

What are the Prospects for Energy Futures on Tribal Lands?

By
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Abstract

This case explores the scientific principles behind renewable energy conversion systems, including solar energy, wind energy, geothermal energy, and biofuel and biomass energies. The intent is to build a basis for understanding the current and potential future uses of renewable energies on tribal lands. The case suggests resources for students to investigate what tribes are already doing with the various types of renewable energies. The case also suggests resources for students to learn about the potential of renewable energy as a source of tribal employment, and to consider what training might be necessary for a career working with various types of renewable energy. This case is a research-based case that has the students doing work outside the classroom. The pedagogical method of this case is to break up a class of students into small groups, each of which will work on a different topic, or a different aspect of a given topic. For example, students might research and one of the following topics: solar power, wind power, biofuel and biomass production, energy conservation, or the energy management of tribal resource. The task for the students working in small groups is to research their topic, and to present their finding back to the class as a whole.

The setting

James came to class quite excited about a report he had just read. His instructor had given him a copy of a report by the National Wildlife Federation entitled “The New Energy Future in Indian Country: Confronting Climate Change, Creating Jobs, and Conserving Nature.”² James asked to read portions of the Executive Summary to the other students in hopes of getting them interested in studying the energy and jobs potential of their own reservation. Here is what he read:

“Indian Tribes are disproportionately bearing the brunt of climate change, and their economic, cultural, and spiritual practices, which are closely tied to the natural world, are suffering. But the vast potential on tribal lands to generate clean energy from renewable energy resources like solar, wind, biomass, and geothermal power presents tribes with the opportunity to be a significant part of the solution. They can help confront climate change and continue their legacy as conservationists, while creating clean energy jobs and generating revenue in their communities....

¹ Rob Cole is a member of the faculty at The Evergreen State College. This material is based upon work supported by the National Science Foundation under Grant No. 0817624. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. Copyright held by The Evergreen State College. Please use appropriate attribution when using and quoting this case. Cases are available at the Enduring Legacies Native Cases website at <http://www.evergreen.edu/tribal/cases/>

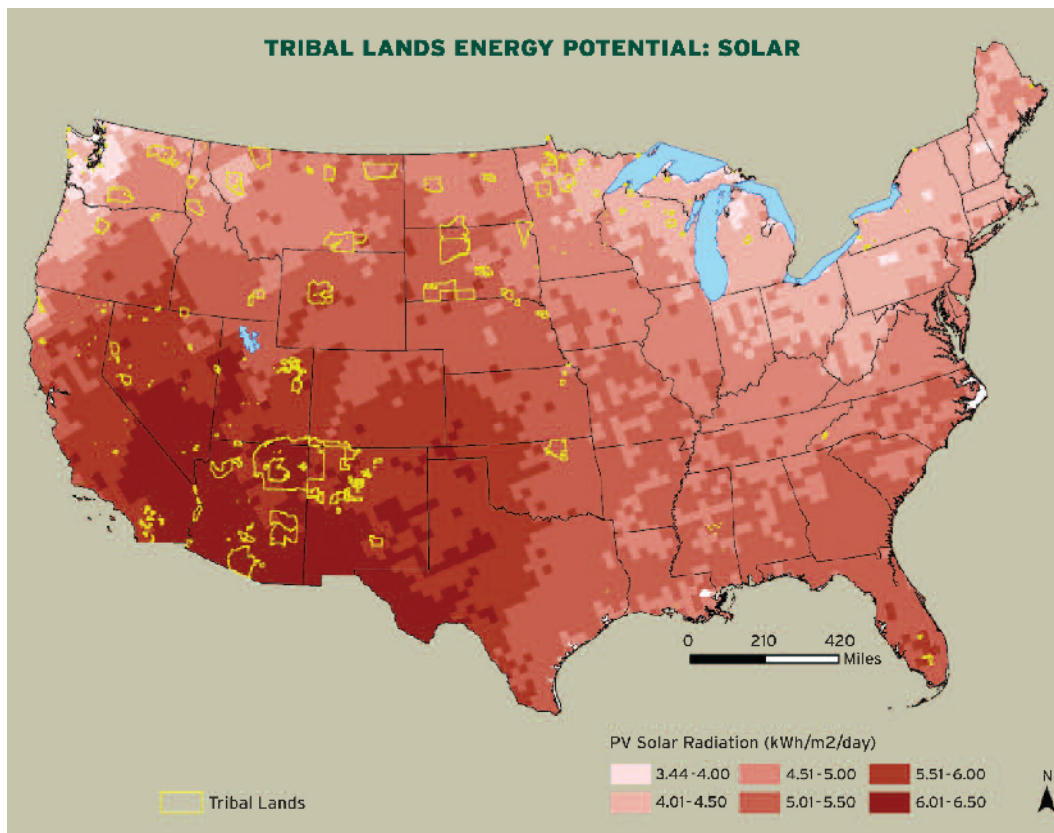
² 2010, “The New Energy Future in Indian Country: Confronting Climate Change, Creating Jobs, and Conserving Nature,” National Wildlife Federation, <http://www.nwf.org/News-and-Magazines/Media-Center/Reports/Archive/2010/The-New-Energy-Future-in-Indian-Country.aspx> (accessed 5/7/2010)

