Geminus

AI for the Energy Transition

The industrial sector isn't prepared for the energy transition. It's stuck balancing carbon avoidance today with innovation for a carbon-free tomorrow using AI technology that can't capture the realities of industrial processes. This whitepaper explores the limitations of data-driven modeling for heavy industry and outlines a path forward by combining synthetic and real-world data using machine learning.

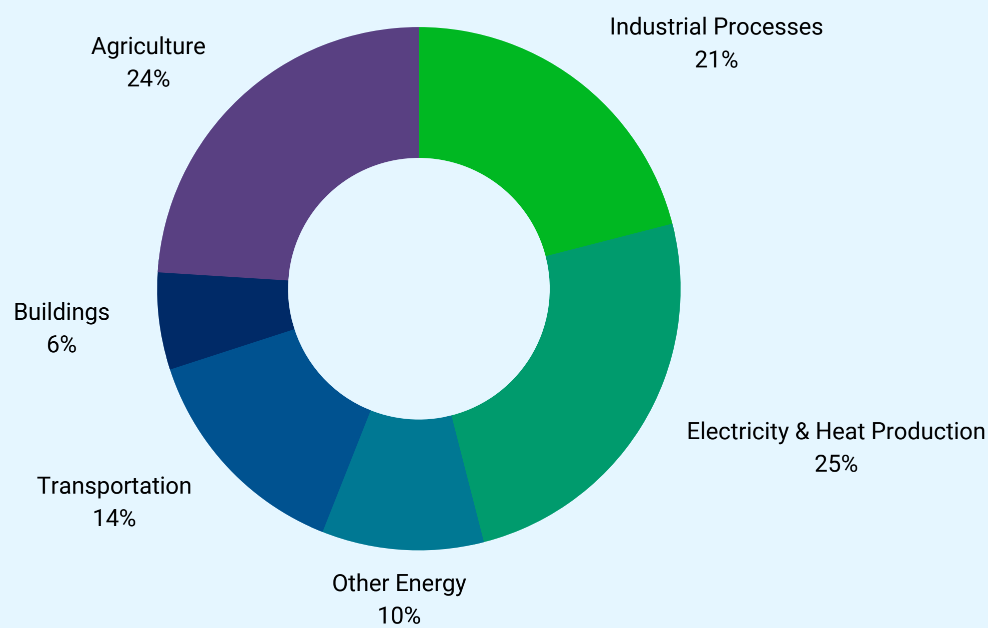
Physical technologies – such as batteries that store evermore energy, systems that pull CO_2 out of process streams, and hydrogen produced from renewable energy sources – are driving the energy transition. But commercializing these technologies is no small feat. Entering the market meaningfully requires these technologies to scale both technically and economically; many climate-tech solutions cannot check both boxes. The common enabling factor is predictive insight, which gives an understanding of how a given configuration will perform, or how to operate a system at maximum efficiency. Only with this insight can we ensure these ambitious solutions' technical and economic viability.

This is the promise of AI for the energy transition.

BCG estimates that by 2030, AI can reduce greenhouse gas emissions (GHGs) by 5-10% and create $1-$3 trillion in financial value via revenue growth and cost savings. To realize this vision, we need to go after major sources of emissions, starting with industrial processes and electricity & heat production, which make up 46% of global GHGs.

Global Greenhouse Gas Emissions by Economic Sector

According to the EPA and IPCC



To maximize the impact of AI, it has to both decarbonize the processes we have in place today and enable the scale-up of disruptive net-zero technologies. All while delivering a triple bottom line: **lower costs, maximum productivity, and the lowest carbon footprint possible.**

Traditional AI is at the Mercy of Data

AI's role in the energy transition depends on its ability to deliver true optimization. Walking the tightrope of minimizing energy consumption while delivering maximum performance demands a model that is both accurate and fast – giving trusted answers to the ideal selection from millions or billions of scenarios – often in seconds or less.

