

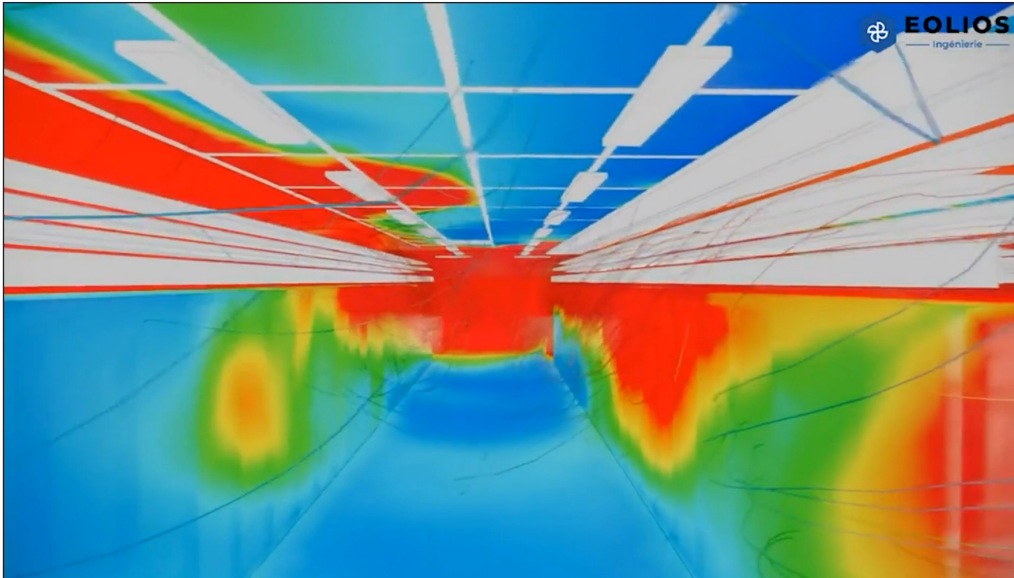


Latent Heat

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The video essay reinterprets technical images from the cooling industry, transforming them from tools of efficiency into critical lenses. It helps reveal how data center heat management relates to broader ecological impacts, exposing the environmental dimensions of digital infrastructure.





Creator's Statement

In thermodynamics, latent heat is the energy that is absorbed or released when the state of matter changes. This energy does not disappear: it is transformed and displaced, as can be observed when steam condenses on a window as water boils. This seemingly abstract physical principle is useful for understanding the energy logic that structures the functioning of the epicentre of the computing industry: data centers. In data centers, servers convert electricity into computing power, which in turn generates heat. Most of the electricity used by servers is converted into waste heat. Rather than being disposed of, this thermal by-product is managed through complex cooling systems that transfer it to other media because of the threat it poses to electronics. In turn, the removal of heat by fans or cooling towers requires additional electricity consumption, much of which continues to be powered by fossil fuels (Hogan 2021). The accelerated growth of the data center sector has promoted mechanisms for monitoring emissions and a corporate discourse focused on energy efficiency and climate responsibility (Pasek and Wiessner 2022). However, these institutional frameworks are challenged by research from the field of media ecology (Hogan 2018), which reveals a key tension: carbon markets—designed for global accountability—often dilute responsibility at the local level, while externalising impacts to peripheral communities and masking burdens on ecosystems and water resources. These systemic externalities, hidden behind technological solutionism, compensation mechanisms and aesthetic apparatuses, operate through spatio-temporal displacements that shape the invisible geographies of digital capitalism.

One of the aesthetic apparatuses in the industry's quest for efficiency and energy optimisation is digital twins: virtual replicas of data centers that model heat dissipation, airflow, and energy consumption. These three-dimensional simulations, powered by sensors and algorithms, make it possible to optimise fan layout, reduce hot spots or anticipate the impact of operational changes such as the installation of new equipment. It is a kind of technical image—generated from data and imbued with an objectivist aura—that has become a key tool for rationalising energy management. A decade ago, filmmaker Harun Farocki anticipated that “the virtual image will become the standard by which to measure the imperfections of reality” (Farocki 2014). Today, digital twins embody this principle: they construct a parallel version of the world in which heat is quantifiable and manageable, but never problematised as a systemic phenomenon. In this closed universe, the externalities of digital infrastructure—emissions, energy consumption, water use—disappear from the field of vision, generating an epistemic blindness (Latour 2004). In this sense, the images of the digital twins function as aesthetic devices that project an image of sustainability while obscuring the contradictions of the infrastructural model.

