AI
Blueprint for the Future

Coalition for Innovation, supported by LG NOVA

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October 2025

Preamble

The Coalition for Innovation is an initiative hosted by LG NOVA that creates the opportunity for innovators, entrepreneurs, and business leaders across sectors to come together to collaborate on important topics in technology to drive impact. The end goal: together we can leverage our collective knowledge to advance important work that drives positive impact in our communities and the world. The simple vision is that we can be stronger together and increase our individual and collective impact on the world through collaboration.

This "Blueprint for the Future" document (henceforth: "Blueprint") defines a vision for the future through which technology innovation can improve the lives of people, their communities, and the planet. The goal is to lay out a vision and potentially provide the framework to start taking action in the areas of interest for the members of the Coalition. The chapters in this Blueprint are intended to be a "Big Tent" in which many diverse perspectives and interests and different approaches to impact can come together. Hence, the structure of the Blueprint is intended to be as inclusive as possible in which different chapters of the Blueprint focus on different topic areas, written by different authors with individual perspectives that may be less widely supported by the group.

Participation in the Coalition at large and authorship of the overall Blueprint document does not imply endorsement of the ideas of any specific chapter but rather acknowledges a contribution to the discussion and general engagement in the Coalition process that led to the publication of this Blueprint.

All contributors will be listed as "Authors" of the Blueprint in alphabetical order. The Co-Chairs for each Coalition will be listed as "Editors" also in alphabetical order. Authorship will include each individual author's name along with optional title and optional organization at the author's discretion.

Each chapter will list only the subset of participants that meaningfully contributed to that chapter. Authorship for chapters will be in rank order based on contribution: the first author(s) will have contributed the most, second author(s) second most, and so on. Equal contributions at each level will be listed as "Co-Authors"; if two or more authors contributed the most and contributed equally, they will be noted with an asterisk as "Co-First Authors". If two authors contributed second-most and equally, they will be listed as "Co-Second Authors" and so on.

The Blueprint document itself, as the work of the group, is licensed under the Creative Commons Attribution 4.0 (aka "BY") International License: https://creativecommons.org/licenses/by/4.0/. Because of our commitment to openness, you are free to share and adapt the Blueprint with attribution (as more fully described in the CC BY 4.0 license).

The Coalition is intended to be a community-driven activity and where possible governance will be by majority vote of each domain group. Specifically, each Coalition will decide which topics are included as chapters by majority vote of the group. The approach is intended to be inclusive so we will ask that topics be included unless they are considered by the majority to be significantly out of scope.

We intend for the document to reach a broad, international audience, including:

- People involved in the three technology domains: CleanTech, AI, and HealthTech
- Researchers from academic and private institutions
- Investors
- Students
- Policy creators at the corporate level and all levels of government

Chapter 2:
Beyond Emissions: Balancing People, Planet, and Profit at Scale in AI Infrastructure

Authors: John Barton

Facts and Figures:

U.S. data centers consumed 176 TWh of electricity in 2023, contributing ~60 $MtCO_2e$. AI workloads (e.g., GPT-3) are primary drivers of this growth, with one training run using 1,287 MWh.

Water use is significant: direct cooling used ~66 billion liters in 2023, and indirect power generation consumed another ~800 billion liters.

Google, Microsoft, and Meta collectively withdrew ~2.2 billion m^3 in 2022, comparable to the annual use of two Denmarks.

Community-level impacts include generator emissions (~100 tons NOx/year in Wisconsin; ~14 tons formaldehyde/year in Memphis), noise pollution, and increased infrastructure costs.

Environmental justice concerns are acute, with facilities often sited in underserved or vulnerable regions with minimal local benefit and high health/environmental burdens.

Public opposition has delayed or blocked ~$64 billion in data center projects across 24 U.S. states as of 2025.

Overview

Artificial intelligence (AI) infrastructure demands enormous physical resources — energy, water, land — and produces wide-ranging ecological and civic consequences. While emissions are often the primary metric of concern, the full picture includes upstream and downstream effects on water systems, air quality, public infrastructure, and community well-being. These impacts are not only accelerating but disproportionately concentrated in regions with limited oversight or leverage, such as Appalachia, the Southwest, and other under-resourced areas.

Local communities face additional external influences including thermal pollution, diesel exhaust from backup generators, and grid strain, particularly in water-stressed and low-regulation regions. These externalized costs, compounded by tax exemptions and minimal job creation, highlight the urgent need to rethink sustainability beyond emissions-only metrics.

List of Stakeholders (Audience/Readers)

Public Sector & Governance

This group includes entities responsible for policy, regulation, and public resource management at all levels of government.

Local & Regional Authorities:

- Municipal and county governments (city councils, zoning boards, public works)
- Water authorities and regional water boards
- School boards and local educational institutions
- Economic development agencies

State & Federal Regulators:

- Environmental protection agencies (e.g., EPA, state-level environmental quality boards)
- Public utility commissions and energy departments (DOE)
- State oversight offices (auditors general)
- Federal agencies (e.g., USDA, NTIA)

Cross-Jurisdictional Bodies:

- Regional funding commissions (Appalachian Regional Commission)
- Tribal nations and Indigenous land authorities

Private Sector & Infrastructure

This category covers the corporations and financial entities that design, build, and operate the infrastructure, along with their investors.

Technology & Infrastructure Providers:

- AI companies and cloud service providers (e.g., Google, Microsoft, AWS)
- Hyperscale data center developers
- Utility companies and grid operators
- Construction, logistics, and engineering firms

Investors & Financial Services:

- Real estate investment trusts (REITs) and infrastructure asset managers
- Private equity firms
- Insurance providers and ESG risk analysts

Civil Society & Community

This section includes groups and individuals directly affected by AI infrastructure, along with non-governmental organizations advocating on their behalf.

