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MEMORANDUM FOR JONATHON HATHAWAY, NSDPI RESEARCH DIRECTOR

From: 2025 Summer Interns

Subject: Power Generation Trends in the USA and the PRC: 1950-Today

1. Executive Summary

Since the 1950s, the United States and China have taken divergent paths in power generation, transmission, and storage. The U.S. transitioned from coal to natural gas and renewables through market-driven innovation but now faces aging grid infrastructure and rising electricity demand from artificial intelligence, electric vehicles, and data centers. China, by contrast, has pursued a state-led model, rapidly developing wind, solar, and battery storage while building the world's largest ultra-high-voltage (UHV) transmission network. While the US invests in grid modernization and storage incentives, China's centralized planning has focused on rapidly developing traditional and emerging energy technologies. These differences increasingly shape each country's energy security, economic resilience, and geopolitical influence.

2. Background

Reliable, scalable power generation is a cornerstone of economic competitiveness, industrial capacity, and national security. The ability to produce, store, and distribute electricity efficiently determines a state's capacity to support advanced manufacturing, sustain military readiness, and lead in emerging technologies like AI and semiconductors.[i] To address this vital need, China and the United States have developed unique power strategies and industries.

The electricity sector comprises generation, which involves producing electricity at power plants; transmission, which involves moving electricity across distances through power lines; and distribution, which delivers electricity to final destinations like homes and businesses. In this memo, power generation is understood specifically as electricity generation, meaning that transmission and distribution (along with imports) are less relevant.

Over the past five decades, both China and the United States have undergone significant energy industry transitions guided by varying political and economic forces. Propelled by state-led investments and industrial policy, China has emerged as the world's top energy consumer and a global leader in renewable equipment manufacturing and deployment. Meanwhile, the US has diversified its energy portfolio through market-based innovation and legislation like the Inflation Reduction Act. However, entrenched fossil fuel infrastructure, political polarization, and fragmented regulation hinder America's energy transition.

3. Historic Energy Trends in the United States

1950s–1960s: Nuclear Power
WWII increased industrialization and shifted the U.S.'s reliance from coal to petroleum, gaining superiority in energy in the 1950s. Between 1950 and 1970, energy sources diversified as household demand for natural gas increased.[ii]

- The development of civilian nuclear power capability started in 1954, establishing the first nuclear power plant at Shippingport, Pennsylvania.[iii] By the mid-1960s, U.S. civilian nuclear capacity had increased to 75 nuclear power plants.

1970s–1980s: Fossil Fuel Dominance
The 1973 OPEC oil embargo exposed the U.S.'s overreliance on imported oil, triggering a pivot to coal and nuclear generation. In response, Nixon's Project Independence sought full energy self-sufficiency by 1980, resulting in the creation of the U.S. strategic petroleum reserves, the Alaska Pipeline, and continuation of petroleum price controls.[iv]

- The 1978 Public Utility Regulatory Policies Act liberalized the electricity market, allowing competition and independent power producers.[v]
- The 1979 Three Mile Island partial reactor core meltdown and the subsequent 1986 Chernobyl incident led to discussions on nuclear safety and waste disposal policies, slowing nuclear expansion.[vi]

1980s–1990s: Regulatory and Market Shifts
Shifts in the power generation industry during the 1980s and 1990s were driven by economic deregulation, growing concern of U.S. dependence on foreign oil, and environmental regulation. Electricity production continued to grow steadily overall, and coal remained the top energy source for electricity production.

- The Clinton Administration emphasized renewable energy, reducing greenhouse gas emissions, and launched the Wind Powering America Initiative.[vii]
- Deregulation in states like California, New York, and Texas dismantled monopoly utilities and created competitive energy markets.[viii]

2000-2010: The Shale Revolution
From 2005 to 2010, horizontal drilling and hydraulic fracturing technologies revolutionized the energy industry, increasing crude oil and natural gas production.[ix]

- Oil refining capacity in the US increased by 17% in the 2000s and the expansion of U.S. pipeline networks developed efficiency of the U.S. energy sector leading to natural gas overtaking coal in power generation.
- Environmental concerns and energy scarcity helped double renewable energy's share from 2000 to 2019.[x]

2010–Present: Renewable Growth and Infrastructure Challenges

The past fifteen years of power generation in the United States has seen a decline in net crude oil imports, and despite public opinion pushback on nuclear energy, a steady growth in the renewable energy sector.

