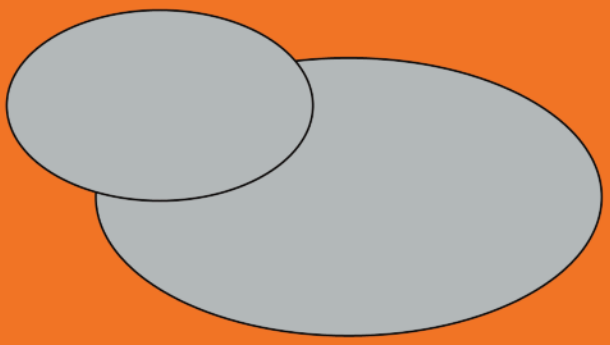
Powered by the Sun

THE EARTH'S WATER CYCLE

1. ENERGY FROM THE SUN HEATS LAND, LAKES RIVERS AND OCEANS TURNING WATER INTO VAPOR.



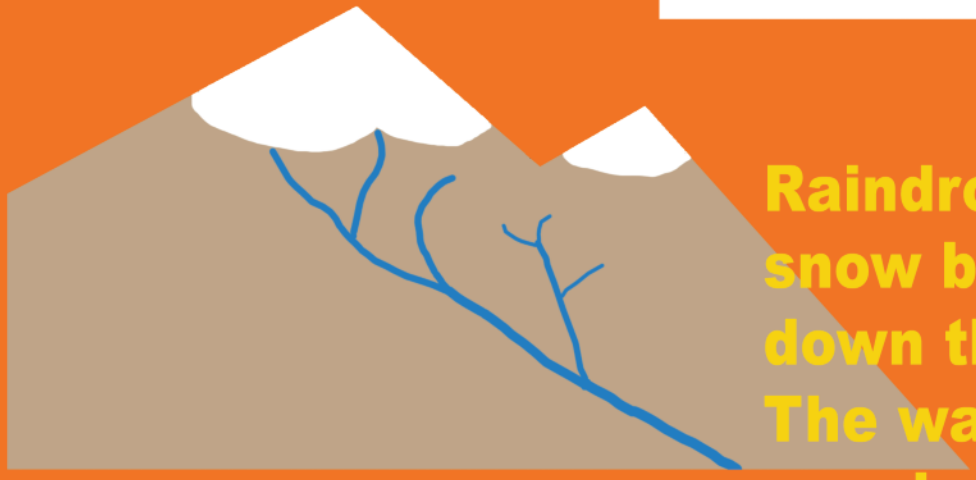
2. WATER VAPOR RISES IN THE ATMOSPHERE WHERE IT FORMS CLOUDS.

3. WATER VAPOR IN THE CLOUDS COOLS AND FALLS BACK TO THE GROUND AS RAIN, SNOW, SLEET AND HAIL.

THE POWER OF GRAVITY ON FLOWING WATER

Rain and snow fall on high ground.

Gravity is a force that pulls everything toward the center of the Earth.



Raindrops and melting snow begin rushing down the mountain. The water joins in ever-larger streams.

As more water flows downhill through flatter ground, streams become rivers. Eventually, the force of gravity on flowing water creates a flat body such as a lake or ocean.

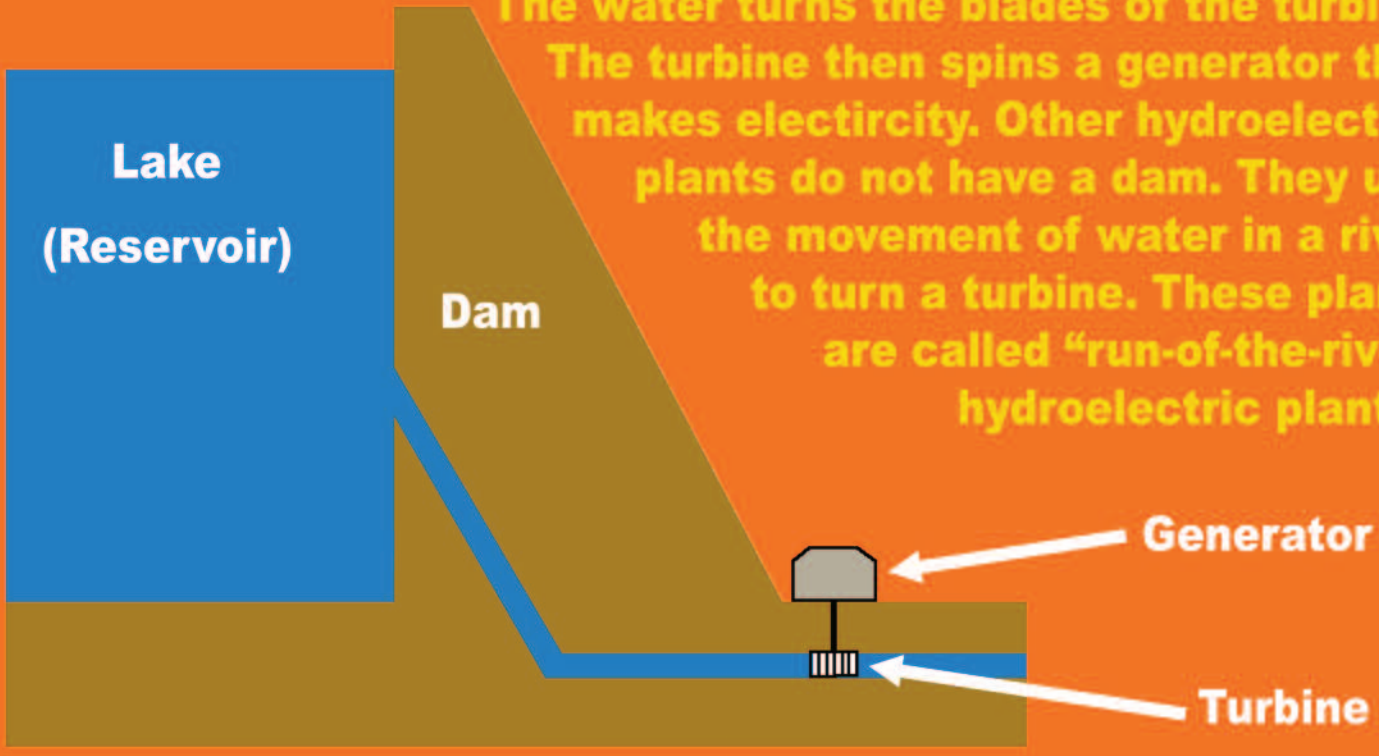
Water is heavy, and its downward movement represents energy that can be harnessed to do useful work.

