Lesson 4: So, You Want to Build a Nuclear Power Plant?

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Description of the lesson

Through a budgeting simulation and cost-benefit analysis activity, students examine factors that increase final construction costs and time needed to plan, build, and complete a nuclear power plant in the United States. Students will also discuss the size of the nuclear energy market in the United States and debate the pros and cons of multiple energy sources.

Economics

This lesson provides examples of how firms weigh costs and benefits prior to making long and short-term business decisions. Faced with budgeting constraints, time considerations, and government regulations, firms must allocate their factors of production efficiently in order to optimize their chances of being profitable.

Objectives:

Students will be able to:

- analyze a budget for the construction of a nuclear power plant using data from a simulation.
- evaluate the costs and benefits of building a nuclear power plant.
- describe factors that contribute to the high cost of building nuclear power plants.
- examine the pros and cons of using hydropower, nuclear power, solar power, and wind power to generate electricity.

Concepts:

Factors of production, decision-making, investment in capital goods, government regulations

Materials:

- Slides 4.1 – 4.8
- Activity 4.1: Nuclear Power Plant Budget, one copy per group of three or four students
- Activity 4.2: Unexpected Events, cut apart into three separate events
- Activity 4.3: Energy Source Costs/Benefits, copied and cut apart into four separate energy
- sources. One set per group.
- Activity 4.4: Which Energy Source Should We Use?, one copy per group of three or four students, (copied on the back of Activity 4.1)
- Visuals 4.1 – 4.4: Which Energy Source Would You Pick? (each hung in a separate section of classroom prior to start of lesson)
- Blue painter's tape or masking tape
- Calculators

Suggested Time Frame: 60 minutes

National Standards in Economics or Personal Finance:

Voluntary National Content Standards in Economics

- Standard 2: Decision Making
  - Effective decision making requires comparing the additional costs of alternatives with the additional benefits. Many choices involve doing a little more or a little less of something: few choices are "all or nothing" decisions.

- Standard 15: Economic Growth
  - Investment in factories, machinery, new technology, and in the health, education, and training of people stimulates economic growth and can raise future standards of living.
- Standard 16: Role of Government and Market Failure
  - There is an economic role for government in a market economy whenever the benefits of a government policy outweigh its costs. Governments often provide for national defense, address environmental concerns, define and protect property rights, and attempt to make markets more competitive. Most government policies also have direct or indirect effects on people's incomes.

Procedure

1. Display Slides 1 and 2. Begin the lesson by asking students to think of examples of when they use electricity throughout a typical day. (Answers may include: charging smart phones, using computers, turning on lights, riding in an electric vehicle, using refrigerator, etc.)

   Ask students which energy sources are used to create the electricity they use each day. (Answers may include: coal, natural gas, nuclear, wind, solar, hydro, geothermal)

2. Display Slide 3 and highlight the daily and annual electricity consumption per household and total yearly electricity consumption for the United States. Point out that the two largest categories of household electricity consumption are heating and cooling.

3. Ask students why overall consumption of electricity has increased in the United States since 1950. (Answers may include: larger population, advances in technologies that require the use of more electricity, shift away from fossil fuels, 2.5x increase in the square footage of our homes, heating and air conditioning become commonplace in many U.S. homes.)

4. Display Slide 4 Explain the following :
   - Fossil fuels are found in the Earth's crust and contain carbon and hydrogen, which can be burned for energy.
   - Clean energy is used to refer to the electricity that is generated by facilities that do not directly emit greenhouse gases such as carbon dioxide during the generation process.
   - Renewable energy is energy produced from sources like the sun and wind that are naturally replenished and do not run out.

5. Display Slide 5 and explain that currently there are several different sources of energy used to produce electricity in our country, with the two most used being natural gas and coal.

6. Ask students to categorize each electricity generation source into three categories: fossil fuels, clean energy, or renewable energy. Remind them that some energy sources are considered clean AND renewable so a source can show up in more than one category. (Answers will vary.)

7. Display Slide 6 and ask students if they agree or disagree that nuclear energy is a clean energy. (Answers will vary.)