“On average, Tribal households pay significantly more in home energy expenses than other Americans. Most utilities are solely owned and operated by non-Tribal entities, so the money paid to energy providers immediately leaves tribal communities. More than 14 percent of American Indian households on reservations have no access to electricity, compared to 1.2 percent of all U.S. households. However, tribal lands, which cover almost 5 percent of the total area of the United States, hold an estimated 10 percent of the country’s renewable energy resources, including enough solar energy potential to generate 4.5 times the national total energy consumption in 2004.³

“The infrastructure and revenue streams created by tribal renewable energy and energy efficiency projects could help tribes achieve economic growth and energy independence, and strengthen tribal sovereignty....”

“Several pilot projects are under way across the country. Programs in the Department of Energy and Department of Health and Human Services, other state incentives, and the rising carbon offset market are helping tribes save money and discover critical funding opportunities....”

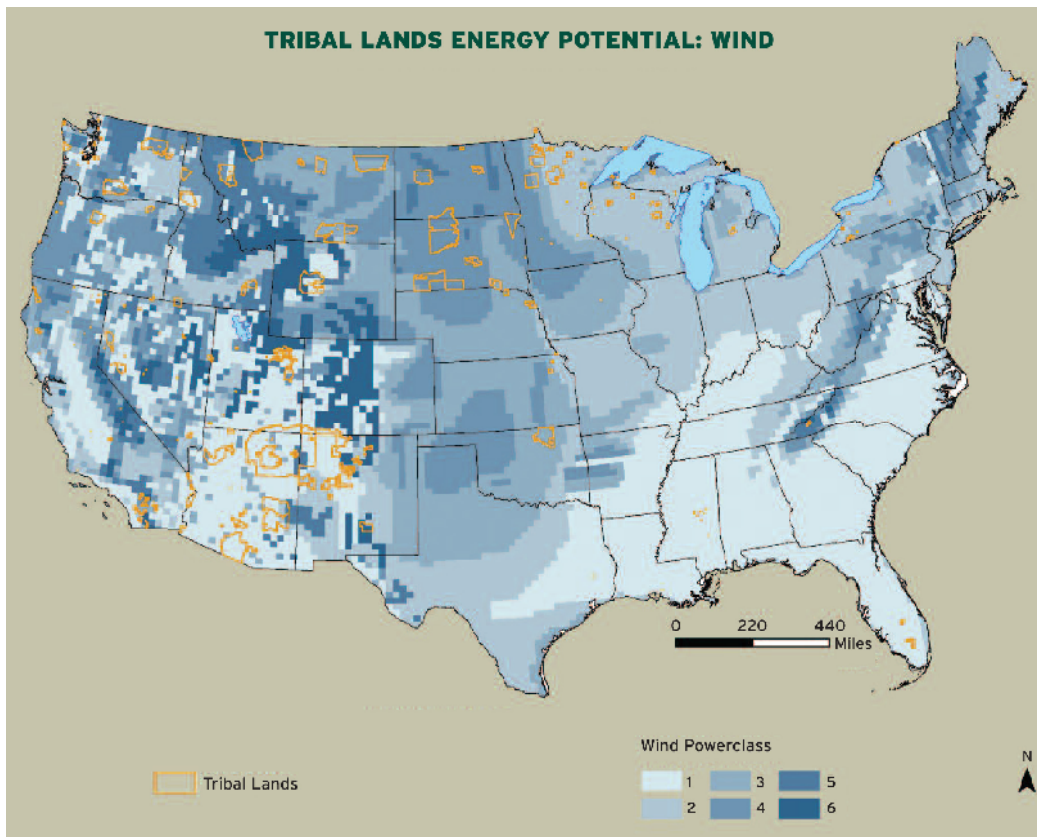
James showed the students a couple of maps from the report that illustrated the renewable energy potential on tribal lands in the United States. Here’s the solar energy map:



