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MODEM Pilot Project Modular ORE Data-center Express Manufacturing System

Additional submitted attachment is included below.

EPIC 5 Research Concept Proposal Response:

MODEM Pilot Project: Modular ORE Data-center Express Manufacturing System

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1. Brief Description of Proposed Concept

Sperra proposes a **pilot demonstration of a near-shore floating solar-powered data center system** at **AltaSea in the Port of Los Angeles**, designed to showcase pairing **offshore floating solar PV** with **co-located, modular data centers** built on 3D-printed marine concrete platforms.

This project will validate Sperra's **Modular ORE Data-center Express Manufacturing (MODEM) System** —a low-carbon, modular infrastructure that enables **scalable deployment of clean energy and flexible digital loads** in coastal waters (**Figure 1**). The floating data centers serve as **direct, behind-the-meter offtake for near-shore and offshore solar**, and optionally for wave energy as well.

Cooling is achieved via **closed-loop non-evaporative systems**, with **optional seawater integration** where appropriate. All components are fabricated using local materials and printed on-site in California ports, supporting union labor and avoiding global steel supply chains.

This system will demonstrate a replicable solution for California's growing digital demand while advancing offshore solar, improving grid reliability, and protecting ratepayers from the growing harms of land-based data center expansion.

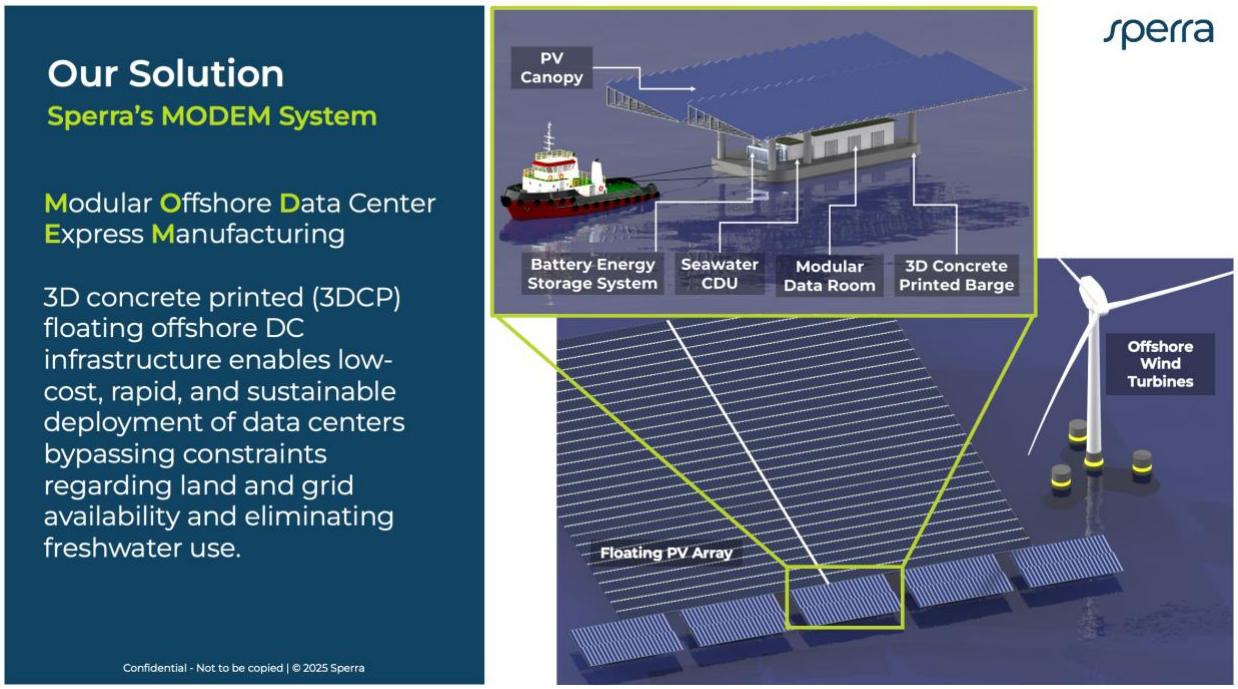

Figure 1:Illustration of Sperra's Modular ORE Data-center Express Manufacturing (MODEM) System.

