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Canal Solar Data Center Pilot Co-Located Canal Solar and Data Center Infrastructure

Additional submitted attachment is included below.

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EPIC 5 Research Concept Proposal Response:

Canal Solar Data Center Pilot: Co-Located Canal Solar and Data Center Infrastructure

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1. Brief Description of Proposed Concept

Sperra proposes a **land-based "Power Couple"[i] demonstration project**: a modular data center co-located with a 3D-printed **canal solar (CS) canopy**, forming a novel clean energy–digital infrastructure pair that maximizes value to the grid and minimizes cost to ratepayers.

This project will deploy a flexible data center adjacent to a solar-covered irrigation canal (**Figure 1 and Figure 2**). The floating or fixed-bottom solar canopy will reduce evaporation and generate clean electricity, while the nearby data center acts as a **dispatchable, colocated energy offtaker**. Together, the system will operate as a Power Couple—optimizing energy use, unlocking new solar capacity without additional land, and **relieving stress on the transmission grid**.

This fully land-based version of the Sperra system builds on CEC, NSF, NYSERDA, and DOE-funded 3D concrete printing (3DCP) research and is designed to be **rapidly deployable, low-cost, and scalable**. The data center will use **closed-loop cooling**, not seawater or evaporative systems, and can participate in load balancing and demand response.

Figure 1: Ai-generated illustration of co-Located floating canal-solar and data center infrastructure.

Figure 2: Ai-generated illustration of co-Located fixed-bottom canal-solar and data center infrastructure.

2. Alignment with Senate Bill 96 and Technological Breakthroughs

California's digital infrastructure is expanding rapidly—especially AI and cloud computing. For example, Pacific Gas and Electric Company (PG&E) recently shared that it is proactively working to serve 10 gigawatts (GW) of new electricity demand from data center projects over the next ten years—that's enough energy to power approximately 7.5 million homes simultaneously[ii].

This rapid expansion is creating direct harm to ratepayers in the form of:

- **Grid congestion**: Land-based data centers require large, inflexible interconnections that worsen peak load and drive up infrastructure costs.[iii]
- **Water depletion**: Many centers still use evaporative cooling, threatening local freshwater supplies.[iv]
- **Rising electricity prices**: Increased demand leads to higher marginal generation costs, capacity market pressures, and stranded asset risks.[v]
- **Emissions**: Without clean power, fossil-fueled backup (often natural gas) is used, undermining California's GHG targets.[vi]

The proposed concept directly supports SB 96 goals by unlocking dual infrastructure value and overcoming major technical and market barriers:

- **Transmission Relief:** By siting flexible data loads next to renewable generation, we reduce the need for costly transmission upgrades and interconnection delays.
- **Clean Load Growth:** Flexible compute demand aligned with solar output allows the system to absorb excess solar during midday peaks—minimizing curtailment and improving capacity factors.
- **Water Conservation & Land Efficiency:** Canal solar avoids additional land use and saves billions of gallons of water annually, addressing multiple sustainability goals at once.
- **3DCP Innovation:** By using 3D-printed, modular structures for both the solar canopy and the data center shell, the system can be built quickly, affordably, and with local labor and materials creating good jobs for EPIC ratepayers and reduce greenhouse gas emissions.

This project embodies the Power Couple model promoted by Rocky Mountain Institute (RMI), demonstrating how collocated renewable energy and flexible data infrastructure can **lower electricity prices for ratepayers and increase grid reliability** through:

- Behind-the-meter energy use
- Load shifting to solar production hours
- Optional grid export/storage
- Grid service participation (e.g., frequency regulation, capacity)

3. Anticipated Outcomes and Ratepayer Benefits

Direct Ratepayer Benefits:

- **Lower Electricity Prices:** By reducing peak demand and curtailment, the system improves overall grid efficiency, driving down marginal electricity prices.
- **Grid Infrastructure Avoidance:** Eliminating the need for new long-distance transmission lines or peaker plants can save billions in capital expenditures.
- **Resilience and Local Reliability:** Distributed generation and demand reduce the strain on substation and feeder capacity, especially in rural or agricultural zones.

Broader System Benefits:

- **Water Savings:** The canal solar canopy significantly reduces evaporation, supporting agricultural water availability.
- **GHG Reductions:** 100% of the data center's energy use is covered by clean solar energy, with zero fossil backup.
- **Workforce and Equity:** The system is fabricated on-site using regional materials and labor, creating accessible, family-sustaining jobs.

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4. Metrics to Evaluate Impacts

- **Power Usage Effectiveness (PUE):** <1.25 with closed-loop cooling
- **Canal Evaporation Reduction:** >80% reduction over shaded areas
- **Ratepayer Benefit Proxy:** ≥20% reduction in marginal cost of electricity in the feeder/substation zone during peak hours
- **Grid Interconnection Delay Avoided:** >3 years compared to utility-scale solar + remote data center deployment
- **LCOE of Canal Solar:** <$0.03/kWh
- **Local Job Creation:** # of jobs per MW deployed using 3DCP methods

5. Strategic Goal Alignment

Primary Strategic Goal: *Distributed Energy Resource Integration*

This research pioneers a **next-generation DER archetype**—a physical Power Couple—that directly increases clean energy penetration and grid flexibility.

Also Supports:

- *Climate Adaptation:* Dual-use infrastructure improves drought resilience.
- *100% Net-Zero Emissions:* Fully solar-powered data operations.

- *Building Decarbonization:* Supports smart, off-grid building analytics and cloud services.
- *Equity:* Local manufacturing with domestic materials, accessible workforce entry points.

6. Additional Information

- **Location:** Central Valley, Inland Empire, or SoCal canal corridor
- **Timeline:** Design in 2025–26; prototype build and test by 2027
- **Cooling:** Closed-loop air or hybrid system, no seawater or evaporative use
- **Manufacturing:** Onsite 3DCP system deployed at local staging area
- **Data Center Load Size:** Initial deployment target of 500 kW to 1 MW of flexible compute

Portions of this proposal were developed using AI-assisted tools, with oversight and edits by our team to ensure accuracy and relevance.

7. References

[i] RMI. 2023. *Power Couples: Pairing Clean Energy with Flexible Loads*. https://rmi.org/how-power-couples-can-help-the-united-states-win-the-global-ai-race/.

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[iii] S&P Global. 2024. "Datacenters Amplify Grid Congestion Challenges as Renewable Curtailment Rises." https://www.spglobal.com/market-intelligence/en/news-insights/research/datacenters-amplify-grid-congestion-challenges-as-renewable-curtailment-rises.

[iv] Bloomberg. 2025. "AI's Environmental Toll: Data Centers and Water Demand." https://www.bloomberg.com/graphics/2025-ai-impacts-data-centers-water-data/?embedded-checkout=true.

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[vi] Reuters. 2024. "Global Data Center Industry to Emit 2.5 Billion Tons of CO_2 through 2030: Morgan Stanley." https://www.reuters.com/markets/carbon/global-data-center-industry-emit-25-billion-tons-co2-through-2030-morgan-stanley-2024-09-03/.