

# AI-Powered ESG Intelligence in the ICT Sector

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*Data Centers at the Nexus of AI Growth and Decarbonization | A Framework for  
Dynamic Sustainability Performance Management*

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Section 01

# Executive Summary

The AI-ESG imperative for data center operators

The information and communications technology (ICT) sector, and particularly its data center infrastructure, stands at the epicenter of a historic tension. Global electricity demand is forecast to rise by 3.3% in 2025 and 3.7% in 2026, more than twice as fast as total energy demand growth driven overwhelmingly by the rapid expansion of AI-powered data centers. By 2030, worldwide data center electricity consumption is projected to nearly double from 448 TWh to 980 TWh, placing unprecedented pressure on global power systems and corporate sustainability commitments.

Simultaneously, a cascade of mandatory regulations has transformed sustainability from an aspirational ambition into a binding compliance obligation with financial penalties and reputational consequences. The EU Energy Efficiency Directive requires annual disclosure of energy consumption, PUE, waste heat reuse, and renewable energy use. The CSRD demands audited ESG disclosures. The EU AI Act imposes requirements for risk assessments and disclosures related to AI workloads and their hosting infrastructure.

This paper argues that AI-powered ESG intelligence offers the data center sector a transformative pathway out of this compliance trap. By leveraging the very technology driving demand to optimize its own environmental footprint, operators can shift from static, reactive compliance to dynamic, value-creating performance management.

<p><b>980 TWh</b></p> <p>Projected global data center electricity consumption by 2030- up from 448 TWh in 2025</p>	<p><b>40%</b></p> <p>Cooling energy reduction achievable with AI-driven optimization (Airedale Cooling AI)</p>	<p><b>45%</b></p> <p>Emissions reduction documented through carbon-aware workload scheduling (2025 study)</p>
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## The Three-Pillar Framework

- ▶ **Detect gaps before they become liabilities:** AI-driven predictive analytics, real-time sensor networks, and digital twins enable proactive identification of cooling inefficiencies, grid carbon intensity mismatches, and regulatory reporting deficiencies before they escalate into compliance failures or financial penalties.

- ▶ **Turn ESG data into P&L impact:** Reinforcement learning for cooling optimization reduces energy consumption by up to 40%; carbon-aware workload scheduling cuts emissions by 45% while extending server life; and 24/7 carbon-free energy matching drives renewable procurement strategies that lower electricity costs and enhance investor confidence.
- ▶ **Provide real-time proof, not retrospective promises:** Integrated AI platforms combining IoT sensors, digital twins, and automated carbon accounting APIs enable continuous, auditable sustainability performance data across Scope 1, 2, and 3 emissions transforming ESG from a compliance burden into a competitive differentiator.

<h1>1.09</h1> <p>Google's trailing-twelve-month PUE- best-in-class at hyperscale (Q1 2025)</p>	<h1>300x</h1> <p>Water efficiency improvement delivered by NVIDIA Blackwell liquid cooling systems</p>	<h1>1,920 MW</h1> <p>Amazon AWS nuclear PPA with Talen Energy the new frontier of clean energy procurement</p>
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Section 02

# Introduction

The data center sector's ESG inflection point

## A Cascade of Binding Mandates

The regulatory landscape for data centers has transformed fundamentally over the past 24 months. Unlike many sectors where mandates are phased in over years, data center operators face a simultaneous wave of binding requirements across multiple jurisdictions.

Regulatory Framework	Scope	Key Requirement
<b>EU Energy Efficiency Directive (EED)</b>	Data centers ≥500 kW rated power	Annual reporting: energy consumption, PUE, waste heat utilization, renewable energy use. First submissions covering 2024 reporting period; waste heat obligations in force from January 2025
<b>Corporate Sustainability Reporting Directive (CSRD)</b>	Large companies operating significant data center footprints	Standardized, audited ESG disclosures; data centers explicitly identified as a priority sector for detailed environmental disclosures
<b>EU AI Act</b>	AI workloads and hosting infrastructure	Risk assessments, reporting, and disclosures related to AI workloads. Cloud and AI Development Act (2026) expected to reward ESG leaders with faster approvals
<b>China PUE Mandate</b>	All new or retrofitted large/mega data centers	PUE below 1.25 by end of 2025—a stringent national standard affecting a major global data center market
<b>Australia (proposed)</b>	Data centre and AI infrastructure developers	Underwrite new renewable power supply, pay full grid connectivity costs, support demand flexibility mechanisms

## The Scale and Urgency of the Energy Challenge

Data centers consume approximately 1% of global electricity but that share is growing rapidly. The IEA's Electricity Mid-Year Update 2025 identifies data centres and AI workloads as primary demand drivers alongside air conditioning and electric vehicles. Gartner estimates that AI-optimized servers alone will account for 432 TWh of electricity demand in 2030, up from just 93 TWh in 2025 a nearly fivefold increase in five years. In the United States alone, data center energy capacity is projected to increase from 25 GW to 120 GW by 2030.

