Activity Guide for Water-Electricity Connections

This activity is meant to help students understand that it takes water to make electricity; and it takes electricity to clean and deliver water. If they want to save electricity, they can use less water. If they want to save water, they can use less electricity.

Standards:

- **Animals AND plants adapt to living in the desert. We can take advantage plant adaptations by landscaping with plants that are adapted to the desert. They have evolved to survive drought and require very little water. Using less water on our landscaping helps save electricity too!**
- **How does weather (drought) affect the water-energy system?**
- **How can increased CO_2 or La Niña impact New Mexico's climate?**
- **Science can help us make decisions about how to prepare for drought. Simple things work, like putting a nozzle on your hose, using a car wash instead of washing your car at home, taking shorter showers (and using a low-flow shower head).**
- **How is your electricity made? What energy sources are used to boil the water? Which of those sources were formed by living organisms and which were formed by nonliving processes?**

Supplies:

- City diagram – one per group (click here)
- Beads to cover the spaces on the laminated city (Squashed marbles called "mini gems" work well. Beans would work too, or even paper circles the size of the spaces on the city.):
  - Blue "mini gem" marbles (or lima beans) for city water, enough for each group to get about 15 - 20. For Albuquerque, place in two bowls, one labeled "aquifer," and one labeled "river." Divide the marbles (or beans) evenly into the bowls.
  - Yellow "mini gem" marbles (or chick peas) to represent electricity, about 25 per group. Put them in a bowl labeled "Power Plant."
  - Purple or another color of "mini gem" marbles (or pinto beans) to represent the water used to make electricity. For Albuquerque, these should be put in a bowl labeled "San Juan River Water." You will need the same amount of these marbles (or beans) as you have of electricity. They will be traded, one for one.
- One dipper that holds about 25 of your purple "mini gem" marbles (or pinto beans).
- Signs:
  - *Cost for water in the city:* ***1 electricity => 2 city waters*** *(In Albuquerque, that's one aquifer water and one river water for one electricity.)*
  - *Cost for electricity:* ***1 San Juan water => 1 electricity***
- Flash Cards for warm up (click here)
- The NEED poster (click here) to explain how water is used to make electricity
- Energy-Water Nexus poster (click here)
- Conservation Hints - one per group (click here)

Activity Directions:

I. Set-Up

a. Place the San Juan Water bowl filled with purple 'mini gems" (or pinto beans), i.e. the water that is used to make electricity, on the far side of the room. Place the power plant bowl filled with the yellow "mini gems" (or chick peas), i.e. the electricity, near the first bowl. In front of the power plant put up the sign that says, ***1 San Juan water => 1 electricity.***

b. Place the bowl(s) with city water filled with blue "mini gems" (or lima beans) at the front of the room. In front of the bowls put up the sign that says, ***1 electricity => 2 city waters.***
c. Have on hand: Flash Cards, NEED poster, Energy Nexus poster, City diagrams (1 per group), Conservation Hints (1 per group)
d. Write these 3 questions on the board:

1. How is water used to make electricity?
2. How is electricity used to bring you water?
3. List at least 2 ways you can save electricity by saving water.

II. Warm up (20 minutes) (You could easily spend more time on this!)

a. Direct students to the 3 questions you wrote on the board. Tell them that at the end of the activity, they should be able to answer all three.
b. Ask students to guess how much water it takes to make a few common things. Use the flash cards (click here). When they are surprised, explain that it takes water to grow necessary plants, but it also takes water to make the electricity that a factory uses. Water is also used in factories to cool machinery. Show the NEED poster (click here) and explain how turbines use water in the form of steam to spin the copper coil inside the magnet of the generator. Explain that uranium, gas, and solar mirrors also are used to make the steam that spins the turbines. Which of these sources came from living matter and which came from non-living sources? Which are renewable? Non-renewable?
c. Now ask them where their water comes from. Brainstorm ways that it takes electricity to deliver clean water to them like pumping from the source, cleaning (if needed), disinfecting, delivering water to homes, etc.. Remind them that it takes a lot of electricity to clean their wastewater too.
d. Show Energy–Water Nexus poster (click here). Highlight how water and electricity are connected in the poster.

