

Policy Paper

China vs. US: The Green Energy Race
Overview of China's and America's green
investment plan and what that means
for the future of fossil fuels

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Abstract

The role of climate change in geopolitics has changed significantly in the last decade. The climate topic has shifted the geopolitical winds towards a complete restructuring of the future global economy. Today, a multilateral order is being challenged with a new era of green-energy competition spanning over greater geographic and economic spheres, driven by rapid technological change and advancements. Energy security and technological developments in renewables will determine who will become global leaders, awarding them with competitive and strategic economic advantages. Renewable energy programs and policies in China and the United States have rapidly increased in a short period of time. Facing the rapid global expansion of China’s energy-sphere of influence, the United States began competing with China by offering affordable finance for global clean energy development in lieu of fossil fuels. By financing more clean energy projects, the United States would contribute to meeting the goals of the 2015 Paris Agreement on Climate Change and provide a counterweight to China’s energy investments around the globe.

This paper calls on global renewable energy leaders such as China and the United States to collaborate more closely by building a competitive sustainable energy platform, along with its global partners such as the European Union. By sharing information, costs, and efforts, it would possibly accelerate technological advancements towards more renewables and climate-friendly policies. The idea is for governments to create an environment in which companies can compete to produce more renewable technologies. China is realizing quickly that if governments increase their efforts, especially by supporting research and development, this is likely the key to winning the “green-energy race”. Better yet, increased technology cooperation and competition between countries and their respective companies, could help motivate and engage other countries into action as well and ultimately mitigate greenhouse gas emissions.



The “Renewed” Energy Race

China and the United States (US) are the world’s biggest producers of CO₂ and have ironically entered the Green Energy Race – transforming the energy security dynamics through renewable energy deployment. Crucial changes are occurring within the global energy system, impacting every nation on the planet, and shifting the very geopolitical sphere of influence. Renewable energy is now at the centre of the global energy landscape.¹ Technological advances and falling costs have made renewables grow faster than any other energy source, and China has a running start.²

Between April 22-23, 2021, American President Joseph Biden invited 40 world leaders to a virtual summit called the Leaders’ Summit on Climate. It underscored the urgency – and the economic benefits – of spurring stronger climate action. The US, producing 13% of global CO₂ emissions in 2019 alone, pledged a reduction of greenhouse gas emissions by 50-52% by 2030 and a net-zero carbon economy by 2050.³ The plan ultimately requires electricity generation to be carbon-free by 2035.⁴ China, who accounts for one-third of global emissions, is the largest market for clean power, but is still simultaneously the world’s biggest polluter. Both the US and China are losing billions in climate related disasters. The economic and health consequences of air pollution in China are providing incentive to invest into renewables. In 2012, RAND Corporation estimated that air pollution cost China \$535 billion, or 6.5 percent of its GDP.⁵ In the

United States, climate change disasters such as hurricane damage, real estate losses, energy, and water costs— come to 1.8 percent of U.S. GDP, or almost \$1.9 trillion annually, by 2100.⁶

China’s pledge, during Bidens Leaders’ Summit, resembled the same message from September of 2020 when President Xi Jinping told the UN General Assembly “We aim to have CO₂ emissions peak before 2030 and achieve carbon neutrality before 2060.... COVID-19 reminds us that humankind should launch a green revolution.”⁷

With such ambitious targets that will restructure the global energy sector, it begs several questions: What is motivating the US and China to invest heavily in renewables now? What impact will this have on the future of fossil-fuels? What geopolitical implications will this new technology have on the global balance of political power when so many countries will reduce their reliance on oil and gas in the future?

Decarbonization measures already initiated globally, mainly in the European Union (EU), are positively reinforcing its importance on the energy transition to influence and increase technological advances and competitiveness of solar and wind energy.⁸ These initiatives are propelled by the 2015 Paris Agreement that aims to limit global warming well below 2 degrees Celsius compared to pre-industrial levels.⁹ Not to mention, the newly released

¹ See projections: Motyka, Marlene. “2021 Renewable Energy Industry Outlook.” *Deloitte United States*, 30 Mar. 2021, www2.deloitte.com/us/en/pages/energy-and-resources/articles/renewable-energy-outlook.html.

² See study: “Renewable Power Generation Costs in 2019.” *IRENA*, 2019, www.irena.org/publications/2020/Jun/Renewable-Power-Costs-in-2019.

³ *President Biden Invites 40 World Leaders to Leaders Summit on Climate*. (2021, March 26). The White House. <https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/26/president-biden-invites-40-world-leaders-to-leaders-summit-on-climate/>.

⁴ Biden For President. (2020, October 29). *Plan for Climate Change and Environmental Justice | Joe Biden*. Joe Biden for President: Official Campaign Website. <https://joebiden.com/climate-plan/>.

⁵ Crane, Keith, and Zhimin Mao. “Costs of Selected Policies to Address Air Pollution in China.” *RAND*, 2015. *Crossref*, doi:10.7249/rr861.

⁶ Ackerman, Frank, and Elizabeth A. Stanton. “The Cost of Climate Change.” *Natural Resources Defense Council*, 2008. *NRDC*, www.nrdc.org/sites/default/files/cost.pdf.

⁷ United Nations. (2020, September 22). ‘Enhance solidarity’ to fight COVID-19, Chinese President urges, also. UN News. <https://news.un.org/en/story/2020/09/1073052>.

⁸ Eyl-Mazzega, M. A., & Mathieu, C. (2020). The European Union and the Energy Transition. *The Geopolitics of the Global Energy Transition*, 27–46. https://doi.org/10.1007/978-3-030-39066-2_2.

⁹ UNFCCC. (2018, March 1). *The Paris Agreement*. United Nations Climate Change. <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>.

