### Contention 1 - Oil

#### Prices are high enough to fund Vision 2030.

Monk ’24 [Ashby; Khalid Alsweilem, Michael Lepech, and Malan Rietveld; August 1; Research Director, Stanford Research Initiative on Long-Term Investing, Stanford University; Visiting Scholar, Center for Sustainable Development & Global Competitiveness, Stanford University Senior Advisor, Decision Support Center, Kingdom of Saudi Arabia; Director, Center for Sustainable Development & Global Competitiveness, Stanford University; Board Member, Stanford Research Initiative on Long-Term Investing, Stanford University; Stanford Center for Sustainable Development and Global Competitiveness, “Saudi Arabia: From the Big Push to the Long Push,” https://sdgc.stanford.edu/sites/g/files/sbiybj18741/files/media/file/saudi-resilience\_big-to-long-push\_1\_aug\_24.pdf]

Eight years ago, the Saudi Arabian government announced the most ambitious plan yet to reduce the Kingdom’s historical economic dependence on oil. The implementation of Vision 2030 has dramatically accelerated since 2022, with the current investment boom representing a classic “Big Push” towards diversification. Gigascale infrastructure investments are complemented by industrial policies focused on renewable energy, refining, chemical production, and the Kingdom’s abundance of natural resources beyond oil, while sweeping social, regulatory and legal reforms target high-value service sectors, notably tourism, technology and financial services. Recently, the PIF has accelerated venture-style investments in biotech, artificial intelligence (AI), consumer services and automated manufacturing – underlined by the establishment of a $40bn to $100bn fund focused on AI investment, which would make the Kingdom a dominant global investor in this area. While much about Vision 2030 is pioneering and historic, the Big Push approach to public investment has been a recurring feature in the history of commodity-dependent economies. In the Middle East, sustained commodity windfalls have historically been accompanied by sharp increases in public investment to break the region’s historical oil dependence. Based on seminal work by Rosenstein-Rodan (1943) and later by Murphy, Shleifer and Vishny (1989), Easterly (2006) defines a Big Push as the “simultaneous increase in investment in many different sectors, as well as a package of complementary policy changes and technical interventions”, coupled with “a national plan and administrative apparatus to direct the investments, technical interventions, and policy changes.” The long-term challenge of diversifying the Saudi economy, however, means that the Big Push will inevitably evolve into a “Long Push”, extending well beyond 2030. Successful diversification strategies involve generational policy and capital commitments due to the gradual cultivation of comparative advantages. In two recent papers, Alsweilem, Cader and Rietveld (2023a and 2023b) apply the lens of Economic Fitness to the challenge of designing diversification strategies, industrial policy and SWF/SDF investment programs. This approach captures the diversity of an economy’s productive capabilities and its ability to produce complex products. Productive capabilities, mapped using disaggregated export data, are determined by the level of human and physical capital, intellectual property, quality of institutions, infrastructure, skills and technical know-how. Particularly when starting from initial conditions of a narrow industrial base, relatively expensive input costs and high oil dependence, the pursuit of diversification through increased economic fitness is a deeply strategic, long-term undertaking. The Saudi advantage is an ability to harness large oil revenues for sustained public investment. The inevitable extension of the ambitious timeline of Vision 2030 will therefore be a positive development, but one that requires economic resilience across and beyond the oil-revenue cycle. The current level of public investment can be accommodated by oil revenues associated with the US$75-85 per barrel oil-price range that has prevailed since the second half of 2022, coupled with limited use of debt financing started from a low level of overall indebtedness. [[FIGURE OMITTED]] At the same time, under the current policy mix, the prevailing oil-revenue levels will not accommodate rebuilding of foreign-asset pools that were significantly drawn upon following the post-2014 shock. Indeed, the increase in public and PIF investment since 2022 has been accompanied by an increase in new external-debt issuance, rather than the accumulation of net foreign assets (see Figure 1). Concurrently, the PIF has outlined the need to increase new capital deployments to around US$70bn per year from the current range of US$40bn to US$50bn to continue meeting its Vision 2030 targets.1 Resilience across the oil-revenue cycle requires rebuilding and growing a foreign-asset portfolio that will diversify Saudi Arabia’s wealth and income sources. Access to stable and sustainable streams of foreign income is of critical importance to the resilience of the Saudi economy, as this foreign income finances the import of most consumer goods, from cars to food, medical supplies, clothing, technological and household appliances, and essential services. Moreover, in the context of Vision 2030, foreign income is needed to pay for the importing of most intermediate goods – capital goods, machinery, raw materials, chemicals, and services – associated with large-scale infrastructure and megaproject investments. Finally, preserving external balance in the context of rising imports is critical to macroeconomic stability and resilience, given the fixed exchange rate between the Saudi Riyal and US dollar. Historically, oil exports have been the near-exclusive source of fiscal revenue and hard-currency earnings through which to pay for imports and manage the fixed exchange rate. Thus, income from the foreign assets can play a critical role in supplementing oil revenue in funding the sustained domestic-investment push (the Long Push) set in motion by Vision 2030. Below, we consider policy options that will promote the build-up of income-generating foreign assets, but first it is instructive to summarize the most salient fiscal reforms that have occurred in Saudi Arabia over the past decade. II. Petrodollars to Petroriyals: The PIF’s Innovative Diversification Mandate The collapse in oil prices in the second half of 2014 resulted in several important policy reforms in Saudi Arabia. The most profound shift was around the balance between foreign and domestic asset accumulation. Since that time, the Public Investment Fund (PIF) has become the primary instrument through which oil revenues are intermediated towards large-scale public investments associated with Vision 2030. This represents a historic break with the so-called petrodollar recycling model, which has been a prominent feature of the macroeconomic management of Gulf states since the 1970s. According to the petrodollar recycling model (Caballero, Farhi and Gourinchas, 2008), oil-price spikes historically boosted oil exporters’ incomes by more than the demand for spending and domestic investment, leading to higher savings and current-account surpluses. Historically, these surpluses were largely “recycled” into dollar and other reserve-currency assets (and, after the Global Financial Crisis in 2008, into increasingly diversified foreign assets through rapidly growing SWFs) – hence the term “petrodollar recycling”. In recent years, the petrodollar-recycling pattern has already been fundamentally upended – not just in Saudi Arabia, but across the Gulf states. Surplus assets that were historically mainly accumulated through foreign-exchange reserves held by the Saudi Arabian central bank, have declined since 2014. There are many reasons for this shift, including demographic trends, higher per capita domestic spending needs leading to smaller fiscal surpluses for a given oil price, and a growing appetite for less-liquid and higher-risk assets. But the most significant factor has been the PIF’s Big Push into domestic investments, which is now evolving into an innovative model for institutional investment: achieving high performance through economic diversification. The net effect has been the relative shift away from the accumulation of foreign assets in favor of long-term investments in local currency, with the PIF taking center stage in the Big Push for the diversification and modernization of the Saudi economy. In effect, surpluses are increasingly held in the form of “petroriyals”, rather than petrodollars. If this proves to be a permanent structural break it will have profound implications for Saudi Arabia’s macroeconomic and fiscal policy. The Kingdom’s ability to draw on foreign-exchange reserves to stabilize public spending and investment, while managing the fixed exchange rate in the event of a negative oil-revenue shock has already declined, given the reduction from US$750bn before the 2014 shock to the current level of US$450bn (according to official data from SAMA); while imports, government spending and the PIF’s capital deployments have increased considerably. While this domestic focus has already delivered impressive results and brought about a much-needed focus on long-term investment over short-term consumption, we argue that foreign assets and income remain vital to Saudi Arabia, not least due to large-scale infrastructure and megaproject investments which require significant intermediate capital goods and services from abroad. While there is increased appetite for resorting to debt financing, non-oil revenues and privatization proceeds, it is inevitable that non-oil revenue sources and debt-service costs will be correlated with oil revenues. The cost of adjustment through these channels will, therefore, also rise during a negative oil-revenue shock. The primary risk stemming from the post-2014 emphasis on domestic investment over foreign-asset accumulation, therefore, is that it could make Saudi Arabia more dependent on oil revenue for fiscal and external stability. As we explain in greater detail below, an important long-term objective should be to continue diversifying sources of public revenue, so that it is balanced across oil, mining, sales taxes, tourism, debt financing, and – as we argue for in this paper – financial income on both domestic and foreign assets. This portfolio of revenue sources will feature a mix of uncorrelated revenue streams and combine local- and foreign-currency income. As the Big Push evolves into the Long Push, this will enable Saudi Arabia to sustain spending and investment across the oil-revenue cycle – and help prepare for an eventual post-oil future. III. Progress on Reducing Oil Dependence: Revenue Diversification, but Rising Break-Evens Historically, even when oil prices have fallen sharply (as in 2009 and 2014), oil’s share of total revenue in Saudi Arabia has remained above 85%, given the lack of non-oil tax revenue – and, hence, such shocks had to be met with sharp, procyclical cuts in public spending and investment. The landmark introduction of a VAT sales tax in the aftermath of the 2014 oil shock, however, initiated a structural shift that