Affected Communities:

- Local residents and neighborhood associations
- Utility ratepayers
- Communities in tax-exempt or PILOT (Payments in Lieu of Taxes) zones

Advocacy & Public Interest Groups:

- Environmental justice coalitions and grassroots organizers
- Labor unions and tech equity coalitions
- Public health departments and local planning boards
- National civil rights and legal aid organizations

Global & Research Entities

This final group includes international bodies, academic institutions, and media that shape the global context and public understanding of AI infrastructure's impacts.

Global Governance & Oversight:

- Multilateral climate and infrastructure funders (e.g., World Bank, IMF)
- International sustainability standards bodies (ISO)
- Global watchdog organizations (e.g., Amnesty International, Global Witness)
- Supply chain and critical minerals governance coalitions

Knowledge & Media:

- Academic researchers
- Investigative journalists and specialized media
- Think tanks and public policy labs
- Independent ESG auditors

- AI industry governance bodies (e.g., Partnership on AI)

The Problem:

AI infrastructure is no longer a niche domain; it is central to how knowledge is produced, how decisions are made, how surveillance systems operate, and how global computation scales. The physical systems powering it — supporting models like GPT, national defense, and enterprise AI — are intensely resource-dependent, placing accelerating demands on electricity, water, land, and labor. These burdens fall disproportionately on communities with the least power to resist them.

These burdens are often hidden—by design. Not just physically, but through decision-making structures that obscure who decides, who pays, and who is accountable. Costs are externalized. Public engagement is bypassed. Communities are left with the consequences. With the rise of generative AI and continuous inference workloads, these demands are compounding exponentially, straining people, ecosystems, and economies.

Across the country, siting decisions frequently exploit disenfranchised regions—Appalachia, the Southwest, and other areas with cheap land, weak regulation, and under-resourced governments. Projects are often approved before public notice, and communities may only learn of them after rezoning or construction is already underway. Civic exclusion and externalized costs fall hardest on marginalized groups with the least leverage. In West Virginia, grid upgrades for proposed data centers could cost ratepayers over $440 million, underscoring how local communities may be forced to subsidize infrastructure for global platforms.

Narrow reporting metrics compound these harms. Environmental assessments often focus only on emissions, omitting water, land, and heat impacts. Mid-sized AI data centers can draw up to 300,000 gallons of water per day—comparable to the daily use of 1,000 households—yet such withdrawals rarely appear in sustainability reports. This selective accounting creates blind spots that mask the full scope of ecological damage.

In 2023, U.S. data centers used an estimated 66 billion liters of water for cooling and another 800 billion liters indirectly through power generation. Phoenix facilities collectively draw more than 177 million gallons per day, while in The Dalles, Oregon, Google's campus now consumes nearly 25% of the city's water supply. Aquifers and watersheds are stressed, wastewater discharges raise ecological risks, and noise and air pollution add chronic health burdens.

- Microsoft's Wisconsin site is projected to emit nearly 100 tons of nitrogen oxides annually.
- xAI turbines in Memphis emit nearly 10 tons of formaldehyde into a community already facing quadruple the national cancer risk.

These facilities are structured around subsidy and speculation. Governments provide hundreds of millions in public incentives while corporations minimize tax obligations.

- In Oldham County, Kentucky, a $6B project attempted to classify as a private utility to bypass zoning laws, abandoning the effort only after community pushback.
- Nationwide, over $64 billion in data center projects have been blocked or delayed due to public resistance in 24 states.

Despite promises of growth, the permanent jobs created are few — often fewer than 100 positions for billion-dollar facilities — while the infrastructure burdens of water withdrawals, grid stress, and road wear are borne locally. Universities and localities justify these projects on speculative ROI and prestige, even as they hollow out public budgets.

Greenwashed environmental, social, and governance (ESG) claims often deflect attention from these ongoing harms. Facilities sited on carbon-intensive grids may still claim carbon neutrality via offsets or purchase agreements, while omitting lifecycle emissions from chip manufacturing, mining, and global shipping. This selective framing disguises the true scale of extraction.

At scale, these pressures are accelerating. In 2023, U.S. data centers consumed 176 terawatt-hours of electricity (about 4.4% of national usage) and withdrew over 66 billion liters of water for direct cooling. By 2030, AI demand could require as much as 298 gigawatts—roughly a quarter of national electrical usage—and nearly 400 billion liters of water annually.

These burdens are not distributed evenly. Infrastructure is concentrated in regions with fragmented civic resistance and limited oversight, ensuring global users and cloud providers remain shielded from the physical, civic, and ecological costs. Communities are excluded from meaningful participation, often left to protest as their only form of engagement.

The result is a systemic asymmetry: benefits flow outward to platforms, investors, and end users, while under-resourced communities absorb degraded infrastructure, displaced public services, environmental harm, and long-term liabilities. These regions are not accidental victims but strategic targets, selected precisely because their land, water, political capacity, and people are treated as expendable.

The system is designed to scale computation, not community resilience. To correct this imbalance, AI infrastructure must be restructured around equity, accountability, and long-term viability. Sustainability, not exploitation, is the way forward.

Our New Vision: People, Planet, Profit Framework

AI infrastructure is already expanding at an unprecedented pace with new facilities reshaping local economies and ecosystems across the country. Yet the costs of this expansion—environmental, social, and economic—are too often shifted disproportionately onto vulnerable communities. Current siting and permitting practices externalize risks and conceal true costs, leaving local populations to bear the burdens of pollution, resource strain, and inequitable economic trade-offs.