Metric	2025	2030	Change
Global data center electricity (TWh)	448	980	+119%
AI server electricity demand (TWh)	93	432	+364%
US data center capacity (GW)	25	120	+380%
Global electricity demand growth (% YoY)	3.3%	~3.7%	Sustained acceleration

## The Persistent Efficiency Plateau

Despite years of industry focus on energy efficiency, progress on PUE, the ratio of total facility energy to IT equipment energy has stalled. The 2025 industry survey revealed that average PUE levels show little change for the sixth consecutive year, even as average server rack power densities continue to rise, with greater adoption of racks in the 10–30 kW range. Many data centres still operate above the widely accepted PUE benchmark of 1.3–1.4.

The cooling system alone constitutes approximately 50% of total energy consumption, the single largest opportunity for AI-driven optimization. Meanwhile, water usage is emerging as a critical ESG concern, particularly as liquid cooling solutions for high-density AI workloads present both water efficiency opportunities and new challenges.

### The AI Paradox and Imperative

The data center sector faces a profound paradox: the AI workloads driving unprecedented energy demand are also the most powerful tools available to optimize and decarbonize data center operations. Machine learning models that predict cooling demand, reinforcement learning agents that optimize HVAC systems in real time, and carbon-aware workload schedulers that shift computing tasks to times and places where renewable energy is abundant represent a virtuous cycle in which the same technology that exacerbates the problem becomes central to its solution.

Section 03

# Pillar One

Detecting gaps before they become liabilities

## AI-Driven Predictive Cooling Optimization

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Traditional data center cooling operates on static setpoints or rule-based control systems that cannot respond to the dynamic interplay of IT load, ambient temperature, humidity, and server density. AI transforms this landscape through reinforcement learning agents augmented with time-series forecasting systems that continuously learn optimal cooling strategies, reducing energy consumption while maintaining thermal stability.

Airedale by Modine has launched Cooling AI, an AI-enhanced control system achieving up to 40% reduction in cooling energy consumption by synchronising chiller and fan performance within an AI-driven control architecture. For modular data centers, machine learning approaches using real-time thermal imaging can forecast temperatures and reduce active cooling duration, lowering PUE while optimizing energy usage for operational functionality.

## Digital Twins for Real-Time Performance Monitoring

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Digital twins- virtual replicas of physical assets updated in real time enable continuous monitoring and optimization of data center performance. An intelligent thermal management strategy based on digital twin technology has been demonstrated for a data center prototype, with the digital twin capable of real-time monitoring and optimization across cooling, power distribution, and IT load.

Dell's Concept Astro harnesses AI, automation, and digital twins to optimize workloads based on energy availability and reduce the cost of operations. The DECICE project's AI Scheduler incorporates predictive patterns for workload allocation, analyzing historical trends alongside real-time system data to optimize workload placement for both performance and environmental impact. The Open Compute Project has initiated a community-driven digital twin ecosystem aiming to make data centres more efficient, flexible, and scalable.

## NLP and Generative AI for Regulatory Gap Analysis

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The complexity of overlapping EED, CSRD, EU AI Act, national building codes, and voluntary frameworks including the Climate Neutral Data Centre Pact and The Green Grid metrics makes manual gap analysis impractical. Generative AI tools can map existing sustainability data against disclosure requirements, identify missing data points, and flag policy gaps reducing analysis timelines from months to weeks.

The Green Grid has launched a new Data Center Resource Effectiveness (DCRE) metric that expands upon PUE, WUE, and CUE, taking a holistic approach to a data centre's energy management and providing a framework for AI-enabled compliance tracking. For operators facing simultaneous reporting obligations across EED (waste heat data since January 2025), CSRD, and national mandates, this integrated approach to gap detection is becoming a competitive necessity.

## Real-Time Emissions Intelligence

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Emerging platforms are bringing real-time carbon accounting to data center operations at unprecedented scale. ClimaTiq's API automates carbon footprint calculations by drawing on over 330,000 global emission factors, using AI to process complex data inputs and helping operators meet rising sustainability and regulatory expectations at scale. Greenly's AI-powered carbon accounting platform automates collecting, structuring, and processing carbon data allowing users to automatically import physical inventory, accounting, and logistics data and rapidly structure the information using proprietary algorithms.

