Fast-track sustainability with AI

Applying artificial intelligence to help reduce your environmental footprint and accelerate positive change

The duality of AI in sustainability

Artificial intelligence (AI) holds a paradoxical role in the global race to reduce greenhouse gas (GHG) emissions and tackle the many challenges of climate change.

Unchecked, AI training and inference can be extremely carbon intensive, especially for generative AI projects, requiring large amounts of power and other resources.

Training the OpenAI* GPT-3 large language model (LLM) with 175B parameters required 1,287 MWh of electricity, resulting in >500 metric tons carbon emissions[1]. That's the equivalent of just over 116 round-trip flights between New York City and Sydney, Australia (per passenger)[2].

Hugging Face* estimates that inference on the 176B parameter BLOOM model emits ~19kg CO2e/day of API deployment[3].

Yet at the same time, AI offers unprecedented opportunity to accelerate innovation toward greater sustainability and mitigate the impacts of climate change.

Increasing climate resiliency through early warning systems for extreme weather events

Supporting the transition to renewable energy, balancing supply and demand with smart energy grids

Expediting development of adaptions, such as drought-resistant crop engineering

Accelerating research and monitoring including climate modeling and ecological conservation efforts

Energy used in AI lifecycle

40% Training

60% Inference
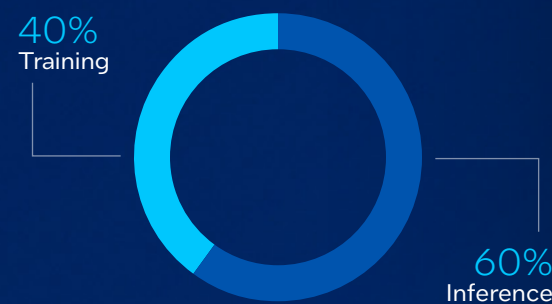
AI can help drive sustainable change within your organization

Thoughtfully applying AI can also be the fastest path to meeting decarbonization goals, as well as identifying opportunities for greater efficiency and growth.

Reduce energy and resource waste

Identify and eliminate inefficiencies by applying AI to your existing processes

Gain new insights to optimize operations

Discover opportunities to increase operational and resource efficiency

Create 'Tech Positive' transformation

Drive new, sustainable value, finding resiliency and differentiation through AI

No matter where you are on your AI adoption and maturity journey, there are opportunities. Your projects can be relatively small , like starting to apply next-logical-step digitization to existing workstreams to accelerate decision making, or they can be groundbreaking and ambitious projects that will revolutionize how you execute a chosen use case. With both traditional and generative AI, you can deliver new, more sustainable value across your business.

Sustainability + IT: a two-fold endeavor

Just as IT has been the lynchpin of digital transformation, technologists will be equally critical leaders in sustainable transformation. Organizations are looking to IT to help reach:

Tech zero: Reducing the carbon footprint of an organization's IT function

Tech positive: Using technology as a lever for the whole organization to reach its net-zero goals and to have a positive overall impact, driving business growth and accelerating innovation

Striving toward tech zero and environmentally-responsible AI

To maximize the impact of the energy spent on AI initiatives and minimize the carbon footprint of your compute infrastructure, a proactive approach to project design and IT management is critical.

Seven steps to right-sizing your AI

1 Be selective about your AI projects

Not every problem should be solved with AI. Critically consider your problem and use case, as well as the alignment with your digital strategy and roadmap, determining if AI is the correct choice to solve the problem or if other methods requiring fewer resources can suffice.

2 Emphasize data quality over data quantity

Carefully select the right model, using smaller, domain-specific models where possible, and prune or compress your neural network based on your use case to reduce compute requirements and lower energy consumption in training and inference.

3 Assess accuracy requirements

Create energy and compute-time savings by using lower precision or mixed-precision during training and inference, where possible.

4 Optimize your hardware

A more heterogenous AI infrastructure, with a combination of AI computing chipsets that meet specific application needs, will help ensure you save energy across the board, from storage to networking to compute. And with built-in acceleration technologies you can drive significant performance/watt improvements and energy savings. Plus, utilizing available libraries of software optimizations can help ensure you're getting the best performance from your chosen hardware and applications.

5 Take advantage of repeatability and scale

Avoid energy-intensive initial model training with pre-trained models and/or shared and federated learnings. Similarly, utilizing open APIs enable more efficient cross-architecture solutions, allowing you to build tools, frameworks, and models once and deploy everywhere with more optimal performance.

6 Implement intelligent power management + liquid cooling

Optimize the energy efficiency of hardware, increase server utilization, and optimize cooling-related power usage by automatically orchestrating adjustments to optimize energy use and detect anomalies, proactively identifying problems before they arise.

7 Build a carbon-aware computing environment

For workloads that are not time sensitive, reduce carbon emissions by modulating workload execution when grid carbon intensity is lowest, taking advantage of renewable energy as much as possible.

