Jennifer Heymann

Waterplan (Climateplan Inc.) submits the attached comment addressing the cooling water demand profile of the proposed Bloom Energy fuel cell (SOFC) technology compared to conventional thermoelectric generation.

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New Mexico Environment Department
Air Quality Bureau
525 Camino de los Marques, Suite 1
Santa Fe, New Mexico 87505

Re: Comment Related to Operational Water-Saving Benefits in Support of Air Quality Permit Application No. 10883 - Yucca Growth Infrastructure, LLC (YGI Microgrid)
Agency Interest No. 41351; PRN20260001; Doña Ana County, New Mexico

Dear Air Quality Bureau:

Climateplan Inc. (d/b/a Waterplan) ("Waterplan") submits this comment in qualified support of the above-referenced permit application and asks that the New Mexico Environment Department record our written interest pursuant to 20.2.72.206 NMAC. Waterplan is an organization focused on operational water risk and stewardship, and has a commercial relationship with Oracle, the project's primary infrastructure beneficiary. We disclose that relationship here so the New Mexico Environment Department can weigh this comment accordingly. The analysis below rests on public data sources cited in the appendix, which the New Mexico Environment Department can independently verify.

The focused point Waterplan raises is that the proposed Bloom Energy Server solid oxide fuel cell (SOFC) energy technology has a different direct water profile from conventional water-cooled natural-gas thermoelectric generation. The permit application's routine-operations section states that the SOFC converts natural gas to electricity through an electrochemical reaction without combustion, water and heat produced in the process are recycled to produce steam needed for fuel reforming, and the system requires no cooling water during normal operation. The manufacturer's data sheet included in the permit record states that no water is required for the electrochemical generation process during normal operation.

The water difference relates to the technology

Conventional thermal power plants often require water as both a process medium and a cooling medium. This technical reality is extensively documented in a foundational study conducted by Macknick et al. for the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) and published in the peer-reviewed journal *Environmental Research Letters* (2012). This rigorous research establishes that operational water consumption and withdrawal factors vary substantially by generating technology and, crucially, by cooling system. Specifically, the NREL analysis explains that conventional thermoelectric facilities, including nuclear, coal, and traditional natural gas, rely on water as both a working fluid and a cooling medium to condense steam as part of the standard Rankine cycle. This conclusion is further reinforced by the U.S. Geological Survey (USGS), which explicitly confirms that a power plant's specific cooling-system technology is the primary determinant of its water withdrawal and consumption.

The proposed Bloom system does not rely on a steam turbine and cooling tower to generate electricity, so it fundamentally bypasses the conventional water demand. That is the technical basis for Waterplan's qualified support on the water side. The relevant water claim is narrow and quantifiable: the proposed energy technology materially reduces direct, on-site, normal-operation water consumption for power generation relative to a conventional water-consuming natural-gas thermoelectric configuration of similar output.

Scale of the potential direct water savings

To estimate scale, Waterplan compared the permit application's maximum annual production rate of 21,567,164 MWh per year with New Mexico natural-gas cooling-water consumption factors calculated from EIA's 2024 thermoelectric cooling-water workbooks and EIA's New Mexico Electricity Profile 2024. Because this calculation utilizes the permit application's maximum allowable annual output, these figures represent the maximum theoretical upper bound of potential avoided water use under a 100% capacity factor baseline. Real-world volumetric savings will scale proportionally with actual plant generation. The calculation is: gallons per MWh = reported water consumption in million gallons x 1,000,000 divided by reported net generation in MWh.

Table 1: Potential annual avoided water consumption at maximum output relative to regional New Mexico benchmarks (see Appendix for source data and calculation basis)

Comparison case	Direct water consumption benchmark	Potential direct water difference at YGI Microgrid	Interpretation
Proposed Bloom SOFC energy technology, normal operation	~0 gal/MWh for power-generation water use after initial fill (960,000 gal)	Baseline	Permit application states no water will be used for cooling during normal operation.
New Mexico natural-gas combined cycle with reported cooling water	~126 gal/MWh	~2.72 billion gal/year (~8,360 acre-ft/year)	Direct water use avoided relative to a water-consuming NGCC benchmark.
Water-reporting New Mexico natural-gas thermoelectric weighted average	~315 gal/MWh	~6.79 billion gal/year (~20,800 acre-ft/year)	Direct water use avoided relative to the 2024 EIA water-reporting New Mexico gas benchmark.
New Mexico natural-gas steam generation with reported cooling water[1]	~762 gal/MWh	~16.4 billion gal/year (~50,400 acre-ft/year)	Direct water use avoided relative to a water-consuming gas steam benchmark.

