Certificate in Renewable Energy/Energy Efficiency, Associate's Degree with renewable energy focus, non-credit courses in how to save on energy costs for your home, intro to solar technology, residential energy auditing, intro to HVAC, weatherization installer course, and many more.
- **Berkshire Community College:** Solar installation and sales, weatherization.
- **Holyoke Community College:** Solar energy certificate, sustainability studies degree, sustainable agriculture, wind energy certificate.
- **Center for Eco Technology in Northampton,** offer certification testing, weatherization bootcamp, weatherization crew chief training.
- **Online at Solarenergy.org,** free intro to renewable energy course, and solar courses for a fee.

Lesson # 3 - The Carbon Cycle and Climate

Academic Learning Goals –

Students will learn science vocabulary and concepts and practice reading skills related to the GED exam.

Clean Energy Learning Goals –

Students will have a better understanding of how global warming is happening through learning about the carbon cycle and why reducing our usage of fossil fuels is essential to mitigating the effects of global warming.

Materials:

- The Carbon Cycle and Climate – GED-level unit on Climate Change from the Green Jobs Curriculum, Franklin Hampshire County Regional Employment Board
<http://franklinhamshirereb.org/images/pdf/jpclimatechange curriculum.pdf>
The lesson materials include GED level readings on the carbon cycle, reading comprehension questions, and activities to test and reinforce vocabulary.
- Carbon cycle video www.youtube.com/watch?v=0Vwa6qtEih8
- Internet access and projector

Time to teach lesson: 2 hours

Teaching Instructions

Introduction

1. Assess student background knowledge with a number of statements about the carbon cycle taken from the lesson materials.
2. Ask students whether each statement is true or false and have them make note of their answers. These statements will be repeated at the end of the lesson (so don't give the correct answer now).

Activities:

1. Show carbon cycle video <http://www.youtube.com/watch?v=0Vwa6qtEih8>, and discuss some of the vocabulary from the video.
2. Have students read the lesson excerpt on the Carbon Cycle and Climate and answer the associated questions about the reading (included in the lesson materials).
3. Work on the vocabulary exercises included in the lesson materials, which include many that might be found on the GED science exam.
4. Repeat the true/false statements made at the start of class and ask students if they want to revise their original answers. Go over the correct responses.

Demonstration of Learning:

Reading comprehension questions from the Carbon Cycle and Climate materials and participation in discussion. Repeat the statements made at the start of class to gauge whether or not the accuracy of students' response have improved.

Lesson # 4 - Should we be concerned about global warming?

Academic Learning Goals –

Use critical reading and thinking skills needed for the GED test to analyze an opinion/editorial piece and identify bias and perspective, soundness of logic and argument, interpret data from graphic representation and determine its usefulness.

Clean Energy Learning Goals –

Raise awareness about clean energy issues.

Materials:

- Interpreting Graphs handout. The graphs can also be found online at: <http://blogs.discovermagazine.com/badastronomy/?p=55208#.UZY9br9FfVQ>
- Editorial from The Wall Street Journal “No Need to Panic About Global Warming”. <http://online.wsj.com/article/SB10001424052970204301404577171531838421366.html>
- Reading comprehension questions handout
- Values and Assumptions handout

Time to teach lesson: 2-3 hours

Teaching Instructions

Introduction

1. Have students discuss these questions in pairs:
 - What is global warming?
 - How does it happen?
 - Should we be concerned about it? Why or why not?
 - What information would you need to know if global warming was cause for concern or not?
 - In your opinion, does it matter that you learn about global warming and its effects or not? Why or why not?
2. Pass out the Interpreting Graphs handout:
 - Look at the first graph showing the global average temperatures from 1997-2012.
 - Ask students to explain what the graph represents.
 - What implications are there? How could this map be misleading?
 - Then have them look at the 2nd graph, which shows temperature change since 1980.
 - Ask students to explain what the graph represents.
 - What implications are there? How could this map be misleading?
3. Discuss the importance of making sure you are getting the whole picture when assessing information and how people choose numbers and graphs to make a point.
4. Continue with warming up critical thinking skills by introducing the concept of an editorial/opinion piece. Explain the value of being able to analyze an editorial writer’s point of view. Pass out the Values and Assumptions handout and have students work on it pairs or small groups. This will be preparation to reading and evaluating an editorial.

Activities:

1. Now that the students have warmed up their critical thinking minds, read an editorial called “No Need to Panic About Global Warming”.
2. Have students answer the reading comprehension questions.
 - Remind students to keep a careful eye on the validity and evidence of the authors’ arguments and discuss their responses.

Demonstration of Learning:

Revisit the earlier warm-up questions and compare the post-lesson responses to the earlier responses.

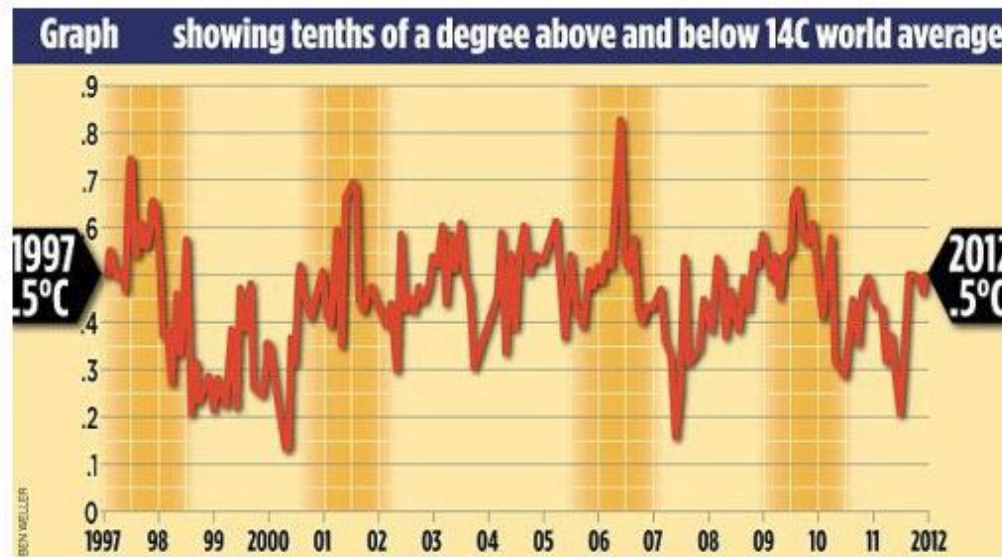
Wrap-up

Wrap up and reflection happen in class discussion. Final thoughts are to be careful about information presented to support an opinion, and in turn, to be careful in our writing.

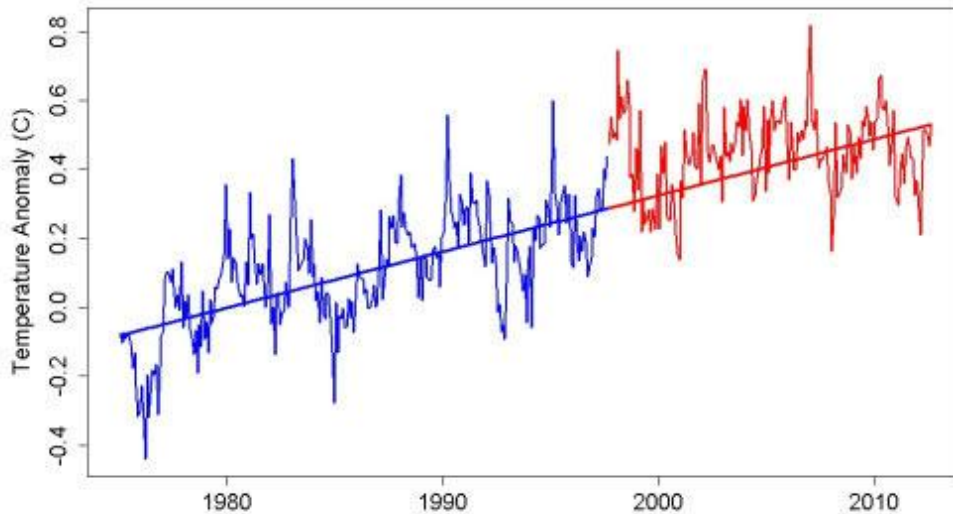
Interpreting Graphs – Changes in Temperature over Time

- If you were just looking at the first graph, what would the implications be about global warming in the last ten years?
- How do those implications change when you see the graph that dates further back?
- What does this tell us about representing information on a graph?

Not this...



This.



Reading Questions Handout for No Need to Panic About Global Warming
Wall Street Journal Article

GED Skills Practiced: Identifying the main idea, restating information, identifying faulty logic, recognizing values, and summarizing ideas.

1. What is the author's thesis?
2. How does the paragraph about carbon dioxide relate to his argument? Do you think this is good point to bring up to support his thesis or not? Why?
3. What reasons does he give for why people are "passionate" about climate change? Do you think his reasons are accurate representations of why people are "passionate" about global warming? Why or why not? [You may also consider why he chooses the word passionate instead of, say, concerned].
4. At one point he compares scientists who deny the importance of global warming to Russian scientists who feared for their lives, and lost them, because they believed in genes. Do you think this is a good comparison? Why or why not?
5. What reasons does he give as to how policy that doesn't interfere with greenhouse gases is good for the economy and the "less-developed" world? Do you think this is a well-supported claim?
6. Judging from this article, what are the author's **values**?
7. Overall, do you find his argument convincing? Why or why not? Has he made a clear and strong case as to why not doing anything about global warming is preferable to doing something about it? Do you have any suggestions as to what would make this a stronger argument?
8. Is there other information you'd need to know to make up your mind whether to agree with him or not? If so, what kind of information?

Class: GED, 7+ Reading level
Program: X-Cel, Inc. Adult Education

We hit a homerun with the lesson on light bulbs and efficiency. Students have seen the value of efficiency in light bulbs and have bought CFLs.

Introductory Summary

This sequence of 3 lessons focuses on increasing GED students' general energy awareness and understanding of climate change through activities, videos, and quizzes. The final lesson then introduces them to clean energy career pathways that may hold promising job prospects and engages them in research about the knowledge, skills, abilities needed, as well as information on the programs and trainings available.

Incorporating writing, discussion, online resources and teacher-created tools, these lessons were developed by X-Cel to support increased student engagement in career and next step counseling accomplished in tandem with academic instruction. Student and teacher response to this approach, and these lessons specifically, was positive.

Lessons:

1. Energy Efficiency and You
2. CO2 and You
3. Is Green In Your Future?

Teacher recommendations:

Teachers advise that subsequent users of these lessons carefully review the math required for these lessons. Students may need extra support, or the math may need to be simplified. The piloting teachers created a simplified version of *The Lighting Solution* problems. It follows Lesson #1.

Lesson # 1 - Energy Efficiency and You

Academic Learning Goals –

- Students will be able to calculate kilowatt usage and cost using division and multiplication.
- Students will be able to create a bar graph using data.

Clean Energy Learning Goals or Counseling Goals –

- Students will be able to describe what energy efficiency means.
- Students will be able to identify some implications of clean energy at home and in their own life.

Materials:

- *A Lighting Solution* and *A Smart Choice* problems from *Math Mania* worksheets from the Mass Save website. <http://www.masssave.com/residential/learning-center/fun-ways-to-learn/~media/Files/Residential/Information%20and%20Edu%20Docs/MathMania.ashx>. This activity will be used to determine how much money can be saved over the course of the year by changing light bulbs or buying different appliances.

- Answer sheet for *Math Mania* problems from the Mass Save website.
<http://www.masssave.com/residential/learning-center/fun-ways-to-learn/~media/Files/Residential/Information%20and%20Edu%20Docs/MathManiaAnswers.aspx> (NOTE: Problem #1 A lighting solution answer #8 "\$14" is incorrect, it should be \$16.42)
- Chart paper and markers for graphing answers to problems.
- *Energetic Experiments Worksheet*, Mass SAVE website.
<http://www.masssave.com/residential/learning-center/fun-ways-to-learn/~media/Files/Residential/Information%20and%20Edu%20Docs/EnergeticExperiments.aspx> used as an extension activity.

Time to teach lesson: 1.5 hours

Teaching Instructions

Introduction

Students need to have the ability to multiply and divide decimals; also exposure to metric system is helpful.

1. Introduce the lesson by saying that there are everyday questions and problems about energy efficiency that require math skills to solve.
2. Conduct full class brainstorm and share out ideas and terms related to energy efficiency.

Activities:

1. Ask students to read through *The Lighting Solution* directions. Answer any questions about how to proceed.
2. Have students work in groups on *The Lighting Solution*.
3. Ask students will graph their answers on chart paper.
4. Then ask students to work on *Smart Choice*.

If time permits, ask students to do *Energetic Experiments* as an extension activity. These experiments require additional materials.

Demonstration of Student Learning:

Exit Slip Activity: Define what the term energy efficiency means. How many incandescent light bulbs do you have in your home or apartment? How many kWh did you use last month? What was your electric bill? What impact would changing all your light bulbs to CFLs have for you?

Wrap-up

Class discussion about what GED skills were used today?

Simplified Worksheet for *The Lighting Solution*

Jane just installed one 25-watt CFL in her kitchen. It gives off as much light as a 100-watt incandescent bulb. She will use this light for five hours every evening.

Jane's friend Sam has one 100-watt incandescent light bulb in her kitchen, too, and she uses it from 5 p.m. until 10 p.m. She hasn't switched over to CFLs yet, though she's planning to.

NOTE: Electric companies measure electricity use in kilowatt hours (kWh).

PART 1: Kilowatt hours

Step 1: Calculate how many kilowatt hours the 25-watt CFL uses in five hours.

First, divide the wattage of the light bulb by 1,000 to find out how many kilowatts the bulb uses.

(Number of watts \div 1,000 = number of kilowatts)

Next, multiply the number of kilowatts by the number of hours the light bulb will be on. (Number of kilowatts \times number of hours used = number of kilowatt hours).

Step 2: Use the same two formulas to calculate how many kilowatt hours the 100-watt incandescent light bulb uses in five hours.

Which bulb uses more energy (Jane's CFL or Sam's incandescent)?

PART 2: Savings

To learn how much it costs to use each bulb, multiply the number of kilowatt hours by the cost of each kilowatt hour (the average cost of a kilowatt hour is 12 cents or \$0.12)

(Number of kilowatt hours \times cost of kilowatt hour = cost of using the bulb)

How much does it cost to use a CFL for five hours?

How much does it cost to use an incandescent bulb for five hours?

Which bulb uses more electricity? How much more? (Hint think back to PART 1)

Which bulb costs more to use? How much more?

If you used a CFL for five hours a day for a whole year (365 days) how much would you save versus an incandescent bulb?

Lesson # 2 - CO2 and You

Academic Learning Goals –

- Students will be able to build their environmental science vocabulary
- Students will be able to convert from metric units to US customary units
- Students will be able to multiply, divide and add decimals

Clean Energy Learning Goals or Counseling Goals –

- Students will be able to explain the impact of humans in CO2 production
- Students will be able to describe the scarcity of non-renewable resources

Materials:

- Internet access, LCD projector
- *Energy Awareness Quiz*, National Energy Foundation, Department of Energy website: http://www1.eere.energy.gov/education/pdfs/environment_energyawarenessquiz.pdf
- How Much CO2 Do You Spew?, National Energy Foundation, Department of Energy website: http://www1.eere.energy.gov/education/pdfs/environment_energyawarenessquiz.pdf (This is in the same packet as the *Energy Awareness Quiz*.)
- YouTube video: *Animation: Climate Change, Energy and Action*: http://www.youtube.com/watch?v=s9dxc_jVIY&feature=related

Time to teach lesson: 1.5 hours

Teaching Instructions

Introduction

1. Lead a reflection on what students have gathered about home energy use based on previous lesson. For example, electric usage could be compared and graphed by each student and a class comparison could be made.
2. Introduce this lesson's focus on clean energy on a bigger, national or global level, allowing students to work on math skills, including converting metric units to standard ones.
3. To prepare students for the *Energy Awareness Quiz*, preview the vocabulary:

| | |
|--------------------|-------------------|
| equivalent | combustion |
| developing country | acid rain |
| abundant | smog |
| nonrenewable | nuclear radiation |
| kerosene | geothermal |
| uranium | hydropower |
| fossil | |

Activities:

1. Have students will take the *Energy Awareness Quiz* individually.
2. After students have completed the quiz, lead a class discussion reflecting on these questions: What surprised you? What did not surprise you? Why?
3. Ask the class to read aloud *How Much CO2 Do You Spew?* Students answer questions from this survey.
4. Lead a class discussion with guiding questions: What does this mean for the world? For us?
5. Show the class the YouTube video: *Animation: Climate Change, Energy and Action* together.

Demonstration of Student Learning:

Exit Slip Activity: Describe one thing you learned from today's lesson.

Homework activity: Write about: What environmental problems are related to the combustion of fossil fuels?

Wrap-up:

Lead a reflection discussion and preview of next lesson: What careers/jobs do you think are related to clean and green energy and environmental issues?

Lesson # 3 - Is Green in Your Future?**Academic Learning Goals –**

- Students will be able to research and gather data about career pathways
- Students will be able to incorporate data and research into an essay

Clean Energy Learning Goals or Counseling Goals –

- Students will be able to identify and research Clean energy career pathways

Materials:

- *Green Careers Presentation* (teacher-created presentation; the last slide's content is specific to Western Massachusetts, but can serve as a guide for a local presentation).
- *ONet Online Green Economy Sector* website: <http://www.onetonline.org/find/green> used by students to explore different green economy sectors and occupations and occupational requirements.
- Computers with Internet access

Time to teach lesson: 1.5 hours

Teaching Instructions**Introduction**

Ask students to share ideas that they came up with from last week's reflection question. What jobs/careers are out there? Define green/clean energy jobs. Are they new? Are they different?

Activities:

1. Show the *Green Careers Presentation*.
2. Show students the *ONet Online Green Economy Sector* website.
3. Using list of jobs class just brainstormed, student's own occupational interests, or instructor direction, ask students to research two green career paths using ONet Online web resources.
4. Ask students to collect the following:
 - Average wage (national and Massachusetts)
 - The top three skills this job requires
 - The top three abilities the job requires
 - The top three knowledge bases the job requires
5. Ask students to write a brief one paragraph description of what a person does in this job, including what the education level of most of the people in this job have.

Demonstration of Student Learning:

Homework assignment: Write a three paragraph essay based on the data gathered while answering the question: Which of the two jobs you researched best fits you and why?

Wrap-up:

Ask students: What GED skills did I use during this lesson? How could I learn more about a particular career path?

Growing Job Fields

PLAN YOUR CAREER TO MEET JOB DEMANDS

Four Growing Fields

- **Green Careers:** any occupation that is affected by activities such as conserving energy, developing alternative energy, reducing pollution, or recycling
- **Manufacturing:** production of goods for use or sale
- **STEM Careers:** jobs requiring knowledge of science, technology, engineering, and math.
- **Healthcare:** any job in the medical field.

Reasons to Choose Green Careers

- **Fast growing field** Since 2011, clean energy employment has grown by 11.2%, about 10 times faster than the overall job growth rate of 1.2% in Massachusetts (Mass Clean Energy Council).
- **Competitive Pay** Median wages are 13% higher in green energy careers than the economy average (Franklin Hampshire Employment Board).
- **Contribute to helping the world** Green jobs are mainly aimed at increasing energy efficiency, recycling, and renewable energies and decreasing our reliance on fossil fuels, decreasing pollution and harmful emissions. This is becoming increasingly important to help keep our climate in tact.
- **New field with lots of training opportunities** especially in Massachusetts. College degree often not required. Good advancement opportunities.

Types of Green Jobs

- Weatherization technicians, contractors, installers (air sealing, insulation)
- Solar panel installers, solar project managers
- Building inspectors
- Construction workers
- Energy auditors
- Office jobs for green companies
- Sales and marketing for green companies
- HVAC technicians
- Bus drivers (any public transportation job)
- Carpenters
- Wind energy engineers
- Sustainability officers (oversee sustainability at their organizations/companies)
- Renewable energy engineers
- Etc- the list goes on!

Skills In Demand for Green Jobs

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- Hand and power tools
- Desire to learn
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Local Training Opportunities

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- **Berkshire Community College:** Solar installation and sales, weatherization.
- **Holyoke Community College:** Solar energy certificate, sustainability studies degree, sustainable agriculture, wind energy certificate.
- **Center for Eco Technology in Northampton,** offer certification testing, weatherization bootcamp, weatherization crew chief training.
- **Online at Solarenergy.org,** free intro to renewable energy course, and solar courses for a fee.

Class: GED Prep, 6.0 – 8.0 GLE
Program: X-Cel, Inc. Adult Education

The clean energy content got students to think beyond the GED and to dream about possible careers and begin to consider what skills they'd need.

Introductory Summary

These three lessons meet GED students where they are at in two ways: tight focus on basic science, math and GED skills essential for passing the test and compelling information about electricity generation, climate change, energy efficiency and clean energy occupations. The lessons have an emphasis on the ways students can help their own personal/family budgets through energy conservation.

Incorporating national data and energy education tools, videos and teacher-created resources, these lessons when piloted spurred keen student interest in clean energy. In addition, the emphasis on group and pair work was a welcomed means to gain GED skills and praised by participating students.