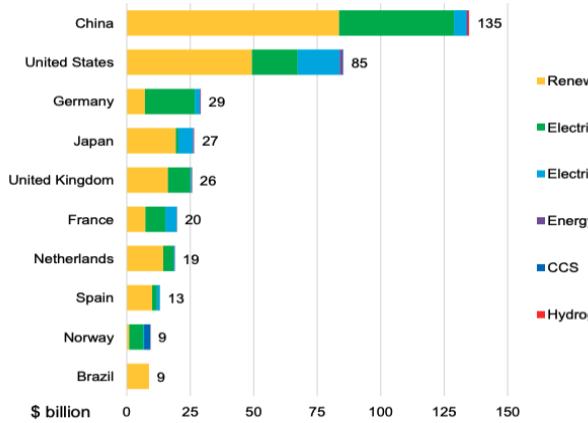


AR6 climate change report by the United Nations Intergovernmental Panel on Climate Change (IPCC), which provides a clear summary and stark warning for policy leaders on the future of man-made climate change due to the burning of fossil fuels.¹⁰

Seeing the great potential of this renewable industry, the US and China, have thus entered the “Energy Race.” Figure 1 shows China’s energy transition investment in 2020 at \$134.8 billion, maintaining its first-place status as the largest investor of any country in the world.¹¹ Renewable energy capacity investment for China stands at \$83.6 billion in 2020, and outlays on electric transport of \$45.3 billion.¹² The U.S. was the second-biggest investing country, standing at \$85.3 billion. Renewable capacity investment fell 20% to \$49.3 billion, while electric transport outlays edged up 3% of \$18 billion.¹³

Therefore, with growing populations and rapid industrialization of growing economies, comes increased consumption of goods and services that were (and still are) heavily dependent on fossil fuels. However, to guarantee these growing demands, governments must match this with adequate energy supplies and have hence begun to heavily diversify its energy portfolio. According to a 2019 study by BloombergNEF, governments around the world invested USD 363.3 billion in clean energy investments, and 19% in offshore wind, compared to previous years.¹⁵

Figure 1: Global investment in energy transition by country, 2020



(Source: Bloomberg NEF, 2021)¹⁴

¹⁰ See report here: IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (Masson-Delmotte, V., P. et al): <https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/>.

¹¹ “Energy Transition Investment Trends: Tracking Global Investments in the Low-Carbon Energy Transition.” Bloomberg

NEF, 19 Jan. 2021, assets.bbhub.io/professional/sites/24/Energy-Transition-Investment-Trends_Free-Summary_Jan2021.pdf.

¹² Ibid.

¹³ Ibid.

¹⁴ Ibid.

¹⁵ BloombergNEF. “Clean Energy Investment Trends 2019.” BloombergNEF, 2019, data.bloomberglp.com/professional/sites/24/BloombergNEF-Clean-Energy-Investment-Trends-2019.pdf.

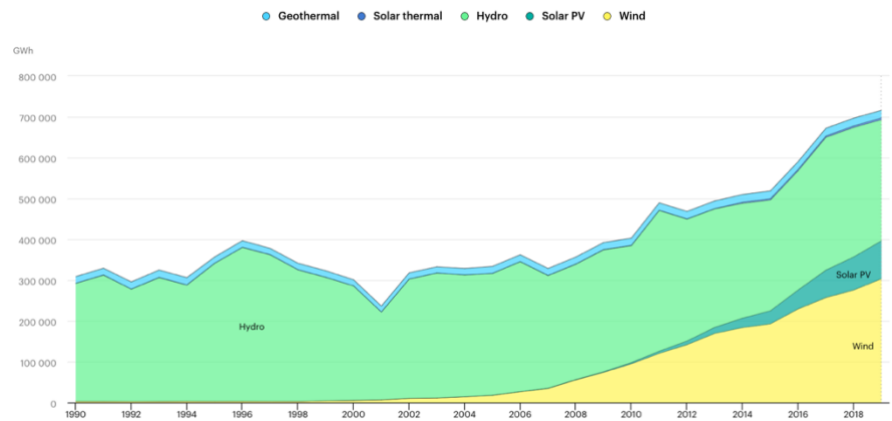


How and why is the US and China investing into green energy?

Figure 2: Renewable electricity generation by source (non-combustible), United States 1990-2019

The United States

In 2019, Susan Nickey, managing director at Hannon Armstrong Sustainable Infrastructure Capital Inc. stated that: “More and more corporations and consumers [in the US] ...want 100 percent renewable energy,” adding that city and state governments are adopting renewable-friendly policies to reflect that growing demand.¹⁶



(Source: <https://www.iea.org/fuels-and-technologies/renewables>)

The year 2019 was a remarkable year in the US as it hit a record \$55.5 billion in renewable energy investments, up by 28% from 2018.¹⁷ This meant that solar rose 16% to \$23.3 billion while wind went up by 44% to \$31.8 billion, almost entirely thanks to onshore projects. Other technologies saw minimal investment, with biofuels for instance down 38% at \$320 million, the lowest rate for that sector since 2016.¹⁸ This increase in renewables is in fact demonstrated in figure 2 whereas in 2018 wind exceeded hydro power as a renewable source of energy. As of 2019, wind power is producing 303,410 GWh of energy, hydro 296,701 GWh, and solar 93,129 GWh. It goes without saying, then, that the US is on a positive upward trend towards sustainability.

So, how did they get there? Interestingly enough, despite former President Donald J. Trump’s efforts of withdrawing federal support for Obama-era climate goals and slapping a 30% tariff on solar panels, which led to a loss of at least 23,000 jobs on two big solar projects,¹⁹ it indirectly inspired a backlash in US cities, states, and corporations to install renewable energy sources. Developers in the US of both solar and wind were driving ahead with projects in order to be qualified for the soon-to expire tax credits. In solar, the incentive is the Investment Tax Credit and ensured that if construction started in 2019 and placed in service by 2023, then the project owner (commercial developer or household) would be eligible to receive a credit equivalent of up to 30% to finance such renewable projects. This outweighed US solar industry problems, such as the tariffs imposed on equipment imported from China and

¹⁶ “Energy Transition Investment Trends: Tracking Global Investments in the Low-Carbon Energy Transition.” *Bloomberg NEF*,

¹⁷ Gregorio, D. (2018, June 22). *Renewable energy seeks demand, investment to survive Trump squeeze*. Reuters. <https://www.reuters.com/article/us-renewables-energy-trump/renewable-energy-seeks-demand-investment-to-survive-trump-squeeze-idUSKBN1JI2CE>.

¹⁸ Angus McCrone. (2020). *Global Trends in Renewable Energy Investment 2020*. Frankfurt School-UNEP Centre, 1–52. <https://wedocs.unep.org/bitstream/handle/20.500.11822/32700/GTR20.pdf?sequence=1&isAllowed=y>.

¹⁹ Henze, V. (2020, January 16). *Late Surge in Offshore Wind Financings Helps 2019 Renewables Investment to Overtake 2018*. BloombergNEF. <https://about.bnef.com/blog/late-surge-in-offshore-wind-financings-helps-2019-renewables-investment-to-overtake-2018/>.



gave companies the head start, they needed. Companies such as Italian based Enel Green Power recently stated that it plans to build the largest solar farm in North America in a town near Waco, Texas.²⁰ Even Goldman Sachs Group inc. has bought a solar storage project in California.²¹ American companies are listening to the fact that they have investors, customers, and shareholders, all demanding for a sustainable future. It is, to say the least economically beneficial, i.e., profitable to invest in renewables.

