SOLUTIONS TO MEET THE GLOBAL ENERGY SECURITY DEMANDS OF TODAY AND TOMORROW

The Future of Energy Starts with Us

Honeywell

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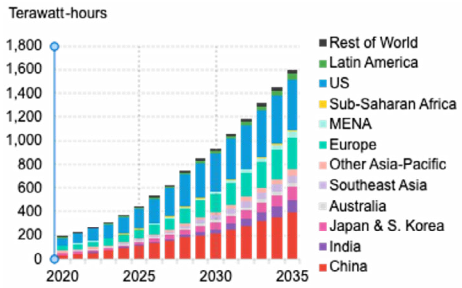
EXECUTIVE SUMMARY

The world stands at a critical moment in its pursuit of energy security. As population growth, rapid economic advancements, and the increasing reliance on energy-intensive systems, such as data centers, drive demand skyward, the global requirement for energy will significantly surpass today's levels. BloombergNEF anticipates a 32% surge in worldwide energy demand by 2050, with electricity needs projected to rise even more sharply by 75% in the same timeframe.[1]

Global data center power demand outlook by market, 2015-2035, Economic Transition Scenario
BloombergNEF



Energy markets are responding and evolving at an unprecedented rate. Regional variables such as resource availability, consumer demand, and economic realities, are forcing markets to evolve distinctly. **Simultaneously, governments are advancing policies and regulations to meet their own region's unique energy security objectives – impacting ever-expanding, interconnected global energy markets.**

The United States is uniquely positioned to navigate these complexities and lead global energy security efforts, which will also ensure efficiency, environmental responsibility, and affordability. To do this, there are three critical pathways to pursue, each requiring sound energy policies and technological innovation.

THE PATHWAYS TO ENERGY SECURITY

Enhance Efficiency

New technologies like artificial intelligence (AI) and automation can optimize existing energy systems and processes (e.g. exploration & production, smart grids, refineries) and help integrate new energy sources more swiftly and efficiently. Using AI can drive more efficient and cost-effective demand side energy management applications, energy production, and transport.

Augment The Energy Mix

Unleashing domestic energy resources, like liquefied natural gas (LNG), is critical for energy security. By establishing markets for low-carbon hydrogen, ammonia, and liquid organic hydrogen carriers (LOHC), the U.S. can gain a competitive edge in the global energy landscape. The increased energy demand will foster growth in these emerging energy markets and stimulate investment in carbon capture technologies, which can enhance domestic production efficiencies, including through improved oil recovery and support for cleaner power generation.

Facilitate the Deployment of Next-Generation Fuels

Energy security is closely linked with the need to enable the fuels of tomorrow, like Sustainable Aviation Fuel (SAF) and Electro-Sustainable Aviation Fuel (eSAF). Investing in the expansion and modernization of infrastructure for both traditional and next-generation fuels will foster local economic development and ensure that energy is where it is needed, when it is needed most.

Policy frameworks that facilitate these three pathways can preserve established markets, while helping develop and sustain tomorrow's energy markets. These include policies that **leverage the use of natural resources, facilitate project development, modernize the grid and deploy energy storage technologies, and protect and promote incentives for next-generation energy technologies.**

The United States, as one of the world's largest energy producers and consumers, is uniquely positioned to lead the next global energy evolution through innovative technologies that create value domestically and can be exported to global markets. However, the journey toward energy security in the U.S. will hinge on the collective ability of stakeholders to embrace technological advancements and enact supportive policies. The only way to achieve a resilient and secure energy future that meets the demands of a growing population while upholding environmental stewardship is through concerted and collaborative action across industry, technology, and government.

THE PATH TO ENERGY SECURITY STARTS BY ENHANCING EFFICIENCY

Enhancing energy efficiency is the cornerstone of the pathway to achieving energy security. According to a recent survey conducted by Honeywell of 300 U.S. decision-makers and influencers in energy and energy-adjacent industries, **91% of stakeholders believe that AI has near-term potential to enhance energy security, but only 12% of respondents indicated that AI is currently a critical part of their energy operations.** By improving the ways energy is generated, distributed, and consumed, energy producers can maximize output while minimizing waste and make better use of existing resources. This requires leveraging advanced technologies, such as artificial intelligence (AI) and advanced automation. These technologies can analyze vast amounts of data, optimize operations across various sectors—from the power grid to refineries—and improve decision-making in real time.

The industrial landscape is witnessing a significant generational shift – the aging workforce is retiring, creating substantial skills gaps. The implementation of AI can help address this pressing challenge and serve as a powerful enabler for less experienced professionals to augment their capabilities. AI also offers an opportunity for organizations to reimagine job roles within the energy industry. As AI technologies take over repetitive and routine tasks, this shift empowers employees to engage in complex problem-solving, enabling them to make informed decisions that significantly contribute to operational success.