Lessons:

1. Electricity Generating Lesson
2. Global Warming and the Greenhouse Effect
3. Energy Efficiency and Clean Energy Jobs

Teacher recommendations

After piloting these three lessons, the teacher recommends the following changes:

- Shorten Lesson #1
- In Lesson #1, replace oral discussion with written questions that students work on in pairs or small groups.
- Lesson #3 – Further develop this lesson by presenting students with more than one clean energy job profile. With more than one profile, ask students to do a compare and contrast activity, an important skill to develop for the GED. Also, inclusion of more jobs makes the lesson more robust and meaningful for students.

Lesson # 1 - Electricity Generating Lesson

Academic Learning Goals –

- Students will understand
 - the difference between potential & kinetic energy,
 - how electricity is generated,
- Students will be able to determine non-renewable vs. renewable methods of electricity generation.
- Students will practice summarizing and categorizing.
- Students will improve understanding of graphs.

Clean Energy Learning Goals –

- Students will understand the various methods of electricity generation and the advantages & disadvantages of each.

Materials:

- *Electricity*, Intermediate Energy Infobook, NEED (National Energy Education Development Project), page 34. <http://www.need.org/needpdf/Intermediate%20Energy%20Infobook.pdf>. Reading introduces students to how magnets are used to generate electricity.
- *Today's Most Important Energy Resources and Alternative Energy Strategies*, Energy Fact Sheets, Energy Sourcebook, Junior High, p. F12 – F17, http://www.tvakids.com/teachers/pdf/jrhigh_sourcebook.pdf. Fact Sheets introduce students to the range of energy resources, both non-renewable and renewable.
- Thames & Kosmos Alternative Energy and Environmental Science Wind Power Kit, commercial product purchased through Amazon.com used to build a working wind turbine and generate electricity.
- Chart paper and markers

Time to teach lesson: 2 hours

Teaching Instructions

Introduction

As homework from an earlier lesson, students are asked to do research on electricity generation. Students are asked to share what they've learned.

Activities:

1. Instruct the class to read selection about how electricity is generated from the *Electricity* section of the Intermediate Energy Infobook.
2. Lead a class discussion about electricity generation.
3. Present an electricity generator built from a kit and explain how it works. Demonstrate how the electricity is generated.
4. Explain the difference between renewable and non-renewable energy resources as well as the term "fossil fuels."
5. Ask students to share with the class the information they found in their pre-lesson research on different methods of electricity generation.
6. Divide students into groups and hand out Electric Power Production reading from Junior High Energy Sourcebook. Ask each group to create and fill in a chart categorizing the various methods of electricity generation as renewable or non-renewable, and listing the advantages and disadvantages of each.
7. Ask groups to share the information contained in their charts.

Demonstration of Student Learning:

Ask students to respond, as a written homework assignment, to the following questions about electricity generation. This will be reviewed in Lesson #2.

1. Explain how electricity is generated.

2. What is the difference between renewable and non-renewable energy?
3. Name two forms of renewable energy.
4. Name two forms of non-renewable energy.
5. Which method of generating electricity do you think is best for the Boston area and why do you choose that method?

Wrap-up

Homework: *GED Science*, pages 136-138, Steck-Vaughn

Lesson #2 - Global Warming and the Greenhouse Effect

Academic Learning Goals –

- Students will be able to create a graph to visually show data from a chart
- Students will understand the oxygen/carbon dioxide cycle
- Students will be able to find information in a reading passage
- Students will be able to apply information to a new situation

Clean Energy Learning Goals or Counseling Goals –

- Students will gain understanding of global warming, its causes and consequences.
- Students will gain an understanding of the greenhouse effect.
- Students will gain an understanding of how they can lessen the speed of global warming.

Materials:

- *What is U.S. electricity generation by energy source?* Data from US Energy Information Administration <http://www.eia.gov/tools/faqs/faq.cfm?id=427&t=3>. Data is used by students to develop their graphing skills and increase their understanding of US electricity generation.
- *The Greenhouse Effect*, Exploring Energy, NEED (National Energy Education Development Project), grade level: Elementary/Intermediate, page 9. <http://www.need.org/needpdf/Exploring%20Energy.pdf> Reading is used to introduce students to the greenhouse effect.
- *Greenhouse Effect Question/Answer Worksheet* (teacher-created)
- Simple Illustration of the carbon cycle from *Oxygen and Carbon Cycles* online resource at http://www.tnmanning.com/Test/Tests/oxygen_and_carbon_cycle.htm. Piloting teacher used the illustration with the elephant to open discussion about the carbon cycle.
- Newsprint, markers, yardsticks (enough for each group of three to have).

Time to teach lesson: 2 hours

Teaching Instructions

Introduction

Instruct students to complete the Lesson #1 Assessment and go over answers to Lesson 1 Assessment. Make sure that discussion includes the different levels of carbon dioxide emissions generated by different kinds of electricity generation.

Activities:

1. As students arrive, have students who were present for Lesson #1 (Electricity Generation) complete the Lesson #1 Assessment. Give students who were not present for Lesson #1 the Lesson #1 homework to complete.
2. When everyone has arrived, go over the Lesson #1 homework with the class.
3. Break students into groups of three. Give them newsprint, markers and yardsticks. Ask each group to create a graph showing the % of different types of U.S. electricity generation from the US Energy Information Administration electricity generation data.
4. Ask groups to post their graphs on the wall and explain them to the class.
5. Instruct all students to write answers to the following questions as a pre-lesson assessment. Collect pre-tests but do not go over answers at this time.
 - a. What does greenhouse gas mean? Give an example of a greenhouse gas.
 - b. What does the earth's atmosphere do to the temperature of the earth and why does that happen?
6. Give a brief explanation of the oxygen/carbon dioxide cycle using illustration from *Oxygen and Carbon Cycles* online resource. Hold a discussion focused on how plants and animals support each other in the oxygen/carbon dioxide cycle.
7. Group students into pairs. Have students read the *Greenhouse Effect* and answer questions on *Greenhouse Effect Question/Answer Worksheet*.
8. When students have finished answering the questions, ask them to trade their *Greenhouse Effect Question/Answer Worksheet* with a partner. Then ask them to read their partner's answers and write on their partner's worksheet, indicating if they agree or disagree with their partner's answers and giving their reasons why.
9. Go over answers to the *Greenhouse Effect Question/Answer Worksheet* with the whole class and make sure everyone understands the concepts of the greenhouse effect and global warming.

Name _____

Partner's Name _____

What are some greenhouse gases?

Partner: Do you agree with the answer? YES NO

Why? _____

Explain how the atmosphere keeps the earth warm.

Partner: Do you agree with the answer? YES NO

Why? _____

What has caused the amount of greenhouse gases to increase over the last fifty years?

Partner: Do you agree with the answer? YES NO

Why? _____

If the amount of greenhouse gases in the atmosphere increases a lot, what will probably happen to the temperature on the earth? Why?

Partner: Do you agree with the answer? YES NO

Why? _____

The moon does not have any atmosphere. Based on what you read, do you think the temperature on the moon is warm or cold? Why?

Partner: Do you agree with the answer? YES NO

Why? _____

Demonstration of Student Learning:

Asks students to respond in writing to the following questions about global warming:

- Give an example of a greenhouse gas.
- How does the atmosphere keep the earth warm?
- What has caused the amount of greenhouse gases to increase over the past 50 years?
- What is the biggest source of electricity generation in the United States?

Wrap-up

Review the lesson and make sure everyone understands the concepts of the greenhouse effect and global warming.

Homework:

- *GED Science*, pages 44-45, 91, Steck-Vaughn
- Students will be asked to brainstorm possible actions to slow global warming

Lesson # 3 - Energy Efficiency and Clean Energy Jobs

Academic Learning Goals –

- Students will be able to find specific information in a document
- Students will be able to summarize material from a document

Clean Energy Learning Goals or Counseling Goals –

- Students will know several ways they can reduce energy consumption in their household.
- Students will have a basic knowledge of some clean energy jobs available in Massachusetts and the education/training needed to enter those jobs.

Materials:

- *Renewable Energy* YouTube video: <http://www.youtube.com/watch?v=p5CJpxHQwHw> used to introduce clean energy occupations.
- *What You Can Do At Home*, US EPA website: <http://www.epa.gov/climatechange/wycd/home.html> used to introduce actions students can take to increase energy efficiency in their homes.
- *Green Jobs Fact Sheets*, Energy Education and Workforce Development, Energy Efficiency and Renewable Energy website: http://www1.eere.energy.gov/education/clean_energy_jobs.html used to introduce specific clean energy occupations.

Time to teach lesson: 2 hours

Teaching Instructions

Introduction

Ask students to share out their ideas on how to lessen global warming (homework from Lesson #2).

Activities:

1. As students arrive, ask students who were present for Lesson #2 to complete the Lesson #2 Assessment. Give Students who were not present for Lesson 1 the Lesson #2 homework to complete.
2. When everyone has arrived, go over the Lesson #2 homework with class.

3. Ask students to share their ideas on how to lessen global warming (given as homework from Lesson #2).
4. Ask students if they can name any ways to save energy at home and if they know of any clean energy jobs (this will serve as pre-assessment).
5. Divide the class into groups and have the groups work together to read *What You Can Do at Home* on how to save energy at home.
6. Ask each group to come up with a list of things that can be done at home to save energy. Then ask each group to share their lists with the class.
7. Show the *Renewable Energy* YouTube video to the class.
8. Distribute *Green Jobs Fact Sheets*, divide the class into pairs, and ask each pair to summarize one clean energy job and the training needed to enter that job.

Demonstration of Student Learning:

Teacher asks students to respond in writing to the following questions about saving energy and clean energy jobs:

- List two ways you can save energy in your home.
- List one clean energy job and describe the training/education required to prepare for that job.
- Would you be interested in doing that clean energy job? Why or why not?
- What is the biggest source of electricity generation in the United States?

Wrap-up

Facilitate a class discussion on steps students can take to save energy at home and steps students can take to find out more information about clean energy jobs in the area.

Class: GED, Beginning
Program: Clinton Adult Education

Teaching about clean energy was our growing edge. We will keep building curriculum around it.

Introductory Summary

The essential question of this four lesson unit is: What can individuals do to prevent continued global warming? Developed for and piloted with beginning GED learners, the lessons are designed to meet multiple standards for Mathematics and English Language Arts in the Massachusetts Adult Basic Education Standards. The unit culminates with an opportunity for students to identify an action they can take in their lives to reduce their personal energy use.

Incorporating online videos, readings, math activities and simple science experiments, these lessons were seen as engaging and fun by students and were taught in a math class. Students were also excited to discover how much money they could save by taking simple measures to increase energy efficiency in their homes.

Lessons:

1. What is Global Warming and How is it Affecting the Environment?
2. Understanding Your Electric Bill and Energy Experiments
3. Problem Solving – Math Mania
4. Energy Efficiency Decision Making

Teacher recommendations

After piloting these lessons, the teacher made the recommendation that Lesson One and Lesson Two be modified to include student research on the effects of global warming on their home country, and reporting out on those effects to their peers.

Lesson # 1 - What is Global Warming and How is it Affecting the Environment?

Academic Learning Goals –

- Learners will solve problems by comprehending, comparing, applying, analyzing, evaluating, and synthesizing information. (Massachusetts Adult Basic Education Standards [MABES], English Language Arts, Critical Thinking Standard 1)
- Make inferences, form hypotheses, extrapolate information, and draw conclusions from a speech, text, illustration, chart or graph (MABES, English Language Arts, Critical Thinking Standard 1.3b)

Clean Energy Learning Goals or Counseling Goals –

- Students will understand the carbon cycle and how energy use is changing the cycle/system.
- Students will understand how the changing system/cycle increases global warming and how this is affecting their home land directly, as well as the entire planet.

Materials:

- *Clean Energy Vocabulary Pre-Test* (teacher-created) used as introduction and measure of student prior knowledge.
- YouTube video *What's the Deal with Carbon* used to introduce the concept of the carbon cycle. <http://www.youtube.com/watch?v=2Jp1D1dzxj8&feature=related>
- YouTube video *Carbon Footprint Animation* used to explain the carbon cycle. <http://www.youtube.com/watch?v=AGRlo87oAUg&feature=related>
- Reading: *Gore Pitches 10 Year Shift to Clean Energy*, non-fiction reading used to present carbon cycle and global warming. http://www.nbcnews.com/id/25718230/ns/us_news-environment/t/gore-pitches--year-shift-clean-energy/#.UXcLASHgnS

Time to teach lesson: 1 hour, 10 minutes

Teaching Instructions

Introduction

1. Begin the class by asking students to do the *Clean Energy Vocabulary Pre-Test* to gain understanding of prior knowledge.
2. Give the Clean Energy Vocabulary Pretest: Place the number of the correct vocabulary word next to the matching definition.

| | |
|-----------------------|--|
| 1. Global Warming | _____ A process that makes the earth gradually warmer due to the release of gases such as carbon dioxide. |
| 2. Carbon Cycle | _____ A thin piece of protective material fastened around a door or window to stop rain, wind, or cold from coming in. |
| 3. Energy Star | _____ A protective material used to reduce the loss of heat, electricity, or sound. |
| 4. CO2 | _____ A government-backed program helping businesses and individuals protect the environment through superior energy efficiency. |
| 5. Green House Effect | _____ A naturally occurring chemical compound. |
| 6. Thomas Edison | _____ Invented incandescent light bulbs. |
| 7. Insulation | _____ Light bulbs where the energy is used for light rather than heat and light. |
| 8. CFL light bulbs | _____ Increase in the world's temperatures. |
| 9. Weather stripping | _____ The organic recycling of carbon from the atmosphere into organisms and back again. |

3. Next, ask the class to consider the following questions:
 - a. What is the carbon cycle?
 - b. What is global warming?
4. Show YouTube videos: *What's the Deal with Carbon?* and *Carbon Footprint Animation*.
5. Discusses main ideas of each video and work with students to identify the details that support the main ideas.
6. Follow videos and discussion with a class brainstorm activity about what could be done to slow down global warming.

Activities:

1. Ask the class to consider how climate change affects them and read together *Gore Pitches 10 Year Shift to Clean Energy*.
2. As the class reads article together, ask students to write down any questions that they have.
3. Once discussion begins, address the student questions first.
4. Facilitate further class discussion using the following guiding questions:
 - What is Mr. Gore's message?
 - Why do we need to pay attention to global warming?
 - What needs to be done to protect our environment?

Demonstration of Student Learning:

Homework assignment: How has global warming affected your home country? Research and be prepared to share what you have found with the class.

Wrap-up:**Words Activity:**

1. Give each student an index card and have them write down 5 words that come to mind when they think about Global Warming.
2. Instruct students to find a partner and share words.
3. Ask partners to agree on 3 words to be shared whole class.

Lesson # 2 - Understanding Your Electric Bill & Energy Experiments**Academic Learning Goals –**

- Students will be able to successfully communicate their findings about the affect of global warming on their home country.
 - Learners will speak with ease and confidence for a variety of purposes. (MABES, English Language Arts, Oral Communication Standard)
 - Summarize orally events from a story, article, or experience (MABES, English Language Arts, Oral Communication Standard 1: OC1.2d)
- Students will understand how electricity usage is calculated.
 - Compute fluently and make reasonable estimates. (MABES, Math and Numeracy, Number Sense Standard 3N-3)
 - Use a calculator to calculate whole numbers and decimals to two places to solve problems. (MABES, Math and Numeracy, Number Sense Standard 3N-3.9)
 - Carry out calculations using multiplication and division with two and three digit numbers using efficient written methods, including ways to check answers and interpret remainders. (MABES, Math and Numeracy, Number Sense Standard 3N-3.11)
- Students will be able to write a clear paragraph with a topic sentence, supporting detail, and a closing.
 - Learners will express themselves through writing for a variety of purposes. (MABES, English Language Arts, Writing Standard 1)
 - With assistance, write a paragraph on an assigned topic, including a topic sentence

followed by details to support the main idea. (MABES, English Language Arts, Writing Standard, 1.3b)

Clean Energy Learning Objectives –

- Students will be able to understand how their electric bill is calculated, leading to an awareness of their electricity usage.
- Students will understand energy loss caused by lack of insulation, dripping faucets, and light bulb choice.

Materials:

- *Meter Reading Worksheet* from the Mass Save website used to teach meter reading.
<http://www.masssave.com/residential/learning-center/funways-to-learn/~media/Files/Residential/Information%20and%20Edu%20Docs/MeterReader.ashx>
- Calculator – one per person used for both Meter Reading and Energetic Experiments.
- *Energetic Experiments Worksheet* from the Mass Save website. Three experiments to demonstrate the importance of energy efficiency.
<http://www.masssave.com/residential/learning-center/fun-ways-to-learn/~media/Files/Residential/Information%20and%20Edu%20Docs/EnergeticExperiments.ashx>

These experiments require the following materials:

- *Experiment One: A Drop of Savings*
 - Measuring cup
 - Sink with hot tap water
 - Clock or watch
- *Experiment Two: The Power of Insulation*
 - Two paper cups
 - Measuring cup
 - Crushed ice or snow from outside
 - Newspaper
 - Rubber band
 - Warm sun or lamp
 - Magic marker
 - Ruler
 - Clock or watch
- *Experiment Three: Change a Light, Change the World*
 - Desk lamp plugged into a power outlet
 - Several clear incandescent light bulbs, some burned out and some still usable
 - A 23-26 watt CFL
 - Sealable plastic bag
 - Five ice cubes
 - Clock or watch
 - Measuring cup

Time to teach lesson: 1 hour 10 minutes

Teaching Instructions

Introduction

1. When students arrive have the following questions on the board for a Journal entry:
 - What is the carbon cycle?
 - What is causing the carbon cycle to change?
2. Students share responses to these questions.
3. Each student will also share what they discovered about the effect of global warming on their home country.

Activities:

1. Introduce the meter reading activity, presents the steps and the calculation involved in doing *Meter Reading Worksheet* to the whole class.
2. While the students work on the calculations in the activity independently, set up the *Energetic Experiments*.
3. In pairs, students share their meter calculation results. If there is a discrepancy in answers, students try to determine which answers are correct. If students are not able to resolve, have the partners raise their hands for help.
4. Energetic Experiments:
Students conduct all three experiments as a whole class and determine the cause of the results for each experiment, followed by direct instruction with regard to those they couldn't. For example: the structure of the incandescent bulbs causes heat and light, whereas the CFL bulbs cause only light.

Demonstration of Student Learning:

Have students write a paragraph about how to use findings to be more energy efficient at home.

Wrap-up

Think-Pair-Share Activity:

1. Give the class one minute to think of one important idea they learned during this class.
2. Ask students to turn to a partner and share their ideas (2-3 Minutes)
3. Ask partners to choose 1 idea to share with the rest of the class.

Lesson #3 - Problem Solving – Math Mania

Academic Learning Goals –

- Students will be able to solve challenging math problems based on real-life situations.
 - Compute fluently and make reasonable estimates. (MABES, Math and Numeracy, Number Sense Standard 3N-3.)
 - Use a calculator to calculate whole numbers and decimals to two places to solve problems. (MABES, Math and Numeracy, Number Sense Standard 3N-3.9)

- Students will be able to compute fluently and make reasonable estimates. (MABES, Math and Numeracy, Number Sense Standard 5N-3)
- Students will be able to add, subtract, multiply, and divide decimals of any size. (MABES, Math and Numeracy, Number Sense Standard 5N-3.1)
- Students will be able to represent data in graphical form, specifically a bar graph.
 - Collect, organize, and represent data. (MABES, Math and Numeracy, Statistics and Probability Standard 4S-1)
 - Represent information so that it makes sense to others in graphical form. (MABES, Math and Numeracy, Statistics and Probability 4S-1.3)
 - Make and evaluate arguments or statements by applying knowledge of data analysis. (MABES, Math and Numeracy, Statistics and Probability 4S-4)

Clean Energy Learning Goals –

- Students will understand the monetary value of energy efficiency.

Materials:

- *Math Mania Worksheet* from the Mass Save website.
- <http://www.masssave.com/residential/learning-center/fun-ways-to-learn/~media/Files/Residential/Information%20and%20Edu%20Docs/MathMania.ashx>. This activity will be used to determine how much money can be saved over the course of the year by changing light bulbs (A Lighting Solution activity) or buying different appliances (Smart Choice activity).
- Chart paper –used to record ideas about the changes people could make to reduce global warming.
- Calculators – used for the *Math Mania* calculations
- Grid paper –used for the graphing activity
- Index cards – used in the wrap-up activity: Ticket to Leave

Time to teach lesson: 1 hour 10 minutes

Teaching Instructions

Introduction

1. Conduct a whole class brainstorm on the changes people could make to reduce global warming.
2. Records ideas on chart paper.

Activities:

1. Present *Math Mania* Problem #1: A Lighting Solution (if necessary, allow students to work in pairs).
2. Discussion: Ask questions 4-8.
3. Ask students to create a bar graph to represent their findings.
4. Have students present their graphs to the class.
5. Present Problem #2: Smart Choices (again, if necessary, allow students to work in pairs).
6. Ask students to compare answers in pairs.

7. To end the activity, ask each student to write 2 evaluative statements based on the data collected and share one of these out loud with the class.

Demonstration of Learning:

Instruct students to write two evaluative statements based on the data collected.

Wrap-up

Ticket to Leave Activity:

Ask students to write down one important thing they learned in class on an index card and turn in the index card on their way out.