It comes as no surprise then that President Biden's \$2 trillion Clean Energy Plan could not have come at a better time. Undoubtedly, not only does the Earth need it – but the economy and consumers demand it too. During President Biden's first month in office, several executive actions were signed, including the freezing of new oil and gas leases on public lands, and doubling offshore wind production by 2030.²²

The President has further instructed the Environmental Protection Agency (EPA) and the Transportation Department to relook at fuel-efficiency standards for cars and fuel subsidies. It is said he will also “revive an interagency working group Trump disbanded in 2017 that sets the ‘social cost of carbon’, an estimation of the economic damage caused by the release of a ton of carbon dioxide into the atmosphere.”²³

The backbone to President Biden's infrastructure spending to advance climate policy is thus a clean electricity standard (CES) that would push the US electricity sector to net-zero carbon emissions by 2035.²⁴ Given the importance of electricity in the circular economy, the CES is arguably Biden's single most important climate policy promise.

As traditionally conceived, a national clean energy standard is a federal regulation that would depend on utilities to increase the share of carbon-free sources on the electrical grids, ultimately reaching the goal of 100% by 2035. Already, nearly all major electric utilities have pledged to go carbon-neutral or zero out emissions by 2050.²⁵ This would require individual American States to formulate their own implementation plans (it will be controversial for Republican States to say the least). Perhaps Biden's American Jobs Plan – calling Congress to invest \$100 billion in infrastructure and jobs – will prompt such states to move towards CES. The challenge will be to ensure that fossil fuel sources and communities dominated by coal production are taken care of through this transition. As of 2019, five states, three of which are Republican States, accounted for about 71% of total US coal production.²⁶ Such fossil fuel dependent states, and within them the fragile communities, face the future of mass budget shortfalls and job cuts for the next few years. The turned focus towards climate mitigation has resulted in the declining cost of renewable energy and in turn led to the sharp decline in demand for coal. In fact, coal generation fell by 43% since 2015.²⁷

²⁰ Webb, S. (2021, May 6). *Enel announces three major Texas renewable energy projects, including its largest US solar farm*. Houston Chronicle. <https://www.houstonchronicle.com/business/energy/article/Enel-announces-three-major-Texas-renewable-energy-16151867.php>.

²¹ *Ibid.*

²² Press Release: “President Biden to Take Action to Uphold Commitment to Restore Balance on Public Lands and Waters, Invest in Clean Energy Future.” *US Department of Interior*, 27 Jan. 2021, www.doi.gov/pressreleases/fact-sheet-president-biden-take-action-uphold-commitment-restore-balance-public-lands.

²³ Biden For President. (2020a, August 5). *The Biden Plan to Build a Modern, Sustainable Infrastructure and an Equitable Clean Energy Future*. Joe Biden for President: Official Campaign Website. <https://joebiden.com/clean-energy/>.

²⁴ *Ibid.*

²⁵ Carpenter, S. (2020, October 16). *U.S. Utility Companies Rush To Declare Net-Zero Targets*. Forbes. <https://www.forbes.com/sites/scottcarpenter/2020/10/15/us-utility-companies-rush-to-declare-net-zero-targets/?sh=2a97d8e5693b>.

²⁶ EIA. (2020, October 9). *Where our coal comes from - U.S. Energy Information Administration (EIA)*. US Energy Information Administration. <https://www.eia.gov/energyexplained/coal/where-our-coal-comes-from.php>.

²⁷ Ember. (2021, March 31). *United States*. <https://ember-climate.org/global-electricity-review-2021/g20-profiles/united-states/>.

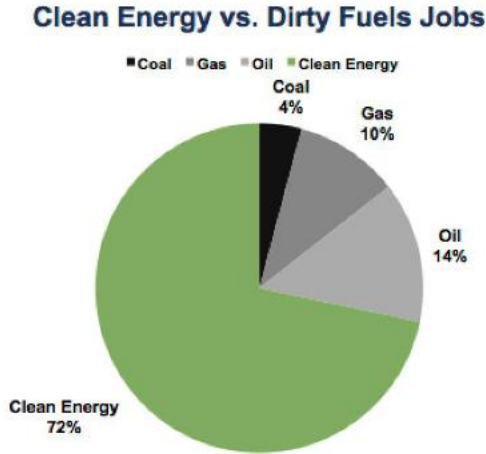


Therefore, it will be essential to implement just transition programs for such communities in order to build more sustainable and diverse economic bases, and hence, reducing their reliance on fossil fuel production as a revenue source and create new, lower-carbon economies to support and secure family-sustaining jobs.

The conditions and opportunity for renewable investments are ripe. Companies that used to mainly take on solar and wind projects are growing their renewables practices by investing in new technologies such as battery storage, hydrogen, and carbon capture, to name a few. They're adding stakeholders and making acquisitions to keep up with the demand.

However, the transition from an oil-based economy will not come without its consequences. The American Petroleum Institute (API), the industry's main lobby, contends that Biden's moratorium will cost millions of jobs.²⁸ It is simply not the case. In fact, clean energy jobs in the US outnumber all fossil fuel jobs by over 2.5 to 1; and they exceed all jobs in coal and gas by 5 to 1 (see figure 3).²⁹

Figure 3: Renewable electricity generation by source (non-combustible), United States 1990-2019



(Source: Sierra Club, 2017)³⁰

Furthermore, for all the importance oil has on its economy, even heavy oil producing states such as New Mexico and Texas are preparing for a new energy era. Law firms representing Big Oil are earning hefty dollars by going green, as investors and companies encourage them to grow their renewable energy practices.³¹

A look at the Senate: Democrat (majority) vs. Republicans

For the first time since 2010, the Democrats are in control of both chambers of Congress and the Presidency. Given the Democrats' strong focus on climate policy in the 2020 election, how does this change what is possible now?

²⁸ American Petroleum Institute. (2020, September 25). *Extended Offshore Energy Moratorium Denies Thousands of New American Jobs and Billions of Dollars in Potential Revenue*. API. <https://www.api.org/news-policy-and-issues/news/2020/09/25/expanded-offshore-moratorium>.

²⁹ "Sierra Club Clean Energy Jobs Report Final (1).Pdf." *Sierra Club*, 2017, www.docdroid.net/G6njmYC/sierra-club-clean-energy-jobs-report-final-1-pdf.

