

Sustainability Through Source Reduction: Possibilities and Opportunities

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**Pollution Prevention Institute
Kansas State University**



Pollution Prevention Institute

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Pollution Prevention Institute (PPI)

- Since 1989
- K-State College of Engineering - Engineering Extension
- 100% grant-funded
- **Non-regulatory**



“The Pollution Prevention Institute's mission is to promote sustainability through environmental education and services to industry, institutions, and communities.”



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Small Business Environmental Assistance Program

- Environmental compliance assistance
- Multimedia (air [mostly], waste, water, and pollution prevention)
- Small- and medium-sized businesses (mostly under 100 employees)
- Free and confidential
- Contact information

Website: www.sbeap.org

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K A N S A S

SBEAP

Small Business Environmental Assistance Program



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Pollution Prevention (P2) Program

- Technical assistance
 - Any size industry
- Internship program
- Workshops, seminars, and educational materials to spread P2 awareness



2024 PPI intern group

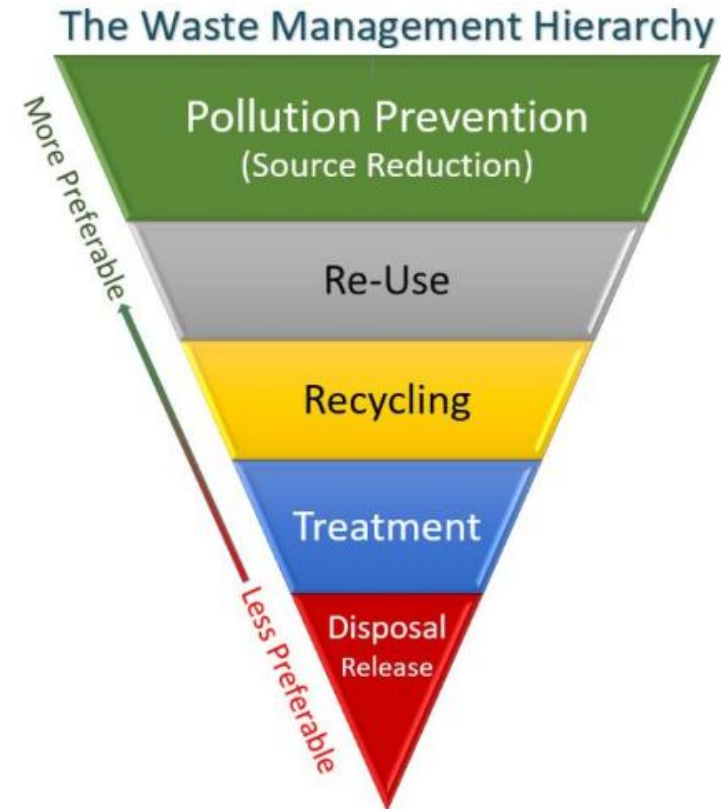


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Pollution Prevention or P2

- Reducing or eliminating waste and pollution at the source
- Prior to treating or disposing of it
- Triple bottom line
 - People, planet, and profit

Change the material
Change the process
Change the technology



How does an AI work?