To counter these systemic failures, we propose the People, Planet, Profit framework, built on lifecycle accountability and civic equity. This is not aspirational—it sets the minimum operational standard for sustainability. The framework restructures AI infrastructure around resilience, legitimacy, and long-term viability. Each pillar is framed by a clear **Goal**, followed by actionable measures that embed sustainability into decision-making.

The framework calls for planning that embeds sustainability into the operational design of AI infrastructure. Rather than treating environmental harm as a compensable side effect, the priority must be to proactively prevent harm, internalize resource costs, and align infrastructure planning with durable systems that protect communities and ecosystems. Sustainability must be treated as a binding requirement—an operational baseline that guides every siting, permitting, and investment decision.

People

Goal: Integrate human-centered metrics into infrastructure planning—job quality, health exposure, and civic cost distribution—so that communities gain tangible benefits from hosting AI infrastructure.

- Establish binding community benefits agreements and tax equity frameworks.
- Ensure job quality, worker protections, public health safeguards, procedural inclusion, and localized economic return in planning decisions.
- Mitigate pollution burdens such as diesel generator emissions, HVAC-related noise, and thermal output that disproportionately affect working-class and marginalized communities.
- Embed public trust as a design constraint, not a PR strategy.

Planet

Goal: Quantify and reduce environmental loads at every lifecycle stage: energy use, water draw, pollution, and waste. Prioritize local ecological integrity, not just emissions offsets.

- Replace carbon neutrality claims with real environmental accounting across the full lifecycle, including upstream emissions (chips, transport) and local degradation (cooling discharge, groundwater stress).
- Reject offset schemes that disguise fossil dependency.
- Optimize water-use effectiveness, enforce thermal discharge limits, and select sites that protect ecosystems.
- Conduct grid impact studies and disclose resource demands before approval.

Profit

Goal: Treat resilience, transparency, and long-term viability as cost drivers, not externalities. Align siting, financing, and risk management with lifecycle realities and civic accountability.

- Measure profitability through durability, transparency, and infrastructure resilience.
- Integrate legal exposure, water volatility, public resistance, and decommissioning costs into ROI models.
- Disclose public funding, tax exemptions, and civic cost burdens.
- Account for hidden subsidies and externalized harms as financial liabilities, reinforcing sustainability as a binding operational requirement.

Projections indicate the U.S. could see over 10,000 AI-optimized data centers by 2030. This buildout is not just a question of scale—it generates compounding ecological, economic, and political risks when combined with today's extractive siting patterns, rising water demands, diesel emissions, and the shifting of costs onto local communities.

If left unchecked, these practices will deepen long-term vulnerabilities for both infrastructure providers and the communities that host them. Policymakers, civic planners, and infrastructure investors must therefore move beyond short-term throughput and prioritize long-term resilience. That requires embedding lifecycle costs, water system capacity, and public trust into every siting and design decision, and treating sustainability not as an optional add-on but as the minimum operational standard.

People, Planet, and Profit are not abstract concepts or ideals; they are the practical foundation of financially responsible and sustainable AI infrastructure development. This triadic framework anchors long-term viability in human, environmental, and financial outcomes—the benchmark of whether AI infrastructure will truly endure.

Case Studies by Sustainability Domain

While the risks of unchecked development have been widely documented, examples of directional progress remain fragmented, underreported, or excluded from industry strategy documents and permitting frameworks. This document curates emerging models, partial successes, and boundary-testing prototypes that illustrate how the principles of People, Planet, and Profit can work together in practice.

Each case study was selected based on evidentiary grounding, relevance to infrastructure decision-makers, and potential for policy translation. All were chosen for their ability to operationalize at least one facet of the Vision: civic equity, ecological alignment, or lifecycle financial accountability. These are not hypothetical designs, but live experiments—some state-driven, some corporate-led, and some Indigenous or community-initiated.

Each marks a shift away from extractive norms and toward infrastructure that internalizes long-term impacts, invites public trust, and models system-wide accountability. They are not blueprints. They are prototypes of possibility—signals that transformation is already underway. Initiatives such as community air monitoring or localized heat reuse often fly under the radar, yet they are among the most politically feasible and economically efficient levers for reform. These accessible interventions deliver outsized impact when codified and repeated. These small civic or environmental shifts can recalibrate entire projects.

When design constraints are treated as ethical guardrails rather than barriers, sustainable infrastructure becomes not just feasible but the only model that can scale without system failure. Many involve tradeoffs, yet all are operationally relevant. These case studies are valuable not because they offer complete solutions, but because they show meaningful deviation from the status quo. Each example reveals how infrastructure can evolve toward sustainability when civic priorities, ecological limits, and long-term investment logic are treated as design constraints, not afterthoughts.

When viewed collectively, these case studies form a strategic knowledge base that deserves active preservation and policy translation. No single example solves for all three dimensions of sustainability. However, even narrow wins such as improved permitting or integrated water management create precedents that shift institutional expectations. Directional progress builds the scaffolding for future norms.

PEOPLE: Civic Equity, Public Health, and Procedural Inclusion

Infrastructure decisions that begin with community needs tend to yield more durable outcomes. Procedural inclusion — through public comment, health screening, or Indigenous governance — helps prevent backlash, streamline implementation, and protect legitimacy. These cases show how civic participation is not a courtesy, but a structural advantage in high-impact infrastructure. From FOIA-driven oversight in Tucker County to CBA-backed benefits in New York's South Fork Wind, procedural inclusion is emerging as a risk-mitigation strategy.

See also: Brookings — Civic Participation and Infrastructure • NEPA — Public Participation Guide

Public Comment and Permitting Participation

Public comment processes give communities direct influence over infrastructure decisions. When paired with legal enforcement mechanisms, they can materially reshape projects and embed accountability. These cases demonstrate how structured civic engagement, combined with regulatory action, can significantly alter infrastructure design and implementation.