The NADIKI research initiative aims to make AI's environmental impact measurable in real time at the infrastructure and IT level. For hydrogen-powered data center initiatives, blockchain-secured emissions intelligence platforms now provide real-time tracking of carbon, water, and energy inputs and outputs, with Scope 1, 2, and 3 emissions reporting aligned with global standards.

*Our clients will have access to accurate, real-time data delivered directly from the data centre. — NADIKI Project Lead*

Section 04

# Pillar Two

Turning ESG data into P&amp;L impact

## AI-Optimized Cooling and Energy Efficiency

The financial case for AI-driven cooling optimization is compelling and increasingly well-documented. Airedale's Cooling AI delivers up to 40% reduction in cooling energy consumption, translating directly to lower electricity bills and improved PUE. NTT DATA's net-zero target for 2030 explicitly identifies energy efficiency through AI-driven cooling optimization as a core strategic lever.

Google's 2025 Environmental Report highlights a 12% reduction in data centre energy emissions in 2024, achieved despite increased demand from AI workloads. This progress is attributed to investments in efficient infrastructure, including the Ironwood TPU nearly 30 times more power efficient than Google's first Cloud TPU from 2018. Fleet-wide data center PUE dropped below 1.10 for the first time in six years, demonstrating that best-in-class efficiency is achievable at hyperscale even as AI drives density.

## Carbon-Aware Workload Scheduling

Perhaps the most innovative AI application in data center sustainability is carbon-aware computing—moving workloads to times and places where renewable energy is more abundant. This marks a fundamental mindset shift from efficiency-focused to emissions-focused optimization.

Researchers have developed hierarchical optimization frameworks for geo-distributed data centers that account for the dynamic interplay of time-varying grid carbon intensity, electricity prices, and data center cooling efficiency. Margot Génereux at Google developed an optimization model that reassigns AI workloads across Google's global data centers to minimize carbon emissions while respecting capacity limits.

*By integrating real-time hardware health with carbon-intensity data, our framework learns how to route AI workloads in a way that cuts emissions while protecting the long-term reliability of the machines themselves. — Lead*

researcher, 2025 Workload Routing Study

A groundbreaking 2025 study demonstrated that integrating real-time hardware health data with carbon-intensity data enables workload routing that cuts emissions by 45% while extending server lifespan by approximately 1.6 years. The dual benefit emissions reduction and asset life extension significantly strengthens the financial case for carbon-aware scheduling.

## 24/7 Carbon-Free Energy Matching and Nuclear PPAs

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Beyond annual renewable energy matching, leading operators are moving toward 24/7 carbon-free energy ensuring that every hour of data center operation is matched by carbon-free electricity generation. Google reported a 66% hourly carbon-free energy match across its global operations in 2025, demonstrating that concentrated effort can deliver round-the-clock clean energy at hyperscale.

nLighten has introduced the ICFEn score, capturing hourly carbon-free energy matching and heat recovery while factoring in contributions to grid stability. From April to June 2025, the company's UK data centres achieved an ICFEn score of 94.61% a standard that moves the industry well beyond simple annual renewable matching.

The economics of decarbonisation have driven operators beyond renewables into next-generation clean energy procurement. Amazon's 1,920 MW nuclear PPA with Talen Energy supporting AWS data centres through 2042 represents a landmark shift toward 24/7 carbon-free electricity as a competitive necessity. The agreement includes provisions for exploring Small Modular Reactor (SMR) technology, positioning Amazon at the frontier of clean energy procurement for data center infrastructure.

## Hardware Efficiency: The Foundation Layer

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Operational AI optimisation cannot compensate for inefficient hardware. NVIDIA's Blackwell systems increase water efficiency by over 300x, as liquid cooling for AI infrastructure enables data centre and AI factory efficiency previously unattainable with air cooling. The GB300 NVL72 platform cuts energy spikes in AI training, easing pressure on grids and reducing over-provisioning. NVIDIA's 800 VDC Architecture addresses the exponential growth of AI workloads pushing power usage higher, offering a path to higher efficiency at rack scale.

Trane Technologies unveiled the industry's first comprehensive thermal management system reference design for gigawatt-scale NVIDIA AI factories, building on NVIDIA Omniverse Blueprint for real-time digital twins. Salesforce deploys autonomous AI agents, binding supplier agreements, and intelligent cloud distribution to drive real-world decarbonisation across the data centre ecosystem.