8. Display Slide 7. (Same as Slide 5 but separated by category) Ask students what percentage of our electricity is currently generated by fossil fuels (Answer: 60.1%), what percentage is generated by nuclear (Answer: 18.2%), and what percentage is generated by renewable energy (Answer: 21.7%).

9. Display Slide 8. Tell students there is debate around the idea of nuclear energy being considered a "clean" energy. Proponents of nuclear energy point to the fact that it is a zero-emissions resource, it requires a very small land footprint, and it creates minimal waste. Opponents of nuclear energy point to the creation of nuclear waste, the potential for accidents, and high costs associated with building nuclear power plants.

10. Display Slide 9 and point out there are 54 nuclear power plants and 93 nuclear reactors out of a total of more than 11,000 electric power plants currently in operation in the United States. The colors represent the Nuclear Regulatory Commission regions. NRC regional offices oversee the major nuclear facilities that the agency regulates.

11. Explain that nuclear reactors are machines that contain and control nuclear chain reactions while releasing heat at a controlled rate. A nuclear power plant uses the heat that a nuclear reactor produces to turn water into steam, which then drives turbine generators that generate electricity. Nuclear energy tutorial and video can be found here and video only on Slide 10: https://www.iaea.org/newscenter/news/what-is-nuclear-energy-the-science-of-nuclear-power

12. Tell students the newest nuclear reactor came online in Georgia in July 2023, and it was the first one built in the United States in three decades. Ask students why they think so few nuclear power plants or reactors have been built in the last 30 years. (Answers will vary but might include: perceived safety issues, failure of nuclear power plants in the past, high cost of building a nuclear power plant, long time it takes to build nuclear power plants.)

13. Explain that there are costs and benefits to building a nuclear power plant in the United States. There are also many barriers to entry associated with building nuclear power plants. Historically, nuclear power plants have been very expensive to build and have taken many years to complete, and as a result, a very small number have been built in the United States in the last three decades.

14. Tell students that they are going to participate in an activity to help them focus on and identify the costs of building a nuclear power plant, which will include a nuclear reactor.

16. Display Slide 11. Divide students into groups of three or four and explain that each group will track budget changes for a hypothetical power company interested in constructing a new nuclear power plant and reactor in the United States.

17. Explain that they will focus on three categories of spending when tracking the budget numbers: land, labor, and capital. Review the following economic terms and definitions with students on Slide 12:
    - Land- "Gifts of nature" that can be used to produce goods and services; for example, oceans, air, mineral deposits, virgin forests and actual fields of land. Land is also known as natural resources.
    - Labor- The quantity and quality of human effort available to produce goods and services. Also known as human resources.
    - Capital- Resources and goods made and used to produce other goods and services. Examples include buildings, machinery, tools and equipment.

18. Distribute a copy of *Activity 4.1: Nuclear Power Plant Budget* to each group. Review the instructions and answer any related questions. A copy is displayed on Slide 13.

19. Remind the class that the *Activity 4.1* instructions said the project would take seven years to complete. Instruct each group to fill in the "Completion Year" in the "Initial Costs" column. (To find this number, add seven to the year when you are teaching the lesson.)

20. Inform students they will now experience a series of events that will impact both the initial budget projections and the length of time it will take to complete the build of the nuclear power plant and reactor.

21. Select one student to read *Activity 4.2: Unexpected Events (Events 1)* to the class. Once the card has been read, display Slide 14 and show students which budget lines need to be updated. Allow time for each group to recalculate their Activity 4.1 budget numbers. Not all budget lines will change, so instruct students to carry their original budget numbers over to the next column for those lines that see no changes as a result of the events. The chart is embedded in Slide 13 so you can add the numbers as you work through the scenarios, returning to the chart as you update it through the next steps.

22. Ask students what happened to the initial budget and projected timeline for construction after the Events 1 card was read. (Answers: budget costs have increased and it's going to take longer to complete the project.)

23. Select a different student to read the Events 2 card from *Activity 4.2* to the class. Once the card has been read, display Slide 15 and show students which budget lines need to be updated. Remind students that the new calculations should be made using the new projected budget and projected completion numbers found after the Events 1 card was read.