Learn more about how to ensure greater sustainability in your AI workloads ›

The power of carbon-aware computing

The ability to dynamically select the location and/or timing of your compute workloads (AI or any other workloads) can have a huge impact on the overall carbon intensity of your IT infrastructure and expedite the journey to Tech Zero.
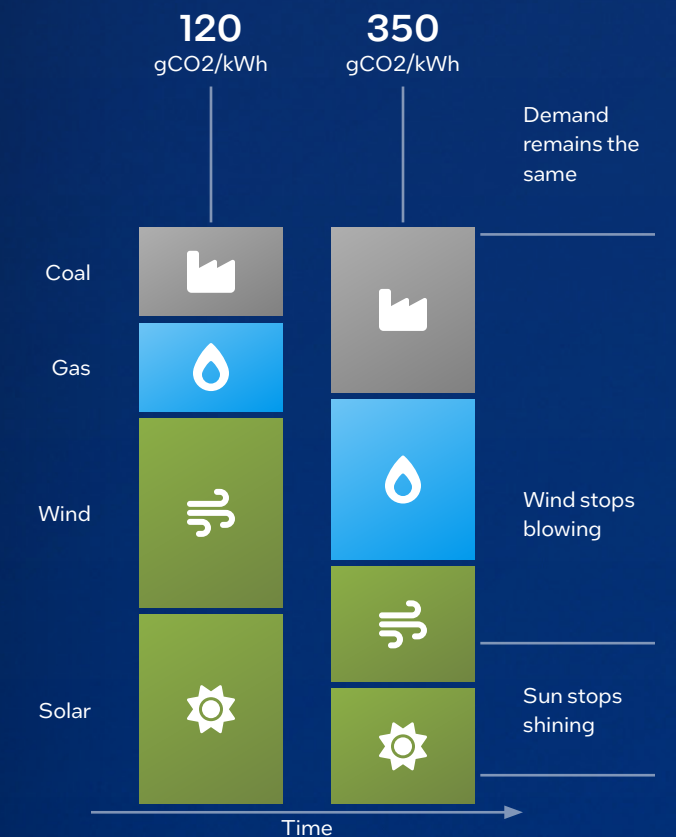
As you can see, the "carbon cost" between the two sample grids is significant. With all factors besides grid energy mix being the same, a workload on Grid B, with a greater reliance on fossil fuels, carries nearly 3x the carbon intensity of a workload on Grid A, powered with more renewable energy.

Building a carbon aware computing environment with software like the Carbon Aware SDK available from the Green Software Foundation*, you have control to use less carbon intensive computing environment available and help reduce your IT organization's emissions.

Check out the Carbon Aware SDK available today from Green Software Foundation ›

Carbon Intensity Awareness

Choose your region (where and when) the energy used has the lowest carbon cost

120 gCO2/kWh

350 gCO2/kWh

Demand remains the same

Coal

Gas

Wind — Wind stops blowing

Solar — Sun stops shining

Time

Reduce energy and resource waste

AI offers a great opportunity to bring new understanding to existing business functions. By not only better monitoring today's processes and operations, but also identifying and predicting future needs, AI can help eliminate inefficiencies.

AI is well-suited to help support:

Facilities management

Monitor various environments across your organization, building an understanding of usage patterns and better detecting areas of waste. AI-driven insights can identify energy and resource saving opportunities within common operations such as heating, cooling, ventilation, lighting, and more.

What could this look like:

- Smart buildings solutions that can marry occupancy data with lights, shades, thermostats, and more to reduce energy consumption
- Environmental monitoring systems to monitor air and water quality, detect pollution and predict future changes to help create safer, more efficient operations

Asset management

Prolong the life of your equipment and save energy by predicting asset health and risk of failure. By collecting and analyzing performance data, AI solutions can help reduce your organization's waste footprint (while also avoiding costly downtime!).

What could this look like:

- Preventative maintenance systems, collecting and analyzing data across various machines and sensors to help ensure proper, efficient operations and extend the life of equipment, thereby reducing waste
- Developing fine-grained energy monitoring to support carbon calculation, enriching understanding of current-state operations and projecting future impact

Resource efficiency visibility

Enhance traceability of consumption, utilization of materials across your organization to right-size inventory and provisioning and reduce waste across your resources.

What could this look like:

- Inventory monitoring and management to help prevent overstock and food waste
- Asset utilization management to optimize production capacity of equipment and maximize value, while also reducing energy and resource waste

Anomaly detection

Automatically monitor processes to identify abnormalities, allowing you to quickly to reduce waste and identify opportunities for improvement.

