A Multi-Polar World at Risk

What About Energy Security?

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CONTENTS

WHAT ABOUT ENERGY SECURITY?

In the 1970s and 1980s, energy security meant assuring a stable supply of affordable oil and reduced vulnerability to the threat of embargos and price manipulations by exporters. Many of the measures introduced were aimed at reducing oil imports and exports, diversifying the sources of energy (and specifically oil) supply, increasing energy efficiency, establishing strategic oil reserves and imposing controls on the price of oil.

For most of the post-2000 period, the governments of the world have abandoned their energy security concerns as they shifted focus towards attaining the goals of climate policy. Most OECD governments are now voluntarily committed to work towards the so-called "net-zero" emissions goal by 2050.

A new set of security concerns is arising as a result. One of the central features of global efforts to reduce GHG emissions is their reliance on accelerating the production and deployment of five critical technologies: solar photovoltaic (PV) electricity, industrial wind turbines, batteries to store electricity in bulk, electrolysers for the production of hydrogen, and heat pumps. The International Energy Agency now reports frequently on the trends with respect to these technologies and advocates for policies that will increase their production and use. In 2023, the IEA published an *Energy Technology Perspectives (ETP) Special Briefing* intended to provide policy makers with "strategic insights" in this area.

Manufacturing operations are highly geographically concentrated: currently, four countries and the European Union account for 80-90% of global manufacturing capacity for the five clean technologies examined in this briefing. China alone accounts for 40-80% across these technologies. If all announced projects were to be realized, these shares would shift to 70-95% and 30-80% respectively.

China also has a major role in the production of some critical minerals that are used in the renewable energy sector and in batteries. It is the dominant player in global mineral processing, and its upstream control over raw commodities is also increasing.[1] It refines 68% of the world's nickel, 40% of the copper, 59% of lithium, and 73% of

[1] https://www.brookings.edu/articles/chinas-role-in-supplying-critical-minerals-for-the-global-energy-transition-what-could-the-future-hold/

cobalt. As for minerals, it produces over 60% of the world's vanadium and graphite, and 40% of the world's molybdenum, aluminum, and lead. Rare earth elements over which China has a substantial hold over mining activity include 17 metallic elements, four of which – neodymium, dysprosium, praseodymium, and terbium -are of particular importance to "clean" energy technologies.

This is not an accident. China has achieved this manufacturing and market dominance as a result of clear and sustained policy signals and deployment targets in its Five-Year-Plans.

China's state-owned and controlled companies are directed by the government (i.e. the Chinese Communist Party) to operate in ways differently than the privately-owned and operated firms in most OECD countries. China engages in trade that is based not solely or even principally on markets but on government protection and mercantilism. Mercantilism is a nationalist economic policy that is designed to maximize the exports and minimize the imports for an economy. In other words, it seeks to maximize the accumulation of resources within the country and use those resources for one-sided trade. Their objective in trade is often to drive their higher cost competitors out of business, gain a near monopoly on supply, and then raise prices. They also can serve the broader strategic interests of the Chinese state.

Due to their climate policies, OECD countries are increasing their dependence on a single country for their future energy supplies. The concentration of supply capabilities in one country far exceeds what OPEC had in 1973. The fact that China is continually challenging western countries for geopolitical supremacy adds to the risks that it might use its domination of supply capability in future to unilaterally determine the supply and price conditions. In effect, OECD countries are endangering their own people. They are making China great again.

WHAT ABOUT ENERGY SECURITY?

The concept of energy security has changed greatly since the 1970s and 1980s. Then, improving Canada's energy security was the central goal of federal government energy policy. Energy security meant assuring a stable supply of affordable oil and reduced vulnerability to the threat of embargos and price manipulations by exporters. Many of the measures introduced were aimed at reducing oil imports and exports, diversifying the sources of energy (and specifically oil) supply, increasing energy efficiency, establishing strategic oil reserves and imposing controls on the price of oil.

Oil Shock of 1973–74

October 1973–January 1974

From the vantage point of policymakers in the Federal Reserve, an oil embargo by Arab producers against the U.S. further complicated the macroeconomic environment of the early 1970s.