Section 05

# Pillar Three

Providing real-time proof, not retrospective promises

## Integrated ESG Data Platforms

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Real-time, auditable sustainability data is becoming the new industry standard. NTT DATA's first Global Data Centers Sustainability Report established a transparent, auditable baseline for ESG disclosure documenting Scope 2 emissions from purchased energy and operational energy use, with goals to procure renewable energy for non-IT power, invest in PPAs, generate renewable energy onsite where feasible, and improve PUE through AI-driven cooling optimisation.

Salesforce's Net Zero Cloud expanded in 2025 with Agentforce AI-powered digital assistants that automate emissions measurement, reporting, and management across the data centre ecosystem. Microsoft's 2025 Environmental Sustainability Report provides a comprehensive framework for transparent, AI-enabled ESG disclosure, tracking progress toward the company's 2030 goals: carbon negative, water positive, and zero waste, while protecting ecosystems.

## Digital Twins for Continuous Assurance

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Digital twins are proving crucial for advancing sustainable data centers, enabling the integration of advanced monitoring and energy optimisation with renewable energy sources. They simulate operations and provide auditable data trails for regulatory compliance. The Open Compute Project's digital twin initiative aims for an open, interoperable, and community-driven ecosystem that makes data centres more efficient, flexible, and scalable creating a shared infrastructure for continuous ESG assurance.

## Real-Time Carbon Accounting APIs

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The ClimaTiq API enables real-time, product-level carbon footprinting by drawing on over 330,000 global emission factors. This API streamlines carbon reporting and helps operators meet rising sustainability and regulatory expectations at scale. For hydrogen-powered data center initiatives, blockchain-secured emissions intelligence platforms provide real-time tracking of carbon, water, and energy inputs and

outputs, with Scope 1, 2, and 3 emissions reporting aligned with global standards combining AI precision with blockchain's tamper-proof auditability.

## **AI's Own Environmental Footprint: The Accountability Imperative**

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Real-time proof requires operators to be transparent not just about their sustainability gains but about AI's own environmental footprint. Bain's climate-economic modelling finds that in a high-growth scenario, AI and data centers could emit 810 million metric tons of CO<sub>2</sub> annually by 2035- 2% of global emissions. Google's total greenhouse gas emissions in 2024 were 51% higher than in 2019, driven substantially by data center construction.

The NADIKI research initiative's goal of making AI's environmental impact measurable in real time at the infrastructure and IT level represents an important step toward accountable AI deployment. For operators committed to real-time proof, this means disclosing not only the sustainability benefits of AI applications but also the energy and water consumed by the AI systems themselves with equal rigour.

Section 06

# Global Best Practices

Data center leaders pioneering AI-ESG integration

Eight global leaders have demonstrated that AI-powered ESG management is not theoretical but operational delivering measurable results across energy efficiency, renewable procurement, water stewardship, and carbon emissions reduction. Their experiences provide a practical blueprint for the industry.

<p><b>Google</b></p> <p><b>1.09</b></p> <p>Trailing-12-month PUE (Q1 2025)</p> <p><b>66%</b></p> <p>Hourly carbon-free energy match</p>	<p><b>12% emissions reduction:</b> Data centre energy emissions fell in 2024 despite increased AI demand, driven by the Ironwood TPU nearly 30x more power efficient than Google's first Cloud TPU.</p> <p><b>60 clean energy agreements:</b> Signed in 2024, bringing 2.5 GW of new clean energy generation online. Procured over 8 GW of clean energy globally and replenished 4.5 billion gallons of water.</p> <p><b>Workload carbon optimization:</b> Researcher Margot Généreux developed a model that reassigns AI workloads across global data centers to minimize carbon emissions while respecting capacity limits.</p> <hr/> <p><b>Key Lesson:</b> <i>Hyperscale efficiency (PUE 1.09), renewable procurement (8 GW), and AI-driven workload optimization can be integrated into a unified decarbonization strategy at global scale.</i></p>
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<p><b>Microsoft</b></p> <p><b>125M L</b></p> <p>Water saved per facility annually</p> <p><b>85%</b></p> <p>Waste diversion—6 years ahead of target</p>	<p><b>Water-positive design:</b> New data centre projects eliminate municipal water for cooling, saving 125+ million litres annually per facility. Water-positive target met ahead of schedule.</p> <p><b>Zero-waste milestone:</b> Exceeded zero-waste demolition target six years ahead of schedule, achieving 85% diversion in FY24.</p> <p><b>Pragmatic optimism:</b> Despite a 23.4% increase in overall emissions driven by data centre construction, Microsoft maintains commitment to carbon negative by 2030 through CFE procurement and circular economy investments.</p> <hr/> <p><b>Key Lesson:</b> <i>Aggressive water positivity and zero-waste targets are achievable even as data centre construction scales, though Scope 3 emissions from construction remain the most challenging frontier.</i></p>
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<p><b>Amazon AWS</b></p> <p><b>1,920 MW</b></p> <p>Nuclear PPA with Talen Energy</p>	<p><b>Nuclear PPA milestone:</b> Signed agreement with Talen Energy for 1,920 MW of carbon-free electricity from the Susquehanna nuclear plant, supporting AWS data centres through 2042.</p>
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## 2042