Map courtesy of the National Wildlife Federation

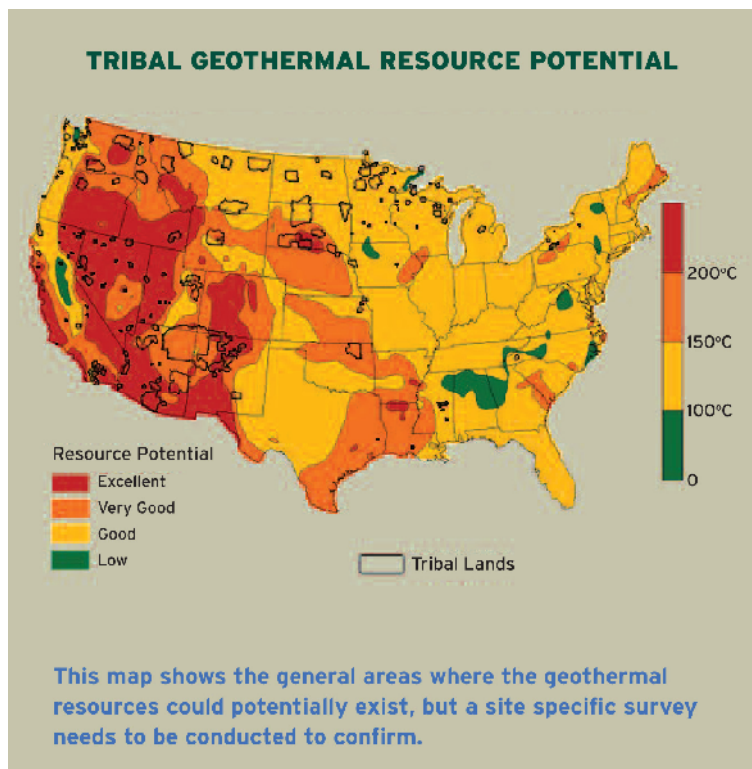
³ as quoted in footnote 1 above: 2004, National Renewable Energy Laboratory Analysis

Here's the wind energy map:



