Water Use, Side by Side

Agriculture, power generation technologies, and data-center cooling — three different unit systems, laid out so the comparisons Connell and others are making (corn vs. gas plant, etc.) can actually be checked rather than repeated.

1. Agriculture / feedstock water use

Measured per acre or per animal — not directly comparable to gal/MWh below without knowing the acreage or herd size involved. Included because Connell's corn comparison and the community's cattle/poultry operations are both live reference points in this fight.

CROP/LIVESTOCK	WATER USE	NOTE
Corn (irrigated, US avg)	~1.5 acre-ft/acre/season (~489,000 gal/acre/season)	USDA/EIA 2022 average. Connell's cited "13 acres = ~120,000 gal/day" implies ~9,230 gal/acre/day — roughly 2x the seasonal-average daily rate (~4,900 gal/acre/day) worked out from this figure. Not necessarily wrong (peak irrigation days run hotter/higher than the season average) but worth knowing his number may reflect a peak-day rather than average-day assumption.
Rice (paddy, flood-irrigated)	Requires ~100% irrigation, materially more than corn	Specific gal/acre figure not confirmed in this pass — flagged as open, not fabricated. Widely cited as one of the most water-intensive US row crops due to continuous paddy flooding.
Dairy cow (mature)	7–24 gal/day	Lactating cows roughly double this (14–48 gal/day). USGS.
Poultry (broiler flock)	~10 gal/day increase per 1,000-bird flock (growth-stage figure, not total facility use)	Separately, a CA processing (slaughter) facility used 4–5 million gal/day — that's facility-level processing water, not per-bird farm water; don't conflate the two.
Hogs/pigs	0.5 (weaned) → 1.5 (grow-finish) → 4 (gestating sow) → 6 (lactating sow) gal/day	SDSU Extension. Water need rises steadily with life stage; lactating sows drink ~12x what a newly weaned pig does.

2. Power generation — cooling water by technology

Gal/MWh generated — the standard, comparable unit for this category. This is the one that actually maps onto "which generation technology should Meridian use."

TECHNOLOGY	WATER USE		WHY
Solar PV	`~0`	LOWEST	No combustion, no steam cycle. Occasional panel-washing only.
Fuel cells (Bloom-type SOFC, gas-fueled)	`Negligible`	LOWEST	Electrochemical, not combustion — no steam cycle. Water from the reaction is internally recycled to reform fuel.
Reciprocating engines	`Near-zero (gal/week for closed-loop makeup)`	LOWEST	Closed-loop radiator cooling, like a large engine block — no steam cycle to condense.
Small/linear generators	`Presumed near-zero (not independently confirmed for linear generators specifically)`	LOW	Same no-steam-cycle logic as reciprocating; flagged as inferred, not directly sourced for linear generators (e.g. Mainspring-type) specifically.
Simple-cycle gas turbine	`~0`	LOWEST	No steam bottoming cycle, nothing to condense.
Combined-cycle gas turbine	`~2,800 gal/MWh (wet-cooled avg, EIA 2020)`	MODERATE	Adds a steam bottoming cycle off the turbine exhaust heat — that steam needs cooling. Dry-cooled combined-cycle variants exist, trading water for a small efficiency loss.
Biomass (steam cycle)	`Cooling water comparable to coal steam plants: ~500–600 gal/MWh closed-loop, ~20,000–50,000 gal/MWh open-loop`	HIGH	Same basic steam-turbine tech as coal, just different fuel. Separately, a cited "40,000–100,000 gal/MWh" figure for biomass appears to include upstream feedstock-crop irrigation, not just plant cooling — don't conflate feedstock water with plant-cooling water when this comes up.
Coal steam (reference point)	`~500–600 gal/MWh closed-loop, 20,000–50,000 gal/MWh open-loop`	HIGH	Included only as the common public reference point people mentally compare gas plants to.

> **What this means for the "which tech for Dreadnaught" question:** fuel cells, reciprocating/linear engines, simple-cycle turbines, and solar all cluster at the low-water end for essentially the same reason — none of them have a steam cycle to cool. Combined-cycle is the only "cleaner NOx" option (via SCR, see the earlier

pollutant chart) that trades into meaningfully higher water use. Biomass is high on both water and combustion pollutants — worth knowing if it's ever floated as a "renewable" alternative, since it doesn't clear the water bar Ballast opponents are using.

3. Data center cooling water use

You named three profiles — there are at least two more worth knowing, and the water story depends less on the chip-level method than on what the facility does with the heat once it's collected.

PROFILE	WATER USE		NOTE
Air-cooled (fan + refrigerant heat exchanger, CRAC/CRAH)	`Near-zero direct water`	LOWEST	Trades water for electricity — fans and compressors draw more power instead.
Direct-to-chip / cold plate (liquid loop on the chip)	`Depends on facility heat rejection, not the loop itself`	VARIABLE	The chip-level loop is usually closed and doesn't consume water — but the heat still has to leave the building. If it's rejected via an evaporative cooling tower, water use is high; if rejected via a dry cooler, it's low. "Cold plate" alone doesn't tell you the water number.
Immersion cooling (servers submerged in dielectric fluid)	`~90% less than traditional evaporative cooling`	LOW	Can pair with a dry cooler for near-zero facility water use, same logic as cold plate.
Hybrid/adiabatic (air-cooled most of the year, water-assisted on hot days)	`Variable, seasonal`	VARIABLE	The "hybrid" you already knew about — water use concentrated in a handful of peak-heat days per year rather than spread evenly.
Rear-door heat exchangers / in-row cooling	`Depends on facility heat rejection`	VARIABLE	A 5th profile you didn't list — chilled water (or refrigerant) circulated to a door/unit right at the rack instead of a room-level system. Same "depends on rejection method" logic as cold plate.
Free/outside-air economizer cooling	`Near-zero, climate-dependent`	LOW	A 6th profile — uses outside air directly when ambient conditions allow, mechanical cooling only as backup. Works best in cooler/drier climates; less reliable fit for South Carolina's humidity/heat.

The real lesson: "which cooling profile" is really two separate questions bundled together — how heat gets off the chip (air/cold-plate/immersion), and how heat leaves the building (evaporative tower vs. dry cooler vs. hybrid). The second question drives the water number far more than the first. A data center could use cutting-edge direct-to-chip liquid cooling and still be water-hungry if it dumps that heat through cooling towers — or use "old-fashioned" air cooling at the chip level and be genuinely water-light if it's paired with dry heat rejection.

Figures from EIA (todayinenergy, 2020/2024), USGS Livestock Water Use, USDA ERS irrigation data, Bloom Energy technical materials, and industry cooling-technology comparisons (Wartsila, JetCool, energy-solutions.co). Several figures (rice, hogs, linear generators) flagged as unconfirmed rather than guessed. Local copy: MGW.reference.water-use-comparison.071526.v2.html.