

7.4 SIEMENS: LEADING THE WAY TOWARD A LOW CARBON ECONOMY

? FOCUS QUESTIONS:

- What is carbon sustainability? What part do humans play in the carbon cycle?
- How is the global community, specifically Germany, addressing carbon sustainability?
- What part are individual countries taking on to address this issue?
- How is sustainability addressed within the private sector?
- What choices can the individual make to further help carbon sustainability?

STANDARD #3 PEOPLE, PLACES AND ENVIRONMENTS.

STANDARD #7 PRODUCTION, DISTRIBUTION AND CONSUMPTION.

STANDARD #8 SCIENCE, TECHNOLOGY AND SOCIETY.

STANDARD #9 GLOBAL CONNECTIONS.

LESSON OVERVIEW:

This lesson focuses on understanding the carbon cycle and its impact on the global environment and economy. During the lesson students will engage in a variety of learning activities including focused reading, viewing, discussion, research and multi-media creation. The lesson is designed to incorporate cross-curricular learning opportunities by including common core learning targets across the contents. Additionally, the modular design of the lesson allows teachers to tailor the inquiry experience based on student population, specific district/state learning targets, and time constraints.

An option included within this lesson is a final project/portfolio in the form of a student-created website. The website project could be done individually, with a partner, or in a small group. The website would be a multi-media creation that would incorporate graphics, writing, and video. Over the course of the lesson, the website project is distributed into smaller assignments to be completed at the end of individual activities.

While the lesson activities include printable hand-outs and think sheets for students, these were created to be easily transferable into individual student notebooks or folders. Additionally, each video featured in the lesson includes viewing/discussion questions that could be used for notebook reflection. Using a notebook rather than handout



approach coincides with the lesson's purpose of highlighting how to reduce carbon emissions by reducing paper use and also creates a record of student learning that can be referred to throughout the lesson and school year. Please note that due to the extended timeline for this lesson and the structure of multiple activities, the format of this lesson differs slightly from others in this book.

TEACHER BACKGROUND INFORMATION:

Germany is in the midst of transforming itself from a fossil fuel dependent greenhouse gas producer to an international sustainability pioneer by decarbonizing its energy supplies. The term used by Germans for this process is *Energiewende* (Energy Transition) and has become synonymous with the current push for low carbon renewable energy sources throughout Germany. The speed at which this transition has taken place is demonstrated through the following comparison: at the turn of the 21st century the United States actually generated more of its electricity from renewables than Germany, 8% versus 6% respectively. By 2012 Germany had leap-frogged the United States' 11% share, generating a robust 25% of its energy from renewable resources¹. Most experts point to the Renewable Energy Act of 2000 (Erneuerbare-Energien-Gesetz, EEG) as the catalyst that led to the latest series of energy transition efforts in Germany. Despite initial opposition from conservative officials, the aspects of the law that protect private investments, including the guaranteed feed-in tariffs and grid connection requirement, caused farmers and private citizens to back the bill and thus in the end, convinced conservative members in the *Bundestag* to throw their support behind it. That is, once farmers realized that the law allowed them to produce and sell their own power at a guaranteed price-point with a cheaper buy-back rate, they exercised additional pressure on their elected representatives. Thus, the *Energiewende* has signaled a paradigm shift in both the citizenry, who now expects to have a say and take an active role in energy production, and in the new corporate approach that moves from the "take, make, waste" model toward a renewable, cyclical, waste-free and benign system based on resource productivity in which fewer emissions and waste equals more profit. Moreover, data collected in Germany over a ten-year-period points to the overall initial success of the *Energiewende*, specifically in that from 1991 to 2011 Germany's GDP was up 27% while greenhouse gas emissions dropped 24%.² In all, the fact that Germany, a highly developed democratic industrial power, has managed to shrink its carbon footprint while simultaneously increasing its GDP not only reinforces the efficacy of the policy on the domestic front, but it also serves as an example for other developed nations across the globe that are ripe for an energy transition of their own.

Sources:

- 1 Independent Statistics and Analysis (n.d.). Germany. U.S. Energy Information Administration. Retrieved May 6, 2013, from <http://www.eia.gov/countries/country-data.cfm?fips=gm>.
- 2 Morris, Craig, Pehnt, Martin (2012, November 28). Energy Transition: The German Energiewende. Heinrich Böll Stiftung. Retrieved May 6, 2013, from <http://energytransition.de/wp-content/themes/boell/pdf/German-Energy-Transition-KF.pdf>.