Prince William County, VA – Digital Gateway Project: AP News — Virginia county approves data center project after 27-hour hearing *See also:* InsideNova — Digital Gateway debate

In this case, sustained, organized public engagement materially shaped high-impact development. The Prince William County Board of Supervisors held a **27-hour public hearing** before approving the Digital Gateway project. Hundreds of residents raised concerns about visual blight, environmental degradation, and cultural site encroachment, forcing developers to negotiate concessions.

Key Highlights:

- 27-hour public hearing with hundreds of participants
- Concerns raised: visual blight, environmental harm, cultural encroachment
- Concessions: 800+ acres preserved, 1,500-foot buffers, historic site protection, trails and parks
- Legally binding zoning conditions enforced

Context: A proposed data center campus faced unprecedented community opposition tied to environmental and cultural concerns.

Outcome: Developers were required to integrate community demands through binding zoning conditions.

Impact: Public comment materially reshaped the project's footprint, demonstrating that community engagement can redirect scale and secure enforceable benefits.

Becker, MN – Amazon Data Center Generators: Data Center Frontier — Minnesota PUC says no to Amazon's bid to fast-track 250 diesel generators *See also:* Star Tribune — Minnesota PUC rejects Amazon diesel plan

In 2024–25, Amazon attempted to fast-track the installation of 250 backup diesel generators at a proposed Minnesota data center by requesting exemption from the state's certificate-of-need process. Community members, environmental advocates, and the Minnesota Attorney General's office challenged the request, citing serious air quality concerns and the precedent it would set for future projects. The case highlighted how state-level review processes can serve as crucial checks against speculative or environmentally risky development.

Key Highlights:

- Amazon sought exemption for 250 diesel generators
- Opposition from Minnesota AG, environmental groups, and local community
- Risks: air quality impacts and precedent for bypassing review
- Regulatory outcome: PUC unanimously denied exemption

Context: Amazon sought to exempt 250 diesel generators from certificate-of-need review in Minnesota. **Outcome:** State regulators, supported by civic and institutional opposition, unanimously rejected Amazon's exemption request.

Impact: Amazon's plans were delayed and subjected to full emissions review, proving the effectiveness of procedural safeguards as a financial and environmental check.

Community Benefit Agreements (CBAs)

Community Benefit Agreements provide legally binding structures for channeling development gains back into local communities. They ensure benefits such as jobs, training, and reinvestment are guaranteed rather than promised. Unlike Community Benefit Plans (CBPs), CBAs are enforceable contracts that bind developers to commitments, making them a tool of both accountability and equity.

Sunrise Wind (Long Island, NY): Sunrise Wind — Local Benefits Agreements to Advance Sunrise Wind Project *See also:* NYSERDA — Sunrise Wind project details

The Sunrise Wind project is a landmark example of a high-value CBA, signed in 2023 with a total package worth **$169.9 million**. The agreement earmarks funds for workforce development, health services, and infrastructure upgrades, linking renewable energy expansion to tangible community benefits. Its scale demonstrates the potential of CBAs to transform local economies while building trust.

Key Highlights:

- Total value: $169.9 million
- $1M for workforce training, $2M for public health
- Infrastructure upgrades and local hiring pipelines
- Legally binding contract with local and regional authorities

Context: One of the largest negotiated CBAs in U.S. clean energy. **Outcome:** Secured unprecedented levels of community reinvestment, including jobs, training, and public health funding.

Impact: Demonstrated the potential of CBAs to scale public benefit in high-value infrastructure projects.

Columbia Law CBA Database – Solar Energy Projects: Columbia Climate School — Community Benefits Agreements Database *See also:* Energy News Network — CBA examples in renewable projects The Columbia Climate School's CBA database catalogs dozens of community benefit contracts across the renewable energy sector. Examples from Ripley, Byron, and Maui County provide clear models of recurring financial investment in local communities, including structured annual payments, infrastructure improvements, and reinvestment funds.

Key Highlights:

- Ripley Solar: 270 MW, $472,500 annual payments with escalators
- Byron Solar: 280 MW, ~$24M total lifecycle payments
- Maui County Solar: 20 MW, $55,000/year for 25 years
- Common provisions: road upgrades, emergency services, community impact funds

Context: Solar projects across multiple states provide tested CBA models.

Outcome: Delivered recurring financial and infrastructure investments to host communities.

Impact: Established replicable models for binding community benefits, now supported by permitting norms and legal precedents.

ReImagine Appalachia / Clean Air Task Force: ReImagine Appalachia — Community Benefits • Clean Air Task Force — Community Benefits Resource Inventory *See also:* Just Transition Fund — Community benefits resources These organizations develop frameworks for equity-centered development, creating toolkits that include wage provisions, local hiring standards, and reinvestment strategies. Their work shows how advocacy groups can equip communities with negotiation tools that rival corporate legal resources, leveling the playing field in infrastructure decision-making.

Key Highlights:

- Living wage provisions
- Local hire benchmarks
- Profit reinvestment into transition or resilience
- Policy and permitting toolkits for rural and post-industrial regions

Context: Advocacy-driven frameworks designed for post-industrial and rural regions.

Outcome: Produced customizable tools and language for embedding equity into project negotiations.

Impact: Enhanced coalition capacity to secure fair wages, jobs, and reinvestment in communities vulnerable to energy transition shocks.

Health Screening Tools & Procedural Equity Frameworks

Health screening tools and procedural equity frameworks expand the definition of feasibility to include cumulative health and environmental burdens. By integrating these tools into planning, infrastructure siting decisions can avoid reinforcing inequities and direct resources to resilience in overburdened communities.