24. Select a different student to read the Events 3 card from *Activity 4.2* to the class. Once the card has been read, display Slide 16 and show students which budget lines need to be updated. Remind students that the new calculations should be made using the new projected budget and projected completion numbers found after the Events 2 card was read.

25. Once all groups have completed the task of recalculating the budget totals and new projected completion date, ask the following questions from Slide 17:
    - What happened to the total project costs after each event card was read? (Answer: Costs increased)
    - How much did your final project cost increase? (Answer: $2,194,410,000 or $2,194.41 million)
    - How did government regulations impact final budget costs and the projected completion date? (Answer: Regulations increased final budget costs and caused delays)
    - How many years will the project be delayed when finally completed? (Answer: five years)

26. Share with students that the events they just experienced were based on events that occurred during the construction of the new Vogtle *(pronounced "Voh-guhl")* nuclear power plant and reactors in Georgia. Although some of the numbers on the event cards were estimates, the end results were the same; a project over budget and years late on completion.

27. Tell students that power companies weigh costs AND benefits before making decisions about whether or not they will build nuclear power plants and reactors. Remind students that up to this point, they have only looked at the costs of building nuclear power plants and reactors and they have not examined any of the benefits or compared nuclear energy costs to other energy source costs. Now they will have an opportunity to learn more about benefits associated with nuclear power and three other clean energy sources.

28. Inform students that they will now explore options related to replacing fossil fuels with clean energy sources. Remind them that fossil fuels are currently used to produce 59% of the electricity used in the United States.

29. Tell students to turn Activity 4.1 over to find *Activity 4.4: Which Energy Source Should We Use?* Remind students that they will be working in the same groups as they did during Activity 4.1. Distribute the card sets from Activity 4.3 Energy Source Costs/Benefits.

30. Have groups distribute one energy card from the set *Activity 4.3: Energy Source Costs/Benefits* to each student in the group. Starting with student 1 (card 1) have each speaker in the group share the costs and benefits associated with their energy source. As the cards are read, group members should list the costs and benefits of each energy source in the appropriate spaces shown on Activity 4.4.

31. Once all four cards have been read, give the students time to discuss costs and benefits associated with each energy source.

32. Tell students that they will now explore options for phasing out the creation of electricity using fossil fuels. Their task will be to examine which clean energy source or sources they will use instead of fossil fuels (natural gas and coal) to create enough electricity to meet current consumer demand.

33. Display Slide 17 to remind students that nearly 60% of the electricity used in the United States is currently produced using natural gas and coal.

34. Ask students which of the four clean energy source benefits seem to be the most important when weighing the decision to phase out the use of fossil fuels to produce electricity. (Answer: Total amount of energy the source can produce, capacity to produce at maximum levels)

35. Tell students to rank the four clean energy sources in order of how viable each would be in helping to phase out using fossil fuels to produce electricity.

36. Tell students they will now show how they ranked the clean energy sources by voting with their feet. Point out the locations of Visuals 4.1 – 4.4 and ask each group to go stand next to the sign with the name of their first energy source choice to replace the creation of electricity made with fossil fuels. Note the number of groups at each sign.

37. Select one group at each sign to explain their 1st place ranking of the energy source they selected. (Answers will vary.)

38. Repeat the previous two steps by asking each group to move to their second, third and fourth choices. Select different groups to explain why their choices were lower in their ranking order. (Answers will vary.)

39. Conclude the lesson by telling students that power companies across the country are currently having the very same discussion about how to replace the production of electricity using fossil fuels with various clean energy sources.

40. Show Slide 19 and explain that a single nuclear power plant and reactor can generate much more electricity compared to other clean energy sources. This fact, coupled with the long operational life of nuclear power plants, the percentage at which they can operate at maximum power, and their clean energy status are the main reasons why power companies are debating whether or not to invest in nuclear technology for the future.