resulted in non-oil revenues growing steadily ever since. Saudi Arabia also engaged in successful debt issuances, including foreign borrowing in the aftermath of the 2014 oil price shock. These developments mean that Saudi Arabia’s portfolio of revenue sources is now more diversified than before the 2014 shock (see Figure 2). This diversification is evident both in the total size of non-oil revenues annually and the fact that oil’s share of total revenue has remained below 70%, even during the large windfall in 2022. [[FIGURE OMITTED]] A common rule of thumb for assessing fiscal dependence on oil is to estimate the average price per barrel required to balance the budget for assumed levels of spending and oil production. Such fiscal “break-even price” estimates either assume real spending, non-oil revenues, and production volumes to be constant or following a steady growth path. In the Saudi case, production volumes are well anchored given its leadership role in OPEC, which means output typically fluctuates in a range of 9 million to 11 million barrels a day (on rare occasions widening to 8 million to 12 million barrels per day). Further, non-oil revenues can be assumed to increase steadily, while spending growth can be linked to medium-term expenditure commitments. [[FIGURE OMITTED]] As shown in Figure 3, Saudi Arabia’s break-even oil price decreased after the 2014 oil-revenue shock due to the growth of non-oil revenues and a sharp reduction in spending. While most regional estimates put the Kingdom’s break-even oil price slightly above those of its peers, such as Qatar, the United Arab Emirates and Kuwait, the decline in the break-even price after 2014 reflects significant progress, particularly considering the resumption of spending growth since 2019. Figure 3 should, however, be caveated: a meaningful reduction in oil dependence will break the historical tendency of break-evens to correlate with oil revenues over the cycle. While it will take a few more years to get a better understanding of more recent fiscal dynamics in Saudi Arabia, it appears that the fiscal break-even oil price has again risen in response to increased oil revenues in 2022 and 2023. The most recent estimates by the IMF, for example, released in the fourth quarter of 2023, suggested that the most recent break-even oil price for Saudi Arabia is once again US$86 per barrel. Further, estimates of the break-even oil price that attempt to account for investment and expenditure through the PIF are higher than those focused exclusively on the budget. The increase in break-even oil prices in recent years suggests that the procyclical relationship between spending, investment and oil prices remains a concern. [[FIGURE OMITTED]] Oil dependence is also evident with respect to Saudi Arabia’s external balances. A short-hand proxy for the oil-price sensitivity of the Saudi current-account balance is to estimate an “external break-even” price for oil. This is akin to the fiscal break-even oil price, but rather than estimating the oil price required to balance the budget, the focus is rather on the oil price needed to generate sufficient export revenues to pay for imports. Figure 4 shows Brad Setser’s estimates for Saudi external break-even oil prices (see Setser and Frank, 2017 for methodology). Note that the recent increase in the external break-even price for oil is in line with fiscal break-evens. Recent IMF estimates of Saudi Arabia’s external break-even oil price also show an increase from around US$50 per barrel in 2020 to over US$90 per barrel for 2024. Moreover, as shown in Figure 5, relative to both total exports and the total non-oil GDP, non-oil exports have remained relatively flat since 2010. These data indicate that Saudi Arabia remains dependent on oil revenues for external financing. [[FIGURE OMITTED]] Finally, oil dependence also manifests through cyclical correlation between oil and various economic indicators. Procyclicality is evident in the historical correlation between capital expenditure and oil revenues, shown in Figure 6. This correlation suggests that the burden of fiscal adjustment has historically fallen on the capital-spending component of the budget. Given the central role of the PIF in capital projects and infrastructure investments, a key objective is ensuring these can be sustained in the event of lower oil revenues, breaking the historic tendency to freeze capital projects when oil revenues decline. [[FIGURE OMITTED]] A stop-start pattern in public investment is problematic from a diversification perspective and presents a potential challenge to the Vision 2030 agenda, should oil revenues decline. Commodity-dependent, high-cost economies need patient capital in which investment is sustained beyond the medium term. The relative absence of obvious “low-hanging fruit” in the effort for diversification of the Saudi economy requires a Long Push, rather than a Big Push – thereby putting a premium on institutions and policies that can promote countercyclical resilience and sustainability. Overall, the 2014 oil-revenue shock and its aftermath initiated important fiscal reforms, notably the growth of non-oil revenues and successful debt issuances. That said, the recent increase in fiscal and external break-even price of oil, in correlation with higher oil prices and revenues, suggests that the procyclical tendencies remain. Macroeconomic stability and fiscal resilience, therefore, persist as notable risks in the event of sharp or protracted decline in oil revenues. In the remainder of this paper, we consider policies that will enhance sustainability, stability and resilience – which are critical to the transition from the Big Push to the Long Push. Box 1: Cross-Border Co-Investment, Leapfrogging Innovation and Attracting FDI Some commodity-dependent economies use their SWFs and SDFs to pursue and accelerate long-term opportunities that can unlock significant gains in productivity, innovation, and technology adoption. First, SWFs are uniquely positioned to provide the patient, long-term capital that is required to innovate from a low initial level. Second, and more importantly, strategic cross-border SWF investments can target the transfer of knowledge, technology and “know how”, where those productive capabilities are missing in the local market, thereby shortening the horizon over which high-complexity economic activities become feasible. Strategic SWFs and SDFs can be effective tools for stimulating local economies and markets, while delivering strong investment returns (Sharma, 2017). Indeed, when these funds are structured correctly, there is considerable evidence that robust investment performance and national development priorities can align. Casady, Monk and Sharma (2024) show that, as of March 31, 2022, Singapore's Temasek achieved a 40-year “total shareholder return” of 16% while catalyzing numerous domestic industries. Similarly, the Mubadala Investment Company, a sovereign investor based in Abu Dhabi, holds a five-year rolling rate of return of 12.2% since 2017. Moreover, the Sixth Swedish National Pension Fund (AP6) posted a five-year average return of 16.8% and a ten-year average return of 13%. Clark and Monk (2015) argue that SDFs typically pursue a combination of four development objectives alongside commercial returns: Reinforcing: SDFs that own existing but underperforming national assets—such as companies, infrastructure, or other real assets—are responsible for reorganizing, professionalizing, and innovating state holdings to drive commercialization and enhance returns. Crowding-In: SDFs that invest in emerging domestic industries can achieve greater financial and developmental returns when they attract capital commitments from both private and public investors from other nations. For instance, if an SDF demonstrates credible commercial acumen, it can syndicate local deals with investors who might otherwise invest elsewhere. Catalytic: SDFs not tied to specific industries or national assets can catalyze new industries, thereby diversifying the economy away from sectors that are no longer profitable or sustainable in the long term. These SDFs also address gaps in the economy by investing in solutions that will undoubtedly be required within the next decade. Financialization: Leveraging their capabilities and resources, SDFs can enhance the financial infrastructure of the local economy, thereby supporting the development process through the expansion of the capital market and the emergence of new financial intermediaries and investors focused on regional opportunities. In the case of Saudi Arabia, the PIF is pursuing all four diversification priorities simultaneously. This is an ambitious agenda, which will require significant resources. Fortunately, the Saudi economy is already large, with a GDP of more than US$1.2 trillion. The Vision 2030 will see this large economy transformed and transitioned away from fossil-fuel dependence and towards a net-zero footprint. The environment established in Saudi Arabia through Vision 2030 is ideally suited to this model of cross-border co-investment, led by the PIF. The strategic use of the PIF’s balance sheet to co-invest with sector-specific global corporate leaders can promote leapfrogging – essentially, “importing” technologies to skip intermediate steps on the productivity-growth ladder – thus expediting the expansion of Saudi productive capabilities. Moreover, we believe that the co-investment model will also create opportunities for “crowding-in” private Saudi capital – and triangulate between the PIF, global firms and the domestic private sector and investor base. The establishment of local investment opportunities in partnership with global corporations will also promote the deepening of the Kingdom’s capital markets and provide investment vehicles and destinations for attracting FDI, creating an opportunity to reduce corporate tax rates to a globally competitive level of 15%. Reduced investment taxes would be productive at this point of development, given the need to attract FDI, as it will enhance foreign-investor appetite in Saudi Arabia. Higher taxation may be considered once a critical level of investment has been attracted and the Saudi tax system has evolved to the point where a comprehensive package of investment and tax incentives can be offered to long-term investors. IV. Increasing Resilience: The Role of Foreign Assets and Investment Income While 2024 oil prices are currently within a range that allows Saudi Arabia to break even on a broadly expansionary fiscal path and cover its import costs, the reform momentum that was initiated by the 2014 collapse in oil prices would be tested in the event of a similar decline in oil revenues. Generating hard-currency financial income is a critical function of many SWFs, with offshore allocations accounting for all or most assets of the Norwegian, Abu Dhabi, Kuwaiti, Qatari and Chilean funds (in addition to several non-commodity SWFs, such as those from New Zealand, Australia, China and Singapore). In this section, we outline the conceptual case for accumulating foreign assets, particularly in resource-dependent economies, before considering how such a policy could be designed and implemented in Saudi Arabia.