CalEnviroScreen (California): OEHHA — CalEnviroScreen *See also:* EPA EJScreen — Federal screening tool CalEnviroScreen is a state-developed tool that ranks communities based on cumulative environmental risk and vulnerability, guiding permitting, policy targeting, and funding allocation. Its use demonstrates how structured screening mechanisms can shift state-level resource distribution toward equity.

Key Highlights:

- **Function**: Ranks communities by cumulative environmental risk and vulnerability
- **Use Case**: Guides permitting, policy targeting, and resource allocation
- **Potential**: Could influence AI/data infrastructure siting decisions

Context: Built to address longstanding environmental justice concerns in California.

Outcome: Enabled targeted state resource allocation to vulnerable communities.

Impact: Provides a replicable model for guiding infrastructure siting and reducing disproportionate burdens.

Civic-Led Planning & Governance Innovations

Civic-led innovations show how communities use transparency, organization, and advocacy to influence — or slow — data infrastructure projects that threaten health or environmental equity. These examples reveal the growing power of grassroots coalitions to leverage procedural levers against powerful corporate actors.

Tucker County, WV – Community Resistance to Data Center: WV DEP — Response to Public Comment (PDF) • Tucker United — Community Coalition *See also:* WV Public Broadcasting — Tucker County resistance coverage Residents of rural Tucker County mobilized under the coalition *"Tucker United"* to contest a Ridgeline data center powered by methane gas. The coalition combined traditional advocacy tactics — town halls, FOIA requests — with technical measures such as independent air quality monitoring. Although the project has not been formally halted, civic action slowed its momentum significantly.

Key Highlights:

- Formation of *Tucker United* coalition
- FOIA requests and independent monitoring
- Organized town halls and community education
- Slowed project momentum despite lacking veto authority

Context: Grassroots coalition mobilized against gas-powered data center development.

Outcome: Raised awareness, generated scrutiny, and slowed project momentum.

Impact: Showed how civic pressure can disrupt or delay projects even without formal veto power.

Memphis, TN – xAI Turbine Controversy: AP News — NAACP, environmental group notify xAI of intent to sue over pollution *See also:* Commercial Appeal — xAI turbine fight In South Memphis, a predominantly Black community already facing high environmental risk, residents and EJ advocates opposed two methane turbines proposed to power Elon Musk's xAI data center. Local organizers combined grassroots mobilization with scientific studies showing elevated health risks, including asthma and cancer. Their advocacy delayed air permit approvals and drew national attention to the environmental justice dimensions of the project.

Key Highlights:

- Two methane turbines proposed for xAI facility
- Community concerns: asthma, cancer, and air quality
- Mobilization by NAACP and environmental justice groups
- Air permits delayed due to community and scientific pushback

Context: Proposed turbines in an environmentally overburdened Black community.

Outcome: Public backlash, supported by health data, forced the state to delay air permits.

Impact: Highlighted the power of frontline communities to assert environmental justice and health equity in siting decisions.

PLANET: Environmental and Ecological Safeguards

Environmental performance is no longer a secondary concern; it is an operational necessity. Data centers and digital infrastructure that **reuse heat**, **minimize water draw**, or **integrate into district energy loops** are proving more scalable and less volatile. Ecological foresight strengthens both system resilience and public alignment. Projects that pair heat reuse with municipal coordination — such as in Stockholm and Mäntsälä — demonstrate that environmental alignment can also reduce grid volatility.

Water Usage

Water is an increasingly contested resource for communities near large data centers. Monitoring and transparency on **Water Usage Effectiveness (WUE)** remain limited across U.S. facilities, highlighting the need for lifecycle water audits. These examples show how water demand from data centers can place stress on local resources and ecosystems, making transparent reporting essential.

Amazon – Hermiston, OR: Oregon Live — Amazon data center water use in Hermiston *See also:* Columbia Insight — Amazon's Hermiston water use scrutiny Amazon's Hermiston facility reported using **66.8 million gallons of water in 2023**. This scale of consumption raised concerns over long-term local water availability and the absence of transparent lifecycle accounting.

Key Highlights:

- **Usage**: 66.8 million gallons in 2023
- **Concern**: High draw on local supply without full transparency
- **Risk**: Potential strain on municipal and agricultural resources

Context: Amazon's case underscores how data center water withdrawals can directly affect regional water security in smaller communities with limited reserves.

Outcome: Sparked public debate and highlighted the need for mandatory disclosure of lifecycle water use.

Impact: Pressured operators to provide greater transparency and plan for long-term water resilience.

Loudoun County, VA: Loudoun Times-Mirror — Data centers used 1.85 billion gallons of water in 2023 *See also:* Data Center Frontier — Loudoun's data center water usage Loudoun County, the largest concentration of data centers in the U.S., consumed **over 1.85 billion gallons of water in 2023**. The concentration of withdrawals creates compounding pressure on regional water infrastructure.

Key Highlights:

- **Usage**: Over 1.85 billion gallons in 2023
- **Concern**: Large-scale, concentrated withdrawals intensify resource stress
- **Risk**: Regional ecosystem and community water needs placed in competition with data center operations

Context: Loudoun's water use illustrates how cumulative withdrawals across clustered facilities can amplify ecological and civic impacts at a metropolitan scale.

Outcome: Triggered state-level scrutiny and calls for lifecycle water audits.

Impact: Reinforced water as a critical constraint on data center expansion in high-density hubs.

WUE Benchmarks: AKCP — WUE Guide *See also:* Nature — Masanet et al. (2021) on data center sustainability Industry benchmarks such as Water Usage Effectiveness (WUE) provide a comparative metric for measuring efficiency across data centers. By offering standardized ratios, they highlight leaders, laggards, and industry averages.

