TECFUSIONS

NATURAL GAS AS PRIMARY POWER FOR DATA CENTERS

CHALLENGES & SOLUTIONS

WHITE PAPER

INTRODUCTION

As data centers scale to meet the demands of a digital-first world, the need for reliable, efficient, and sustainable primary power sources has never been greater. TECfusions is pioneering the integration of natural gas as a primary energy solution, moving beyond its traditional role as backup to become the mainstay of data center power infrastructure. This transition addresses both operational imperatives and sustainability objectives, positioning TECfusions at the forefront of energy innovation for mission-critical facilities.

The market for natural gas is experiencing a renaissance, driven in large part by the explosive growth in data center power demand. Industry forecasts project that up to 6 billion cubic feet per day of new natural gas demand could be added by 2030[1] solely to generate electricity for data centers, as operators increasingly favor on-site generation to ensure reliability and cost control. Natural gas remains the most affordable and dependable option for meeting the immense and continuous baseload requirements of hyperscale data centers, especially as advancements in renewables have yet to fully address the challenges of round-the-clock power delivery.

"Natural gas is no longer just a backup-it's the backbone of reliable, sustainable power for the world's most demanding data centers."

Melissa Farney
Director of Marketing

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THE CASE FOR NATURAL GAS AS PRIMARY POWER

The exponential growth in data center services is driving unprecedented demand for energy that is not only reliable and scalable but also environmentally responsible. As digital infrastructure becomes more integral to global commerce and communication, the stakes for uninterrupted, high-quality power supply have never been higher. Natural gas is emerging as a pivotal solution in this landscape, offering a unique combination of efficiency, operational reliability, and a lower emissions profile compared to traditional fossil fuels.[2]

Unlike renewable energy sources such as solar and wind, which are subject to intermittency and require significant storage solutions to ensure round-the-clock availability, natural gas delivers consistent baseload power. Modern combined-cycle natural gas plants routinely achieve capacity factors of 80% or higher, making them ideally suited to the 24/7 operational requirements of hyperscale and enterprise data centers.[2] This capability ensures that mission-critical digital operations remain unaffected by fluctuations in weather or grid instability.

Recognizing these advantages, utilities and energy providers are planning significant expansions in natural gas infrastructure specifically to support the data center sector. As a result, natural gas is increasingly viewed not just as a transitional fuel, but as a cornerstone of both current operations and the broader shift toward a cleaner, more resilient energy mix. This strategic positioning makes natural gas an essential component in the pursuit of sustainable, future-proof data center power.

KEY ADVANTAGES OF NATURAL GAS FOR PRIMARY POWER

Efficiency and Reliability

Natural gas-fired power plants are distinguished by their exceptional operational flexibility, a crucial attribute for data centers that experience fluctuating and often unpredictable power demands. These plants can rapidly adjust their output to match real-time load requirements, ensuring a consistent and uninterrupted power supply that is essential for mission-critical digital operations. The reliability of natural gas as a primary power source is further enhanced by its delivery infrastructure. Natural gas is transported through an extensive underground pipeline network, which is inherently protected from weather-related disruptions and logistical challenges that can affect above-ground fuel supply chains. This robust supply chain means that data centers powered by natural gas are less susceptible to outages, supporting the high-availability standards demanded by the industry.

Accessibility

Natural gas is delivered through pipelines on demand, which allows data center managers to closely control their supply and budget. Natural gas supply and delivery are extremely reliable, since pipelines are typically underground and protected from the natural elements, although human error or natural disaster induced disruptions sometimes occur. The natural gas pipeline system comprises of a huge network of pipelines, so many pathways are available to transporting gas from one point to another. As the gas supply becomes more interconnected and diversified, the impact of disruptions decreases.

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KEY ADVANTAGES OF NATURAL GAS FOR PRIMARY POWER (CONT'D)

Environmental Benefits

Natural gas is widely recognized as the cleanest-burning fossil fuel, producing substantially lower emissions of carbon dioxide, nitrous oxides, and particulates compared to coal or diesel. According to the U.S. Energy Information Administration, natural gas emits nearly 50% less CO_2 than coal when combusted,[3] and 15–20% less than gasoline. Its adoption for power generation has played a significant role in reducing carbon emissions from the electricity sector, with the United States achieving the largest decline in CO_2 emissions since 2005 largely due to the shift from coal to natural gas.[4]

Beyond carbon dioxide, natural gas combustion releases far fewer harmful air pollutants than other fossil fuels. These reductions translate into significant public health benefits, as such pollutants are linked to respiratory illnesses, cardiovascular disease, and other serious health conditions. For data centers, which are rapidly becoming some of the largest consumers of electricity, this cleaner emissions profile is essential to meeting both regulatory requirements and ambitious corporate sustainability targets. In particular, for data centers that are sited near urban or suburban populations, the use of natural gas can help improve local air quality and reduce the facility's overall environmental footprint.

Natural gas also plays a pivotal role as a transitional fuel in the broader shift toward renewable energy. While renewables like wind and solar are expanding rapidly, their intermittent nature and current storage limitations mean they cannot yet provide the consistent, 24/7 baseload power required by data centers. Natural gas, with its high efficiency and rapid dispatch capability, complements renewables by providing reliable power when solar and wind output is low. This synergy allows data centers to maximize their use of renewables without sacrificing reliability, supporting a sustainable energy mix as the industry evolves. As technological advances continue to reduce methane leakage and improve extraction practices, the environmental benefits of natural gas are expected to further increase, reinforcing its role as a key enabler of cleaner, more resilient data center operations.

By leveraging natural gas as a primary energy source, data centers can make meaningful progress toward ambitious sustainability targets while maintaining the operational excellence required by their customers and stakeholders.

Economic Advantages

From an economic perspective, natural gas offers considerable cost savings over alternative fuels. Data center operators can expect to save 38 to 45 percent on fuel costs per kilowatt-hour compared to diesel,[5] a benefit that is particularly pronounced for large-scale and hyperscale facilities with substantial energy needs. The price stability and lower cost of natural gas not only reduce operational expenditures but also help insulate data centers from the volatility of electricity markets. Additionally, on-site natural gas generation opens up new revenue opportunities. Depending on local utility regulations and market conditions, operators may be able to sell excess power back to the grid, participate in demand response programs, or provide grid emergency response services—further enhancing the economic case for natural gas as a primary power solution.

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NATURAL GAS VS. ALTERNATIVE ENERGY SOURCES

While data centers have traditionally relied on grid electricity supplemented by diesel generators, the evolving landscape of energy generation presents a range of primary power options—each with distinct advantages and trade-offs. Natural gas, diesel, and renewables such as solar and wind are the primary contenders, but their suitability for large-scale, mission-critical data center operations varies significantly.

Natural gas distinguishes itself by offering a reliable, always-available baseload power source that is both cleaner and more cost-effective than diesel. Its extensive pipeline infrastructure ensures a steady supply that is largely immune to the delivery disruptions that can affect liquid fuels. In contrast, diesel generators, while capable of rapid response and high-power density, are typically reserved for backup due to their higher emissions, operational costs, and fuel storage limitations. Diesel's environmental impact and increasingly stringent regulations further constrain its viability as a primary power source for modern data centers.

Renewable energy sources, including solar and wind, are essential for society's long-term sustainability goals. However, their intermittent nature and dependence on weather conditions mean that, without substantial energy storage solutions, they cannot yet provide the consistent, around-the-clock power required by hyperscale data centers. While renewables can and should be integrated into the energy mix, often in hybrid configurations with natural gas, natural gas remains the most practical and scalable solution for delivering reliable, low-emission baseload power today. As storage technologies mature and grid infrastructure evolves, the balance between these sources will continue to shift, but at present, natural gas offers a compelling combination of reliability, environmental performance, and economic value for primary data center power.

Feature/Benefit	Natural Gas	Diesel Generators	Renewables (Solar/Wind)
Emissions	Low (cleaner fuel)	High	None (but intermittent)
Supply Chain	High (pipeline network)	Vulnerable to disruptions	Weather-dependent
Cost per kWh	Lower than diesel	Higher	Variable (storage needed)
Baseload Capacity	Yes (24/7 operation)	No (backup only)	No (intermittent)
Permitting	Easier (lower emissions)	Challenging	Easiest
Monetization	Yes (grid services)	Limited	Yes (when grid-connected)

Fig. 1 Natural Gas vs. Alternative Energy Sources

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IMPLEMENTATION CONSIDERATIONS AT TECFUSIONS' DATA CENTER LOCATIONS

TECfusions' Keystone Connect site in Upper Burrell, Pennsylvania, exemplifies this innovative approach to data center deployment, leveraging on-site natural gas resources and advanced infrastructure to deliver scalable, resilient, and sustainable digital operations. There were many important considerations and key factors as we sought out this megascale location that would implement natural gas as the primary power source.

Site Assessment and Feasibility

One of the first steps is to assess pipeline access, local utility agreements, and the regulatory environment to determine suitability for natural gas as a primary power source, then to evaluate existing infrastructure and the potential for integration with renewable energy sources to further enhance sustainability.

Keystone Connect benefits from a unique position within Pennsylvania's energy landscape, situated on a 1,395-acre property that includes on-site natural gas fracking and drying stations. This direct access to natural gas not only ensures a reliable and cost-effective fuel supply for power generation but also reduces exposure to market volatility and supply chain disruptions common with external fuel sourcing.

The site's existing industrial infrastructure, inherited from the former Alcoa R&D campus, supports rapid adaptation for high-density data center use, with 12 MW of capacity already available and a roadmap for 3 GW at full capacity. Local utility agreements, regulatory frameworks, and the opportunity to export excess power to the grid are all being evaluated to maximize both operational efficiency and community benefit.

Operational Integration

TECfusions recognized the need to design systems for seamless transition between grid and on-site generation, ensuring redundancy and maximizing uptime. This included considering how to future proof for hybrid models that combine natural gas with renewables, using gas as a stable baseload and renewables for peak shaving or further emissions reduction as alternative energy sources become more viable.

The Keystone Connect facility is designed for operational flexibility and resilience. On-site natural gas power generation forms the backbone of the campus's energy strategy, enabling dual utility and microgrid capabilities that ensure uninterrupted uptime even in the face of grid instability or external disruptions. The integration of on-site generation with the regional grid allows for seamless transitions between utility and locally produced power, providing redundancy and maximizing operational uptime. As the project scales, TECfusions is also exploring hybrid models that incorporate renewable energy sources to further reduce emissions and support peak shaving strategies. This layered approach enables the site to maintain a stable baseload with natural gas while leveraging renewables for additional sustainability gains.

KEY DECISION CHECKLIST

- Conduct comprehensive site and infrastructure assessments to confirm pipeline access and supply chain reliability.
- Engage with local utilities and regulators for net metering, streamlined permitting, and incentive maximization.
- Develop phased implementation plans, allowing for integration with future renewable technologies.
- Consider site infrastructure and redundancy needs, as well as ways to align with corporate sustainability and growth objectives.
- Monitor and optimize system performance, leveraging data analytics for continuous improvement.

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IMPLEMENTATION CONSIDERATIONS AT TECFUSIONS' DATA CENTER LOCATIONS (CONT'D)

Regulatory and Permitting

NNatural gas systems generally face fewer permitting hurdles due to their lower emissions, allowing for more rapid deployment and greater capacity expansion within regulatory limits. TECfusions' Keystone Connect is fortunate benefit from a favorable regulatory environment, particularly because of the adaptive reuse of the former industrial site which streamlines permitting and accelerates deployment, allowing TECfusions to bring capacity online quickly to meet the surging demands of AI and high-performance computing workloads. The project's eligibility for Pennsylvania's Redevelopment Assistance Capital Program (RACP) grant underscores this alignment with state priorities for sustainable redevelopment and economic revitalization.

Additionally, the project's phased deployment ensures that expansion aligns with both market demand and evolving regulatory requirements, while ongoing engagement with local and state authorities ensures continued compliance and community support. TECfusions' commitment to exporting excess power positions Keystone Connect as not only a consumer but also a potential contributor to regional grid stability and sustainability.

In summary, the Keystone Connect site in Upper Burrell demonstrates how strategic integration of on-site natural gas resources, adaptive infrastructure reuse, and advanced operational design can deliver a resilient, efficient, and sustainable data center campus—setting a new standard for the industry in both scale and environmental responsibility.

CONCLUSION

Natural gas is not just a backup solution—it is a robust, efficient, and sustainable primary power source for the next generation of data centers. By adopting natural gas as a cornerstone of our energy strategy, TECfusions can deliver unmatched reliability, cost efficiency, and environmental stewardship, setting a new standard for digital infrastructure. As the demands of AI, cloud computing, and digital services continue to accelerate, only solutions that combine operational excellence with environmental responsibility will stand the test of time. With our innovative approach and commitment to on-site generation, TECfusions is poised to lead the industry into a new era of resilient, future-ready data center power.

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About

TECfusions is a global data center operator dedicated to innovative, sustainable technology and energy-efficient solutions. With over thirty sites operational or in due diligence worldwide, we specialize in designing, building, and managing next-generation data centers for AI and HPC. The strategic approach for adaptive reuse of industrial facilities enables rapid deployment and market readiness, delivering capacity in record time. Additionally, we are committed to dedicated microgrid integration for on-site energy infrastructure. Our environmentally enhanced configuration technology is in high demand by global tenants for lower cost data center operations for new build and existing aging infrastructure.