Authoritarian Excellence, Democratic Hesitance: The Differing Results of the United States and China's Energy Transitions in the 21st Century

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Introduction

On April 22, 2016, China and the United States signed the Paris Agreement, pledging to engage in policies that would limit the global temperature increase to below 2℃ over pre-industrial levels (United Nations 2025). A year after signing, the United States under President Donald Trump withdrew from the Paris Agreement[1]. Less than two years after that, the United States rejoined the Paris Agreement under President Joe Biden. In January 2025, the United States again exited the Paris Agreement (The White House 2017; Goldberg 2025). In the same period, China has not only remained a signatory to the Paris Agreement, but each successive Five-Year Plan has included stronger commitments to emissions reduction through energy transition (Pratama et al. 2025). While China has been engaged in a consistent, decades-long process of transition to low-emission renewable energy sources, the United States has wavered, to the detriment of the world. These radically different approaches to multilateral climate commitments reflect the underlying political processes driving these two countries' governance. In the years leading up to and following the Paris Agreement, China's energy transition has been more successful than that of the United States, due to centralised authoritarian governance in China and federal, electoral governance in the United States. This paper will first offer context for the nature of these two countries' participation in the global climate crisis, then explain the discrepancy in policy outcomes through comparison of the differing political structures, and finally discuss the findings with predictions for the future of American and Chinese energy policy.

Context

The global climate crisis has been identified as a "super wicked problem" due to the existential threat it presents to human life alongside the incredible, interlocking challenges preventing its solution (Lazarus 2009, 1160). Stymying the solution, inter alia, are problems such as the numerous interest groups with competing goals, the absence of a supranational authority, the incentives for those most poised to solve the issue to ignore it, and the fact that time is a factor, meaning that the crisis becomes progressively more destructive and difficult.

Situated in the crisis are the United States and China, the world's two largest economies and the world's two largest emitters of greenhouse gases (Mori 2018, 6). These countries are both the greatest contributors to the crisis and the agents most capable of solving it. The United States is graced with an abundance of oil and natural gas, being the world's greatest producer of both (Jianchao et al. 2021, 1249). China has far less oil and gas, but is endowed with a great base of coal, burning over 50% of the world's reserves (Jianchao et al. 2021, 1247; BP 2022). China is the greatest greenhouse gas emitter in the world in absolute terms, but emits far less per person than the United States. Combined, the United States and China account for 41% of world greenhouse gas emissions, according to the most recent estimates (European Commission, Joint Research Centre 2024, 7). Despite these remarkable statistics, China and the US also lead the

[1] Though the formal withdrawal process is not immediate, the president ceased commitment to the agreement's provisions immediately.

development and production of low-carbon renewable energies: they are the first and second countries by wind capacity, solar energy manufacturing, production of nuclear energy, and others (L. Li and Taeihagh 2020, 7; International Atomic Energy Agency 2025).

Furthermore, their emissions volumes and geopolitical strength give these countries the authority to set the global agenda for energy transition. Other states look to the US and China to take action as the largest emitters and hegemonic or regional actors (Lazarus 2009, 1190). The choices made by these two countries influence and determine the actions taken in other countries, a consideration that will be expanded upon in the discussion section of this paper. Given that these two states lead the world in both non-renewable and renewable energy, understanding the performance of their energy transitions is crucial both to predicting the future of the global energy transition and response to the climate crisis, and to forming strategies to quicken the energy transition. Both states are situated in mixed economies and use an array of strategies for achieving the transition to low-carbon and renewable energy usage. These mechanisms all involve an interplay between the market and central government authority, to varying degrees. The US develops policy through a federal system of shared state-central government power, with policy subject to changes based on interparty conflict and electoral turnover. In the period discussed, the Obama administration expanded energy transition initiatives, which were stymied by the following Trump administration. The Biden administration instigated and passed the Inflation Reduction Act, though it has been defunded by the second Trump administration. China is a politically centralised one-party state, where an unelected bureaucracy sets policy goals through successive five-year plans (FYPs). Though there are many differences between these countries, their mixed economies and shared use of market and authority mechanisms create an axis for comparison.