Key Highlights:

- **Best-in-class**: 0.2 L/kWh
- **Industry average**: 1.8 L/kWh

Context: Current water usage far exceeds best-practice benchmarks, underscoring the importance of transparent reporting and lifecycle audits.

Outcome: Elevated the role of WUE as a key sustainability metric.

Impact: Provided measurable targets for both regulators and operators.

Heat Reuse Projects

Heat reuse is emerging as a strategy to reduce waste, improve efficiency, and provide co-benefits to communities. Instead of discarding heat, infrastructure partnerships can transform it into a resource for district heating and energy transition. The following cases highlight municipal and corporate partnerships that repurpose digital waste heat into public benefit.

Stockholm Data Parks (Sweden): Stockholm Data Parks — Turning data center heat into city heating *See also:* Energy Digital — Stockholm heat reuse impact Stockholm Exergi's district heating system integrates colocated data centers to capture and redistribute waste heat. By linking IT facilities to an extensive 2,800 km heating network, Stockholm turns what would be waste into a source of clean urban energy.

Key Highlights:

- Integration: 2,800 km heating network
- Impact: ~100 GWh/year of heat reused, warming ~30,000 homes

Context: Demonstrates how district heating infrastructure can transform digital waste into a citywide resource.

Outcome: Institutionalized partnerships between utilities and data centers for co-benefit design.

Impact: Provided a replicable model of circular infrastructure in major metropolitan areas.

Mäntsälä, Finland (Nebius): World Economic Forum — Mäntsälä waste heat recovery *See also:* Sitra — District heating from data center waste heat Nebius's data center converts its waste heat into municipal district heating, directly reducing reliance on fossil fuels. In a small Finnish town, this collaboration provides a meaningful contribution to municipal energy needs while reducing emissions.

Key Highlights:

- Function: Converts waste heat into municipal energy
- Impact: ~20,000 MWh/year of heat recovered

Context: Highlights how smaller municipalities can partner with digital infrastructure to achieve energy resilience.

Outcome: Strengthened municipal energy independence and reduced carbon reliance.

Impact: Demonstrated adaptability of heat reuse even in smaller urban centers.

Odense, Denmark (Meta): Meta — Odense Data Center and district heating *See also:* Wired — Meta's Odense heat recovery Meta's hyperscale facility connects to Odense's district heating system, using high-efficiency heat pumps to displace fossil fuel heating. As one of the first corporate-backed projects of its scale, it demonstrates the feasibility of coupling hyperscale infrastructure to municipal sustainability goals.

Key Highlights:

- Facility: Linked to district heating grid
- Method: High-efficiency heat pumps

Context: Shows how corporate investment in energy-efficient systems can align hyperscale data centers with community energy goals.

Outcome: Delivered carbon reduction by displacing fossil fuels.

Impact: Established a precedent for corporate–municipal partnerships in sustainable energy systems.

Policy and Regulatory Mandates

Policy frameworks are shifting heat reuse from voluntary best practice to binding requirement. Regulations ensure that sustainability goals are not optional, but structural obligations for infrastructure operators. This case demonstrates how forward-looking policy can establish enforceable sustainability standards.

EU Energy Efficiency Directive – Heat Reuse Mandate: European Commission — Energy Efficiency Directive *See also:* Covington — EU Energy Efficiency Directive overview The EU is implementing new heat reuse requirements to embed sustainability in digital infrastructure. By mandating minimum levels of waste heat recovery, the directive reframes heat as a resource with economic and ecological value.

Key Highlights:

- Requirement: New data centers >500 kW must reuse at least 10% of waste heat by July 2026
- Expansion: Requirement increases to 20% by 2030
- Significance: Treats waste heat as a co-product to be managed and monetized

Context: Regulatory foresight reduces compliance costs and accelerates sustainable design integration.

Outcome: Provided a clear framework for aligning infrastructure with EU decarbonization goals.

Impact: Established a policy model that could be replicated globally.

Emerging Sustainable Facilities

Emerging facilities showcase innovative claims about sustainability, but credibility depends on transparency and verifiable results. Projects often highlight renewable sourcing and efficiency gains but may lack lifecycle reporting to substantiate their claims. This case highlights how credibility and verification remain central to public trust.

SATO Qritical.AI – Joliette, Québec: Newsfile — SATO Qritical.AI announcement *See also:* GuruFocus — SATO Qritical.AI announcement coverage SATO promotes its AI facility as powered by renewable energy and cooled with low-emission systems leveraging Québec's hydro grid. This project positions itself as a model for "next-generation" green infrastructure, but critics highlight the absence of robust third-party verification.

Key Highlights:

- Claim: Renewable energy sourcing + low-emission cooling
- Gap: Insufficient transparency on lifecycle impacts

Context: Highlights the need for independent verification of sustainability claims to maintain public trust.

Outcome: Drew investor and regulatory attention to gaps in reporting.

Impact: Raised standards for disclosure in self-claimed "green" data projects.

Industry Heat Reuse Initiatives & Tools

Industry-wide initiatives are developing frameworks to measure and scale heat reuse practices across infrastructure types. These programs are designed to build transparency, consistency, and comparability across projects worldwide. This case shows how collaborative benchmarking can accelerate industry-wide change.

Uptime Institute & Net Zero Innovation Hub *Links:* Uptime Institute — Heat Reuse Primer • Energy Digital — Heat reuse and Stockholm Exergi *See also:* Uptime Institute — Sustainability reports Uptime Institute and the Net Zero Innovation Hub are collaborating to create simulation and benchmarking tools that allow regulators and operators to measure and compare heat reuse across facilities. Their work aims to close the gap between aspirational sustainability commitments and measurable outcomes.