Sign reading "Gas shortage! Sales limited to 10 gallons of gas per customer" posted at a Connecticut filling station during the energy crisis (Photo: Owen Franken/Corbis Historical/Getty Images)

https://www.federalreservehistory.org/essays/oil-shock-of-1973-74

Improving energy security among the countries of the Organization for Economic Cooperation and Development (OECD), it was then recognized, required collective efforts by the major oil consuming countries to develop their own sources of production and reduce dependence on the Organization of Petroleum Exporting Countries (OPEC) . The International Energy Agency was formed and served as forum for collective action.

With the benefit of hindsight, we can now see that some of the policies implemented in that period were poorly conceived and had limited, if any, benefits in terms of increasing the reliability or affordability of supply. The policies taken did not completely eliminate oil price volatility, but they reduced the exposure of OECD countries to major supply disruptions.

https://youtu.be/0dcRbgUesHU

For most of the post-2000 period, the governments of the world have abandoned their energy security concerns as they shifted focus towards attaining the goals of climate policy. The Paris Agreement, reached in 2015, established a framework in which countries agreed to submit plans every five years as to how they will reduce greenhouse gas (GHG) emissions so as to meet the aspirational goal of restraining the rise in average global temperatures to no more than 1.5 degrees C. over those that which prevailed in pre-industrial times. Pressured by the United Nations, international financial institutions and hundreds of well-funded environmental organizations, most OECD governments are now voluntarily committed to work towards the so-called “net-zero” emissions goal by 2050.

HOW ENERGY MARKETS HAVE CHANGED

The decline in emphasis on energy security in the OECD countries can be largely explained by the changes in markets. Of greatest importance probably has been the changes in the supply and demand for oil.

In 1973, global oil production was about 60 million barrels per day. OPEC was supplying 56% of the world's oil, up from 47% in 1965. This heavy concentration of production capacity in just a few countries made it possible for them to manage supply so as to influence oil prices and support their pursuit of geopolitical objectives. The United States, the world’s largest oil importer in 1973, depended on imports for 6.2 million barrels per day of its oil supply, 82% of which came from the Middle East.

My, how things have changed. In 2022, world crude oil and liquids production was over 100 million barrels per day, with almost 70 million barrels per day coming from non-OPEC countries. The United States is the world’s largest producer, and is a significant net oil exporter. Europe, China, India and Japan are now the largest oil importers.

The security risks associated with energy import dependence still exist, but they differ among regions. Most of Asia, but especially Japan, China and India, are heavily dependent upon oil imports from the Middle East

producers. The European Union's energy mix in 2020 consisted of 34.5% oil and petroleum products, 23.7% natural gas, 17.4% renewables, 12.7% nuclear energy and 10.5% solid fuels (coal and lignite). The EU imported 57.5% of the energy it consumed, leaving it highly vulnerable to interruptions in imports or sharp rises in energy prices. Just under a quarter (24.4%) of the EU's imported energy was from Russia. In terms of specific fuel sources, Russia supplied 19.3% of the EU's oil consumption and 41.1% of its natural gas consumption. The Russian invasion of the Ukraine and the subsequent reduction of supply from Russia have thus raised energy security concerns to a new level.

There are few major security issues related to oil and natural gas for countries located in the Americas. As noted previously, the United States is now the largest oil producer in the world, and Canada, Brazil and Mexico are also large oil producers and exporters. Those four countries alone now produce 34% of the world's oil and there are immense resources in Venezuela constrained only by the tragically poor governance of that country.

What countries are the top producers and consumers of oil?

The top 10 oil[1] producers and share of total world oil production[2] in 2023[3]

Country	Million barrels per day	Share of world total
United States	21.91	22%
Saudi Arabia	11.13	11%
Russia	10.75	11%
Canada	5.76	6%
China	5.26	5%
Iraq	4.42	4%
Brazil	4.28	4%
United Arab Emirates	4.16	4%
Iran	3.99	4%
Kuwait	2.91	3%
Total top 10	74.59	73%
World total	101.81	

[1] *Oil* includes crude oil, all other petroleum liquids, and biofuels.
[2] Production includes domestic production of crude oil, all other petroleum liquids, and biofuels and refinery processing gain.
[3] Data source: U.S. Energy Information Administration, International Energy Statistics, Total oil (petroleum and other liquids) production, as of April 11, 2024

https://www.eia.gov/tools/faqs/faq.php?id=709&t=6

Similarly, there are few energy security issues associated with coal. Over 30 countries are significant coal producers, although the top four producers (China, India, Indonesia and the United States) account for three quarters of the world's production.