Contract term for carbon-free electricity

**SMR exploration:** The deal includes provisions for exploring Small Modular Reactor technology within Talen's Pennsylvania operations—positioning Amazon at the frontier of next-generation clean energy procurement.

**RWE green energy partnership:** Strategic framework under which RWE supplies renewable energy from wind and solar farms, while Amazon provides cloud computing and AI services in return.

**Key Lesson:** *Data center decarbonization is driving innovation in clean energy procurement beyond traditional renewables, including nuclear PPAs and SMR development that other industries will follow.*

## NVIDIA

### 300x

Water efficiency improvement with Blackwell

### 800V

New VDC architecture for AI factory efficiency

**Liquid cooling revolution:** Blackwell systems increase water efficiency by over 300x versus air-cooled predecessors, enabling data centre and AI factory efficiency previously unattainable.

**Energy spike reduction:** GB300 NVL72 platform cuts energy spikes in AI training, easing pressure on grids and reducing over-provisioning. Hardware and software together improve grid stability during power-intensive operations.

**AI factory reference design:** NVIDIA introduced a comprehensive reference design and partner-driven strategy to transform global infrastructure into high-performance, high-efficiency AI factories.

**Key Lesson:** *Data center sustainability begins at the hardware level. AI-optimized chips, liquid cooling, and advanced voltage architecture deliver efficiency gains that no amount of operational optimization can match.*

## Equinix

### Net-Zero

Target by 2040 across value chain

### IDC #1

MarketScape Leader, Sustainability 2025-26

**IDC MarketScape leadership:** Named a Leader in the inaugural IDC MarketScape: Worldwide Datacenter Services Sustainability 2025–2026, recognised for water management innovation, AI sustainability, and customer decarbonization instruments.

**Customer decarbonization:** Provides instruments enabling customers to reduce their own Scope 3 emissions demonstrating how colocation providers extend ESG intelligence across the value chain.

**Edge AI and liquid cooling:** Equinix's edge AI infrastructure leverages renewable energy coverage; shifting toward liquid cooling for high-density AI workloads while maintaining sustainability performance.

**Key Lesson:** *Colocation providers have a dual responsibility: to decarbonize their own operations and to provide the tools enabling customer decarbonization extending ESG intelligence across the entire value chain.*

## Digital Realty

### 60%

Emissions reduction per sq ft target by 2030

### 300+

Data centres across global portfolio

**FRA20 Frankfurt:** 16 MW of AI-ready IT capacity running entirely on renewable energy, as part of a plan to develop 11 interconnected data centres in the region.

**AMS11 Amsterdam:** AI-optimized and sustainability-focused facility expanding capacity while strengthening regional connectivity demonstrating that AI-readiness and sustainability are complementary design principles.

**Lenovo Neptune integration:** Liquid cooling deployed across more than half of all data centers worldwide, enabling enterprises to deploy AI-ready infrastructure with sustainable and scalable qualities.

**Key Lesson:** *Sustainability and AI-readiness are not trade-offs but complementary design principles for next-generation data centre infrastructure.*

**NTT DATA**

**51%**

Renewable energy for non-IT load globally

**2030**

Net-zero target for data centers

**Net-zero roadmap:** Aims to achieve net-zero emissions across data centers by 2030, offices by 2035, and value chain by 2040, with AI-driven cooling identified as crucial to these goals.

**First sustainability report:** Published first comprehensive Global Data Centers Sustainability Report establishing transparent baselines for auditable ESG disclosure.

**AI-driven cooling:** Deployed AI cooling optimization across facilities as a core strategic lever for achieving net-zero targets while managing rising power densities from AI workloads.