Lesson #4 – Energy Efficiency Decision Making**Academic Learning Goals –**

- Students will be able to read a short informational text and determine the main idea of each section.
 - English language learners will read and comprehend a variety of English texts for various purposes. (MABES, ESOL Reading Standard)
 - Identify main idea, supporting details, sequence, and common transitions in simplified or adapted short texts on a familiar topic. (MABES, ESOL Reading Standard: R1.3b)

Clean Energy Learning Goals –

- Students will understand what they can do personally to save the planet and save money.

Materials:

- Virtual Home Tour, Mass Save website: <http://www.masssave.com/virtualhome/index.html>
Used to take the students on a virtual tour of a house to examine where energy can be saved at home.
- *Change the World, Start with Energy Star*: <http://www.masssave.com/residential/learning-center/fun-ways-tolearn/~media/Files/Residential/Information%20and%20Edu%20Docs/CheckUpGuide.ashx>
This will be used as a means for students to examine ways to save energy personally and to inform future decision making.
- One postcard for per student used to remind the students of their promise to make at least one change and make a difference.
- Means to project website.

Time to teach lesson: 1 Hour 10 minutes

Teaching Instructions**Introduction**

Write this question on the board for a journal entry: What can you personally do to save energy? This will be done by the students upon arrival.

Activities:

1. Using the Mass Save Virtual Home Tour, have students take a virtual tour of a home of their type. In the tour they will go room to room to find out where energy could possibly be wasted.
2. Using an overhead or projection system, project and read together: *Change the World Start with Energy Star*.
3. Use this guide so students can determine how energy efficient their home is.
4. After each section, ask the students what the main idea was and have them support their responses with supporting details.

Demonstration of Student Learning:

Ask students to address a postcard with their home address and on the flip side write down one thing they will do to either save energy, explore a clean energy career, or get involved as an activist. Mail the postcards to students in 3-4 months.

Wrap-up

Chalk Talk Activity:

On a whiteboard write in large letters: What are Your Thoughts? As the students leave have them write whatever thought comes to mind. This is done in silence!

ABE/ESOL Lesson Sequence Examples

Class: GED, Level II

Program: ACCESS

Designed by a teacher using the Student Achievement in Reading (STAR) method, these seven lessons expose students to basic concepts of climate change, energy conservation and clean energy. The aim of this lesson sequence is to provide students with background concepts and facts so that students can comprehend the current media and public emphasis on the sources and uses of energy. Lesson Six makes a link between climate change, energy sources and uses and occupations and training.

As students learned more about clean energy and climate change, they were able to link their new knowledge to current events. This was a significant contribution to class discussion and continued learning. You can find clean energy information everywhere, even cereal boxes!

Designed to meet STAR Reading lesson criteria (www.startoolkit.org), these lessons provide opportunities for vocabulary development, reading fluency, and reading comprehension, all of which are components of the STAR reading strategies. Class activities include crossword puzzles, cloze activities, writing and an online scavenger hunt. Lessons 5 and 6 are designed with Massachusetts information and resources. Lesson 5 would be applicable as designed in other states; Lesson 6 can serve as a model that teachers from other states could adapt with training and credential information relevant to their location.

Lessons:

1. How Global Warming Works / Global Warming
2. The Greenhouse Effect
3. Global Warming: What's Happening / More About the Greenhouse Effect
4. Is Global Warming a Real Problem? / What Might Happen if the Earth Heats Up?
5. Mass SAVE Scavenger Hunt
6. Exploring Environmental Technology Opportunities at Cape Cod Community College
7. Types of Renewable Energy / What is Renewable Energy?

Teacher recommendations:

The information in Lesson 6 can be presented by the teacher (as the lesson is designed) or staff from a local clean energy skill training program can visit the class and provide the information.

Lesson # 1 - How Global Warming Works / Global Warming

This lesson was developed to meet guidelines for the STAR Reading program, an evidence-based reading system developed for adult learners at the pre-GED level.

Academic Learning Goals –

- Students will be able to use five vocabulary words (consensus, global warming, weather, climate, anomaly) that were taken from the reading selection for this lesson.
- Students will practice reading fluently using reading material appropriate to their fluency level. Higher level fluency students use collaborative oral reading, while the lower level uses echo reading, in which the instructor reads a paragraph aloud, then the student reads the same paragraph trying to read as fluently as the instructor.

Clean Energy Learning Goals –

- Students will begin to learn about global warming; the differences between climate and weather, evidence for global warming, and natural changes in climate

Materials:

- Reading material for 6-8 GLE, *How Global Warming Works*, Jonathan Strickland and Ed Grabianowski, pages 1 – 2 <http://www.howstuffworks.com/environmental/green-science/global-warming.htm>
- Reading material for 5 GLE, *Understanding Global Warming* http://education.nationalgeographic.com/education/encyclopedia/global-warming/?ar_a=1
- Cloze Crossword Puzzle (teacher-created)

Time to teach lesson: 1.5 hours

Teaching Instructions**Introduction**

1. Tell students that the reading lessons for this and the next five classes will be about global warming and climate change.
2. Conduct a brief brainstorming activity to see what students already know about global warming by using a mind map with “Global Warming” as the prompt.
3. Tell students that the word parts being learned are ones that will be used as they improve reading using STAR. Learning these words will help students understand the global warming information and why the class is learning it.
4. Tell students that it is okay to use other forms of the words, e.g. past tense, plural.

Activities:

1. Write down each word and read them to the class.
2. Write each word’s part of speech and definition on the board and instruct students to copy them into their notebooks.
 - consensus - n. – agreement
 - weather - n. - local and short-term changes in temperature, humidity, precipitation, etc.
 - climate - n. - the average weather conditions in a region over a long period of time
 - anomaly - n. - a deviation or departure from what is normal
 - convene – v. – to come together in a group for a meeting
3. Using the chart below, demonstrate the use of each word in a sentence.

4. Using the chart below, asks individual students questions that require them to respond orally, in complete sentences, using the vocabulary word correctly.

| Word | Teacher sentence | Prompt |
|-----------|--|---|
| consensus | At our meeting we reached consensus about when we will do the GED Practice Tests this spring. | Do you think that there is consensus among the class about the value of a GED? The importance of arriving at class on time? The necessity of having a good paying job? |
| weather | I listen to the weather report each day so that I know what to wear when I go outside. | What is your favorite type of weather? Would you want to live where the weather is constant all the time or where there is variation? |
| climate | The climate of Cape Cod is somewhat different from that of Boston – cooler summers, warmer winters, less snow. | What was the climate like where you grew up? What would be the ideal climate in your opinion? |
| anomaly | I consider it a real anomaly if I sleep through the entire night. | Would you consider it an anomaly if you arrived at class early? Late? Woke up before your alarm went off? Skipped a meal? |
| convene | Our class convenes at 9:30am on Tuesdays, Thursdays, and Fridays. | Do you belong to any sort of group (church, club, friends) that convenes on a regular basis? Do you enjoy convening with a group that has similar interests as you, e.g. book club, garden club, car club, sports club? |

5. Have students complete a cloze/crossword puzzle worksheet.
6. Ask students to read the reading selection for this lesson at the appropriate level to improve their fluency.

Demonstration of Student Learning:

Have student complete a crossword puzzle using the new words as well as some from previous lessons. The crossword clues are written in the form of a cloze exercise.

Wrap-up/Reflection:

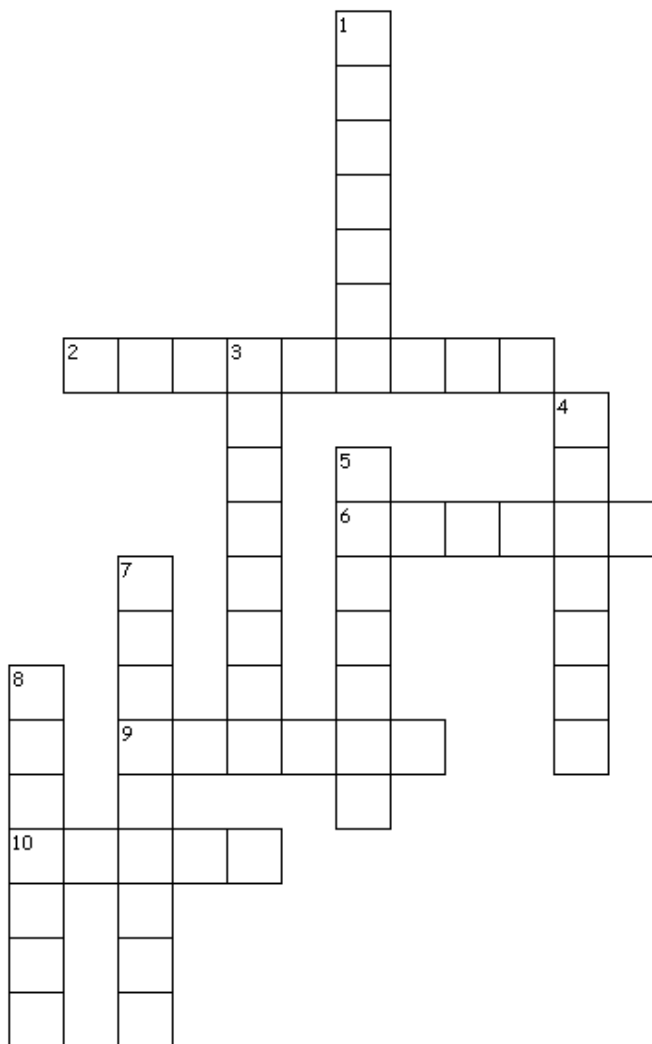
Ask students to be on the lookout for the words in print or on TV.

Cloze Crossword Puzzle

anomaly
climate
consensus
convene
dispersed
lament
mania
profound
sedate
weather

Across

2. We _____ the information about the flu to as many people as possible.
6. Will you _____ the change of seasons from winter to spring?
9. After our St. Patrick's Day dinner of corned beef and cabbage, I felt too _____ to wash the dishes.
10. Jane loves to travel to new, interesting places every chance she gets; it is a _____ for her.



Down

1. If the _____ is rainy, the anniversary celebration will be moved indoors.
3. Hank felt a _____ sense of relief when his laboratory test for cancer came back negative!
4. The committee that is planning the retirement party for the boss will _____ at 7pm next Thursday.
5. Many people would like to live where the _____ is warm all year long.
7. The company and the union that represents its workers debated for a long time before they reached _____ about wages and benefits.
8. It must be a(n) _____ for everyone to be in such a good mood this morning!

Lesson # 2 - The Greenhouse Effect

This lesson was developed to meet guidelines for the STAR Reading program.

Academic Learning Goals –

- Students will be able to complete a cloze exercise that includes the five vocabulary words that were taken from the previous reading selection for this lesson.
- Students will have a better understanding of the effects of global warming as a natural process after watching a video.
- In addition, they will practice reading fluently using reading material appropriate to their fluency level. Higher level fluency students use collaborative oral reading, while the lower level uses echo reading.

Clean Energy Learning Goals –

- Students will begin to learn about the greenhouse effect
- Students will learn about the influence the greenhouse effect has on the earth's temperature and weather, as well as the fact that life on earth is dependent upon this warming phenomenon.
- Students will understand how the greenhouse effect has intensified as human activities have increased the amount of greenhouse gases in the atmosphere.

Materials:

- Reading material for 6-8 GLE, *How Global Warming Works*, Jonathan Strickland and Ed Grabianowski, page 3 <http://www.howstuffworks.com/environmental/green-science/global-warming.htm>
- Reading material for 5 GLE, *The Greenhouse Effect* and *What's So Bad About Global Warming?* <http://www.kidzworld.com/article/4858-understanding-global-warming>
- *Cape Cod: The Sands of Time*, video published by the National Park Service. http://www.nationalparktravel.com/cape_cod_dvd.htm. This video shows how Cape Cod was formed during naturally occurring periods of glaciations followed by global warming. It also shows daily changes that occur on the Cape, illustrating to some extent, the difference between long term and short term fluctuations.
- Cloze Activity (teacher-created)

Time to teach lesson: 1. 5 hours

Teaching Instructions

Introduction

Remind students that the reading lessons for this and the next four classes will be about global warming and climate change. Briefly review previous class about global warming and brainstorm the term “greenhouse” effect using mind mapping.

Activities:

1. Show the class the video, *Cape Cod: the Sands of Time*.
2. Ask students to read the reading selection for this lesson at the appropriate level to improve their fluency.

Demonstration of Student Learning:

Instruct students complete the cloze activity using the vocabulary words from the previous, as well as older, lessons. Have students read the readings for this lesson aloud to practice their fluency.

Wrap-up

Ask students to be aware of stories in print or on TV about global warming or glaciers.

Cloze Activity

anomaly
climate
consensus
convened

morbid
subside
vocation
weather

1. People with allergies often feel much better once they move to a location with a warm, dry _____.
2. Last year on St. Patrick's Day it was so warm that my friend actually got a sunburn. What a(n) _____ !
3. Anyone who is able to turn their passion into a _____ is lucky indeed.
4. As soon as the cold and windy weather _____, I am going to clean up my yard.
5. Do you think that it is a good idea for video games to be rated so that parents will know if they are terribly _____ ?
6. My family cannot seem to reach a _____ about what we should eat for our Easter dinner.
7. When the GED teachers _____, they decided that the GED Practice Tests will be on May 14, 16, and 17.
8. The _____ was so miserable that I stayed inside all day and read a book.

Lesson #3 - Global Warming: What's Happening / More about the Greenhouse Effect

Academic Learning Goals –

- Students will know the meanings of and be able to use five words: combustion, emissions, infrared radiation, organic, primary.
- Students will be able to complete a cloze exercise that includes the five vocabulary words that were taken from the previous class reading selection.
- In addition, they will practice reading fluently using reading material appropriate to their fluency level. Higher level fluency students use collaborative oral reading, while the lower level uses echo reading.

Clean Energy Learning Goals –

- Students will learn that there are several atmospheric gases that facilitate the greenhouse effect and that the contribution of human activities to the quantity of these gases has most likely been instrumental in the speed at which climate change is occurring.

Materials:

- Reading material for 6-8 GLE, *How Global Warming Works*, Jonathan Strickland and Ed Grabianowski, page 4 <http://www.howstuffworks.com/environmental/green-science/global-warming.htm>
- Reading material for 5 GLE, *More About the Greenhouse Effect* and *Greenhouse Gasses* (but not including the small experiment) <http://dnr.wi.gov/org/caer/ce/eeek/earth/air/global.htm>
- Cloze Activity for Global Warming: What's Happening / More About the Greenhouse Effect (teacher-created)

Time to teach lesson: 1.5 hours

Teaching Instructions

Introduction

1. Tell students that the new vocabulary words appear in the next reading about global warming.
2. Tell students that the word parts being learned are ones that will be used as they improve reading using STAR. Learning these words will help students understand the global warming information and why the class is learning it.
3. Learning these words will help students understand the global warming information and why the class is learning it.
4. Tell students that it is okay to use other forms of the words, e.g. past tense, plural.

Activities:

1. Write each word down and read them to the class.
2. Write each word's part of speech and definition on the board.
3. Ask students to copy the words into their notebooks.
 - combustion - v. - burning
 - emissions - n. – something that is discharged or given off

- infrared radiation - n. – light waves that produce heat
 - organic - adj. – chemical compounds composed of carbon, mostly from plants and animals
 - primary – adj. – main or most important
4. Using the chart below, demonstrate the use of each word in a sentence.
 5. Using the chart below, ask individual students questions that require them to respond orally, in complete sentences, using the vocabulary word correctly.

| Word | Teacher sentence | Prompt |
|--------------------|---|---|
| combustion | The mulch at Cumby's underwent spontaneous combustion one summer. | What is a time when you use combustion in your life? What is an example of combustion as a good thing? A bad thing? |
| emissions | When the weather conditions are a certain way, the emissions from the power plant in Sandwich are visible from Route 6. | What is something with bad smelling emissions? Harmful emissions? Good smelling emissions? |
| infrared radiation | Incandescent light bulbs give off a lot of infrared radiation, while CFLs and LEDs do not. | What is something in your home that gives off infrared radiation? Have you ever burned yourself on something that gives off infrared radiation? |
| organic | I try to buy organic foods – things that have not been treated with chemical fertilizers, pesticides, etc. | What is a good thing about buying organic products? What is a bad thing? |
| primary | Teaching is my primary job, while working for my husband in his web business is my secondary job. | What is your primary goal in life? What is your primary reason for getting your GED? |

Demonstration of Student Learning:

Students complete the cloze activity using the vocabulary words from this lesson.
Students read the readings for this lesson aloud to practice their fluency.

Wrap-up

Students will be on the lookout for the words in print or on TV.

Cloze Activity

combustion
organic

emissions
primary

infrared radiation

What do you think is the _____ reason that people choose to watch TV instead of exercise?

When the weather has been very dry during the summer months, there is an increased danger that _____ of a forest will occur where people have built campfires and not put them out properly.

When your car has been parked in the sun, the greenhouse effect keeps the _____ inside the car.

I love to smell the _____ coming from a bakery!

It is a good idea to use _____ fertilizer because it is not as likely to cause pollution.

Lesson # 4 - Is Global Warming a Real Problem? / What Might Happen If Earth Heats Up?

Academic Learning Goals –

- Students will be able to complete a cloze/crossword puzzle exercise that includes the vocabulary words that were taken from the previous lessons' reading selections.
- Students will engage in a group discussion about the articles topics in order to demonstrate their understanding about global warming.

Clean Energy Learning Goals or Counseling Goals –

- Students will learn some of the reasons why some people don't believe that global warming is happening or that humans have influenced the pace of global warming.
- Students will learn why most scientists think that global warming is in fact proceeding at a rapid pace due to human impact.
- Students will learn some things that individuals can do to reduce greenhouse gas emissions.
- Students will understand that there are national policies that could be enacted that would lessen the amount of greenhouse gases released into the atmosphere.

Materials:

- Reading material for 6-8 GLE, *Is Global Warming a Real Problem? And Can We Stop Global Warming?* from *How Global Warming Works*, Jonathan Strickland and Ed Grabianowski page 8 – 9 <http://www.howstuffworks.com/environmental/green-science/global-warming.htm>
- Reading material for 5 GLE, *What Might Happen if Earth Heats Up?* <http://dnr.wi.gov/org/caer/ce/eeek/earth/air/global.htm>
- Vocabulary Crossword (teacher-created)
- YouTube video, *Amazing video of exploding under-ice methane gas in Siberia* <http://www.youtube.com/watch?v=FM0hczFNDZI> The purpose of the showing this video of exploding methane gas was to show how climate change has caused melting of permafrost in Arctic areas and, as a result, the release of methane gas.
- YouTube video, *Chasing Ice: Time-Lapse Cameras Capture Rapidly Melting Glaciers* https://www.youtube.com/watch?v=76liY_NbSO This video shows dramatic changes in glaciers over a relatively short period of time, while the photos of the Polar Regions show a reduction in the amount of ice, particularly at the North Pole.
- Pictures from the following websites:
 - The Antarctic Region http://www.windows2universe.org/earth/polar/polar_south.html
 - Warming of the Polar Regions http://www.windows2universe.org/earth/polar/polar_climate.html The pictures at this website show the loss of polar ice.
 - Canadian Tundra <https://www.google.com/search?q=canadian+tundra&hl=en&client=firefox-a&hs=siz&rls=org.mozilla:en-US:official&tbm=isch&tbo=u&source=univ&sa=X&ei=dWRTUaDcCaKW0QHh3YHIDQ&ved=0CDEQsAQ&biw=1280&bih=827> Photos of the Canadian tundra illustrate the advance of trees into the formerly treeless tundra as the area warms.

- Vocabulary crossword puzzle exercise

Time to teach lesson: 1.5 hours

Teaching Instructions

Introduction

Introduce students to the new vocabulary words.

Activities:

1. Review the vocabulary words from the previous lesson with a complete-the-sentences activity/crossword.
2. Show the class two videos and look at pictures that clearly show the results of climate change.
3. Prompts discussion by asking students to describe the changes that they see in the photos.
4. Have students read the appropriate reading for their level from this lesson to improve their fluency.
5. Have students read the readings for this lesson aloud to practice their fluency.

Demonstration of Student Learning:

Have students complete a complete-the-sentences activity using the vocabulary words from the previous lessons. Have students read the readings for this lesson aloud to practice their fluency.