TIME:



Depending on level of participation (1-5) Weeks

INSTRUCTIONAL RESOURCES:

- Photograph Handout (**Handout 7.4.1 on Instructional Resource Disc**)
- Video: What's the Deal with Carbon: <http://www.youtube.com/watch?v=2Jp1D1dzxj8>
- Video: NASA: Keeping up with Carbon: <http://www.youtube.com/watch?v=HrIr3xDhQ0E>
- "What's the Deal with Carbon?" Exit Card Handout (**Handout 7.4.2 on Instructional Resource Disc**)
- Video: Infographic of Information: <http://www.youtube.com/watch?v=6-qbf5IsFH0>
- Video: Keynote speech at International WBGU Symposium : <http://www.wbgu.de/en/symposium-2012/>
- Keynote Transcript: http://www.bundestkanzlerin.de/ContentArchiv/EN/Archiv17/Reden/2012/2012-05-09-rede-wbgu-symposium_en.html





- Video: What is German Energiewende?: <http://www.youtube.com/watch?v=NBx493I0W7k>
- A Global Issue: International Efforts to Create a Low Carbon Economy Handout (**Handout 7.4.3 on Instructional Resource Disc**)



- The Energy Transition- The German Energiewende: <http://energytransition.de/>
- Building a Carbon-Neutral Paradise: <http://www.popsci.com/science/article/2009-06/nine-worlds-most-promising-carbon-neutral-communities>



- Building a Carbon-Neutral Paradise: Reading and Reflection Handout (**Handout 7.4.4 on Instructional Resource Disc**)
- Video: Spongebob Square Pants in The Endless Summer : <http://www.youtube.com/watch?v=xlkprv-Upco>
- Sustainable Business Models Handout (**Handout 7.4.5 on Instructional Resource Disc**)
- Siemens Corporation PowerPoint (**PowerPoint 7.4.6 on Instructional Resource Disc**)



- Business Letter Template (**Handout 7.4.7 on Instructional Resource Disc**)
- Video: President Obama Visits Siemens: <http://www.youtube.com/watch?v=vdJskk8Z3us>
- Video: Michael Bloomberg – Taking the Lead on Global Warming: <http://www.youtube.com/watch?v=QscMMQgBdI>



- Video: Governor Christie on Climate Change: <http://www.youtube.com/watch?v=uPxDnb2-aVI>
- Video: President Obama’s 2013 Inaugural Address: A Call to Action on Climate Change: <http://www.youtube.com/watch?v=b3zuiGeG0JA>



- Renewable Ripple Handout (**Handout 7.4.8 on Instructional Resource Disc**)
- Video: Germany’s Green Revolution: <http://video.pbs.org/video/2326679795/>
- Local Sustainability Plan Comparison Handout (**Handout 7.4.9 on Instructional Resource Disc**)



- Creately Blog: <http://creately.com/blog/examples/storyboard-templates-creately/#Storyboard>
- Video: Siemens: The Next Big Step: <http://www.youtube.com/watch?v=sfQZWinj1Sc>
- PSA Plan Exit Slip Handout (**Handout 7.4.10 on Instructional Resource Disc**)

- EcoGuru Results Handout (**Handout 7.4.11 on Instructional Resource Disc**)
- Smart Notebook computer program (optional)
- Student notebooks or folders

**PROCEDURE:****Activity 1: Photograph Sort and Carbon Cycle Introduction****Estimated Time:** 45 minutes

Purpose: Introduce students to the carbon cycle and begin to generate thought around high and low carbon processes. This activity sets the stage for future activities as students look at sustainability as a global issue.

Divide the class into small groups (3-5 students per group). Each group will be given the Photograph Handout (**Handout 7.4.1 on Instructional Resource Disc**) with various photographs depicting different levels of energy use. Direct the groups to sort the photographs into categories of their choice. Once groups have completed the sort, have groups share the categories they used, making a master list of categories on the board.

Students will watch the videos “What’s the Deal with Carbon” and Nathaniel Manning’s TED talk video “The Carbon Cycle”. The teacher should have the students consider the following questions for purposeful viewing or follow-up discussion: able format.

- What was the original carbon cycle system?
- How have humans changed the system?
- What impact does our involvement in the system have on the environment?

After the video and any further discussion, students will re-sort the photographs through a two-step process. First, students will decide if each photograph is an example of generating energy or using energy. Second, students will further sort into sub-categories determining if each example is a high-carbon process or low-carbon process (the end result will be four categories).

After the final sorting activity, the teacher should lead a class discussion by asking students to think of what photographs they would take from their everyday experience to show local examples of both high- and low-carbon processes.

The teacher should distribute the “What’s the Deal with Carbon?” Exit Card Handout (**Handout 7.4.2 on Instructional Resource Disc**) for a formative assessment to check student understanding of the carbon cycle and the human impact.

