Energy teacher pack

Identify the energy source, conversion, useful service and losses before judging a proposal.

For learners around age 14 and curious adults. Three 40-minute sessions. Use with the current AHA Energy manuscript. References use chapter titles so they work in both print and ebook.

Learning goals

Identify the energy source, conversion, useful service and losses before judging a proposal.

Use the terms energy; power; efficiency; heat pump; storage; energy carrier. Show the reasoning behind an answer and identify where the example stops applying.

Reading route

1. 1 What was Tesla trying to collect?

2. 15 Why a heat pump can deliver more than it uses

3. 21 How to test an extraordinary claim

Teaching plan

Session 1: Ask the opening question before reading (5 minutes). Read the first selected chapter together (15). Draw the mechanism or compare two possible explanations (15). End with a one-sentence explanation (5).

Session 2: Read the remaining selected material (10 minutes). Complete the worksheet individually, then compare reasoning in pairs (20). Discuss the common wrong turn (10).

Session 3: Revisit one uncertain answer (10 minutes). Try the extension (15). Give a two-minute explanation without the book (10). Use the exit question (5).

Materials and access

Paper, pencil, the book and an optional calculator. Read diagrams aloud, allow spoken or drawn responses, and give extra time for vocabulary. No real accounts or specialist equipment are needed.

Energy learner worksheet

Opening question

A heat pump delivers three units of heat for one unit of electricity. Has it created energy?

Investigation

An imaginary heat pump uses 2 kWh of electricity and takes 4 kWh of heat from outdoors during a stated period. Draw arrows into and out of the system. Separately, a battery receives 10 kWh and later returns 8 kWh.

1. How much heat does the heat pump deliver?

Show your reasoning, label units or evidence, and state any assumptions.

2. What is its heating COP for this example?

Show your reasoning, label units or evidence, and state any assumptions.

3. What is the battery's round-trip efficiency?

Show your reasoning, label units or evidence, and state any assumptions.

Transfer question

At COP 2 instead of 3, delivering 6 kWh of heat needs 3 kWh of electricity. Explain why performance conditions matter.

Exit question

What would you now check before accepting a claim about this topic? Name one specific check and explain why.

Energy answers and teaching notes

Answer 1

2 + 4 = 6 kWh of heat.

Answer 2

COP = 6/2 = 3. The extra delivered heat came from outdoors.

Answer 3

8/10 = 80%. Two kWh were not returned as useful electrical output.

Common wrong turn

A patent is a documented proposal, not proof that a device delivers useful power. Hydrogen and batteries carry or store energy supplied through other processes.

Extension discussion

At COP 2 instead of 3, delivering 6 kWh of heat needs 3 kWh of electricity. Explain why performance conditions matter.

Assess the explanation

Give one point each for a correct conclusion, visible reasoning, correct units or evidence, and a relevant limitation. A correct number with no explanation is not a complete answer. Accept equivalent wording and well-supported alternative interpretations where the question allows them.

If the learner gets stuck

Return to the diagram or the smallest example. Ask what is being counted, compared or transferred. Let the learner revise the answer after explaining the mistake; do not reward speed over understanding.

Family connection

Choose one energy claim and ask: What enters? What leaves? Where are the measurements? Who independently repeated the test? Never build high-voltage or concentrated-sunlight experiments.