³⁰ "Sierra Club Clean Energy Jobs Report Final (1).Pdf." *Sierra Club*, 2017, www.docdroid.net/G6njmYC/sierra-club-clean-energy-jobs-report-final-1-pdf.

³¹ Huq, N. (2021, May 6). *Law Firms in Oil Country See Green in Renewable Energy Clients*. Bloomberg Law. <https://news.bloomberglaw.com/business-and-practice/law-firms-in-oil-country-see-green-in-renewable-energy-clients>.



It is no secret that a vast majority of Republicans in the federal office outright reject climate change. In fact, according to the Center for American Progress, “there are still 139 elected officials in the 117th Congress, including 109 representatives and 30 senators, who refuse to acknowledge the scientific evidence of human-caused climate change.”³² Under the Republican party, supporting policies on cutting emissions and investing in renewable energies was quite slim and hence, was the reason why Congress has not seriously confronted climate change issues for more than a decade. The Republican power and majority in the Senate made it impossible. The issue now is that even though the Democrats hold majority, they will still have immense struggles to pass important climate bills due to the filibuster. The Senate is unique among western democracies in effectively requiring a super-majority to pass major pieces of legislation. Republicans in the Senate still have the power to block every single progressive priority, such as Biden’s climate policies, using a procedural tool called the filibuster, which requires at a minimum 60 votes to advance legislation.

The filibuster will ultimately decide whether President Biden will succeed or not. However, a loophole exists which is the budget reconciliation bill, and it ultimately instructs certain committees to change spending, revenues, or deficits by specific amounts, and uniquely requires only a simple majority in the Senate rather than the 60 votes needed.³³ Therefore, for the Biden administration to stand a chance on climate action, it could be argued, and recently confirmed by Energy Secretary Jennifer Granholm, that the most straightforward way is to implement a clean energy standard via the budget reconciliation and create a clean energy credit trading system on the government balance sheet.³⁴

³² Drennen, A., & Hardin, S. (2021, March 29). *Climate Deniers in the 117th Congress*. Center for American Progress. <https://www.americanprogress.org/issues/green/news/2021/03/30/497685/climate-deniers-117th-congress/>.

³³ Christian, M., Hale, Z., & Potter, E. (2021, January 14). *Budget reconciliation offers Democrats pathway to act on climate change*. S&P Global Market Intelligence. <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/budget-reconciliation-offers-democrats-pathway-to-act-on-climate-change-62118325>.

Under that system, utilities would have to meet a target for zero-emissions electricity. If they do not, they must buy credits from the government or pay an alternative compliance fee and revenue from those payments could go into investments and funding to assist in the transition to cleaner energy. For now, we will have to see what the future holds.

China

As an authoritarian government, China can execute and implement quick and dramatic policies due to lack of checks and balances. Some scholars refer to this as China’s “authoritarian advantage.”³⁵ Policies can be passed through parliament much more quickly than in a democratic government system as argued above. Over the past 30 years, thanks to policies aimed at developing the economy, China has emerged as an economic titan becoming the second-largest economy with a broadening eager ready-to-spend middle class, all the while being a global leader in technological innovation, and a military superpower. China recognizes its growing domestic demand of consumers and hence needs to rapidly expand its energy resources.

China’s carbon neutral pledge is fundamental to achieving worldwide net-zero emissions. As the world’s biggest polluter, China is taking steps to reduce its emissions of greenhouse gases and incorporated clean energy as part of its next five-year plan that began in 2021. It must be pointed out, however, that according to the latest report by the Centre for Research on Energy and Clean Air (CREA), due to the effects of Covid, China’s CO₂ emissions from fossil fuels and cement production

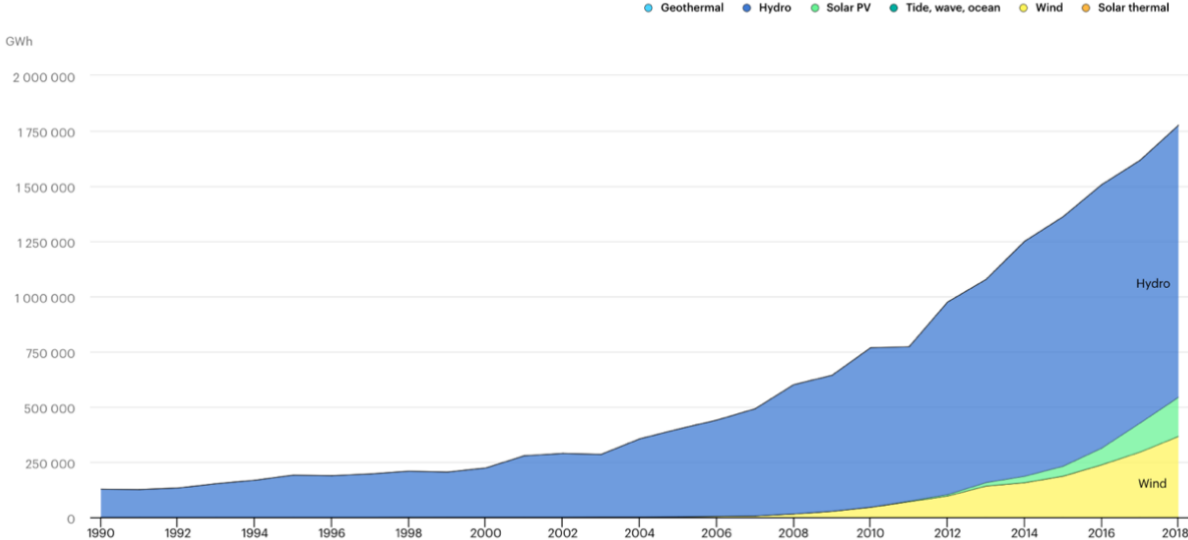
³⁴ Tamborrino, K. (2021, April 14). *Granholm: Reconciliation possible for clean energy standard, but no decisions made*. POLITICO. <https://www.politico.com/news/2021/04/14/jennifer-granholm-clean-energy-reconciliation-481545>.