- Between 2008 and 2015, the U.S. became the world's largest natural gas producer, with net crude oil imports dropping from 12.5 million barrels per day in 2005 to 4.7 million in 2015.[xi]
- As of 2023, fossil fuels supplied 60% of utility-scale generation, with renewables at 21.4% and nuclear at 18.6%.[xii]
- The 2022 Inflation Reduction Act provided $370 billion for clean energy initiatives.[xiii]
- Private investments from companies like Microsoft and Amazon and the creation of the National Energy Dominance Council in 2025 reflect new directions in policy and private-public energy leadership.[xiv]

4. Historic Energy Trends in China

1970s- 1990s: Post Mao Reforms

Since 1949, China's electric power industry has been largely controlled and owned by the state. The main policy lever they use is state-led initiatives like Five Year Plans (FYP). Materially, China's power generation sector was dominated by coal and their energy sector was oriented towards self-sufficiency, with little integration into global energy markets.

- 1978 Deng Xiaoping's Economic Reforms launched China's rapid industrialization powered by abundant domestic coal.[xv]
- In many ways, power generation policy in China started in 1981 under the 6th FYP, where China shifted from Mao's ineffective province self-sufficiency policies towards addressing national energy efficiency.[xvi]
- China's Ministry of Electric Power Oversight centralized control over energy planning and distribution leading to bottlenecks and outages despite capacity growth.[xvii]
- As coal alone could not meet the energy demands of China's rapidly growing industrial base, the state increasingly turned to petroleum as a complementary energy source. Through state-implemented policies such as Special Economic Zones in 1980, they became a net importer of petroleum in 1993.[xviii]
- The 8th FYP (1991–1995) promoted domestic coal production and hydroelectric power, while the 9th FYP (1996–2000) accelerated fossil fuel use.[xix]

2000-2010: Corporatization

The 2000s also saw increasing industrial energy demands, power outages, and a growing dependence on expensive oil and gas imports, prompting a push toward energy security and renewable development.

- In 2000, coal made up 77% of electricity generation in the country, however, FYPs started funneling money towards renewables.[xx]
- The 2002 Power Sector Reform corporatized and unbundled its state-owned power sector, creating major State-Owned Enterprises utility corporations.[xxi]

- The Tenth Five Year Plan (2001–2005) accelerated domestic coal production and fossil fuel imports alongside major state investments in renewable energy.[xxii]
- The establishment of the Energy Bureau in the National Development and Reform Commission influenced the 11th FYP from 2005-2010 signaling shifts and investments in energy sources developing research into nuclear power, expanding capacity of domestic oil reserves, and the establishment of the Golden Sun renewable energy program.[xxiii]

2010-Present: Renewables and Global Leadership

The 2010s marked a shift towards investment and policy directives focused on renewable energy. China emerged as the global leader in renewable energy, with the most installed solar, wind, and hydro generation capacity.

- Chinese companies have become dominant in manufacturing solar panels, wind turbines, and batteries.[xxiv]
- The 12th FYP (2011–2015) prioritized energy intensity reductions (16%) and expanded non-fossil sources from 8.6% to 11.4%. The 13th FYP, paired with Made in China 2025, targeted a 58% coal share, upgraded coal plants, and made China the world's top hydroelectricity producer.[xxv]
- China's centralized government enables large amounts of state-sponsored investment into R&D. In 2019, China was spending around 2% of its GDP through research subsidies only on improving green energy technology.[xxvi]

5. Conclusion

Given the United States and China are two of the world's largest energy producers and consumers, their differences in energy policy is indicative of the challenges posed by 21st-centruy energy demands. While the U.S. leverages private-sector innovation and market-based incentives to modernize its energy infrastructure, China's centralized planning has enabled rapid deployment of renewable technologies and transmission capacity at scale. As both nations confront rising electricity demand—particularly from data centers, AI, and electrified transportation—their contrasting approaches will continue to shape global energy markets, influence national security outcomes, and determine leadership in the clean energy transition.

