2. Course objectives

General Education Objectives

There are a number of general education objectives that should be met by all science classes, regardless of subject matter, usually in the lecture—lab combination.

Objective 1. Students will be able to demonstrate how the tools of the discipline are applied in the laboratory setting.

Objective 2. Students will be able to explain the mechanics of a particular type of resource or energy system.

Objective 3. Students will be able to demonstrate the importance of location (of both resources and population). What is the importance of location (of both resources and population)?

Objective 4. Students will be able to interpret environmental impact, current energy production and future resource potential.

Objective 5. Students will be able to assess where resources are more likely to be found.

Objective 6. Students will be able to understand the geologic processes that lead to the formation of specific minerals and groundwater.

Objective 7. Students will be able to perform research rather than waiting for “instruction” from the classroom teacher.

Objective 8. Students will be able to present their research in a clear and coherent manner.

Objective 9. Students will be able to interpret limitations on the supply and the use of these resources.

Objective 10. Students will be able to interpret populations using maps and online databases.

Objective 11. Students will be able to state the potential of different energy sources, and infer their location on a map of the world and regional scale in the lecture, in general education classes, regardless of subject matter.

3. Labs on Fossils and Nuclear Energy

The labs on fossils and nuclear energy focus on issues of supply and environmental impact. Some examples are given below.

Environmental impact of Coal Extraction

Students examine satellite images available on the Google website (http://earth.google.com/satellite) and using these data, they analyze the environmental impact of coal mining.

Students are given a series of information about a coal mining operation and are asked to interpret the data and make recommendations for future actions.

Nuclear Energy

Students create maps showing how much nuclear waste has already been produced, and how much will be produced by the time a particular repository is available, using data sets available online. Using these maps and some knowledge of repository design from the lecture class and assigned reading, they assess the options for nuclear waste disposal in the US.

Sample maps of current geothermal energy production and future potential.

4. Labs on Alternative Energy Resources

Our current use of alternative energy resources is examined in the context of population distribution and patterns of electricity consumption. Prior to investigating each individual resource, students compile a map of population by state, including the locations of major cities, and a map of electricity consumption by state. These maps are completed using online data sets, e.g. http://www.eia.gov/electricity/state/.

Sample maps of energy consumption by state.

Students then compile maps from data sources illustrating current use and future potential of alternative energy resources, including wind, wave, geothermal and solar for electricity production.

Sample maps of current geothermal energy production and future potential.

5. Lab Reports

Lab reports are an important component of a general education science class, as they teach students how to formally present data and results. Many students in the general education classes have had little experience in this form of writing. It is therefore important for them to learn a consistent structure for their lab report, and the structure is used in week 6 to provide consistent feedback. Students also require detailed instructions for future assignments, as they find it difficult to figure out what information to put in each section.

Abstract

Environmental impact, current energy production and future resource potential are issues that are explored throughout the course. A number of assignment requirements are required. These are then written in a reproducible manner that students will not be required to rewrite, and students are directed to place it on their report.

Introduction

Incorporating data on current usage of fossil fuels, nuclear, wave and wind energy, the students develop a deeper understanding of the issues surrounding energy production and sustainability.

Course Specific Objectives

Subject matter objectives are also important, and the goal of this class is to familiarize students with where our resources come from, their future potential and the consequence our resource use has on the environment.

Laboratory investigations of online databases to enhance student understanding of energy resources

Students create maps showing how much nuclear waste has already been produced, and how much will be produced by the time a particular repository is available, using data sets available online. Using these maps and some knowledge of repository design from the lecture class and assigned reading, they assess the options for nuclear waste disposal in the US.

Sample maps of nuclear waste produced by 2012 and predicted by 2023.

Conclusion

These maps give students a visual reference for interpreting why some states are more suitable for a particular energy resource, and why some are not, such as how arsenic’s surprising high rank in production of solar power.

Lab reports encourage students to interpret the maps in light of concepts from the lecture class, such as the need for electricity to be produced close to population centers, and the need for a consistent base load as well aspeak power capacity.

5. Conclusions

The student is now running for his second semester, and there was a very small number of students who signed up for the first semester in fall 2014, so there is not yet any formal analysis of outcomes.

Some initial observations include:

- Students are coming into the lab class expecting to undertake their own research rather than waiting for “Instruction” from the classroom teacher.
- Students writing improvements significantly over the course of the semester.
- Students develop a deeper understanding of local geologic phenomena.

Some recommendations for future improvements include:

- Inclusion of data on hydroelectric power.
- Incorporating data on current usage of fossil fuels, nuclear, wave and wind energy.

Future improvements include:

- Incorporation of data on hydroelectric power.
- Incorporating data on current usage of fossil fuels, nuclear, wave and wind energy.