THE EMERGING SECURITY ISSUES

A new set of security concerns is arising as a consequence of climate policies.

MANUFACTURING OF NEW TECHNOLOGIES

One of the central features of global efforts to reduce GHG emissions is their reliance on accelerating the production and deployment of five critical technologies: solar photovoltaic (PV) electricity, industrial wind turbines, batteries to store electricity in bulk, electrolysers for the production of hydrogen, and heat pumps. The International Energy Agency now reports frequently on the trends with respect to these technologies and advocates for policies that will increase their production and use. In 2023, the IEA published an Energy Technology Perspectives Special Briefing intended to provide policy makers with "strategic insights" in this area.

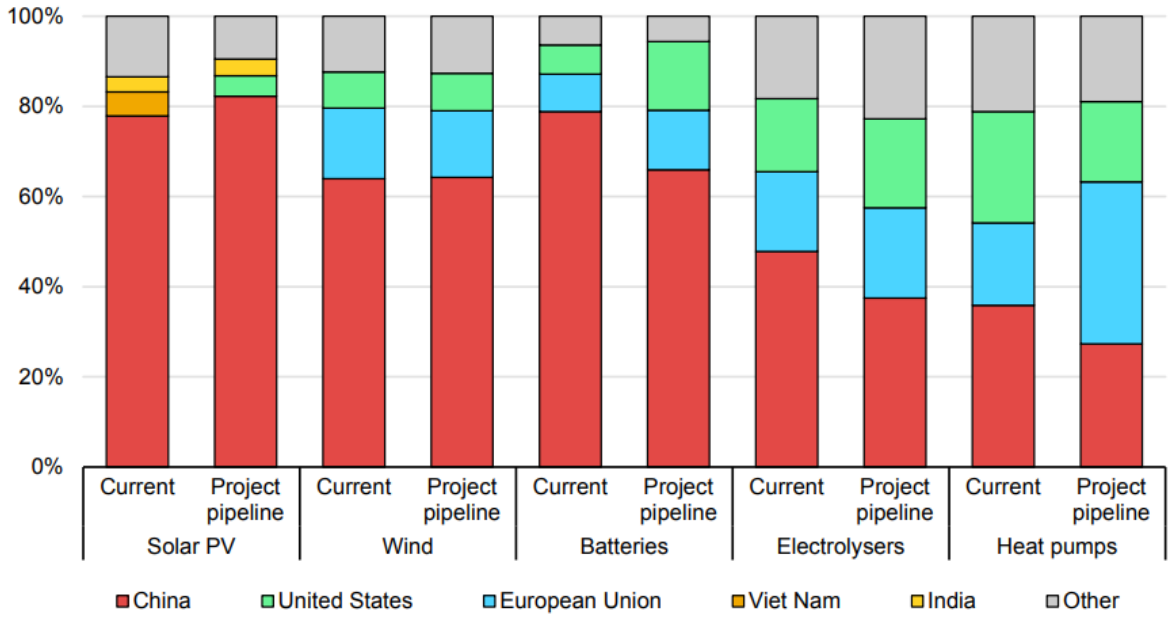
The report was filled with enthusiastic commentary on the rapid growth in installed and planned manufacturing capacity and on the likelihood that at present rates of growth, capacity will probably be sufficient to meet the demand anticipated in countries' 2030 emissions reduction targets. Not surprisingly, the IEA briefing declined to comment on the magnitude of taxpayer-funded subsidies that have made possible that expansion. It is ironic that the IEA should not have commented on an extremely important energy security issue related to the global effort to increase reliance on the five technologies – China's dominance of the global market.

Instead, its commentary was more neutral.