But traditional AI approaches are incompatible with industrial processes for two reasons:

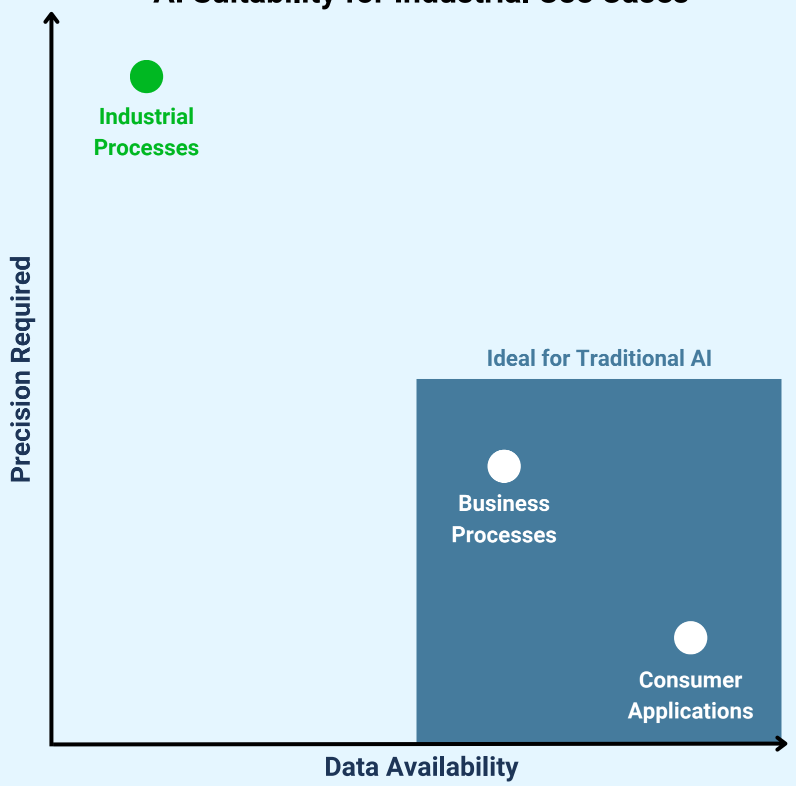
01

The precision required in industry is much higher than in typical AI use cases. Email marketing, payroll automation, and even ChatGPT tasks are less demanding than making sure a plant runs safely, profitably, and efficiently.

02

The quantity of data needed for traditional AI to succeed isn't available in industrial scenarios. Installing hundreds of sensors can be prohibitively expensive, and even then may fail to capture all the possible future scenarios that may unfold.

AI Suitability for Industrial Use Cases



Merging Synthetic and Real Data

Geminus overcomes the challenges of data-reliant AI by uniquely and scalably integrating reliable synthetic data with real-world data using machine learning. The result is intelligent models that precisely match the behavior of real systems, without the data pain associated with traditional AI approaches. The synthetic data comes from trusted physics-based simulations – commonly used industrial tools that accurately capture the behavior of complex systems but often require long computation times. Incorporating even a very sparse amount of real-world data enhances the accuracy of the simulated data, which enables the generation of extremely accurate and fast machine learning models. This is wrapped in a platform that repeatably outputs production-grade models, and in only days as opposed to weeks, months, or even years for data-heavy approaches.

Optimize Today and Scale Tomorrow

The industrial sector isn't prepared for the energy transition. It's stuck balancing carbon avoidance today with innovation for a carbon-free tomorrow using AI technology that can't capture the realities of industrial processes. Furthermore, the keyword is **transition**. Industrial companies need to decarbonize existing infrastructure while disruptive net-zero technologies come online. According to a recent MIT Technology Review study, the number one way digital technologies will help industrial decarbonization in the next 18-24 months is by improving existing processes. The best way to do this is by optimizing current energy systems like NGL plants, well networks, or combined cycle power plants to minimize carbon emissions without sacrificing productivity or energy security.

In parallel, Geminus tools can optimize methane detection sensing platforms to more rapidly identify the source of leaks, or enable carbon capture systems to come online, using readily available simulation tools eventually coupled with data from pilot plants. Finally, truly disruptive technologies such as geothermal power and green hydrogen can be scaled more efficiently with greater confidence as to the right configurations and operational settings to make these technologies truly viable.

Navigating the energy transition requires more than just new materials and hardware. We believe the right form of AI can be the difference between aspiration and reality, to make a bigger impact on the climate, faster.

Geminus

Geminus has taken a different approach to industrial AI, swapping purely data-driven techniques for the latest developments in computational science. Our next-generation predictive intelligence solution fuses measurement data and physics to power resilient and efficient decision-making in a fraction of the time. Enabling the optimization and decarbonization of existing infrastructure, while scaling tomorrow’s net-zero solutions.

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