VIEW POINT

SMART ENERGY MANAGEMENT FOR AI WORKLOADS: INFOSYS EAAS BLUEPRINT FOR DECARBONIZED DATA CENTERS

Infosys®
Navigate your next

Excessive energy consumption

The pervasive adoption of cloud computing and implementation of artificial intelligence (AI) use cases is accelerating investment in AI data centers. It is estimated that 33% of global data center capacity will be optimized for AI workloads by 2025[1]. While made-to-order data centers are imperative for AI services, their energy intensity poses environmental challenges.

Typically, data centers account for 1-2% of global power consumption, and 5-15% of the energy usage can be attributed to AI workloads. This share of AI load is projected to increase to 35-50% by 2030. From a global standpoint, AI data centers are set to consume 4.5% of electricity by 2030[2], growing 4x+ faster than other sectors[3].

Training of AI models further increases consumption. In fact, the energy required to train large AI models can exceed the annual consumption of small cities. The International Energy Agency (IEA) estimates that a typical AI data center uses as much electricity as 100,000 households, and large work-in-progress facilities may consume up to 20x more power[4].

Deconstructing energy consumption

Figure 1 summarizes the factors responsible for high energy consumption in AI data centers. Notably, 60% energy is consumed by servers and 40% by cooling systems[5].

Advanced cooling systems

Conventional HVAC systems do not address the requirements of high-density AI racks. Liquid cooling, which is up to 3,000x more efficient than air cooling, requires substantial energy input.

AI workloads

Training of large AI models demands massive computational resources. Thousands of GPUs run for days / weeks. Rack power density is expected to reach 250 kW by 2025 vis-à-vis 10-20 kW in conventional data centers.

GPU servers

High-performance GPUs consume 3–5x more electricity than standard CPUs.

Continuous operations and uptime

24x7 operations to support global applications, cloud services, and real-time AI inferencing results in high energy consumption.

Figure 1: Drivers of energy consumption

The decarbonization imperative

The 2015 UN Climate Change Conference (COP21) in Paris set a baseline "to limit the temperature increase to 1.5°C above pre-industrial levels"[6]. The energy industry, which is responsible for 75.7% global greenhouse gas emissions[7], needs to prioritize decarbonization for achieving the target set by the Paris Agreement.

Decarbonization is the process of reducing or eliminating carbon dioxide and other greenhouse gas emissions to mitigate climate change[8]. Decarbonization strategies range from transitioning to renewable energy and adoption of digital energy management systems to investment in low carbon technologies[9].

Energy transition and energy efficiency are foundational for decarbonization. Energy transition reduces carbon emissions by replacing fossil fuels with renewable energy such as wind, solar, and hydropower[10]. Energy efficiency is achieved by using lesser and lesser energy for a given quantum of service. Significantly, existing technologies can drive 2x energy efficiency improvement by 2040[11].

Energy efficiency accelerates net-zero goals by facilitating a transition from megawatts to negawatts. As a thumb rule, one unit saved equals two units generated. Further, optimization of every watt reduces demand, carbon emissions, and the load on local grid infrastructure. Importantly, unused energy is a strategic asset in climate and energy planning.

Until recently, superior energy efficiency was achieved primarily through retrofit engineering. This approach upgrades buildings with energy-efficient technologies and systems. Retrofitting of infrastructure with wall / roof insulation, glazed windows, and eco-friendly heating, ventilation and cooling (HVAC) systems is effective, but requires substantial capital investment and can disrupt existing operations[12].

Pivoting to green tech

Global annual investment in energy projects is expected to touch US$ 300 billion by 2030[13]. The investment includes energy efficiency projects, clean energy capacity expansion, and infrastructure modernization.

A digital-first approach rationalizes the cost of integrating renewable energy sources and implementing energy efficiency programs. In addition, digital applications offer insights to drive targeted retrofit strategies.

Figure 2 highlights energy efficiency initiatives undertaken across countries, including policies, incentives, tax credits, subsidies, and regulatory measures. These initiatives drive economic growth, while ensuring energy security.

