GRID & SILICON
TECHNOLOGY EXPLAINER

Cooling Towers and Dry Coolers: Where Data Center Heat Goes

How does a data center move heat outside, and how much water does it use?

In the news

In November 2026, a news story asked how much water big AI data centers use. To find the answer, we need to follow the heat.

Computers make heat

A data center is a building full of computers called servers. Each server has chips. A chip is a small part that does the computer's work. Chips use a lot of electricity. Almost all the electricity a chip uses turns into heat. If a chip gets too hot, it can slow down or break. So the heat must be carried away all day and all night.

Heat moves from hot to cold

Heat is energy that moves from a warmer thing to a cooler thing. Heat always moves from a warmer place to a cooler place. A cooling system uses this rule again and again. Hold an ice cube in your hand. Heat moves from your warm hand into the cold ice. Your hand feels cold, and the ice melts.

Inside: from the chip to the coolant loop

Some servers are cooled by fans that blow air over the chips. But many new AI chips get too hot for air alone. They are cooled with liquid instead.

A cold plate is a flat metal block that sits on top of a chip. Cool liquid flows through thin channels inside it. Heat moves from the hot chip into the metal and then into the liquid. This liquid is called coolant. Coolant is a liquid that carries heat away from hot parts. Pumps push the warm coolant through pipes.

The pipes make a coolant loop. A coolant loop is a closed path of pipes that the same coolant flows around again and again. The coolant picks up heat at the chips and gives off heat outside. Then it comes back cool. Because the loop is closed, the coolant is used again and again. Outside, one of two machines moves the heat into the air. One is a cooling tower. The other is a dry cooler.

Cooling towers

Evaporate means to change from a liquid into a gas. When water evaporates, it becomes water vapor. Water vapor is water in the form of a gas.

Water takes in a lot of heat when it evaporates. Think about getting out of a pool. The water on your skin evaporates. It takes heat from your skin, so you feel cold.

A cooling tower is a machine that cools by letting water evaporate into the outside air. In one common kind, warm coolant flows through pipes inside the tower. Water is sprayed over the pipes. Fans pull air through. Some of the sprayed water evaporates and carries heat away. The cooler coolant flows back to the servers.

The water that evaporates leaves as vapor in the air. It does not come back. That water is used up.

When water evaporates, its minerals stay behind. Over time, the leftover water gets too full of minerals. Blowdown is water drained from a cooling tower because it has too many minerals. Fresh water replaces the water lost to evaporation and blowdown.

Cooling towers need very little electricity. But on hot days, they can use a lot of water.

Dry coolers

A dry cooler is a machine that cools the coolant with fans and outside air, without evaporating water. Inside, warm coolant flows through metal tubes with thin metal fins. Fans blow outside air across the fins. Heat moves from the warm coolant into the cooler air.

A dry cooler uses little or no water. But it works best when the outside air is much cooler than the coolant. On a hot day, less heat moves into the warm air. The fans work harder, and some data centers turn on machines that work like big air conditioners. On hot days, a dry cooler can use more electricity.

Some data centers use dry cooling most of the year and add a little water on the hottest days.

Water or electricity: a tradeoff

A tradeoff is when you give up some of one thing to get more of another thing. Cooling towers save electricity but use more water. Dry coolers save water but can use more electricity on hot days.

Making electricity can use water too. Some data centers build their own power plants, and those plants also use a lot of water.

A researcher told CNBC that the biggest AI data centers can use up to 10 million gallons of water a day. That number is an estimate. The real amount depends on the machines, the place and the weather. Engineers choose the cooling that fits each place.

Key ideas

- Almost all the electricity a chip uses turns into heat.
- Heat always moves from a warmer place to a cooler place.
- A coolant loop carries heat from the chips to a machine outside. The coolant is used again and again.
- A cooling tower uses water: the water that evaporates leaves as vapor and does not come back.
- A dry cooler uses little or no water, but it can use more electricity on hot days.

Words to know

Blowdown: Water drained from a cooling tower because it has too many minerals.

Cold plate: A flat metal block on top of a chip. Coolant flows through it.

Coolant: A liquid that carries heat away from hot parts.

Coolant loop: A closed path of pipes that the same coolant flows around again and again.

Cooling tower: A machine that cools by letting water evaporate into the outside air.