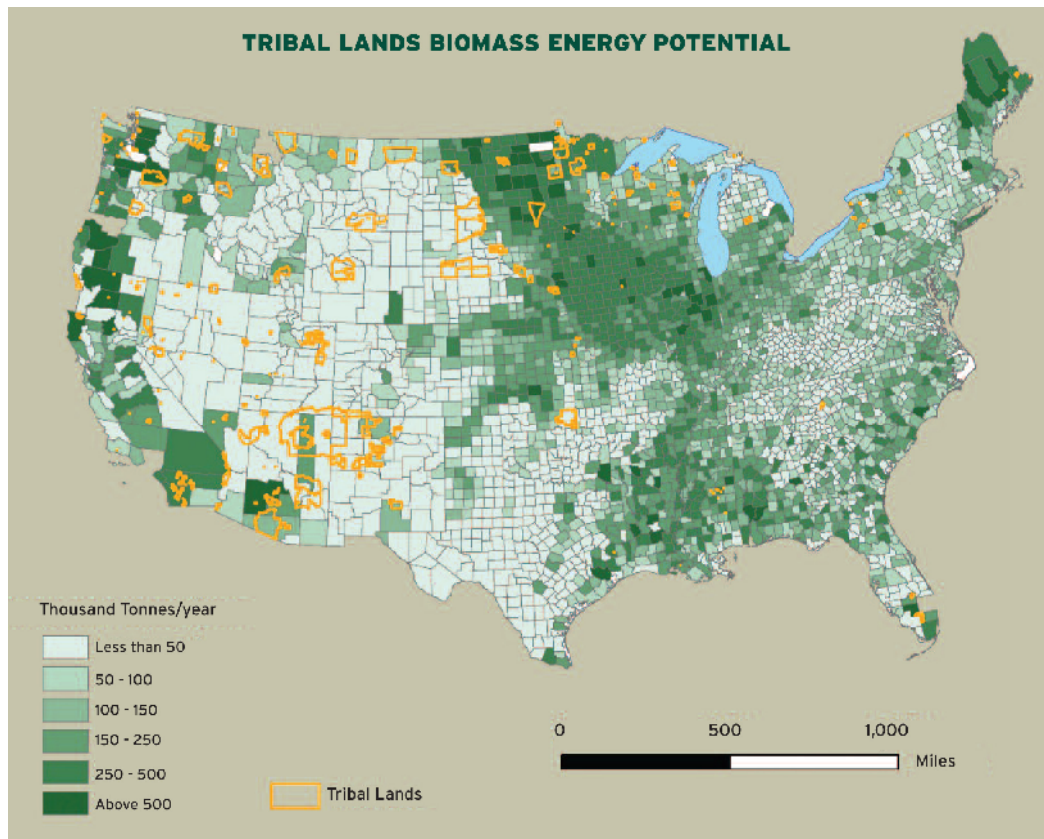
Map courtesy of the National Wildlife Federation

Here's the geothermal map:



Map courtesy of the National Wildlife Federation

And here's the biomass map:



Map courtesy of the National Wildlife Federation

The students were aware of the fact that fossil fuels were contributing significantly to global warming. The students were also aware that the world's oil producers were nearing their peak capacity (so-called "peak oil") for the rate at which they could pump oil from beneath the surface. They had the sense that the need to produce more renewable energy was in everyone's best interest. But they didn't know a lot about renewable energy. As a consequence, they found the maps quite intriguing, and wanted to hear more. So the instructor suggested that the class break up into small groups, each taking a different portion of the renewable energy spectrum. For example, one group would investigate the potential for solar power on many reservations, including the example of the Hualapai tribe's investment in solar photovoltaic arrays to power a thirteen-mile long water pipeline in Arizona. The instructor suggested that the students also investigate the potential for solar hot water heating for local buildings, particularly since evacuated tube technology has made solar hot water heating viable even in areas that are cloudy. The instructor also suggested that some students investigate passive solar energy construction, since window glass is the cheapest solar energy collector around. Another group might explore the potential for wind power on numerous other reservations, especially those in the Great Basin and the Great Plains. Several tribal nations, including the Sioux of the Rosebud Nation, have already installed wind power projects, and more are building wind generators each year. The Bureau of Indian Affairs, in a 2009 report, identified seventy-seven

reservations that could support viable wind-based economies.⁴ The potential use of geothermal energy, including geothermal heat pumps for buildings, would be the focus of another group. The instructor suggested the project of the Confederated Tribes of Warm Springs as a useful example. Biomass and biofuels, both for liquid fuels and for electricity production, would be a focus of another group. The Shakopee project in Minnesota would be an excellent example.

