The Promise of AI in Energy: Unlocking Energy Independence and Ensuring National Security

INTRODUCTION

The rise of artificial intelligence (AI) promises unparalleled advancements across every industry in the United States with the potential to enhance nearly every product and service through innovation. Energy is no exception. AI has the potential to revolutionize how we generate, distribute and consume power—transforming everything from demand forecasting to grid management and supply chain logistics. Yet, this promise hinges on a crucial bottleneck: the slow and expensive deployment of new energy resources.

Data centers, the backbone of digital economies and the entire AI industry, require vast amounts of power to process, store and analyze the data that fuels advancements. AI-powered search summaries require up to ten times as much power as typical search engine queries, driving unprecedented growth in electricity demand. According to the Electric Power Research Institute, domestic data center power demand could more than double by 2030 compared to today, with AI systems significantly contributing to this surge. Without the rapid expansion of reliable and affordable energy infrastructure, the growing energy needs of AI-driven technologies could outpace supply, threatening both innovation and domestic investments in a growing sector.

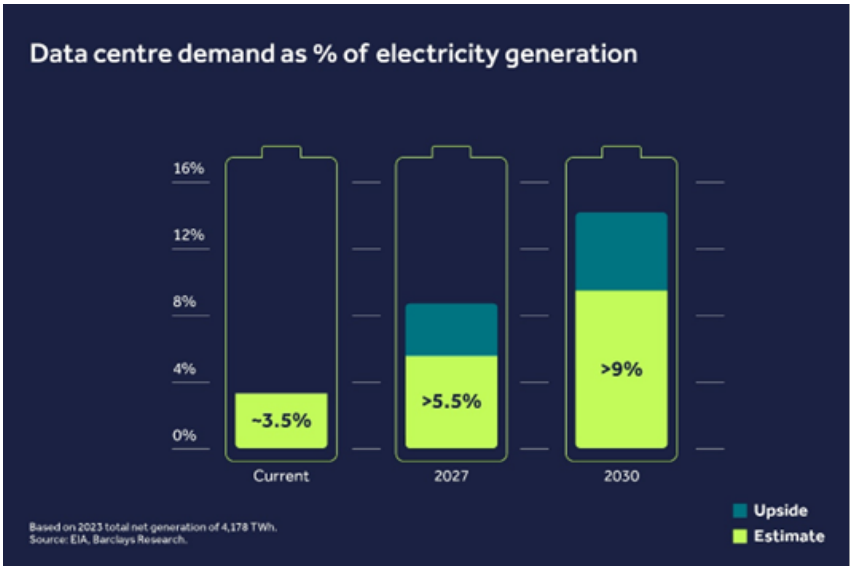

Figure 1: Barclays - Artificial Intelligence is hungry for power

THE NEED: GEOPOLITICAL RIVALS HAVE AN EDGE IN ENERGY DEPLOYMENT

Today, the United States is the global leader in AI, but maintaining this advantage is not guaranteed. Nations around the world—especially China—seek to supplant America's leadership role for their own purposes, both to empower their own industries and to better challenge America's geopolitical might. Policymakers are already showing significant and increasing interest in accelerating the country's leadership in this industry, but a serious threat remains. Poor energy policy could cede AI leadership to China, weakening our national security and economic wellbeing, while also increasing global greenhouse gas emissions.

Figure 2: Stanford University - Global AI Power Rankings: Stanford HAI Tool Ranks 36 Countries in AI

To maintain AI leadership, policymakers must foster a regulatory environment where datacenters continue to be quickly built in the U.S. There are two major reasons for continuing to promote domestic datacenter deployment. First, when data is stored outside U.S. borders, Americans lose control over it, posing security and privacy risks. Second, there is a benefit for proximity as datacenters used for AI applications must be located close to one another to maximize effectiveness in real-world applications, although this is less important for AI model training. By building AI datacenters domestically, we can ensure enhanced security and greater control over data and benefit from efficient and effective models.

Unfortunately, American developers are finding it increasingly difficult to access to the energy necessary to keep up with the growing demand for datacenters. As energy

demand is rapidly increasing, it is becoming harder and harder to bring new power resources onto the U.S. grid in a timely and affordable manner. The United States faces a critical bottleneck: outdated permitting processes that stifle the development of the diverse energy resources needed to sustain AI-driven growth.

In stark contrast, China is deploying new forms of energy generation at a rapid pace, largely due to lavish subsidies and limited environmental regulations. Rapid energy infrastructure expansion positions China to meet these challenges head-on, with fewer permitting and environmental constraints. Without reforms, America risks ceding strategic ground to hostile nations who recognize the integral connection between energy and AI deployment.

