

ELI5: The Big Picture

Imagine a big computer lab that drinks water, eats electricity, and gets hot like a giant toaster. Right now it acts like a thirsty houseguest who uses all your towels and doesn't pay rent.

Your four rules are asking the computer lab to:

1. **Stop drinking the tap water** — use a special bath instead.
2. **Share its body heat** — warm the neighborhood's swimming pool and greenhouses.
3. **Use a smaller brain for easy jobs** — not a race-car engine to open a juice box.
4. **Show its water/electricity report card without cheating** — prove it followed the rules without giving away secrets.

That's basically it. Now let's audit each rule properly.

Scoreboard First

Rule	ELI5 Name	Does It Work?	Main Catch	Realistic Impact
1	No more tap water drinking	✓ Yes, mostly	Very expensive bath fluids	High in dry places
2	Share your body heat	✓ Yes, sometimes	Need neighbors close by who want heat	Moderate
3	Use a tiny brain	⚠ Only for some jobs	Not for big chatbots yet	Big for sensors, small for huge AI
4	Honest report card	✓ Yes as a helper	Doesn't stop lying meters, just hides data safely	Trust boost

Pillar 1: Zero-Liquid Discharge & Waterless Compute

ELI5

Instead of spraying water through cooling towers to cool the computers, you dunk the hot parts in a special liquid that stays inside pipes. The heat is carried away by air fans outside, not by evaporated drinking water.

Audit Deep-Dive

The physics that matters

Evaporative cooling removes heat by turning water into steam. For every watt of heat you need to dump, you need:

water

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h

f_g

Q

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$\approx$

2,260 J/g

1 watt

For a 50-megawatt facility, that's over 500 million liters of evaporated water per year in a hot climate — enough to fill about 200 Olympic pools.

Two things must happen for this to truly save water:

Requirement	What Goes Wrong If Skipped
The computers must actually be liquid-cooled	Many "immersion" pilots only cool a few racks; the rest still use water towers.
The hot liquid must be cooled by air , not by another wet tower	If you still pipe the dielectric fluid to a cooling tower, you still evaporate water.
The facility must treat and recycle any cleaning/flushing waste	Otherwise ZLD becomes "Liquid shipped somewhere else as hazardous waste."

The catch: the special bath

Dielectric cooling fluids are expensive and controversial:

- **Fluorocarbons** (like 3M Novec / Fluorinert): very safe electrically, but many are PFAS ("forever chemicals"). Disposal is becoming regulated or banned.
- **Synthetic hydrocarbons**: cheaper, but flammable and degrade over time.
- **Natural esters**: biodegradable, but less common and lower temperature tolerance.

A full tank can hold millions of liters of fluid at 50–250 per liter. That is a CapEx line item in the hundreds of millions of dollars.

Does it prevent aquifer collapse?

Only **locally**. If a data center in Phoenix switches to dry-cooled immersion, it stops pulling from the Colorado River basin aquifer. That's real. But the city's aquifer problem is also caused by farms, lawns, and leaky pipes. A data center going waterless helps; it doesn't save the whole aquifer.

Number to watch: consumptive water use per kWh of IT load.

Grade: B+ for engineering, B– for economics, A– for permitting in dry regions.