Methods

This paper is based on analysis of the current peer-reviewed literature surrounding energy policy in China and the US, with a focus on 2020-25 sources in top journals. Where policy changes moved faster than the literature, official documents and major paper reporting filled the gaps.

Comparison of the Transitions

Over the past two decades, China has committed to and achieved more in its energy transition than the United States has. Both countries use a mix of market mechanisms and state authority to encourage transition to renewable energy in the private sector, including emissions trading schemes, direct funding, and regulatory oversight. The differing organisation of power in both states has led to the difference in outcomes, with China's centralised and single-party authority facilitating a rapid, unbroken transition that stands in stark contrast to the oscillation between energy advance and retreat characteristic of the United States. While these trends have implications for the energy transition to come, thus far they have resulted in China sourcing 33% of its electricity from renewable sources, while the United States, a country less dependent on

energy-intensive manufacturing, sourced only 21% of its electricity from renewables (Ember 2025; US Energy Information Administration 2024). American policies, designed to reduce greenhouse gas emissions and incentivise renewable energy deployment, have resulted in a decrease in 0.1 kg CO_2 emissions per dollar of GDP (World Bank Open Data 2025). Comparable Chinese policies have resulted in 0.3 kg CO_2 emissions per dollar of GDP, an especially favourable comparison given China's greater reliance on manufacturing. This section will compare the strategies used by the two states in the various policy avenues used to achieve energy transition.

Subsidisation

Subsidies on energy production and consumption are key tools for adjusting market incentives toward renewable energy and forcing polluters to internalise the social cost of their behaviour. Both the US and China rely heavily on these mechanisms to increase the development and usage of renewable energies. Five-Year Plans since the early 2000s have outlined intentions to reduce emissions and increase commitments to energy transition through market mechanisms. The landmark legislation of the early 2000s was the 2006 Chinese Renewable Energy Law, which introduced feed-in tariffs (FiTs) (L. Li and Taeihagh 2020, 8). Despite their name, these are not taxes on trade but rather price subsidies for renewable energy producers. As the owner of the electricity grid through state enterprises, the central Chinese government possesses wide authority over energy supplier-producer commerce, and can thus fine-tune subsidies to producers to both meet state energy goals and promote renewable energy (Yao, Huang, and Du 2019). The FiTs have been very effective at driving investment in renewables, with a one-dollar increase in FiT subsidy driving renewable investments up by $3.40 (Lin and Xie 2024, 6). These subsidies have been designed to taper off over time, which has improved the efficiency of renewable energy projects and reduced the government's financial burden without disincentivising investment (Lin and Xie 2024, 1). By tapering the FiTs, China has been able to sustain the program longer than other states, which often saw collapse in their FiT programs due to funding constraints (Pyrgou, Kylili, and Fokaides 2016; L. Li and Taeihagh 2020, 8). FiTs are effective at promoting investment, so China's ability to succeed in deploying FiTs where other countries have failed demonstrates an advantage of the Chinese planning bureaucracy. In 2018, China implemented the Environmental Protection Tax Law, which applied taxes (negative subsidies) to air pollutant emissions. Though the law excluded CO_2, it and other greenhouse gases frequently occur from the same activities generating covered emissions, like SO_2. The heavy taxation of other emissions thus led to a significant reduction in emissions of CO_2 and other greenhouse gases (X. Gao, Liu, and Hua 2022, 430–35).

The United States prefers to subsidise through nonrefundable tax credits, whereby producers and consumers can reduce their tax burden through the replacement of high-carbon energy with low-carbon energy. This preference arises from the nature of party politics in the American legislature, as tax credits are easier to achieve in the US Congress than more extensive subsidies, and are easier to achieve as a compromise between conservative and liberal partisans (Surrey