However, through the language of the visual arts, these aseptic simulations can be re-signified under an optic that expands the framework of their representation, one that is capable of tying the digital economy to its intensive use of resources. Every Google search, every interaction with generative AI models, every transaction on a blockchain constitutes a thermal event that requires cooling and therefore implies an environmental cost (Hogan 2021). It is in this sense that the 3D renders of the digital twin acquire new meanings as a result of the critical voices of academia and science, which operate by re-signifying the aesthetic apparatus. From this new perspective, the images of the digital twins—with their thermal gradients from red to blue—not only illustrate the circulation of heat, but also map its externalities, that is, the chain of energy transformations that culminate as CO₂ in the atmosphere or affect the local water table. The coloured arrows, lines and masks that represent heat dissipation can be read as symbols of a deferred ecological debt: visual forms that postpone the costs of digital growth. While the digital twins project a world of tamed heat, the voiceover reveals their efficiency as a scenario in which their ecological impact is left out of the picture.

Heat—and its graphic representation—becomes an index of deferred and displaced ecological debt. But this displacement is not only technical or symbolic, it also has a political dimension: who bears the thermal consequences of digital growth? The expansion of these infrastructures entails material negotiations with the ecosystems on which they depend: ecosystems and communities that now become territories of

sacrifice: “places that, to their extractors, somehow don’t count and therefore can be poisoned, drained, or otherwise destroyed, for the supposed greater good of economic progress” (Klein 2014: 310). This same logic of calculated disregard transforms thermal byproducts into political artifacts—the measurable heat emissions from data centers become physical testimony to the externalization of costs onto spaces and bodies. Latent heat thus ceases to be a merely physical concept and becomes a critical instrument of ecological traceability. It allows us to trace the invisible materialities of the digital economy, to assess their externalities, and to confront the narratives of dematerialisation that seek to keep them out of the field. Far from being a neutralised threat, the heat map emanating from data centers is a thermal memory of the energetic present: a symptom of the tensions between digital growth and planetary limits.

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Biography

Roc Albalat is a researcher and visual artist. He works in the field of image and digital environments. His practice is based on a critical and archaeological approach to audiovisual and digital technologies, with a particular focus on archival and experimental media. Since 2017, one of his main areas of research has been the exploration of the uses and ideologies of artificial intelligence. This interest began with the project programmatically titled *The Bad Pupil: Critical Pedagogy for Artificial Intelligences*, and has since expanded into over twenty research projects, publications and installations, which can be consulted on the Estampa collective website: tallerestampa.com/. He is also the author of the *Cartography of Generative AI*. Albalat is a professor and PhD candidate at BAU, a University Centre of Art and Design in Barcelona.

Reviewed by Anne Pasek, Trent University

“Latent Heat” combines audio clips of environmental media studies scholars discussing the infrastructures and impacts of the cloud with found footage of industry graphics and digital twins exploring the thermal modelling of data center server racks. The combination, underscored with a minimalistic but gloomily sacral soundtrack, makes a repeated and insistent point: digital life has material footprints that run hot and loom large for the prospects of climate mitigation.

I appreciate a lot of what the video essay brings to the table. The reappropriation of industry imagery, and the lingering shots on large plumes of heat exhaust and ever-neatly assembled multiples of racks and chips, effectively underlines much of the scholars’ verbal commentary. I am struck by the fact that the video essayist has brought internal boosterism and external critics together into an effective chorus. The conceit of following the thermal story of the data center, from the cooling pipes intersecting walls, to the air currents pulling heat off of cabinets and into the dumping grounds of the atmosphere, serves both a pedagogical and affective function. Watching the video essay, we learn to see heat through multiple registers, and with a degree of appropriate fear for what rising temperatures can do to both computers and climate.

The added analytic of ‘latent heat,’ sketched in the accompanying statement, deepens this approach, arguing that heat can be an invitation to think across time and space—a form of memory that ultimately resists the entropic engineering of the cooling pipes and fans. And so, as we move from the threat inside our digital infrastructures, to the formless spaces imagined outside them, we would do well to remember: heat never disappears; it only redistributes.

Reviewed by Samir Bhowmik, University of the Arts Helsinki

“Latent Heat” is a timely and thoughtful work that connects thermodynamics with the environmental politics of digital infrastructures. Its strength is the transformation of latent heat from a physical principle into a critical tool for tracing the hidden costs of data centers. The video essay shows how energy flows that are often concealed in technical systems can be made visible and interpreted through the lens of media and ecology. The discussion of digital twins is especially strong. The author shows how 3D models of heat and airflow are presented as neutral and efficient, yet in fact obscure the ecological and political contradictions of data growth. This attention to the aesthetics of thermal simulation is original. It opens a new space for reading these images not only as technical tools but also as signs of deferred ecological debt. The text is well grounded in theory. It connects Farocki, Hogan, Latour, and Klein while keeping its own clear

argument. The video essay moves beyond description to offer a political reading of heat as a byproduct that falls unevenly on places and communities. In doing so, it highlights how digital infrastructures create sacrifice zones in the name of progress. The video is more atmospheric than analytical, but the creator's statement gives it a strong frame. Together, they show the potential of artistic research to reveal hidden dimensions of computation. Overall, "Latent Heat" reframes familiar critiques in environmental media and offers a sharp vocabulary for thinking about the energy politics of the digital economy.

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Competing Interests

The author has no competing interests to declare.