Dry cooler: A machine that cools with fans and outside air, without evaporating water.

Evaporate: To change from a liquid into a gas.

Heat: Energy that moves from a warmer thing to a cooler thing.

Tradeoff: Giving up some of one thing to get more of another thing.

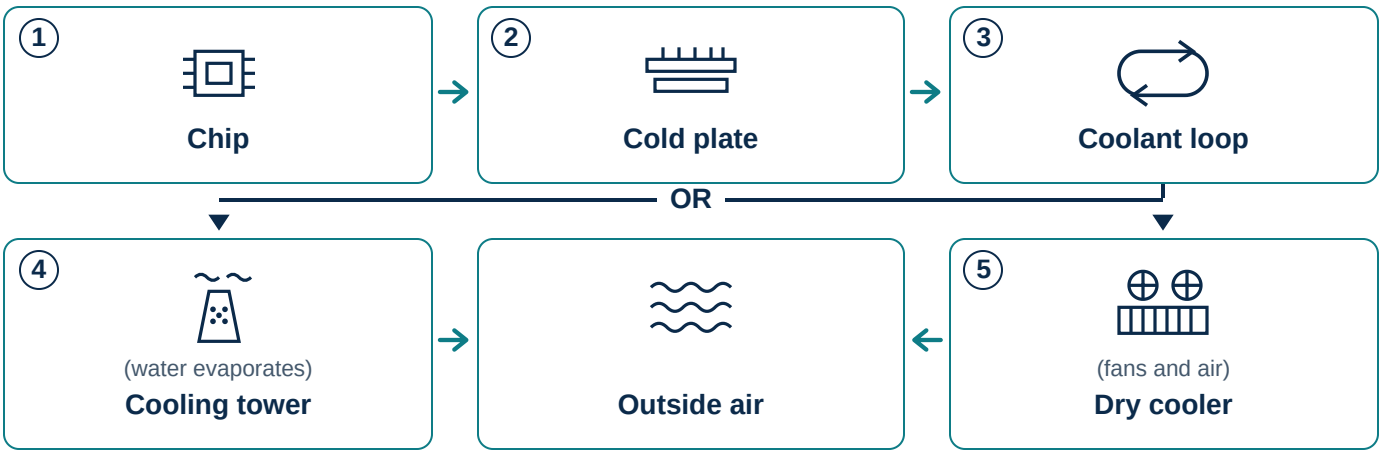
Water vapor: Water in the form of a gas.

Try it: feel evaporation (safe, with an adult)

Wet a paper towel with plain room-temperature tap water. Lay it on the back of your hand. Gently fan it with a sheet of paper. Your skin feels cooler as the water evaporates and carries heat away. Now try a dry paper towel. Which one feels cooler?

The path of the heat

This diagram shows the path in the sections about the coolant loop, cooling towers, and dry coolers.



Heat moves from the chip into the cold plate, then into the coolant. The coolant loop carries the heat outside. A cooling tower moves it into the air by letting water evaporate. A dry cooler uses fans and air instead.

Not shown: pumps, the return pipes, and the fresh water added to a cooling tower. Real data centers often have more than one loop and more steps than this simple diagram.

Original source

Voters rejected AI data centers over resource concerns.

Here's why measuring water usage is hard

CNBC · November 5, 2026

https://www.cnbc.com/2026/11/05/meta-spacex-ai-data-centers-use-millions-of-gallons-of-water-a-day.html

For teachers and parents: scan the code to print the article or read it aloud. Students do not need the article to answer the questions.

About the news story

On November 5, 2026, CNBC reported on how much water large AI data centers use. Many new AI data centers cool their chips with a closed loop of liquid that uses very little water each day. Most water is used outside, where the heat is sent into the air. Dry cooling uses far less water but can use far more electricity, especially in hot places. Evaporative cooling uses little electricity but can lose a lot of water on the hottest days. Many data centers mix the two.

GRID & SILICON
STUDENT SHEET

Cooling Towers and Dry Coolers: Where Data Center Heat Goes

Initials _____ Date _____

Keep the explainer beside you. Look back for every answer. This lesson is for one student. You can do it by yourself.

Short or spoken answers are fine. An adult may write down what you say. If a partner or an adult joins you, one person can read aloud while the other follows along, then you can switch. A partner is optional, not required.