1970, 732–36). Refundable tax credits, or subsidies, pay more to producers and consumers than their minimum tax burden and are thus more powerful and easier to tailor to market needs. Johnston finds that in the renewable energy sector specifically, the American preference for nonrefundable tax credits reduces innovation in renewable energy and is generally insufficient for renewable energy development (Johnston 2019, 456–58). Despite their lower efficacy, the most significant energy subsidies of the past couple of decades have been through tax credits, though they have increased in scope. Under the Obama administration, tax credits were provided to purchasers of alternative fuels, though private interests expanded the credit to natural gas, which is not a low-carbon or renewable source of energy (Bose Styczynski and Hughes 2019, 266, 270). The first Trump administration saw expanded tax credits for carbon capture, utilisation, and sequestration projects due to liberal provisions in the Bipartisan Budget Agreement (Hafner and Tagliapietra 2020, 58). Most recently, the Inflation Reduction Act, the most extensive American climate legislation to date, introduced a panoply of tax credits for renewable energy (Bistline et al. 2023; US EPA 2022). The second Trump administration has aimed to reverse the landmark progress of the Biden administration, illegally cutting funding and seeking to repeal tax credit provisions (Britton and Runyon 2025).

While the tax credits are still in force, the Trump administration's weaponisation of the Internal Revenue Service and uncertainty created by the about-face in US policy will reduce renewable energy investment, thereby inhibiting the American energy transition. The United States' subsidy programs are too weak to incentivise the rapid shift to renewable, low-carbon energy demanded by the climate crisis. Furthermore, with energy investment requiring years of planning and production, the uncertainty and frequent halting of subsidies diminishes the intended stimulative effect of tax credits. That the tools and drama of American policymaking result from partisanship in Congress and electoral turnover allows the Chinese case to stand in stark contrast. China's central authority and consistent, long-term planning have allowed for the crafting of sophisticated, effective subsidies that drive investment into renewables. Emerging energy technology and infrastructure typically require government support and sometimes protection due to high research, development, and production costs (Markard 2018, 632). As these projects mature, their costs decrease and their need for government support declines. The American system has demonstrated its incapacity to meet the support needs of renewable energy for a quick and effective transition, while China's long-term subsidies, centrally designed, effectively induce energy development with tools that other countries cannot sustain.

Emissions Trading

China began piloting emissions trading schemes (ETSs) for SO_2 at the provincial level in the early 2000s. These ETSs were relatively effective but limited by underdeveloped regulatory mechanisms, and were followed up by more effective regional CO_2 ETSs in the 2010s that were expanded through the 2020s (L. Li and Taeihagh 2020, 8). While the 2010s ETSs were highly effective at reducing emissions in the regulated regions, they also led to emissions moving from regions subject to ETSs into unregulated regions, diminishing the impact (Y. Gao et al. 2020, 11).

In 2021, China expanded these regional programs into a national one, covering over 40% of the state's emissions, the largest such program in history. Most recently, China launched a reformed Chinese Certified Emissions Reduction program in 2024, supplementing the ETS by allowing firms to introduce projects not otherwise covered by the national ETS into the program, which will expand the coverage of Chinese emissions ('China National ETS | International Carbon Action Partnership' 2025). As China has built up its ETSs, the increased sophistication of the government and economy has contributed to the development of the ETS, reducing the need for government intervention and improving its efficiency. Though it is early in the lifespan of the current ETS formulation, its sophistication, developed from successive rounds of policy refinement, and sheer scope are promising for further emissions reduction.

The United States also started emissions trading with SO_2, launching the federal Acid Rain Program in the 1990s to protect local ecology (Sanders and Barreca 2022). The United States has never launched a federal greenhouse gas ETS, though there are state-level initiatives in California, Washington, and the Northeast corridor. The program in the Northeast corridor, the Regional Greenhouse Gas Initiative (RGGI), was launched in 2009. While quite successful at reducing emissions in the covered area, it has also led to significant "emissions leakage", such that high emissions activities move to nearby areas and reduce the actual efficacy of the program (Fell and Maniloff 2018, 17–19). The California cap-and-trade initiative has been more extensive than the RGGI, and is one of the most effective ETSs internationally at reducing emissions in the area it covers, which now includes Quebec (Narassimhan et al. 2018, 983). Though the California system has been effective, it has been hampered by the ability of private interests to carve out concessions that reduce their industries' need to transition to low-carbon energy, as well as the problem of emissions leakage into other states (Basseches 2021, 15–17). Washington state launched its own such program in 2023, though with insufficient data available, the effects are indeterminate (Mesa 2024).