#### Nuclear energy crushes demand, triggering price shocks.

Adams 13 (Rod Adams is the USS Von Steuben former engineer officer, 12/10/13, “Do oil and gas suppliers worry about nuclear energy development?” ANS Nuclear Cafe, pg. online @ http://ansnuclearcafe.org/2013/12/10/do-oil-and-gas-suppliers-worry-about-nuclear/)

Carol Browner, who served as the Environmental Protection Agency administrator in a Democratic administration, insisted that nuclear energy has an important role to play in reducing fossil fuel dependence and reducing CO2 emissions. Those examples show that the most receptive audiences for the nuclear energy alternative are people who buy a lot of fuel without selling any, and people who are deeply concerned about air pollution and climate change. The former understand that having additional supplies of reliable power will mean more competition to provide more stable and lower prices. The latter group knows that we cannot continue to dump CO2 into the atmosphere at an ever-increasing rate without unexpected consequences. It’s time to get more aggressive in nuclear energy marketing. The uranium industry should teach people how heat is fungible in order to excite its potential supporters and capture attention from energy pundits. **Nuclear fission** heat **has** already reduced the world’s dependence on oil; there is plenty of remaining **opportunity**. Nuclear energy pushed oil out of the electricity market in most of the developed world. Fission has replaced oil combustion in larger ships, but most others still burn oil. Nuclear-generated electricity has replaced oil burned for locomotives, city trolleys, and space heat, but there is room for substantial growth in these markets. Uranium producers should be influential members in the coalitions that are working to electrify transportation systems. Fission heat, especially with higher temperature reactors, can replace oil heat in industrial processes, including those well-proven processes that can turn coal, natural gas, and biomass into liquid fuels. Fission can also reduce oil use by pushing gas out of the power generation business, thus freeing up more natural gas for other uses. As the gas promoters love to point out, methane is a flexible and clean burning fuel. It is important to remind their customers that fuel burned in power plants is not available for any other use.

#### Perception alone is enough to trigger overreactions

Adams 13 (Rod Adams is USS Von Steuben former engineer officer, 12/10/13, “Do oil and gas suppliers worry about nuclear energy development?” pg. online @ http://ansnuclearcafe.org/2013/12/10/do-oil-and-gas-suppliers-worry-about-nuclear/)

The world oil market is not a free market. Prices are manipulated by a small number of producers that adjust production rates to achieve desired prices that are high enough to provide maximum profits, without being high enough to encourage customers to aggressively pursue alternative energy sources. That is the most important take away for attendees at the OPEC Embargo +40 summit held in Washington DC on October 16. Unfortunately, the meeting sponsors avoided acknowledging that nuclear energy is the alternative energy source that most worries established hydrocarbon suppliers. Nuclear has held that position since the early 1960s, when General Electric first won a head-to-head competition against coal to sell the Oyster Creek nuclear power plant. Nuclear energy is reliable, virtually emission-free, and uses a widely distributed, abundant fuel source that is no longer subject to influence by the same producers that manipulate other fuel prices. It’s cheap, clean heat can help turn coal, natural gas, and plants (vegetation) into liquid fuels that can be drop-in replacements for petroleum-based fuels.

#### It ensures volatility

Campos-Martins ’23 [Susana and David F. Hendry; July 9; Senior Research Fellow in Economics at Global Priorities Institute and the University of Oxford, Lecturer at Imperial College London and Saïd Business School, University of Oxford; Co-director of Climate Econometrics and Senior Research Fellow of Nuffield College, Former Professor of Economics at Oxford University and Econometrics at LSE; Centre for Economic Policy Research, “The global carbon transition is driving oil and gas extreme volatility,” https://cepr.org/voxeu/columns/global-carbon-transition-driving-oil-and-gas-extreme-volatility]

Oil and gas loadings seek to measure how much an asset’s volatility is affected by common factors, particularly geopolitical events in the oil and gas industry. It is not surprising that some supermajors, including Shell, BP, Chevron, and ConocoPhillips, have the largest exposure to these shocks. However, oil and gas companies tend to have different exposures to global shocks. Companies operating in markets or countries with more stringent climate policies are more exposed to climate transition risk. Investors must price carbon transition risk to compensate for their exposure (Bolton and Kacperczyk 2021). Research by Engle and Campos-Martins (2023) examines portfolio optimality, which can be used to determine how investors in oil and gas companies can reduce their exposure to broad geopolitical risk. Text-based proxies of climate concerns and news Events with large impacts shaking the oil and gas industry come from different sources, including geopolitical. The ‘price war’ between Saudi Arabia and Russia in the first quarter of 2020 rapidly spilled over to the global stock market, confirming tail risks can have major implications for the global economy. We use a text-based proxy – the Media Climate Change Concerns (MCCC) index of Ardia et al. (2020) – to determine whether climate concerns and news are potential drivers of volatility shocks to the oil and gas industry. Additionally, we use two monthly climate change news indices proposed by Engle et al. (2020) to differentiate between effects of positive and negative news, thus reflecting climate sentiment. Our results provide a systematic assessment of climate-driven oil and gas industry global risks, consistent over time, as perceived by the press, the public, global investors, and policymakers. However, not all geoclimatic shocks are alike. Climate change risk is more of a concern to oil and gas investors when there is turmoil in the US energy market. While Russia’s invasion of Ukraine resulted in record high oil prices, oil and gas dividends and share buybacks created incentives to hold oil and gas companies’ shares despite EU countries ramping up investment in renewables and increasing energy efficiency and security. What do we find? There are two types of climate risk drivers: physical and transition. Physical risk concerns how climate change can adversely impact capital stock, economic activities, and markets directly as extreme climate disasters become more frequent. Transition risk includes exposure to sudden changes in carbon pricing policy, legislation (such as the UK’s 2008 Climate Change Act), new clean-energy technology, and market sentiment. We find systemic implications of climate change for financial markets are most likely to come from exposure to transition risk, especially disorderly transition. News with explicit mentions of the fossil fuel industry and carbon pricing, or of carbon and technological disruption, drive global oil and gas variance shocks. To date, legal actions and liability or litigation risk seem to have no impact. Setzer and Higham (2021) show that most cases of climate change litigation filed before courts have been brought against governments for their support for the fossil fuel industry. However, societal impact relating to the consequences of climate action failure seems to affect the oil and gas industry, possibly by altering investors’ taste for climate change, interpreted as market sentiment risk drivers, creating pressure on the industry. Negative climate change news amplifies the effects of oil (variance) shocks as it increases uncertainty about the viability of investments in carbon-intensive assets and activities in a low-carbon economy. For example, the Deepwater Horizon disaster in 2010 had an impact on oil markets at the same time as concerns about its environmental impact, possibly increasing uncertainty about the future viability of the oil and gas industry. When no cross-sectional or cross-country information is used in the analysis, only oil shocks explain extreme returns to energy equity prices unlike for the oil and gas global common variance, reinforcing both how a common climate policy can be important and why negotiations during climate summits can disrupt global markets. Investors appear to be pricing climate change risks in oil and gas stocks rather than in the commodities, possibly reflecting short-term optimism about oil and gas versus the long-term nature of climate change. An alternative explanation may be consumers’ misperception of the carbon footprints of oil producers. Major oil and gas producers have committed to reduce their (relatively small) scope 1 (direct) and 2 (indirect from the consumption of purchased energy) emissions. These two categories are targeted because oil and gas companies have a limited ability to reduce their scope 3 emissions (indirect emissions related to products purchased and sold). Presently, oil has a low elasticity of demand as consumers are unable to substitute fossil fuels easily when prices increase, but that will change as electric cars replace gasoline-driven ones. Combined, these results suggest that the effects of climate change concerns on financial markets are more intricate and systemic than expected. The signs and magnitudes of impacts differ across climate risk drivers. Physical risk appears to be heavily discounted by investors because of its long-term nature, whereas transition risk tends to materialize in a shorter horizon. When accounting for climate sentiment, global turmoil seems to materialise only when climate news is negative and worldwide. Moreover, the adverse effect is amplified by oil price movements but weakened by stock market shocks. Conclusion Governments and companies need to assess their climate pledges and rethink the way they publicize or politicize them. The announcement of infeasible net-zero goals or carbon prices that are too low or ineffective, may not (only) damage a firm’s or country’s competitiveness individually, but may (also) disrupt global markets. The stability and resilience of the financial system will be crucial in managing climate-related transition risks and as well as regulation (Hengge et al. 2023) in mobilizing capital for low-risk green investments.