³⁵ The Diplomat. (2020, February 8). *Coronavirus and China’s ‘Authoritarian Advantage’*. <https://thediplomat.com/2020/02/coronavirus-and-chinas-authoritarian-advantage/>.



grew by 15% in the first quarter of 2021 alone.³⁶ As a result, China's emissions generated nearly a record high of 12 billion metric tons of CO₂ in the year ending March 2021.³⁷ China's pledge for the emissions reduction plan can only work if the current expansion of steel demand for construction slows down. At this rate, the plan to be carbon neutral by 2060 is in jeopardy. Regardless, the investment into renewables seems to be, economically speaking, just a competitive advantage on the world stage for China.

comparison to the US in figure 2, the numbers for China in figure 4 are completely elsewhere in terms of renewable electricity generation. Hydro power is generating 1,232,100 GWh, more than double of what it was in 2009. Solar generation is at 176,901 GWh, and wind power at 365,801 GWh. However, despite the impressive figures, China's large and growing population is demanding more energy, and China will have to step it up even more if it is to reach its carbon-neutral pledge by 2060. At this rate, it is not enough.



(Source: <https://www.iea.org/fuels-and-technologies/renewables>)

That said, in 2019, China was the biggest investor in renewable energy, spending \$84.4 billion alone.³⁸ China simultaneously saw a 10% rise in wind investments to \$55 billion and a total capacity of 790GW of renewable power, mainly from hydroelectric, solar and wind power combined.³⁹ China is already leading in renewable energy production figures and surpassing the US by a landslide. It is currently the world's largest producer of wind and solar energy, and the largest domestic and outbound investor of renewable energy. China's goal is global leadership of this industry. In

Figure 4: Renewable electricity generation by source (non-combustible), China (People's Republic of China and Hong Kong China) 1990-2018

To prepare for such setbacks, China's One Belt One Road (OBOR) initiative, adopted as far back as 2013,

³⁶ Myllyvirta, L. (2021, May 21). *Analysis: China's carbon emissions grow at fastest rate for more than a decade*. Centre for Research on Energy and Clean Air. <https://energyandcleanair.org/analysis-chinas-carbon-emissions-grow-at-fastest-rate-for-more-than-a-decade/>.

³⁷ *Ibid.*

³⁸ Henze, V. (2020, January 16). *Late Surge in Offshore Wind Financings Helps 2019 Renewables Investment to Overtake 2018*.

BloombergNEF. <https://about.bnef.com/blog/late-surge-in-offshore-wind-financings-helps-2019-renewables-investment-to-overtake-2018/>.

³⁹ IEA. (2021, February 1). *Renewables – Global Energy Review 2020 – Analysis*. <https://www.iea.org/reports/global-energy-review-2020/renewables>.



is ahead of the race in that its renewable energy investments saw an increase in shares from 38% in 2019 to 57% in 2020.⁴⁰ With the proposal of the OBOR Initiative and the deepening of cooperation with the countries along the routes, China captures increasing shares in the renewable energy market year by year, becoming the largest international investor in the renewable energy sector.⁴¹ According to the International Energy Agency (IEA), between 2015-2021 China installed 36% of all global hydro electricity generation capacity, installed 40% global wind energy, and 36% of solar.⁴²

Moreover, in 2016, four of the world's five biggest renewable energy deals were made by Chinese companies.⁴³ As early as 2017, China owns five of the world's six largest solar-module manufacturing companies and is number one as the world's largest wind turbine manufacturer.¹¹ However, even though China announced it would provide \$360 billion for the renewable energy industry by 2020, it also built 85 coal-fired power plants.⁴⁴ Therefore, it must not go without saying, that since 2019, Chinese financial institutions had committed \$36 billion for over one-quarter of the 399 gigawatts of coal plants currently under development outside China from Pakistan to Bangladesh to Vietnam.⁴⁵ Coal use does not seem to be diminishing anytime soon.

On the other hand, as the world shifts from carbon to renewable, China has been active in developing the electricity network that is currently the backbone of the clean energy system. In other words, what else is

prompting this race to renewables at such unprecedented speed? Unsurprisingly, self-preservation is the main motivator. The Chinese government is aware of its growing problem of air and water pollution and ultimately, if it wants to grow as a world leader and stay that way, it must mitigate the risks of socioeconomic instability. Since China's pledge to carbon-neutrality by the year 2060, China is incorporating renewable energy at a faster pace than the US, due in large part to its high consumption of coal, which is currently the primary source of the country's environmental degradation.⁴⁶ In terms of energy security, China must incorporate alternative sources into its energy matrix since it has no other choice, and not to mention would bring savings of up to USD 228 billion per year to China's economy accounting for improved health and reduced CO2 emissions in the air.⁴⁷

China in the lead: Investments in strategic minerals needed for renewable technology

To get ahead in the green race, one must secure the raw materials needed to build the renewable technology in the first place. China has already taken the lead here and positioned itself to dominate the global supply of copper, a material in high demand as the world transitions to alternative energy systems. Not only that, as the world's largest metals consumer, China reserves the right to intervene in the

⁴⁰ Wang, C. N. (2021, January 21). *China Belt and Road Initiative (BRI) Investment Report 2020 – Green Belt and Road Initiative Center*. Green BRI Center. <https://green-bri.org/china-belt-and-road-initiative-bri-investment-report-2020/>.

⁴¹ Xiulan, L. (2020). Opportunities and Challenges for China's Renewable Energy Overseas Investment Case Country Study (Vietnam). *Heinrich Böll Stiftung Beijing*. Published. <https://www.ghub.org/en/wp-content/uploads/sites/2/2020/08/bri-re-vn-report-en-aug-2020.pdf>.

⁴² Buckley, T., & Nicholas, S. (2017). *Chinas Global Renewable Energy Expansion. Institute for Energy Economics and Financial Analysis*. Published. https://ieefa.org/wp-content/uploads/2017/01/Chinas-Global-Renewable-Energy-Expansion_January-2017.pdf.

⁴³ *Ibid.*

⁴⁴ Wang, C. N. (2021, January 21). *China Belt and Road Initiative (BRI) Investment Report 2020 – Green Belt and Road Initiative Center*. Green BRI Center. <https://green-bri.org/china-belt-and-road-initiative-bri-investment-report-2020/>.

⁴⁵ Buckley, T. (2020, May 15). *IEEFA update: The renewable energy transition is coming to Asia*. Institute for Energy Economics & Financial Analysis. <https://ieefa.org/the-renewable-energy-transition-is-coming-to-asia/>.

⁴⁶ Kan, Haidong. "Environment and Health in China: Challenges and Opportunities." *Environmental Health Perspectives*, vol. 117, no. 12, 2009. *Crossref*, doi:10.1289/ehp.0901615.