The regional ETSs of the United States and China were important beginnings for reducing emissions and incentivising the use of low-carbon energy. Whereas China has steadily improved and expanded its ETS mechanisms to the national level, the American systems remain regional and thus continue to suffer heavily from emissions leakage. Besides leakage issues, the Chinese ETS covers more of total national emissions than the American programs do, incentivising more of the economy to transition to renewable energy. Furthermore, even at the state level, American compliance mechanisms are weakened by private lobbying, which slows down the energy transition further. China's centralised political power has led to a much larger ETS, which will go further in promoting the state's energy transition.

Renewable Energy Certificates

A secondary market mechanism for promoting energy transition has been the Renewable Energy Certificate (REC), or Tradable Green Certificate (TGC), as it is identified in China. In these programs, regional or central governments set Renewable Portfolio Standards (RPSs) for energy suppliers to maintain a minimum portfolio of renewable energy, and purchase certificates

from renewable energy producers. These certificates can be traded, and thus serve the dual purpose of improving the economic efficiency of energy provision through the market mechanism and increasing funding for renewable energy producers, incentivising investment. The Chinese National Energy Administration began trialling TGCs as a follow-up to their feed-in tariff program in 2017, making it mandatory in 2021 (L. Li and Taeihagh 2020, 8). This program was significantly effective at reducing greenhouse gas emissions and promoting the development of new renewable energy projects, furthering China's transition (G. Huang et al. 2024, 17).

As with ETSs, the United States has local REC programs, but no plans for a national scheme. Unlike with ETSs, however, far more states participate in RPSs, and to much greater effect (US EPA 2017). States have launched RECs since the 1990s, which means that the United States has had a much longer experience with such programs than China. The portfolio standards and concomitant RECs have led to an average of one-third of new energy infrastructure in participating states being renewable, by certain estimates (Joshi 2021). Other, more stringent, estimates find much smaller improvements to energy infrastructure and emissions reduction attributable to RECs, and call for national programs to achieve stronger results (Feldman and Levinson 2023, 18–19).

While the Chinese certificate system has seen significantly positive results in a short amount of time, the comparatively longer-run US systems have less impressive results. Furthermore, while the US system has been launched by individual states, the Chinese program is centrally devised, achieving greater economies of scale and effectiveness. The American TGC programs have been effective, but are held back by the lack of national coordination. China's central policymaking, governed through successive FYPs, has allowed iteration on renewable energy policy experiments and led to China's rapid implementation of effective policies like the REC program (L. Li and Taeihagh 2020, 7).

Comparison of Political Structure

China's political structure is a striking combination of bureaucratic authoritarianism and a mixed market economy. Both the political and economic spheres are controlled by a sophisticated central bureaucracy, which permits varying levels of autonomy to its regions and provinces (Ng 2024; Whiting 2023). The central, single-party governance of China has accelerated its development and allowed it to reach centrally designed goals without contestation. The United States, on the other hand, is characterised by a mostly democratic electoral federal political system and mixed market economy, wherein the latter is significantly less embedded in the former than in the Chinese case. The planning authority of China's central government has allowed China to act more swiftly and decisively in reducing dependence on nonrenewable energy sources, such as its provision of subsidies through control over energy suppliers. Centralised policymaking allows the Chinese state to plan and achieve long-term goals like its FYPs and deployment targets for hybrid vehicles (Bose Styczynski and Hughes 2019, 265). The deliberative nature of American policymaking, while undoubtedly crucial to preserving civil liberties, minority rights, and citizen welfare, is uniquely unsuited to wicked

problems like climate change, which requires consistent and deep commitments to energy transition (Lazarus 2009, 1180). This strength of the American system becomes a weakness when applied to the energy transition, while the failures of the Chinese system become a strength. As the Russian case demonstrates, authoritarian systems are by no means superior or even on par with democratic systems for the purpose of energy transition (Mitrova and Melnikov 2019). What China shows, however, is that *when* a bureaucratic authoritarian system is committed to energy transition, its institutions are particularly adept at achieving decarbonisation.