The instructor also suggested that the students not be completely taken in by the statements of the National Wildlife Federation, but that they examine the writings of groups representing Native Americans, for example the National Congress of American Indians (NCAI), or the Council of Energy Resource Tribes (CERT). Specifically, the instructor read from an NCAI statement regarding land and natural resources:

“Indian nations have the right to establish policies to control their lands and resources and to maintain high standards of environmental quality for tribal communities. Tribal government officials are dedicated stewards with culturally-based knowledge in best practices and insight regarding the difficult tasks of managing, preserving and protecting their homelands. The federal government as trustee has limited responsibilities in managing trust lands and resources that are compatible with tribal government goals, objectives and principles. The NCAI monitors federal, state and local activities which may assist or conflict with the ability of tribal governments to establish and regulate land use and environmental policies and practices that provide cultural continuity and sustainable tribal economies.”⁵

The instructor suggested that all students make an effort to find statements by groups representing American Indians, such as NCAI, or CERT.

The instructor then suggested that a series of groups be formed, each to investigate a different aspect of renewable energy or energy conservation. The instructor generated the following list of questions for each of the groups and subgroups investigating different forms of renewable energy and energy conservation:

Solar Energy Group

- (1) Solar generation of electricity by photovoltaic power systems.
 - What are the basics of photovoltaic cells, and how do they work?
 - Which reservations in the United States have the greatest potential to use photovoltaic systems?
 - What is the potential of using photovoltaic systems in this region? What local businesses or companies have already installed photovoltaic systems? How well are they operating?

⁴ 2009, *Wind Atlas for Indian Reservations*, Office of Indian Energy and Economic Development, U.S. Department of the Interior.

⁵ 2010, Website of the National Congress of American Indians (NCAI), (accessed November 20, 2010), <http://www.ncai.org/Land-Natural-Resources.24.0.html>

- What are the tradeoffs between installing a stand-alone photovoltaic system off the electrical grid, versus a photovoltaic system that is connected to the electrical grid?
 - What type of arrangements with the local electricity provider are there to buy back electricity that a photovoltaic system might put onto the electrical grid?
 - Which tribes, Hualapai and others, have already installed photovoltaic systems? How are the installed systems performing? How successful does the Tribe consider their installation?
 - What are potential sources of funding for photovoltaic systems?
 - What is the potential for employing local tribal members in the installation and maintenance processes?
 - What kind of training is necessary to become an electrician who could deal with solar photovoltaic systems as well as standard systems?
- (2) Solar heating of hot water for tribal center buildings and for individual housing.
- What are the basics of solar hot water heaters, and how do they work?
 - What are the kinds of flat plate collectors and evacuated tube collector in use today?
 - Which reservations in the United States have the greatest potential to use solar hot water systems?
 - What is the potential of using solar hot water systems in this region? What local businesses or companies have already installed solar hot water systems? How well are they operating? How well do they reduce local water heating bills?
 - Would it make sense to construct solar hot water systems on the reservation, or would it make sense to purchase them from an external manufacturer?
 - Which tribes have already installed solar hot water heating systems? How are the installed systems performing?
 - What are potential sources of funding for solar hot water systems?
 - What is the potential for employing local tribal members in the installation and maintenance processes?
 - What kind of training is necessary to become a plumber who could deal with solar hot water systems as well as standard water supply systems?
- (3) Passive solar energy principles for local construction.
- What are the basics of passive solar energy construction? How and why does it work?
 - What is the history of indigenous people's use of passive solar energy principles in the southwestern region of the country?
 - How does an understanding the seasonal location of the sun in the sky help influence the design of a building?
 - How does an understanding the hourly location of the sun in the sky each day help influence the design of a building?
 - If south-facing windows afford a heat collection device in the winter, how does one prevent them from over-heating the building in the summer?
 - What are some possible applications for passive solar construction for low-cost housing in the local area?