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 (https://www.prnewswire.com/news-releases/pge-data-center-demand-pipeline-swells-to-10-gigawatts-with-potential-to-unlock-billions-in-benefits-for-california-302518859.html).

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.[i]
- **Water depletion**: Many centers still use evaporative cooling, threatening local freshwater supplies.[ii]
- **Rising electricity prices**: Increased demand leads to higher marginal generation costs, capacity market pressures, and stranded asset risks.[iii]
- **Emissions**: Without clean power, fossil-fueled backup (often natural gas) is used, undermining California's GHG targets.[iv]

The proposed offshore floating solar–data center "Power Couple"[v] directly addresses these issues:

- **Locates compute at the source of renewable generation**, eliminating interconnection delays and transmission losses.
- **Uses seawater or closed-loop cooling**, avoiding any freshwater use.
- **Supports distributed clean energy** without requiring land or grid buildouts.
- **Enables energy developers to monetize offshore solar**, providing stable offtake and improving project bankability.

The pilot demonstrates novel applications of **3D-printed low-carbon marine concrete**, modular design for floating platforms, and optimized energy/load balancing for offshore solar and flexible compute loads.

3. Anticipated Outcomes and Ratepayer Benefits

This pilot project will deliver the following outcomes:

- **Protects ratepayers from electricity price increases** by removing data center load from California's stressed grid.
- **Reduces grid congestion** by moving load offshore and operating behind-the-meter.
- **Prevents water depletion** by fully eliminating evaporative cooling (via closed-loop or seawater options).
- **Accelerates offshore solar deployment** by offering high-value, co-located offtake.
- **Cuts lifecycle emissions** through clean energy use, long-lived marine infrastructure, and local manufacturing.
- **Creates local green jobs** and supports economic equity by producing the platforms in California ports using local labor.

If scaled, this model can displace significant GHG emissions and avoid the need for costly grid expansions driven by digital load growth.

4. Metrics to Evaluate Impacts

- **Power Usage Effectiveness (PUE)**: <1.2 with closed-loop or seawater cooling
- **LCOE Reduction**: ≥30% vs. steel floating platforms
- **Water Savings**: 100% elimination of freshwater use
- **Load Shifted Offshore**: 100% of compute demand powered by co-located floating solar
- **Carbon Emissions Avoided**: ≥25% lifecycle reduction compared to natural gas-powered data centers
- **Grid Relief**: No new interconnection required, >90% behind-the-meter power utilization

5. Strategic Goal Alignment

Primary Strategic Goal: Distributed Energy Resource Integration

This project pioneers a **new class of DERs**—offshore floating solar with co-located flexible loads—that reduce system costs, increase reliability, and deliver clean energy at scale.

Also Supports:

- **Achieving 100% Net-Zero Emissions**: 100% clean energy supply for AI/cloud demand
- **Climate Adaptation**: Resilient offshore infrastructure that avoids land and water risks
- **Building Decarbonization**: Provides zero-carbon cloud services for smart building systems
- **Transportation Electrification**: Supports maritime AI, port electrification, and EV edge infrastructure

6. Additional Information

- **Location**: AltaSea, Port of Los Angeles
- **Technology**: Floating solar is primary generation; wind/wave optional
- **Cooling Options**: Closed-loop systems standard; seawater cooling optional
- **Visibility**: Public showcase during the 2028 Olympics
- **Manufacturing**: Platforms built with local labor using on-port 3D concrete printing
- **Deployment Timeline**: 2026–2028, before the 2028 L.A. Olympics

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] 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.

[ii] 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.

[iii] Newley Purnell. 2024. "AI Data Centers' Soaring Power Costs Pressure Energy Grids." *Wall Street Journal*. https://www.wsj.com/business/energy-oil/ai-data-center-power-costs-bbfcd862?reflink=desktopwebshare_permalink.

[iv] 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/.

[v] 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/.