#### Meeting Vision 2030 commitments is the only pathway to restricting Iranian proliferation AND upholding deterrence.

Farouk ’23 [Yasmine; March 30; Nonresident Scholar in the Middle East Program, Ph.D. in Political Science from Sciences Po University; Carnegie Endowment for International Peace, “Riyadh’s Motivations Behind the Saudi-Iran Deal,” https://carnegieendowment.org/posts/2023/03/riyadhs-motivations-behind-the-saudi-iran-deal?lang=en]

On March 10, Saudi Arabia, Iran, and China issued a joint statement announcing an agreement to resume diplomatic relations between Riyadh and Tehran. After seven years of military and diplomatic hostility, the two Gulf powers agreed to work toward resolving their disagreements based on a set of international rules and two bilateral agreements signed in 1998 and 2001. This year’s agreement came after five days of comprehensive and intense negotiations in Beijing—and two years of Saudi-Iranian closed-door talks in Iraq and Oman. Much of the analysis has focused on China’s growing role in the Middle East amid global power competition. But Saudi motivations go beyond hedging against U.S. withdrawal from the region or balancing one great power against another. Why China’s Role Mattered Both the substance and process of this agreement is a case study of China and Saudi Arabia’s shared understanding of a rules-based international order and of international security. This is an agreement on the principles of conflict resolution between two states rather than an agreement on the solutions to be reached. It reiterates recurrent Saudi and Chinese attachment to norms such as nonintervention in the domestic affairs of nations that have been constant pillars of the Sino-Saudi partnership since 2006, shown in their joint statements, actions within the UN system, and in China’s Global Security Initiative. <<TEXT CONDENSED, NONE OMITTED>> China’s mediation also helped navigate a long-standing dispute between Saudi Arabia and Iran over the conflict in Yemen. Riyadh’s initial position included preconditions for any talks with Iran on Tehran “leaving Yemen to Yemenis,” as the kingdom viewed Iran’s support for the Houthis as a main obstacle to any de-escalation. But over the past two years, the Saudi position has evolved, and China helped broker a compromise by which Riyadh agreed to Tehran’s request to announce the restoration of diplomatic relations before Iran halted support to the Houthis. The public trilateral statement lacks any Iranian gesture on Yemen, but its language and consecutive press reports confirm that Chinese mediation finally got the parties to an agreement, which provides them with a two-month grace period to show goodwill before the restoration of diplomatic relations enters into effect. Saudi Arabia can’t guarantee an Iranian constructive role, but it is counting on some Chinese understanding, albeit imperfect, of its position in Yemen. Saudi Arabia is also betting on China’s vested interest in the success of Beijing’s first exercise of diplomatic leadership in the region. In addition, Saudi statements frame Iran’s engagements per this agreement as promises made to China. An unnamed Saudi official listed China’s role as one of the most difficult issues to resolve during the negotiations. Unlike the previous mediators (most recently Oman and Iraq), China has the leverage to guarantee Iran’s respect for its engagements within this trilateral process, at least from a Saudi point of view. Beijing has already pleased Riyadh by conveying high-level Iranian security officials and not just Iranian diplomats, whom Saudi Arabia perceives as less in control of Iran’s behavior in the region. Riyadh has traditionally lacked the coercive diplomatic tools and the military deterrence to pressure security and military agents inside Iran, especially the Islamic Revolutionary Guard Corps, into compromise. Chinese mediation may compensate for this weakness, but it also puts Beijing under the spotlight if Tehran violates the engagements it made in and to Beijing. Last, failed experiences are a pillar of the Saudi approach to any dialogue with Iran—including reliance on Western and regional powers to try to pressure Iran into a compromise. China is playing the “sponsor” role for the first time and has the benefit of Riyadh’s doubt. It is the first global power to use its leverage with Iran to address specific Saudi requests regarding Tehran’s regional policy without publicly framing them as Chinese security initiatives or a nuclear deal. There are two downsides to Beijing’s choice to highlight the regional ownership of this agreement. First, China presented itself as a “reliable friend of the two countries,” keeping itself at an equal distance from both. This is a position that Saudi Arabia doesn’t necessarily favor, even if it benefits from China’s leverage over Iran. Second, China is also signaling its distance from the final outcome, despite reiterating the promise that it “will continue its constructive role.” Chinese priorities in the Middle East remain largely economic, with security being a function of them. Saudi Arabia’s Vision 2030 <<PARAGRAPBH BREAKS RESUME>> Saudi Arabia’s de-escalation with Iran is part of a larger foreign policy focus on supporting its socioeconomic development plan, known as Vision 2030. The kingdom is investing billions of dollars to implement the plan, and an escalation with Iran would threaten the project’s funding, deter much needed foreign investment, and dash Saudi dreams of becoming a regional and global hub especially for cloud computing, logistics, trade, and industry. China’s mediation came at a time when the regional diplomatic and economic balance of power tilts toward Saudi Arabia. High oil prices are allowing the kingdom to advance its economic development plans and double down on its financial, “Saudi first” diplomacy to regain regional and international influence. Saudi leadership has worked to solidify the country’s international standing since 2018 by revamping its process for foreign policy making, ending diplomatic confrontations, and improving the international narrative on the Saudi role in the Yemen war. The United States is moving to reduce the gap in Saudi Arabia’s defense against Iran and its militias. Israel has become a de facto security partner within U.S. Central Command, and its eagerness for normalization with Saudi Arabia poses a threat to Iran. Importantly, reports on Saudi coverage of Iranian domestic unrest and its apparent private investment in Iranian opposition media provided the kingdom with a powerful bargaining card. On the other side of the Gulf, Iran is under pressure from both domestic protests and crippling international economic sanctions and diplomatic isolation. These factors increase Iran’s need for economic support, not only from China but also from its rich neighbors, led by Saudi Arabia. Although this might look like an ideal situation for Riyadh, it is not: Iran has a track record of lashing out at its neighbors when regime stability is at stake. Examples include the 1996 Khubar tower attacks and the 2019 attacks on oil infrastructure in Abqaiq and Khurais, leading to reports of an “imminent Iranian attack” following threats to Saudi Arabia amid Iranian protests last November. Tehran is also closer to achieving weapons-grade enriched uranium, which would likely increase Iran’s deterrence to a new level and unleash more hostile actions against its Gulf neighbor. China might economically and diplomatically sponsor a de-escalation between Iran and Saudi Arabia, but it doesn't necessarily mean that Beijing will intervene if Tehran decided to breach it. The Main Takeaways This agreement highlights the difference between Saudi Arabia’s relationship with China and its partnership with Russia. When it comes to foreign policy, the most central agreement between Russia and Saudi Arabia is the OPEC+ agreement. In fact, Russia’s agreement to sell Iran advanced military equipment and cyber warfare capabilities in return for Iran’s drones, which it has used in Ukraine, is a direct threat to Saudi Arabia’s security. The March 10 agreement gives Saudi Arabia a stake in drawing China away from a potential Russia-Iran-China axis that may embolden Iran’s offensive actions in the region, further empower it to escape U.S. and international sanctions on its economy, and increase Russian and Iranian encroachment on Saudi Arabia’s oil market share in China. Global power competition between the United States and China, Western shunning of Russia and Iran because of the war in Ukraine, and the clinical death of the Iran nuclear deal are already drawing the three countries closer. The agreement should be seen as a Saudi attempt to shield itself from getting caught in the middle of Western escalation with Iran, Russia, and China. Finally, the fundamental Saudi position is that Iran has no role in the Arab world. This will remain a vector for Riyadh’s enhanced cooperation with the United States and Western powers to move from defense to deterrence against Iran. For the time being, Saudi Arabia is choosing to deal with Iran with a detached pragmatism; essentially, “We cannot get rid of them, and they can’t get rid of us.” Based on this logic, Saudi Arabia is relying on regulated coexistence in the Gulf and a mix of competition and containment in Syria and Iraq. Turning the page on conflict with Iran will not be easy, even if the two countries respect the rules that they agreed on in Beijing. Riyadh will need to manage the complex link between Iran’s expectations for economic dividends from de-escalation with Saudi Arabia and the escalation of U.S.-led sanctions on economic cooperation with Iran. It will also need to mitigate potential spillover from Israel’s shadow war with Iran, Iran’s competing relationship with the United Arab Emirates, and adverse actions from Iran’s revolutionary guard and Iranian-backed militias across the region. For the time being, it seems that both governments in Riyadh and Teheran are determined to move closer.