Vocabulary Crossword

anomaly
climate
combustion
consensus
convene

emissions
infrared radiation
organic
primary
weather

Across

3. Alejandra and Diana will _____ with other adult students in Boston today.

4. The great smelling _____ from the bakery made me want to stop in for a sweet treat!

6. I use _____ fertilizer on my garden.

8. The _____ of gas in a car is what powers the engine.

9. My _____ reason for exercising each day is to try to stay in shape.

Down

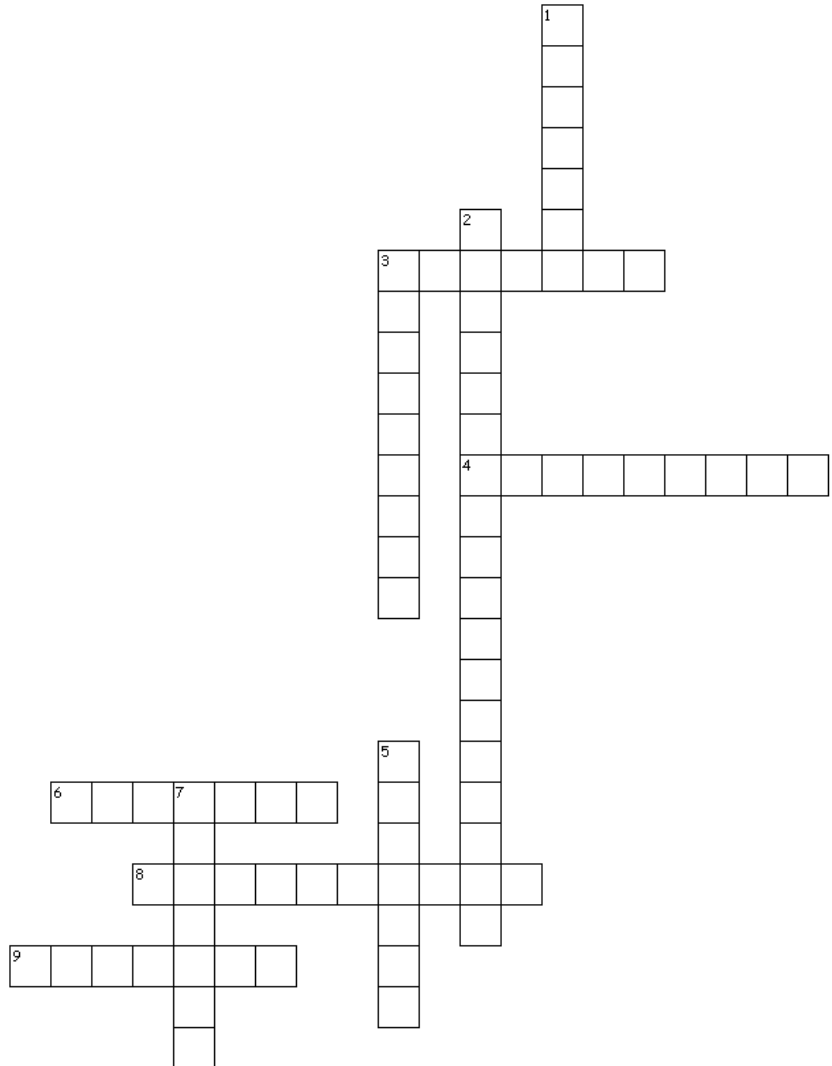
1. Many scientists think that _____ change is the result of human activities.

2. My friend's cat likes to sleep under a lamp because the _____ from the light bulb keeps him warm.

3. After many hours of discussion the workers and their boss finally reached _____ about benefits.

5. I can hardly wait for the _____ to be warm and sunny.

7. Would it be a(n) _____ if a student had perfect attendance for the entire year?



Lesson # 5 - Mass Save Scavenger Hunt

Academic Learning Goals –

- Students will be able to complete a complete-the-sentences exercise that includes the five vocabulary words (interpreted, moot point, objectively, subtle, trend) that were taken from the previous class reading selection.
- Students will be able to navigate and locate specific information on the Mass Save website.

Clean Energy Learning Goals –

- Students will seek out information in response to questions on a “Scavenger Hunt” worksheet. As a result they will read and understand many energy saving suggestions that they can use in their own living situation.

Materials:

- Complete-the-sentences worksheet (teacher-created)
- Mass Save website, Virtual Home Tour <http://www.masssave.com/virtualhome/index.html>
- Scavenger Hunt Worksheet (teacher-created). Used to guide students through the Virtual Home of their choice on the Mass Save website. In order to find the required information they will need to read most of the information in each virtual room.

Time to teach lesson: 1.5 hours

Teaching Instructions

Introduction

Introduce students to the Mass Save website as a source of information for saving both energy and money.

Activities:

1. Writes each word down and read them aloud to the class.
2. Write each word’s part of speech and definition on the board.
3. Ask students to copy the words into their notebooks.
 - interpret – v. - give the meaning of; explain
 - moot point – n. – a debatable question or a subject open to discussion
 - objectively – adv. - dealing with facts without letting your personal feelings get in the way
 - subtle – adj. - so slight that it is difficult to detect
 - trend – n. - the general direction in which something tends to move
4. Using the chart below, demonstrate use of the word in a sentence.
5. Using the chart below, ask individual students questions that require them to respond orally, in complete sentences, using the vocabulary word correctly.

| Word | Teacher sentence | Prompt |
|-------------|---|---|
| interpret | I think that weathermen have a very difficult time interpreting what the weather will be. | How would you interpret the fact that daffodils are blooming? Are you able to interpret the importance of having a GED? |
| moot point | I think that a subject like immigration reform is a moot point – it needs to be discussed more. | What is something that you think is a moot point – something that needs discussion? |
| objectively | It can be difficult to objectively evaluate the performance of someone who is close to you. | Could you objectively decide the winner of a writing contest of the people in our class? Of students from a school in NYC? Of your child's class? |
| subtle | When I made a subtle change in the way that I held my tennis racket, I got tennis elbow. | Subtle changes occur during the spring. Can you think of some? |
| trend | These days the trend in employment is for companies to hire people with more education. | Do you follow fashion trends? Do you think that there is a trend toward using more energy efficient products? If there was a trend toward riding bikes everywhere instead of driving cars, would you join in? |

6. Have students complete a Complete-the-Sentences worksheet.
7. Have students follow instructions on the Scavenger Hunt worksheet in order to find specific information on the Mass Save website.

Demonstration of Student Learning:

Successful completion of vocabulary and Scavenger Hunt worksheets.

Wrap-up

Ask students to be on the lookout for the words in print or on TV.

Complete-the-Sentences Worksheet

Complete these sentences. They will usually require more than just one word!

1. interpret

If I found it impossible to interpret the instructions for putting together a gas grill, I would _____.

2. moot point

I think that building a wind farm off of Cape Cod is/is not a moot point, because _____.

3. objectively

I would find it very difficult to think objectively about _____ because _____.

4. subtle

If my friend had a subtle smile on her face on April Fool's Day, I would think that _____.

5. trend

I think that a trend toward healthier eating would _____.

Scavenger Hunt Worksheet
(to be used with the Mass Save Virtual Home Tour)

Follow the instructions below to learn energy and money saving tips that you can use in your own home. Begin in the Living Room, read the first question then answer then move on to the next room..

Go to Living Room

What is the highest energy user in an entertainment center?

Go to the Kitchen

What appliance should you replace if it is more than 15 years old?

Go to the Office

How long can you expect an LED desk lamp to last?

Go to the Bathroom

What is a great way to manage water usage?

Go to the Living Room

Are fireplaces an efficient way to heat a room?

Go to the Dining Room

How much money can you save each year by replacing five of the most often used light fixtures in your home with ENERGY STAR models?

Go to the Bathroom

How can moisture created by baths and showers be managed?

Go to the Living Room

About what percent of a household's energy use is consumed by a TV?

Go to the Office

What should you do with the power strip to your computer when you are not using the computer?

Go to the Laundry Room

How many loads of laundry does the average family wash each year?

Go to the Bedroom

What percent can be saved on your heating bill by turning down the thermostat 1 degree?

Go to the Laundry Room

What can save about \$100 on average per year on your utility bill while using up to 50% less energy and save about 25 gallons of water each time it is used?

Go to the Bedroom

What is a significantly more effective cost saving step than replacing windows?

Go to the Living Room

How much money will an ENERGY STAR ceiling fan on your utility bill?

Go to the Dining Room

What can be done to older windows to make them properly weatherized?

Congratulations! You have learned a lot about saving energy in your home.

Lesson # 6 - Exploring Environmental Technology Opportunities at Cape Cod Community College

Academic Learning Goals –

- Students will become aware of environmental technology certificate programs available at Cape Cod Community College. In addition, they will learn about different types of degree programs and the amount of time required for each.

Clean Energy Learning Goals or Counseling Goals –

- Students will learn that there are programs available on the Cape for students that are interested in pursuing careers in Clean Energy fields.

Materials:

- Certificate program descriptions from the Cape Cod Community College (MA) online catalog.
- Exploring Environmental Technology Opportunities at Cape Cod Community College Worksheet (teacher-created) used to ask questions about the certificate programs

Time to teach lesson: 1.5 hours

Teaching Instructions

Introduction

Make students aware of the Clean Energy certificate programs that are available at Cape Cod Community College, giving a brief description of each Clean Energy field.

Activities:

1. Ask students work independently to examine the descriptions and requirements for each certificate program.
2. Have students choose one of the certificate programs to look at in greater depth and answer worksheet questions about.

Demonstration of Student Learning:

Have students complete the Exploring Environmental Technology Opportunities at Cape Cod Community College worksheet.

Wrap-up:

Students were polled as they left about which field they investigated and whether or not it was a field they might pursue.

Exploring Environmental Technology Opportunities at Cape Cod Community College

Use the information from the Cape Cod Community College Catalog to investigate **one** of the Certificate Programs offered in the clean energy field. Answer the following questions:

Which certificate program are you investigating?

Where are some of the classes in the Environmental Technology Certificate program held besides at Cape Cod Community College?

How many courses are required for a student to earn a certificate in the program you are reading about?

What will a person with this certificate have basic knowledge about?

What are two things that a person with this certificate would be qualified to do?

1.

2.

Why do you think that students are encouraged to enroll in a Cooperative Work Experience/Internship?

Which of the Program Outcomes would require that a person is confident to speak about the technology he/she is working with?

Do you think that the program you are investigating will require any math skills? Please explain why or why not.

Are there additional career opportunities available to people who get this certification? If yes, what are they?

Is this a career path you would consider once you have your GED?

Environmental Technology Certificate Photovoltaic Technology

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Page 1 of 1

The Environmental Technology certificates are a collaborative partnership among Cape Cod Community College, Massachusetts Maritime Academy and University of Massachusetts - Dartmouth, for persons seeking to acquire skills and knowledge in eight environmental fields: Coastal Zone Management, Environmental Site Assessment, Geographic Information Systems, Photovoltaic Technology, Small Wind Technology, Solar Thermal Technology, Wastewater Management, and Water Supply. Students may need to travel to each of the three schools in order to complete all the courses in any certificate program. Students are encouraged to enroll in ENV260 Cooperative Work Experience/Internship.

| Course # | Course Title | Credits | Prerequisites | Semester Offered | Semester Taken | Grade Earned |
|---------------|--|---------|--|----------------------|----------------|--------------|
| ENV170 | Renewable Energy Sources | 3 | MA1020, ENL020 & ENL050 or satisfactory basic skills assessment scores | Fall, Spring, Summer | | |
| ENV171 | Energy Efficiency and Conservation Methods | 3 | MA1020, ENL020 & ENL050 or satisfactory basic skills assessment scores | Fall | | |
| ENV173 | Introduction to Solar Energy | 3 | MA1020, ENL020 & ENL050 or satisfactory basic skills assessment scores | Spring | | |
| ENV178 | Photovoltaic Installation | 3 | ENV173 | Varies | | |
| ENV260 | Internship (recommended) | 3 | ENV178 or ENV170 & permission of instructor | Fall, Spring, Summer | | |
| Total Credits | | 12/15 | | | | |

Overview

This certificate provides a solid understanding of photovoltaic technology, site analysis, system design, and installation methods. Students completing ENV173 and ENV178 are qualified to take the North American Board of Certified Energy Practitioners Entry Level Photovoltaic Certificate of Knowledge Exam. This certificate may appeal to anyone interested in learning more about solar energy and applying that knowledge to their home, business, or career.

Career Outlook

The "clean energy cluster" is a large and fast growing segment of the Massachusetts economy. Solar energy represents a significant portion of the cluster and its projected growth. A person with this certificate has basic knowledge of photovoltaic systems, suitable for a supervised, entry-level position with a dealer/installer, or other PV industry company or organization. Professionals in building trades can gain the knowledge necessary to expand their services to include photovoltaic system design, consulting, specification, and installation. A wide range of additional career opportunities are available within the clean energy cluster for students with degrees in a variety of fields, such as science, engineering, business, law, political science, and communication.

Program Outcomes

Upon completion of the Photovoltaic Technology Certificate, students are able to:

- Conduct a basic home energy audit and make energy efficiency and conservation recommendations.
- Conduct a solar energy site assessment and quantify the amount of solar energy available at a particular site.
- Properly site, size, and design a residential scale photovoltaic system for both on and off grid applications.
- Accurately explain the benefits and limitations of photovoltaic systems.
- Conduct an economic and environmental assessment of proposed photovoltaic systems.

Environmental Technology Certificate Small Wind Technology

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Cape Cod Community College Catalog

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The Environmental Technology certificates are a collaborative partnership among Cape Cod Community College, Massachusetts Maritime Academy and University of Massachusetts - Dartmouth, for persons seeking to acquire skills and knowledge in eight environmental fields: Coastal Zone Management, Environmental Site Assessment, Geographic Information Systems, Photovoltaic Technology, Small Wind Technology, Solar Thermal Technology, Wastewater Management, and Water Supply. Students may need to travel to each of the three schools in order to complete all the courses in any certificate program. Students are encouraged to enroll in ENV260 Cooperative Work Experience/Internship.

| Course # | Course Title | Credits | Prerequisites | Semester Offered | Semester Taken | Grade Earned |
|---------------|--|---------|--|----------------------|----------------|--------------|
| ENV170 | Renewable Energy Sources | 3 | MAT020, ENL020 & ENL050 or satisfactory basic skills assessment scores | Fall, Spring, Summer | | |
| ENV171 | Energy Efficiency and Conservation Methods | 3 | MAT020, ENL020 & ENL050 or satisfactory basic skills assessment scores | Fall | | |
| ENV177 | Introduction to Wind Energy | 3 | MAT020, ENL020 & ENL050 or satisfactory basic skills assessment scores | Spring | | |
| ENV180 | Small Wind Installation | 3 | ENV177 | Varies | | |
| ENV260 | Internship (recommended) | 3 | ENV118 or ENV170 & permission of instructor | Fall, Spring, Summer | | |
| Total Credits | | 12/15 | | | | |

Overview

This certificate provides a solid understanding of small wind technology, site analysis, system design, and installation methods. This certificate appeals to anyone interested in learning more about wind energy and applying that knowledge to their home, business, or career.

Career Outlook

The "clean energy cluster" is a large and fast growing segment of the Massachusetts economy. A person with this certificate has basic knowledge of small wind-electric systems, suitable for a supervised, entry-level position with a dealer/installer, or other small wind industry company or organization. Professionals in building trades can gain the knowledge necessary to expand their services to include small wind system design, consulting, specification, and installation. A wide range of additional career opportunities are available within the clean energy cluster for students with degrees in a variety of fields, such as science, engineering, business, law, political science, and communication.

Program Outcomes

Upon completion of the Small Wind Technology Certificate, students are able to:

- Conduct a basic home energy audit and make energy efficiency and conservation recommendations.
- Conduct a wind energy site assessment and quantify the amount of wind energy available at a particular site.
- Properly site, size, and design a residential scale small wind system for both on and off grid applications.
- Accurately explain the benefits and limitations of wind-electric systems.
- Conduct an economic and environmental assessment of proposed small wind systems.

Environmental Technology Certificate Solar Thermal Technology

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Cape Cod Community College Catalog

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The Environmental Technology certificates are a collaborative partnership among Cape Cod Community College, Massachusetts Maritime Academy and University of Massachusetts - Dartmouth, for persons seeking to acquire skills and knowledge in eight environmental fields: Coastal Zone Management, Environmental Site Assessment, Geographic Information Systems, Photovoltaic Technology, Small Wind Technology, Solar Thermal Technology, Wastewater Management, and Water Supply. Students may need to travel to each of the three schools in order to complete all the courses in any certificate program. Students are encouraged to enroll in ENV260 Cooperative Work Experience/Internship.

| Course # | Course Title | Credits | Prerequisites | Semester Offered | Semester Taken | Grade Earned |
|---------------|--|---------|--|----------------------|----------------|--------------|
| ENV170 | Renewable Energy Sources | 3 | MA1020, ENL020 & ENL050 or satisfactory basic skills assessment scores | Fall, Spring, Summer | | |
| ENV171 | Energy Efficiency and Conservation Methods | 3 | MA1020, ENL020 & ENL050 or satisfactory basic skills assessment scores | Fall | | |
| ENV173 | Introduction to Solar Energy | 3 | MA1020, ENL020 & ENL050 or satisfactory basic skills assessment scores | Spring | | |
| ENV179 | Solar Thermal Installation | 3 | ENV173 | Varies | | |
| ENV260 | Internship (recommended) | 3 | ENV118 or ENV170 & permission of instructor | Fall, Spring, Summer | | |
| Total Credits | | 12/15 | | | | |

Overview

This certificate provides a solid understanding of solar hot water technology, site analysis, system design, and installation methods. Courses in this certificate count towards training requirements for the North American Board of Certified Energy Practitioners Solar Thermal Installer Certification. This certificate may appeal to anyone interested in learning more about solar energy and applying that knowledge to their home, business, or career.

Career Outlook

The "clean energy cluster" is a large and fast growing segment of the Massachusetts economy. Solar energy represents a significant portion of the cluster and its projected growth. A person with this certificate has basic knowledge of solar thermal systems, suitable for a supervised, entry-level position with a dealer/installer, or other solar industry company or organization. Professionals in building trades can gain the knowledge necessary to expand their services to include solar thermal system design, consulting, specification, and installation. A wide range of additional career opportunities are available within the clean energy cluster for students with degrees in a variety of fields, such as science, engineering, business, law, political science, and communication.

Program Outcomes

Upon completion of the Solar Thermal Technology Certificate, students are able to:

- Conduct a basic home energy audit and make energy efficiency and conservation recommendations.
- Conduct a solar energy site assessment and quantify the amount of solar energy available at a particular site.
- Properly site, size, and design a residential scale solar hot water system for both domestic hot water and pool heating applications.
- Accurately explain the benefits and limitations of solar hot water systems.
- Conduct an economic and environmental assessment of proposed solar hot water systems.

Lesson # 7 - Types of Renewable Energy / What is Renewable Energy?

Academic Learning Goals –

- Students will be able to complete a cloze exercise that includes the five vocabulary words (dwindle, replenish, abundant, conventional, deplete) that were introduced in this lesson.
- In addition, they will practice reading fluently using reading material appropriate to their fluency level. Higher level fluency students use collaborative oral reading, while the lower level uses echo reading.

Clean Energy Learning Goals –

- Students will understand the difference between renewable and non-renewable energy and why the development of renewable energy sources is important.

Materials:

- Reading material for 6-8 GLE,
 - *Types of Renewable Energy* <http://www.renewableenergyworld.com/rea/tech/home>
 - Why is renewable energy important?
<http://www.renewableenergyworld.com/rea/tech/why>
 - Reading handout excerpted in part from *Types of Renewable Energy*
<http://www.renewableenergyworld.com/rea/tech/home>
- Reading material for 5 GLE from, *What Is Renewable Energy?* and *Wind Energy, Biomass Energy, Solar, Hydro, Geothermal*
<http://www.alliantenergykids.com/EnergyandTheEnvironment/RenewableEnergy/000625>
- Cloze Activity that includes the vocabulary words from the reading (teacher-created)

Time to teach lesson: 1.25 hours

Teaching Instructions

Introduction

1. Tell students that the new vocabulary words will appear in the next reading about renewable energy.
2. Tell students that the word parts being learned are ones that will be used as they improve reading using STAR. Learning these words will help students understand the global warming information and why the class is learning it.
3. Tell students that it is okay to use other forms of the words, e.g. past tense, plural.

Activities:

1. Writes each word, its part of speech, and definition on the board.
2. Using the chart below, demonstrate the use of each word in a sentence.
3. Using the chart below, ask individual students questions that require them to respond orally, in complete sentences, using the vocabulary word correctly
4. Have students read a selection at the appropriate level to improve their fluency.

5. Have students copy these words into their notebooks.

- dwindle – v. – to gradually become smaller in size, amount, or strength
- replenish – v. – to fill up again, restock
- abundant – adj. – available in large quantities
- conventional – adj. - things that are normal, ordinary, and following the accepted way
- deplete – v. – to use up the supply of

| Word | Teacher sentence | Prompt |
|--------------|---|---|
| dwindle | My bank account always dwindles to almost nothing by the next payday. | What is something you use that you would replace immediately once your supply has dwindled? |
| replenish | I go grocery shopping to replenish the food in my cupboards. | What is something that rain can replenish? Sunshine? Food? |
| abundant | I loved yesterday because there was an abundant amount of sunshine. | What is something that you like to have an abundant amount of? Would NOT like to have an abundant amount of? |
| conventional | I usually dress in a very conventional way. | What is something you would never do because it is so unconventional? Would do even though it is so conventional? |
| deplete | Once our supply of Pre-GED books is depleted, it is time to buy more. | What is something that you would never let be depleted because it is so important to you? |

Demonstration of Student Learning:

Have students complete a cloze activity using the vocabulary words from the lesson. Ask students read aloud to practice their fluency.

Wrap-up:

Ask students to share about the types of energy sources that are used in their native countries. Ask students to be on the lookout for the words in print or on TV.

Cloze Activity

dwindles replenish abundant conventional depleted

I think that if there was a(n) _____ amount of kindness between people, the world would be a much better place.

I thought that I could use a(n) _____ tool for my project, when instead I needed a specialized one.