User input

Analyze the input
Identify the keywords
Determine the input
Fall back

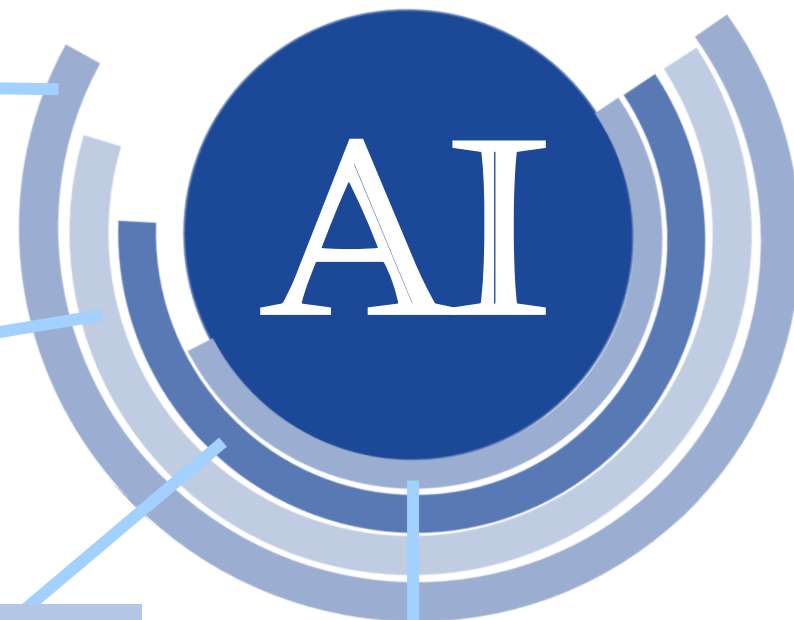
**Natural
language
processing**

**Information
Retrieval**

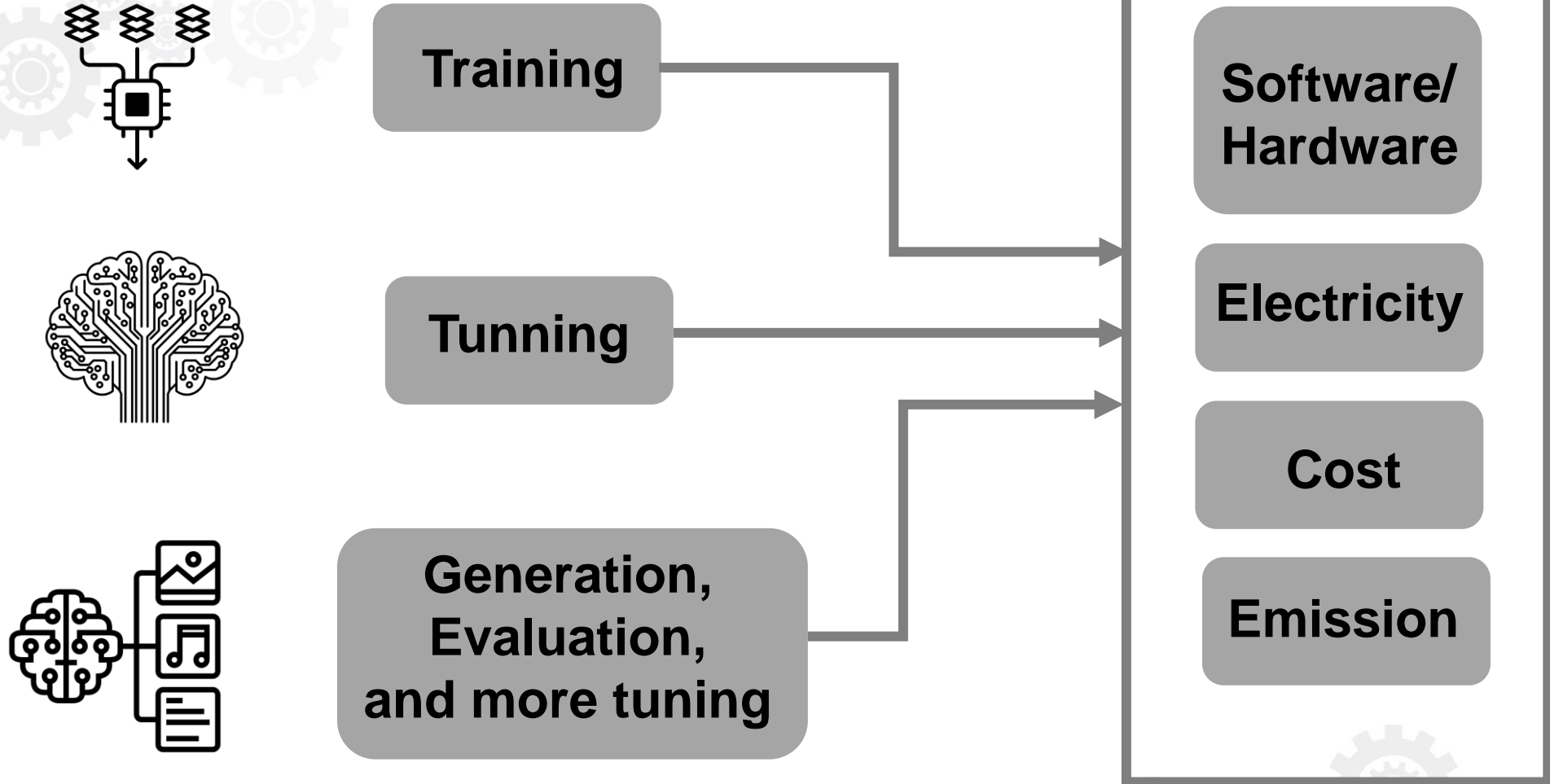
Vast database
Wealth of information
Retrieves publicly available resources
Pretrained models
Retrieval Augmented Generation

Response Generation

Structured data into human-readable
(text, image, and audio)