Note: (1) The gas-steam comparison represents an upper bound; it is included for completeness rather than as the most likely alternative configuration for a new facility in this basin.

These figures represent water that a conventional water-cooled plant of similar output would consume; they are not a measure of water use for fuel cells, which the cooling technology largely avoids. This comparison is not a claim of zero total water use. It is a direct, on-site, normal-operation power-generation comparison. The practical implication is important. Based on the permit materials, the facility's routine water supply is limited to ordinary site-service needs such as drinking water, restrooms, sanitation, and limited operational support. It would not require a supply for continuous cooling-tower or condenser makeup water unless the energy technology or operating assumptions materially change.

Why the distinction matters in the watershed context

The project is proposed in a water-constrained part of southern New Mexico, where basin-wide water availability and intense hydrological variability present significant regional risks. The Supreme Court's recent Rio Grande Compact proceedings highlight the acute supply tensions characterizing the Lower Rio Grande. As detailed in the Special Master's Fourth Interim Report, a recurring history of drought has effectively made scarcity the norm below Elephant Butte Reservoir, routinely causing surface water supplies to dwindle.

Within a watershed defined by such chronic supply volatility and legal frameworks, the cooling system choice for any new facility carries weight. Conventional water-cooled thermoelectric generation would impose a continuous, non-discretionary demand for cooling-water makeup in a basin where surface supplies are already under documented stress. By avoiding the steam cycle and cooling system entirely, the proposed SOFC technology removes that continuous operational demand at the point of generation. That distinction makes this a more water-conservative generation technology than conventional power generation for a water-constrained region.

Recommendations for the permitting record

Though not required by law, Waterplan recommends that the public record reflect a quantifiable and currently under-documented benefit of this project: a significant reduction in direct operational water use for power generation compared to conventional power generation, attributable to the SOFC technology's lack of a steam cycle and cooling system.

This is a narrow, quantifiable technical distinction:

- No cooling-water use in normal operation: The permit application and manufacturer data sheet state the Bloom SOFC system uses no water for cooling during normal, steady-state operation. This comment addresses cooling-water demand specifically and does not characterize other incidental water uses.
- Avoided conventional demand: The absence of a steam turbine and cooling system removes the continuous cooling-water consumption characteristic of conventional water-cooled thermoelectric plants.

Peer-reviewed lifecycle literature notes that total environmental footprints depend on complex system boundaries and supply chains. Those broader questions are distinct from the direct, on-site outcome addressed here, namely the avoided cooling-water demand for power generation in a drought-stressed basin.

Conclusion

Waterplan offers qualified support for the permit application related to the proposed energy technology and its water implications. More specifically, Waterplan supports the applicant's use of the Bloom SOFC energy technology described in the permit record because it materially reduces direct, on-site, normal-operation water consumption for power generation compared with conventional water-consuming natural-gas thermoelectric alternatives. This qualified support is limited to the technology’s water-saving profile and does not constitute an endorsement of other aspects of the project or its operational impacts.

We respectfully ask NMED to note this distinct water profile in the permitting record.

Respectfully submitted,

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Appendix: Source Notes and Calculation Basis

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Facility Permitting and Operational Specifications

- Permit Application: Yucca Growth Infrastructure, LLC, *Initial New Source Review (NSR) Air Quality Permit Application No. 10883 (YGI Microgrid)*, prepared by Trinity Consultants for the New Mexico Environment Department (NMED) Air Quality Bureau (April 2026).
- Facility Parameters: The application specifies an installed facility input capacity of 2,462.005 MW with a maximum theoretical annual output of 21,567,164 MWh/year (input capacity × 8,760 h). Total greenhouse gas emissions are estimated at 10,144,115 tons/year of carbon dioxide equivalent (CO_2e). Waterplan reproduces this figure as a parameter stated in the permit application and takes no position on the facility's emissions. This comment is limited to direct operational water use.
- Generation Technology: The facility design replaces traditional combustion units with the Bloom Energy Server 6.5 solid oxide fuel cell (SOFC) system.
- Operational Water Profile: Section 10 ("Written Description of the Routine Operations of the Facility") and the manufacturer's engineering data sheet state that electricity is generated via an electrochemical reaction without combustion. Water and heat generated during steady-state operations are internally recycled to generate steam required for fuel reforming. Consequently, the system requires no external water supply during normal, steady-state operations, restricting water consumption exclusively to the initial system startup phase.
- Manufacturer Performance Specifications: The Bloom Energy Server 6.5 technical data sheet explicitly states *"Water: None during normal operation"*. Each Energy Server module provides a net output of 325 kW AC, operating at a net AC efficiency of 53% to 65% on a Lower Heating Value (LHV) basis, with a corresponding Higher Heating Value (HHV) heat rate between 5,811 and 7,127 Btu/kWh.