Many people rely on coffee to pep them up when their energy level _____ near the end of the day.

The waitress asked if I would like for her to _____ the water in my glass.

Once my supply of paper towels is _____ I will buy more.

Types of Renewable Energy Reading Handout

Types of Solar Energy

Solar energy technologies use the sun's energy and light to provide heat, light, hot water, electricity, and even cooling, for homes, businesses, and industry.

There are a variety of technologies that have been developed to take advantage of solar energy. These include:

- Photovoltaic Systems - Producing electricity directly from sunlight.
- Solar Hot Water - Heating water with solar energy.
- Solar Electricity - Using the sun's heat to produce electricity.
- Passive Solar Heating and Daylighting - Using solar energy to heat and light buildings.

Wind Energy

We have been harnessing the wind's energy for hundreds of years. From old Holland to farms in the United States, windmills have been used for pumping water or grinding grain. Today, the windmill's modern equivalent - a wind turbine - can use the wind's energy to generate electricity.

Wind turbines, like windmills, are mounted on a tower to capture the most energy. At 100 feet or more aboveground, they can take advantage of the faster and less turbulent wind. Turbines catch the wind's energy with their propeller-like blades. Usually, two or three blades are mounted on a shaft to form a rotor.

A blade acts much like an airplane wing. When the wind blows, a pocket of low-pressure air forms on the downwind side of the blade. The combination of lift and drag causes the rotor to spin like a propeller, and the turning shaft spins a generator to make electricity.

Geothermal Energy

Geothermal energy is the heat from the Earth. It's clean and sustainable. Resources of geothermal energy range from the shallow ground to hot water and hot rock found a few miles beneath the Earth's surface, and down even deeper to the extremely high temperatures of molten rock called magma.

Almost everywhere, the shallow ground or upper 10 feet of the Earth's surface maintains a nearly constant temperature between 50° and 60°F. Geothermal heat pumps can tap into this resource to heat and cool buildings. A geothermal heat pump system consists of a heat pump, an air delivery system (ductwork), and a heat exchanger-a system of pipes buried in the shallow ground near the building. In the winter, the heat pump removes heat from the heat exchanger and pumps it into the indoor air delivery system. In the summer, the process is reversed, and the heat pump moves heat from the indoor air into the heat exchanger. The heat removed from the indoor air during the summer can also be used to provide a free source of hot water.

Bioenergy

We have used biomass energy or bioenergy - the energy from organic matter - for thousands of years, ever since people started burning wood to cook food or to keep warm.

And today, wood is still our largest biomass energy resource. But many other sources of biomass can now be used, including plants, residues from agriculture or forestry, and the organic component of municipal and industrial wastes. Even the fumes from landfills can be used as a biomass energy source.

The use of biomass energy has the potential to greatly reduce our greenhouse gas emissions. Biomass generates about the same amount of carbon dioxide as fossil fuels, but every time a new plant grows, carbon dioxide is actually removed from the atmosphere. The net emission of carbon dioxide will be zero as long as plants continue to be replenished for biomass energy purposes. These energy crops, such as fast-growing trees and grasses, are called biomass feedstocks. The use of biomass feedstocks can also help increase profits for the agricultural industry.

Hydropower

Flowing water creates energy that can be captured and turned into electricity. This is called hydroelectric power or hydropower.

The most common type of hydroelectric power plant uses a dam on a river to store water in a reservoir. Water released from the reservoir flows through a turbine, spinning it, which in turn activates a generator to produce electricity. But hydroelectric power doesn't necessarily require a large dam. Some hydroelectric power plants just use a small canal to channel the river water through a turbine. A small or micro-hydroelectric power system can produce enough electricity for a home, farm, or ranch.

Ocean Energy

The ocean can produce two types of energy: thermal energy from the sun's heat, and mechanical energy from the tides and waves.

Oceans cover more than 70% of Earth's surface, making them the world's largest solar collectors. The sun's heat warms the surface water a lot more than the deep ocean water, and this temperature difference creates thermal energy. Just a small portion of the heat trapped in the ocean could power the world. Ocean thermal energy is used for many applications, including electricity generation.

Ocean mechanical energy is quite different from ocean thermal energy. Even though the sun affects all ocean activity, tides are driven primarily by the gravitational pull of the moon, and waves are driven primarily by the winds. As a result, tides and waves are intermittent sources of energy, while ocean thermal energy is fairly constant. Also, unlike thermal energy, the electricity conversion of both tidal and wave energy usually involves mechanical devices.

Class: Intermediate ESOL/ Career Pathways
Program: Holyoke Works

Introductory Summary

The clean energy content and activities provided by the materials from National Energy Education Development Project (NEED) were incorporated into an intermediate ESOL Career Pathways curriculum at Holyoke Works.

The goal of the lessons was to introduce learners to clean energy concepts such as sources of energy and energy consumption around the world. While exploring green careers and visiting clean energy companies was a focus in this ESOL Career Pathways class, students also turned their attention to the personal implications of energy consumption and examined their own energy usage. The students showed a lot of interest in the topic and were excited to share what they learned in the classroom with their friends and family members.

I observed a greater level of self awareness and interest from the students. They are talking to friends and family, paying more attention to the news and can apply concepts and vocabulary taught. And no one will throw out plastic bottles anymore – they're recycling. I was surprised by the enthusiasm – how much they learned and shared, and talked about changing their habits - they're educators now.

The lessons helped students build reading and vocabulary skills. They gained working understanding of vocabulary related to Green Occupations that they could apply in everyday activities, such as watching TV and reading the newspaper.

Lessons:

5. Basics of Energy
6. Energy Around the World

The clean energy lessons were incorporated into the program's ESOL curriculum and taught over the course of a six week Green Career Unit using approximately 20 hours of instructional time. The unit included visits to some local clean energy companies and guest speakers.

Teacher Recommendations

The teacher also introduced the Energy Math Challenge (Elementary Level) from NEED, <http://www.need.org/needpdf/Energy%20Math%20Challenge.pdf>. A math lesson is a logical step from learning about forms of energy to calculating consumption and production to deepen understanding of concepts learned in previous lessons. The Energy Math Challenge offers both elementary and intermediate/secondary level materials that can be used in a variety of ways.

This teacher found that she needed more time than anticipated to assess the math skills of the English Language Learners and teach/review basic math and fractions before tackling the material. She was able to enlist the help of a colleague to teach a math lesson on fractions once she realized that the students were not equipped for the Math Challenge, and recommends that other teachers take time to assess their English Language Learners' math skills and review as needed before undertaking the Energy Math Challenge.

Lesson #1 - Basics of Energy

Academic Learning Goals –

- Students will be able to differentiate sources of energy

Clean Energy Learning Goals –

- Students will be able to understand the implications of use of different forms of energy

Materials

- *Energy Infobook* (Elementary Level) from the National Energy Education Development Project (NEED) <http://www.need.org/needpdf/Elementary%20Energy%20Infobook.pdf>. Includes *What is Energy, History of Energy*
- Index cards with names and definitions of each energy source

Teaching Instructions

Introduction

Write the word “energy” on the whiteboard and ask students to brainstorm following questions:

- What is energy?
- How do we use it?
- Why do we use it?

Activities

1. Have students read *What is Energy?*
 - Ask how the ideas the students generated compare with the information in the reading?
 - Add the points from the reading to the brainstorm list.
2. Before having students read *History of Energy*, gauge their familiarity with the sources of energy.
 - What do they know about each source?
 - What do they think it is?
 - Where does it come from?
3. Read *History of Energy* and review each type of energy source: biomass, coal, geothermal, hydropower, natural gas, petroleum, propane, solar, wind, and electricity.
4. Teacher facilitated discussion with these sorts of prompts:
 - How does energy affect our everyday lives?
 - Which sources of energy do we use most?
 - Is there an unlimited supply of this source of energy?

Demonstration of Student Learning:

Students engage in discussion with the ability to name sources of energy and give examples of how energy affects their everyday lives.

Lesson # 2 - Energy Around the World

Academic Learning Goals –

- Students will be able to talk about energy use/production around the world.

Clean Energy Learning Goals –

- Students will be able to understand different kinds of energy sources around the world.

Materials:

- Energy Around the World Lesson
<http://www.need.org/needpdf/Energy%20around%20the%20World.pdf>. Materials include *Country Profiles* and maps
- Scraps of paper with names of countries listed in lesson material from which students will draw a country to research (or another method by which students will choose or be assigned a country)
- Map of the world
- Poster making materials: scissors, crayons, markers, glue, rulers, poster paper

Teaching Instructions

Introduction

1. Explain to students that they will be learning about energy use in different countries and that they will be creating posters to present the information about each country.
2. Explain that throughout the profiles, measurements are reported in metric units. Students may want to convert these measurements for context during their presentations.
3. Ask students why they think all units have been reported in metrics, while income figures are reported in U.S. Dollars.
4. Go over the following terms of measurements with the class:
 - **1 Btu** (British thermal unit) = approximately the amount of energy released by burning one wooden kitchen match.
 - **1 Q** (quad—1 quadrillion (10¹⁵) Btu). Quads are used to measure very large quantities of energy. The U.S. uses one quad of energy about every 3.75 days.
 - **1 MMT** (million metric ton). A measurement of the amount of carbon dioxide released by fuel use.

Activities

1. Hand out the *Country Profile on Australia*. Review the data together and check for understanding.
2. Have students work in pairs and have each pair draw the name of a country (or use another method by which students select a country to work on).
3. Hand out *Country Profiles* for each of the countries that students select.
4. In pairs, have students create a poster about the country they've selected. The poster should represent the information found in the country profile, such as: the continent, size, population, government, language, per capita income, transportation, literacy, climate, electricity generation, energy production/consumption, CO2 emissions, energy balance, resources, environmental concerns.

Demonstration of Student Learning:

Students present their posters and the information they learned to the class.

Class: ESOL, Level 3
Program: ACCESS Program

Introductory Summary

This five lesson sequence culminates with student-created skits in which student actors develop a clean energy scenario ranging from making a decision to purchase a fuel efficient car to convincing a neighbor to recycle or a family member to turn down the thermostat. Leading up to this final applied lesson, the sequence covers vocabulary and basic climate change concepts using videos, quizzes, flashcards and class discussions.

"I'll buy a new sweater," one student said in the student-created skits. These skits allowed students to practice their clean energy vocabulary, demonstrated their understanding of the need for energy conservation and helped them articulate the case for energy efficiency. They were excited because these skills will allow them to talk knowledgably to friends and family about this topic.

This sequence is geared for English Language Learners, the lessons integrate reading, writing, speaking and pronunciation, and listening standards with a heavy emphasis on new vocabulary acquisition. Throughout the sequence, students develop their own Clean Energy Handbooks to serve as resources for their continued learning.

Lessons:

1. Clean Energy Vocabulary
2. Understanding Climate Change
3. Understanding Climate Change, Vocabulary Review and Application
4. Causes, Effects and Solutions
5. Applied Vocabulary and Concepts of Clean Energy

Lesson # 1 - Clean Energy Vocabulary

Academic Learning Goals –

- Students will learn and practice English vocabulary that is commonly used when discussing clean energy.

Clean Energy Learning Goals –

- Students will become familiar with the definitions of clean energy terms and will be able to correctly pronounce each.

Materials

- *The Earth Heats Up*, Hi-Lo Non Fiction Passages for Struggling Students adapted by Pam Halloran, Scholastic, 2006. This article provides an overview on global warming for students.
- Pictures cut from magazines or downloaded from the Internet using Google for coal, turbine, petroleum (drilling rigs), people (consumers), cornfield (biomass), and solar panels. These are used to help students learn the definitions and vocabulary.

- Blank index cards to use for term names.
- Student-created Clean Energy Handbooks. For this lesson, students will create a title page and vocabulary page to begin their Clean Energy Handbook. These are notebooks in which students will record vocabulary and other learning.

Time to teach: 1.5 hours.

Teaching Instructions

Introduction

1. Write “Clean Energy” on the board.
2. Brainstorm with the class what they know about this term.
3. Write a list of other words associated with clean energy that haven’t come up in the brainstorm.
4. Write all of the new vocabulary on cards.
5. Write definitions next to each term.
6. Review the pronunciation of the words.

Activities:

1. Instruct students to make a title page for their Clean Energy Handbooks.
2. Have students copy the words and definitions from the board into their Clean Energy Handbooks.
3. Next, have the students read *The Earth Heats Up*.
4. Facilitate a class discussion about the reading and identify additional new vocabulary. Instruct students to add these additional words and definitions to the list in their Handbook.

Demonstration of Student Learning:

1. Using pictures and cards with vocabulary words on them, create a large chart on the front board.
2. Ask students to take turns writing definitions next to words and pictures.
3. Ask students to read their definitions aloud.
4. Correct for accuracy and pronunciation.

Lesson # 2 - Understanding Climate Change

Academic Learning Goals –

- Students will be able to show evidence of understanding by summarizing ideas in writing.

Clean Energy Learning Goals –

- Students will increase their understanding of clean energy and climate change vocabulary.
- Students will understand a basic and brief explanation of the causes and effects of climate.
- Students will gain an understanding of the causes and effects of climate change.

Materials

- Students' individual Clean Energy Handbook. These are used to review vocabulary before watching video.
- Quiz on Energy Sources #1 <http://www.neok12.com/quiz/ENESRC02> Quiz on Energy Sources #2 <http://www.neok12.com/quiz/ENESRC03> These are used as a warm-up review.
- You Tube Video: *Confronting Climate Change with Al Gore*, <http://www.youtube.com/watch?v=qglVY0iqhEk> (5 minutes) The video provides a quick and brief overview of climate change.

Time to teach lesson: 1.5 hours

Teaching Instructions

Introduction

1. Review vocabulary in the Clean Energy Handbook, stressing correct pronunciation and meaning.
2. To continue warm-up, have students will complete the online energy sources quiz.
3. Print out the quiz results.
4. Ask students to add them to their handbook.
5. Ask students to add new vocabulary that will be heard in video to their handbooks.

Activities:

1. Show the 5 minute video, *Confronting Climate Change with Al Gore* to the class.
2. Discuss the main ideas as a class.
3. Discuss the possible effects on the environment from climate change.

Demonstration of Learning:

Ask students to write a reflective paragraph about their individual reaction to this information.

Lesson # 3 - Understanding Climate Change, Vocabulary Review and Application

Academic Learning Goals –

- Students will develop a greater understanding of vocabulary used in the areas of clean energy and climate change.
- Students will apply vocabulary.

Clean Energy Learning Goals –

- Students will have a working knowledge of clean energy and climate change vocabulary.

Materials:

- Quiz on Energy Sources #1 <http://www.neok12.com/quiz/ENESRC02> Quiz on Energy Sources #2 <http://www.neok12.com/quiz/ENESRC03> These are used as a warm-up review.

- Energy Flashcards <http://www.flashcardmachine.com> students will make their own flashcards which will be used for self-assessment.
- Students' Clean Energy Handbooks used as a reference as needed.

Time to teach lesson: 1.5 hours

Teaching Instructions

Introduction

As a warm up, ask students to review the vocabulary and the online energy sources quiz result in their Handbook.

Activities:

Ask students to go to the flashcard machine site and create a set of flashcards for clean energy vocabulary that they can use for self- assessment. (The flashcard site needs registration. Walk students through this process, or do this as a group activity.)

Demonstration of Student Learning:

Flash card self-assessment.

Lesson # 4: Causes, Effects and Solutions

Academic Learning Goals –

- Students will use knowledge gained in the three previously taught lessons to help with the understanding of a full length video about global warming.

Clean Energy Learning Goals –

- Students will gain a deeper understanding of the causes, effects and solutions for global warming.

Materials:

- Students' Clean Energy handbooks, used as reference, as needed.
- Discovery Channel video: *Global Warming: What You Need to Know* with Tom Brokaw. January 23, 2012, (90 minutes) used to increase students' knowledge about the causes and effects of and solutions to global warming. <http://www.youtube.com/watch?v=xcVwLrAavyA>
- Newsprint and 3 different colored markers. Separate sheets for each category of the Climate Change Chart

Time to teach: 3 hours

Teaching Instructions

Activities:

Show the video, *Climate Change: What You Need to Know*, periodically stopping to check for understanding.

Demonstration of Student Learning:

Make a Climate Change chart on the board with three categories: Causes, Effects, and Solutions. Ask students to take turns telling three things they learned from the movie for each category.

Wrap-up

Make an edited copy of the categories to give students as a handout for their handbooks.

Lesson # 5: Applied Vocabulary and Concepts of Clean Energy

Academic Learning Goals –

- Students will apply knowledge about Clean Energy and Global Warming to real life situations.

Clean Energy Learning Goals –

- Students will show understanding of the causes, effects and solutions for global warming throughout the development and presentation of short skits.

Materials

- Clean Energy handbooks
- Skit prompts:
 - Convincing a neighbor to recycle
 - A husband or roommate convincing their partner to turn down the heat
 - A girlfriend telling her boyfriend why he should slow down when driving
 - A couple buying a car that is more green
 - Using recycled paper such as newspaper or comics to wrap gifts
 - A parent convincing a teenager to take short showers
 - Walking or taking a bicycle to get coffee
 - Bringing a mug to work for tea or coffee
 - Getting an energy audit from Mass Save

Time to teach lesson: 1.5 hours

Teaching Instructions

Introduction:

Review material in handbook and use it as a reference to develop skit.

Activities:

1. Ask students to choose from the list of skit prompts that they would like act out. They should be in group of two or three depending on what the skit requires.
2. Have the groups write out skit script.
3. Have the students move to a quiet area to practice.
4. Have the students present their skits to the whole class.

Demonstration of Learning:

Presentation of skit and verbal feedback from classmates.

Advising/Counseling Lesson Sequence Examples

Class: GED

Program: The Literacy Project

Introductory Summary

This lesson sequence was delivered as a series of career and education advising workshops in collaboration with GED instructors. It was designed to teach students about the general career exploration process and tools while also exposing them to the specific clean energy occupations and the skills and training needed to attain them.

With these lessons students undertake a process of assessing their interests and skills – a first step in setting educational and career goals. They gain familiarity with the language and terminology of career exploration and clean energy occupations.

One lesson uses a presentation that includes general information about green jobs as well as regional information specific to Western Massachusetts. Before creating your own presentation on local or regional green jobs, search the internet, YouTube, and your local workforce board or workforce development agency resources. You may find something already developed for your own region that you can use or adapt.

A number of extension activities are suggested in order to expose students to a more comprehensive array of career planning tools and steps. The suggested resources, such as the *Integrating Career Awareness* curriculum guide, are not specific to clean energy, but can be used as tools to guide students through the career planning process. The self-assessment and occupational research skills they learn through these lessons are transferable to whatever field of interest they choose to pursue further.

Lessons:

1. Introduction to Green Jobs
2. Claim Your Skills

Teacher Recommendations

In this program students had done some skill and interest exploration activities during the program intake session, so students were ready to jump into a discussion of skills-matching during the *Introduction to Green Jobs* workshop. It is recommended that the lesson, *Claiming Your Skills*, be taught first if students have not already had an opportunity to explore and identify their individual interests and skills. The workshops might also work better as several one-hour sessions.

This lesson sequence would best follow after learners have learned been exposed to lessons on green energy fundamental concepts, such as those found in the Green Curriculum of the Franklin Hampshire Regional Employment Board. <http://franklinhamshirereb.org/adult-basic-education-green-curricula>

Lesson #1 - Introduction to Green Jobs

Instruction or Counseling Time = 4 hours

Academic Learning Goals –

- Learn an effective note taking strategy.

Clean Energy Learning Goals –

- Learn vocabulary and terminology related to Green Jobs.
- Learn about Green Jobs labor market information.

Materials:

- Chart from GED Lesson on Green Careers, Western MA Green Curriculum Project <http://franklinhampshirereb.org/images/pdf/akgreencareerscurriculum.pdf>
- Ten Steps to Good Note Taking <http://www1.chapman.edu/arc/goodnotes.html>
- Green Careers Orientation <http://www.franklinhampshirereb.org/green-careers-orientation> (This is a 30-minute audio-visual presentation that includes general information about green jobs as well as regional information specific to Western Massachusetts. Before creating your own presentation, search the internet, YouTube, and your local workforce board for similar local or regional materials.)
- Art supplies: Poster board, markers, tape / glue
- Computer & printer

Teaching Instructions

Introduction

This lesson presumes that learners have been exposed to an introduction related to Green Lessons including: understanding energy use; taking steps to reduce energy use; navigating utility bills; peak oil and its implications; the carbon cycle.

Students can work together in groups or as a full class (depending on class size) to brainstorm responses to the question prompts found in the chart that is part of the Green Careers Lesson listed above.

After small groups have filled in the chart, reconvene the larger group to discuss and deepen the group's collective thinking and expand the chart as makes sense. Use the chart to open a discussion about green jobs. Possible discussion questions:

- What is a green job?
- Why are we hearing so much about green jobs?
- Are the jobs you listed green jobs? What makes them green?
- Do we have local examples of any of these jobs?

Activities:

1. Review "Ten Steps to Good Note Taking"

2. Explain that the class will be watching a presentation on Green Careers and ask students to practice using the tips on note taking while watching.
3. Show the Green Career Orientation listed above or create your own presentation to give to students.
4. Pause at points during the presentation to check for understanding, discuss students' responses, and emphasize key information for note taking.
5. Track key points on newsprint or whiteboard to discuss in greater depth afterwards.