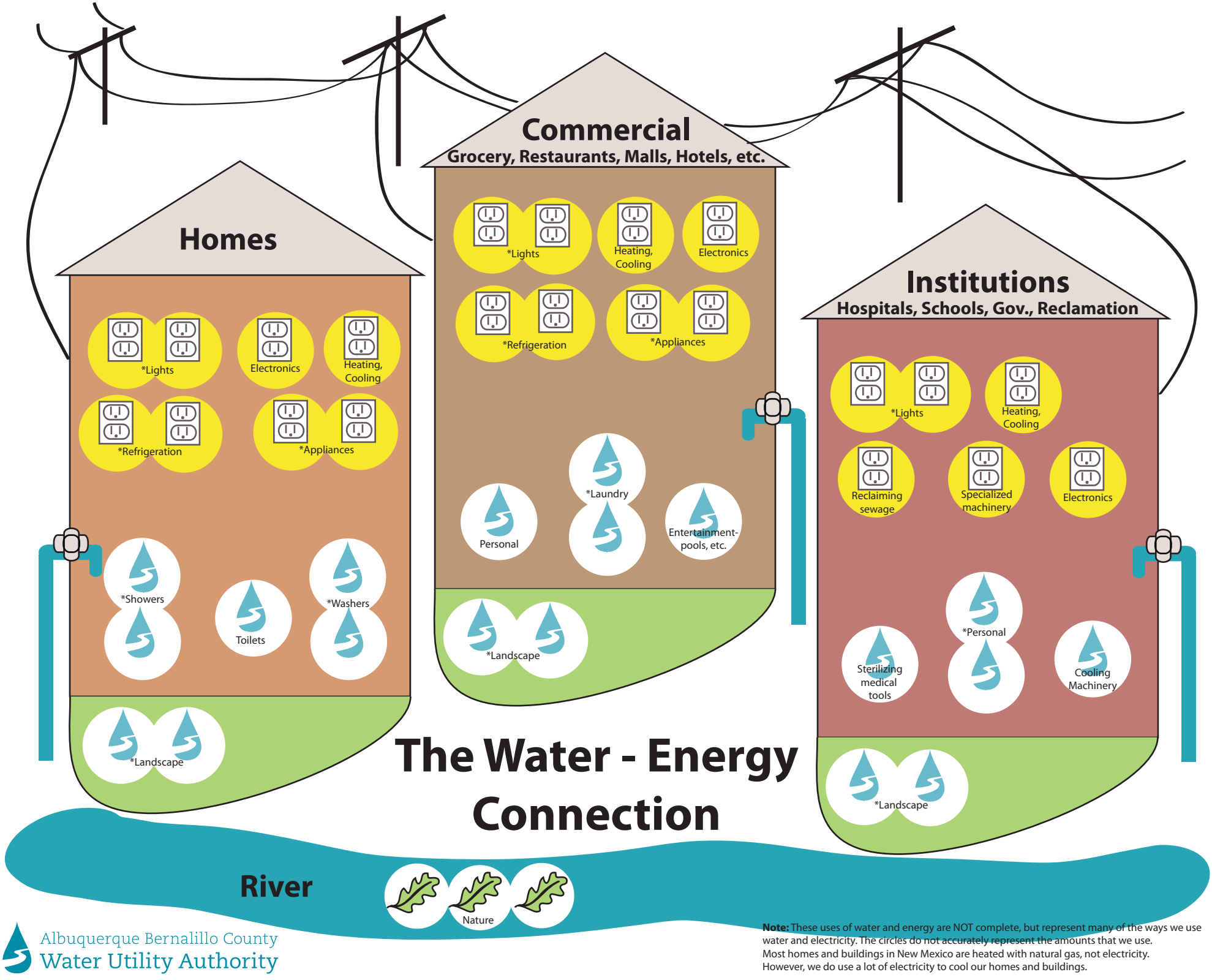
III. The activity (20 minutes) Divide students into groups of 3 or so