Closure

41. Review the important content in the lesson with the following questions.
    - What are the factors of production used to create a nuclear power plant and reactor? (Answer: Land, Labor, Capital)
    - What factors contributed to the high cost of building the nuclear power plant and reactor in this lesson? (Answer: Global supply and demand issues affecting the costs of several inputs, labor shortages, government regulations)
    - What are the benefits of producing electrical power with nuclear energy? (Answer: Nuclear is a clean energy, one nuclear power plant can produce enough energy to power hundreds of thousands of homes, nuclear power plants can run at full capacity 92% of the time, nuclear power plants can operate for decades)
    - What are the costs of producing electrical power with nuclear energy? (Answer: expensive to build, radioactive waste, risk of accident, not a renewable energy source, need uranium to operate and mining this resource comes with several costs)
    - If the dollar costs of producing nuclear power plants are so high, why do some firms choose to use this source of energy production? (Answer: Because the benefits over time exceed the costs)
    - Why will phasing out the use of fossil fuels to produce electricity be a long and costly process? (Answer: 60% of electricity is currently produced by these energy sources, no single clean energy source exists that can quickly and easily produce that amount of electricity, each clean energy source comes with different costs and shortcomings)

Assessment

Tell students they have been given the task of creating a brief written report for local elected officials highlighting potential benefits and costs of building a nuclear power facility ten miles outside of their town. See Slide 20.

The local officials will be asked by their constituents to comment on a recent proposal to build a nuclear power plant and reactor in their area and they are looking to gather insightful information that will help them form an opinion on whether or not they will support the proposed construction of the nuclear facility.

Each report should include a minimum of three potential benefits and three potential costs of construction and operation of a nuclear power facility near your town.

Use the following resources to help gather information for your report:

1. Office of Nuclear Energy: https://www.energy.gov/ne/articles/advantages-and-challenges-nuclear-energy

2. Conserve Energy Future: https://www.conserve-energy-future.com/pros-and-cons-of-nuclear-energy.php

3. Let's Talk Science: https://letstalkscience.ca/educational-resources/stem-explained/what-are-pros-and-cons-nuclear-energy

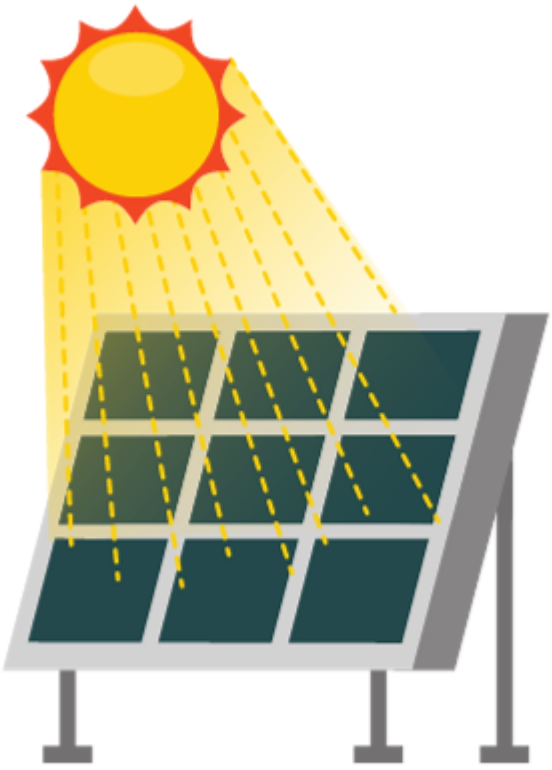
Extension

Have students develop a pamphlet or webpage on which they provide the student body of their school with an explanation of nuclear power, its costs, its benefits, and the prevalence of nuclear power facilities throughout the United States and the rest of the world. Tell them to use the information from Activity 4.4 and the web links listed in the Assessment section to complete this task.