Demonstration of Student Learning:

Using their notes, students will work in teams or individually to create a poster developing some of the themes from the orientation, such as: why green; green occupations, industry certifications; local green training opportunities; new and emerging occupations.

Compile the posters into a single bulletin board to be updated regularly with green job and training notices and information.

Dedicate a box or folder for new material and ask the class to continue gathering information to post on the Green Jobs bulletin board. Ask students to take turns being responsible (each week or month) for updating the board with the new materials.

Wrap-up

After the poster is completed, students can write a reflection essay describing their poster. This essay might then be used to practice writing drafts, peer editing, or to practice other specific writing skills.

Lesson # 2 - Claim Your Skills**Academic Learning Goals –**

- Build vocabulary and terminology related to skill identification, career exploration, and employment search.
- Categorize information - identify interests and match them with a wide variety of careers within six broad categories of work.

Clean Energy Learning Goals –

- Prepare students to consider if they are well suited for a particular green industry or green job.
- Build vocabulary and terminology related to green industry.

Materials:

- Video on Speed networking by The Opportunity Network - <http://www.youtube.com/watch?v=9jNFYQcgD6s>
- Skills, Value Interest Survey – can use www.masscis.intocareers.org , or a variety of other state and national career exploration sites. Other examples can be found in the Integrating Career

Awareness into ABE and ESOL Classroom curriculum guide section on Self Exploration Lesson on Goal setting <http://collegetransition.org/publications.icacurriculum.html>

- Video on developing an elevator speech: <http://www.youtube.com/watch?v=qtAwGlu7qhw>

Time to teach lesson:

8 hours (2 class periods of 4 hours each)

Teaching Instructions

Activities:

1. Start with a Speed networking exercise: Have students line up and do a speed networking exercise. In the context of clean energy, the counselor/workshop presenter should model the pitch in context of background and goals associated with clean energy. Examples of questions include:
 - What is your employment background?
 - What is your educational background?
 - What do you know about clean energy?
 - What are your career and education goals?
 - Why did you decide to come back to school?
 - What do you need to achieve your goals?
2. Show the video on Developing an Elevator Speech: <http://www.youtube.com/watch?v=qtAwGlu7qhw> and explain that students will be developing one of their own.
3. Have students complete a skill inventory (like the one found here: www.masscis.intocareers.org) or another career planning website. Now have the students add a summary of their skills to their elevator speech for another round of speed networking.

Demonstration of Learning:

Students will do a second round of Speed Networking after learning about elevator speeches and completing a skill inventory using skill vocabulary they've developed.

Wrap-up

Discussion questions:

- What was the difference between the 2 speed networking activities?
- What are your Next Steps? (And how can instructor or advisor help you?)

Extension Activities

A variety of career exploration activities could follow these lessons. The extension activities below are sequenced to enable students to gradually develop a written career and education plan.

Resume Writing

- Teach a class on writing resumes and cover letters or take a field Trip to One Stop Career Center for a resume writing workshop.

- Resume matching activity: Prepare 5 job postings, 5 resumes, and 5 cover letters and have students match them appropriately. This activity illustrates the need to customize resumes and cover letters to job postings and provides a good opportunity to discuss online application process and “robo-weeding” of applicants.
- Video Resources: Creating a Resume <http://www.youtube.com/watch?v=bdhs0VRJODo>
Creating a Cover Letter (11mins, 41 seconds): <http://www.youtube.com/watch?v=uSLGa2bRU-g>

Goal Setting /Career and Education Planning

- Over time students can develop a written career and education plan like the ones found here:
<http://www.doe.mass.edu/acls/ecp/> or
<http://collegetransition.org/publications.icacurriculum.html>

Class: GED and ESOL

Program: Quinsigamond Community College

Introductory Summary

This sequence of lessons was developed by the Education and Career Advisor working with both GED and ESOL students. The goals were to increase students' awareness of clean energy terms and concepts and explore clean energy occupations while also learning 21st century workplace skills such as navigating websites. Students also gained an understanding of the topic of personal/home energy consumption and the environmental and economic impact of energy conservation.

Students and I came away very revitalized from the lessons. They had a lot more general knowledge than I expected. One student sparked discussion about how to conserve energy. Another had received a letter from Nat'l Grid because after they replaced their light bulbs their household had become one of the top energy savers in their area.

A program wide clean energy bulletin board was set up in the common area as a way to launch the topic for discussion, introduce vocabulary, and highlight clean energy concepts. The students found the bulletin board interesting and it did spur discussion. During the initial brainstorming activity the advisor found that students communicated varying levels of personal awareness and sense of personal responsibility about clean energy issues. Students shared personal experiences related to energy use and savings, compared differences in their towns' approaches, and suggested recycling resources.

Students internet navigation skills vary and the career exploration lesson on green jobs provided an opportunity for students to learn and practice navigation. The lesson uses the Massachusetts Career Information System (Mass CIS) website and the section on Green Jobs, but any career exploration website may be substituted.

The research on green occupations spurred further discussion about where to find information about training and certificate programs as well as general questions about the college application process.

Lessons:

1. Thinking Green: What Does it Mean?
2. Navigating the Possibilities of a Green Job
3. Career Planning: Helping you Set and Reach your Goals

Lesson # 1 - Thinking Green: What does it mean?

Academic Learning Goals –

- Students will develop reading comprehension and vocabulary skills.

Clean Energy Learning Goals –

- Students will gain knowledge and awareness of Green/Clean energy terms and concepts.

Materials

- Bulletin Board – used for introduction of Green Energy concepts and discussion of concepts.
- “Ten ways to Go Green and Save Green” information sheet created by Worldwatch Institute http://www.worldwatch.org/resources/go_green_save_green
- Thinking Green presentation
- Green Energy Terms Matching Activity handout

Time to teach lesson: 1 hour

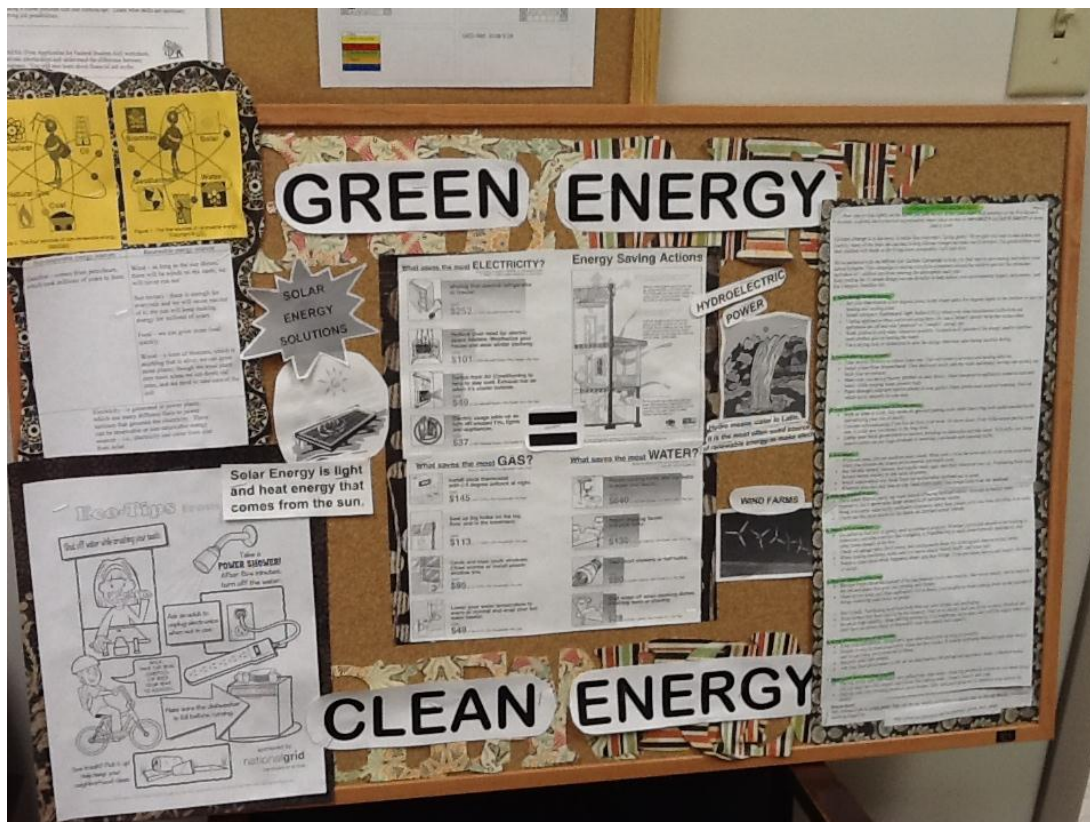
Instructions

Introduction/Warm-up/ Prior Knowledge:

1. Give students a Green Energy Terms matching handout as an informal assessment of knowledge about clean energy concepts.
2. Use Thinking Green presentation provided (or another one) to introduce the lesson and facilitate the discussion of the brainstorming activity and information sheet.

Activities:

1. In small groups, ask students to brainstorm ways to go green and save green.
2. Ask groups to share their results and write results of brainstorm on board.
3. Afterwards, handout “Ten ways to Go Green and Save Green” to compare the results of the brainstorming activity with the ways to go and save green listed on the information sheet.
4. Update the white board brainstorm list with additional points from the reading.



GREEN ENERGY TERMS MATCHING ACTIVITY

Developed from <http://thegreenbeagle.com/green-vocabulary>

| | |
|---------------------------------------|---|
| Alternative Energy _____ | A. Any petroleum based fuel (gasoline, natural gas, fuel, oil, etc). |
| Energy efficiency _____ | B. Also known as the Greenhouse Effect. When too many greenhouse gasses such as carbon dioxide and methane are trapped in the atmosphere, the temperature on the Earth rises causing the ice at the north and south poles to melt. |
| Environment _____ | C. energy derived from sources that do not use up natural resources or harm the environment. |
| Environmentally Friendly _____ | D. the latest term to describe a home designed to be environmentally friendly, including energy and water efficiency, healthy and more. |
| Fossil Fuel _____ | E. The series of activities, including collection, separation, & processing, by which materials are recovered from the waste stream for use as raw materials in the manufacture of new products. |
| Global Warming _____ | F. A generic statement often used to designate a product or process that has a reduced ecological footprint when compared to other products/processes. |
| Geothermal Energy _____ | G. can mean the area around you, or it sometimes just means nature. |
| Going Green _____ | H. the goal to reduce the amount of energy to provide products and services. |
| Green Homes _____ | I. important to making sure that humans have and continue to have, the water, materials, and resources to protect health and the environment. |
| Nonrenewable Energy _____ | J. Energy we get directly from the Earth, usually in the form of heat. Volcanoes are an excellent source of geothermal energy. |
| Recycling _____ | K. Sources of energy that cannot be replaced in reasonable period of time. Fossil fuels (coal, petroleum, natural gas) are examples . |
| Renewable Energy _____ | L. a lifestyle that consists of helping reduce that individual's negative impact on the environment. |
| Sustainability _____ | |



Thinking Green.

What does it mean?



What do you know about ways to go green and save green?

- Brainstorm Activity: List of ways class members go green and save green.
- Results written on whiteboard in classroom.

Worldwatch Institute: Vision for a sustainable world.

- A global environmental organization helping to create an environmentally sustainable society.
- Handout of “10 Ways to Go Green and Save Green” – Worldwatch Institute

1. Save energy to save money.

- Set your thermostat a few degrees lower in the winter and a few degrees higher in the summer to save on heating and cooling costs.
- Install compact florescent light bulbs (CFLs) when your older incandescent bulbs burn out.
- Unplug appliances when you’re not using them. Or, use a “smart” power strip that senses when appliances are off and cuts “vampire” or “phantom” energy use.
- Wash clothes in cold water whenever possible. As much as 85 percent of the energy used to machine-wash clothes goes to heating the water.
- Use a drying rack or clothesline to save energy otherwise used during machine drying.

2. Save water to save money.

- Take shorter showers to reduce water use. This will lower your water and heating bills too.
- Install a low-flow showerhead. They don't cost much and the water and energy savings can quickly pay back your investment.
- Make sure you have a faucet aerator on each faucet. They conserve heat and water and keep water pressure high.
- Plant drought-tolerant plants that need minimal watering in your garden.

3. Less Gas = more money (and better health)

- Walk or bike to work. This saves on gas and parking costs while improving your cardiovascular health and reducing your risk of obesity.
- Consider telecommuting if you live far from your work.
- Lobby your local government to increase spending on sidewalks and bike lanes.

4. Eat smart.

- Buy locally raised, humane, and organic meat, eggs, and dairy whenever you can. Purchasing from local farmers keeps money in the local economy.
- Watch videos about why local food and sustainable seafood are so great.
- If you eat meat, add one meatless meal a week. Meat costs a lot at the store – and it's even more expensive when you consider the related environmental and health risks.

5. Skip the bottled water.

- Use a water filter to purify tap water instead of buying bottled water. Not only is bottled water expensive but it generates large amounts of container waste.
- Bring a reusable water bottle (preferably aluminum rather than plastic) with you when traveling or at work.

6. Think before you buy.

- Go online and find new or gently used secondhand products. Whether you've just moved or are looking to redecorate, consider a service like craigslist or FreeSharing to track down furniture, appliances and other items cheaply or for free.
- Check out garage sales, thrift stores and consignment shops for clothing and other everyday items.

7. Borrow instead of buying

- Borrow from libraries instead of buying personal books and movies. This saves money not to mention the ink and paper that goes into printing new books.
- Share power tools and other appliances. Get to know your neighbors while cutting down on the number of things cluttering your closet or garage.

8. Buy smart.

- Buy in bulk. Purchasing food from bulk bins can save money and packaging.
- Wear clothes that don't need to be dry-cleaned. This saves money and cuts down on toxic chemical use.
- Invest in high quality, long-lasting products. You might pay more now, but you won't have to replace items as frequently and this means less waste.

9. Keep Electronics out of the trash.

- Keep your cell phones, computers, and other electronics as long as possible.
- Donate or recycle them responsibly when the time comes. E-waste contains mercury and other toxics and is a growing environmental problem.
- Recycle your cell phone.
- Ask your local government to set up an electronics recycling and hazardous waste collection event.

10. Make your own cleaning supplies.

- The big secret: you can make very effective, non-toxic cleaning products whenever you need them. All you need are a few simple ingredients like baking soda, vinegar, lemon and soap.
- Making your own cleaning products saves money, time and packaging – not to mention your indoor air quality.

Renewable Energy

- Renewable energy resources are inexhaustible resources, many of which produce no air emissions. The installation of renewable energy technologies can improve the local economy. There are also economic advantages to diversifying the energy supply. Overall, as we get more energy from renewable sources, we will enhance the health, security, and prosperity of Massachusetts, the nation and the world.



Renewable Energy

- Renewable energy resources include:
- Sun
- Wind
- Water, including tidal and wave energy
- Biomass, from both plants and other organic material
- Fuel Cells
- And More

Resources to learn and discover more about Green/Clean Energy:

- [Museum of Science, Boston | Energized!](#)
- [About Clean Energy - Massachusetts Clean Energy Center](#)

Lesson # 2 - Navigating the Possibilities of a Green Job

Academic Learning Goals –

- Students will learn how to research occupations with the use of the MassCIS or another career exploration website.

Clean Energy Learning Goals –

- Students will be able to identify and describe three Green Occupations and their associated profiles (e.g. skills, tasks, responsibilities, work environments)

Materials:

- Computer, internet access and link to Mass Career Information System (MassCIS) <https://masscis.intocareers.org> or another career exploration website.
- Green Jobs Scavenger Hunt handout

Time to teach lesson: 2 hours over 2 (1 hour) class periods

Teaching Instructions

Activities:

1. Using a smartboard or LCD projector, demonstrate how to navigate through whichever career exploration website you choose, using the following steps (written for Mass CIS, but can be modified to any site):
 - a. Log on to masscis.intocareers.org and click on the “About Us” link listed under resources and read the brief description of MassCIS.
 - b. Facilitate a brief discussion about the website :
 - i. Has anyone used it before?
 - ii. Who is this type of resource designed for?
 - iii. What sort of information do you expect to find there?
 - c. Return to home page and the “Adult” link to access the sign in page.
 - d. Sign in using the “Select your town” option, using Worcester and the 01605 zip code.
 - e. Click on the “Green Jobs” link to the left of the web page under “Occupations and Employment”
 - f. Read the overview of the green jobs and there will be a discussion of the two types of green jobs noted on the page.
 - g. Click on the “Green Occupations” link and read the three ways occupations are becoming green.
 - h. Ask students to click on “Construction Managers” link to show and explain the information available for their research, such as “At a Glance”, “Common Work Activities” link, “Wages Link”, “Employment Outlook” link, etc. a video link is also available to view.
2. Give students three large note cards and asked to identify three different green occupations with a brief description of each, taking the information from the “At a glance” option
3. Ask students to share the information about the occupations they’ve have researched with the rest of the class.

In a follow up class students will be asked to sign into the MassCIS website independently and to navigate their way to the Green Jobs link. They will then complete a Scavenger Hunt questionnaire designed to help them learn to navigate the Green Jobs section of the MassCIS website independently.

Demonstration of Student Learning:

Students will complete the Green Jobs Scavenger Hunt to demonstrate ability to navigate the website.

Green Jobs Scavenger Hunt Activity

Go to the website: <https://mass.cis.intocareers.org>

What does the shortened term “MassCIS” stand for?

Click on “Adult”

Sign in using “Worcester” and your zip code

Click on “Green Jobs”

Find the answers to the following questions:

1. According to the US Government what is one of the things an occupation or business must do to be considered green?

2. Name one of the Green Jobs Videos available to view and describe what you will learn if you watch it.

3. What is one of the ways occupations are becoming green?

4. How many new occupations are linked for research because of green technology and existing occupations that are already green or becoming green?

5. What does an energy auditor do?

6. What is the national median income of an energy auditor?

7. What does an energy auditor have to be knowledgeable about?

8. What are the licensing/certification requirements of an energy auditor?

9. What is the employment outlook for an energy auditor?

10. What is a Program of Study directly related to the occupation of an Energy Auditor?

11. Name two Greening Industries:

12. Name two additional resources to learn more about green jobs, green occupations and greening industries:

Lesson # 3 - Career Planning: Helping you Set and Reach your Goals

Academic Learning Goals –

- Students will learn about the career planning process and how to use internet tools to explore career interests.

Clean Energy Learning Goal –

- Students will have increased awareness of green energy occupations and the skills needed to obtain employment in this career pathway.

Materials

- Computer, internet access and link to Mass Career Information System (MACIS) <https://masscis.intocareers.org> or another career exploration website.
- Career Exploration on the Internet (Version C) handout. Found in Integrating Career Awareness into the ABE & ESOL Classrooms curriculum guide. <http://collegetransition.org/publications.icacurriculum.html>

Time to teach lesson: 1 hour

Teaching Instructions

Introduction

1. Ask students to use the notecards gathered to choose two occupations to research further using one of the career exploration templates listed above.
2. Review the handout with the students to make sure that they understand the questions.
3. Explain to students that the handout is a template that provides commonly asked questions to help students learn about occupations and that it is just a guide. Encourage students to add questions that are important to them and brainstorm additional questions.

Activities:

1. Have students choose an occupational title from the previous activity that they would like to research further.
2. Have students work individually or in pairs to use the MassCIS or another career exploration website to complete the Career Exploration on the Internet handout.

Demonstration of Student Learning:

Students will complete the template to demonstrate ability to navigate the career exploration website.

Wrap-up

Discussion questions to ask upon completion of the activity:

- Were you surprised by how much or how little education was needed for some jobs?
- Were you surprised by how much or how little the wage was for some jobs? Which ones and why?

- What relationship did you observe between how much education/training a job requires and the wage of the job?

Extension Activity

Students might enter the information they gather on green occupations into a career and education plan, if they find that they wish to pursue the occupation further. An example of a career and education plan can be found in Integrating Career Awareness into ABE and ESOL Classrooms Curriculum <http://collegetransition.org/publications.icacurriculum.html>.

Introductory Summary

One counselor created three different games to reinforce vocabulary and concept acquisition with beginning ABE students. The games served as a support to these students who were, at the same time, engaged in a series of clean energy lessons with their ABE classroom teacher. The games: Clean Energy Match Game, Clean Energy Crossword Puzzle and Clean Energy Jeopardy helped these largely non-native English speaking students to practice basic terminology associated with clean energy. The games can be used as fun reinforcement of new vocabulary and concepts, either together or individually. They also provide a model that can be adapted to other clean energy content and vocabulary. Student response to these was positive, particularly by immigrant students for whom these games (including crossword puzzles) are unfamiliar.

Lessons:

1. Clean Energy Match Game
2. Clean Energy Crossword Puzzle
3. Clean Energy Jeopardy Game

Lesson # 1 - Clean Energy Match Game

Materials:

- 2 sets of laminated homemade Concentration cards (teacher-created using common symbols that represent different types of energy)
- Game Board (teacher-created)

Time to teach lesson: 1 hour

Teaching Instructions

Introduce the match game and demonstrate how 2 cards in the game could be matched and then taken off the board.