⁴⁷ "Renewable Energy Prospects: China." *IRENA*, IRENA, 2014, www.irena.org/-/media/Files/IRENA/Agency/Publication/2014/Nov/IRENA_RE_map_China_summary_2014_EN.ashx?la=en&hash=807F1019E27CA5C3D36FBA445EC48F150D58A6B5: pg. 3



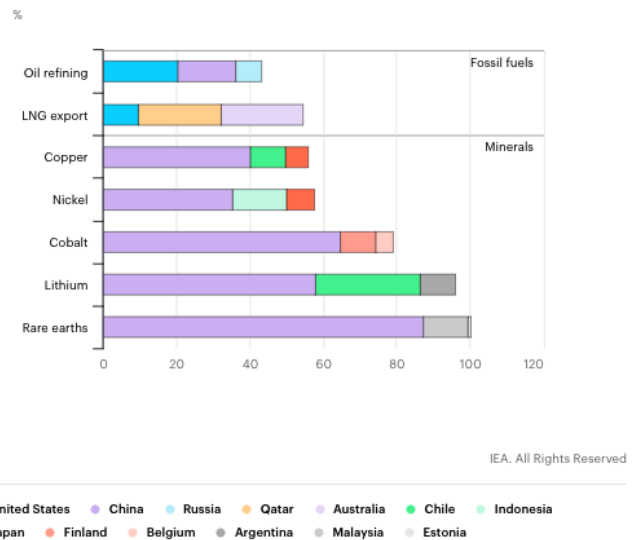
commodities markets.⁴⁸ Materials such as concrete, steel, plastic, glass, iron, chromium, copper, aluminium, manganese, nickel, zinc and molybdenum (to name a few) are needed for renewable technology and largely depends on the relative market share of different photovoltaic technologies.⁴⁹ Moreover, China is dominant in the lithium sector that is essential for batteries, electric vehicles and so on – and a global leader in smart grid investment.

Such materials are the “fuel” needed to build the solar panels, the wind turbines, store the energy in batteries, electric cars etc. China is the largest producer and exporter of these renewable technologies to date and holds nearly a third of the world’s renewable energy patents. This dominance cascades into the supply and production chain, too. For instance, polysilicon is needed to construct solar cells. The machines that put this together are currently made in China. Most recently, Xinte, a subsidiary of China's TBEA Group, will invest this year \$1.35bn in a plant that is designed to produce 99,050 t/yr of polysilicon and some by-products including carbon head material, trichlorosilane and sodium hydroxide needed for renewable technologies.⁵⁰

The Biden Administration is set to put the US back on track by 2030 and will do everything they can to make America the “world’s leader in clean energy research, investment, commercialization, manufacturing, and exports.”⁵¹ However, they have a long race ahead of them if they are to gain and secure essential materials such as the ones listed above. The US has just gotten started. For example,

figure 5 and 6 display China’s dominance in both extraction and production of strategically important minerals, especially lithium, needed for the green technology revolution. The US currently does not process any of the below listed materials, and out of the top three extracting countries, the US extracts only 13% of rare earths, while China dominates with 60%.⁵² Lithium, a key raw material for new-energy vehicle batteries, is concentrated primarily in Chile and Australia (see figure 6). China's import dependence for lithium was nearly 80% in 2020, and its dependence on Australia was around 60%.⁵³

Figure 5: Share of top three producing countries in total processing of selected minerals and fossil fuels, 2019



(Source: IEA, 2019)

⁴⁸ Reuters. (2021, May 20). *Explainer: What's happening with industrial commodity prices in China?* <https://www.reuters.com/world/china/whats-happening-with-industrial-commodity-prices-china-2021-05-20/>.

⁴⁹ European Commission. (2020). *Raw material demand for wind and solar energy*. https://ec.europa.eu/jrc/sites/jrcsh/files/jrc120228_-_raw_material_demand_two-pager_pubsy_final.pdf.

⁵⁰ Argus. (2021, March 12). *China's Xinte adding to polysilicon capacity*. Argus Research Center. <https://www.argusmedia.com/en/news/2195373-chinas-xinte-adding-to-polysilicon-capacity>.

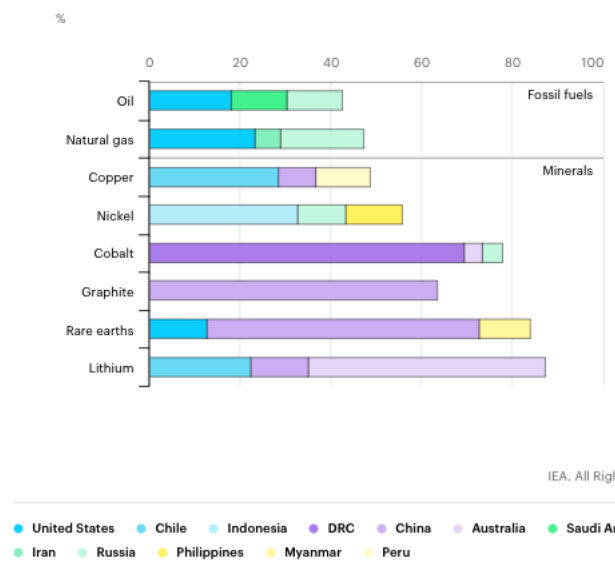
⁵¹ Biden For President. (2020a, July 29). *Plan to Create 10 Million Clean Energy Jobs | Joe Biden*. Joe Biden for President: Official Campaign Website. <https://joebiden.com/climate-labor-fact-sheet/>.

⁵² “Executive Summary – The Role of Critical Minerals in Clean Energy Transitions – Analysis.” IEA, IEA, 2019, www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/executive-summary.

⁵³ “China’s Heavy Reliance on Lithium from Australia May Ease with Rising Domestic Supplies.” *Global Times*, 18 July 2021, www.globaltimes.cn/page/202107/1228968.shtml.



Figure 6: Share of top three producing countries in total processing of selected minerals and fossil fuels, 2019



(Source: IEA, 2019)

It goes without saying that the geopolitical motivations for China are clear. Investing into renewable energy is inevitable, and China knows that it needs to strategically dominate the markets of these new technologies in order to have influence over their development in the future. Other superpowers, such as the EU, need to watch out as China is in the lead to becoming the global energy leader.

Why is energy security so important?

Energy security has and always be an inherent tool for ensuring survival of a country. Energy is needed for the everyday life of citizens, basic functions like heating homes, fuel for transportation, providing electricity, supplying armies, and facilitates economies, to name a few. A country's development and advancements directly depend on energy. It goes

without saying that the more the country can innovate towards renewables, batteries, battery storage and electric cars, the more it will be able to draw the industrial and economic benefits of this transition – in turn generating jobs and economic growth.