- What is the potential for employing local tribal members in the construction and maintenance processes?
- What are potential sources of funding for passive solar applications in low-cost housing construction?
- What is the relationship between the passive solar heating (or cooling) functions of a building, and the natural lighting afforded by the window? How does one begin to design a space that works with the sun on an hourly basis?
- What kind of training is necessary to become a designer or architect who could deal with passive solar systems applied to housing and small-scale buildings?

Wind Energy Group

(1) Principles of wind-generated electricity.

- What is a wind generator, and how does it work?
- What is the difference between a horizontal axis machine and a vertical axis machine? What are the advantages and disadvantages of each?
- Why do most commercial wind turbines have three blades, rather than two?
- How does the height above the ground of a wind generator influence the power it can extract from the wind?
- Compare the relative power that might be extracted from winds of 10 miles per hour, 20 miles per hour, and 30 miles per hour.
- Which is more important to wind generation, steady winds at a relatively low velocity, or high winds of occasional, intermittent duration? Explain your reasoning.
- What kind of protective devices must be built into a wind generator to protect it from winds that are too strong?
- What is the potential for employing local tribal members in the construction and maintenance processes?
- What kind of training is necessary to work with wind generators as a design engineer, or as an electrician who could install and maintain wind generators?

(2) Existing tribal wind energy installations.

- Which tribal areas in the United States have the greatest potential to use wind generators?
- What are the characteristics of the winds that would make a good site for wind generation?
- What are some of the specifics of tribes that have already installed wind power? For example, how has the Rosebud system worked?
- How successful does the Rosebud Tribe consider their work with wind energy?
- What is the potential of using wind energy systems in this region? What local utilities, businesses or companies have already installed wind energy systems? How well are they operating?
- What are the tradeoffs between installing a stand-alone wind generating system off the electrical grid, versus a wind generating system that is connected to the electrical grid?

- What type of arrangements with the local electricity provider are there to buy back electricity that a wind generating system might put onto the electrical grid?
- What are potential sources of funding for wind generating systems?
- What is the potential for employing local tribal members in the installation and maintenance processes?
- What kind of training is necessary to work with wind generators as a design engineer, or as an electrician who could install and maintain wind generators?
- What has been the work of Native Energy (<http://www.nativeenergy.com/>) in wind energy generation?

Geothermal Energy Group

(1) Principles of geothermal energy.

- What are the basics of geothermal energy systems, and how do they work?
- Geothermal systems can be used for heating buildings, and they can be used for generating electricity. How might these two types of systems be similar, and how might they differ?
- In some parts of the country institutions have used heat pumps to extract heat from ground water to heat buildings, and returned colder water to the aquifer. What is a heat pump (a refrigerator in the kitchen is one type of heat pump), and how does it work?
- How does one assess the availability of geothermal energy in the local region?
- What are a range of costs of installed geothermal systems?
- What is the potential of using geothermal energy systems in this region? What local utilities, businesses or companies have already installed geothermal energy systems? How well are they operating?

(2) Existing tribal geothermal energy installations.

- Which tribal areas in the United States have the greatest potential to use geothermal energy?
- Which tribes have installed geothermal energy systems, or are planning to install such systems? Consider the work of the Confederated Tribes of Warm Springs, as well as that of other tribes.
- How successful does the Confederated Tribes of Warm Springs consider their work with geothermal energy?
- What is the potential of using geothermal energy systems in this region? What local utilities, businesses or companies have already installed geothermal energy systems? How well are they operating?
- Are there local examples of groundwater heat pump systems? If so, what are their characteristics, and how well are they operating?
- What type of arrangements with the local electricity provider are there to buy back electricity that a geothermal energy system might put onto the electrical grid?
- What are potential sources of funding for geothermal energy generating systems?
- What is the potential for employing local tribal members in the installation and maintenance processes?