The following steps guide play:

- Decide which player goes first with the flip of a coin.
- Player turns over any two cards, allowing the rest of the players to easily see the turned cards.
- If the cards match, the player takes them and begins his pile of “winnings.”
- If the cards do not match, the player turns them back over, making sure they are in their original positions
- If the player’s cards matched, the player gets to take another turn.
- The player continues taking turns until the player does not make a match.
- The next person takes a turn, trying for a match.

- Play continues in this way until all the cards have been turned into matches and gone to a player's winnings pile
- The winner is the player with the most cards

Match Game - #1



Images for match game hidden

Match Game - #1



Images for match game revealed

Lesson # 2 - Clean Energy Crossword Puzzle

Materials:

- Crossword Puzzle Blank
- Answer sheet
- Vocabulary List
- Pencils

Time to teach: 2 hours

Teaching Instructions

Share some crossword puzzle strategies:

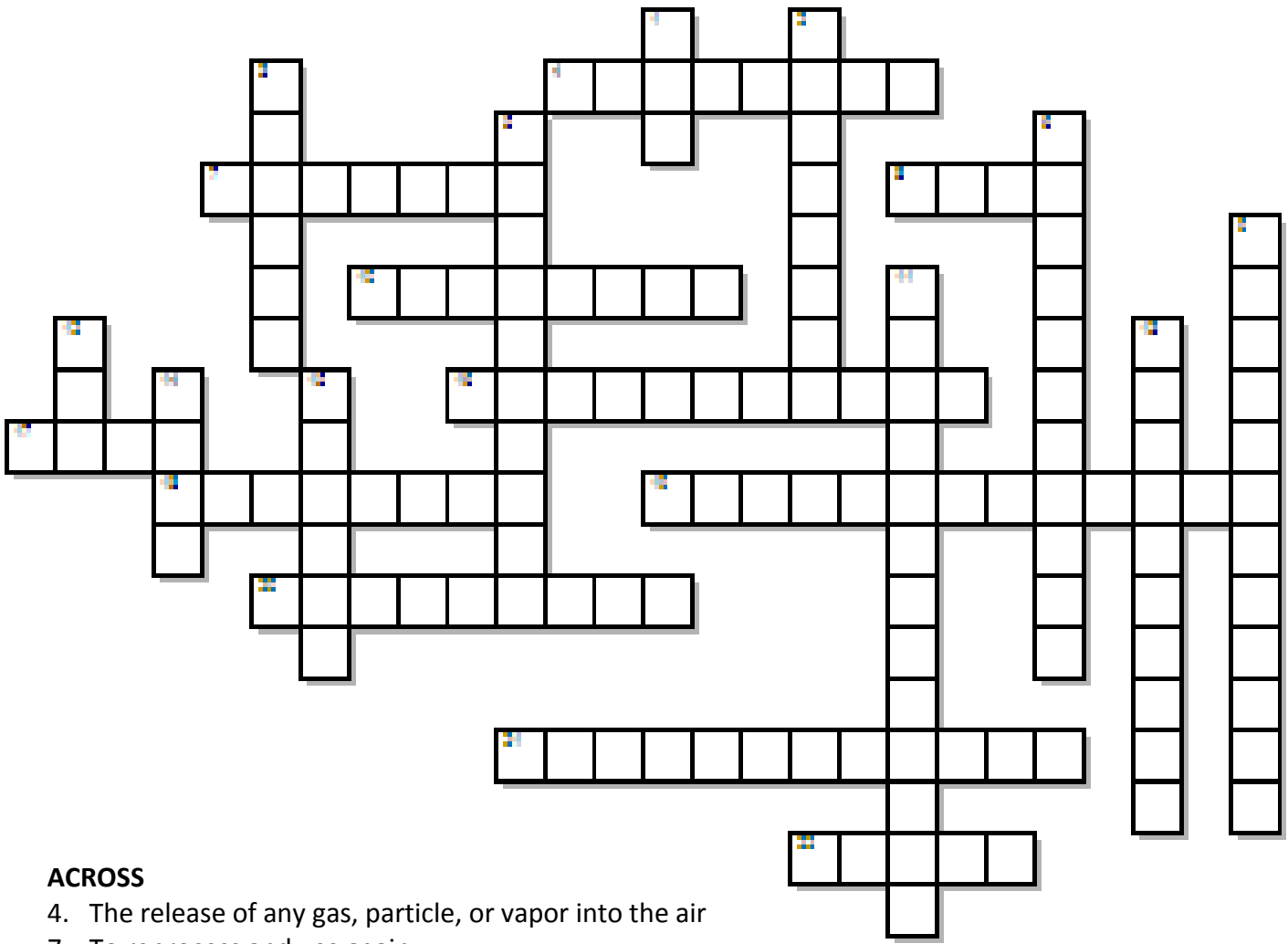
- Solve the fill- in- the-blank clues first, as they are usually the easiest. Then you will have a network of answers from which to work.
- Fill in all the words that you know, and then go back to figure out the words you don't know.
- Solve as many as you can and then start at #1 across and then down.
- Doing crossword puzzles is a good way build a larger vocabulary
- If students get bogged down, they can work in pairs.
- If students need more help, hand out the vocabulary list.

Word List for Crossword Puzzle:

Aluminum
Biodegradable
Cellulose
Coal
Emission
Emitting
Energy
EPA
Fluorescent
Geothermal
Hydrocarbons
Hydroelectric
Kilowatt
Oil

Finally, go over the puzzles as a class, reviewing what words go where.

Clean Energy Puzzle



ACROSS

4. The release of any gas, particle, or vapor into the air
7. To reprocess and use again
8. A black carbon fossilized material
10. Light _____ diode
16. Heating, _____, and air conditioning
17. A unit of electric power
18. An easily recyclable soda can
19. Electricity generated by water power
20. A common type of insulation
21. An appliance that uses the most electricity
22. Powered by the sun

DOWN

1. A fossil fuel
2. 1000 watts
3. Usable heat or power
5. Compact _____ lights
9. The substance, when mixed with methane, produces natural gas
11. Capable of decomposing in nature
12. Environmental Protection Agency
13. To save energy and money, we should install programmable _____.
14. Energy _____ appliances use 10% - 50% less electricity

Lesson # 3 - Clean Energy Jeopardy Game

Materials:

- Jeopardy game board with dollar amounts and categories
- Clean Energy money
- Jeopardy questions / answers

Time to teach: 1.5 hours

Teaching Instructions

Introduce Jeopardy using these steps to guide play:

- Divide the class into teams.
- Determine the order in which members of each team will go up to answer questions.
- Flip a coin to determine which team will get the chance to answer the first question. Make sure each team can see and read the board clearly.
- Give each student / team \$2000 to begin.
- Ask the first member of the chosen team to select a dollar amount from any category.
- Read the question corresponding to the answer.
- Give other teams a chance to answer if the first student cannot provide the correct response.
- If an answer a student gives is incorrect, they pay the amount that question is valued.
- If a student answers correctly, they receive the amount that the question is valued.
- Remove the card from the grid once the question has been answered.
- Play proceeds with each team taking a turn and within each team with students attempting to answer questions in the pre-determined order.
- Play continues until all questions are correctly answered.
- The person/team who has the most money at the end wins the game.

Jeopardy

| Definitions | Energy Savers | Abbreviations | Fuel | Energy Facts | More Definitions |
|-------------|---------------|---------------|-------|--------------|------------------|
| \$100 | \$100 | \$100 | \$100 | \$100 | \$100 |
| \$200 | \$200 | \$200 | \$200 | \$200 | \$200 |
| \$300 | \$300 | \$300 | \$300 | \$300 | \$300 |
| \$400 | \$400 | \$400 | \$400 | \$400 | \$400 |
| \$500 | \$500 | \$500 | \$500 | \$500 | \$500 |

Jeopardy Questions and Answers

| Definitions | Saving Energy | Abbreviations | Fuel | Energy Facts | More Definitions |
|---|---|---|--|--|--|
| <p>\$100</p> <p>Q: Using the sun's rays to produce electricity or heat</p> <p>A: Solar energy</p> | <p>\$100</p> <p>Q: Name 2 things we should recycle</p> <p>A: glass, paper, plastic, cans</p> | <p>\$100</p> <p>Q: CFL</p> <p>A: compact fluorescent light</p> | <p>\$100</p> <p>Q: With which fuel do we cook at home?</p> <p>A: gas, electric</p> | <p>\$100</p> <p>Q: Name 1 kind of insulation</p> <p>A: cellulose, fiberglass, Rockwool, plastic, foam</p> | <p>\$100</p> <p>Q: Systems to harvest electrical power from coastal waves</p> <p>A: tidal wave power</p> |
| <p>\$200</p> <p>Q: Measure of electric power delivered to a customer</p> <p>A: Kilowatt</p> | <p>\$200</p> <p>Q: Why should we install programmable thermostats?</p> <p>A: save energy, save \$\$, improve efficiency</p> | <p>\$200</p> <p>Q: HVAC</p> <p>A: heating, ventilating, air conditioning</p> | <p>\$200 – Q: Name 2 methods of home heating</p> <p>A: oil, solar, coal, electricity, gas, wood</p> | <p>\$200</p> <p>Q: Which appliance uses the most electricity?</p> <p>A: refrigerator, dryer</p> | <p>\$200</p> <p>Q: Usable heat or power</p> <p>A: energy</p> |
| <p>\$300</p> <p>Q: Electricity generated by water;</p> <p>A: hydroelectric power</p> | <p>\$300</p> <p>Q: In which 2 seasons should air filters be changed?</p> <p>A: winter, summer</p> | <p>\$300</p> <p>Q: LED</p> <p>A: light emitting diode</p> | <p>\$300 – Q: A black carbon material formed from fossilized plants and used for fuel</p> <p>A: coal</p> | <p>\$300</p> <p>Q: What do we call 1000 watts?</p> <p>A: kilowatt</p> | <p>\$300</p> <p>Q: Appliances that use 10 – 50% less energy or water are called this.</p> <p>A: Energy Star appliances</p> |
| <p>\$400</p> <p>Q: Capable of decomposing in nature within a short period of time</p> <p>A: biodegradable</p> | <p>\$400</p> <p>Q: Why should we install low flow shower heads?</p> <p>A: lower energy costs, reduce hot water use, reduce consumption</p> | <p>\$400</p> <p>Q: EPA</p> <p>A: environmental protection agency</p> | <p>\$400</p> <p>Q: Name 2 fossil fuels;</p> <p>A: oil, coal, gas</p> | <p>\$400 – Q: Name 2 ways to save money on your electric bill; A: shut off lights, insulate windows and doors, reduce water temperature, reduce AC temperature, lower thermostat</p> | <p>\$400</p> <p>Q: To reprocess and use again</p> <p>A: recycle</p> |
| <p>\$500</p> <p>Q: The release of any gas, particle, or vapor into the environment</p> <p>A: emissions</p> | <p>\$500 DAILY DOUBLE</p> <p>Q: Why should we use LED Christmas lights instead of mini-lights?</p> <p>A: cooler. 1/10th of energy reduces fire risk</p> | <p>\$500 – DAILY DOUBLE – Q: What is the greenhouse effect?</p> <p>A: heating of the atmosphere resulting from the absorption of certain gases of solar energy that has been captured and reradiated by the earth's surface</p> | <p>\$500 – Q: Name 2 kinds of renewable energy; A: wind, water, geothermal, solar, tidal</p> | <p>\$500 – Q: What should we insulate our homes?; A: save energy, improve efficiency, save \$\$</p> | <p>\$500</p> <p>Q: What is a mixture of methane and hydrocarbons used as fuel called?</p> <p>A: natural gas</p> |

Developmental English and College Math Lesson Sequence Examples

Class: ENG 090/ ENG094, Developmental College Writing/ Reading

Program: Greenfield Community College

Introductory Summary

These three lessons were developed for a developmental English class at a community college. English 090/094 is a course designed to help students improve reading study skills for comprehension, vocabulary building and critical reading and thinking. These three lessons build an awareness of climate change and capitalize on the topic in order to develop critical reading and thinking skills, particularly through the use of a close reading of texts (including poetry), comparing and contrasting techniques, group discussion, and writing assignments. These lessons were not developed to be offered one after the other, but to be interspersed across a semester-long course.

The purpose behind the creation of these lessons was to develop the topic of green and renewable energy as a “throughline” of the semester-long course. The throughline was envisioned as one of the primary lenses through which students look as they read. The goal was to have students gain an overall idea of the historical and scientific reasons for the current state of the planet and thus the imperative nature of green energy awareness and implementation. Students will gain critical thinking skills as they delve into material that surrounds issues with pros and cons to each side, making ethical considerations which require them to make the leap from viewing words on a page to becoming active readers (and *active citizens*, which is the hallmark of true powerful literacy).

Lessons:

1. Introductions
2. Power / Blind Spot
3. By the Numbers / Unlimited

Teacher recommendations

- Use of these lessons in an ABE classroom will likely require modifications. ABE teachers may wish to use the materials, but develop appropriate activities for their students. ABE teachers might also find it useful to see lesson from developmental English class as a way to know better how to help their students prepare for and succeed in such courses.
- Lesson #1 builds from activities in *The Literature Workshop* by Sheridan Blau.
<http://www.heinemann.com/products/0540.aspx>
- As Lesson #3 was designed, students were able to select from any of the texts they worked with over the semester to develop their comparative analysis essay. The teacher felt that it would be worthwhile to offer students more structure around clean energy and climate change and any essay that might come out of the texts used in these three lessons.

Lesson #1 - Introductions

Academic Learning Goals –

- Students will practice responding to poetry and sharing their thoughts with the group orally and in writing.

Clean Energy Learning Goals –

- There is not a direct clean energy goal for this lesson. The goal is that students will begin to think about the notions of “real” or “good” work (and what that means to them personally) and about the relationship between beauty and usefulness. There is an implied clean energy goal because clean energy might be considered good work that is timely, useful and beautiful. So, the clean energy goal is subtle, but important: students will begin to articulate what values they hold and to think about those values as they relate to our world and to natural and manmade objects.

Materials:

- Marge Piercy’s poem “To Be of Use”. Available online at The Writer’s Almanac: <http://writersalmanac.publicradio.org/index.php?date=2006/09/04>
- Pen, paper

Time to teach lesson: 1 – 1.5 hours (The length of time to teach depends on the number of students and how much they like to or are willing to speak up in class)

Teaching Instructions

Introduction

This lesson can be used to help students get to know each other better, as well as to begin to articulate their thoughts in writing and help them become comfortable sharing their thoughts in small groups and with the whole class. The teacher can be explicit about these lesson goals, as well as encourage students to read, enjoy, and think about poetry. No prior knowledge of poetry is necessary.

Activities:

1. Ask students to read the poem silently and to read it more than once.
2. After students have read the poem a few times, ask them to “take a line for a walk.” This involves the following:
 - a. Give students 5 minutes to look over the poem and tell them to circle or underline anything that stands out to them or to write notes about any questions or thoughts they have in the margin.
 - b. Ask students to write down one line from the poem that speaks to them or stands out to them for any reason (strong agreement with or disagreement with the line, beautiful language, personal connection, a question they have about something they don’t understand, etc) and proceed to free-write from there, in any direction their thoughts take them.
 - c. Give students about ten or twelve minutes to write.

- d. After that, ask the students to bring their writing to a close.
3. Ask students to count off as a class to form groups of three.
4. In these groups, have students share what they have written. Ask students to read exactly what they have written (so they can get comfortable with this practice and will begin to understand that it is important to articulate thoughts in writing, even informally) but then will tell them they can discuss the poem in their small group after each person has read.
5. During this time, circulate and “eavesdrop” on the conversations (this helps students stay focused) and avoid joining any conversation (this helps foster the idea that there is no “one, right answer,” and that it is their job is to think and talk in class).
6. After students have shared their writing and had a small group discussion, call the group together and ask groups to report out on their sharing.
7. Students may report on whether the group chose similar or different lines, how their discussion went, whether someone else’s ideas helped them see something they had not thought of before. By asking them to reflect and report out on how the group functioned as well as the content gives a slightly different focus to this part of the lesson (rather than have a whole group re-hash of what they just talked about). However, if a group member wants to comment on another member’s writing or on the content of another’s ideas (in a supportive way), encourage that because this is a precursor to critical analysis.

Demonstration of Learning:

Homework: Ask students to respond to the question “What is real work?” This is a low-stakes writing assignment to get students thinking and writing. Collect the work, comment on it, and do not grade it (except as a check to receive credit for doing it). This low stakes writing can serve as a drafts or notes for longer, more polished pieces later in the semester.

Wrap-up:

Helps to keep the conversation on topic by having students group ideas by recording their ideas, responses, metacognitive observations about their group work, etc. on the board.

Lesson #2: Power/ Blind Spot**Academic Learning Goals –**

- Students will practice responding to and analyzing poetry.
- Students will practice note taking.
- Students will understand how one text can be used as a lens for another.

Clean Energy Learning Goals –

- Students will understand how peak oil affects the need for clean energy.
- Students will be able to identify factors that have led to our reliance on fossil fuels and to clearly articulate reasons for the need for alternative energy systems.

Materials:

- Adrienne Rich's poem *Power* available online at: <http://www.poemhunter.com/best-poems/adrienne-rich/power/>
- *Blind Spot: Peak Oil and the Coming Global Crisis*, DVD by Media Education Foundation, available to purchase DVD or streaming rights at: <http://www.mediaed.org/cgi-bin/commerce.cgi?preadd=action&key=147>. *Blind Spot* provides a lot of historical, economic and social commentary and is very straightforward about the dire situation humanity is in because of our addiction to oil.
(Transcript available at: http://www.mediaed.org/assets/products/147/transcript_147.pdf).
Some students may find transcript very helpful.)

Time to teach lesson: 4 hours - This could be two separate lessons, depending how long each class meeting is. The class in which this lesson was piloted met once a week for four hours, so the poem activity occurred before break and the DVD and lens discussion after break.

Teaching Instructions

Activities:

1. Have the class read *Power* aloud. Students might need help with vocabulary, information about Marie Curie and determining what is literally going on in the poem and what Rich's larger message is. In the reading, focus discussion on what power means in various instances and the notion of wounds coming from the same source as power...what that means, if they agree or disagree with the idea, how it can be manifested in their lives.
2. After discussing the poem, introduce the notion of using a text as a lens for looking at another text or piece. Ask students to think about *Power*, and the use of *Power* as a lens, as they watch *Blind Spot*.
3. Show the class *Blind Spot*.
4. Ask students to take notes while they watch the DVD for information about peak oil and some of the challenges the world will face when cheap abundant petroleum is no longer available.
5. Hold a class discussion of *Blind Spot*. The below are possible discussion prompts excerpted from the Media Education Foundation resources:
 - a) Why does the United States need oil? What industries rely heavily on it? What could potentially happen if the world supply of oil was cut off from the U.S.?
 - b) Did you know that Americans make up only 4.5% of the world population? What are your initial thoughts on this statistic? Was it more or less than you thought? How about the levels of consumption in America relative to this population figure? How do you feel about the fact that the U.S. does 30% of the world's private consumption? How do you explain this?
 - c) Americans aren't genetically predisposed to being the world's greatest consumers. How do you think the modern advertising industry and the popular media convince us that consumption is fundamental to human happiness and a normal lifestyle?
 - d) How can we, as a country, reverse the inconvenient truth that global economic growth is depleting the world's natural resources? Is it as simple as convincing everyone to stop shopping? Wouldn't this raise a whole other set of problems by crashing the economy and costing waves of job losses among people who own and work in stores, and countless jobs

beyond? What kinds of solutions do you see to these kinds of huge, seemingly mind-boggling problems? What solutions does the film seem to point to? And beyond changes at the systemic and institutional level, what do you think you can do *personally* to effect positive social change?

Guide the class discussion back to *Power* and focus on Rich's question in the context of peak oil: Can we deny that our "wounds" come from the same source as our power with regard to peak oil?

Through class discussion of *Blind Spot* and *Power* and facilitation, help students come to see and examine the relationship between the two, and note how the poem can be looked at as a lens for the information about peak oil.

Demonstration of Learning:

Homework: Ask students to write a response to *Power* and *Blind Spot* together and to articulate in writing how the poem acts as a lens for the DVD. This too is a low-stakes writing assignment to get students thinking and writing. It can be collected, commented on, but not graded (except as a check to receive credit for doing it). Looks to see if and how the student is using one text to help explain another text, or how they are see the two pieces relating to each other – in this way it can be a diagnostic tool to inform further instruction.

Wrap-up:

Instructor reflects with students so that they can see that they are engaging in literary critical analysis when they talk about the texts this way.

Lesson #3: By the Numbers/ Unlimited

Academic Learning Goals –

- Students will learn the components and structure of a successful comparative analysis essay.
- Students will know the terms: frame of reference, grounds for comparison, thesis and decide on using a text by text or a point by point structure for their argument.
- Students will write a compare/contrast essay based on two texts (including written or media materials).

Clean Energy Learning Goals –

- Students gain more specific information about the levels of carbon and methane in the world and how green energy techniques can help by not contributing more to the problem.
- Students will be able to identify positive feedbacks that are causing global warming to increase due to rising carbon dioxide levels and methane spikes.
- Students will be able to identify various forms of clean energy: solar, wind and water turbine, geothermal, biomass and articulate positive attributes of each.
- Students are becoming familiar with green energy vocabulary and terms.