"*Manufacturing operations are highly geographically concentrated: currently, four countries and the European Union account for 80-90% of global manufacturing capacity for the five clean technologies examined in this briefing. China alone accounts for 40-80% across these technologies. If all announced projects were to be realized, these shares would shift to 70-95% and 30-80% respectively.*"

"*China appears well positioned to capture USD 500 billion, or around 65% of the projected output from global clean energy technology manufacturing capacity in 2030, including both existing and announced projects…More than two-thirds of this output would be surplus to domestic requirements and need to find export markets*."

Figure 7 Geographical concentration of current and announced manufacturing capacity



IEA. CC BY 4.0.

Notes: Wind refers to onshore wind nacelles in this analysis. For electrolysers, the analysis only includes projects for which location data was available. Shares are based on manufacturing capacity. 'Current' refers to installed capacity data for 2022. "Project pipeline" refers to the sum of current installed capacity and all announced manufacturing capacity additions (as of end-Q3 2023) through to 2030. "Other" refers to the aggregate of all capacity outside of the top three countries/regions for each technology and timeframe.

Source: IEA analysis based on data from InfoLink, BNEF, WoodMac, BMI and UN Comtrade.

China's dominance of the markets varies by technology. It has 80% of the current manufacturing capacity for solar PV, and also so has 80% of the world's planned capacity additions. The next two countries with respect to installed capacity are Viet Nam and India. The OECD countries barely count as suppliers. In other words, the OECD countries, including most of Europe, the United States, Canada and others, are almost entirely dependent for their supply of solar energy equipment on Asian countries with sharply different global strategic interests.

A closer look at the components that make up solar PV panels highlights even higher degrees of concentration than those of the finished modules alone. Solar PV modules are assembled from cells, which in turn are made from wafers, which in turn are made from polysilicon. China is the largest producer of all three sub-components (cells, wafers, polysilicon) today, accounting for 85-97% of global installed capacity at each stage of the supply chain. In fact, the supply chain concentration in China has been increasing over the period since 2010.

China has almost two-thirds (63%) of global manufacturing capacity for onshore industrial wind turbines and, based on current plans, will retain this share until at least 2030. Its share of global manufacturing capacity for

offshore wind turbines probably will rise to 70-80% by 2030. China also accounts for about 40% of global electrolyser manufacturing capacity and 35% of heat pumps manufacturing capacity. Finally, China now accounts for 75% of global installed manufacturing capacity for batteries, and this share is projected to decline only modestly as the United States, under the Inflation Reduction Act, subsidizes huge additions to battery manufacturing capacity there.