Key Highlights:

- Function: Build simulation and benchmarking tools for heat reuse
- Applications: Inform permitting, carbon offset frameworks, and infrastructure design

Context: Industry-wide tools can help standardize reporting and accelerate adoption of heat reuse practices at scale.

Outcome: Created reference benchmarks for regulators and operators.

Impact: Advanced global readiness for scaling sustainable digital infrastructure.

PROFIT: Resilience, Lifecycle Economics, and Equitable Investment

Sustainability is now a financial strategy. Projects aligned with **lifecycle economics** — where long-term costs are modeled, internalized, and made transparent — demonstrate more consistent ROI and fewer regulatory shocks. Whether through **grid-aware design** or **ESG-led investment models**, these cases show that ecological and civic alignment increasingly protects the bottom line. Capital markets are rewarding sustainability-forward AI infrastructure: Equinix and STACK Infrastructure have issued green bonds and secured sustainable financing, while Moody's reports ESG-aligned projects often receive **15–25 basis point interest reductions**.

Lifecycle Economics and Internalized Cost Models

Financial foresight ensures data center growth is not driven by short-term gains alone but by anticipating future energy demand and cost structures. By integrating long-term forecasts into planning, utilities and developers can avoid volatility and improve resilience. This example demonstrates how proactive utility planning can stabilize infrastructure investment and reduce risks.

Hydro-Québec: Canada Energy Regulator – Market Snapshot *See also:* Utility Dive — Hydro-Québec forecasts digital demand Hydro-Québec forecasts significant digital infrastructure demand growth and has integrated this into its long-term transmission planning. This forward-looking approach demonstrates how utilities can build resilience into infrastructure planning.

Key Highlights:

- Forecast: Additional 4.1 TWh of demand by 2032
- Integration: Incorporated into transmission planning
- Impact: Supports cost predictability and reduces exposure to volatility

Context: Planning for long-term grid demand minimizes risk and stabilizes financial returns for both utilities and developers.

Outcome: Enabled proactive transmission upgrades to accommodate projected demand.

Impact: Reduced likelihood of future cost shocks or supply shortfalls.

Regulatory Foresight and Stability

Regulations set the rules of the game for infrastructure expansion, and early alignment with these requirements can prevent costly delays. Strong, clear mandates not only protect the environment but also provide investors and operators with confidence. This example illustrates how binding regulatory foresight can reduce financial and operational risks.

EU Energy Efficiency Directive: European Commission — Energy Efficiency Directive *See also:* Covington — EU Directive impact on data centers The EU has enacted binding requirements for waste heat reuse in new data centers, embedding sustainability into the regulatory fabric. This binding approach reframes sustainability from a voluntary goal to a legal obligation for operators.

Key Highlights:

- Requirement: New facilities >500 kW must reuse at least 10% of waste heat by 2026
- Expansion: Requirement increases to 20% by 2030
- Impact: Early adoption reduces compliance costs and accelerates permitting

Context: Binding EU mandates demonstrate how policy foresight stabilizes investment and operational planning.

Outcome: Provided developers with certainty in design requirements and reduced regulatory risk.

Impact: Established global precedent for enforceable sustainability standards in digital infrastructure.

Grid-Aware and Utility-Aligned Design

The ability to integrate data center growth with energy system readiness is a critical determinant of long-term stability. By forecasting energy demand with advanced tools, utilities can align new infrastructure with existing grid capacity, avoiding sudden price swings and reliability crises.

This example shows how predictive analytics can de-risk large-scale infrastructure expansion.

Hydro-Québec: Hydro-Québec Strategic Plan 2022–2026 *See also:* Montreal Gazette — Hydro-Québec AI forecasting tools Hydro-Québec deploys advanced AI forecasting tools to align energy demand with grid capacity. By integrating forecasting models like LSTM and CNN neural networks, it demonstrates how predictive analytics can de-risk infrastructure expansion.

Key Highlights:

- Tools: AI-based forecasting using LSTM and CNN neural networks
- Function: Matches data center development to grid readiness
- Benefit: Avoids congestion charges and energy pricing volatility

Context: Grid-aware design reduces financial volatility while ensuring infrastructure resilience.

Outcome: Enabled more predictable integration of large-scale digital infrastructure into provincial energy systems.

Impact: Prevented cost overruns and strengthened grid reliability.

ESG-Led Investment and Capital Structures

Financial markets are not only observing but actively shaping infrastructure sustainability. Green bonds, sustainability-linked loans, and ESG ratings have become important drivers of capital allocation, directly rewarding companies that embed sustainability into their operations. These examples show how ESG finance mechanisms are being applied across different regions and operators.

Equinix: ESG Today – Equinix Green Bond *See also:* Equinix Investor Relations — Green Bond Report Equinix issued **€1.15 billion in green bonds** to finance low-carbon data center retrofits.

Key Highlights:

- €1.15B bond issuance
- Purpose: finance retrofits for low-carbon operations
- Investors rewarded sustainability-linked capital structures

Context: Demonstrates how major data center operators can leverage green bond markets to fund decarbonization.

Outcome: Successfully raised large-scale financing for infrastructure retrofits.

Impact: Reinforced the role of bond markets in accelerating low-carbon transitions.

STACK Infrastructure: Data Center Frontier – STACK Infrastructure Green Investment *See also:* Bloomberg — STACK Infrastructure financing STACK secured **$6 billion in green investment**, including $1.4 billion in sustainability-linked debt.

Key Highlights:

- $6B in financing
- $1.4B specifically tied to sustainability-linked debt
- Major scale of ESG-driven financing in data infrastructure

Context: Illustrates how private equity-backed operators can tap large-scale ESG capital structures.