Materials:

- YouTube video: *The Twin Sides of the Fossil Fuel Coin*.
<http://www.youtube.com/watch?v=lna16XSJQvM> This video is used to broaden student understanding of the issue of climate change. It is not very hopeful, but it is radical, which can make for an interesting discussion.
- YouTube video: *Unlimited: Renewable Energy in the 21st Century*
<http://www.youtube.com/watch?v=1UoK-IPfXMw> This video, while mentioning the need for immediate global action for this global problem, focuses more on what is being done and what can be done to address the situation and also does a good job of introducing information about alternate forms of generating energy.
- *How to Write a Comparative Analysis*, Kerry Walk, for the Harvard Writing Center,
<http://www.fas.harvard.edu/~wricntr/documents/CompAnalysis.html>

Time to teach lesson: 4 hours (This could be two or three separate lessons, depending how long each class meeting is. The class in which this lesson was taught met once a week for four hours; *The Twin Sides of the Fossil Fuel Coin* part of the lesson happened before the break and *Unlimited: Renewable Energy in the 21st Century* and comparative analysis essay format discussion happened after break.)

Teaching Instructions**Introduction:**

Introduce this lesson by explaining that students will watch two videos, take notes and discuss each separately and together. Then, as a group, they will come up with a structure that might be used for a comparative analysis essay about these two films, including similarities and differences, about what each offers and delivers as far as information, attitude, etc. Students will be using these “texts” to generate a whole class, in-class model of a comparative analysis essay.

Let students know that they are likely to be required to do a comparative analysis or a compare/contrast essay during their college career.

Activities:

1. Show the class *The Twin Sides of the Fossil Fuel Coin* video. The video may need to be paused to talk over some of the information (for example, when this lesson was piloted, students needed help understanding what two to four degrees Celsius means in Fahrenheit, and needed some clarity on “positive feedbacks” and that they aren’t always a good [positive] thing).
2. Show the class *Unlimited: Renewable Energy in the 21st Century*.
3. Have the class read together *How to Write a Comparative Analysis*.
4. After reading and discussing the above, have the class plan out an essay using the two “texts.” Students can easily list and discuss ways that the pieces are different (and somewhat the same), but the emphasis in the discussion is on the frame of reference, the grounds for comparison and the thesis.

Demonstration of Learning:

Students are asked to select pieces from the text of their own choosing about which to write a comparative analysis essay and write the essay as a homework assignment.

Class: Introduction to Algebra (MAT 105)

Program: Greenfield Community College

Introductory Summary

These clean energy math problems were developed for a college level Introduction to Algebra course (MAT 105). While most may be too advanced for a GED class, they may be appropriate for a college transition or bridge level class. They offer teachers and students a glimpse into the kinds of math that students will encounter in college. Teachers can extract the clean energy content for more basic problems and scaffold lessons that build the conceptual, and perhaps computational, skills needed for tackling these types of problems.

The teacher found that students responded enthusiastically to the practical content of the problems, but found the math difficult. They were engaged with comparing costs of different light bulbs (# 1) lesson, but some found the calculations with decimal numbers difficult. The refrigerator lesson (# 5) was not as successful because it required research out of class.

Teacher Recommendations

While clean energy concepts explored here are laden with calculations, the teacher recommends that before introducing the mathematical approach, introduce the content more conceptually and then guide students slowly and methodically through the calculation steps. Then have students work in pairs or small groups.

CLEAN ENERGY PROBLEM #1



An energy saving light bulb costs \$3.00 and has a lifespan of about 10,000 hours



An incandescent light bulb costs about \$0.50 and lasts about 1000 hours

The energy saving bulb uses 13 watts of electricity while the incandescent bulb uses 60 watts. The illumination from both bulbs is the same.

The national average cost per kilowatt-hour for residential use was \$0.1103 for January 2011.

1 kilowatt-hour is 1000 watt-hours and 60 watt bulb will consume during 1 hour - 60 watt-hours of electricity. Then $60/1000=0.06$ x the price of 1 kilowatt-hour (\$0.1103).

1 kilowatt-hour is 1000 watt-hours and 13 watt bulb will consume during 1 hour - 13 watt-hours of electricity. Then $13/1000=0.013$ x the price of 1 kilowatt-hour (\$0.1103).

Question:

Which bulb costs less to use for 1 year if it is used daily for 8 hours a day?

How much money would you save using the bulb that costs less to use?

Answer:

To run a bulb 8 hour a day for a year is $8 \times 365 = 2920$

The incandescent bulb is $.06 \times .1103 = .006618$ per hour

$.006618 \times 2920 \text{ hours} = 19.32456 + 1.5$ (the cost of 3 bulbs) $= 20.82456$

The energy saving bulb is $.013 \times .1103 = .0014339$ per hour

$.0014339 \times 2920 = 4.186988 + 3.0$ (the cost of 1 bulb) $= 7.186988$

Savings $= 20.82456 - 7.186988 = 13.637572$

An incandescent cost about \$20.82 a year an energy saving bulb cost about \$7.19 a year and the difference is about \$13.64 less to use incandescent bulbs

Did You Know?

If every American home replaced just one light bulb with a light bulb that's earned the ENERGY STAR, we would save enough energy to light 3 million homes for a year, save about \$600 million in annual energy costs, and prevent 9 billion pounds of greenhouse gas emissions per year, equivalent to those from about 800,000 cars.

CLEAN ENERGY PROBLEM #2

Energy Calculations

Although energy can be measured in watts, energy is usually measured in kilowatts, especially in electricity bills. 1 Kw = 1000 watts

If watts are given, and you need to convert to **kW**, divide by _____1000_____.

If minutes are given, and you need to convert to **hours**, divide by ____60_____.

Remember to:

- Show Formula
- Show Calculation (include units)
- Final answer (include units)

Example

Your coffee maker has a power rating of 1900 W and is used for 2 hours per day.

How much energy does it take to make the morning coffee?

If 1 kWh of electricity cost \$0.15 in Greenfield, how much did it cost to use the coffee machine mentioned in the above problem?



CLEAN ENERGY PROBLEM #3

Show your work (including formula and units) when doing the calculations.

For this assignment, energy should be calculated in **kWh**, meaning you have to convert W to **kW** and minutes to **hours**!

FORMULA BOX :

$$E = P \times t$$

$$\text{Total cost} = \text{Energy} \times \text{Price}$$



Your dishwasher has a power rating of 2300 W and has been running for 45 minutes. How much energy has been used?

At \$0.15 / Kwh how much would that cost to run the dishwasher for 45 min?

CLEAN ENERGY PROBLEM #4



My daughter runs a hair dryer every day for 5 minutes. It takes me 5 minutes to dry my hair every morning as well. Neither my son nor my wife uses a hair dryer. Whew. That's a relief.

a) If the hair dryer uses 2500 watts of power, how much energy is used?

b) At \$0.15 per Kwh, how much does that cost on a monthly basis (use 30 days/ month)?

CLEAN ENERGY PROBLEM #5



Here's a cool question.

I have an older refrigerator. It uses 700 watts of electricity every hour it is working. When I go on vacation for 2 weeks (14 days) each year, would it be worth it if I unplugged the refrigerator and emptied it out for those 2 weeks? Would I actually save any reasonable amount of money in electric costs?

At \$0.15 per Kwh how much would I save?

CLEAN ENERGY PROBLEM #6



The last question really got me thinking. If I was on vacation for 2 weeks (14 days) would it save money if I cut the power to my Hot Water Heater for that time period? Would the savings be enough to make a difference in my electric bill?

Use \$0.15 per Kwh in your calculations.

My Electric water heater has an EF - energy factor of .90

| Electric water heater and energy factor | | | |
|---|---------|---------------------|--|
| EF Energy factor | Gallons | Typical yearly cost | EF or energy factor for electric water heater is higher than gas water heater since element is immersed in water and full heating goes into water. No waste goes up flue stack as in gas water heater. However gas delivers more BTUs faster than electric. |
| .95 | 40-50 | \$492 | |
| .93 | 40-50 | \$503 | |
| .90 | 40-50 | \$520 | |
| .88 | 60 | \$531 | |

CLEAN ENERGY PROBLEM #7

How much can I save annually if I stop the Ghost power drain from my major appliances in my home? That's a good question.

Let's look at my Microwave oven first. What would I save yearly if I unplugged my Microwave oven when not in use?



Power usage for a microwave oven:

| Product/Mode | Average(W) | Min(W) | Max (W) |
|--------------------|------------|--------|---------|
| Ready, door closed | 3.08 | 1.4 | 4.9 |
| Ready, door open | 25.79 | 1.6 | 39 |
| Cooking | 1433 | 966.2 | 1723 |

CLEAN ENERGY PROBLEM #8

Let's examine my desktop computer with a LED monitor. My wife is always asking me to shut it off at night and I like to keep it running so I don't have to boot it up every morning. Am I really wasting money? Examine the chart below to see how much it is really costing me to keep my computer and monitor running 24/7?

| Product/Mode | Average (W) | Min (W) | Max (W) |
|------------------------------|-------------|---------|---------|
| Computer Display, LCD | | | |
| Off | 1.13 | 0.31 | 3.5 |
| On | 27.61 | 1.9 | 55.48 |
| Sleep | 1.38 | 0.37 | 7.8 |
| Computer, desktop | | | |
| On, idle | 73.97 | 27.5 | 180.83 |
| Off | 2.84 | 0 | 9.21 |
| Sleep | 21.13 | 1.1 | 83.3 |

CLEAN ENERGY PROBLEM #9

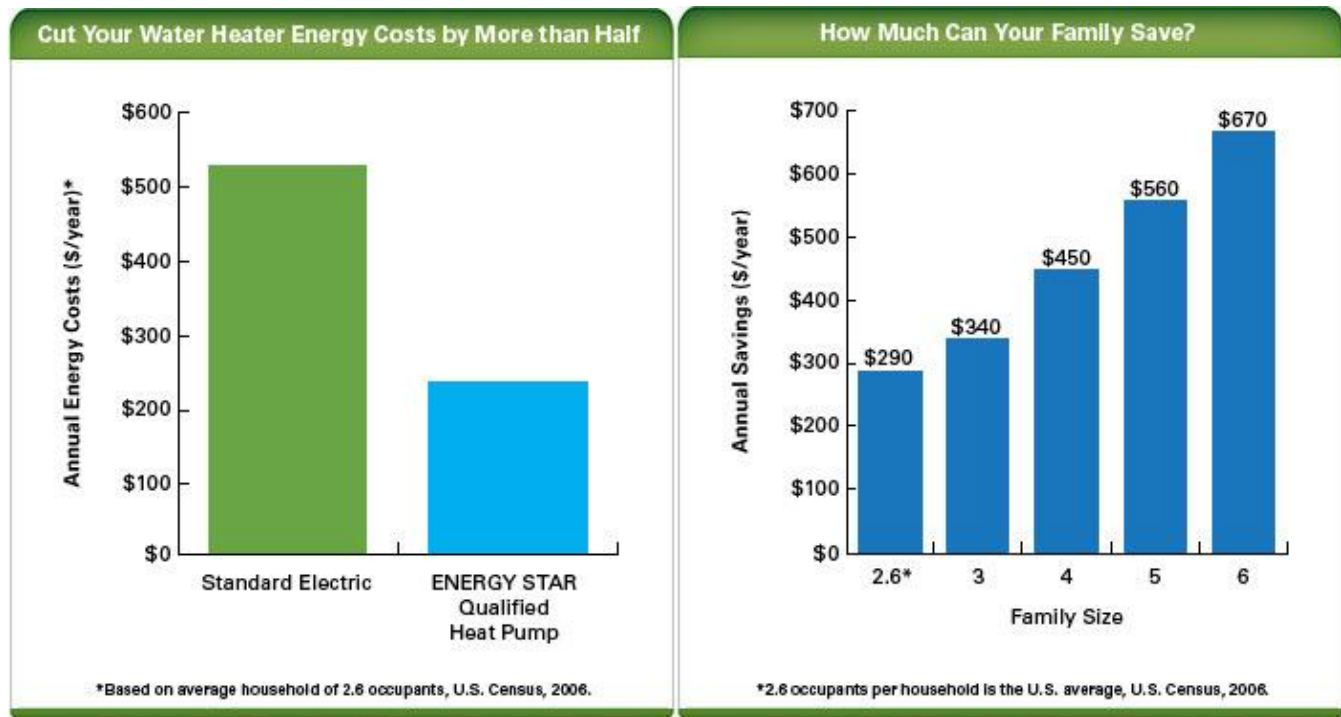
How much does it cost me annually to leave my television plugged in when I'm not using it? Refer to the chart below to help you with your calculations. Use the average data to get the best result.

| Television/VCR | Average(W) | Min (W) | Max (W) |
|----------------|------------|---------|---------|
| Off by remote | 5.15 | 2.15 | 13.3 |
| Off by switch | 5.99 | 2.15 | 13.11 |



CLEAN ENERGY PROBLEM #10

If I was to replace my 40 gal electric water heater in the near future, what would be my best bet to meet the needs of my family of 4 people? Use the data below to support your choice.



Big savings. ENERGY STAR qualified heat pump water heaters can save the average household almost \$300 per year on its electric bills compared to a standard electric water heater. That's enough money to go on a weekend getaway every year. Larger families — that typically use more hot water — will save even more!

A smart investment. While a qualified heat pump water heater costs more upfront, the savings will pay back the difference in about three years. Replace your aging electric water heater before it fails, and start enjoying the savings right away.

A purchase that protects the environment. If everyone buying an electric water heater this year chose an ENERGY STAR qualified heat pump model instead of a standard model, we would avoid 19.6 billion pounds of carbon dioxide emissions. That's the equivalent of taking 1.6 million cars off the road.

| Water Heater Type | Fuel Source | Efficiency (EF) | Installed Cost | Tax Credits | Yearly Energy Costs | Expected Life (years) | Yearly Cost to Operate* |
|--------------------|--------------|-----------------|----------------|-------------|---------------------|-----------------------|-------------------------|
| Heat Pump Electric | Electric | 2.35 | \$1999 | \$600 | \$159 | 12 | \$275 |
| Solar w/electric | Sun/Electric | 3.0 | \$6499 | \$5440 | \$175 | 15 | \$245 |
| Tankless Hybrid | Gas | .98 | \$2599 | \$780 | \$254 | 20 | \$345 |
| Natural Gas | Gas | .62 | \$715 | \$75** | \$323 | 10 | \$387 |
| Electric | Electric | .92 | \$649 | \$0 | \$450 | 8 | \$531 |

CLEAN ENERGY PROBLEM #11

In most homes the refrigerator is the second-largest user of electricity (13.7%), right after the air conditioner (16%). With most appliances you save energy by using them less, but you can't very well do that with your fridge. The main way to save money with your fridge is to use an efficient model. New fridges aren't just a little more efficient, they're *incredibly* more efficient. A 1986-era 18 c.f. fridge uses **1400 kWh** a year, while a modern energy-efficient model uses only **350 kWh** -- a whopping 75% reduction. At 11¢ kWh, trading in a pre-1986 fridge for a new efficient one would save hundreds a year in electricity costs. And some older fridges are even worse than the average.

The challenge:

1. Identify your refrigerator by make and model. The Tag should be somewhere inside your refrigerator on the sidewall.
2. Visit the *Energy Star* website with you Refrigerator's serial Number in hand to find out how much energy it uses yearly. <http://www.energystar.gov/index.cfm?fuseaction=refrig.calculator>
3. Use this chart to estimate the amount of money you can save annually, with a newer, more energy efficient refrigerator.

| A 22 cubic foot fridge made in this year... | Uses about this much energy... | Replacing with a 2001+ model saves: | Replacing with a 2008+Energy Star model saves: | Replacing with a CEE Tier 3 model saves: |
|--|---------------------------------------|--|---|---|
| 1987-89 | 1150 kWh | \$83 / yr. | \$101 / yr. | \$110 / yr. |
| 1990-92 | 1100 kWh | \$73 / yr. | \$92 / yr. | \$101 / yr. |
| 1993-00 | 850 kWh | \$37 / yr. | \$55 / yr. | \$64 / yr. |
| 2001-2010 | 600 kWh | - | \$18 / yr. | \$28 / yr. |
| 2001-2004 Energy Star (10%+ better) | 550 kWh | - | \$9 / yr. | \$18 / yr. |
| 2004-2008 Energy Star (15%+ better) | 525 kWh | - | \$5 / yr. | \$14 / yr. |
| 2008-2010 Energy Star (20%+ better) | 500 kWh | - | - | \$9 / yr. |
| CEE Tier 3 (30%+better) | 425 kWh | - | - | |

Now find a new model that could offer savings over your current model.

<http://appliancecalculator.stanford.edu/>

Once you price out the cost of a new energy efficient refrigerator you can go to this website to calculate your savings per year and also figure out the time in years to recoup you cost for the new refrigerator: <http://michaelbluejay.com/electricity/refrigerators.html>

Now summarize your findings in a few complete sentences. Is it worth replacing your present refrigerator and what would be the savings in energy usage, in dollars and cents and in environmental impact?

For more information on refrigerator efficiency and the Energy Start program:

http://www.energystar.gov/index.cfm?c=refrig.pr_best_practices_refrigerators

Other Approaches from ABE Clean Energy Ambassadors

Bristol Community College, Center for Adult Basic Education and Workplace Literacy

A GED teacher and Career Advisor/Technology Instructor teamed up to lead a series of lessons and activities. Their goals were to give students the conceptual and vocabulary tools to be able discuss the controversy surrounding the economic, environmental, and public health issues related to nuclear power, natural gas fracking, and waste-to-energy trash incineration. The lessons developed vocabulary and computer/Internet skills while also exposing students to relevant science topics they might encounter on the GED.

The teachers used a broad range of activities, media, and resources, including: lessons from the National Energy Education Development Project (NEED); guest speakers; a field trip to a clean energy business; NESEA's Building Energy conference; video; and news stories.

Examples of materials used:

- Huffington Post: "Don't Frack Illinois; http://www.huffingtonpost.com/tony-ingraffea/dont-frack-illinois_b_3009249.html
- New York Times: As Fracking Proliferates, So Do Wastewater Wells; <http://www.nytimes.com/2013/03/29/us/wastewater-disposal-wells-proliferate-along-with-fracking.html?pagewanted=all>
- Hydrofracking Fact and Fiction: What You Need to Know About the Controversial Practice; <http://www.policymic.com/articles/10408/hydrofracking-fact-and-fiction-what-you-need-to-know-about-the-controversial-practice>

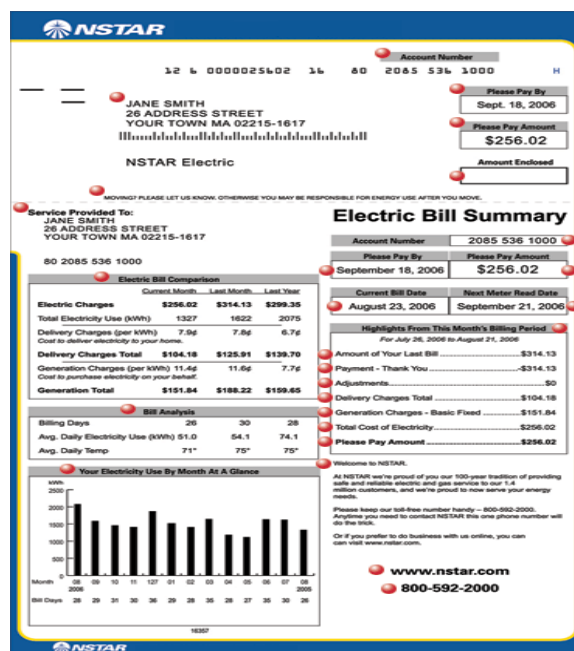
The students were interested and engaged and came to see that clean energy affects us all and is worth our concern. Many of the students had experiences of living in other parts of the world and were able to provide perspectives and insights for how energy is used differently. They also discovered that there are job opportunities available in renewable energy, energy efficiency and green building.

Quinsigamond Community College, Adult Community Learning Center

A GED teacher introduced the topic of clean energy, using question prompts, such as: What is clean energy? Why is it important? How does it impact our lives? What are the career opportunities in the field? Students used an internet search to find the answers to these questions and compared them to their earlier brainstormed answers. Following lessons from NEED, the students visited the college library and learned how to use library resources and search tools to find books related to the topic of clean energy.

Cape Cod Community College ACCESS Program

One ESOL teacher shared her utility bills with her class. Using the charts and graphs that appear on the bill, students were able to practice their information interpretation skills. In addition, students discovered that their utility bills were significantly higher than the teacher's. She was able to share utility bills from different times (prior to installing Energy Star appliances, before and after her son went to college, etc.). The bills clearly showed the effects of what increased energy conservation can do. This developed into a rich ongoing discussion about energy conservation strategies and approaches that students have taken to heart.



From nstar.com

Another ESOL teacher taught an arc of three lessons that built students' clean energy vocabulary, familiarized them with the issue of global warming, looked at energy sources around the world (*Who's Got What?* http://www.sciencemuseum.org.uk/onlinestuff/games/whos_got_what.aspx) and culminated with an introduced to job opportunities in the clean energy economy (YouTube video *Renewable Energy*, by IntoCareers <http://www.youtube.com/watch?v=p5CJpxHQwHw>). Throughout the lessons, these ESOL students practiced grammar, explained ideas using vocabulary, and expressed opinions about the clean energy content they were enthusiastically learning.