What could this look like:

- AI vision-based quality assurance management to quickly recognize defects early in the manufacturing process to reduce waste and quickly re-route materials to salvage or recycling processes
- Leak detection using sensors and/or computer vision analytics to monitor flow, pressure, temperature, and more detecting liquid or gas leaks in near-real-time, minimizing waste and preventing potential damage

Read how Prescriptive Data NANTUM*, powered by Intel, lowered energy consumption in a 1.8 million square foot building in New York City by 11 percent

Learn how restaurants like Chipotle* are using PreciTaste* and Intel® OpenVINO and Intel® RealSense technology to reduce food waste and improve profitability

Gain new insights to optimize operations

AI can also unlock new opportunities for greater efficiency across your organization, helping ensure you're making the most of available resources and improving processes.

AI can help with:

Supply chain optimization

Apply automatic prediction and decision making to optimize your supply chain efficiency and use insights about downstream demand to improve forecasting, reducing waste across the value chain.

What could this look like:

- Demand forecasting, ensuring the right products are available at the right time, reacting to shopper trends to avoid overstock waste as well as reduce the carbon footprint associated with logistics for moving and storing inventory
- Container logistics optimization, maximizing the amount of goods transferred while minimal fuel expenditures

Production optimization

Utilize physical and virtual automation to accelerate continuous process improvement across your organization, fostering greater efficiency while also reducing waste.

What could this look like:

- Adopting digital twins to assess and optimize energy and/or materials efficiency and design out waste, testing across variables in new or changing production environments
- Intelligent crop monitoring, combining data from satellite imagery, sensors, and weather data to inform decisions about planting, irrigation, and fertilization

Transportation optimization

Improve your transportation-related workstreams, optimizing routes and timing, as well as streamlining necessary logistics enroute, to enhance fuel efficiency and reduce carbon footprint.

What could this look like:

- Smart roads and intelligent traffic management, optimizing routes and traffic flow based on usage patterns and environmental conditions to reduce delays and congestion, therein reducing idle vehicle emissions
- Supporting electric vehicle (EV) charging needs from location selection to optimizing charging schedules to predicting user behavior to support adoption of more sustainable transportation and reduce environmental impact of vehicle charging
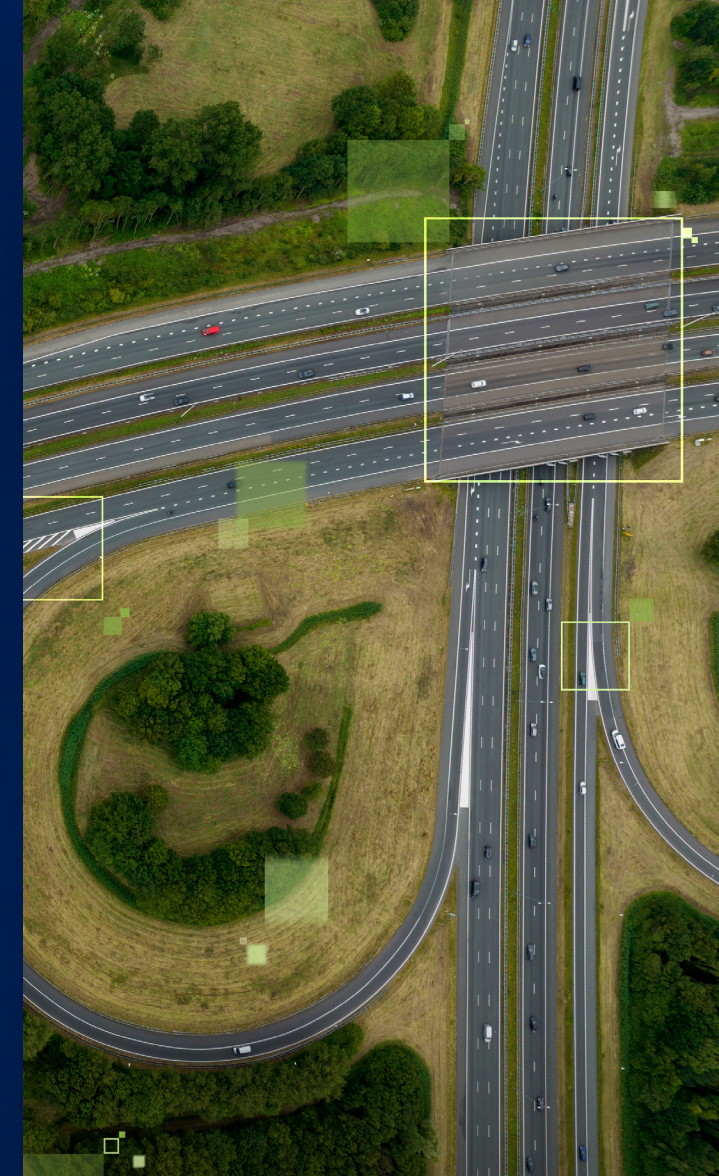
Arizona's Bell Road Highway has seen **20%** reduction of traffic on weekdays and **43%** reduction on weekends, using GRIDSMART* intelligent traffic management camera system, an Intel® Market Ready Solution[4]

See how a remote Norwegian fish farm improved efficiency, profitability, and sustainability thanks to Intel collaboration in developing a 5G video analytics solution ›

Create tech positive transformation

Perhaps most excitingly, AI can open a door to opportunities to create new and unique environmentally-aware offerings and carry forward sustainable transformation throughout the marketplace.