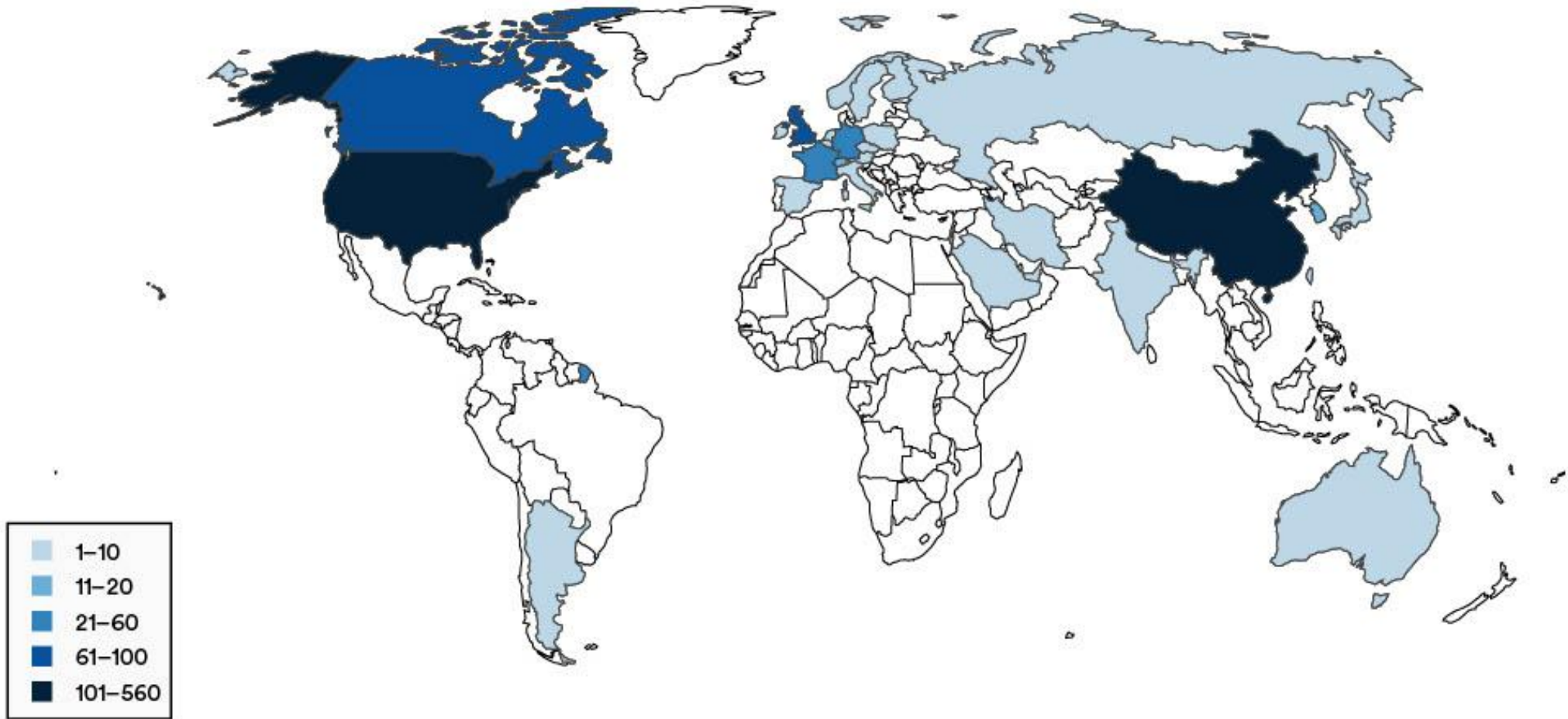


AI Environmental Concern