a. Hand out a laminated city diagram to each group. Go over the parts. Make sure they understand what services are provided to all of us by commercial customers and institutions. Explain that they will provide those services by placing a bead (or bean) on each circle. The joined circles with asterisks require 2 beads (or beans).
b. Go over the steps students must take to provide these services to their citizens.
    1. Start at the water source at the far end of the classroom. Get a dipper of water there (about 25 water beads). You may want to do the scooping so students don't get too many.
    2. Trade in your water for electricity (1 water => 1 electricity). This can cause a bottleneck, so ask students to stand aside while they count their waters. When they know how many water beads they have, they can go get that many electricity beads at the power plant. [Review: Why do you need water to get electricity? To make steam to turn the turbine and cool machinery.] Take away the electricity and its water source as soon as students are finished getting their electricity so that they are not tempted to come back and try to get more.
    3. Return to your city to start providing services to your citizens.
    4. When you want to purchase water, go to the water source(s) for city water. Trade 1 electricity for 2 city waters. [Review: Why do you have to use electricity to get water? To pump the water, clean and/or disinfect the water.] Remind students that they CANNOT use the water from the power plant in their city. Their city must have only the blue beads (or the lima beans) covering the water needs.
    5. See if you can provide all services for your town.
    6. Ask students if they were successful.

c. If they didn't cheat, they won't be able to cover all their needs. At this point, stop the class and explain that you can see they are having trouble fulfilling their need of their town. Hand out the Conservation Hints page (click here). If their citizens will agree to these conservation measures, they can use only one marble (or bead) for each of the joined circles on the city diagram. For example, if they will xeriscape instead of planting lawns, they will only need one marble, instead of two, to landscape.

IV. Discussion (10 minutes) What about drought?

a. Take out one third of the purple water beads (pinto beans). Now there is less water available to make electricity? How will your classroom divide up the remaining water?
b. Now take most of the water out of river bowl too. The only water resource left is the aquifer. What can we do to preserve our aquifer so that we can use it for the drought? Save water AND save electricity.
c. Brainstorm ways to do this.
d. Go over the 3 questions on the board and check for student understanding.



Albuquerque Bernalillo County
Water Utility Authority

Note: These uses of water and energy are NOT complete, but represent many of the ways we use water and electricity. The circles do not accurately represent the amounts that we use. Most homes and buildings in New Mexico are heated with natural gas, not electricity. However, we do use a lot of electricity to cool our homes and buildings.

One 12-ounce can of soda

1 12-ounce can of soda = 16.5 gallons of Water

(62.7 liters of water)

Project WET Curriculum and Activity Guide: Water Works
1995, Project WET International Foundation and CEE

forty sheets of paper

40 sheets of paper = 100 gallons of water

(380 liters of water)

Project WET Curriculum and Activity Guide: Water Works
1995, Project WET International Foundation and CEE

We don’t make these in NM, but . . .

One pair of jeans

1 pair of jeans = 1,800 gallons of water

(6,840 liters of water)

Project WET Curriculum and Activity Guide: Water Works
1995, Project WET International Foundation and CEE

We don’t make these in NM, but . . .

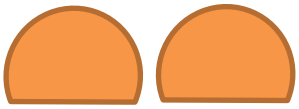
One car

One ton of steel used to make one car =
32,000 gallons of water

(121,600 liters of water)

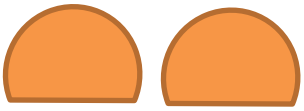
Project WET Curriculum and Activity Guide: Water Works
1995, Project WET International Foundation and CEE

Water and Energy Savings



Incandescent Light bulbs **OR**  Compact Fluorescents

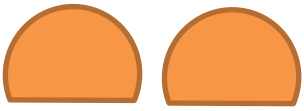
Top-loading Washers **OR**  Front-loading Washers



Old Appliances **OR**  Energy Star Appliances

(like clothes washers, dishwashers) (like clothes washers, dishwashers - air dry when possible)

Yards with Lawns **OR**  Xeriscape yards (desert plants)



Old Refrigerators **OR**  Energy Star Refrigerators

(And don't stand there with the door open!)

Long Showers **OR**  Five-minute showers

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