Country	National-level initiatives
Australia	• Clean Energy Finance Corporation (CEFC) funding for clean energy projects • Powering Australia plan • Energy Efficiency Grants for Small and Medium Sized Enterprises program
China	• Five-year plans with energy intensity targets • Dual control policy • Energy efficiency standards and labeling
Germany	• Energy Efficiency Act • National Action Plan on Energy Efficiency (NAPE) • KfW energy efficiency programs
India	• Bureau of Energy Efficiency (BEE) Standards and Labeling program • National Mission for Enhanced Energy Efficiency • Unnat Jyoti by Affordable LEDs for All (UJALA) Scheme • Energy Conservation Building Code
UAE	• National Green Certificates Program • Dubai Supreme Council of Energy (DSCE) policies • UAE Energy Strategy 2050
UK	• Help to Heat • Energy Company Obligation (ECO) • Warm Homes: Social Housing Fund
USA	• Inflation Reduction Act • ENERGY STAR Program • State Energy Program (SEP)

Figure 2: National energy programs

Business enterprises need to adopt a two-pronged approach in their decarbonization journey (Figure 3). Firstly, they need to look inward to explore deep green retrofits, an energy mix enriched with green supply sources, and digital solutions to manage energy supply and demand. Secondly, they need to look beyond the enterprise to explore collaboration with external stakeholders and purchase market instruments such as renewable energy certificates and green bonds.

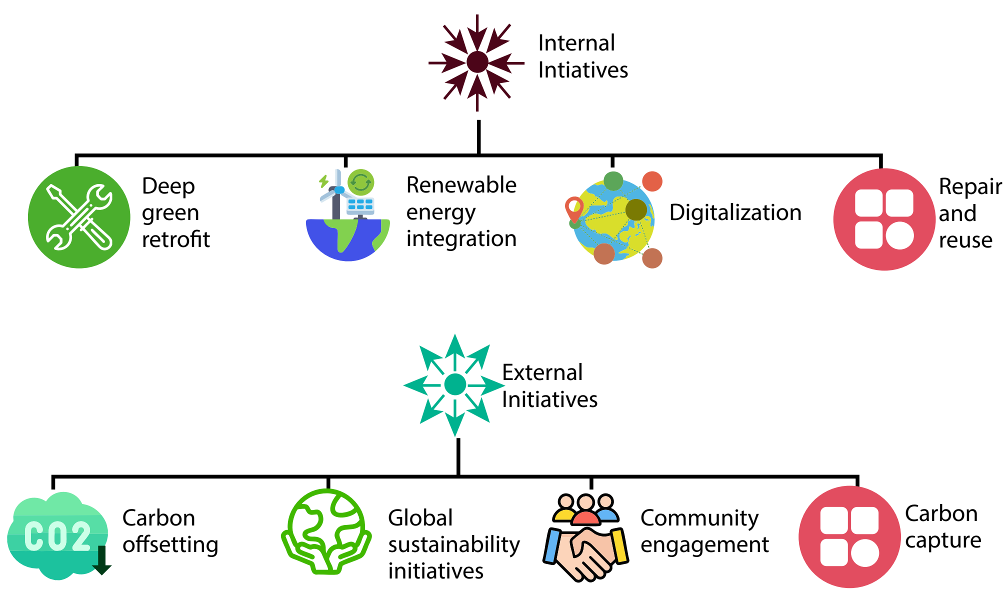


Figure 3: Enterprise decarbonization strategies

The Infosys story

Infosys achieved carbon neutrality ahead of the 2030 target by combining energy efficiency initiatives, renewable energy investments, and community-based projects. Read more.

Figure 4 presents the challenges and benefits of adopting digital technologies in the carbon-neutral journey.

Challenges

- Cost of implementing emerging technologies and modernizing existing infrastructure
- Technical limitations and the need for domain expertise Policy and regulatory requirements, including standardization
- Safeguarding digital infrastructure and data across energy systems

Benefits

- Operational efficiency through real-time monitoring, predictive asset maintenance, and automated decision making
- Significant cost savings
- Reduction in carbon emissions
- Community engagement in renewable energy and energy efficiency projects

Figure 4: Towards a low-carbon landscape

Energy efficiency in data centers

Electricity consumption in high-demand environments such as AI data centers burdens local grids. However, advanced digital technologies mitigate power capacity by transforming energy systems[14]. Figure 5 discusses technology solutions that enable demand-side energy transition at AI data centers. The solutions optimize energy usage and enhance energy efficiency, while facilitating seamless integration of clean energy sources. Notably, hyperscalers, including AWS, Microsoft, Google, and Meta, have migrated to renewable energy and energy-efficient data centers to expand global operations sustainably.

