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INTELLIGENCE UPDATE

Data centers face new scrutiny over heat island effect

Peter Judge 9 Jul 2026

Opposition to data center developments has been spreading due to local issues such as rising electricity prices, noise pollution, water consumption, a changing landscape, as well as the global issue of greenhouse gas emissions. A fresh charge has been recently added to that list: causing local temperature increases due to the heat island effect.

Built-up areas tend to be hotter than rural or natural areas, due to the well-researched and widely recognized urban heat island effect. This is mainly caused by the absorption of solar energy by buildings and road surfaces, which in turn heats up the air. But data centers are garnering extra attention lately because they can also emit large amounts of waste heat near population centers.

A recent academic paper proposes a connection between waste heat and urban heat islands. The paper is based on limited evidence and has yet to be peer-reviewed, but it has been widely reported in the media. Some groups opposing data centers are already calling for measures to curb local warming — occasionally confusing it with global warming.

Data center operators and developers will likely encounter the heat island effect in their community engagement and permitting processes, and will be expected to demonstrate both monitoring and mitigation measures.

"Alarming" research revealed

In the paper *The data heat island effect: quantifying the impact of AI data centers in a warming world*, researchers led by Professor Andrea Marinoni of the University of Cambridge (UK) used satellite data to propose a link between data centers and elevated land surface temperatures. The paper estimated that operational data center facilities warmed their surrounding environment by an average of 2°C (3.6°F), and sometimes by up to 9°C (16°F). The analysis implicitly attributes the temperature increase to waste heat from cooling systems.

The analysis relies on a NASA (National Aeronautics and Space Administration) global land surface temperature dataset collected between 2004 and 2024, with a resolution of 500 meters (approximately 547 yards). The research team removed seasonal variations and focused on the locations of 8,472 data centers built outside urban areas during this period (using location data from DataCenterMap). The paper describes these data centers as "AI hyperscalers," but the dataset consists mostly of smaller facilities (around 10-20 MW) that predate the AI boom.

The research was picked up by mainstream media, with CNN describing it as an "alarming" discovery. During the June 2026 heatwave in the UK, residents in Slough complained that this major European data center hub was creating hotspots above 36°C (97°F). In the US, national groups opposing data centers, including the national policy resource center Good Jobs First, have added the heat island effect to the list of harms that operators should address through Local Benefits Agreements (LBAs), which are designed to neutralize local opposition.

The heat island is real

Residents near a data center may detect waste heat from its cooling systems, particularly as average facility capacities increase, but the heat produced by the data centers included in the study could not account for the abrupt temperature increases observed. They are powered up gradually; at 10-20 MW they produce relatively little waste heat, which is emitted in a plume rather than radially.

The concrete roofs and carparks of data centers alone produce a heat island effect sufficient to account for the temperature increase reported by Marinoni et al, without invoking waste heat. All buildings are warmer than their surroundings because of the thermal properties of concrete and other construction materials — and cities are up to 12°C (22°F) warmer than surrounding rural areas.

The heat island effect created by construction materials and heat rejection systems is already within the remit of local permitting. Data centers are subject to the same mitigation requirements as other buildings, including the creation of green spaces and the use of designs and materials that limit solar gain and minimize air-conditioning demand.

Planning regimes vary, but all require environmental impact analysis, often demanding computational fluid dynamics (CFD) simulations to demonstrate acceptable levels of pollutants, noise and heat around the facility.

Although waste heat currently makes only a minimal contribution to local warming, waste heat production will increase as facilities expand and densities increase. Behind-the-meter power generation by thermal systems, such as gas turbines, will further increase on-site heat output (and emissions).

Efficiency improvements, valuable in their own right, will also partially offset this component of local warming. Waste heat storage and reuse will also help to reduce the impacts by capturing the heat load rather than venting it into the environment — a consideration raised by the Global Urban Data Centres Pact, launched in June 2026 by a coalition of mayors from 41 cities across six continents.

- The heat island effect is real, but waste heat is a minimal contributor at present.
- Despite this, local warming by data center waste heat has become part of the folklore of data center opposition — and cannot be overlooked.
- Actions to mitigate warming include building design and materials, and on-site vegetation.
- Efficiency measures and waste heat storage and reuse will limit waste heat's future contribution to local warming.

ABOUT THE AUTHOR

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