

- GDP (gross domestic product)
- greenhouse gases
- nitrogen oxides
- per capita
- global warming
- fracking
- fossil fuels
- particulate pollution
- emphysema
- green economy
- sulfur dioxide
- cardiovascular disease
- congestive heart failure

LESSON

The Impact of Energy Systems - Social, Economic, Health, and Environment

BIG IDEA(S)

The generation of energy for human consumption has impacts on individual health, the environment and the economy.

TASK LIST SUBCATEGORY

- 102 Describe how energy is fundamental to our everyday lives
- 104 Describe sources and uses of energy
- 106 Describe the impact of energy systems (social, economic, health, and environmental)
- 203 Communicate the value of solar energy to different audiences
- 416 Use solar industry vocabulary

OBJECTIVES

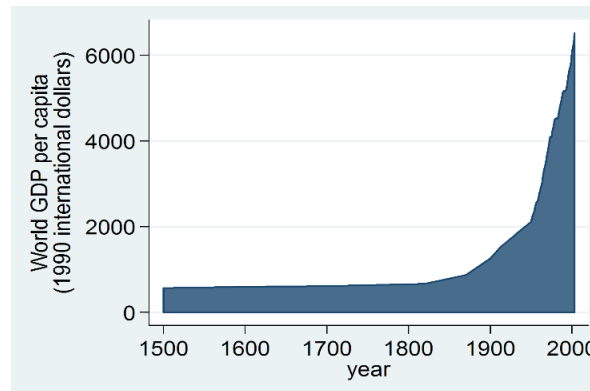
Students will be able to:

- Weigh the costs and benefits of the consumption of carbon-based fuels
- Students will share the advantages and disadvantages of energy transition

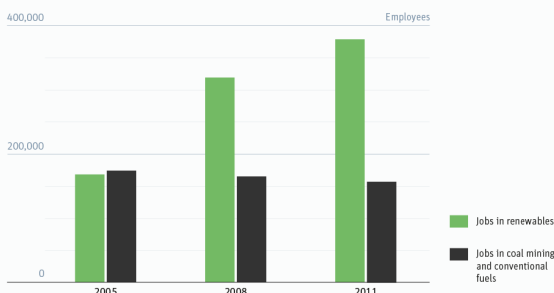
OVERVIEW

JOBS

Originally, the use of wood fuel, coal, and petroleum products helped lead the way to an enormous expansion of human productivity and comfort. These power sources led to better forms of cooking, home heating, transportation (in the forms of trains, boats and cars) and electrification. Populations around the world, on average, gained much higher standards of living through their use.



Renewables create more jobs than conventional energy does
Employment in Germany in renewable and conventional energy sectors, 2005-2011
Source: BNEF, BSWF



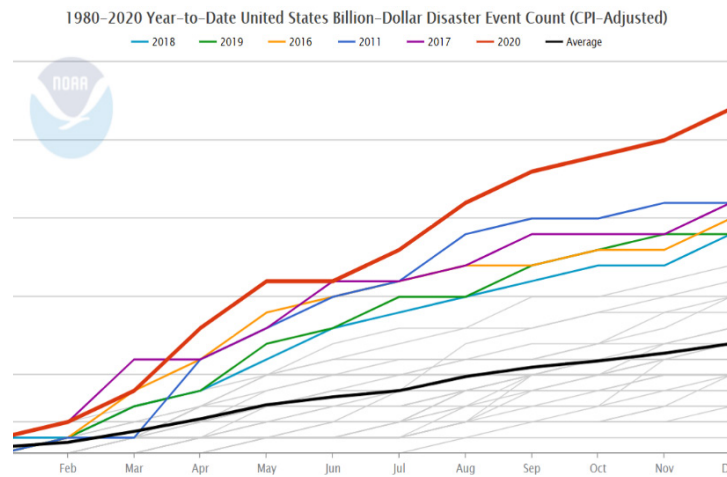
But with the expansion of their use over time, they also produced harmful side effects. These include pollution, global warming and extreme weather events. The replacement of the fossil fuels infrastructure (oil and coal production and distribution) with renewables is known as the green economy. While jobs producing oil and coal will be eliminated, there will be a net gain in jobs when those losses are weighed against jobs created in the building out of the renewable infrastructure. These jobs include the production of

solar panels, the installation of solar panels, the production of wind turbines, the installation of wind turbines, and the production and operation of nuclear power stations.