Internet of Things (IoT) systems allow real-time monitoring of variables such as ambient temperature, indoor lighting, and equipment condition. AI tools enhance energy management by analyzing data acquired via IoT devices to identify consumption patterns, predict energy demand, and automate decision-making processes[15]. Notably, cognitive automation integrates AI and IoT to significantly reduce energy waste - for instance, smart lighting and HVAC systems.

Innovative energy management practices powered by IoT and AI minimize the carbon footprint and rationalize overheads of AI data centers. AI-driven cooling systems and predictive asset maintenance not only reduce energy consumption and prevent energy loss but also ensure that data centers operate optimally.

Cloud computing

Scalable data storage and processing capacity support advanced energy management systems

Digital Twins

Virtual replica of physical systems enables real-time optimization of energy systems

Smart microgrids

Localized gride that operate independently enhance grid resilience by integrating renewable energy sources

IoT and AI/ML

Real-time data from connected devices, predictive analytics and AI-driven automation optimize energy consumption

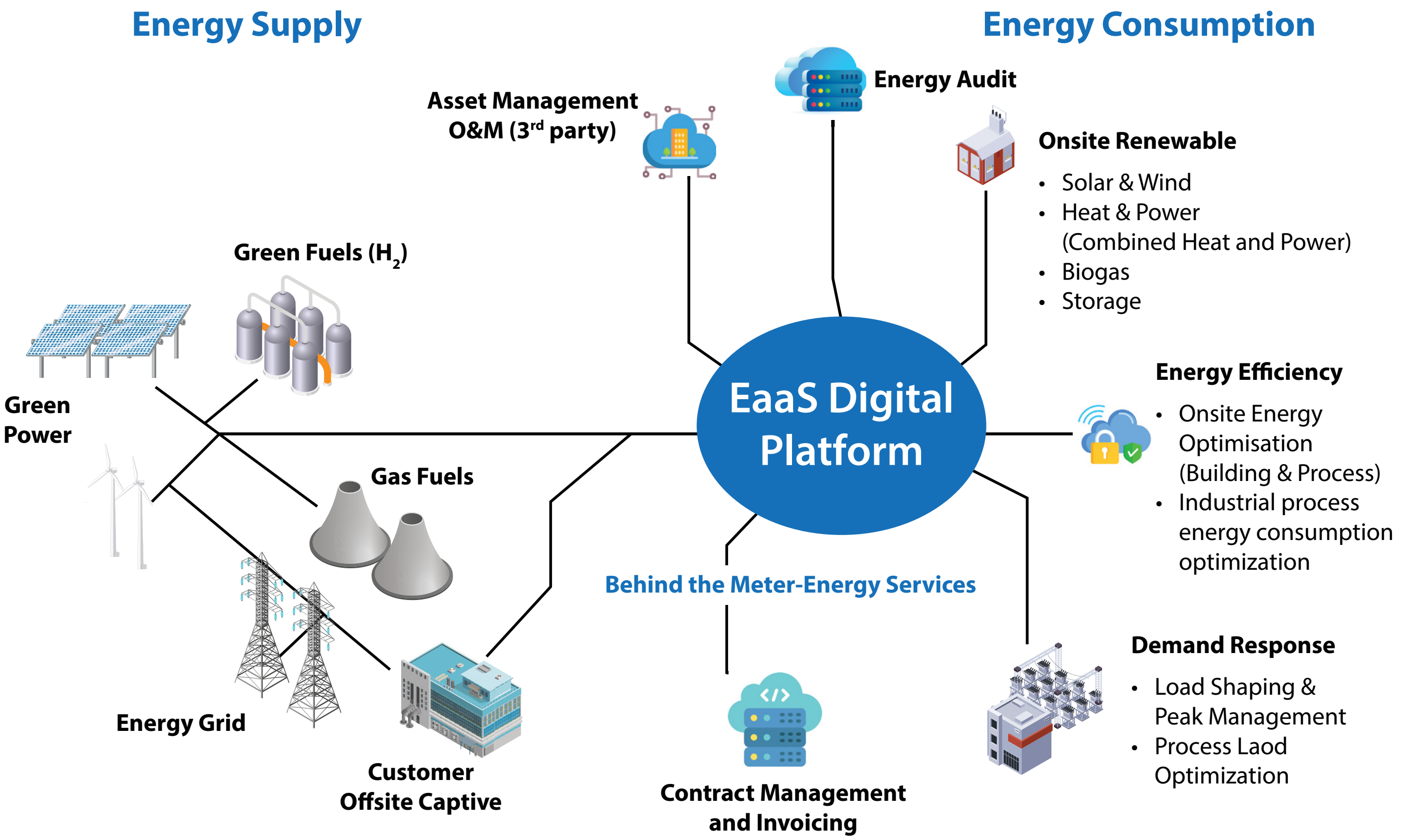
Figure 5: Energy efficiency solutions

Introducing Energy-as-a- Service

Infosys Energy-as-a-Service (EaaS) platform, developed in collaboration with bp, enables AI data centers to monitor, optimize, manage, and monetize energy usage in real time. The hardware-agnostic platform accelerates energy transition and accelerates return on investment.

The scalable, modular, and rapidly deployable EaaS platform unifies energy supply and demand management. The intelligent system supports AI-based modeling and training. Further, the Infosys platform analyzes data from live streams across energy sources and data center assets, and offers actionable insights to effectively manage energy assets and services.

Figure 6 shares high-level features of the AI-powered EaaS platform. It uses IoT gateways for cloud integration and incorporates a dashboard for data visualization across modules. A single-pane view of energy management empowers operations teams at AI data centers to combine real-time insights and predictive analytics to achieve decarbonization goals. Significantly, the Infosys EaaS platform facilitates data-driven decisions to mitigate issues, conserve energy, and ensure reliable energy supply.



Infosys EaaS platform use cases

Infosys reduces carbon emissions

The Infosys EaaS platform enabled the Infosys Pune Development Center to achieve 7% reduction in energy usage and eliminate 7,900 tCO_2e within six months. In FY2023, the 18-building campus with 40,000+ staff increased renewable energy utilization by 75%, which reduced CO2e emissions by more than 50%. Moreover, the platform enabled robust demand-side management and energy source optimization, resulting in a 20% decrease in energy unit price. Finally, optimization of energy consumed for space heating, cooling and asset operations enabled 10% energy savings.