To maintain a competitive edge in AI, the U.S. must accelerate the deployment of domestic energy projects with an "all-of-the-above" outlook. Specifically, policymakers need to prudently utilize every tool available including streamlining our permitting and regulatory system to remove unnecessary obstacles and create a tax code that accelerates energy deployments. Strengthening energy infrastructure is not just a domestic priority, it is a geostrategic necessity for securing AI leadership and ensuring that America remains at the forefront of technological and economic innovation.

THE OPPORTUNITY: AI'S ROLE IN TRANSFORMING THE ENERGY SECTOR

AI offers transformative capabilities with the potential to significantly enhance the efficiency, stability and sustainability of our energy system. By leveraging advanced data analytics, AI can make energy systems more adaptable, responsive and reliable across a range of applications. As the U.S. needs more electricity and energy, AI can help our nation meet this growing demand by improving existing operations and accelerating the deployment of new technologies.

Key AI Benefits for the Energy Sector:

1. **Equipment Reliability Optimization**: AI-driven predictive maintenance and fault diagnostics enhance the reliability and lifespan of energy assets by identifying and addressing issues before they escalate.
2. **Operational Efficiency and Optimization**: Advanced algorithms improve energy generation, storage and distribution efficiency while reducing waste and optimizing performance across the value chain.
3. **System Management and Forecasting**: AI enables real-time grid monitoring and accurate demand forecasting to ensure stability, prevent outages and balance energy supply with consumption.
4. **Infrastructure Planning**: AI tools optimize site selection, design and upgrades

of energy infrastructure, aligning investments with future energy demands and geographic factors.

5. **Sustainability and Compliance**: By monitoring emissions, detecting leaks and automating compliance reporting, AI supports organizations in meeting environmental goals and regulatory requirements.
6. **Market and Resource Management**: AI enhances energy trading, pricing strategies and supply chain logistics, improving market efficiency and reducing resource transportation costs.
7. **Resource Development Support**: From hydrocarbon exploration and production to weather forecasting, AI supports the safe and efficient development of energy resources by providing actionable insights.
8. **Innovation and Lifecycle Analysis**: AI accelerates research and development while optimizing the lifecycle performance of energy assets to ensure sustainable, long-term operations.
9. **Stakeholder Engagement**: AI-powered analytics and tools foster better communication and education, empowering stakeholders with insights into energy systems and their benefits.
10. **Risk Management**: AI strengthens cybersecurity defenses and ensures operational safety by detecting vulnerabilities and addressing potential threats.

These applications are only a glimpse into how AI can unlock all of America's energy resources for a secure, affordable and clean future. It is important to note that many of these applications can be used across the entire energy sector and they are rarely specific to one industry over another.

AI Benefits to the Energy Sector by Industry

Benefit	Energy Storage	Electric Grid	Geo-thermal	Hydro	Nuclear	Oil & Gas	Wind & Solar
Reliability Optimization	✓	✓	✓	✓	✓	✓	✓
Operational Optimization	✓	✓	✓	✓	✓	✓	✓
System Management		✓				✓	
Infrastructure Planning		✓		✓		✓	✓
Sustainability & Compliance		✓			✓	✓	✓
Market Management	✓	✓				✓	✓
Resource Development			✓	✓		✓	✓
Innovation	✓	✓	✓	✓	✓	✓	✓
Education & Engagement		✓		✓	✓	✓	✓
Risk Management	✓	✓	✓	✓	✓	✓	✓

By leveraging these benefits, the United States can build an energy system that is not only more robust and adaptable but also equipped to meet the demands of a growing economy. Alignment between energy innovation and technological advancement is essential for ensuring America's leadership in both energy and AI.

POLICY PARADIGM: HOW TO RAPIDLY UNLEASH AFFORDABLE ENERGY

To secure America's leadership in both AI and energy innovation, we need to deploy energy infrastructure faster than ever. Failing to expand energy infrastructure quickly may lead to energy demands outpacing energy supplies. Policymakers must adopt an all-of-the-above energy strategy to avoid this emerging energy crisis by:

1. Providing financial incentives for new energy resources
2. Reforming our nation's permitting system
3. Providing robust research funding for AI energy applications
4. Streamlining intergovernmental coordination related to AI and energy

TARGETED AND LIMITED INCENTIVES

The federal government has a long history of incentivizing energy production, recognizing its essential role in economic growth and national security. Early federal efforts included monumental projects like the Hoover Dam, which provided reliable hydroelectric power and water resources, and the Rural Electrification Act, which brought electricity to millions of Americans, transforming rural economies. As energy demands grew, federal incentives evolved to address emerging challenges and opportunities. Federal support for nuclear energy, hydraulic fracturing, transportation fuels and renewable energy were all important to accelerate the scaling of technologies to ensure affordability and address energy security concerns.