OVERVIEW - CONTINUED

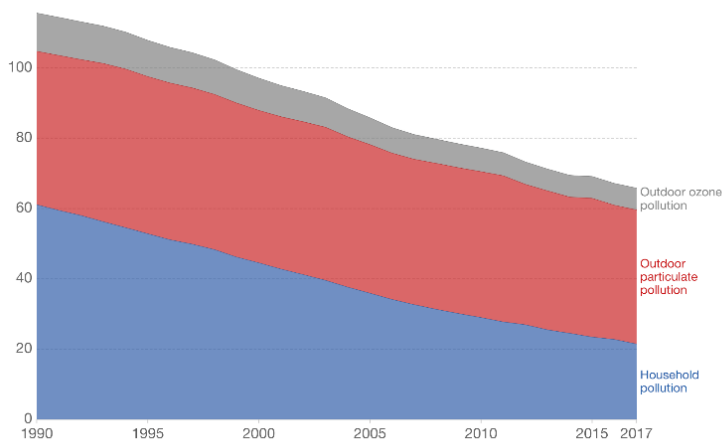
REDUCTION OF EXTREME CLIMATE EVENTS

The scientific community is in almost complete agreement that rising temperatures resulting from greenhouse gas emissions (largely carbon dioxide and methane) has increased the occurrence of extreme weather events. These include tornadoes, hurricanes, flooding, droughts, fires, and dangerously high temperatures. In addition, global warming is leading to rising sea levels, which produce coastal flooding and erosion. The combined effect of extreme climate events and sea level rise not only causes damages in the hundreds of billions of dollars but directly leads to the loss of thousands of lives.



Death rates from air pollution, World, 1990 to 2017

Age-standardized death rates from outdoor ozone, particulates, and indoor fuel pollution per 100,000 individuals.



Source: IHME, Global Burden of Disease

OurWorldInData.org/air-pollution/ • CC BY

POLLUTION

Fossil fuels contribute to both air and water pollution. Particulates are released into the air from smokestacks, forest fires but also take the form of tiny droplets formed from complex reactions of chemicals such as sulfur dioxide and nitrogen oxides, which are pollutants emitted from power plants, industries and automobiles. These kinds of particulates are harmful to both

plants and animals (when they are breathed into the lungs). They cause lung and cardiovascular diseases (such as emphysema, asthma and congestive heart disease).

Coal production, gas and petroleum production through fracking, and the production of chemical products derived from petroleum also frequently results in the pollution of nearby sources of water. Government regulation has resulted in the lowering of pollutants from many sources. Various industries have pressured the government to relax the standards affecting them.



TOPIC OF STUDY

Energy Systems



INSTRUCTIONAL

TEXTS/REFERENCES

Materials from the overview

MATERIALS NEEDED

Teacher presentation: Use material from the overview

Content: Review information referred to in overview and familiarize with the trends referred to. Prepare to explain gross domestic product per capita (total of all goods and services divided by the number of people).

Technology: Computer, projection device

IMPLEMENTATION (LESSON PLAN)

ENGAGE

Have students identify their favorite prepared food product. Have them map out the supply chain and resources necessary to get that food product into their hands.

EXPLORE

Two thirds of the class will be placed into two teams where they will be tasked with developing a marketing campaign that either supports the expansion of electric car usage or reinforces the continued use of gas powered cars. A third team will develop the criteria for evaluating the other teams' presentations.

EXPLAIN

Teacher will use the resources in the overview for the instructional conversation

EXTEND

Students are to pick a source of energy related pollution and find articles that support opposing views regarding that source. They should be prepared to share their findings in a small group in class.

EVALUATE

Students will choose one of the articles they found and explain how it is biased toward one point of view. They will be evaluated based on how their argument is supported by the text.