#### Extinction.

Davenport ’24 [Kelsey; January 22; Director for Nonproliferation Policy at the Arms Control Association, Master’s from the Kroc Institute for International Peace Studies at the University of Notre Dame; The Institute for Peace and Diplomacy, “Balancing on the Nuclear Edge,” https://peacediplomacy.org/2024/01/22/balancing-on-the-nuclear-edge-pathways-to-manage-iran-at-the-nuclear-threshold-and-prevent-proliferation-in-the-middle-east/]

Iran’s advancing nuclear program poses a growing proliferation risk, but restoring the 2015 nuclear deal, known as the Joint Comprehensive Plan of Action (JCPOA), is no longer a viable policy option. While the U.S. intelligence community assesses that Tehran is not undertaking key nuclear weaponization-related activities, the country is closer to a nuclear weapon than at any point in its history.1 This threshold status, combined with rising regional tensions, increases the risk of conflict erupting over Iran’s nuclear ambitions or Tehran determining that nuclear weapons are necessary for state security and making the political decision to pursue the bomb.

While a new comprehensive nuclear agreement stands the best chance of rolling back Iran’s nuclear program and preventing proliferation in the long term, it is unlikely that negotiations will begin in earnest until after the U.S. election in November 2024. Even if talks were to resume before that, the trajectory of Iran’s nuclear program would require Tehran to modify its nuclear activities to create an environment conducive to those negotiations.

This paper examines the steps that the United States and its partners should pursue to stabilize the current nuclear situation over the coming year and incentivize Iran to roll back some of its most proliferation-sensitive nuclear activities. It argues that de-escalatory measures would reduce the risk of kinetic action against Iran’s nuclear program and the likelihood of proliferation.

The Post JCPOA-Diplomatic Vacuum

The 2015 nuclear deal negotiated between Iran and six countries known as the P5+1 (China, France, Germany, Russia, the United Kingdom, and the United States) proved to be an effective, verifiable agreement that traded stringent nuclear restrictions and monitoring for sanctions relief. Despite the success of the accord and Iran’s implementation of the nuclear requirements, then-U.S. President Donald Trump withdrew the United States from the deal, known as the Joint Comprehensive Plan of Action (JCPOA), and reimposed sanctions on Iran in May 2018. A year later Iran began breaching the JCPOA’s limits and has expanded its nuclear program significantly beyond the capacity of the pre-JCPOA program.

President Joe Biden pledged to return the United States to compliance with the accord alongside Iran2 and came close to reaching an agreement with Tehran in August 2022 to revive the nuclear deal. However, an unrealistic eleventh-hour demand by Iran killed that agreement and cast doubt on Tehran’s intentions to return to the JCPOA.3

Since then, the political space for U.S.-Iranian negotiations has narrowed significantly. The United States and its European partners are under pressure to refrain from reaching any deal with the current Iranian government after its brutal crackdown on domestic protesters and Tehran’s long-running support for Hamas. As a result of this pressure, the Biden administration is cautious about any further engagement with Iran ahead of the November 2024 presidential election.

Iran’s nuclear advances since talks broke down in August 2022 continued to erode the nonproliferation value of the JCPOA. As Iran masters new nuclear capabilities, the knowledge gained cannot be reversed, negatively affecting the strength of the nuclear restrictions.

Furthermore, Iran’s nuclear advances since talks broke down in August 2022 continued to erode the nonproliferation value of the JCPOA. As Iran masters new nuclear capabilities, the knowledge gained cannot be reversed, negatively affecting the strength of the nuclear restrictions.4 As a result, restoring the JCPOA is no longer viable from a technical or political standpoint.

Iran’s actions since August 2022 suggest that while Tehran continues to rhetorically support a return to the JCPOA, opposition to restoring the nuclear deal is solidifying. Comments in December 2023 from Iranian Foreign Minister Hossein Amirabdollahian that the JCPOA is “becoming useless” are indicative of that shift.5 However, there does appear to be more openness to de-escalatory steps to stabilize the current situation, as compared to 2021 when Iran rejected interim measures. For instance, Iran temporarily slowed down higher-level enrichment in the second half of 2023 and allowed the installation of enrichment monitoring devices in May 2023, suggesting Tehran may be willing to take further steps to reduce nuclear risk.

An Unsustainable Status Quo

While the JCPOA is off the table, U.S. and Iranian strategies appear to be focused on building leverage while trying to control escalation and avoid triggering a wider conflict. That approach, however, is not sustainable given the trajectory of Iran’s nuclear program and heightened regional tensions.

As of late 2023, Iran can produce enough weapons-grade nuclear material for one bomb in about a week and enough for five bombs in about three weeks.6 While the timeframe for Iran to produce enough weapons-grade material for one bomb will likely remain constant, the time to multiple weapons will drop further if Iran continues to stockpile highly-enriched uranium and install more efficient centrifuges. As the window to multiple bombs worth of weapons-grade fissile material shortens, the proliferation threat increases.

It is highly unlikely that Iran will risk breaking out to build just one bomb, but when it can produce enough material for several weapons before the international community can react, there is a greater chance Tehran will make the political decision to build nuclear weapons. Weaponization would take additional time—anywhere from six months to one year—but that process would take place at covert facilities and be more difficult to detect and disrupt when compared to the production of fissile material, which takes place at known sites.7

Additionally, Iran severely curtailed International Atomic Energy Agency (IAEA) inspections in February 2021, including suspending a more intrusive monitoring arrangement that gave inspectors access to facilities that support the country’s nuclear program but do not contain nuclear materials, such as centrifuge production workshops.8 As a result, there is an increased risk that Tehran could divert these materials without detection.

The monitoring gap creates longer-term challenges as well. IAEA Director General Rafael Mariano Grossi assesses that the agency lost its continuity of knowledge regarding Iran’s nuclear activities due to the reduced access to information and facilities.9 Even with Iranian assistance, it will be challenging for the agency to reconstruct credible baselines for certain materials, such as centrifuges. Without reliable baselines, it will be more challenging, if not impossible, to verify certain limits that may be included in any future nuclear agreement.

There is a greater risk that the United States, or more likely Israel, miscalculates Iran’s intentions or Iran misjudges the space it has to expand its program and crosses a redline.

Iran’s nuclear advances coupled with limited IAEA monitoring increase risk in several key areas. First, there is a greater risk that the United States, or more likely Israel, miscalculates Iran’s intentions or Iran misjudges the space it has to expand its program and crosses a redline. Either scenario increases the risk of kinetic action against Iran’s nuclear facilities. While any large-scale attack on Iran’s nuclear sites may roll back the country’s nuclear program in the short term, military action is more likely to push Tehran to ratchet up its nuclear activities, or more seriously, to withdraw from the Nuclear Nonproliferation Treaty (NPT) and/or openly pursue nuclear weapons to prevent further attacks. Tehran already threatened to withdraw from that treaty if the European parties to the JCPOA attempt to reimpose UN sanctions modified by the nuclear deal under a special ‘snapback’ provision in Resolution 2231 (the United States cannot exercise this option given that it withdrew from the JCPOA).10 The snapback cannot be vetoed.

Perhaps more likely, Iran may judge that it can maintain the leverage of being a threshold state while further insulating its economy from the effects of sanctions. Under this scenario, an Iranian nuclear weapon remains an existential threat and the pressure on Tehran to negotiate diminishes.

Allowing Iran to remain on the threshold of nuclear weapons also has implications for the broader nonproliferation regime and regional stability. The perception of a long-term latent nuclear threat could push Iran’s regional adversaries to match its nuclear weapons capability. Saudi Arabia, for instance, has threatened to build a nuclear weapon if Iran goes down that path.11 More broadly, a failure to return Iran to compliance with legal obligations under the NPT would weaken nonproliferation norms at a time when the treaty is under significant stress. Thus, the risks of remaining on the current trajectory underscore the critical importance of a new diplomatic strategy for engaging with Iran.

The Limits of the U.S. Approach

The Biden administration is committed to the long-standing U.S. policy goal of preventing Iran from obtaining nuclear weapons. However, it currently appears focused on de-escalating nuclear tensions without directly engaging Iran and building leverage for future talks. This approach is often described as “no deal, no crisis.”

For the United States, alongside other European and NATO countries, this strategy includes ratcheting up coercive measures and attempting to isolate Iran diplomatically and economically, primarily by building up support for sanctions. Another component of the U.S. strategy includes deterring Iran from making the decision to build nuclear weapons, including through signaling a credible military threat if Iran attempts to pursue nuclear weapons.

While the United States appears open to de-escalation with Iran to reduce nuclear risk, the Biden administration has not clearly articulated its longer-term diplomatic goals to prevent proliferation now that restoring the JCPOA is off the table.