**Key Lesson:** *Colocation providers can achieve meaningful renewable energy penetration (51%) while establishing transparent, auditable ESG baselines providing the foundation for continuous, verifiable improvement.*

**Salesforce**

**Agentforce**

AI agents for autonomous emissions management

**Net Zero**

Cloud platform at enterprise scale

**Agentforce deployment:** Net Zero Cloud expanded in 2025 with AI-powered digital assistants that help organizations measure, report, and manage greenhouse gas emissions at scale, automating tracking and reporting.

**Intelligent cloud distribution:** Uses AI to distribute cloud workloads across data centers based on carbon intensity, renewable energy availability, and grid conditions reducing emissions without compromising performance.

**Binding supplier agreements:** Implemented supplier agreements requiring data centre partners to meet specific sustainability performance standards, extending ESG intelligence across the value chain.

**Key Lesson:** *AI-powered carbon accounting and autonomous workload distribution can be delivered as a service, enabling enterprises to decarbonise their cloud footprint without building their own AI capabilities.*

Section 07

# Comparative Analysis

Key lessons from data center leaders

Company	Primary AI Focus	Key Outcome	Timeframe
<b>Google</b>	Workload optimization, PUE efficiency, hourly CFE	PUE 1.09; 12% emissions reduction; 66% hourly CFE	2024–2025
<b>Microsoft</b>	Water-positive design, CFE procurement, zero waste	125M litres saved per facility; 85% waste diversion	2024–2030
<b>Amazon AWS</b>	Nuclear PPAs, renewable procurement	1,920 MW nuclear PPA; SMR exploration through 2042	2025–2042
<b>NVIDIA</b>	Hardware efficiency, liquid cooling, energy spikes	300x water efficiency; 40% cooling energy reduction potential	2025
<b>Equinix</b>	Customer decarbonization, edge AI, net-zero 2040	IDC MarketScape Leader; renewable energy coverage for AI	2025–2040
<b>Digital Realty</b>	AI-ready sustainable facilities, liquid cooling	60% emissions reduction per sq ft by 2030 target	2025–2030
<b>NTT DATA</b>	AI-driven cooling, renewable PPAs, net-zero roadmap	51% renewable energy; net-zero data centres by 2030	2024–2030
<b>Salesforce</b>	Autonomous AI agents, intelligent cloud distribution	AI-powered Net Zero Cloud with Agentforce at enterprise scale	2025

## Emerging Patterns Across Leaders

- ▶ **Hardware efficiency is foundational:** NVIDIA's 300x water efficiency improvement and Google's 30x TPU efficiency gains demonstrate that AI-optimized hardware delivers emissions reductions that operational optimization alone cannot achieve. Procurement decisions must prioritize energy and water efficiency alongside performance.
- ▶ **24/7 carbon-free energy is the new frontier:** Annual renewable energy matching is no longer sufficient. Google's 66% hourly CFE and Amazon's nuclear PPAs signal a shift toward round-the-clock clean energy procurement as a competitive necessity rather than an environmental luxury.
- ▶ **Water stewardship is rising in strategic importance:** Microsoft's water-positive design and NVIDIA's liquid cooling advances reflect growing investor and regulatory focus on water usage in data centers- a metric that will attract increasing mandatory reporting attention.
- ▶ **AI optimizes both infrastructure and workloads:** The most sophisticated operators use AI not only to cool facilities but also to schedule workloads, with documented 45% emissions reduction
- ▶

potential from carbon-aware scheduling a capability that compounds infrastructure efficiency gains.

- ▶ **Colocation providers enable customer decarbonisation:** Equinix and NTT DATA demonstrate that colocation providers can extend ESG intelligence across the value chain, helping customers reduce Scope 3 emissions and creating durable competitive differentiation.

Section 08

# Action Plan

Transitioning from compliance to competitive advantage

For data center operators seeking to translate AI-powered ESG intelligence into operational and financial advantage, a phased approach across 36 months is recommended. Each phase builds the sensor infrastructure, data integration, AI capabilities, and governance frameworks required to achieve real-time, auditable ESG performance.