Outcome: Expanded STACK's investment capacity with sustainability obligations.

Impact: Positioned ESG financing as a mainstream model for hyperscale infrastructure.

SingTel: Reuters – SingTel Green Loan *See also:* The Straits Times — SingTel green financing SingTel obtained a **S$643 million green loan** to build a high-efficiency data center in Singapore.

Key Highlights:

- Loan amount: S$643M

- Purpose: construct energy-efficient data center
- Demonstrates expansion of green financing into Asia-Pacific

Context: Shows how telecom operators are adopting ESG finance for digital infrastructure.

Outcome: Secured cost-effective financing for high-efficiency facility construction.

Impact: Extended ESG-driven investment models into Asia-Pacific digital markets.

Moody's: Moody's – ESG Ratings and Financing Costs *See also:* Moody's -- Sustainable Finance and credit Moody's reported that **ESG-aligned projects receive lower financing costs**, strengthening the investment case for sustainability.

Key Highlights:

- ESG-linked projects yield 15–25 basis point financing reductions
- Broadens access to capital for sustainable operators
- Reinforces financial incentives for sustainability alignment

Context: Validates financial advantages of sustainability integration across capital markets.

Outcome: Enhanced investor preference for ESG-rated infrastructure.

Impact: Strengthened the financial case for embedding sustainability into infrastructure strategy.

Civic Risk and Trust as Financial Factor

Public opposition is not just a political issue — it has direct financial consequences. Companies that ignore or bypass civic engagement risk costly delays, reputational damage, and increased regulatory scrutiny. This example highlights how civic pressure can directly influence financial viability and project timelines.

Becker, MN – Amazon Data Center Generators: Business Insider – Amazon Generators *See also:* Star Tribune — Minnesota PUC rejects Amazon generator exemption Amazon attempted to bypass emissions permitting for 250 diesel generators, sparking opposition. This case underscores the material impact civic and regulatory engagement can have on high-value digital infrastructure projects.

Key Highlights:

- Request: Sought exemption from permitting process
- Opposition: Faced resistance from community groups and Minnesota Attorney General's office
- Result: Denial by the Minnesota Public Utilities Commission

Context: Civic resistance introduces material financial risks that can rival or exceed technical barriers.

Outcome: Project was delayed and subjected to a full emissions review.

Impact: Demonstrated the power of civic engagement in shaping financial and operational outcomes for developers.

Missed Opportunities and Volatility Events

Data center growth without lifecycle planning risks creating stranded assets, overloaded grids, and sudden financial volatility. The accelerating pace of digital demand in the U.S. highlights the cost of failing to integrate energy planning with infrastructure development. This example shows how neglecting foresight can escalate risks and constrain growth.

U.S. Data Center Demand: Lawrence Berkeley National Laboratory – Data Center Energy Forecast *See also:* Business Insider — Data center energy surge projections Electricity demand for U.S. data centers is projected to more than double between 2023 and 2028. Without proactive planning, this surge could overwhelm regional grids and drive regulatory or civic pushback.

Key Highlights:

- Forecast: 176 TWh in 2023 → 325–580 TWh projected by 2028
- Risk: Without grid planning, growth may be constrained by legal action, community resistance, or infrastructure bottlenecks

Context: Missed planning opportunities elevate financial risks, constraining growth and investor confidence.

Outcome: Highlighted the urgent need for integrated grid planning and lifecycle investment strategies.

Impact: Raised the likelihood of constrained capacity, stranded assets, or abrupt policy interventions.

Conclusion

Imagine an AI infrastructure project that begins not with a permit filing, but with a public water audit, a grid impact assessment, and a binding community benefits agreement. A system where every megawatt of projected use is tied to resilience metrics, and public trust is treated as a core design constraint. This is not naive or utopian. These practices already exist in other domains: climate finance, public health, & social impact infrastructure. What's missing here is the will to make designing for sustainability the default.

Even from a purely profit-driven perspective, sustainability is the only path forward for AI infrastructure. For all major stakeholders, the benefits are clear:

- For developers, sustainability ensures smoother permitting, reduces construction risk, and lowers long-term project volatility.
- For operators and cloud providers, sustainability delivers operational stability, ESG legitimacy, and reduced regulatory friction.
- For investors, sustainability strengthens due diligence, reduces asset exposure, and improves long-term return.
- For policymakers, sustainability transforms reactive moratoriums into proactive strategy, aligning infrastructure with long-term public goals.
- For communities, sustainability reduces health and environmental burdens, secures local benefits, and builds trust in infrastructure decisions.

The risks in continuing to ignore sustainable design are not hypothetical: grid strain is measurable, water depletion is already here, and community resistance is growing. Infrastructure built to bypass scrutiny cannot be retrofitted into legitimacy, but infrastructure designed for resilience, equity, and transparency can not only survive—it can lead. Resilience isn't charity. It's strategic infrastructure planning. It's the highest-yield investment we can make. However, the window of opportunity is closing. With every siting decision, procurement contract, or regulatory update, we choose between embedded resilience or deepening risk. The case studies show responsible, sustainable infrastructure is achievable at scale, but it will become unattainable if we continue to externalize costs and delay reform. The shift toward sustainable infrastructure is already happening in policy mandates, civic-led permitting reforms, district energy networks, and low-carbon site planning. These efforts demonstrate that aligning for People, Planet, and Profit is not a burden on innovation; it is how innovation endures.

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John Barton, Founder & Executive Director of the Spectrum Gaming Project, is an AI strategist and

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For more information about the Coalition for Innovation,
including how you can get involved, please visit coalitionforinnovation.com.

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