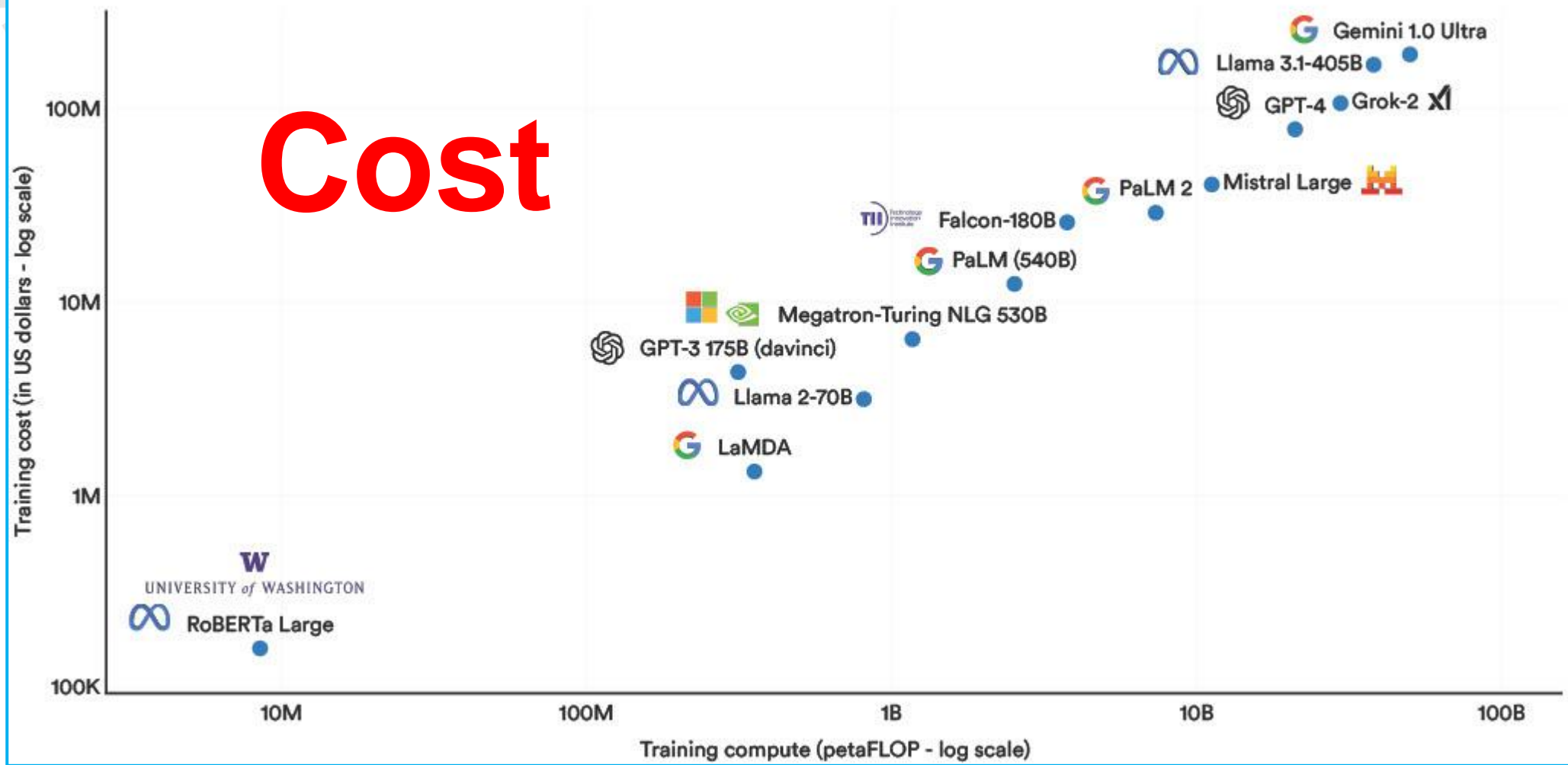
Number of notable AI models by geographic area, 2003–24 (sum)