HYDROELECTRIC PLANTS
MAKING ELECTRICITY

A **hydroelectric plant** uses falling water to turn machines that make **electricity**. The part that the water turns is called a **turbine**. It has blades. Like an old-fashioned water wheel, the turbine spins when water passes through it. The part that makes electricity is called the **generator**. The turbine and generator are connected. Water spins the turbine, and the generator turns too. Magnets in the generator push **electrons** through coils of wire. A stream of moving electrons is called electricity.

For hundreds of years we have used water wheels to capture the energy in falling water. Wheels ran machines that ground grains and performed other useful work.

Here is one kind of hydroelectric plant. A dam is built across a river to hold back the water. A lake is created behind the dam. Gravity causes water high in the dam to rush down a big pipe. The water turns the blades of the turbine. The turbine then spins a generator that makes electircity. Other hydroelectric plants do not have a dam. They use the movement of water in a river to turn a turbine. These plants are called "run-of-the-river" hydroelectric plants.



Questions for students

1. Name something that creates water vapor in the atmosphere?

2. How does water vapor in the air return to Earth?

3. What force of nature causes water to flow down hill?

4. What turns the turbines that create the electricity in a hydroelectric plant?

5. Do you think that a hydroelectric plant operates on solar energy? Why?

6. Does a hydroelectric plant burn fuel to produce electricity?

7. Can you think of some advantages of hydroelectric plants?

8. Can you think of some disadvantages of hydroelectric plants?

9. What is created by the dams at certain hydroelectric plants?

10. How do lakes change the landscape?

11. How would the valley have appeared before the dam?

12. What kind of animal and plant life lived there before the dam?

13. How does the valley appear after the dam was built, creating a lake?

14. What kind of animal and plant life lives in the lake?

15. What are some advantages of the lake?

16. What are some disadvantages of the lake?

17. Do you think that run-of-river hydroelectric plants might be preferable to hydroelectric plants with dams?

18. Can you think of advantages and disadvantages of run-of-river hydroelectric plants?

19. Overall, do you think that water generated electricity is preferable to electricity generated by other sources?

Answer Key for Teachers

Many questions require opinions; no "right" or "wrong" answers.

1. Name something that creates water vapor in the atmosphere?
Chiefly the sun, but wind, manmade heating of water by another energy source

2. How does water vapor in the air return to Earth?
It rises to form clouds. When the cool, condensation creates rain, sleet, snow, and hail, which fall back to the Earth.

3. What force of nature causes water to flow down hill?
Gravity

4. What turns the turbines that create the electricity in a hydroelectric plant?
Flowing or falling water

5. Do you think that a hydroelectric plant operates on solar energy? Why?
Indirectly by the water cycle described above. Require no fuel source other than falling or flowing water

6. Does a hydroelectric plant burn fuel to produce electricity?
No

7. Can you think of some advantages of hydroelectric plants?
Non-polluting source of electricity,

8. Can you think of some disadvantages of hydroelectric plants?
May not be able to release enough water to meet electrical needs in times of drought. Plants with dams block passage of animals and boats wishing to travel upstream

9. What is created by the dams at certain hydroelectric plants?
Lakes

10. How do lakes change the landscape?
Flood the valley. Displacing certain types of fish and animals that thrive in streams. Force larger animals from the flooded valley. Displace the forest.

11. How would the valley have appeared before the dam?
Students describe an unflooded valley

12. What kind of animal and plant life lived there before the dam?
Species of fish that require a long trip upstream to spawn. Species that thrive in river and stream environments, rather than a lake.

13. How does the valley appear after the dam was built, creating a lake?
Students describe a reservoir

14. What kind of animal and plant life lives in the lake?
Many species of fish and other aquatic life thrive in a much larger water environment

15. What are some advantages of the lake?
Reservoirs store water for human consumption and irrigation. Helpful in times of drought. Create scenic and recreation opportunities.

16. What are some disadvantages of the lake?
Change the free-flowing nature of the original valley

17. Do you think that run-of-river hydroelectric plants might be preferable to hydroelectric plants with dams?
Students' opinions

18. Can you think of advantages and disadvantages of run-of-river hydroelectric plants?
Pro: do not block flow of the river, do not alter the natural environment to the extent that plants with reservoirs do
Cons: not as efficient because flowing water does not exert as much force on turbine turning the generator that falling water does in a plant with a dam, no stored water to release in times of drought

19. Overall, do you think that water generated electricity is preferable to electricity generated by other sources?
Students decide