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New Report Offers Path for Cleaner, More Cost-Effective Data Centers in California

Locating data centers near solar generation in rural areas can avoid the buildout of expensive new grid infrastructure

SAN FRANCISCO, Calif. — Siting data centers at strategic points of congestion along the power grid can harness unused solar power and avoid pollution usually associated with AI computation. A new report, commissioned by Next 10 and led by University of Pennsylvania Professor Benjamin Lee, compared siting data centers in an urban setting vs a rural location close to solar generation. Results reveal an alternative solution to costly infrastructure upgrades through the use of curtailed energy.

“For data center owners seeking a cost-effective and clean power supply, California’s strong renewable energy portfolio makes the state an attractive location,” said **F. Noel Perry, Founder of Next 10**. “And existing solar curtailment provides the opportunity for large energy users to step in and address grid congestion while avoiding the need for extensive infrastructure buildout that would otherwise fall on ratepayers. This report shows that cleaner data centers are possible, and California can provide a model.”

Curtailment happens when energy cannot get from its generation point, such as a solar farm in Fresno County, to its end point, such as a school in Sacramento County. Generators must pay to offload the energy, and local methane gas that is closer to the demand center is often used to meet the need. The report, [*Curtail to Compute: Siting Datacenters to Leverage California’s Stranded Renewable Energy*](#), found that curtailment rose statewide by 23% from 2023 to 2024 and that the energy wasted could have powered 500,000 California homes for a year.

Researchers found that 70% of the curtailed energy could be traced to grid congestion, not oversupply. The typical solution to grid congestion is to build more transmission infrastructure — an expensive and time-consuming project that Californians are likely to see on their energy bills. CAISO estimates that it would cost \$700 million to \$1.1 billion to build the needed high-voltage transmission lines serving the Bay Area alone. Siting a data center along a rural transmission corridor where solar energy is abundant and otherwise wasted not only allows that power to be used productively, it also avoids the need for expensive infrastructure buildout.

Curtailment in PG&E's "Fresno Zone" is the highest in the state. Without intervention, by 2039, Path 15, a transmission line that runs through rural Fresno County from Southern California to the Bay Area, is likely to be congested 84% of the year.

"Data centers need a cost effective and low-carbon solution to their computational demand," said **Benjamin Lee, Professor of Electrical and Systems Engineering and Computer and Information Science at University of Pennsylvania**. "Meanwhile, we need to make sure the huge amounts of solar energy the state generates are put to good use, especially in rural areas of the state. Our models show data centers benefit from added load flexibility when using curtailed energy, and on-site battery storage adds to the efficiency. This approach has the added benefit of reducing the environmental impact of AI, which frequently relies on more polluting energy sources."

The report analysed the following scenarios:

- **Urban baseline:** A 20 MW data center — roughly enough energy to power 16,500 homes — located in Silicon Valley that cannot access curtailed clean energy produced in faraway rural areas because of grid constraints.
- **Rural:** A 20 MW data center located in Fresno County can access local curtailed solar energy.
- **Rural + Battery:** That same 20 MW data center when paired with a 10 MW battery storage system can not only access curtailed solar energy, it can store it for different computational needs.

These scenarios show that cleaner energy direct from its rural source is cheaper *and* more efficient than traditional fossil fuels in an urban setting. As a consequence, the report recommends establishing "curtailment compute zones" for data centers along grid congestion points, and strengthening market incentives for those data centers to use battery storage for added demand flexibility.

"Curtailed solar energy represents a missed opportunity for California to put carbon-free electricity to use," said **Stephanie Leonard, Research Director at Next 10**. "But by siting a data center close to the power line congestion, we can move energy demand closer to the source instead of spending more money and resources to move the energy further away from its generation point."

Find the report here: <https://www.next10.org/publications/curtail-to-compute>

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