Warm-ups

Write or draw in the boxes. Short or spoken answers are fine. An adult may write down what you say.

Warm-up A: Why does a data center need to carry heat away from its chips?

Warm-up B: Why do you feel cold right after you get out of a pool?

Word of the Week

Evaporate: To change from a liquid into a gas.

Use it in a sentence:

Stuck on a word? Open the Glossary: gridandsilicon.com/glossary/

Part 1: Circle the best answer

1. A chip uses electricity. What does almost all of that electricity turn into?

A. Light
B. Heat
C. Water

2. You hold an ice cube in your warm hand. Which way does the heat move?

A. From your hand into the ice
B. From the ice into your hand
C. Heat does not move

3. What does a cold plate do?

A. It makes the chip use less electricity
B. It sprays water on the chip
C. It moves heat from the chip into the coolant

4. Why is the coolant in a coolant loop not used up?

A. It turns into vapor
B. It is a closed loop, so the same coolant is used again and again
C. New coolant is added every hour

5. How does a cooling tower carry heat away?

A. Some of the sprayed water evaporates and takes the heat with it
B. It freezes the coolant
C. It sends the heat back to the servers

6. What happens to the water that evaporates in a cooling tower?

A. It goes back into the pipes
B. It turns into minerals
C. It leaves as vapor in the air and does not come back

7. Why is some cooling tower water drained away as blowdown?

A. It is too cold
B. It has turned into vapor
C. It has too many minerals

8. It is a very hot day. What can happen with a dry cooler?

A. It uses much more water
B. It can use more electricity
C. It stops moving heat at all

9. Which sentence shows the tradeoff?

A. Dry coolers use more water than cooling towers
B. Cooling towers save electricity but use more water
C. Both machines use the same amount of water

Part 2: Fill in the blanks

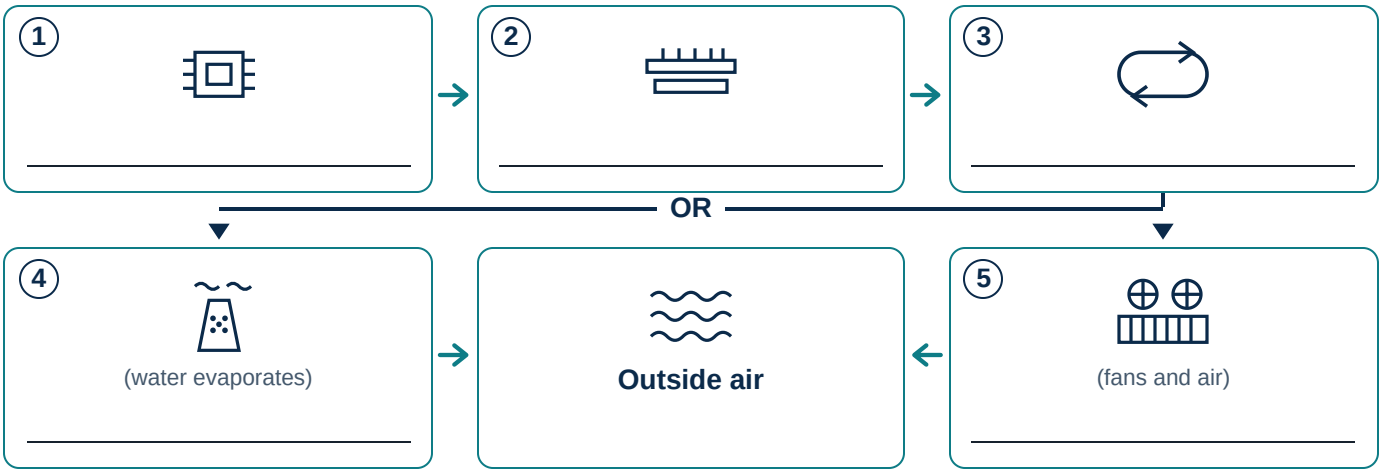
Word bank (use each word once): coolant · vapor · tradeoff · cooler

1. A liquid that carries heat from hot parts is _____.
2. When water evaporates, it becomes water _____.
3. Heat moves from a warmer place to a _____ place.
4. Saving water but using more power is a _____.

Part 3: Label the diagram

Follow the heat from the chip to the outside air. Write one word bank label on each line.