Generally, the United States pairs coercive pressure with a diplomatic offramp, which demonstrates to would-be proliferators that there is a viable path to lifting punitive measures and ending diplomatic isolation. While the United States appears open to de-escalation with Iran to reduce nuclear risk, the Biden administration has not clearly articulated its longer-term diplomatic goals to prevent proliferation now that restoring the JCPOA is off the table.

In the current environment, however, this strategy of building leverage while controlling escalation is unlikely to be effective and risks backfiring. First, Washington is facing new challenges in building international support for pressuring and isolating Iran. The U.S. withdrawal from the JCPOA while Iran was complying with its obligations contributed to a larger sanctions fatigue and made sanctions relief appear a less credible incentive. Furthermore, the geopolitical rift between NATO and Russia has driven Tehran and Moscow to strengthen their relationship.12 As a result, it is more challenging to build and sustain pressure on Iran than in the past. Waning pressure disincentivizes Iran from seeking a deal that provides it with sanctions relief, particularly when there are legitimate concerns about the credibility of that relief.

Second, while the United States has dismissed the JCPOA as a viable diplomatic option, the Biden administration has yet to articulate its new diplomatic approach to addressing the growing nuclear crisis and demonstrate how that approach will benefit Iran.

As a result, there is a real risk that the current U.S. strategy will not bring sufficient pressure or provide necessary incentives for Iran to engage in negotiations. Furthermore, without engagement, there is a greater risk that spoilers, heightened regional tensions, or a nuclear miscalculation trigger a conflict.

### Contention 2 – Quantum Batteries

#### DOE is funding quantum research centers right now

**NQCO 25**[National Quantam Coordination Office, Jan 15 2025, “DOE Announces $625 Million for National Quantum Information Science Research Centers” NQOC, <https://www.quantum.gov/doe-announces-625-million-for-national-quantum-information-science-research-centers/> Date Accessed 3/16/2025//AT]

The **U.S. Department of Energy’s Office** of Science **is announcing that $625 million is available to support** National **Quantum** Information Science **Research Centers**. **These centers**, which are multi-institutional, multi-disciplinary teams, **will accelerate the transformational advances** **in** basic science and **quantum-based novel-technology** platforms needed to develop world-leading capabilities in Quantum Information Science (QIS), and in support of the National Quantum Initiative Act. **Each center will integrate multiple levels of innovation**, blending basic research, engineering, and technology development in a co-design framework. The centers will deliver prototype novel-technology platforms, capabilities, and major scientific breakthroughs that, in the future, can be further developed into a resource or user-facility capability for the entire QIS R&D community.

#### However, nuclear energy also relies on funding from the DOE. This means any increase in the nuclear sector means a cut in other sectors funding

US DOE 25 [US department of Energy, January 8, 2025 “U.S. Department of Energy Announces $13 Million to Support Advanced Nuclear Reactor Licensing Activities”, <https://www.energy.gov/ne/articles/us-department-energy-announces-13-million-support-advanced-nuclear-reactor-licensing#:~:text=New%20cost%2Dshared%20grant%20program,licensing%20advanced%20reactors%20and%20facilities.&text=WASHINGTON%2C%20D.C.%20%E2%80%94%20The%20U.S.%20Department,Licensing%20Cost%2DShared%20Grant%20Program> Date Accessed 3/16/2025//GZ]

**[Just recently] The U.S. Department of Energy (DOE)** today [**announced**](https://www.fedconnect.net/FedConnect/default.aspx?ReturnUrl=%2ffedconnect%2f%3fdoc%3dDE-FOA-00022575%26agency%3dDOE&doc=DE-FOA-0003339&agency=DOE) up to **$13 million is available** to industry **through** a new **Advanced Nuclear Energy Licensing Cost-Shared Grant Program**. **The competitive funding opportunity will help to defray the cost of licensing fees** for first movers attempting to bring advanced reactors to market. “As demand for clean, reliable energy continues to grow, we need to accelerate the deployment of advanced nuclear technologies,” said Principal Deputy Assistant Secretary of Nuclear Energy Dr. Michael Goff. “This program will increase regulatory certainty by joining together public and private funds to expedite the deployment and commercialization of both light-water and non-light water advanced reactor designs.”

#### Funding for quantum research will be cut, DOGE & Trump have been reducing funding for agencies specializing in science and research

Impey 25 [Chris Impey, February 15, 2025. “Cutting Funding for Science Can Have Consequences for the Economy, U.S. Technological Competitiveness” [https://www.homelandsecuritynewswire.com/cutting-funding-science-can-have-consequences-economy-us-technological-competitiveness](https://www.homelandsecuritynewswire.com/cutting-funding-science-can-have-consequences-economy-us-technological-competitiveness%20%20) Date accessed 3/16/2025 //GZ]

**Two months into Donald Trump’s** second **presidency and many parts of US science – across government, academia, and industry – continue to be hit hard by the new administration’s policies. Science-related government agencies are seeing budgets and staff cut,** especially in programmes linked to climate change and diversity, equity and inclusion (DEI). Elon Musk’s Department of Government Efficiency (DOGE) is also causing havoc as it seeks to slash spending. In mid-February, DOGE fired more than 300 employees at the [National Nuclear Safety Administration](https://www.energy.gov/nnsa/national-nuclear-security-administration), which is part of the US Department of Energy, many of whom were responsible for reassembling nuclear warheads at the Pantex plant in Texas. A day later, the agency was forced to rescind all but 28 of the sackings amid concerns that their absence could jeopardise national security.

#### No research in the quantum sector means China will pull ahead in the quantum race, giving them better energy tech

**Huaxia 24**[April 1 2024, “China Focus: Researchers create concept for quantum batteries with efficient remote charging” Xinhua <https://english.news.cn/20240401/0f2a0cff8a88472991445fdd533d9a3a/c.html#:~:text=They%20proposed%20placing%20the%20charger,infinite%20reusability%20without%20environmental%20pollution>. Date Accessed 3/16/2025//AT]

**Chinese researchers have proposed a quantum battery** (QB) **concept to realize remote charging, effectively solve the problem of energy dissipation, and achieve durable and efficient performance in quantum batteries.** Quantum batteries make use of quantum effects to store and supply energy, which may outperform their classical counterparts, but there are still challenges in this field. One is that the environment-induced decoherence causes energy loss and aging in QBs, and the other is that charging is inefficient due to the decreasing of the charger-QB coupling strength with increasing distance. In recent years, **the growing demand for energy has stimulated** academic **interest in the research of transformative energy storage and supply devices.** The QB concept was initiated by physicists in countries such as Poland and Belgium, and followed by their counterparts all over the world. They hoped to develop QBs that were smaller, with stronger charging power and higher charging capacity by using quantum effects and a bottom-up atom manufacturing process. Quantum batteries, storing energy from light in the quantum states of atoms and molecules, could theoretically charge much faster than conventional devices. However, interactions between QBs and their environment tend to cause the devices' delicate quantum effects to break down, reducing its ability to store energy. "Any quantum system cannot be absolutely isolated from its outer environment, which inevitably induces unwanted decoherence to the system," explained An Junhong, professor at Lanzhou University. Using the constructive role of decoherence, the **researchers** from the Hubei University, the Innovation Academy for Precision Measurement Science and Technology (APM) of the Chinese Academy of Sciences (CAS), and the Lanzhou University devised a way **to harness those interactions to charge, rather than deplete, the battery.** They proposed placing the charger and battery, which can take various formats, including an atom in a high-energy state, in a rectangular metal tube. By applying an electromagnetic field throughout the tube, the researchers put the battery, charger and tube environment into a single quantum state. This would allow the charger to exchange energy with the battery without exposing the system to disturbance. The scheme, which has not yet been tried, could work with the battery and charger placed up to 10 centimetres apart. It should result in batteries that don't lose their efficiency over time, according to the researchers. Their study has been published in the journal Physical Review Letters. An Junhong highlighted that their device is completely safe and harmless as the electromagnetic field is always confined within the waveguide and the QB's energy storage, free from electrochemical reactions, promotes infinite reusability without environmental pollution. The next step for the researchers is to scale their QB scheme. "More specifically, **we plan to develop a many-body QB model working in the way of remote wireless charging. This could permit us to efficiently incorporate the superiority of quantum entanglement in enhancing the charging power, charging capacity, and the extractable work of a remote-charging and anti-aging QB**," said An.