Just as China and the US have long competed for fossil fuel resources, these two great powers are competing to incorporate renewable energy sources to diversify their energy mix for long-term security. With the decline of US hegemony and the Chinese economy growing at an unprecedented rate, the competition towards the title of global leader has become ever so appealing, and renewable energy has hence become a more specific preoccupation of national energy policies for these two countries. Conversely, China is ahead of the race as it has a renewable energy investment of more than 30% greater than the US.

China has sufficient renewable natural resources (specifically wind and sun) to potentially meet its future energy demands. Meanwhile, the US is the world's second largest investor in renewable energy, its investments need to grow faster if it wants to catch up. There are many factors that contribute to the importance of investing into renewable energy and becoming the leader. Most importantly, the economic gains (new jobs associated with the development of renewable resources and their export potential); minimising environmental degradation; non-reliance of non-renewable resources such as oil; and political motivations (desires of governments to globally lead clean energy movements), among others.



Geopolitical Implications: The future of fossil fuels and OPEC+?

The green energy transition will of course not go without its geopolitical challenges and particularly for oil and gas producing countries with less diversified economies that are dependent on oil revenues alone. Countries in the Middle East, North Africa, and the rest of the Organization of the Petroleum Exporting Countries (OPEC), and Russia have not made significant progress in terms of innovative sustainable diversification.⁵⁴ This could have severe ramifications for the future of these countries.

It has been made clear that most of the international community has made climate change a priority. Even top oil producing companies such as Royal Dutch Shell said its oil production and carbon emissions have already peaked in 2019, as it detailed plans to gradually wean itself off fossil fuels.⁵⁵ According to a recent statement, Shell expects its oil production to decline by between 1% and 2% each year after, and plans to become a net-zero emitter by 2050 by shifting towards clean energy innovation.⁵⁶ Many oil giants are following suit towards such drastic changes as they have written off billions of dollars of assets and revenues due to global oil demand forecasts that predict they may never reach the profit margin levels before the Covid pandemic.

⁵⁴ Meyer, Robinson. "The Energy Revolution Is Tweaking OPEC Out." *The Atlantic*, 6 July 2021, www.theatlantic.com/newsletters/archive/2021/07/energy-revolution-tweaking-opec-out/619372.

⁵⁵ Shell. (2021, February 11). *Shell accelerates drive for net-zero emissions with customer-first strategy*. <https://www.shell.com/media/news-and-media-releases/2021/shell-accelerates-drive-for-net-zero-emissions-with-customer-first-strategy.html>.

⁵⁶ *Ibid.*

⁵⁷ OPEC+ (2018) is the addition of the 10 Non-OPEC nations, notable among them Russia, Mexico and Kazakhstan.

⁵⁸ The Atlantic Council. (2021). *The Global Energy Agenda*. *The Atlantic Council*. Published. <https://www.atlanticcouncil.org/wp-content/uploads/2021/01/The-Global-Energy-Agenda-2021.pdf>.

During the emergence of the global pandemic, OPEC+ producers struggled to form a collective response.⁵⁷ With Covid lockdowns, the oil and gas industry was turned upside down in 2020, as transportation came to a stop, dramatically reducing nearly all forms of fuel demand.⁵⁸ Global oil demand dropped from about 101 million barrels per day (mbd) in December 2019 to 85 mbd in the second quarter of 2020.⁵⁹ Saudi Arabia pushed for immediate action fearing the decrease in demand of oil worldwide, whilst Russia was hesitant to store more barrels after only agreeing to more reductions at a December 2019 OPEC+ meeting before the outbreak had even begun.⁶⁰ Russia, in particular, has marginally invested in renewable energy, is seeing its great shortfalls and expressed concerns time again about losing market share in its export of oil.⁶¹ Most importantly, Russia is the third largest global producer of oil and provides more than 30% of the European demands in gas. This brings not only economic and political dividends based on the mutual dependence, but oil is most importantly Russia's biggest economic leverage. A decrease in the demand for oil would be detrimental to Russia's security as it provides more than 50% of the consolidated budget to the Federation.⁶² Russia too will be forced to expand its energy sources as well if it wants to survive as a powerful nation.

The IEA Executive Director Dr. Fatih Birol said, solar will be the king of the world's electricity markets. As oil forecasts sees demand plateauing by 2030, the era of global oil demand growth will come

⁵⁹ U.S. Energy Information Administration. (2021, May). *Short-Term Energy Outlook*. EIA. https://www.eia.gov/outlooks/steo/pdf/steo_full.pdf.

⁶⁰ Forsey, A. (2021, February 23). *The Global Energy Agenda*. Atlantic Council. <https://www.atlanticcouncil.org/content-series/global-energy-agenda/the-global-energy-agenda/#h-partner-perspective-opec-back-from-the-brink>.

⁶¹ The Moscow Times. "Russia Faces Huge Revenue Losses From Renewables Push, Finance Minister Warns." *The Moscow Times*, 23 Aug. 2021, www.themoscowtimes.com/2021/07/08/russia-faces-huge-revenue-losses-from-renewables-push-finance-minister-warns-a74463.

⁶² Bogoviz, A. V., Lobova, S. V., Ragulina, Y. V., & Alekseev, A. N. (2018). Russia's Energy Security Doctrine: Addressing Emerging Challenges and Opportunities. *International Journal of Energy Economics and Policy*, 18(5), 1–5. <https://doi.org/10.32479/ijeeep.6736>.



to an end in the next decade. Birol states that Solar is now cheaper than coal and natural gas in most parts of the globe, and hence, by 2030, renewables will capture 80% of new power generation.⁶³ Overall, Birol argues that there is no indication that the pandemic has come close to triggering a major structural shift in the oil intensity of the global economy. That is to say, that if the world economy recovers without significant changes in government policies to accelerate the adoption of low-carbon alternatives, oil demand will recover with it.⁶⁴ The role of government policy for all global powers will therefore be absolutely essential to seize the opportunity presented by COVID and accelerate the energy transition.

Risks and Recommendations

It is therefore clear that there are several security risks that come with the spread of renewable energies, so it is imperative that governments do their best to prepare sooner rather than later.

1) Since the outbreak of the pandemic, and public announcements by global leaders such as the US and China to go carbon neutral, the global energy transition is seemingly accelerating more quickly than expected. For countries that are unprepared, the consequences could be severe. Looking at developing nations, and developed nations for that matter, that do not have a prepared plan for cyber-attacks on their energy systems, the risk of blackouts and ransoms by hackers, hostile states, or terrorist organizations poses as an imminent threat on the

horizon – potentially leading to large economic and social damages.

