Hydropower Worksheet

1. Use the reference material on “Hydropower.” You will use this packet to answer all the questions on this sheet. For any words that you do not know the meaning to, use the GLOSSARY on the last four pages of the packet.

2. How much of America’s supply of electricity comes from hydroelectric power plants (*page 1 top pie chart*)?

3. List the **FOUR** top fuels used to generate electricity in the United States in order of greatest to least (include the percentages).

4. How much electrical generation comes from hydropower and “**other**” sources (*p. 1 top pie chart*)?

5. Of the “**renewable** resources” that contribute to electrical generation in our country, how much is hydropower (*p. 1 bottom pie chart*)?

6. List **FOUR** other renewable resources used to generate electricity.

7. How did **Michigan** fit in with the hydroelectric Power time line (*p. 2*)?

8. Name **TWO** types of hydroelectricity currently generated and **define** what each is (*p. 2, 8 or glossary*).

9. Which kind of power plants are the most expensive to build (*p. 3*)?

10. Which kind of power plants is the least expensive to operate after the power plant is built (*p.3 bottom graphs*)?

11. Define a **kilowatt** and a **kilowatt-hour** (*use the glossary*).

12. List and define impoundment hydropower, run of the river projects and micro-hydropower projects (*p. 4-5*).

13. What is diversion hydropower and does it require a dam (*p.5*)?

14. List the **SEVEN** primary purposes of dams in the U.S. in order from highest to lowest (*p. 6 top pie chart*).

15. What is the ultimate source of hydropower (*page 6*)?

16. Using the diagram on page 6, draw and label a simple sketch representing the “hydrologic (*water*) cycle in nature?

17. Sketch the picture of the “cutaway view” of a hydroelectric plant found on page 7. **Label and define** (*give the function of*) the terms: head, penstock, dam, turbine and generator.

18. List **FOUR** principal advantages of hydropower (*p. 7*).

19. **List and explain** TWO principal disadvantages of hydropower (*bottom of p. 7, top of p. 8*).

20. Using the headings on pages 8-9, list ONE fact under each heading that highlights hydropower in a positive way.

21. What is a “grid system” (*page 10*)? Name at least **FIVE** types of power plants that contribute electricity to a common grid system.

22. Define “**peakload**” and “**baseload**” using the glossary.

23. According to page 11, determine whether … (a) nuclear and fossil fuel power plants and (b) hydropower plants … should be used for “peakload” or “baseload.” Explain your reasoning.

24. Refer to the graph on page 11 and read the “baseload” and “peakload” for each day. Set up a chart as follows and record the values of “baseload” and “peakload” for each day:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sun | Mon | Tues | Wed | Thurs | Fri | Sat |
| Baseload |  |  |  |  |  |  |  |
| Peakload |  |  |  |  |  |  |  |

25. Define “**pumped storage**” (*page 12*). **Sketch** the diagrams to show how pumped storage works.

26. Using the diagram on page 13, **sketch** a typical **transmission** **grid** of electricity to our homes. Be sure to include the arrows indicating the source and destination of the electricity.

**Hydropower Worksheet**

**Answer KEY**

1. Obtain the reference material on “Hydropower.” You will use this packet to answer all the questions on this sheet. For any words that you do not know the meaning to, use the GLOSSARY on the last four pages of the packet.

2. How much of America’s supply of electricity comes from hydroelectric power plants (*page 1 top pie chart*)?

**7%**

1. List the FOUR top fuels used to generate electricity in the United States in order of greatest to least (include the percentages).

### Coal 52% nuclear 20% natural gas 16% petroleum 3%

1. How much electrical generation comes from hydropower and “other” sources?

**7% + 2% = 9%**

1. Of the “renewable resources” that contribute to electrical generation in our country, how much is hydropower?

**99.1%**

1. List FOUR other renewable resources used to generate electricity.

## **Geothermal biomass wind photovoltaic**

1. How did Michigan fit in with the hydroelectric Power time line?

**1880 Grand Rapids Electric light & Power Company, generated electricity by a dynamo, belted to a water turbine at the Wolverine Chair Factory lighting up 16 brush-arc lamps.**

1. Name TWO types of hydroelectricity currently generated and **define** what each is (p. 2, 8 or glossary).

## **Conventional capacity pumped storage**

1. Which kind of power plants are the most expensive to build (p. 3)?

## **Nuclear fossil fuel**

1. Which kind of power plants is the least expensive to operate after the power plant is built (p.3)?

**Hydroelectric**

1. Define a kilowatt and a kilowatt-hour (use the glossary).

**Kilowatt (kW): Unit of electric power equal to 100 Watts or 1.34 horsepower. For example, it’s the amount of electric energy required to light ten 100-W bulbs.**

**Kilowatt-hour (kWH): The unit of electrical energy commonly used in electric marketing; the energy produced by 1 kilowatt acting for one hour. Ten 100-W light bulbs burning for one hour one kilowatt-hour of electricity.**

1. List and define impoundment hydropower, run of the river projects and micro-hydropower projects (p. 4-5).

**Impoundment hydropower: uses a dam to store water. Water may be released either to meet changing electricity needs or to maintain a constant water level.**

**Run of the River Project: utilize the flow of water within the natural range of a river, requiring little to no impoundment. Run-of-river plants can be designed using large flow rates with low head or small flow rates with high head.**