German airport saves energy costs

A passenger and cargo airport in Germany implemented the Infosys EaaS platform to ensure it becomes climate neutral by 2045. The platform analyzed hourly energy and cost data across energy assets, including boilers, chillers, clean energy storage systems, and combined heat and power (CHP) plants. It provided recommendations to improve efficiency of boilers and chillers, optimize CHP plant operations, maximize battery energy storage system (BESS) usage, and upgrade heat pumps. The transformed energy landscape saved ~30% in energy costs, amounting to €2.4 million annually.

Working toward a sustainable future

The demand for AI data centers is set to increase exponentially due to the escalating demand for agentic AI and generative AI. Smart energy sourcing and energy-efficient practices ensure operational resilience. Significantly, AI-based energy management solutions enable data centers to set benchmarks for sustainable operations. An AI-powered ecosystem fosters energy security and sustains low-carbon economic growth.

Author

Prathama Dolas

Prathama is a Senior Consultant and Subject Matter Expert in Sustainability and Building Energy Efficiency at Infosys, with over nine years of experience in the energy sector. Prathama specializes in agile project management, leading Energy as a Service (EaaS) implementation, and stakeholder engagement. With a Maters in Energy and Environment from MNIT Jaipur and industry certifications (GRIHA CP, IGBC AP), she has contributed to organizations such as TERI, CSE, and CII, advancing best practices in green building and sustainability.

References

[1] All About AI: AI Data Centers – Global Statistics

[2] SemiAnalysis: AI Datacenter Energy Dilemma – The Race to Power AI

[3] IEA Report: Energy and AI

[4] IEA Executive Summary: Energy and AI

[5] Best Practices Guide for Energy-Efficient Data Center Design

[6] The Paris Agreement | UNFCCC

[7] https://www.wri.org/insights/4-charts-explain-greenhouse-gas-emissions-countries-and-sectors

[8] Reality Check: Lessons from 25 Policies Advancing a Low-Carbon Future

[9] The Decarbonization Journey

[10] Decarbonizing electric power: Key challenges and opportunities after the 2021 global energy crunch and COP26 climate negotiations | S&P Global

[11] How energy efficiency will power net zero climate goals – Analysis - IEA

[12] Vulnerability Assessment of Arizona's Critical Infrastructure

[13] Energy Efficiency 2022

[14] Digital Transformation in Energy: Top 10 Technologies [2025]

[15] The Role of Artificial Intelligence in Digital Transformation