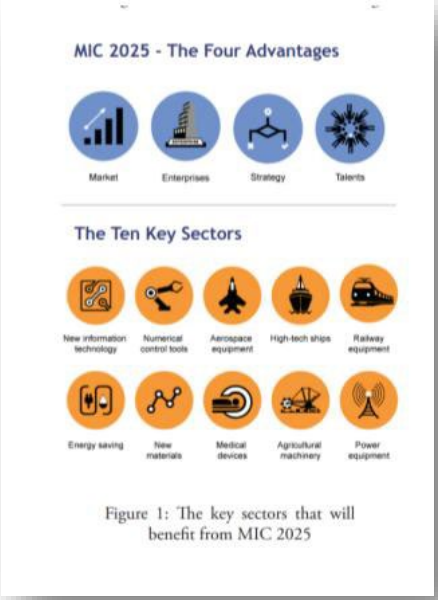


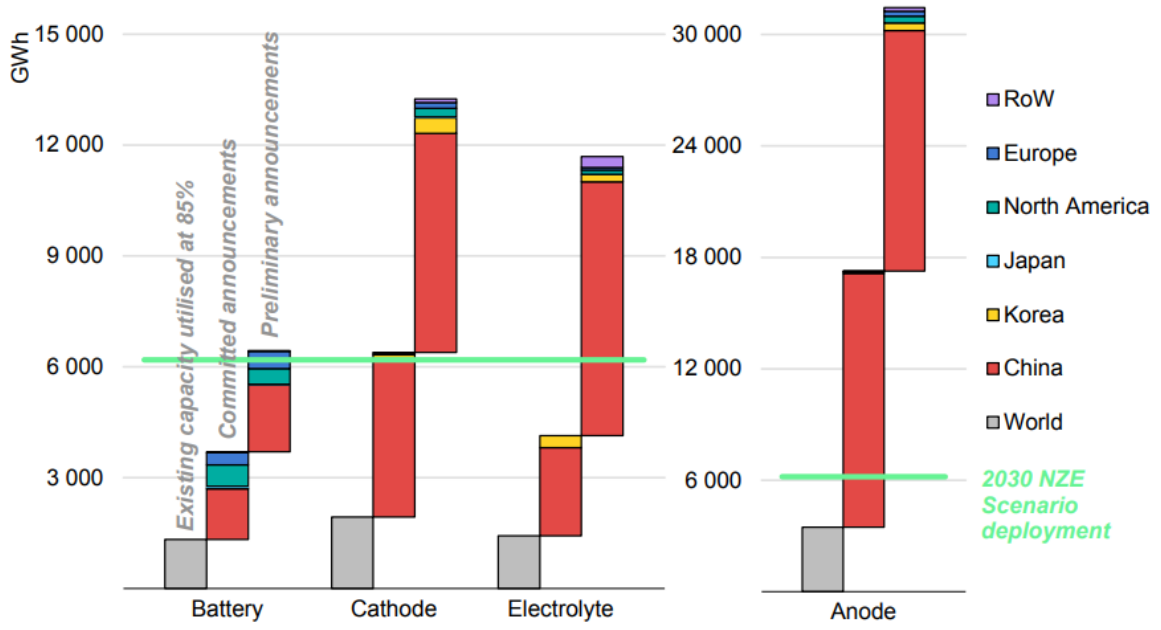
Figure 1: The key sectors that will benefit from MIC 2025

China has a "Made-in-China 2025" goal to be the world's manufacturer of all hi-tech and advanced systems.
https://www.cfr.org/backgrounder/made-china-2025-threat-global-trade

PRODUCTION OF CRITICAL MINERALS

China's dominance of the production of goods needed to support the "energy transition" is not limited to manufactured products. It also has a major role in the production of some critical minerals that are used in the renewable energy sector and in batteries. According to the IEA's Sustainable Development Scenario, demand for these minerals is expected to quadruple by 2040. Under a "net-zero" scenario, it is projected to rise by six times.

Figure 12 Projected throughput from existing and announced battery component manufacting capacity and Net Zero Emissions by 2050 Scenario deployment in 2030



IEA. CC BY 4.0.

Notes: RoW = Rest of World. A utilisation factor of 85% is assumed for all years and regions. Calculations for cathode, anode and electrolyte capacity assume a cathode and anode energy density of around 600 and 1 500 Wh/kg, respectively, and 1 g of electrolyte (solvent + salt) per ampere hour (Ah) and a nominal cell voltage of 3.5 V. For battery and battery components manufacturing specifically, 'committed' refers to projects that are currently under construction or expansion of current plants, with all other announcements being categorised as 'preliminary'.

Sources: IEA analysis based on data from BMI and BNEF.

China is the dominant player in global mineral processing, and its upstream control over raw commodities is also increasing.[2] It refines 68% of the world's nickel, 40% of the copper, 59% of lithium, and 73% of cobalt. As for minerals, it produces over 60% of the world's vanadium and graphite, and 40% of the world's molybdenum, aluminum, and lead. Rare earth elements over which China has a substantial hold over mining activity include 17 metallic elements, four of which – neodymium, dysprosium, praseodymium, and terbium -are of particular importance to "clean" energy technologies.

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This is not an accident. China has achieved this manufacturing and market dominance as a result of clear and sustained policy signals and deployment targets in its Five-Year-Plans.