Effective energy transition requires a mixture of policy mechanisms, and the forward-thinking usage of FYPs leads to well-designed policies that complement each other in directing the economy to greater reliance on renewable energy (L. Li and Taeihagh 2020, 9). The division of legislative, judicial, and executive powers within the United States leads to presidents forming climate initiatives that often fail to live up to expectations. During his first term, President Barack Obama "tried but failed to pass economy-wide legislation" that would institute a national emissions cap and establish a national emissions trading scheme (Hafner and Tagliapietra 2020, 54). This bitter defeat of a much-needed national energy transition bill was followed by President Obama's second-term initiative, the Climate Action Plan. The regulatory program was not only mired by provisions made ineffective by changes made by private utility firms, but its greatest provisions were halted by the Supreme Court (Hafner and Tagliapietra 2020, 55). It is precisely the division of powers among mutually interdependent institutions that delays the American energy shift, whereas China's central control allows for a swifter transition.

China has achieved great successes in its transition by piloting policies at the regional level, then nationalising them with changes based on lessons from the provincial trials (Yang and Yan 2018). This regional experimentation is permitted by central political control over the provinces. This framework allows China to augment policies to be more governed by provinces while preserving ultimate control in the central government (L. Li and Taeihagh 2020, 7). The federalism of the United States, on the other hand, provides a space for resistance against the central government's preferences. In periods of central government energy inaction or regression, states have been able to launch their own initiatives. After President Trump's first attempt to exit the Paris Agreement, climate-conscious states formed the United States Climate Alliance, maintaining their own commitments to energy transition (Basseches et al. 2022). While this regional independence allows for continued transition at a lower level, it can also lead to resistance to federal-level transition initiatives, such as state lawsuits stalling regulation by the Environmental Protection Agency (Dinan 2020, 8). The relative independence of American states has mixed results, which are not only unacceptable for the purposes of achieving a solution to the climate crisis, but also compare unfavourably with the value China's provinces provide the central government in piloting regional programs and carrying out national policy directives.

Finally, the electoral system that undergirds America's political system is far less propitious for energy transition than China's authoritarian one-party system. With time as a factor in solving the climate crisis, consistent action is necessary, and the vicissitudes of electoral politics pose

significant problems when one party objects to the necessary transition. In the past two decades, American climate and energy policy has swung wildly between progress and regress due to electoral changes of the president, and to a lesser degree, Congress. While President Obama's climate initiatives and robust EPA were promising for the American energy transition, his successor, President Trump, undermined these initiatives by eliminating core provisions of the Climate Action Plan and defunding programs for research and development of renewable energy technology (Hafner and Tagliapietra 2020, 57). The Biden administration enacted the greatest clean energy policy in American history with the Inflation Reduction Act, but its core provisions had barely come into effect before Trump's second administration halted its funding and culled staff from the agencies charged with its execution (Centre for Climate Justice 2025). China, on the other hand, has not only been consistent in carrying out clean energy policy but has expanded its scope over time. This is in large part due to the consistent planning by the Central Committee of the Communist Party of China (CPC), which provides ideologically uninterrupted policy guidance through FYPs (Ding et al. 2025, 1–7). This political continuity has been crucial to China's success in promoting a transition to renewable energy while maintaining an economy based on manufacturing, a typically carbon-intensive sector.

Discussion

For the reasons stated above, it is reasonable to describe China's energy transition as "better" than that of the United State, but important caveats must be addressed. Firstly, though China and the United States are the largest economies, the largest emitters, and the largest producers of renewable energy, the structure of their economies is very different. The United States is a developed economy, with the vast majority of its economic activity lying in services and 17.5-19% of its GDP consistently coming from manufacturing over the past decade (World Bank 2025). China is a rapidly developing economy still heavily reliant on manufacturing, though its services sector is increasing, with 38-43% of its GDP coming from manufacturing in the same period (World Bank 2025). With manufacturing making up twice as much of China's economy as that of the United States, the difference in economic situation between the two countries is notable. Despite this discrepancy, it is more than fair to compare the two states, as the higher dependence on manufacturing magnifies China's comparative success. Manufacturing is far more energy-intensive than the service sector, and the development of new energy infrastructure is costly, so China's stronger commitment to transition despite greater costs is impressive (Gutowski 2007, 2). Though there are many differences between a developing economy like China and the United States, the most salient of these differences highlights, rather than compromises, the comparison.