Word bank: Chip · Cold plate · Coolant loop · Cooling tower · Dry cooler



Part 4: Think about it

1. Which uses more water, a cooling tower or a dry cooler? Explain why.

Start: A ... uses more water because ... Last line: write the section name you used, such as Cooling towers.

2. A town has very little water. Which machine would you pick? What is the tradeoff?

Start: I would pick ... because ... The tradeoff is ...

Vocabulary Word Search

Find each word in the list. Words go across, down, or diagonally down to the right. They are never backwards. Circle or highlight each word. Every word is in the explainer.

F	T	B	Q	R	Y	B	S	L	K	X	F	N
B	B	B	Z	W	B	Q	J	R	B	V	K	S
T	W	C	O	O	L	A	N	T	K	P	K	K
S	M	B	B	L	O	W	D	O	W	N	R	W
Z	F	H	Z	M	F	T	N	V	F	I	N	S
R	V	H	J	M	M	R	X	T	V	Q	X	S
C	T	E	K	E	V	A	P	O	R	A	T	E
Q	R	A	H	P	W	D	C	P	D	S	V	R
F	H	T	V	Q	P	E	T	H	B	T	C	V
M	T	O	W	E	R	O	Y	X	I	X	Q	E
Z	H	H	V	K	B	F	J	W	W	P	K	R
Q	V	P	X	P	S	F	L	W	Y	B	Q	V
G	V	W	J	R	C	T	P	L	O	O	P	X

Word list

EVAPORATE
COOLANT
TOWER
BLOWDOWN
TRADEOFF
SERVER
CHIP
HEAT
LOOP
FINS

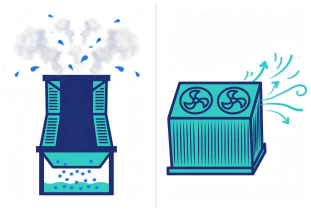
GRID & SILICON - LEARN - ACTIVITY

Carry the Heat Outside

Cooling Towers and Dry Coolers: Where Data Center Heat Goes

Initials _____ Date _____

Almost all the electricity a chip uses turns into heat. That heat has to travel all the way outside, or the chip gets too hot and can slow down or break. Here you feel how evaporation carries heat away, walk the heat along its path, and choose a cooler for two towns.



Left: a cooling tower lets some water evaporate and leave as vapor. Right: a dry cooler uses fans and air, and no evaporating water.

Time: 20-25 minutes **Works for:** 1 student on their own, 1 student with a partner, or 1 student with a teacher or parent **You need:** 2 paper towels, a small cup of plain tap water, a sheet of stiff paper to fan with, 6 small slips of paper, and a pencil

On your own: Do every step yourself; read each question aloud quietly, then write or draw your answer. **With a partner:** Take turns - one does a step, the other reads it aloud and watches; swap jobs at each part. **With a teacher or parent:** They read with you, fan the towel in Part A, and ask the Discuss questions at the end. You make every choice and give every answer.

Part A: Feel evaporation carry heat away

1. **Predict first.** Circle one: A wet paper towel on my arm will feel *cooler / the same / warmer* than a dry one when I fan it.
2. Lay the dry paper towel on the back of your hand or arm. Fan it with the stiff paper for a slow count of 10. Notice how it feels.
3. Dip the second paper towel in the cup of water and squeeze out the drips. Lay it on the same spot. Fan it for a slow count of 10.
4. Swap and repeat once, so you are sure. If you have a partner or teacher, they fan while you feel, then you swap.

Test	How did it feel? Circle or write.
Dry towel, fanned	cool / a little cool / not cool
Wet towel, fanned	cool / a little cool / not cool

Finish the sentence: The wet towel felt cooler because the water _____ and took heat from my skin with it.

Safety: Use only plain tap water at room temperature. Never use hot water, and keep water away from computers, outlets, and power strips.

Part B: Walk the heat from the chip to the outside air

Heat always moves from a warmer place to a cooler place. Follow it, one stop at a time.

1. Write one label on each slip of paper: **Chip**, **Cold plate**, **Coolant loop**, **Cooling tower**, **Dry cooler**, **Outside air**. Lay the first three slips in a row on the table. Put both cooler slips below them, then the Outside air slip after both.
2. Put your pencil on the Chip slip. That is your heat. Say where the heat is, then slide the pencil to the next stop. The cold plate touches the chip, so heat moves from the chip into the cold plate, and then into the coolant - the liquid that carries heat away from hot parts.
3. Slide the pencil around the Coolant loop twice. The loop is closed, so the same coolant goes around again and again. It is not used up.
4. Now choose a fork and finish the trip. Do both forks, one at a time.