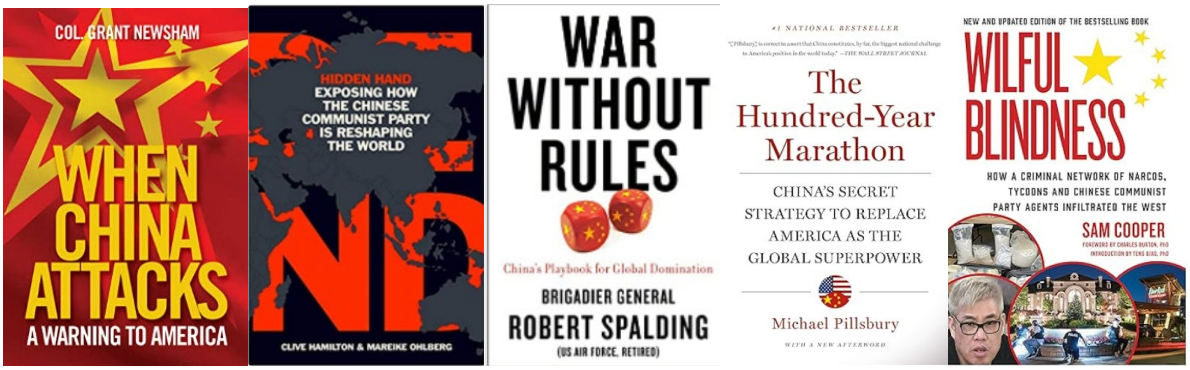
China's state-owned and controlled companies are directed by the government (i.e. the Chinese Communist Party) to operate in ways differently than the privately-owned and operated firms in most OECD countries. One example of this is their approach investing in new manufacturing capacity. Privately owned firms tend to add new capacity when needed, in order to avoid having sunk capital that is being under-utilized. Across the board, manufacturing facilities for several technologies in China typically operate at lower utilization rates than in other major economies. For solar PV manufacturing for example, the IEA estimated the current utilization rate at 38% compared to an average of 65% for the next five largest producers.

Privately-owned and operated businesses could not survive if they operated like that in a market-oriented environment. Yet, China engages in trade that is based not solely or even principally on markets but on government protection and mercantilism. Mercantilism is a nationalist economic policy that is designed to maximize the exports and minimize the imports for an economy. In other words, it seeks to maximize the accumulation of resources within the country and use those resources for one-sided trade.

Mercantilism promotes government regulation of a nation's economy for the purpose of augmenting and bolstering state power at the expense of rival national powers. High tariffs, especially on manufactured goods, were for a long time a feature of mercantilist policy. Before it fell into decline, mercantilism was dominant in modernized parts of Europe and some areas in Africa from the 16th to the 19th centuries, a period of proto-industrialization. In the modern version practiced by China, it includes the search for autarky (I.e. self-sufficiency) in advanced manufactured goods, by massively subsidizing overcapacity in strategic industries like steel, and practicing overt state capitalism (i.e. where the government owns and/or controls all the key investment decisions of large firms).

The result is that China frequently engages in what western countries regard as unfair trade practices. State-owned enterprises control over 40% of industrial assets there, are heavily subsidized, tax-exempted, given preferred treatment (e.g. in government loans, government contracts, licences, access to land, etc.) and protected from competition. Their objective in trade is often to drive their higher cost competitors out of business, gain a near monopoly on supply, and then raise prices. They also can serve the broader strategic interests of the Chinese state.

By continuing to emphasize much increased purchases of selected technologies to meet climate policy goals, OECD countries are increasing their dependence on a single country for their supplies. The concentration of supply capabilities far exceeds what OPEC had in 1973. The fact that China is continually challenging western countries for geopolitical supremacy adds to the risks that it might use its domination of supply capability in future to unilaterally determine the supply and price conditions. OECD countries are endangering their own people. They also are making China great again.



Just one year shy of NetZero 2050.

ABOUT THE AUTHOR

Robert Lyman is an economist with 27 years' experience as an analyst, policy advisor and manager in the Canadian federal government, primarily in the areas of energy, transportation, and environmental policy. He was also a diplomat for 10 years. Subsequently he has worked as a private consultant conducting policy research and analysis on energy and transportation issues as a principal for Entrans Policy Research Group. He is a frequent contributor of articles and reports for Friends of Science, a Calgary-based independent organization concerned about climate change-related issues. He resides in Ottawa, Canada. Full bio.

ABOUT FRIENDS OF SCIENCE SOCIETY

Friends of Science Society is an independent group of earth, atmospheric and solar scientists, engineers, and citizens that is celebrating its 21st year of offering climate science insights. After a thorough review of a broad spectrum of literature on climate change, Friends of Science Society has concluded that the sun is the main driver of climate change, not carbon dioxide (CO2).

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