Harnessing the power of AI you can:

Drive innovation and spark new offerings

Facilitate the creation of new, environmentally-conscious products and services to support the shift to a low-carbon economy across your value chain.

What could this look like:

- Gathering and analyzing data on customer behavior and forecasting future trends to support efficient development of new products

- Accelerating research and development with new, environmentally-friendly materials, expediting development of more sustainable products

Support ESG reporting and accountability

Help increase transparency surrounding progress toward your company's sustainability goals while helping improve the accuracy of carbon reporting. Streamline reporting activities to more easily meet disclosure requirements, as well as move toward real-time data insights for improved decision making.

What could this look like:

- Build more robust and accurate carbon accounting with intelligent emission factor mapping, as well as anomaly and data inconsistency detection

- Increase transparency through automated supplier checks and improved carbon calculation across the value chain, creating a better understanding of Scope 3 emissions and identify opportunities for improvement
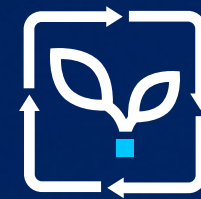
Increase climate resilience and adaptability

Performing scenario planning and simulations to better develop climate resiliency plans for your organization, identifying the risks, opportunities, and trade-offs under various climate change-driven conditions.

What could this look like:

- Tailoring energy profiles based on local conditions to better address renewable energy intermittency and reduce dependence on fossil fuels

- Pinpoint and mitigate risks posed by climate change by analyzing complex climate data and patterns, taking the first step to incorporate climate science into business operations

Your partner in bringing AI everywhere, more sustainably

Deliver the impactful AI outcomes needed to reduce your environmental footprint and create positive change throughout the market with Intel®.

Only Intel® offers an end-to-end, heterogeneous portfolio of AI-optimized hardware, combined with a comprehensive, interoperable suite of AI software tools and framework optimizations to accelerate innovation and maximize your value. Offering optimized performance, Intel® hardware and software solutions can help you quickly deploy and run AI anywhere and operate with more energy efficiency. With Intel, your AI is supported by an application ecosystem across all your compute environments: from PC and edge to cloud and data center.

Intel has always worked with commercial ISVs and industry standards partners – some of the largest in the market – to help ensure your models run faster, right out of box. Plus, with the vast portfolio of Market Ready Solutions from our partner ecosystem, you can quickly deploy market-tested solutions to promote sustainability across your organization.
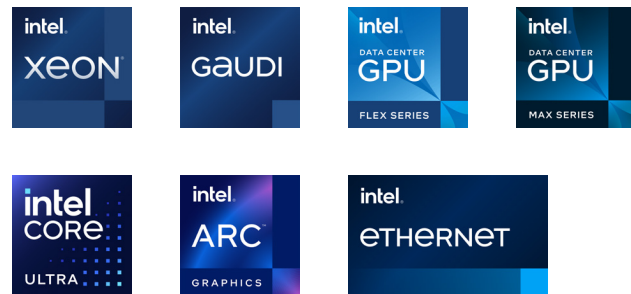
How will you help create a more sustainable future?

To address climate change, we collectively need to take immediate action through systems change, technological innovation, and global collaboration.

At Intel, we're committed to creating a more sustainable computing for more sustainable future. We're here to be your partner in envisioning how AI can foster Tech Positive change for your organization, and helping you build the skills to advance in your AI journey, more sustainably.

Talk to your Intel representative to learn more about Intel AI can support your sustainability journey today

AI-optimized hardware

intel XEON
intel GAUDI
intel DATA CENTER GPU FLEX SERIES
intel DATA CENTER GPU MAX SERIES
intel CORE ULTRA
intel ARC GRAPHICS
intel ETHERNET

Comprehensive suite of software tools and optimizations

oneAPI
intel Developer Cloud
OpenVINO
TensorFlow
ONNX RUNTIME
PyTorch
XGBoost
MODIN
deepspeed

1. Carbon Emissions and Large Neural Network Training, April 2021
2. Equivalency calculated w/ https://www.carbonfootprint.com/calculator.aspx
3. Estimating The Carbon Footprint of BLOOM, A 176B Parameter Language Model November 2022
4. 5G & Distributed Computing Tackle Critical Challenges for Cities

Explore Intel® Market Ready Solutions ›