1

## Phase 1: Foundation | Months 0–6

**Objective:** Move from ad hoc ESG tracking to systematic gap detection across data center operations.

**Key Actions:**

- ▶ Deploy generative AI tools to map sustainability data against EED, CSRD, national PUE requirements, and voluntary frameworks; identify missing data points and reporting inconsistencies
- ▶ Install sensor networks for temperature, humidity, IT load, energy consumption, and water usage-cooling systems (50% of energy) are the priority domain
- ▶ Establish baseline PUE, WUE (Water Usage Effectiveness), and CUE (Carbon Usage Effectiveness) metrics using The Green Grid's standardized methodology
- ▶ Evaluate current renewable energy coverage (annual vs hourly matching); identify opportunities for PPAs, on-site generation, and emerging options including nuclear PPAs
- ▶ Select 1–2 high-ROI AI pilots: AI-driven cooling optimization (up to 40% energy reduction) and/or carbon-aware workload scheduling (45% emissions reduction documented)

**Success Metrics:** Regulatory gap analysis complete; baseline PUE/WUE/CUE established; IoT sensors deployed on pilot facilities; pilot use case defined and resourced

**Key Challenge:** Legacy facilities lacking IoT sensor infrastructure; fragmented data across colocation providers and owned facilities; limited internal AI expertise

2

## Phase 2: Integration | Months 6–12

**Objective:** Integrate ESG data streams with operational systems and deploy initial AI applications.

**Key Actions:**

- ▶ Implement a cloud-based platform integrating IoT sensor data, energy metering, water monitoring, and regulatory reporting NTT DATA's framework and Salesforce's Net Zero Cloud provide reference architectures
- ▶ Deploy reinforcement learning-based cooling control on pilot facilities; Airedale's Cooling AI and AI-driven predictive control frameworks provide proven benchmarks
- ▶ Launch carbon-aware workload scheduling: shift computing tasks to times and locations with lower grid carbon intensity using Google's optimisation model and DECICE AI Scheduler as references
- ▶ Deploy AI systems for early detection of cooling system degradation, power distribution anomalies, and IT equipment health targeting 30% reduction in unplanned downtime
- ▶ Execute power purchase agreements to achieve 50%+ renewable energy coverage for non-IT load, following NTT DATA's 51% achievement model

**Success Metrics:** Unified ESG data platform operational; AI cooling deployed on pilot facilities; carbon-aware scheduling operational; 50%+ renewable energy coverage achieved

**Key Challenge:** Integration costs for legacy building management systems; grid carbon intensity data availability; customer acceptance of workload scheduling changes

### Phase 3: Optimisation | Months 12–24

**Objective:** Scale successful pilots across the data center portfolio and link ESG performance directly to financial outcomes.

**Key Actions:**

- Expand AI cooling optimisation to all data centers; target PUE below 1.20 (air-cooled) or below 1.10 (liquid-cooled hyperscale); Google's 1.09 PUE provides the hyperscale benchmark
- Deploy systems for hourly carbon-free energy tracking and procurement; target 65%+ hourly CFE matching following Google's 66% achievement
- Implement digital twin technology for real-time simulation and performance optimisation—Dell's Concept Astro provides a reference architecture for AI-automation-digital twin integration
- Provide colocation customers with real-time, auditable emissions data enabling Scope 3 reporting; Equinix's customer decarbonization instruments provide the model
- Track and report energy cost savings, reduced carbon allowance purchases under EU ETS, premium pricing from ESG differentiation, and customer retention from ESG transparency

**Success Metrics:** 15–30% reduction in cooling energy consumption; 24/7 CFE matching of 60%+; real-time customer ESG dashboard operational; documented P&L impact quantified

**Key Challenge:** Capital investment requirements for digital twin deployment; grid decarbonisation pace in certain regions; balancing workload placement with latency requirements

3

### Phase 4: Transformation | Months 24–36

**Objective:** Embed ESG intelligence across all operations and realise lasting competitive advantage.

**Key Actions:**

- Develop comprehensive digital twins for all data center assets integrating IoT sensor data, building management systems, IT workload telemetry, and ESG metrics
- Implement systems providing continuous, auditable proof of energy efficiency, water stewardship, carbon emissions, and regulatory compliance—positioning as differentiator for contracts, financing, and regulatory approvals
- Integrate supply chain emissions data from equipment manufacturers, construction contractors, and logistics providers; set Science Based Targets for Scope 3 reductions
- For Scope 1 and 2 residual emissions, pursue net-zero targets following Microsoft's 2030 carbon negative reference; invest in high-quality carbon removal for unavoidable emissions
- Invest in workforce AI literacy: enable facilities, operations, and IT personnel to work effectively alongside AI systems, emphasising human oversight and collaborative capability development

**Success Metrics:** Fully integrated digital twin operational; real-time ESG assurance achieved; comprehensive Scope 3 reporting established; industry recognition as ESG leader