Web Extension: Students should create an infographic (a pictorial graph that incorporates graphics and data together to help clarify meaning) depicting the human impact on the carbon cycle. Infographics should depict both the carbon generators and eliminators. (Some ideas might include common products students use and how much carbon these produce, comparing different versions of products and their carbon output, or looking at carbon output of different lifestyle habits.) As students create their infographics they should refer to the internet to collect necessary data. One helpful site for determining carbon outputs of common household appliances is <http://energy.gov>.

Teachers might want to show the video “Infographic of Infographics”, Infogr.am is a website that is designed to help create these great learning tools.

Activity 2: Transition into Carbon Sustainability as a Global Problem

Estimated Time: 30 minutes

Purpose: Help students connect their newly acquired carbon cycle knowledge into a global environmental issue related to global warming and climate change.

Students should watch the keynote speech by Angela Merkel given at the International WBGU Symposium on May 9, 2012. The teacher should have the students consider the following questions for purposeful viewing or follow-up discussion:

- Why does Chancellor Merkel think that belief in global warming is not a prerequisite for supporting the switch to renewable energy and energy efficiencies?
- According to the chancellor, what role does innovation play in Germany’s desire to keep pace in the emerging low carbon economy?
- Would you say Chancellor Merkel is optimistic or pessimistic about a low carbon future? Explain your answer.

An alternative option would be to use the “Transcript of the Keynote”: for using the keynote speech as a reading assignment rather than a viewing assignment. Use the same focus questions from above.

Activity 3: International Environmental Plans Case Study

Estimated Time: 2 (45-minute) class periods

Purpose: Highlight efforts being made around the globe related to sustainability and reducing carbon outputs.

Students will watch the video “What is the German Energiewende?” to introduce the idea of a national environmental plan. The teacher should have the students consider the following questions for purposeful viewing or follow-up discussion:

- What is significant about Germany’s energy plan?
- How does the plan incorporate the efforts of the individual?

For The High School Level: After the video, the teacher should distribute the Global Issue: International Efforts to Create a Low Carbon Economy Handout (**Handout 7.4.3 on Instructional Resource Disc**). Referring to the website: The Energy Transition: The German Energiewende, the class should work together to complete the first row on the Handout as a model for future case studies.

After using Germany as a model, divide class into pairs to complete a jigsaw case study for additional countries. Each pair should choose a country to research and have students read to complete the 2nd row of the Handout. Once the pair has completed their assigned study, they should meet with other pairs to fill in the rest of their chart.

Once charts are complete, the teacher should lead a discussion to compare the different plans that are in place creating a master list of observations. Students should then write a paragraph on the topic of which country they would want to be part of based on their current environmental policy. (Paragraphs can be done as individuals or with partners depending on the class.)

Web Extension: Students should expand their paragraphs into opinion essays. The subject of their essay should be one of the following:

- In your opinion, which country has the best environmental policy currently in place?
- In your opinion, what considerations need to be taken into account while creating a national environmental policy?
- In your opinion, why should a country create an environmental policy?

Finally, essays should include the following (refer to appropriate grade-level writing standards):

- An introductory paragraph introducing the topic and student’s opinion.
- Three supporting body paragraphs detailing three separate reasons for the above opinion.
- A conclusion paragraph restating the topic and student’s opinion.

For The Middle School Level: After the video, students should access the online article “Building a Carbon Neutral Paradise”. The teacher should distribute the reading guide, Building a Carbon-Neutral Paradise: Reading and Reflection Handout (**Handout 7.4.4 on Instructional Resource Disc**). As a class, model the reading strategy by reading and responding to the introduction together. In pairs or individually (depending on class and/or computer access) students should continue through the slide show by accessing separate case studies. Students should continue to record their notes (teachers can decide whether or not students need a target number for how many ideas to record in the chart).

Web Extension: Students should expand their paragraphs into opinion essays. The subject of their essay should be one of the following:

- In your opinion, which country has the best environmental policy currently in place?
- In your opinion, what considerations need to be taken into account while creating a national environmental policy?
- In your opinion, why should a country create an environmental policy?

Finally, essays should include the following (refer to appropriate grade-level writing standards):

- An introductory paragraph introducing the topic and student’s opinion.
- Three supporting body paragraphs detailing three separate reasons for the above opinion.
- A conclusion paragraph restating the topic and student’s opinion.

Activity 4: International Environmental Plans Case Study – Private Sector

Estimated Time: 2 – 4 (45-minute) Class Periods

Purpose: Take a critical look at how the private sector is responding to climate change and their efforts in carbon neutral practices.