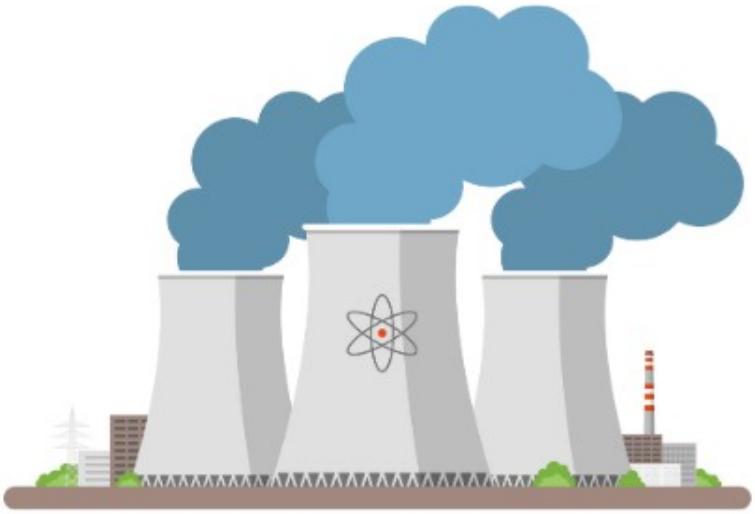
HYDROPOWER

WIND POWER

SOLAR POWER



NUCLEAR POWER



Activity 4.1
Nuclear Power Plant Budget

Directions: You are responsible for tracking budget changes for the construction of a new nuclear power plant and reactor. The "Initial Costs" column shows the budget created by a group of accountants, architects, and engineers at a hypothetical energy firm. The Original Engineering Procurement Costs (EPC) represent the contractual agreement between the project owner and the contractor. The contractual framework in an EPC contract enables the owner to transfer the complete risk of design, procurement, and construction to the contractor.

Note: The lead architect has reported the construction project will take **seven years** to complete.

	Initial Costs ($ millions)	After Event 1	After Event 2	After Event 3
Original Engineering Procurement Construction Costs (EPC)	**3,500**	**3,500**	**3,500**	**3,500**
Visual 1: Land				
Acreage	20			
Uranium	6			
Waste Disposal	20			
Water	1			
LAND TOTAL	**47**			
Visual 2: Labor				
Pipe Fitters and Steel Workers	160			
Cement Workers	190			
Engineers and Architects	317			
Safety Inspectors	80			
General Construction	900			
Other Workers	120			
LABOR TOTAL	**1,767**			
Visual 3: Capital Goods				
Steel	350			
Cement	640			
Wires and Tubing	45			
Turbines	120			
Licenses and Permitting	20			
Miscellaneous Components	600			
CAPITAL TOTAL	**1,775**			
TOTAL PROJECT COSTS:	**7,089**			
COMPLETION YEAR:	**20__**			

Visual 4.1:
Which Energy Source Would You Pick?

Directions: You are responsible for tracking budget changes for the construction of a new nuclear power plant and reactor. The "Initial Costs" column shows the budget created by a group of accountants, architects, and engineers at a hypothetical energy firm. The Original Engineering Procurement Costs (EPC) represent the contractual agreement between the project owner and the contractor. The contractual framework in an EPC contract enables the owner to transfer the complete risk of design, procurement, and construction to the contractor.

Note: The lead architect has reported the construction project will take **seven years** to complete.

	Initial Costs ($ millions)	After Event 1	After Event 2	After Event 3
Original Engineering Procurement Construction Costs (EPC)	**3,500**	**3,500**	**3,500**	**3,500**
Visual 1: Land				
Acreage	20	20	20	20
Uranium	6	6	6	6
Waste Disposal	20	20	20	20
Water	1	1	1	1
LAND TOTAL	**47**	47	47	47
Visual 2: Labor				
Pipe Fitters and Steel Workers	160	160	***176***	176
Cement Workers	190	190	***209***	***313.5***
Engineers and Architects	317	317	***348.7***	***453.31***
Safety Inspectors	80	80	***88***	88
General Construction	900	***1,260***	***1,386***	***1,940.4***
Other Workers	120	120	***132***	132
LABOR TOTAL	**1,767**	2,127	2,339.7	3,103.21
Visual 3: Capital Goods				
Steel	350	***490***	490	***686***
Cement	640	***896***	***1,075.2***	1,075.2
Wires and Tubing	45	***72***	***108***	108
Turbines	120	120	***144***	144
Licenses and Permitting	20	20	20	20
Miscellaneous Components	600	600	600	600
CAPITAL TOTAL	**1,775**	2,198	2,437.2	2,633.2
TOTAL PROJECT COSTS:	**7,089**	7,872	8,323.9	9,283.41
COMPLETION YEAR:	**20__**	20__	20__	20__

Events 1

There is a shortage of steel across the globe and, as a result, **STEEL** prices have increased by **40%** since the start of the project.