On May 12, 2021, President Joe Biden released an Executive Order (EO) on improving the nation's cybersecurity and enhancing its cyber resilience.⁶⁵ The President has directed several government agencies to begin formulating guidelines and rules to shape an environment where security is woven into several parts, notably the energy sector. **The US would greatly benefit by collaborating with its closest allies, such as the EU who have a running start on the topic.** The importance of data-driven technologies in the energy sector was underlined in the European Green Deal and aims to 'explore measures to ensure that digital technologies such as artificial intelligence, 5G, cloud and edge computing and the internet of things can accelerate and maximize the impact of policies to deal with climate change.'⁶⁶ **Similarly, the US can become an international leader in promoting a cybersecurity culture among the wind and solar energy community and stakeholders, encouraging cybersecurity information sharing including cyber threats and alerts, vulnerabilities, cyber incidents, attack patterns, lessons learned, and best practices. Establishing regularly conducted workshops on cyber threats with energy companies conducting business in the US could be essential to mitigate risks of attack.**

2) Smart electricity grids will play an increasingly larger role in mitigating the variability of weather conditions, especially in states and countries with vast differences in exposure to sun. Renewables are expected to produce more than half the world's electricity by 2035, and with that, at lower prices than fossil-fuels.⁶⁷ **From the economical side, the**

⁶³ IEA. (2021, February 1). *Renewables – Global Energy Review 2020 – Analysis*. <https://www.iea.org/reports/global-energy-review-2020/renewables>.

⁶⁴ IEA. (2021b, March 17). *Oil markets face uncertain future after rebound from historic Covid-19 shock - News*. <https://www.iea.org/news/oil-markets-face-uncertain-future-after-rebound-from-historic-covid-19-shock>.

⁶⁵ House, The White. "Executive Order on Improving the Nation's Cybersecurity." *The White House*, 13 May 2021, [www.whitehouse.gov/briefing-room/presidential-](http://www.whitehouse.gov/briefing-room/presidential-actions/2021/05/12/executive-order-on-improving-the-nations-cybersecurity)

[actions/2021/05/12/executive-order-on-improving-the-nations-cybersecurity](http://www.whitehouse.gov/briefing-room/presidential-actions/2021/05/12/executive-order-on-improving-the-nations-cybersecurity).

⁶⁶ Commission Communication, 'The European Green Deal' COM (2019) 640 final.

⁶⁷ McKinsey and Company. "Global Energy Perspective 2021." *McKinsey and Company*, 2021, www.mckinsey.com/~media/McKinsey/Industries/Oil%20and%20Gas/Our%20Insights/Global%20Energy%20Perspective%202021/Global-Energy-Perspective-2021-final.pdf.



lowering of electricity prices and cost of renewable technology should in turn stimulate electrification and catalyse cross-border trade in electricity where electric utilities can reduce their cost during peak periods by importing cheaper off-peak electricity from other jurisdictions.⁶⁸ Moreover, energy companies, with the support of the government, can utilise the savings for R&D in better long-term energy storage. Long-duration energy storage provides 10-100 hours of charging and discharging duration that is beyond the economics or capacity of conventional batteries.⁶⁹ However, we are going to need durations of up to 500 hours or more, and current lithium-ion battery technology do not have the capacity. Therefore, R&D will be essential. Currently, natural gas power plants are turned on to replace “off-times” of wind and solar. As the grid is decarbonized, however, fossil fuel plants will be phased out and as that happens, other resources will be needed to fill the gaps in electricity. Currently, both the US and China are in need of developments here. **Some studies have shown that hydrogen can be directly produced using renewable electricity through water electrolysis, and the production cost is dropping steadily due to the advances in water splitting technologies and availability of low-cost electricity.**⁷⁰ This form of electricity production can be stored long term for seasonal energy shifts, as well as facilitate long-duration energy storage in future carbon-free energy mixes.

3) China’s control of valuable raw materials, the supply of minerals needed to manufacture wind and solar energy, together with electric cars and batteries, raises concern about the security of access to these raw materials. Each material carries their own geopolitical risk, just as oil had its. The leader in green technology might just be the controller of world mineral prices. For example, in 2008, China imposed a limit on the supply to foreign buyers of rare earths whereas it holds a large part of the global production. It led to a panic in the markets and a very

rapid increase in prices. Clearly, this is a very likely scenario for the future of the production of electric cars, solar panels, wind turbines, batteries, battery storage and solar panels, where cobalt, lithium, and copper, for example, are key components (see figure 5 and 6). **The supply chains for these materials and technologies need to be appropriately managed by countries looking to transition to renewables, to avoid creating new adverse social and environmental impacts along the supply chain.** For example, Cobalt, lithium and rare earths needed for batteries are the metals of highest concern, as their demand will begin to increase at unprecedented rates and supply will be at risk. **The industry, as a whole, can begin by implementing responsible sourcing, and by doing so will encourage more mines to engage in responsible practices and certification schemes.**

Lastly, the geopolitics of energy will therefore not end, but instead transform to a new arena where there will be new winners and losers. For the winners of this race, those seeking industrial opportunities from this transition will see the strengthening of its energy security for most of the countries currently importing oil and natural gas, in turn promoting job creation and economic growth. For the losers, instability for oil-and-gas exporting countries such as Russia and Saudi Arabia will be inevitable and forced to transition to renewables and therefore, reinvent their economy in order to fit in the new developing energy generation. To not be left behind means to adapt to the new security risks of securing sustainable and adaptable electricity and mineral supplies.

Whatever the resistance, the green transition has now gathered so much momentum, with net-zero goals enshrined in law in many countries throughout the world, that what once looked impossible now seems inevitable. Just as coal and oil reshaped the world, clean energy will and must do the same. The energy transition will not only curb fossil fuel emissions, the

⁶⁸ Antweiler, W. (2016). Cross-border trade in electricity. *Journal of International Economics*, 101, 42–51. <https://doi.org/10.1016/j.jinteco.2016.03.007>.

⁶⁹ “Hydrogen Production: Electrolysis.” *Energy.Gov*, 2021, www.energy.gov/eere/fuelcells/hydrogen-production-electrolysis.
⁷⁰ Ibid.



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redistribution of power as we know it could be changed in the near future. The winners are positively transitioning the global energy arena towards a more sustainable and healthier future, ultimately shifting away from the greatest risk of all, climate change



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