#### China winning another sector of the green energy race will lead to price shocks across the globe

Haley Zaremba 24 [Haley Zaremba for Oilprice.com, March 18 2024, “China’s Solar Power Dominance Threatens Western Clean Energy Dreams”, [https://oilprice.com/Energy/Energy-General/Chinas-Solar-Power-Dominance-Threatens-Western-Clean-Energy-Dreams.html date Accessed 4/2/2025](https://oilprice.com/Energy/Energy-General/Chinas-Solar-Power-Dominance-Threatens-Western-Clean-Energy-Dreams.html%20date%20Accessed%204/2/2025) //GZ]

**China is doubling down on solar power production, making the West’s chances of catching up even slimmer**. **China has been outspending the rest of the world in clean energy deployment for years now, out-investing other economic superpowers** [**by a factor of four**](https://oilprice.com/Alternative-Energy/Renewable-Energy/China-Is-Crushing-The-Competition-In-Clean-Energy-Spending.html)**. Not only is the window closing for the United States and Europe to produce solar energy competitively in China, the West is increasingly dependent on imports of Chinese clean energy components and raw materials for their own renewable energy expansion strategies**. In 2023 China spent more than four times what the U.S. spent and three times what the entire European Union spent on renewables. As a result, Beijing installed more solar panels in a single year than the United States has in its entire history. At the same time, Chinese exports of whole solar panels shot up by 38% while exports of solar panel components increased nearly two-fold. This is great news for China’s decarbonization trajectory, which in turn means it’s great news for progress toward decarbonization on a global level, as China is [the biggest greenhouse gas emitter](https://www.c2es.org/content/international-emissions/#:~:text=Most%20of%20the%20world's%20greenhouse,the%20United%20States%20and%20Russia.) on the planet. **But it’s very, very bad news for renewable energy industries in the West and for energy security worldwide as more and more of global clean energy supply chains are controlled wholly or in large part by Beijing. China already controls near-monopolies on a vast number of key renewable energy supply chains and nodes. The economic giant produces a whopping 80% of the world’s solar panels, 60% of its electric vehicles, and more than 80% of its electric vehicle batteries. China also produces** [**60%**](https://www.ft.com/content/5b031db7-23dd-43d3-afe1-cef14817296f) **and processes** [**almost 90%**](https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/executive-summary) **of the world’s rare earth minerals. Rare earths such as lithium and cobalt are essential components for clean energy manufacturing and infrastructure, including (but certainly not limited to) electric vehicle batteries, photovoltaic solar panels, and lithium-ion batteries used for renewable energy storage. And that dominance is only going to grow and intensify in the coming months and years as China’s juggernaut performance in 2023 hits the market in full force while Beijing also doubles down on manufacturing and production in 2024.** In fact, Chinese officials announced last week in the [annual national legislature session](https://www.nytimes.com/2024/03/04/business/china-gdp-target.html) that the country plans to accelerate construction of massive solar farms alongside major wind and hydroelectric projects. The announcement comes as part of a new chapter in China’s economy**. China has already built pretty much as much infrastructure as its own economy can possibly absorb, and as a result the economy is** [**slowing down**](https://www.nytimes.com/2023/09/26/business/china-economy-factories-liaoning.html)**. The** [**property bubble is bursting on a national level**](https://www.nytimes.com/2023/08/20/business/china-property-crisis-country-garden.html)**, and unemployment rates are punishing, and set to soar. With a record** [11.79 million **[amount of]** students](https://www.scmp.com/economy/economic-indicators/article/3244076/chinas-college-graduates-hit-record-high-1179-million-2024-adding-job-market-pressure?module=inline&pgtype=article?module=inline&pgtype=article?module=inline&pgtype=article) **expected to graduate from university this year in China, an already massive pool of job-seekers will face punishing levels of competition for an insufficient number of employment opportunities. In response to this critical economic contraction, China has laid out a well defined strategy that** [**leans heavily on emerging technologies**](https://www.nytimes.com/2024/03/07/business/china-solar-energy-exports.html)**, and in particular what Beijing’s leaders are calling a “new trio” of industries — solar panels, electric cars and lithium batterie**s. This forward-facing “new trio” is intended to replace the “old trio” of Chinese manufacturing and exports – clothing, furniture and appliances**. Global leaders find this doubling down on manufacturing in China’s new economic era extremely concerning. In free-market and free-trade focused regions such as the United States and Europe, production comes as a direct response to demand. This is not the way things work in China, which frequently produces for the sake of production, and now risks seriously flooding the global market with a glut of a vast number of “new trio” products, with potentially harsh consequences for the global economy. “**[**China Is Making Too Much Stuff—and Other Countries Are Worried**](https://www.wsj.com/economy/trade/china-is-making-too-much-stuffand-other-countries-are-worried-f949cd27)**,” blared a recent Wall Street Journal headline. More specifically, the concern is that China, faced with far more solar panels, electric cars, and batteries than their own economy can possibly absorb, Beijing will dump the products onto the global market at steep discounts. In the worst-case scenario, the result of this** [**predatory pricing**](https://www.investopedia.com/terms/p/predatory-pricing.asp) **(an illegal activity forbidden by the World Trade Organization) would be that no other producer could possibly compete, causing the failure of non-Chinese firms and leaving China with an all-out monopoly. This would leave the global energy supply extremely vulnerable, and give Beijing an unfathomable amount of leverage over its allies and adversaries alike. Even if free trade and antitrust mechanisms work as they should and prevent this kind of catastrophic takeover, the partial takeover that China has already begun is cause enough for major concern at the global level.** **Already, the** [**United States**](https://oilprice.com/Alternative-Energy/Renewable-Energy/China-Is-Still-Critical-To-Americas-Clean-Energy-Boom.html) **and** [**Europe**](https://oilprice.com/Energy/Energy-General/Europes-Rapid-Renewable-Shift-May-Depend-On-Chinese-Materials.html) **are dependent on China for their own nascent clean energy industries.** So far, the response in the United States has been to employ protectionist policies via the Inflation Reduction Act, while leaders in Europe are [currently agonizing](https://oilprice.com/Energy/Energy-General/Europe-Grapples-with-Balancing-Free-Trade-Principles-and-Clean-Energy-Ambitions.html) over whether to follow suit. Whatever the political and economic reaction will ultimately be, however, it seems it will almost certainly be too little, too late.

### Contention 3 - Biodiversity

#### Even a limited expansion of nuclear power *destroys the biosphere*.

Dr. M.V. Ramana 24, PhD in Physics from Boston University, Professor and Simons Chair in Disarmament, Global and Human Security at the University of British Columbia, and Director of the Master of Public Policy and Global Affairs program at the School of Public Policy and Global Affairs, previously worked at the Nuclear Futures Laboratory and the Program on Science and Global Security, both at Princeton University, member of the International Panel on Fissile Materials, the International Nuclear Risk Assessment Group, and the team that produces the annual World Nuclear Industry Status Report, “Nuclear is not the solution: atomic power in the age of climate change”, Verso Books