**Key Challenge:** Evolving regulatory landscape (CSRD Omnibus, national variations); availability of 24/7 carbon-free energy across all regions; balancing automation with workforce considerations

4

Section 09

# Critical Success Factors

What separates leaders from laggards

Success Factor	Rationale	Reference Benchmark
<b>Data Quality &amp; Sensor Infrastructure</b>	AI is only as good as its data. Cooling systems 50% of total energy must be the priority domain for granular sensor deployment and data standardization	Airedale Cooling AI: IoT integration enables 40% cooling reduction
<b>Hardware Efficiency as Foundation</b>	Procurement decisions must prioritize energy and water efficiency alongside performance. Operational AI cannot compensate for inefficient hardware	NVIDIA Blackwell: 300x water efficiency; Google TPU: 30x power efficiency
<b>24/7 Carbon-Free Energy Strategy</b>	Annual renewable matching is insufficient. Multi-year clean energy strategies must span renewables, nuclear, and emerging SMR technologies	Google: 66% hourly CFE; Amazon: 1,920 MW nuclear PPA through 2042
<b>Customer Decarbonization as Value Prop</b>	For colocation providers, ESG intelligence creates competitive differentiation and customer lock-in by enabling customer Scope 3 reporting	Equinix: IDC MarketScape Leader; NTT DATA: transparent emissions baselines
<b>Responsible AI &amp; Human Oversight</b>	EU AI Act requirements apply directly to AI systems deployed in data centers. Transparency, explainability, and human oversight frameworks are mandatory, not optional	NADIKI initiative: real-time AI environmental impact measurement
<b>Accounting for AI's Own Footprint</b>	Operators must disclose energy and water consumed by AI systems themselves not only the sustainability gains. Bain projects AI data centers at 2% of global emissions by 2035	Google emissions +51% since 2019; NADIKI: real-time AI impact tracking

## The Regulatory Acceleration Signal

For 2026, the forthcoming EU Cloud and AI Development Act is expected to reward the best-performing new data centre projects with faster approval processes creating a direct financial incentive for ESG leadership. For companies planning data centre deployments, understanding these regulatory shifts is essential to realistic timeline and site selection planning. ESG performance is no longer merely a reporting obligation; it is a site approval mechanism.

Section 10

# Conclusion

From compliance trap to competitive advantage

The data center sector's transition from compliance-driven to AI-powered ESG management is not merely possible it is already delivering measurable results across the industry's leading players. The evidence assembled in this paper is compelling: Google achieved a 12% reduction in data centre energy emissions while dropping PUE below 1.10; Microsoft designed facilities that save 125 million litres of water annually per site; Amazon secured 1,920 MW of nuclear power through 2042; NVIDIA delivered 300x water efficiency improvement through liquid cooling; Equinix achieved IDC MarketScape leadership through customer decarbonization instruments; Digital Realty targets 60% emissions reduction per square foot by 2030; NTT DATA reached 51% renewable energy while establishing auditable ESG baselines; and Salesforce deployed autonomous AI agents for enterprise-scale carbon management.

<p><b>12%</b></p> <p>Google's data centre emissions reduction in 2024 despite rising AI demand</p>	<p><b>1.09</b></p> <p>Google's trailing-12-month PUE best-in-class at global hyperscale</p>	<p><b>51%</b></p> <p>NTT DATA's renewable energy for non-IT load a colocation benchmark</p>
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AI enables data center operators to detect gaps before they become liabilities, turn ESG data into P&L impact, and provide real-time proof rather than retrospective promises. The path forward is clear: begin with foundational gap analysis and baseline measurement, integrate data systems and deploy initial AI applications, scale proven pilots and quantify financial returns, and ultimately achieve real-time, auditable ESG performance across the entire portfolio.

*The question is no longer whether AI will reshape data center ESG management. The question is which operators will seize the opportunity and how quickly.*

Those that embrace this transformation will not merely comply with regulation they will gain competitive advantage in an era where sustainability performance increasingly determines which operators secure site approvals, access capital, win customer contracts, and maintain their license to operate. As the forthcoming EU Cloud and AI Development Act signals, ESG leadership will soon be rewarded with faster

regulatory approvals making the investment case not merely environmental but existential for operators seeking to scale.

The AI paradox of the data center sector resolves in a virtuous cycle: the technology driving unprecedented energy demand becomes the most powerful tool for managing that demand responsibly. Operators that build this capability now will not merely survive the regulatory wave ahead they will define the standard to which the entire sector is held.

## Section 11

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