Chip
heat starts here
→
Cold plate
moves heat to coolant
→
Coolant loop
same coolant, again and again
→
Cooling tower OR Dry cooler
pick one fork
→
Outside air
heat ends up here

Fork 1 - Cooling tower. Mime spraying water with one hand. Wave the other hand up and away: some of the water evaporates, becomes vapor, and leaves in the air. That water does not come back. Some leftover water is also drained away as blowdown, because it has too many minerals.

Fork 2 - Dry cooler. Fan the air fast with both hands like the big fans. Air blows past tubes with thin metal fins and carries the heat away. No water evaporates - but on a very hot day the fans have to work harder, so the cooler can use more electricity.

Tell it back. Point to each slip and say the whole trip out loud in one breath, from chip to outside air. If you are working alone, whisper it. If you have a partner or teacher, they listen and point to any stop you miss.

Part C: Pick a cooler for two towns

There is no perfect cooler. Picking one is a tradeoff: you give up some of one thing to get more of another.

Town	My pick (circle one)	Why? Finish: I pick it because...
Desert town. Very hot summers. Water is scarce and must be saved.	Cooling tower Dry cooler	
River town. Plenty of water all year. Electricity is expensive.	Cooling tower Dry cooler	

Name the tradeoff for the desert town:

Discuss, check, and finish

Discuss together

If you are on your own, answer out loud or in writing. With a partner or teacher, take turns answering first.

- Where did the water go in the cooling tower fork? Why can the data center not just use that same water again?
- Why does the dry cooler save water, and what does it give up on a very hot day?
- The coolant in the loop is never used up, but cooling tower water is. What makes them different?

Exit ticket

Cut or copy these three questions. One or two sentences each is enough. You can answer all of them from the explainer alone.

1. Trace the heat: name every stop from the chip to the outside air, in order.
2. How does a cooling tower carry heat away, and what happens to the water that does the job?
3. A town has very little water. Which cooler would you choose, and what is the tradeoff?

Support and stretch

- **Support:** Offer extra time, a quiet space, and breaks. Accept spoken or drawn answers before writing. Leave the Part B station row on the page in view while answering, and let the student hold the wet and dry towels again during Part C.
- **Stretch:** Add blowdown to your Part B trip: explain where it fits and why it happens. Or draw both forks as one diagram, labeling vapor, fins, and fans, and write one sentence under each fork naming what it uses more of - water or electricity.

For the teacher, parent, or partner - quick check: Part A: evaporates (accept: turns into vapor / changes into a gas). Desert town: dry cooler - it saves water; the tradeoff is more electricity on hot days. River town: cooling tower - it saves electricity; the tradeoff is more water used, lost as vapor and blowdown. Exit ticket 1 order: chip, cold plate, coolant loop, cooling tower or dry cooler, outside air.

GRID & SILICON
TEACHER AND PARENT GUIDE

Cooling Towers and Dry Coolers: Where Data Center Heat Goes

How does a data center move heat outside, and how much water does it use?

About 30–40 minutes · Main target grade 6 (works for grades 4–8) · Explainer written at about a grade 5 reading level

What students will learn

- Explain that almost all the electricity a chip uses turns into heat, and that heat moves from warmer to cooler.
- Trace the path of heat from a chip, through a cold plate and a coolant loop, to the outside air, using a diagram.
- Explain how a cooling tower moves heat: some water evaporates and leaves as vapor, so that water is used up.
- Explain how a dry cooler moves heat with fans and air, and why it can use more electricity on hot days.
- Describe the tradeoff between water and electricity when choosing a cooling method.

Supplies

The explainer (4 pages), the student sheet (4 pages, two sheets printed on both sides), a pencil and an eraser. A highlighter is optional.