Source: Epoch AI, 2025 | Chart: 2025 AI Index report



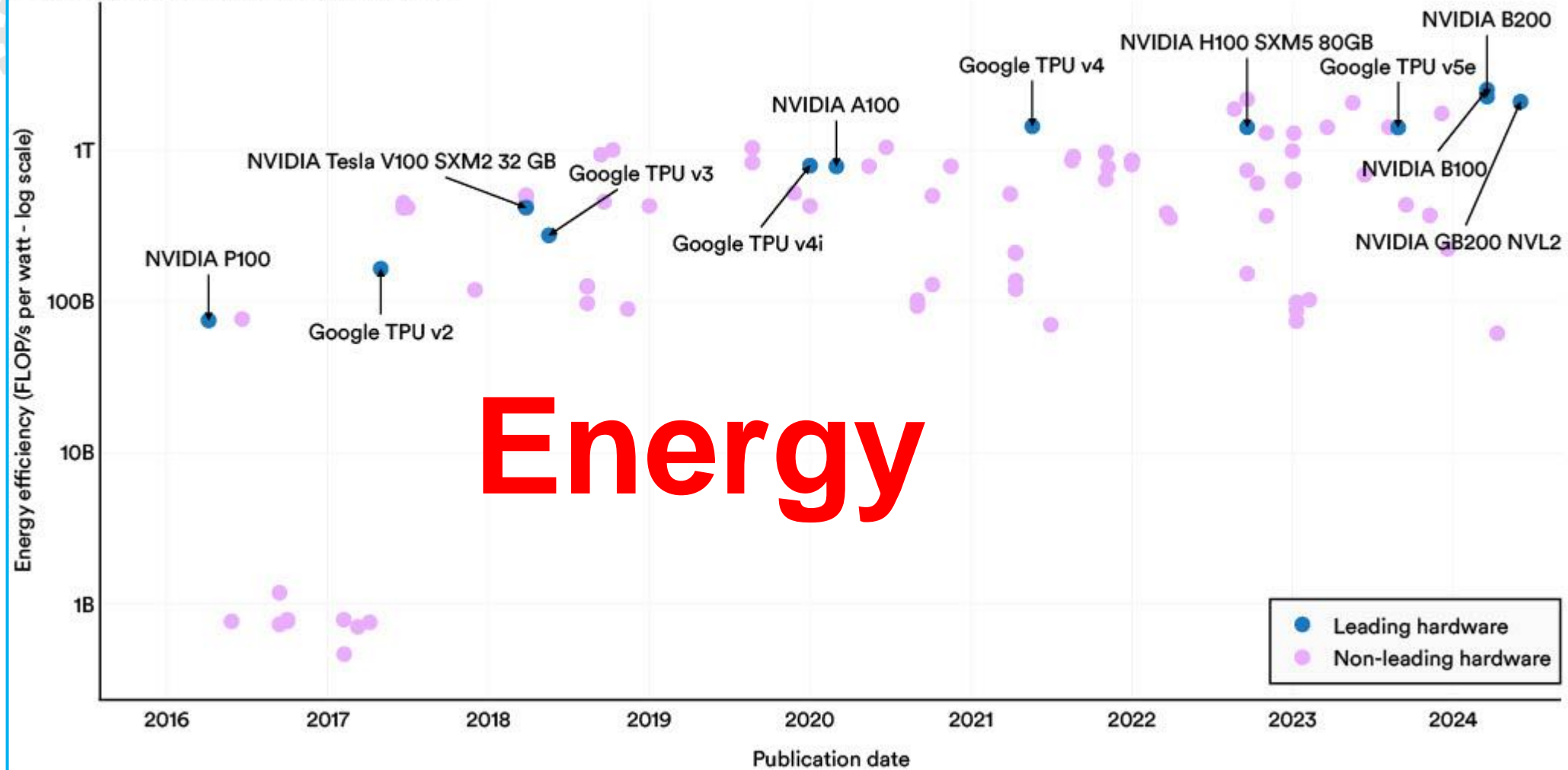
Estimated training cost and compute of select AI models