Due to increased global demand for copper, **WIRE and TUBING** prices have increased by **60%** since the start of the project.

There is a shortage of construction workers in the country who have experience working at nuclear power facilities and, as a result, **GENERAL CONSTRUCTION** costs have surged by **40%.**

Nuclear Regulatory Commission regulators found flaws in the installation of cement flooring in the reactor room and mandated that the flooring be replaced. As a result, **CEMENT** costs have increased by **40%.**

The project will be delayed by **24 MONTHS** because of the steel and construction worker shortages, and the Nuclear Regulatory Commission mandate.

Events 2

A recent surge in construction projects, coupled with a shortage of workers in the cement industry, has resulted in a shortage of cement in the United States. As a result, **CEMENT** prices have increased by **20%** since the previous event card was read.

Global work stoppages have increased and, as a result, **TURBINE** prices increased **20%** since the previous event card was read.

Various factors have caused **LABOR COSTS** in all fields to increase **10%** across the board since the previous event card was read.

Nuclear Regulatory Commission regulators discovered unsafe amounts of wiring degradation and a degraded hydrogen seal in the main generator. As a result, **WIRE and TUBING** costs have increased by **50%** since the previous event card was read.

The project will be delayed by an additional **12 MONTHS** because of cement and turbine issues, labor cost increases, and the Nuclear Regulatory Commission mandate.

Events 3

An ongoing shortage of experienced nuclear power plant construction workers has led to a **40%** increase in **GENERAL CONSTRUCTION** costs since the previous event card was read.

Nuclear Regulatory Commission regulators discovered vibrations in the cooling system piping and called for additional inspections of the reactor unit design. As a result, the cost of **ENGINEERS/ARCHITECTS** has increased **30%** since the previous event card was read.

A partnering cement contractor has declared bankruptcy and shut down. As a result, **CEMENT WORKER** costs have increased by **50%** since the previous event card was read.

As a result of increased global demand for **STEEL**, the price for this good has increased by **40%** since the previous event card was read.

The project will be delayed by an additional **24 MONTHS** because of the shortage of experienced nuclear power plant construction workers, business partner bankruptcy, and Nuclear Regulatory Commission mandate.

CARD 1: Hydropower

Greetings! I'm here to share information about hydropower. Hydropower, or hydroelectric power, is one of the oldest and largest sources of clean and renewable energy out there. Hydropower uses the natural flow of moving water to generate electricity.

Benefits of hydropower: It's clean and renewable, it provides low cost energy, and it helps with flood prevention.

Costs of hydropower: It's expensive to build hydropower plants, droughts can interrupt its effectiveness, and there are limited sources of water available to harness.

One large hydropower facility can generate enough electricity to power 500,000+ homes.

Operational life expectancy of a hydropower facility: up to 100 years

Hydropower has the capacity to produce at maximum power levels 41% of the time during a typical year.

CARD 2: Wind Power

Greetings! I'm here to share information about wind power. Wind power or wind energy describes the process by which the wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in the wind into mechanical power.

Benefits of wind power: It's clean and renewable, it provides low cost energy, and wind turbines can be located in a variety of settings.

Costs of wind power: The wind is not always blowing, wind turbines create noise, installing wind turbines can be expensive, and they can disrupt wildlife.

One hundred wind power turbines can generate enough electricity to power 94,000 homes.

Operational life expectancy of a wind turbine: 20 years

Wind power has the capacity to produce at maximum power levels 35% of the time during a typical year.

CARD 3: Solar Power

Greetings! I'm here to share information about solar power. Solar power works by converting energy from the sun into power. Solar radiation is light that is emitted by the sun. Solar technologies capture this radiation and turn it into useful forms of energy.