How to use it

- This lesson is for one student working alone. A partner or an adult is optional, never required. The student may read the explainer alone, or an adult may read every word aloud, including the questions.
- Each question can be answered from the explainer alone. Students do not need the Word of the Week box or the glossary. The section names in the answer key show where to look. You may point the student to a section if they get stuck.
- Students may draw or write in the warm-up boxes. Short or spoken answers are fine; an adult may write down what the student says. Privacy: use initials only on the sheet.
- Optional roles if a partner or an adult joins: one person reads the explainer aloud while the student follows along; then the student answers while the other person listens. Switch if you like.
- Break it up if needed: explainer one day, questions the next. The word search can be done last or on its own.
- Optional demo (safe, no heat or electricity): wet a paper towel with room-temperature tap water, lay it on the student's hand, and fan it. Compare with a dry towel. See the section about cooling towers. Use only plain tap water.

Answer key

Warm-ups

Warm-up A: Why does a data center need to carry heat away from its chips?

Answer: If a chip gets too hot, it can slow down or break. Drawings that show this idea are fine.

> In the section “Computers make heat”: “If a chip gets too hot, it can slow down or break.”

Warm-up B: Why do you feel cold right after you get out of a pool?

Answer: The water on your skin evaporates and takes heat from your skin. Drawings that show this idea are fine.

> In the section “Cooling towers”: “It takes heat from your skin, so you feel cold.”

Word of the Week

Evaporate: To change from a liquid into a gas. Accept any sentence that uses the word correctly. Example: The puddle will evaporate when the sun comes out.

Part 1: Multiple choice

1. A chip uses electricity. What does almost all of that electricity turn into?

Answer: B. Heat

> In the section “Computers make heat”: “Almost all the electricity a chip uses turns into heat.”

2. You hold an ice cube in your warm hand. Which way does the heat move?

Answer: A. From your hand into the ice

> In the section “Heat moves from hot to cold”: “Heat moves from your warm hand into the cold ice.”

3. What does a cold plate do?

Answer: C. It moves heat from the chip into the coolant

> In the section “Inside: from the chip to the coolant loop”: “Heat moves from the hot chip into the metal and then into the liquid.”

4. Why is the coolant in a coolant loop not used up?

Answer: B. It is a closed loop, so the same coolant is used again and again

> In the section “Inside: from the chip to the coolant loop”: “Because the loop is closed, the coolant is used again and again.”

5. How does a cooling tower carry heat away?

Answer: A. Some of the sprayed water evaporates and takes the heat with it

> In the section “Cooling towers”: “Some of the sprayed water evaporates and carries heat away.”

6. What happens to the water that evaporates in a cooling tower?

Answer: C. It leaves as vapor in the air and does not come back

> In the section “Cooling towers”: “The water that evaporates leaves as vapor in the air.”

7. Why is some cooling tower water drained away as blowdown?

Answer: C. It has too many minerals

In the section “Cooling towers”: “Over time, the leftover water gets too full of minerals.”

8. It is a very hot day. What can happen with a dry cooler?

Answer: B. It can use more electricity

In the section “Dry coolers”: “On hot days, a dry cooler can use more electricity.”

9. Which sentence shows the tradeoff?

Answer: B. Cooling towers save electricity but use more water

In the section “Water or electricity: a tradeoff”: “Cooling towers save electricity but use more water.”

Part 2: Fill in the blanks

1. A liquid that carries heat from hot parts is **coolant**.

   In the section “Inside: from the chip to the coolant loop”: “Coolant is a liquid that carries heat away from hot parts.”

2. When water evaporates, it becomes water **vapor**.

   In the section “Cooling towers”: “When water evaporates, it becomes water vapor.”

3. Heat moves from a warmer place to a **cooler** place.

   In the section “Heat moves from hot to cold”: “Heat always moves from a warmer place to a cooler place.”