Source: Epoch AI, 2024 | Chart: 2025 AI Index report



Energy efficiency of leading machine learning hardware, 2016–24

Source: Epoch AI, 2025 | Chart: 2025 AI Index report

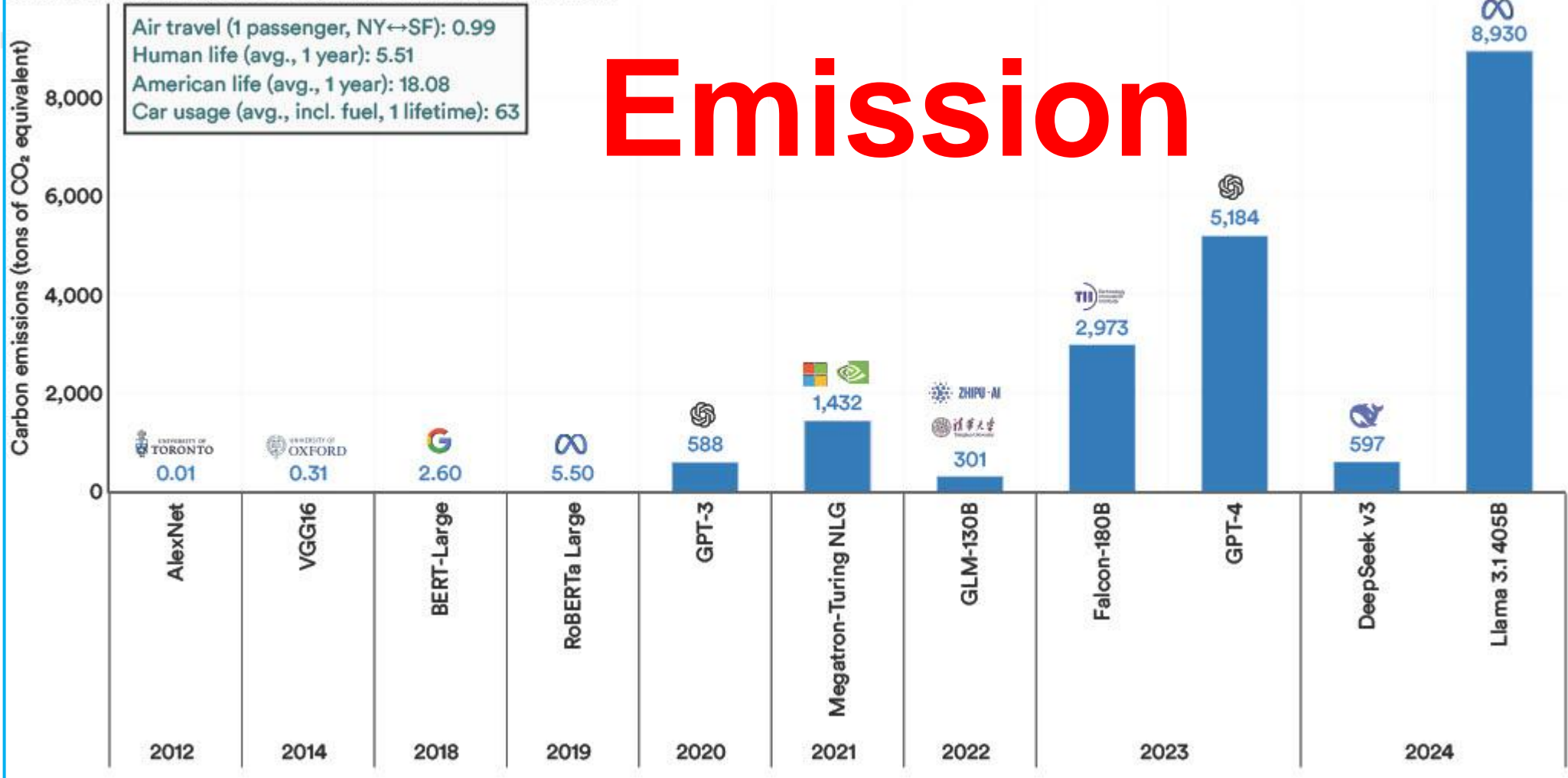


Energy



Estimated carbon emissions from training select AI models and real-life activities, 2012–24

Source: AI Index, 2025; Strubell et al., 2019 | Chart: 2025 AI Index report



Does AI help businesses?

AI IN BUSINESSES AND INDUSTRIES



Core Impacts and Benefits

Automation of Task

Predictive Analytics

Improved Efficiency and Productivity

Supply Chain Management

Decision Making

Cost Reduction

Innovation and Product Campaign

Product Visibility

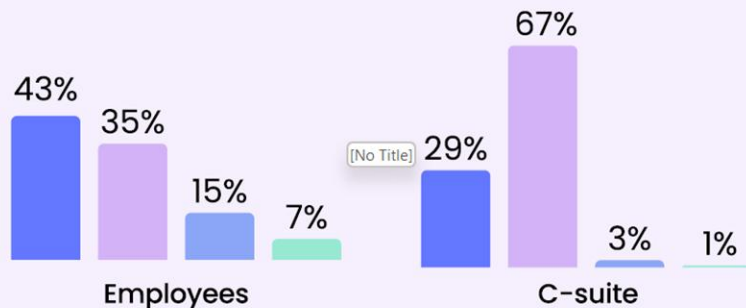


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Challenges of Implementing AI in Business

Who owns the generative AI strategy at your company and holds the power in AI-related decisions?

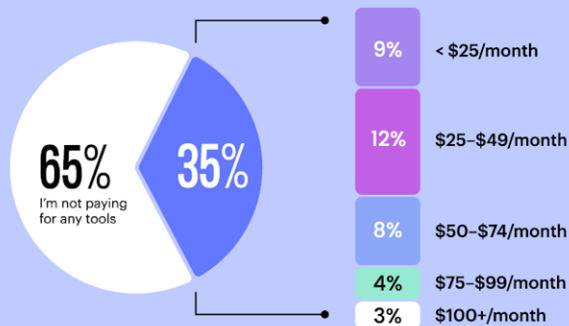
● IT teams and leaders ● Business teams / departments
● Executives ● Users / Employees



Power Struggles

Poor Quality Tools

Are you paying out-of-pocket for any of the generative AI tools you use at work, because your employer doesn't provide the tools you want?



Numbers may not add up to 100% due to rounding

Strategies to Maximize the Potential of AI

- ❖ Data Organization/Collection
- ❖ Formalize and Invest in AI Tools
- ❖ Nurture AI Champions
- ❖ Choosing Company-Specific Vendors

Over half of employees say the information provided by generative AI tools is regularly inaccurate, confusing, or biased.