My bottom line is that nuclear energy, whether with old reactor designs or new faux alternatives, will simply not resolve the climate crisis. The threat from climate change is urgent. The world has neither the financial resources nor the luxury of time to expand nuclear power. Meanwhile, even a limited expansion would aggravate a range of environmental and ecological risks. Further, nuclear energy is deeply imbricated in creating the conditions for nuclear annihilation. Expanding nuclear power would leave us in the worst of both worlds. Too virtuous to meter? Proponents of nuclear energy have other reasons to support their preferred technology. They argue that nuclear reactors can do much more than just generate electricity. The “much more” depends on the specific context, and could include creating well-paying jobs, boosting national pride, providing energy independence, supplying clean water, and producing medical isotopes to treat cancer. As the public has become more concerned about climate change, nuclear advocates have appended to this list two more applications for energy from nuclear reactors: capturing carbon dioxide from the atmosphere (direct air capture) and producing hydrogen and high temperature heat for industrial processes. All of these are reminiscent of what Admiral Lewis Strauss, one of the central characters in the hit Hollywood film Oppenheimer and the chair of the US Atomic Energy Commission in the 1950s, told the National Association of Science Writers on September 16, 1954. Ten days after the ground-breaking for first US nuclear plant, Strauss told his audience that given the great promise of nuclear technology, it would not be “too much to expect that our children will enjoy in their homes electrical energy too cheap to meter.” The many claims about what else nuclear reactors can do make one wonder: Is nuclear energy too virtuous to meter? Let me offer one example from a company called Hyperion Power Generation offering a small nuclear power plant design that was actively covered in the media between 2007 and 2012. In March 2010, the founder of this company, John Deal, told the Albuquerque Journal, “We started this company to clean water in Africa … Our emphasis is helping people not die from not having clean water … If you’ve got energy, you can have all the clean water you want.” This was not a one-off sales pitch. In their 2011 article in Issues in Science and Technology, writer Ross Carper and academic Sonja Schmid offer this description of Deal in action: In the middle of Deal’s talk in Denver, he began flipping through some artist-drawn images. The most striking of all shows a small nuclear reactor, buried and unattended at what looked to be less than 15 feet below the surface. Two simple tubes snake upward from the reactor, drawing the eye to a pair of gray above-ground tanks, with the words “Potable Water” stamped on the side. The setting? An impoverished African village complete with about a dozen mud constructed, thatch-roofed huts. A handful of people were drawn into the image, all of them walking to or from the clean water source, which is apparently powered by a $50 million HPM.7 HPM stands for Hyperion Power Module, the nuclear reactor the company was advertising, and the cost estimate of $50 million for a nuclear reactor should be seen in that light—as wishfully cheap. (A few years later, Pitch Book, a database of private equity-based corporations, listed the company as “out of business.”) Such promises of atomic energy delivering progress to Africa date back to the beginning of the nuclear age. On January 28, 1947, for example, Waldemar Kaempffert, the science editor of the New York Times, predicted, The desert of Sahara could easily be irrigated by electric pumps driven by uranium power, with the result that more surplus cotton than we could sell at a profit and more surplus plant food than we could eat would be dumped on the market. Africa would be transformed into another Europe, with savages [sic!] who never saw a steam shovel or railway train transformed into machine tenders.8 After more than half a century of experience with nuclear technology, ideas about using it to provide clean water to poor people are delusional at worst and deceptively self-serving at best. Reducing the problem of insufficient clean water to an absence of energy ignores the many other problems that prevent African villagers from accessing clean water and the persisting legacies of colonialism and imperialism that led to “underdevelopment” in the first place.9 In his “communal memoir” of the aerospace industry Blue Sky Dream, the journalist David Beers talks about a special characteristic of the former Nazi rocket scientist Wernher von Braun, the man sometimes termed “the father of America’s space program” due to his important role in transferring rocket technology to the United States. The classic American entrepreneurial hero searches out unmet desires in the everyday world and then, with a certain flexible flair, invents the answers, products for the masses to use. Von Braun’s genius lay elsewhere. He was brilliant at inventing new and different uses for the only product he ever desired to make, the space rocket. He was a master at selling his one product to the only customers who could ever afford it, a nation’s rulers.10 Much like von Braun, vendors and advocates of nuclear power are really interested only in selling nuclear reactors, and they try to invent different uses for their favoured product. Delivering clean water, heating houses or industries, and propelling rockets and ships are all only vehicles for selling nuclear reactors. However, the appeal to other uses for nuclear reactors is also, simultaneously, an expression of the inability of the technology to economically deliver on its primary product: electricity. It is the weakness of the nuclear industry that forces it to seek alliances with other constituencies. Too destructive to meter? Nuclear energy does have one virtue, but it is one that its advocates, for the most part, avoid mentioning: its innate and inseparable connection to nuclear weapons, and more generally, to the military. I use the word “virtue” to mean both an inherent attribute and an asset beneficial to its proponents. Technically, there are significant overlaps between the apparatus needed to produce nuclear energy and what is needed to produce the fissile material, the hardest step in acquiring nuclear weapons. In addition, personnel can be interchanged between the nuclear energy and weapons programs. And finally, there are institutional incentives for organizations developing nuclear energy to get involved in making nuclear weapons, due to the political power that flows from the latter. Nuclear technology also contributes to powering long-range submarines, especially those used to fire off nuclear missiles, and to providing the material to manufacture depleted uranium munitions used in Iraq and Ukraine. I elaborate on these connections in chapter 5. Nuclear energy advocates often argue against conflating nuclear energy with nuclear weapons, but the connection is visible for all those who want to look. As of September 2023, 275 of the 410 nuclear reactors labelled as operating by the International Atomic Energy Agency are in countries possessing nuclear weapons. Add countries like Canada and Japan that are militarily allied with nuclear weapon states, and the overlap is staggering. While it is certainly true that not all countries with nuclear energy have produced nuclear weapons, they are closer to being able to do so than they would be if they had never built nuclear reactors. The overlap between the two technologies was obvious to most knowledgeable people at the beginning of the atomic age. In 1946, when discussing a proposal for the international control of nuclear weapons, Robert Oppenheimer, the head of the program that produced the first atomic bombs, which destroyed Hiroshima and Nagasaki, expressed it thus: “We know very well what we would do if we signed such a convention: we would not make atomic weapons, at least not to start with, but we would build enormous plants, and we would design these plants in such a way that they could be converted with the maximum ease and the minimum time delay to the production of atomic weapons.” Within a few years, however, countries with nuclear technology started a sustained campaign to get the public to think differently about nuclear energy, most notably after President Dwight Eisenhower’s “Atoms for Peace” speech in 1953. This “greatest of destructive forces,” Eisenhower prophesized, “can be developed into a great boon, for the benefit of all mankind,” can be put to “universal, efficient and economic usage” and whose “special purpose would be to provide abundant electrical energy in the power-starved areas of the world.” In other words, forget the destructive capacity of nuclear energy. Just focus on what a wondrous future it can create. The Soviet counterpart of this effort is captured by the slogan “May the atom be a worker, not a soldier.” The hope seems to be that by pretending that nuclear energy was not linked to weapons, public fears about the destruction that would result from the use of nuclear weapons would be quelled. Institutions and governments around the world developing nuclear technology often start by touting its potential to produce electricity. This was the case in India. For over two decades, India’s Atomic Energy Commission was ostensibly working on nuclear energy only “for peaceful purposes,” until the 1974 test of a nuclear weapon blew up that pretense.11 Many private companies profit enormously from both nuclear energy and nuclear weapons. Examples include Bechtel, Babcock & Wilcox (now BWX Technologies), and Fluor in the United States, Larsen & Toubro in India, and Rolls Royce in the United Kingdom. While there might not be a similar level of involvement by private companies in countries like China, where public sector and national organizations play the analogous roles, the differences between the two categories are not very material to understanding the structure of, and trends in, the nuclear sector. National laboratories contract out work and are sometimes even managed by private companies. And private companies thrive on public contracts that they often have exclusive access to, belying any notion of free markets and competitive entrepreneurship. For both corporate and governmental entities, nuclear technology is a wonderful asset. As analyst and disarmament activist Andrew Lichterman argues: The nuclear road provides elites in nuclear establishments with privileged access to their own country’s resources, a development context that can be shielded from foreign competition, and forms of trade and industry that can be portrayed as increasing in importance as fossil fuels diminish. This is so whether the intention to develop nuclear weapons is clear or is allowed to remain ambiguous. The powerful tools of nationalism and ‘national security’ secrecy can be used to facilitate the extraction of wealth from the rest of society and prevent scrutiny of national nuclear enterprises that whether in first generation nuclear powers or post-colonial states have been rife with technical problems, corruption, and widespread, intractable environmental impacts.12 Overview of the book The chapters that follow explain why expanding nuclear power production is neither a desirable nor a feasible solution to climate change. Due to the use and production of radioactive materials at reactors, expanding nuclear energy to mitigate climate change will inevitably result in a variety of undesirable risks and environmental impacts. Nor is it compatible with environmental and social justice.13 The consequences and burdens of such an expansion will fall primarily on communities that are distant from the centers of power, and economically and politically too marginal to figure in the calculations of decision makers. In chapter 1, I explain how all nuclear reactors, including small ones, are at risk for severe accidents due to their intrinsic technological characteristics. When it comes to nuclear facilities, I will argue, there is nothing that fits a strict definition of “safe.” The risk is exacerbated by a range of factors, including extreme weather patterns due to climate change, the multiple and conflicting priorities of organizations operating nuclear facilities, and the weakening of regulation by industry lobbyists and other powerful economic actors. Accidents, when they occur, produce radioactive contamination that reaches across space and time; thirty-five years after the Chernobyl accident, parts of Ukraine and Belarus are still uninhabitable because of high radiation levels. Radioactive cesium released by the disaster was found in sheep in England, which remained contaminated for decades; restrictions on eating these sheep were lifted in all areas only in 2012. Expanding nuclear energy production will also result in a growing inventory of radioactive wastes, no matter what kinds of reactors are used. Some of these wastes remain radioactive, and thus hazardous to human health, for hundreds of thousands of years. Despite decades of well-funded research, there is no demonstrated way to safely manage them, and because of the long periods involved, there will always be uncertainties about the fate of these materials.14 As a result, it is likely that radioactive materials will contaminate the biosphere at some point in the future. This is an important cause for opposition from communities near sites chosen for nuclear waste repositories. Another concomitant activity to the operation of reactors is uranium mining, which has been responsible for contaminating land and water around the world, especially in areas occupied by Indigenous communities. Given these inevitable impacts, nuclear power is neither clean nor sustainable. One way that some nuclear energy advocates try to get around these conclusions is by claiming that exposure to radiation is harmless, at least below some threshold. But as I explain, there is ample evidence that exposure to radiation, even at low levels, leads to cancers and other negative health outcomes.

#### Biodiversity loss causes extinction.

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As biodiversity continues to degrade, the foundation of life on Earth becomes increasingly unstable. Biodiversity loss threatens our food, water and air. It increases our vulnerability to natural disasters and imperils ecosystems crucial for human survival and wellbeing.