Students will watch “Spongebob Squarepants in The Endless Summer” video clip. The teacher should have the students consider the following questions for purposeful viewing or follow-up discussion:

- Describe the business model used by Mr. Krabs.
- What are the obvious environmental and human impacts of this model?
- Is this model being practiced outside of this video clip? Is this sustainable?

After the video and discussion, the teacher should distribute the Sustainable Business Models Handout (**Handout 7.4.5 on Instructional Resource Disc**) and guide students through the multi-media PowerPoint featuring the Siemens Corporation (**PowerPoint 7.4.6 on Instructional Resource Disc**) and its current sustainability efforts as a best practices model of what to look for when researching companies. Discuss as a class the company’s sustainability plan and ask students to list specific examples on their handout. The handout has students consider the company’s environmental plan in terms of not only how they decrease the carbon output of the supplies they produce, but also how they reduce demand for products that generate carbon. Additionally, students take note of specific environmental outcomes of the company’s sustainability efforts.

Once the model is completed, with a partner or individually, the student will research a company of their choice – focusing specifically on that company’s sustainability plan. Next, students should meet with each other to discuss what was discovered about individual businesses while filling in the last row.

After the charts are complete, the teacher should lead a discussion to compare the different business plans that are in place by creating a master list of observations.

Once students have completed their company research, they should write a business letter to one of the three companies both commending the company on their current plan and making recommendations for further improvement. Refer to the Business Letter Template (**Handout 7.4.7 on Instructional Resource Disc**).

Web Extension: Students create a “Call to Action” featuring their business letter as a model to encourage others to write to local businesses about their current environmental policies.

To transition the conversation back to the United States, the teacher should show the video of President Obama’s visit to a Siemens factory in Iowa. The teacher should have the students consider the following question for purposeful viewing or follow-up discussion:

- How is this factory an example of both an economic and environmental win-win?

Activity 5: Looking with a Local Lens

Estimated Time: 2-3 (45-minute) Class Periods for lesson and an additional time for public service announcement.

Purpose: Change the focus to the United States and emphasize that while we don't currently have a national environmental plan the topic is gaining momentum. Continue to bring the focus closer to home by looking at state and local policies and industry.

The teacher should choose either to show all three videos or select an appropriate political speech focused on the issue of climate change. Three options include:

Michael Bloomberg: Taking the Lead on Global Warming (<http://www.youtube.com/watch?v=QscMMQgBdtI>)

Governor Christie on Climate Change (<http://www.youtube.com/watch?v=uPxDnb2-aVI>)

President Obama's 2013 Inaugural Address: A Call to Action on Climate Change (<http://www.youtube.com/watch?v=b3zuiGeG0JA>)

The teacher should have the students consider the following questions for purposeful viewing or follow-up discussion:

- What environmental concerns are addressed?
- What action steps were recommended?
- Based on previous lessons how does this compare to plans across the globe?

The teacher should distribute the Renewable Ripple Handout (**Handout 7.4.8 on Instructional Resource Disc**). As students watch the PBS documentary "Germany's Green Revolution" they should record ideas they think could be incorporated into a local, state, or national sustainability plan.

Prior to the lesson the teacher should locate the local sustainability plan for the community. Using the website (www.icleisusa.org), Local Governments for Sustainability students should locate a sustainability plan from another city (the teacher might want to suggest students find a plan from a similar demographic or region or perhaps a neighboring city). As students look at both plans they should complete the Local Sustainability Plan Comparison Handout (**Handout 7.4.9 on Instructional Resource Disc**). (Note – if your city does not have a sustainability plan students should find two different cities to compare.)

Web Extension – Students write and record a public service announcement targeting an audience within their local community (students, neighbors, community officials, etc.). Students should use a story board to help plan their service announcements – some great examples and templates for story boards are available at the Creately Blog.

The teacher should show "Siemens: The Next Big Step" as a model public service announcement. As students watch they could:

- Fill in a story board from the site listed above
- Identify: message, intended audience, call to action, and ad techniques used.

Finally, teachers should distribute the PSA Plan Exit Slip Handout (**Handout 7.4.10 on Instructional Resource Disc**) to help students plan for their public service announcements.

Activity 6: Looking Through a Personal Lens

Students should access the website Eco Guru (ecoguru.panda.org) and complete the survey from the website to "calculate your personal footprint and measure the positive effects of your lifestyle changes." Students should complete the EcoGuru Results Handout (**Handout 7.4.11 on Instructional Resource Disc**) as they go through the online survey.

Web Extension – Students should create a list of lifestyle changes based on the information they have come across throughout the unit as well as from this last website. The list could be organized based on sustainability impact or based on needed resources (time, money, effort).