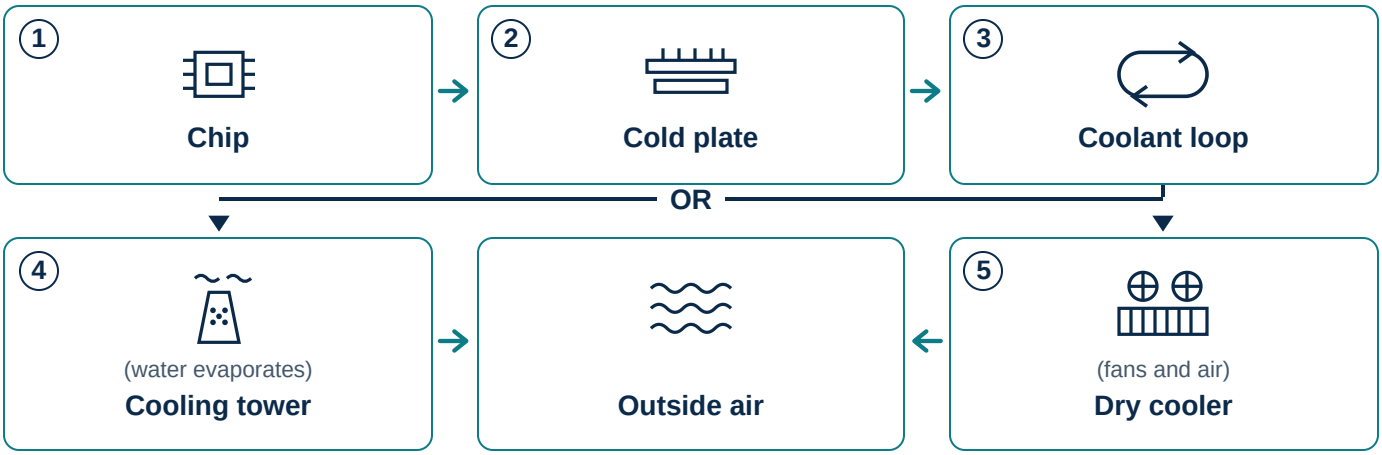
4. Saving water but using more power is a **tradeoff**.

   In the section “Water or electricity: a tradeoff”: “A tradeoff is when you give up some of one thing to get more of another thing.”

Part 3: Label the diagram

Answers: 1. Chip; 2. Cold plate; 3. Coolant loop; 4. Cooling tower; 5. Dry cooler. The last box, Outside air, is already labeled.

These steps are described in the sections “Computers make heat,” “Inside: from the chip to the coolant loop,” “Cooling towers,” and “Dry coolers.” Labels 4 and 5 are told apart by the pictures: the cooling tower shows water drops and vapor and the caption (water evaporates); the dry cooler shows two large fans and the caption (fans and air).



Part 4: Think about it

1. Which uses more water, a cooling tower or a dry cooler? Explain why.

Sample answer: A cooling tower uses more water. It cools by letting water evaporate, and the water that evaporates leaves as vapor and does not come back. A dry cooler uses fans and air, not evaporating water. Section: Cooling towers (also accept Dry coolers or Water or electricity: a tradeoff if the answer uses that section's idea).

> In the section “Cooling towers”: “The water that evaporates leaves as vapor in the air. It does not come back.”

2. A town has very little water. Which machine would you pick? What is the tradeoff?

Sample answer: A dry cooler, because it uses little or no water. The tradeoff is that it can use more electricity on hot days. (A cooling tower answer earns credit only if the student explains the water cost.)

> In the section “Water or electricity: a tradeoff”: “Dry coolers save water but can use more electricity on hot days.”

Accept answers in the student's own words. Scoring idea (2 points each): 1 point for the main idea, 1 point for a reason that matches the explainer. Question 1: the key link is that evaporated water leaves as vapor and does not come back; also check that the student named a supporting section (Cooling towers, Dry coolers, or Water or electricity: a tradeoff). Question 2: a machine choice with a reason, plus the tradeoff (dry cooler: more electricity on hot days; cooling tower: uses more water).

Word search answer key

Every word is in the explainer. Shaded letters mark the 10 hidden words. Words go across, down, or diagonally down to the right. None are backwards.

F	T	B	Q	R	Y	B	S	L	K	X	F	N
B	B	B	Z	W	B	Q	J	R	B	V	K	S
T	W	**C**	**O**	**O**	**L**	**A**	**N**	**T**	K	P	K	K
S	M	B	**B**	**L**	**O**	**W**	**D**	**O**	**W**	**N**	R	W
Z	F	H	Z	M	F	**T**	N	V	**F**	**I**	**N**	**S**
R	V	**H**	J	M	M	**R**	X	T	V	Q	X	**S**
C	T	**E**	K	**E**	**V**	**A**	**P**	**O**	**R**	**A**	**T**	**E**
Q	R	**A**	H	P	W	**D**	**C**	P	D	S	V	**R**
F	H	**T**	V	Q	P	**E**	T	**H**	B	T	C	**V**
M	**T**	**O**	**W**	**E**	**R**	**O**	Y	X	**I**	X	Q	**E**
Z	H	H	V	K	B	**F**	J	W	W	**P**	K	**R**
Q	V	P	X	P	S	**F**	L	W	Y	B	Q	V
G	V	W	J	R	C	T	P	**L**	**O**	**O**	**P**	X