The recognition of the Chinese system's strength in this area is not an endorsement of the CPC, nor is it a total indictment of the United States. There are innumerable strengths of the American system, but wicked problems like climate change flip the advantages and disadvantages of these political structures on their heads. The slowness of the democratic, multiparty federal system allows for multiple voices to be heard and the prevention of large-scale

disasters. Though the Chinese state has developed immensely since the 1950s, the famine induced by the Great Leap Forward stands as an example of the great harm that can be induced by the use of central planning for economic transition (W. Li and Yang 2005). Thus, it is difficult to recommend a nondemocratic centralised system, despite its success when aimed at energy transition.

The observed trend of rapid Chinese energy transition and abortive efforts in America is likely to continue. There is much uncertainty about China's goal to have its carbon emissions peak by 2030 to achieve a net-zero economy by 2060, but most believe it is feasible (Stern and Xie 2023; Y. Huang et al. 2023). The structural factors undergirding China's energy transition are unlikely to change, and the upcoming 15th FYP will clarify the expectations of CPC leadership. Beyond its commitment to emissions reduction, Chinese leadership views the shift to renewable energy as a device for achieving energy independence from the United States and thereby improving national security, which means that this commitment will only intensify as Sino-American relations decline (Kissane 2021, 33). In the United States, domestic natural gas and oil have been seen as the pathway to energy independence, with recent pushes by President Trump to redirect American energy from renewable energy to oil and gas (Newell 2021, 91; Kissane 2021, 30).

While China has a consensus over the need for energy transition, the United States remains "preoccupied by a bitter, protracted debate over current and future climate policy" (Hafner and Tagliapietra 2020, 47). For the rest of the current presidential term, it seems that investment in nonrenewables and disruption of former progressive energy policy is guaranteed. After 2029, it is unclear which faction of the climate debate will be steering American policy, but it is likely that even if progressives are in power, the political agenda will focus on non-climate issues like rebuilding federal government capacity and addressing a brewing constitutional crisis (Oxford 2025; Cuéllar 2025). Even if energy transition is made a priority in the next administration, the upheaval in energy policy created by electoral turnover has demonstrated that progressive policy will be rolled back and undermined. Thus, the Biden administration energy transition goals, such as a completely carbon-free power system by 2035, are unlikely to be carried out (Arent et al. 2022, 10–11).

Conclusion

The global energy transition is far from assured, and the actions of these two great nations will largely determine its direction. The political structures of the United States have thus far been inconducive to an adequate transition, while those of China have been more favourable. For the United States to create policies that address the climate crisis, stronger institutions are necessary. While strong centralisation is a source of power in China, subnational autonomy in the United States has been a mixed but generally positive force for the transition to renewable energy. The electoral process, on the other hand, has been generally negative for the American transition, and thus, political institutions shielded from the vicissitudes of party conflict are necessary. The Federal Reserve System serves as a possible model, with independence of

monetary policy from direct executive or legislative control leading to long-term decision-making. If climate policy could be protected similarly, with statutory emissions targets made by an independent climate policy board, America could perhaps find a way to a just energy transition. While China's policy-making is far from perfect, as long as the CPC views renewable energy as a pathway to energy security and a national good, its political structures are superior for the energy transition. These incentives do not appear to be changing, and thus, the obligation for political reform lies mostly with the United States, at least in this field. More work remains to determine what and how institutions must be built in the United States to achieve a fast and consistent energy transition. For the sake of a world with fewer hunger crises, natural disasters, species extinctions, displacements, and human deaths, this work is necessary.

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