94%

of the C-suite are not completely satisfied with their generative AI vendors.

Lack of ROI



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The Impact of AI on Sustainability

Exploring how Artificial Intelligence, integrated with IoT, drives sustainability in industrial environments.

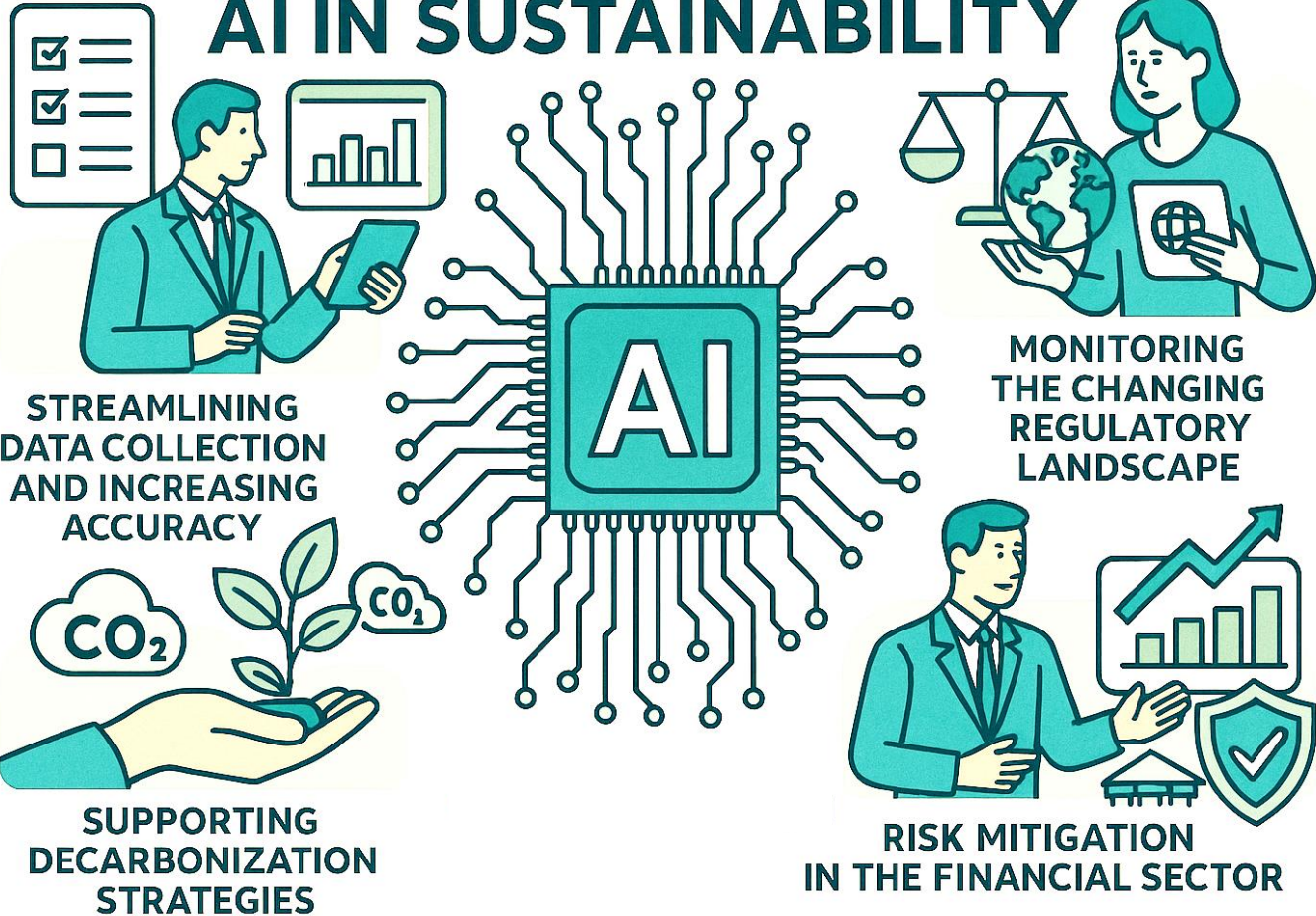


IoT- Internet of Things



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AI IN SUSTAINABILITY



Energy Efficiency
Water Conservation
Waste Management
Planning Accuracy
Streamline Projects