Looking ahead, the federal government must continue its leadership in driving energy innovation through targeted policies. Targeted tax credits, especially those that provide support to accelerate the deployment of technologies that increase energy production while reducing emissions, are critical to ensure timely deployment of affordable, reliant and abundant energy. Recent studies indicate that these tax credits will help reduce household energy bills by up to $489 per year. A diverse mix of energy resources will increase energy production, drive down emissions and ensure resilient supply.

PERMITTING REFORM

While federal incentives are useful in driving energy innovation and production, they alone cannot address the growing urgency of deploying energy resources and infrastructure at the pace required to meet AI-driven demand. Projects often face years or decades of

delays due to outdated permitting processes and regulatory bottlenecks, leading to supply constraints and increased energy costs. America's ambition for AI-driven progress is stymied by delays and canceled projects, delays which will not be felt by competing nations like China.

To ensure energy projects move from concept to reality, policymakers must enact significant reforms to America's broken permitting system. Streamlining the permitting process complements targeted incentives, enabling the rapid expansion of energy resources needed to power AI advancements and secure America's position as a global leader in technology and energy innovation. Without comprehensive permitting reform, the United States will fall behind in the global AI race as energy infrastructure constraints stifle progress and innovation.

CONTINUING SUPPORT FOR AI-ENERGY RESEARCH AND DEVELOPMENT

Sustained funding for Department of Energy (DOE) programs, particularly for our national laboratories and research and development programs, is critical to advancing the application of AI in energy. These programs drive innovation and find breakthroughs in areas such as renewable energy integration, advanced nuclear systems and carbon capture technologies. By exploring AI-driven solutions, the U.S. can enhance the efficiency, reliability and sustainability of our energy systems. The following initiatives are particularly interesting to ensure America's leadership in both AI and energy:

- **Argonne National Laboratory (ANL):** Carbon management, electric grid reliability, market clearing and operations, material science, etc.
- **National Energy Technology Laboratory (NETL):** Carbon management, cybersecurity, materials science, plant optimization, subsurface exploration, etc.
- **Oak Ridge National Laboratory (ORNL):** Energy system optimization, energy efficiency in AI, materials science, AI security, etc.
- **Idaho National Laboratory (INL):** Energy system optimization, emergency response, nuclear energy, nuclear fuels, etc.
- **Los Alamos National Laboratory (LANL):** Electric grid optimization, energy-related supercomputing, fusion energy, subsurface storage, etc.
- **Advanced Research Projects Agency–Energy (ARPA-E):** Data center cooling, electric grid optimization, materials science, subsurface drilling, etc.

Continued support for these programs will enable the development of cutting-edge tools for the public good. Investment in national labs, ARPA-E and other DOE programs can ensure that the U.S. remains at the forefront of innovation, leveraging AI to address complex challenges and create a more robust and adaptable energy infrastructure. Expanding partnerships between DOE, private industry and academic institutions could

further accelerate the commercialization of AI technologies, maximizing their impact across the energy sector.

ENSURE AI'S SEAT AT THE TABLE

To align national energy strategies with technological advancements, integrating the White House's AI Czar into a newly formed National Energy Council (NEC) is prudent. This inclusion could foster cross-sector collaboration, ensuring that federal energy policies and regulations are informed by both the unique energy needs of data centers and the significant opportunities AI provides. By bringing together key stakeholders from government, industry and research, the NEC can effectively serve as a unified body to drive innovation, coordinate initiatives and streamline efforts to modernize the energy sector, protect America's national interests and better utilize all of America's energy resources.

CONCLUSION

To maintain leadership in AI and energy innovation, the United States must act decisively to address the dual challenges of affordable energy deployment and infrastructure modernization. Without comprehensive permitting reform, the U.S. risks ceding AI leadership due to delays and bottlenecks. By accelerating the development of diverse and reliable energy resources through streamlined permitting and targeted incentives, America can meet the growing energy demands of AI technologies, bolster its geopolitical influence and ensure a future defined by innovation, security and economic progress.