**Micro-hydropower project: produce 100 kilowatts (kW) or less. Micro-hydropower plants can utilize low heads or high heads.**

**Low Head Hydropower: A low-head dam has a water drop of less than 65 feet and a generating capacity of less than 15,000 kW. The advantage of low head hydropower is the proximity of the power generation to the destination, reducing loss during transmission.**

1. What is diversion hydropower and does it require a dam (p.5)?

**Diversion hydropower channels a portion of a river through a canal or penstock, but may not require a dam.**

1. List the SEVEN primary purposes of dams in the U.S. in order from highest to lowest (p. 6).

**Recreation 35%**

**Stock/Farm Ponds 18%**

**Flood control 15%**

**Public Water Supply 12%**

**Irrigation 11%**

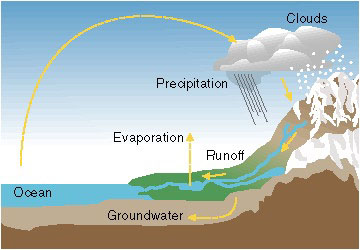
**Other 7%**

**Hydroelectricity 2%**

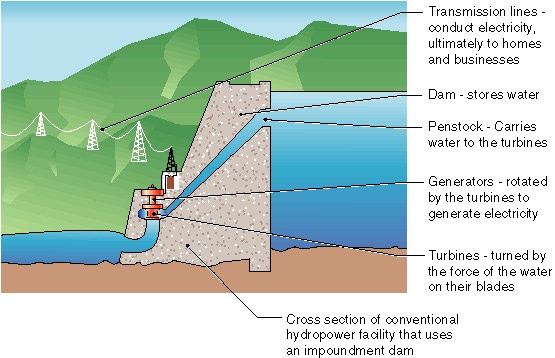
1. What is the ultimate source of hydropower (page 6)?

**The sun**

1. Using the diagram on page 6, draw and label a simple sketch representing the “hydrologic (*water*) cycle in nature?



1. Sketch the picture of the “cutaway view” of a hydroelectric plant found on page 7. Label and define (*give the function of*) the terms: head, penstock, dam, turbine and generator.



1. List FOUR principal advantages of hydropower (p. 7).

* **Large renewable domestic resource base**
* **Absence of polluting emissions during operation**
* **Its capability in some cases to respond quickly to utility load demands**
* **Its very low operating costs**

1. List and explain TWO principal disadvantages of hydropower (pp. 7-8).
   * **High initial cost**
   * **Potential site-specific and cumulative environmental impacts: water quality degradation, mortality of fish, blockage of fish migration, flooding of terrestrial ecosystems by new impoundments**
2. Using the headings on pages 8-9, list ONE fact under each heading that highlights hydropower in a positive way.

* **Applications and Uses of Technology**
* **Favorable Features of Hydropower**
* **Convenience**
* **Efficient and Inexpensive**
* **Leading Source of Renewable Energy**

1. What is a “grid system” (page 10)? Name at least FIVE types of power plants that contribute electricity to a common grid system.

Electricity can be interchanged among several utility systems to meet varying demands

1. Define “peakload” and “baseload” using the glossary.

**Peakload: The greatest amount of power given out or taken in by a machine or power distribution system in a given time**

**Baseload: the minimum constant amount of load connected to a power system over a given time period, usually on a monthly, seasonal, or yearly basis.**

1. According to page 11, determine whether … (a) nuclear and fossil fuel power plants and (b) hydropower plants … should be used for “peakload” or “baseload.” Explain your reasoning.

Demands for power vary greatly during the day and night. These demands vary considerably from season to season, as well. For example, the highest peaks are usually found during summer daylight hours when air conditioners are running.

**Nuclear and fossil fuel plants are not efficient for producing power for the short periods of**

**increased demand during peak periods. Their operational requirements and their long startup times make them more efficient for meeting baseload needs.**

**Since hydroelectric generators can be started or stopped almost instantly, hydropower is more responsive than most other energy sources for meeting peak demands.**

1. Refer to the graph on page 11 and read the “baseload” and “peakload” for each day. Set up a chart as follows and record the values of “baseload” and “peakload” for each day:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sun | Mon | Tues | Wed | Thurs | Fri | Sat |
| Baseload | **20,000** | **23,000** | **23,500** | **23,500** | **23,500** | **23,500** | **20,000** |
| Peakload | **28,500** | **38,300** | **37,000** | **37,000** | **37,000** | **37,000** | **26,800** |

1. Define “**pumped storage**” (*page 12*). **Sketch** the diagrams to show how pumped storage works.

**A plant that usually generates electric energy during peak-load Hydroelectric Plant periods by using water previously pumped into an elevated storage reservoir during off-peak periods when excess generating capacity is available to do so. When additional generating capacity is needed, the water can be released from the reservoir through a conduit to turbine generators located in a power plant at a lower level.**

1. Using the diagram on page 13, sketch a typical transmission grid of electricity to our homes. Be sure to include the arrows indicating the source and destination of the electricity.

**Vast networks of transmission lines and facilities are used to bring electricity to us in a form we can use. All the electricity made at a powerplant comes first through transformers which raise the voltage so it can travel long distances through powerlines. (Voltage is the pressure that forces an electric current through a wire.) At local substations, transformers reduce the voltage so electricity can be divided up and directed throughout an area.**