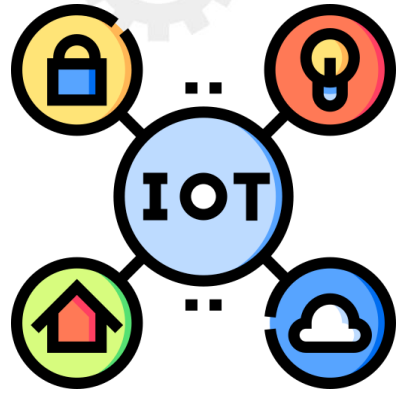
Stay in Compliance
Risk Management
Reputation
Operational Efficiency

Carbon Balance Sheet
Resources recovery
Broader Product Impact

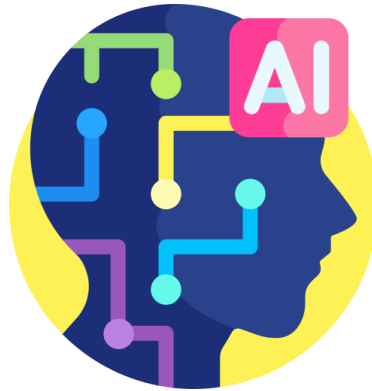
Product Marketing
Cost Savings
Sustainable Investment
Analytics



AI + IoT: A Powerful Duo



Real-Time Data
Continuous Monitoring
Integrated System



Data Collection
Analyze/Model
Actional Insights



Automated Intelligent Decision-Making
Predictive Maintenance
Adaptive Manufacturing
Enhanced Cybersecurity



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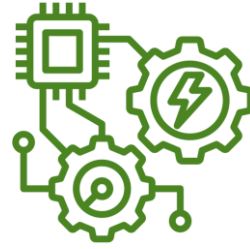
Dual Impact of AI & IoT on Sustainability



Process



Efficiency



Integration



Multigeneration



Economic



Environment

- Minimize resource consumption
- Identify and improve the units' burden to achieve theoretical goals
- Reliable operation and higher output rates
- Feasible desired output by using the same input
- Long-term profitability through green practices
- Driving Innovation with data-driven indicators
- Building resilience



Implementation Barriers

Data-Related Barriers

- Poor and complexity of Data Quality
- Lack of Integration
- Data Standard and Security Concerns
- Master Data Management

Technological Barriers

- High Upfront cost
- Lack of IT and data management system
- Integration complexity – More variable parameters
- Cybersecurity risk

Regulator and Policy Barriers

- Unclear Regulator Framework
- Data Privacy and Security Regulation
- Lack of standardization and Interoperability Standards

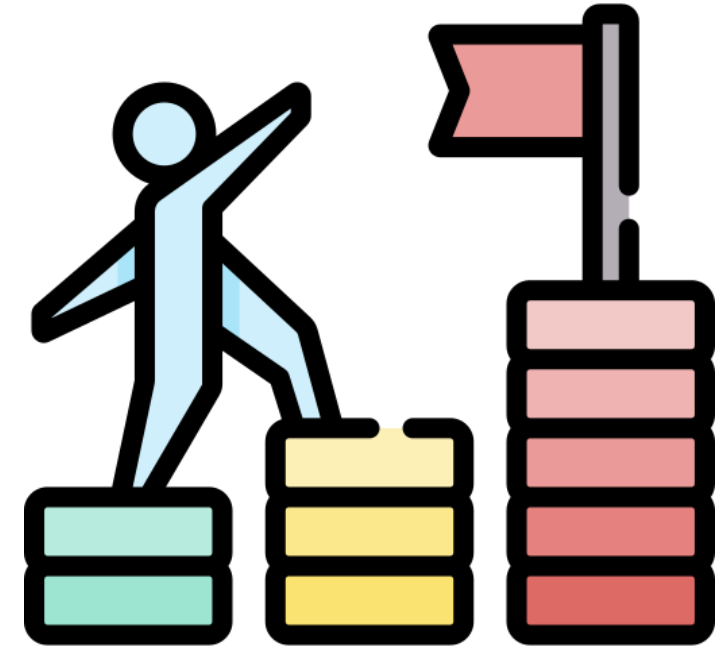
Organization and Human Factors

- Lack of Expertise and Skills
- Resistance to Change
- Unclear on ROI
- Ethical Concern



Steps-by-Steps: Integrating AI into your Sustainability Initiatives

- Identify Environmental Sustainability Goal (ESG) Priorities and Opportunities
- Build an ESG roadmap to drive investment decisions
- Identify Data Sources and Track Data Management Practices
- Plan Measurable Sustainability Projects
- Take Small steps with the Pilot Project
- Leverage Existing AI tools/ Start with Algorithms first
- Review data and engage sustainability experts
- Implement Simple AI solutions and monitor the results
- Scale gradually an AI-driven sustainability Initiative on the successes and learnings





Thank you

Contact

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