EVAPORATE — row 7, column 5, across

COOLANT — row 3, column 3, across

TOWER — row 10, column 2, across

BLOWDOWN — row 4, column 4, across

TRADEOFF — row 5, column 7, down

SERVER — row 6, column 13, down

CHIP — row 8, column 8, diagonal

HEAT — row 6, column 3, down

LOOP — row 13, column 9, across

FINS — row 5, column 10, across

Standards

This is a short reading lesson. It supports parts of the standards below. It does not by itself meet a full NGSS performance expectation, because students do not develop their own model, collect data or design a solution.

Common Core, grade 6 and grades 6–8 science literacy (practiced here; RI.6.1 supported in part, not fully assessed)

CCSS.ELA-LITERACY.RI.6.1: Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.

> **Where:** Supported (partial): Think about it 1 asks students to name the section of the explainer that supports their answer. Other items also ask students to use ideas from the text. Formal quotation and multi-step inference are not assessed, so RI.6.1 is not fully met.

CCSS.ELA-LITERACY.RST.6-8.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics.

> **Where:** Word search, Word of the Week, Part 2.

CCSS.ELA-LITERACY.RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

> **Where:** Part 3 diagram labeling.

CCSS.ELA-LITERACY.L.6.6: Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

> **Where:** Word of the Week sentence; word search.

NGSS middle school (supports only; no performance expectation is met)

Disciplinary core idea PS3.B (as listed with MS-PS3-3): Energy is spontaneously transferred out of hotter regions or objects and into colder ones.

> **Where:** Supported: Q2, Part 2 item 3, and the heat path in Part 3. MS-PS3-3 itself reads: “Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.” Students do not design, build or test a device, so MS-PS3-3 is NOT met. A follow-up design task (for example, testing which cover keeps a cup of ice from melting) would be needed.

Crosscutting concept: Energy and Matter (as listed with MS-PS3-3): The transfer of energy can be tracked as energy flows through a designed or natural system.

> **Where:** Supported: students track heat from the chip to the outside air (Part 3, Q3–Q5).

Disciplinary core idea ESS3.C (as listed with MS-ESS3-3 and MS-ESS3-4): Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.

> **Where:** Supported (partial): students compare how two cooling technologies use water and electricity (Q6–Q9, Think about it 1–2). MS-ESS3-3 asks students to design a method for monitoring and minimizing a human impact, and MS-ESS3-4 asks them to construct an evidence-based argument about population and resource use. This lesson does neither in full, so neither performance expectation is met. Think about it 2 is a small first step toward MS-ESS3-3 reasoning about reducing water use.

Note on numbers: the only water amount in the lesson (up to 10 million gallons a day for the biggest AI data centers) is an estimate from a researcher quoted by CNBC. Real use varies a lot by site, weather and cooling method. It is not assessed.

Sources

- CNBC, “Voters rejected AI data centers over resource concerns. Here's why measuring water usage is hard,” November 5, 2026. https://www.cnbc.com/2026/11/05/meta-spacex-ai-data-centers-use-millions-of-gallons-of-water-a-day.html
- U.S. Department of Energy, Federal Energy Management Program, “Best Management Practice #10: Cooling Tower Management.” https://www.energy.gov/femp/best-management-practice-10-cooling-tower-management
- Next Generation Science Standards, MS-PS3-3. https://www.nextgenscience.org/pe/ms-ps3-3-energy
- Next Generation Science Standards, MS-ESS3-3. https://www.nextgenscience.org/pe/ms-ess3-3-earth-and-human-activity
- Common Core State Standards, Reading Informational Text, Grade 6. https://www.thecorestandards.org/ELA-Literacy/RI/6/
- Common Core State Standards, Science and Technical Subjects, Grades 6–8. https://www.thecorestandards.org/ELA-Literacy/RST/6-8/
- Common Core State Standards, Language, Grade 6. https://www.thecorestandards.org/ELA-Literacy/L/6/