Regional Thermoelectric Water Consumption Methodology

- Analytical Formula: Regional water intensity baseline factors (expressed in gallons per megawatt-hour, or gal/MWh) are established using operational parameters derived from the U.S. Energy Information Administration (EIA).
- Data Sources: Primary regional datasets are extracted from the EIA 2024 *Thermoelectric Cooling Water Data* ("Water cooling by generator and boiler - summary" and "Water cooling by generator and boiler - detail") workbooks, paired with the EIA *New Mexico Electricity Profile 2024* (Table 5), released November 10, 2025.
- State Baseline Derivations (New Mexico 2024):
    - Natural-Gas Combined Cycle (NGCC): Total annual cooling water consumption of 829.019 million gallons divided by a net generation of 6,564,035 MWh yields a baseline intensity of 126.3 gal/MWh.
    - Natural-Gas Steam Thermoelectric: Total annual cooling water consumption of 2,109.207 million gallons divided by a net generation of 2,769,800 MWh yields a baseline intensity of 761.5 gal/MWh.

- Water-Reporting Gas Thermoelectric Weighted Average: Total aggregated annual cooling water consumption of 2,938.226 million gallons divided by an aggregated net generation of 9,333,835 MWh yields a weighted regional baseline intensity of 314.8 gal/MWh.

- Volumetric Projections: The potential avoided annual water use values are modeled by multiplying these calculated regional water intensities directly by the facility's maximum application output of 21,567,164 MWh/year.

- Volumetric Conversion Factors: Volumetric conversions from gallons to acre-feet (acre-ft) utilize the U.S. Geological Survey (USGS) standard conversion factor of 1 acre-foot = 325,851 gallons (or 1,233 cubic meters) derived from the USGS Water Science Glossary.

Academic and Government Literature

- Foundational Thermoelectric Literature: Macknick, J., Newmark, R., Heath, G., and Hallett, K.C., 2012, "Operational water consumption and withdrawal factors for electricity generating technologies: a review of existing literature," *Environmental Research Letters*, Volume 7, Article 045802 (DOI: 10.1088/1748-9326/7/4/045802). Accompanying technical report: Macknick et al., 2011, *A Review of Operational Water Consumption and Withdrawal Factors for Electricity Generating Technologies*, National Renewable Energy Laboratory (NREL) Technical Report NREL/TP-6A20-50900, pp. 2–3 and Table 2. This peer-reviewed framework establishes that thermoelectric generation systems (nuclear, coal, gas) using traditional Rankine steam cycles rely heavily on water for both working fluid replenishment and cooling condenser processes.

- U.S. Geological Survey Thermoelectric Framework: Harris, M.A., and Diehl, T.H., 2019, *Withdrawal and Consumption of Water by Thermoelectric Power Plants in the United States, 2015*: U.S. Geological Survey Scientific Investigations Report 2019–5103, p. 2 ("The amount of water that is withdrawn and consumed by a plant is determined primarily by its cooling-system technology") and Tables 6–9 (DOI: 10.3133/sir20195103). This federal framework independently confirms that a power plant's specific cooling-system configuration serves as the primary determinant of its water withdrawal and operational consumption metrics.

- Lifecycle Boundary Literature: Meldrum, J., Nettles-Anderson, S., Heath, G., and Macknick, J., 2013, "Life cycle water use for electricity generation: a review and harmonization of literature estimates," *Environmental Research Letters*, Volume 8, Article 015031 (DOI: 10.1088/1748-9326/8/1/015031). This study defines the technical boundaries separating immediate, direct, localized on-site operational water footprints from upstream supply chain, fuel extraction, manufacturing, and macro-level lifecycle water footprints.

Hydrological and Legal Frameworks

- Supreme Court Decrees and Inter-State Compacts: *Texas v. New Mexico and Colorado*, No. 141, Original, *Fourth Interim Report of the Special Master*, Hon. D. Brooks Smith (U.S. Supreme Court, Issued February 6, 2026).

- Regional Environmental Context: These sources outline the compounding hydrological stresses caused by accelerated regional groundwater pumping, its subsequent drawdowns on river and return flows, and the Compact Decree's strict operational frameworks aimed at protecting aquifer storage while safeguarding legal project delivery quotas.