- **Questions for Future Research**

- Why has the U.S. retreated from nuclear energy while China continues to invest heavily?
- Can the U.S. leverage private sector innovation to counter China's state-backed clean-energy dominance?
- How can the U.S. exploit China's strategic energy vulnerabilities such as reliance on the Malacca Strait in broader security planning?

- How have specific government interventions (e.g. tax credits and incentives, subsidies, or mandates) more effectively influenced changes in the U.S. and Chinese generation mix overtime?
- Historically, to what extent have China's economic development aims and needs taken precedence over environmental commitments? What might this tell us about the likely role of coal in China's generation mix over the next several decades?
- Nuclear energy has made up a fairly constant share of the U.S. generation mix for multiple decades. Under what circumstances might this change, and are recent developments and projects pertaining to nuclear energy in the U.S. likely to have a noticeable impact?
- How do power grid reliability issues affect the pace of a clean energy transition in the U.S. vs. China?
- What role do AI and data center rising electricity demands play in shaping energy investment in both countries?
- To what extent do supply chain constraints for critical minerals shape each country's long-term green technology manufacturing strategies?
- How can data centers in land-constrained regions like Northern Virginia optimize energy storage and infrastructure, including the potential for vertical or underground solutions?
- What strategies can the U.S. adopt from China's rural electricity grid development to modernize the nation's electricity grid?
- How does the intersection of AI and nuclear energy policy influence geopolitical tensions, specifically the governance of AI in managing nuclear energy systems?
- How do U.S. and Chinese foreign investment strategies in power generation differ in structure, scale, and intent—particularly in regions like Arica, Southeast Asia, and Latin America?
- How is the competition over critical minerals shaping each country's capacity to lead in renewable energy and battery supply chains?
- To what extent is China's state-led approach creating overcapacity in power generation, and what rare the long-term economic and environmental consequences?
- There is no question that both China and the U.S. are intimately tied together economically. Between imports and exports to each other, both nations mutually benefit from bilateral trade. Still, who is to be harmed more by export controls? Could the prevention of obtaining certain goods or services spur innovation? Harm manufacturing? Who has the most to gain from export controls, and similarly, who has the most to lose?
- Renewable energy's most attractive feature, besides its intent to mitigate existing environmental damage, is its long-term affordability. Solar panels, wind power, hydroelectric, biomass and nuclear energy require large initial investment. Furthermore, the transition to using these resources has highlighted certain bureaucratic, political and economic inefficiencies that are felt in some countries more than others. What are the ways that America will be able to approach this transition in a more cost-effective and politically unified way? What are the avenues that have already

or yet to have been explored in making this transition, a transition that will needed to capitalize on energy production to gain a competitive edge over China and maintain its foothold as the leading global superpower?

- What are the technologies (or perhaps, ways of researching technologies) that are exclusively or largely propagated by the United States? Quantum energy? High-tech computing chips? What are ways that the US can more effectively pursue R&D, and how has it historically competed with other technological powerhouses across the globe? Is a free-market society a catalyst to innovation, or is centralized state control and funding a better route to discovering new technologies or better manufacturing existing ones?
- How will China's strategic initiatives including the 15th FYP, Civil-Military Fusion, and the continuation of Made in China-2025 be strategically leveraged for rapid technological development and for solidifying China's position in the power generation and emerging energy technology sectors?
- How can the US continue to use its position in the petroleum and LNG industries to leverage self-sufficiency and geopolitical bargaining?
- With the increased prevalence of AI and data centers, what are emerging security risks that the US energy grid and power generation sector will face? Additionally, how can the U.S. obtain their own energy self-sufficiency with increasing power demand?
- Is China attached towards green energy from a climate consciousness perspective or from an economic self-sufficiency perspective?
- What strategies are the U.S. implementing to jumpstart rare earth refinement in the US/battery technology?
- How is either country tackling the nuclear problem? Small scale generators?

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