- What kind of training is necessary to work with geothermal energy systems as a design engineer, or as an electrician, or plumber, or as a pipefitter who could install and maintain geothermal systems?

Biomass or Biofuels Group

(1) Principles and Applications of Biofuels.

- What are biofuels, where do they come from, and why are they different from fossil fuels?
- Which tribal areas in the United States have the greatest potential to use biofuels?
- Which tribes are currently producing biofuels, or are planning to produce biofuels?
- How are these operations working at present, or how do the planners hope that they will work when they are completed?
- What crops make sense for this region in terms of biofuel production?
- What is the potential of producing biofuels in this region? What local utilities, businesses or companies are already producing biofuels? How well are their systems operating?
- What is a range of costs associated with producing biofuels, and what is a range of prices that can be charged for the biofuels?
- What are potential sources of funding for building a biofuel production facility?
- What is the potential for employing local tribal members in the installation, maintenance and operation processes?
- What kind of training is necessary to work with a biofuel production system?

(2) Principles and Applications of Biomass.

- What is meant by biomass, and how is it different from fossil fuels?
- Which tribal areas in the United States have the greatest potential to use biomass?
- Which tribes are currently producing biomass, or are planning to produce biomass? Include in your research the work of the Shakopee project in Minnesota, and the long-term work of the Menominee Nation in Wisconsin.
- How successful does the Shakopee Tribe consider their installation?
- How successful does the Menominee Nation consider its long-term timber management project?
- How well are these existing operations working at present? For projects in the planning stage, how do the planners hope that their projects will work when they are completed?
- What crops make sense for this region in terms of biomass production?
- What is the potential of producing biomass in this region? What local utilities, businesses or companies are already producing biomass? How well are their systems operating?
- What is a range of costs associated with producing biomass, and what is a range of prices that can be charged for the biomass?
- What are potential sources of funding for building a biomass production facility?
- What is the potential for employing local tribal members in the installation, maintenance and operation processes?

- What kind of training is necessary to work with a biomass production system?
- (3) Timber as Biomass.
- Carbon budgeting of timber resources – How much carbon is sequestered in forest lands over time? This is obviously species dependent, but could suggest different management strategies.
 - How much acreage is necessary to *sustainably* produce a thousand tons of dry wood chips for energy utilization? Again, this is species dependent, as well as length-of-rotation dependent.
 - What are the trade-offs between dedicating some land to wood chip generation, rather than dedicating it to long-term rotation timber stands?
 - How many tons of wood chips per day are necessary to produce one megawatt of electrical power? This depends on the energy conversion technology used, but the Nexterra Company (<http://www.nexterra.ca>) in Canada has extensive experience in building biomass plants, and solid estimates can be made from their existing plants.
 - How does the carbon dioxide reduction from substituting wood chips for natural gas for the electricity produced compare to the carbon sequestering foregone by cutting the trees for wood chips?
 - How many tribal jobs might a wood chip plant generate?
 - What are the income comparisons between growing trees as timber versus growing some acreage as biomass to produce heat and electricity?
 - What is the nature of carbon offsets, and how might they be used to generate income for the tribal nation?
 - Do stands of timber constitute legitimate carbon offsets? In what ways can we calculate the economic value of preserving a stand of timber, whether or not it is used as an offset?
 - What kinds of carbon offsets, beyond timber, might be available to the tribal nation to sell to others?

The instructor assigned students to each of the groups in which there was student interest. Each group was asked to do some research on the web and elsewhere to try to determine the answers to some of the questions given to each group. Although literally thousands of sources of information exist on these topics, the instructor provided the following list of sources, and again asked the question of the students: “What are the prospects for energy futures on tribal lands?”

Resources

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