Policy Focus: Efficiency and Grid Reliability

Policy support is equally essential, as regulatory initiatives can incentivize innovations and facilitate the adoption of energy-efficient technologies. This holistic approach delivers immediate cost savings while also laying the groundwork for sustainable practices that contribute to a more secure and resilient energy landscape in the long run.

Grid reliability is particularly paramount to overall energy security. Interconnection queues have large backlogs and the review and permitting process by regulators can be a lengthy process. Estimates show that total capacity of energy projects in U.S. interconnection queues grew 40% year-over-year in 2022, with more than 1,350 GW of generation and 680 GW of storage waiting for approval to connect.[2] Integrating innovative technologies can improve efficiency, reliability and development of new energy sources. Policymakers have an opportunity to:

1. Ensure full use of smart grid technologies to optimize energy use, reduce waste and promote grid-enhancing technologies, like AI, which would help bring projects on the grid more efficiently and rapidly.
2. Enact government incentives to commercially demonstrate and scale-up energy storage technologies, like long-duration energy batteries, which would support energy deployment.

THE PATH TO ENERGY SECURITY IS BOLSTERED BY AUGMENTING THE ENERGY MIX

To effectively augment the energy mix, it is crucial to promote domestic energy resources, particularly liquefied natural gas (LNG), to ensure energy security. By leveraging America's abundant natural gas reserves, LNG can enhance the stability of the energy supply while reducing reliance on foreign energy sources, boosting both national security and economic growth. Global demand for liquefied natural gas (LNG) is forecast to rise by around 60% by 2040, largely driven by economic growth in Asia, emissions reductions in heavy industry and transport as well as the impact of artificial intelligence.[3]

In addition to LNG, establishing markets for low-carbon hydrogen, ammonia, and liquid organic hydrogen carriers (LOHC) is essential for positioning the U.S. competitively within the global energy landscape. Hydrogen, with its high energy density and clean-burning properties, is a complement to fossil fuels in industries such as steel production, refining, and chemicals manufacturing. By investing in the infrastructure and technologies necessary to facilitate the production and distribution of low-carbon hydrogen and its derivatives, the U.S. can meet domestic energy needs and become a leader in the international market for clean energy products.

Scaling alternative energy sources such as hydrogen and ammonia is critical for the United States to participate in global markets. As Europe and China are advancing their efforts in clean energy technologies, featuring expedited infrastructure development and commitments to accelerate innovation, it becomes increasingly vital for the U.S. to develop and integrate these resources into its energy framework.

A shift toward emerging energy markets has far-reaching implications, stimulating investment in advanced carbon capture technologies. The refining sector accounts for approximately 15% of global CO_2 emissions[4] and presents significant opportunities with Carbon Capture Utilization and Storage (CCUS) technologies. Proven carbon capture solutions are available today that target both pre-combustion and post-combustion applications, capturing CO_2 from various process sources and concentrations, ranging from 3% to 100%. By integrating carbon capture solutions in existing energy production methods, energy producers can also improve oil recovery processes while enabling the ramp-up of cleaner power generation.

Captured CO_2 from these technologies can be repurposed into valuable products, such as chemicals, fuels, and building materials, creating new revenue streams and enhancing the financial viability of CCUS projects. CCUS enables utilities to reduce emissions while continuing to meet energy demand, offering a practical solution that integrates emission reductions into existing infrastructure in a responsible manner, without the need for costly overhauls. As these new markets develop, the interplay between innovative energy resources and carbon capture will be instrumental in driving the transition to a cleaner and more secure energy future.

Policy Focus: Leverage U.S. Natural Resources and Energy Project Permitting Reform

Promoting American energy leadership involves a combination of policies that promote innovation, economic growth and environmental stewardship. Promoting policies that advance domestic resource production involves a strategic approach to harnessing the country's natural resources and ensuring economic growth. The U.S can leverage its natural resources and promote energy project development by **simplifying and expediting the permitting process** for energy projects, including for LNG and linear infrastructure, which can reduce bureaucratic delays and encourage investment in energy projects. This involves:

- **Clear Guidelines:** Establishing clear and consistent guidelines for permit applications to reduce confusion and ensure compliance. Review and update the LNG export study that is used to determine if LNG projects are in the public's interest.
- **Fast-Track Options:** Implementing fast-track options for projects that meet certain criteria, such as those with minimal environmental impact or those that contribute to environmental goals to ensure clean air and water.
- **Judicial Review:** Ensuring timely resolution of legal challenges to energy projects through judicial review processes. Set 60-day judicial review timelines for lawsuits on projects using Section 404 Clean Water Act permits.

Policy Focus: Promote Incentives for Next-Generation Energy Technologies

Promoting policies that support American energy technology development increases national security, creates American jobs, opens export markets and ensures domestic energy security. Energy tax credits have historically spurred innovation, incentivized investment and created good jobs in many parts of the country. To continue these investments, industry needs a reliable energy tax regime that will support project development across the energy sector. **The 45Q Carbon Capture and 45V Clean Hydrogen Production tax credits are helping to underpin project development using next generation American-developed technologies.** Policymakers can promote policies like these to facilitate the development of next-generation energy markets in the near term while advancing policies that will allow these markets to sustain themselves in the longer term. Completing these developments is key to enabling the export of technology to friendly trading partners.

THE PATH TO ENERGY SECURITY IS MAXIMIZED BY ENABLING THE FUTURE OF FUELS

Maximizing the path to energy security involves enabling pathways to future fuels, particularly Sustainable Aviation Fuel (SAF) and Electro-Sustainable Aviation Fuel (eSAF). By sourcing biofuels and utilizing waste materials, SAF bolsters energy security through diversification of fuel sources. Investment in SAF production facilities and infrastructure paves the way for a more sustainable aviation sector. SAF can be blended with petroleum jet fuel and adoption is growing, but not fast enough. By 2035, SAF is expected to encompass 11% of worldwide jet fuel demand — which will require delivering around 13 billion gallons of SAF annually.[5] Accelerating SAF deployment will require stronger policy support, including capital subsidies and demand side incentives, to de-risk investment in alternative pathways.

Most announced SAF capacity still relies on hydro processed esters and fatty acids (HEFA), which are feedstock limited and unlikely to meet long term needs. The emergence of eSAF further diversifies the feedstock mix by using renewable electricity to produce hydrogen, which is then combined with carbon dioxide to create synthetic fuel. This process transforms surplus renewable energy into a viable aviation fuel. Enabling these pathways to future fuels will not only enhance energy security but also contribute to a holistic approach to sustainable resource management that meets the energy needs of a rapidly changing world.

Policy Focus: Promote Incentives and Market Development for Next-Generation Fuels

Given the demand forecast, there is not only room for all types of energy sources but also a pressing need for both existing and new sources of energy. Relying solely on the current energy mix is insufficient to meet future demands. As the U.S. develops policies to augment the current energy mix, focus should also be kept on the opportunities to cultivate new markets that will enhance domestic economic and energy security. Promoting **policies that support the development of both SAF** and eSAF, governments and stakeholders can facilitate research and investments to drive innovation and foster competitive markets for next-generation fuels.

Maintaining incentives, like **the 45Z Clean Production Fuel Credit,** can strengthen markets by providing producers with certainty to deploy the capital needed for increased production of low-carbon ethanol (e.g. soybeans, corn). Given nascent markets and feedstock constraints exist for wide-scale SAF deployment, **policymakers can encourage tech and feedstock-neutral pathways in regulations** to ensure the most economically competitive and efficient pathways to produce SAF are adopted. Similarly, **maintaining open markets for all feedstocks** can drive project development in the U.S. and allow markets to establish and technologies to mature – enabling SAF markets and related supply chains to sustain themselves without government incentives in the longer term.

CONCLUSION

Energy markets are swiftly evolving to meet increasing energy demands worldwide, and unlocking value from the energy evolution is a complex process. With a robust resource base and a host of domestically developed innovative technologies, the U.S. is well positioned to drive accelerated energy security deployment and support global energy demands. By embracing the potential of key domestic assets, such as liquified natural gas, next-generation energy technologies and industrial digitalization and automation, policymakers and legislators can address the challenges of increasing demand and geopolitical instability with the ultimate goal of developing a roadmap for informed decision-making that promotes energy security and economic growth.

This isn't a new challenge. Over the past two decades, the United States has made significant strides in achieving energy independence while maintaining environmental responsibility. As the U.S. now looks to further capitalize on emerging technologies such as Sustainable Aviation Fuel (SAF), hydrogen, and ammonia, these innovative solutions will supplement existing energy resources while creating new growth opportunities and generating jobs in the rapidly evolving clean energy sector. By embracing these advancements, the U.S. can reinforce its leadership role in commercializing technologies that will be exported to the world and ensure a secure and resilient energy future.

Insightful policy and collaboration between industry stakeholders will be critical for the U.S. to lead the global energy evolution. Fortunately, the tools to make it happen are already in place. By continually innovating and developing new energy technologies for industries to harness, Honeywell stands at the forefront of these efforts to forge a pathway to energy security. Together— by uniting resources, innovation, infrastructure and policy — we collectively can achieve these goals.

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Want to know more about Honeywell Solutions for the Future of Energy?

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