Benefits of solar power: It's clean and renewable, maintenance costs are low, and it's well suited for the energy grid.

Costs of solar power: The sun does not always shine, solar panels take up a lot of space, and solar energy storage is expensive.

100,000 solar panels can generate enough electricity to power around 5,000 homes.

Operational life expectancy of a solar panel: 25-30 years

Solar power has the capacity to produce at maximum power levels 25% of the time during a typical year.

CARD 4: Nuclear Power

Greetings! I'm here to share information about nuclear power. Nuclear power comes from splitting atoms in a reactor to heat water into steam, turn a turbine, and generate electricity.

Benefits of nuclear power: It's clean, one reactor and power plant can generate large amounts of energy, nuclear power plants can run uninterrupted for very long times, once operational they produce electricity at a low cost.

Costs of nuclear power: It's expensive to build, radioactive waste, risk of accident, not a renewable energy source, and needs uranium to operate and mining this resource comes with several costs.

One nuclear power reactor/facility can generate enough electricity to power 500,000+ homes.

Operational life expectancy of a nuclear power reactor/facility: 60-80 years

Nuclear power has the capacity to produce at maximum power levels 92% of the time during a typical year.

Activity 4.4

Which Energy Source Should We Use?

Directions: Fill in the appropriate information based on the reports from each energy source representative.

 **Hydropower** Benefits: Costs: How many homes can one large unit power: What is the expected lifetime of a hydropower facility: What percent of the time can hydropower facilities produce at maximum capacity: Ranking:	 **Wind Power** Benefits: Costs: How many homes can 100 units power: What is the expected lifetime of an average wind turbine: What percent of the time can wind turbines produce at maximum capacity: Ranking:
 **Solar Power** Benefits: Costs: How many homes can 100,000 units power: What is the expected lifetime of a solar power panel: What percent of the time can solar panels produce at maximum capacity: Ranking:	 **Nuclear Power** Benefits: Costs: How many homes can one unit power: What is the expected lifetime of a nuclear power reactor/facility: What percent of the time can nuclear power reactors/facilities produce at maximum capacity: Ranking:

Activity 4.4

Which Energy Source Should We Use? (Key)

Instructions: Fill in the appropriate information based on the reports from each energy source representative.

Hydropower

Benefits: **Clean and renewable, provides low cost energy, helps with flood prevention**

Costs: **Can be expensive to build hydropower plants, droughts can interrupt effectiveness, there are limited sources of water available to harness**

How many homes can one unit power: **500,000+**

What is the expected lifetime of a hydropower facility: **100 years**

What percent of the time can hydropower facilities produce at maximum capacity: **41**

Ranking:

Wind Power

Benefits: **Clean and renewable, provides low cost energy, wind turbines can be located in a variety of settings**

Costs: **Wind is not always blowing, wind turbines create noise, installing wind turbines can be expensive, can disrupt wildlife**

How many homes can 100 units power: **94,000**

What is the expected lifetime of an average wind turbine: **20 years**

What percent of the time can wind turbines produce at maximum capacity: **35**

Ranking:

Solar Power

Benefits: **Clean and renewable, maintenance costs are low, well suited for the energy grid**

Costs: **Sun does not always shine, solar panels take up a lot of space, solar energy storage is expensive**

How many homes can 100,000 units power: **5,000**

What is the expected lifetime of a solar power panel: **25 - 30 years**

What percent of the time can solar panels produce at maximum capacity: **25**

Ranking:

Nuclear Power

Benefits: **Clean, one power plant can generate large amounts of energy, can run uninterrupted for long times, produce electricity at low cost once running**

Costs: **Expensive to build, radioactive waste, risk of accident, not a renewable energy source, need uranium to operate and mining this resource comes with several costs**

How many homes can one unit power: **500,000+**

What is the expected lifetime of a nuclear power reactor/facility: **60 - 80 years**

What percent of the time can nuclear power reactors/facilities produce at maximum capacity: **92**

Ranking: