
THE AMERICAN CONSUMER INSTITUTE
CLEARING THE AIR
HONEST TRUTHS ABOUT CLEAN ENERGY
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Introduction

“Clean” or “green” energy is all the rage these days. The terms have become commonplace in everyday vernacular. Politicians, the mainstream media, politically elite, and climate alarmists claim these sources of energy—wind, solar, and electric vehicle (EV)—are going to save the planet. Afterall, wind and solar are renewables, which derive from natural sources and regenerate; the EV relies on battery power and therefore emits zero pollution.

It is very hip to be green. All the cool kids are doing it. All the cool companies are, too, and bragging about it. It’s practically a competition to see who can be the greenest.

Green energy technologies are often propped up and praised while “dirty” fossil fuels are vilified, and in some cases, considered evil. A big movement to switch the country entirely over to green energy is sweeping across the nation, despite the costs and numerous challenges involved. Wind, solar, and EVs are heavily subsidized through the ironically-named Inflation Reduction Act (IRA) of 2022, a chief milestone and accomplishment of the Biden administration. Department agencies and executive offices have followed suit with stringent rules and regulations that favor green energy and punish most others. Several governors have even implemented state policies that restrict the use of fossil fuels, demand increases in wind and solar, and compel motorists to buy EVs. With global leaders sharing this vision, the idea is to create a world that will reach net-zero carbon emissions by the year 2050.

Often left out of the discussion is the emissions-heavy and environmentally destructive processes involved in producing wind, solar, and the batteries for EVs. The life cycle (from cradle to grave) of each one carries its own carbon footprint and global impact. And while the consumption phase may be relatively free of emissions, the creation and retirement stages are energy intensive, potentially harmful, and in some cases completely devastating.

Leaders here and abroad are jumping feet first, eyes half closed and hoping for the best. It might be better to wade through the waters, cautiously and deliberately while finding footing. After all, isn’t this part of the complaint regarding how we approached fossil fuels?

To hear green energy advocates talk, one would think these forms have no environmental repercussions. But like most everything, these sources don’t appear out of thin air, and various apparatuses must be constructed to harness the clean and/or renewable energy they purport to produce. This paper serves to not only elucidate the greenhouse gas (ghg) emissions emitted by wind, solar, and EVs but paint a clearer picture of the energy and resources employed to implement these alternative sources.

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No energy source is perfect; the objective here is not to necessarily condemn forms of energy. The aim is to unearth what is hidden behind the false narrative that the energy sources being espoused as very clean are not necessarily so. This is an honest conversation on the environmental realities of so-called green energy, because so often these realities are buried. We need to have this piece of the puzzle when creating and implementing policies that affect a significant portion of our economy, consumers, and the well-being of the human race. Are these strategies our best option? Are they worth the monumental risks involved?

The truth is, the manufacturing of more wind, solar, and EV batteries will require a substantial increase in mining minerals which are found in rocks all over the world; however, only a handful of countries and companies control the extraction.[1] The U.S. extracts so little of its own minerals, for various reasons, including environmental and permitting, that it must rely on other countries for a majority of them. China is the dominant player, followed by several other developing nations, some of which are among the world's least-developed. These facts create a complicated dynamic for green energy, and in some cases, contribute to more negative environmental impacts.

[1] "5 Things You Should Know About 'Clean Energy' Minerals and the Dirty Process in Mining Them," United Nations, February 25, 2024, https://news.un.org/en/interview/2024/02/1146922.

Wind Energy

The use of wind goes back nearly a century and a half. The first wind turbine in the United States was used in 1888 to power an Ohio home.[2]

Nearly 100 years later in 1980, the world's first wind farm was installed in New Hampshire, and consisted of 20 turbines at 30 kilowatts (kw) each.[2] By 1990 there were 46 farms, and in 2000 there were 97. According to the U.S. Wind Turbine Database, as of May, 74,511 wind turbines span the country with a total rated capacity of 144,950 Megawatts (MW) of power.[3] They are scattered across 43 states, with large concentrations in the Midwest and Northeast.

Our elected officials want more. The National Renewable Energy Laboratory's (NREL) "All Options" scenario projects roughly 250,000 wind turbines in the United States by 2035.[5]

The two types of wind turbines, onshore or offshore, generally vary in size and energy output. Each type of turbine consists of four main components: foundation, tower, nacelle, and rotor (blades). Each turbine is predominantly made of steel; fiberglass, resin or plastic; iron or cast iron; copper; and aluminum.

An onshore turbine will sit upon a steel reinforced circular concrete slab, often three meters in depth and 30 meters in diameter. The offshore turbine's foundation will be comprised mostly of steel.[6]

The average capacity of a U.S. turbine is 3.2 MW. As of 2022, the average hub height (distance from the ground to the middle of a turbine's rotor) is approximately 98 m (322 ft).[7] And the average rotor diameter is over 130 m (430 ft), which is almost twice the wingspan of a 747 plane. These are massive structures.

[2] Zachary Shahan, "History of Wind Turbines," Renewable Energy World, November 21, 2014, https://www.renewableenergyworld.com/storage/grid-scale/history-of-wind-turbines/#gref.
[3] A kilowatt hour is 1,000 watts used for one hour. On average, a typical American household uses approximately 15 to 30 kWh of electricity a day.
[4] B.D. Hoen, J.E. Diffendorfer, et al., United States Wind Turbine Database, U.S. Geological Survey, and Lawrence Berkely National Laboratory Data Release, v. 6.1, May 10, 2024, https://doi.org/10.5066/F7TX3DN0.
[5]Paul Denholm, Patrick Brown, Wesley Cole, et al, "Examining Supply-Side Options to Achieve 100% Clean Electricity by 2035," National Renewable Energy Laboratory, 2022, NREL/TP6A40-81644, Golden, CO https://www.nrel.gov/docs/fy22osti/81644.pdf.
[6]Joel Arnello and Maria Kolte, "Climate Impact of Wind Turbine Production," KTH Royal Institute, June 8, 2023, p. 17, https://www.diva-portal.org/smash/get/diva2:1784546/FULLTEXT01.pdf.
[7] "Wind Turbines: The Bigger, the Better," Department of Energy, August 24, 2023, https://www.energy.gov/eere/articles/wind-turbines-bigger-better#:~:text=The%20average%20capacity%20of%20newly,MW%20or%20larger%20also%20increased.

Production

Wind turbines require substantial raw materials. A typical wind turbine with an output of three MW will be comprised of the components described in Figure 1.

Figure 1

Material	Amount
Concrete	1200 tons
Steel	335 tons
Copper	4.7 tons
Aluminum	3 tons
Rare earth elements	2 tons

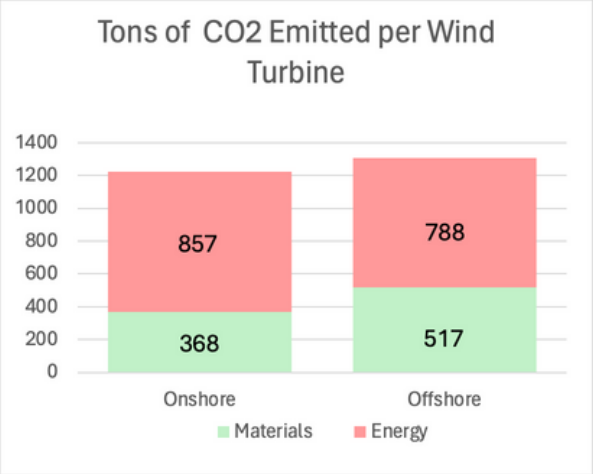
Data from National Wind Watch [8]

The construction process of wind turbines involves several stages that contribute to the overall carbon footprint of the final product: raw material extraction and processing, component fabrication, and assembly.

The primary materials used in wind turbines, such as steel and concrete, have high embodied carbon emissions due to their manufacturing processes. The extraction of raw materials, particularly iron ore for steel production and limestone for cement involves energy-intensive operations and releases significant greenhouse gas emissions, primarily carbon dioxide (CO_2).

KTH Royal Institute of Technology published a study last year articulating the climate impact of wind turbine production.[9] The researchers used 13 different turbine models produced by Vestas, the largest manufacturer in the world, whose production and manufacturing facilities span the globe. They measured emission outputs for both the production of raw materials and the energy required for that production.

Figure 2



The investigation found that the onshore wind turbine's material emissions total 368 tons of CO_2 per MW and its energy usage emitted 857 tons. The materials used for the offshore turbine generate 517 tons of CO_2 per MW and the energy consumed to process the materials emitted 788 tons.

In total, when combining emissions from the material and energy use, the onshore turbine generates 1225 tons of CO_2 per MW. The offshore turbine generates a total of 1305 tons. The data is summarized in Figure 2.

[8] "Metals and minerals in wind turbines National Wind Watch," Northwest Mining Association, https://www.wind-watch.org/documents/author/?a=Northwest+Mining+Association.
[9] Joel Arnello and Maria Kolte, 2023.

Steel and concrete in general are the greatest contributors to ghg emissions. The World Economic Forum acknowledges that the steel industry contributes 7-9 percent of global man-made ghg emissions.[10] Obviously, massive increases in wind turbines will greatly increase steel's overall contribution to emissions.

After constructing the turbines, the finished products need to be hauled to various wind farms. Raw materials extraction and turbine manufacturing comprise up to 86 percent of total lifecycle emissions for wind power; the remaining 14 percent comes from transportation, installation, operation and maintenance, and decommissioning and disposal.[11]

Most turbines are trucked to their final destination. Offshore wind farms have the added complication and carbon footprint of oceanic vessels transporting and erecting the turbines.

Transporting wind turbines is an intricate process that requires significant time to plan and execute. One turbine alone can require ten or more trucks: one for each blade, two for the power equipment, three to five for the tower sections, one for the nacelle, and one for the hub. Turbines are some of the heaviest loads to haul. A smaller turbine could have 12-ton blades, a 56-ton nacelle, and a 72-ton tower; some of the larger turbines could have components weighing 35, 390, and 200 respectively.[12]

The added number of semi-trucks carrying extremely heavy loads will have an impact on highways, causing them to erode more quickly. Such heavy and wide loads will result in more wear and tear on the trucks, especially for the tires, wheels, and suspensions. Shipping distances could be statewide, regional, or even clear across the country.

Land Use

Most wind turbines will require at least 40 to 70 acres of land each, which averages 55 acres, depending on size and capacity.[13] Only a small percentage of the land will actually be used for wind turbine placement and the rest is typically kept free from any equipment to keep the air flow free from obstructions.

Some estimates say that wind generation will increase 570 percent between 2023 to 2050, from just under 500,000 GWh to 3.3 million GWh.[14] Since NREL projected a potential 250,000 turbines, and each turbine requires roughly 55 acres minimum, that could be close to 14 million acres. That's almost the entire state of West Virginia.

[10] "Is a Greener Wind Turbine About to Hit the Horizon?" World Economic Forum, May 2, 2023, https://www.weforum.org/agenda/2023/05/greenertower-greener-steel-wind-power/.
[11] Robert Liew, "Can Wind Power Truly Become Carbon Neutral?" Wood McKenzie, July 8, 2021, https://www.woodmac.com/news/opinion/can-wind-power-become-truly-carbon-neutral/.
[12] Arebella Ruiz, "How Much Does a Wind Turbine Blade Weigh?" The Roundup, August 30, 2022, https://theroundup.org/how-much-does-a-wind-turbine-blade-weigh/.
[13] George Duvall, "How Many Wind Turbines Can Fit on One Acre?" Today's Homeowner, April 7, 2024, https://todayshomeowner.com/eco-friendly/guides/how-much-space-does-a-wind-turbine-need/.
[14] Gavin Maguire, "North America Wind Power Sector Needs Cost Cuts and Supply-chain Revamp," Reuters, April 21, 2023, https://www.reuters.com/business/energy/n-america-wind-power-sector-needs-cost-cuts-supply-chain-revamp-maguire-2023-04-20/.

The largest wind farm in the U.S. resides in West Texas. Roscoe Wind Farm's 627 turbines sprawl across 100,000 acres and transmit 781.5 MW of power.[15]

Many wind farms have been and will continue to be established in the Midwest and Plains states, where wind capacity is relatively high. Of course, to deliver all this clean energy from these wind-rich regions to major load centers in the East will require a lot of additional transmission lines. NREL found that total US transmission capacity would have to increase by 1.3 to 2.9 times current levels by 2035, requiring 1,400 to 10,100 miles of new high-capacity lines per year.[16] This will obviously require energy, materials, and critical minerals as well as additional energy to transport and build the infrastructure, not to mention substantial land to run the lines.

Other Hazards

Wind turbines pose threats to various surrounding wildlife and habitats, threatening their very existence.

Total bird deaths from collisions with turbines are estimated to be between 140,000 and 328,000 per year, including thousands of eagles, hawks, owls, and other raptors.[17] These numbers will only increase, since the Department of Energy aims to substantially increase wind turbine capacity.

Enforcement of eagle protection laws started to wane once the number of applications for wind permits began to increase.[18] Relaxing the laws allows wind companies to kill thousands of eagles without legal consequences; the loose restrictions have facilitated the deaths of roughly 6,000 eagles over several decades. Despite some efforts to relocate wind farms, turbines are still being erected in areas frequented by golden eagles, a species already in decline.

Bats are especially prone to wind turbine deaths; as many as 880,000 bats are killed each year from spinning turbine blades.[19] According to Bat Conservation International, "more than half of the (bat) species in the U.S. are either declining or at some risk of decline. Wind energy is the leading cause of mortality for our long-distance migratory species."[20]

[15] "Roscoe Wind Farm, Texas, US," March 27, 2023, https://www.power-technology.com/projects/roscoe-wind-farm/.
[16] Paul Denholm, Patrick Brown, Wesley Cole, et al, "Examining Supply-Side Options to Achieve 100% Clean Electricity by 2035," National Renewable Energy Laboratory, 2022, NREL/TP6A40-81644, Golden, CO.
17] Molly Espey and Eamon Espey, "Using Markets to Limit Eagle Mortality from Wind Power," Property and Environmental Research Center, July 26, 2022, https://www.perc.org/2022/07/26/using-markets-to-limit-eagle-mortality-from-wind-power/.
[18] Matthew Brown and Camille Fassett, "Criminal Cases for Killing Eagles Decline as Wind Turbine Dangers Grow," AP News, May 17, 2023.
[19] "New Effort Seeks to Spare Bats from Wind Turbine Collisions," Yale Environment 360, September 26, 2023, https://e360.yale.edu/digest/wind-turbines-bats-tech.
[20] Avani Kalra, "Wind Farms, Key to Clean-energy Efforts, Threaten Birds and Bats: Developers Urged to Plan for Wildlife," Chicago Tribune, June 11, 2024, https://www.chicagotribune.com/2024/06/09/wind-farms-wildlife-clean-energy/.

Biologists in Finland found that 63 percent of bird species, 72 percent of bats and 67 percent of terrestrial mammals are displaced from areas where turbines are installed.[21] Such displacement has been linked to decreases in population sizes, changes in birds' mating behavior, and increases in offspring mortality.

Individuals on the east coast are concerned about the escalating number of whale deaths and the potential harm offshore wind has perhaps had and may continue to have on humpbacks and the endangered North Atlantic Right Whale.[22] Deaths have numbered in the hundreds in just the last handful of years and there are concerns that offshore wind projects could very well interfere with the mammal's habitats, further decimating their population. There are currently less than 400 remaining.

Other animal habitats on the ground could be disrupted due to the size and weight of the wind turbines themselves and the heavy machinery required for transportation and construction.[23] Surface roads surrounding the turbines are necessary to assemble and continually maintain the structures. The soil compaction and erosion can agitate animal life, and in the worst cases, kill species.

Disposal and Waste

The typical life span of wind turbines is roughly 25 years. Exposure to the elements takes its toll and they are no longer effective. The structures are then decommissioned, an entire process in and of itself. The turbine is broken down and carried away once again by truck to its final resting place. Some of these destinations could be a great distance, further contributing to carbon emissions.

Since this source of energy expanded somewhat recently, we are only in the beginning stages of decommissioning wind turbines. Wind farms erected two or three decades ago are currently or will soon be in the process of retiring. By 2050 it is predicted that used turbine blades will exceed 43 million tons of waste worldwide, or 800,000 tons annually. [24] The U.S. alone will have close to seven million tons.

Up to 90 percent of the wind turbine tower can be recycled; the blades are another story. Made of fiberglass and covered with a tough epoxy resin, they are designed to withstand years of hammering by the elements. As a result, they are difficult to break down.

[21] Anne Tolvanen and Ari Nikula, "Review: Several Groups of Birds and Mammals Avoid Wind Turbines," Luke Natural Resources Institute, Finland, December 18, 2023, https://www.luke.fi/en/news/review-several-groups-of-birds-and-mammals-avoid-wind-turbines.
[22] Kristen Walker, "East Coast Whale Deaths Warrant More Scrutiny," American Consumer Institute, April 24, 2024, https://www.theamericanconsumer.org/2024/04/east-coast-whale-deaths-warrant-more-scrutiny/.
[23] Whit Gibbons, "Wind Power Comes with Environmental Costs, Hazards," Tuscaloosa News, April 8, 2023, https://www.tuscaloosanews.com/story/opinion/columns/2023/04/08/wind-power-comes-with-environmental-costs-hazards-ecoviews/70074099007/.
[24]"Decommissioned Wind Turbine Blade Management Strategies," American Clean Power, January 2023, p. 2, https://cleanpower.org/wp-content/uploads/gateway/2023/01/ACP_BladeRecycling_WhitePaper_230130.pdf.

Not too many recycling or repurposing solutions have been conceived yet, and certainly aren't available on a large scale. The current processes are not only expensive but generally energy intensive and leave a carbon footprint of up to 744 tons of CO_2 for the three blades that make up a turbine.[25]

The most common manner of wind turbine blade disposal, due to the relative low cost and ease of execution, is hauling them to landfills. Thousands of blades have already ended up in these turbine graveyards. NREL predicts that between 3,000 and 9,000 blades will be retired each year for the next five years in the U.S., and then the number will increase to between 10,000 and 20,000 until 2040.[26]

While wind turbine blades are not especially toxic sitting in a landfill, if improperly handled, they may contribute to dangerous environmental impacts, including the pollution of land and waterways.[27]

Sweetwater, TX is a prime example of what has unintentionally become home to perhaps the world's largest resting place for turbine blades.[28] Thousands have arrived since 2017, blanketing more than thirty acres in stacks rising as high as basketball backboards. Nearby residents are concerned about the potential breeding ground for pests the blade piles create, as well as the dangers posed to curious children. The blades were brought to the landfill with the original intent to grind them up, but so far, that has not been the case. Many believe the company who bought and promised to recycle the blades have no intention of doing so. The locals are understandably upset.

How many more towns will end up like Sweetwater?

[25] Borja Diez-Canamero and Joan Manuel F. Mendoza, "Circular Economy Performance and Carbon Footprint of Wind Turbine Blade Waste Management Alternatives," Science Direct, Volume 164, 1 June 2023, pp 94-105.
[26] Mitch Jacoby, "Recycling Wind Turbine Blades," Chemical & Engineering News, 100 (27), pp. 26–30, August 8, 2022.
[27] Arthur Nelson, "Surging Wind Industry Faces its Own Green Dilemma: Landfills," Reuters, September 10, 2021, https://www.reuters.com/legal/litigation/surging-wind-industry-faces-its-own-green-dilemma-landfills-2021-09-10/.
[28] Russell Gold, "Thousands of Old Wind Turbine Blades Pile Up in West Texas, Texas Monthly, August 24, 2023, https://www.texasmonthly.com/news-politics/sweetwater-wind-turbine-blades-dump/.

Solar Energy

The government has been handing out solar incentives like candy to anyone who will put the panels on their roofs. People are taking advantage. And companies are capitalizing on subsidies to create solar farms.

Panels may have very little emissions while they sit and capture sunlight and transform it into energy; but just like wind turbines, the manufacturing, transportation, and disposal processes are energy intensive and/or create their own set of issues.

Crystalline-silicon solar photovoltaic (PV) panels represent over 95 percent of those on the market.[29] The solar cells are made from a crystal silicon structure and small amounts of valuable metals, like silver and copper, are embedded within. The silicon is cut into small, thin wafers which are then housed within a glass covering, plastic back sheet, and an aluminum frame.

Production

The life-cycle emissions of panels, from mining to manufacturing to installation to maintenance to disposal, is standardized into grams of CO_2 equivalents to account for the various types of emissions and their warming impacts. Manufacturing solar panels emits between 40 to 100 grams of CO_2 per kilowatt-hour (g CO2/kWh) of energy generated.[30]

In order to purify silicon into polysilicon, the primary raw material used in solar, the element needs to be heated to its boiling point of 1,410 degrees Celsius. The process accounts for about half the total carbon emissions due to substantial electricity being employed (often sourced from coal-fired plants).[31]

The crystalline-silicone PV requires massive quantities of semiconductors, which utilize a significant amount of water. A two-foot-wide wafer of semiconductors consumes 4400 gallons of water.[32] One semiconductor facility can use five million gallons of water a day, or two billion a year.

Manufacturing solar panels involves a number of dangerous toxins as well. Below are just a handful.

[29] “End of Life Solar Panels: Regulations and Management,” EPA, October 23, 2023, https://www.epa.gov/hw/end-life-solar-panels-regulations-and-management.
[30] Sabrina Fitchner, “Understanding the Carbon Footprint of Solar Panel Manufacturing,” Solarbe Global, October 30, 2023, https://www.solarbeglobal.com/understanding-the-carbon-footprint-of-solar-panel-manufacturing/#:~:text=Manufacturing%20solar%20panels%20requires%20high,(gCO2%2FkWh)%20produced.
[31] Ibid.
[32] “How the Solar Panel Manufacturing Process is Going Green,” ILUM Energy Solutions, 2024, https://ilumsolar.com/how-the-solar-panel-manufacturing-process-is-going-green/.

Nitrogen trifluoride (NF_3), one of the principal chemicals used to manufacture solar panels, is a very toxic ghg that is 17,200 times more potent than CO_2.[33] While only two percent is released into the atmosphere during manufacturing, NF_3 levels are quickly accumulating; emissions have increased over 1,000 percent in the last few decades. Some scientists claim NF_3 has a potential greenhouse gas impact greater than that of the world's largest coal-fired power plant.[34]

Sulfur hexafluoride (SF_6) is also released during the manufacturing process. Being 23,000 times more potent than CO_2, and with an atmospheric lifetime of approximately 3200 years, SF_6 has the greatest global warming potential of all.[35] While most of its emissions come from its use in the electrical industry to prevent short circuits and accidents, this man-made gas is also released producing PVs.

A 2020 study showed the annual emissions rate of SF_6 rose from about 7.3 gigagrams (Gg) in 2008 to about 9.04 Gg in 2018, a 24 percent increase in just one decade.[36] For reference, nine Gg of SF_6 equates to ghg emissions of approximately 44 million passenger vehicles driven for one year, or 226 billion pounds of coal being burned.[37]

The production of polysilicon creates silicon tetrachloride, that when combined with water, produces hydrochloric acid. Not only is this toxin acidic for soil, it causes skin burns and is a respiratory, skin, and eye irritant.[38]

Workers may also be exposed to cadmium telluride, a toxic metal carcinogen, through inhalation of contaminated air or ingestion from hand-to-mouth contact. The acute health effects from inhaling it include pneumonitis, pulmonary edema, and death.[39]

And lead, a neurotoxin which has been drastically reduced in most manufacturing processes, is still used in PVs.

Transporting the products presents another footprint. The mining of raw materials often takes place far from manufacturing facilities, sometimes continents and oceans away from the site of installation.

[33] Peter Van Voorhis, "EPA: Solar Panels Increased Toxic Greenhouse Gas Emissions," Washington Examiner, March 3, 2017, https://www.washingtonexaminer.com/red-alert-politics/1613356/epa-solar-panels-increased-toxic-greenhouse-gas-emissions/.
[34] F.J. Martin-Torres, "What is Nitrogen Trifluoride?" University of Aberdeen, https://www.ercs.scot/wp/wp-content/uploads/2020/11/Nitrogen-Triflouride-Scientific-Brief-Prof-FJ-Martin-Torres..pdf.
[35] Zhaolun Cui, Yi Li, et al, "Recent Progresses, Challenges and Proposals on SF6 Emission Reduction Approaches," Science Direct, January 1, 2024, https://www.sciencedirect.com/science/article/abs/pii/S0048969723059740.
[36] Peter Simmons, Matthew Rigby, et al, "The Increasing Atmospheric Burden of the Greenhouse Gas Sulfur Hexafluoride," European Geosciences Union, June 23, 2020, https://acp.copernicus.org/articles/20/7271/2020/.
[37] Diego de la Fuente, Rachel Meidl, et al, "SF6: The Little Gas That Could… Make Global Warming Worse," Forbes, March 25, 2021.
[38] Shaker Muasher, "The Possibility of a Solar-Powered Nation: Nitty-gritty," Standford Magazine, September/October 2009, https://stanfordmag.org/contents/the-possibility-of-a-solar-powered-nation-nitty-gritty.
[39] Cadmium Telluride, Science Direct, 2013, https://www.sciencedirect.com/topics/earth-and-planetary-sciences/cadmium-telluride#:~:text=Cadmium%2C%20one%20of%20the%20CdTe,be%20less%20toxic%20than%20cadmium.

China dominates the market in nearly every aspect of panel production: silicon wafers, frame, glass, and back sheet material.[40] Other parts of Asia—such as Vietnam, Thailand, South Korea, and Malaysia—greatly contribute as well. One would be hard-pressed to find a solar panel in the United States whose supply chain fully resided within the borders. Considered the world's biggest polluter, China makes up nearly 30 percent of global emissions and accounts for over half of global demand for coal.[41] In fact, CO_2 emissions associated with refineries in China are 1.5 times greater than those in the EU or U.S.[42]

A recent investigation claims that the overall footprint of solar manufacturing is actually three times more carbon intensive than estimated because "data that governments depend on…..are instead based on modeling assumptions that are likely to have grossly under-estimated — if not made-up — solar's carbon emissions because they cannot get insights from Chinese manufacturers."[43] It is believed ghg emissions are more like 170 to 250 g CO2/kWh (instead of the 40-100, as stated previously).

Land Use

As with wind turbines, solar panels take up space. Depending on the specific technology, a utility-scale solar power plant may require between 6 to 8 acres per megawatt (MW) of generating capacity.[44] A typical plant, which will produce roughly 20MW, may occupy around 3,200 acres total and contain hundreds of thousands of solar panels that are 6 ft by 6 ft.

As of the first quarter of this year, estimates indicate 5,028,932 solar energy systems have been installed nationwide.[45] Between 105 and 126 million panels sit on approximately 4.2 million American homes.[46] About 4,000 larger utility-type farms exist across all 50 states.[47] And ground-mounted solar could require 5.7 million acres by 2035 and as much as 10 million acres in 2050 in order to achieve the current administration's goals. That is roughly the size of Massachusetts and New Jersey, combined.

The Bureau of Land Management has proposed using up to 22 million acres of public land for solar projects in the western U.S., which is roughly equivalent to the size of Maine or an area larger than Scotland.[48] Currently, about 34,000 acres of bureau land is being used for solar.

[40] David Kuchta, "Where are Solar Panels Made? Why Your Manufacturer Matters," Treehugger, September 13, 2021, https://www.treehugger.com/where-are-solar-panels-made-5194436.
[41] Helen Regan, "World's Biggest Polluter Just Had its Hottest Year on Record," CNN, January 5, 2024, https://www.cnn.com/2024/01/05/china/2023-hottest-year-china-climate-intl-hnk/index.html.
[42] Mark Mills, "Electric Vehicles for Everyone? The Impossible Dream," Manhattan Institute, July 2023, https://media4.manhattan-institute.org/wp-content/uploads/electric-vehicles-for-everyone-the-impossible-dream.pdf
[43] C.P. Colum, Lea Booth, "Solar Panels Are Three Times More Carbon-Intensive Than IPCC Claims," Environmental Progress, July 3, 2023.
[44] "Solar Farm Land Requirements," Transect, https://www.transect.com/insights/solar-farm-land-requirements#:~:text=These%20sites%20need%20enough%20space,for%20a%201%20MW%20site.
[45] "Solar State by state," Solar Energy Industry Association, https://www.seia.org/states-map.
[46] "How Many Americans Have Solar Panels in 2024?" Solar Insure, https://www.solarinsure.com/how-many-americans-have-solar-panels#:~:text=With%204.2%20million%20American%20homes,million%20solar%20panels%20in%20total.
[47] Kelsey Misbrener, "New Database Maps Large-scale Solar Projects Across the Country," Solar Power World, November 8, 2023.
[48] Oliver Millman, "The US Says it Needs Up to 22m Acres for the Solar Energy Transition," The Guardian, January 23, 2024, https://www.theguardian.com/us-news/2024/jan/23/us-solar-energy-transition-land.

The largest solar-storage project in the U.S. came online earlier this year. Stretching across 4600 acres in the California Mojave Desert, it boasts nearly two million solar panels and more than 120,000 batteries.[49]

Other Hazards and Environmental Impacts

Since solar panels need to be positioned in areas with plenty of sunlight, often times the chosen locations have dense vegetation and therefore deforestation procedures are employed to clear the area.[50] Building solar facilities on large areas of land requires clearing and grading, often resulting in soil compaction, potential alteration of drainage channels, and increased runoff and erosion.[51] The sizeable quantity of water that solar farms demand can strain these resources in arid settings, adversely affecting native vegetation and wildlife.

The presence of solar infrastructure can also create stress and add barriers to animal movement and migration, fragmenting habitats and inhibiting species' ability to access food, water, and shelter.[52]

The solar panels themselves can leak their chemicals. Pollutants such as lead or carcinogenic cadmium can be almost completely washed out over a period of several months, for example, by rainwater.[53] When solar panels are damaged by weather, mishandling, or improper disposal, these chemicals can leach into the water and soil.

Ideally, solar farms would occupy unused or desolate land that no one wants or claims. But this isn't always the case. Money-starved farmers, tempted by the lucrative offers solar can provide, are leasing generational farmland to solar energy corporations with "frightening regularity."[54] Rows of corn have been turned into rows of metal and glass. Prepping the area for thousands of metallic panels that potentially leak chemicals will forever change the soil. Leaking panels could pollute ponds, wells, and irrigation systems. American Farmland Trust forecasts that 83 percent of new solar energy development will be on farm and ranchland, nearly half of which would be on the most productive land and putting it at risk.[55]

[49] Eric Wesoff, "The Biggest Solar-plus-storage Project in the U.S. Just Came Online," Canary Media, January 25, 2024, https://www.canarymedia.com/articles/solar/the-biggest-solar-plus-storage-project-in-the-us-just-came-online.
[50] "The Environmental Impact of Solar Panels," Empower Energy Solutions, 2022, https://empowerenergy.co/the-environmental-impact-of-solar-panels/.
[51] "Solar Energy Development Environmental Considerations," Solar Energy Development Programmatic EIS, 2012, https://solareis.anl.gov/guide/environment/.
[52] Usman Noor, "Solar Panels and Wildlife—Lessening Environmental Impacts," 8M Solar, May 8, 2024.
[53] Joshua Antonini, "Bright Panels, Dark Secrets: The Problem of Solar Waste," Mackinac Center for Public Policy, June 2, 2022, https://www.mackinac.org/blog/2022/bright-panels-dark-secrets-the-problem-of-solar-waste.
[54] Alice Web, "Does Solar Have a Dark Side? Solar Impacts on Rural Landscapes and the Family Farm," Kinute, February 6, 2024, https://kinute.com/stories/653951956-does-solar-have-a-dark-side-solar-impacts-on-rural-landscapes-and-the-family-farm.
[55] PJ Huffstutter and Christopher Walljasper, "Insight: As Solar Capacity Grows, Some of America's Most Productive Farmland is at Risk," Reuters, April 29, 2024, https://www.reuters.com/world/us/solar-capacity-grows-some-americas-most-productive-farmland-is-risk-2024-04-27/.

Out in the Mojave Desert lies the Riverside East Solar Energy Zone (SEZ), an area ten times the size of Manhattan at 150,000 acres.[56] Sadly mistaken for pristine lakes by boat owners on occasion, the swathes of PV panels come within 200 meters of hundreds of homes. Residents, many of whom want to live out their golden years in this deserted, quiet, and clean oasis, now find themselves developing allergies and breathing difficulties and struggle with the constant noise from the building and installation of the solar panels. Two of the local wells have even dried up.

Within the same SEZ, hundreds of acres designated as critical habitats for endangered species such as the desert tortoise have been bulldozed.[57] They are not the only ones.

The sprawling populations of desert trees and shrubs, which might seem discardable to most, serve a critical purpose through their vast underground network of roots.

According to botanists, these plants breathe in carbon dioxide at the surface and store it underneath.[58] By digging up these plants, “we are removing the most efficient carbon sequestration units on the planet—and releasing millennia of stored carbon back into the atmosphere.”

On top of destroyed habitats for humans, animals, and vegetation, sacred Indigenous sites have been destroyed beyond repair.[59] According to one descendant of the Chemehuevi and Yaqui nations, “more than 800 sites within the I-10 Corridor and 17,000 sites within the Southern California Desert Region will potentially be destroyed.” This happens on reservations all over the country.

An Ohio State University soil scientist says that soil sequesters more than three times the amount of carbon locked in all the plants and animals on Earth.[60] Industrial-size solar facilities would prevent the natural process of carbon sequestration and soil replenishment from happening.

The solar industry is also unfortunately tainted by forced labor camps of Uyghur Muslim minorities in Xinijang, China, where approximately half of global polysilicon is produced.[61] This type of slaved encampment tarnishes the very idea of clean energy; human rights abuses are a stain on any enterprise, regardless of the purported benefits the commodities might have. While the current administration has restricted imports from this region, manufacturing hasn’t slowed down and Xinijang is still supplying parts to the solar industry. Uyghurs are still slaves to the overall solar trade network.

[56] Oliver Wainwright, “How Solar Farms Took Over the California Desert: ‘An Oasis Has Become a Dead Sea,’” The Guardian, May 21, 2023.
[57] Ibid.
[58] Ibid.
[59] Ibid.
[60] Barbara Hollingsworth, “Solar Installations Hasten Loss of Virginia Farmland,” Thomas Jefferson Institute for Public Policy, July 26, 2022.
[61] “China Uses Uyghur Forced Labour to Make Solar Panels, Says Report,” BBC, May 14, 2021, https://www.bbc.com/news/world-asia-china-57124636.

Disposal and Waste

All panels experience degradation, which simply means their power production and efficiency will gradually decline and be less effective at converting the sun's energy into power. The lifespan of the average solar panel is about 20 to 30 years.[62]

Currently only ten percent of solar panels are recycled.[63] Breaking apart the materials that have been fastened and sealed together is a complex process, as well as dangerous, given the various toxins used in their creation. The steep price to drop off panels at a recycling facility likely disincentivizes the practice. Each solar panel can cost up to $45. [64]

It is definitely not without a footprint, either. One study showed that recycling 1,000 kg of silicon PV waste produces ghg emissions of roughly 446 kg of CO2, which is equivalent to burning approximately 193 liters of gas (50 gallons).[65]

Many opt to bring their retired panels to the landfill. Why? The expense is as low as $1 in some places. Therefore, the other 90 percent of solar panels are filling up landfills across the country. Solar panels sitting in a landfill have the potential to leak chemicals and pollute groundwater.[66]

NREL predicts the U.S. could log one million tons of waste from decommissioned solar modules by 2030.[67] Globally, the number is approximately eight times greater, and another ten times by 2050.[68]

The Harvard Business Review speculates that many solar panels will actually be replaced much sooner than their life expectancy, due to more efficient solar technology and ongoing government incentives.[69] In this case, their statistical model predicts nearly 50 times more waste than NREL calculated. Harvard also claims that by 2035, discarded panels will outweigh new units sold by 2.56 times.

Australia is already facing a solar panel waste crisis as their waste levels will increase much faster than previously anticipated.[70] The country lacks a recycling infrastructure, and yet, has the highest per capita solar for residential homes.

[62]Tamara Jude, "How Long Do Solar Panels Last? A 2024 Guide," Market Watch Guides, June 25, 2024.
[63] Mark Peplow, "Solar Panels Face Recycling Challenge," Chemical and Engineering News, May 22, 2022, https://cen.acs.org/environment/recycling/Solar-panels-face-recycling-challenge-photovoltaic-waste/100/i18.
[64] Taylor Curtis, Heather Buchanan, et al, "A Circular Economy for Solar Photovoltaic System Materials," NREL, April 2021, https://www.nrel.gov/docs/fy21osti/74550.pdf.
[65] Donyoung Kim, "Recycling Solar Panels – Completing the Sustainability Cycle of Photovoltaic Power Generation," Association of Renewable Energy and Clean Technology, September 14, 2022.
[66] J Hazard Mater, "Leaching of Cadmium and Tellurium from Cadmium Telluride Thin-film Solar Panels Under Simulated Landfill Conditions," National Library of Medicine, August 15, 2017.
[67] Tree Meinch, "Solutions for Solar Panel Waste are Just Beginning to Surface," Discover, April 2, 2023, https://www.discovermagazine.com/environment/solutions-for-solar-panel-waste-are-just-beginning-to-surface.
[68] Casey Crownhart, "Solar Panels are a Pain to Recycle," MIT Technology Review, August 19, 2021.
[69] Atalay Atasu, Serasu Duran, et al, "The Dark Side of Solar Power," Harvard Business Review, June 18, 2021.
[70] Charlotte Thou, "Solar Panel Waste to Reach Crisis Levels in Next Two to Three Years, Australian Experts Warn," The Guardian, March 29, 2024.

The Manhattan Institute predicts that worn-out solar panels will constitute double the tonnage of today's global plastic waste by 2050.[71]

Electric Vehicles

With multiple tax credits, heavy subsidization, and plenty of other incentives, political leaders are trying to push the conversion to EVs and rid the world of Internal Combustion Engines. EVs will supposedly save the planet. But are they worth the blood, sweat, and tears? The supply chain for an EV battery is riddled with environmental impacts.

The essential minerals of a battery are lithium, cobalt, nickel, graphite, and copper. Just like solar panels, energy-intensive mining is required to extract, produce, and manufacture these components. A typical EV battery weights 1,000 lbs.[73] Collectively, 90,000 lbs of rock/ore are involved just to extract the amount needed for one battery. But to access each ton of ore, anywhere from 3 to 20 tons of earth must be removed. This averages out to about 500,000 lbs of earth removal per car battery.

Figure 3

Element	Amount in battery	Amount of earth required to extract
Lithium	25 lbs	25,000 lbs of brines
Cobalt	30 lbs	30,000 lbs of ore
Nickel	60 lbs	6,000 lbs of ore
Graphite	110 lbs	1,000 lbs of rock
Copper	90 lbs	25,000 lbs of ore

Data from the Manhattan Institute [72]

In addition to the minerals displayed in Figure 3, and the quantity of earth extracted, each battery will contain about 400 lbs of steel, aluminum, and plastic components.

Not every EV has a 1,000-lb battery, however. Vehicle sales data show that three-fourths of EVs purchased in the U.S. in 2022 were Teslas and the Mustang Mach-E, whose batteries approach 1700 lbs.[74]

Production

Just like solar panels, China dominates nearly every aspect of the electric vehicle and battery supply chain; 85 percent of the global cell supplies came from China in 2023.[75] Remember: China is also the world's worst polluter.

Synthesization of the materials needed for production requires heat between 800 to 1,000 degrees Celsius, a temperature that can only cost-effectively be reached by burning fossil fuels.[76]

Total emissions for one EV battery can vary greatly because of so many variables such as its size and where the components are extracted, processed, and eventually manufactured. Some estimates give anywhere from 2.5 and 16 tons.[77]

[71] Mark Mills, "Mines, Minerals, and "Green" Energy: A Reality Check," Manhattan Institute, July 9, 2020, https://manhattan.institute/article/mines-minerals-and-green-energy-a-reality-check.
[72] Ibid.
[73] Ibid.
[74] Mark Mills, 2023.
[75] "US Hikes Tariffs to Further Isolate China from its EV Supply Chain Ambitions," Benchmark Source, May 15, 2024, https://source.benchmarkminerals.com/article/us-hikes-tariffs-to-further-isolate-china-from-its-ev-supply-chain-ambitions.
[76] Iris Crawford, "How Much is Emitted by Manufacturing Batteries?" MIT Climate Portal, July 15, 2022.
[77] Ibid.

Even though U.S. environmental standards are higher than most other countries, metal mining is considered the number one toxic polluter due to the intense methods employed to extract the minerals.[1] One method involves removing topsoil and creating a leaching pool infused with chemicals to separate out the rare earth elements. Another method drills into the ground and uses PVC pipes or rubber hoses to pump chemicals into the earth where the resulting mix is then pumped into leaching ponds for mineral separation.

Mining for critical minerals requires significant amounts of water for separating minerals, cooling machinery, and controlling dust. According to the World Resource Institute, at least 16 percent of the world's land-based critical mineral mines, deposits, and districts are located in areas facing high or extremely high levels of water stress.[2] This means that agriculture, industry, and households regularly use up most of the available water supply. If not careful, critical mineral mining can further strain the already limited freshwater supplies in these regions.

Lithium, for example, is particularly water intensive. Commonly found in brine pools below the surface, miners will pump the brine into large pools onto the above salt flats; the water evaporates and leaves the lithium behind.[3] Mining one ton of lithium uses up a half a million gallons of brine water, which can easily mix with and contaminate fresh water and in some cases, deplete nearby surface and groundwater supplies. Chile and Argentina, where lithium is abundant, have experienced major depletions of available water for Indigenous communities as well as toxic waste found in water used for drinking, livestock, and agriculture.

One ton of rare earth elements results in approximately 2,000 tons of toxic waste: nearly 30 pounds of dust, 9,600-12,000 cubic meters of waste gas, 75 cubic meters of wastewater, and one ton of radioactive residue.[1] For nearby communities, this can result in serious health problems, including cancers and respiratory diseases as well as poisoned fish and crops.

One of the world's largest rare earth element mines, Bayan-Obo in China, produced over 70,000 tons of radioactive thorium waste; it is stored in a pond that has leaked into groundwater.[1] The soil and water in Baotouin Inner Mongolia, China, considered the rare earth capital of the world, is polluted with arsenic and fluorite and causing skeletal fluorosis and chronic arsenic toxicity in the population. China's Jiangxi Province could take 50 to 100 years to clean up and restore the environment from the damage of its rare earth mining.

[78]Renee Cho, "The Energy Transition Will Need More Rare Earth Elements, Can We Secure Them Sustainably?" Columbia Climate School, April 5, 2023.
[79] Shivana Lakshman, "More Critical Minerals Mining Could Strain Sater Supplies In Stressed Regions," World Resources Institute, January 10, 2024, https://www.wri.org/insights/critical-minerals-mining-water-impacts.
[80] Ibid.
[81] Jaya Nayer, "Not So Green Technology: The Complicated Legacy of Rare Earth Mining," Harvard International Review, August 12, 2021, https://hir.harvard.edu/not-so-green-technology-the-complicated-legacy-of-rare-earth-mining/.
[82] Renee Cho, 2023.

Something to keep in mind is that the ore used to extract minerals experiences a decrease in metal content. For instance, the metal content of copper ores from Chile, the world's leading source, has declined from 1.41 percent in 1999 to 0.6 percent in 2023.[83] Further quality deterioration is inevitable. This means that significantly more energy and earth will be required to dig up more ore just to extract and produce the same quantities of minerals we are getting today. All precious metals will encounter this predicament.

Figure 4

Mineral	Net Import Reliance
Copper	41 percent
Lithium	50 percent
Nickel	56 percent
Manganese	100 percent
Cobalt	75 percent
Graphite	100 percent

With the vast majority of minerals being extracted and/or processed in other parts of the world, transporting these materials from extraction sites to processing sites and to car manufacturers also contributes to ghg emissions.

The U.S. imports an astounding 72 percent of the minerals used in EVs.[84] Figure 4 summarizes the degree to which each essential mineral is imported.

Other Environmental Impacts

An EV also requires frequent refueling or charging, which also contributes to ghg emissions. Certainly, the amount of emissions is dependent upon the energy mix of the state or region in which the vehicle is connecting to the grid. According to the Department of Energy, the national average of annual emissions for an EV is 2,727 lbs of CO_2.[85]

Because EVs are heavier and accelerate faster than their gas-burning counterparts, their tires produce approximately 20 percent more pollution, releasing chemicals and microplastics into the environment.[86] The International Union for Conservation of Nature says tires are the second leading source of microplastic pollution in oceans, behind textiles. Burning through tires faster means buying tires more frequently, contributing to more ghg emissions with increased tire manufacturing.

Mining in some of the obscure regions of the world has other negative consequences affecting land and people.

Mozambique, where ten percent of the world's graphite is extracted, is experiencing shrinking of land and forests for small-scale farmers and rural families due to mine concessions.[87] Already an impoverished and war-torn nation, livelihoods and cultural heritage have been lost; very few gain employment with the mining companies coming in. There is also deep concern regarding their buried dead and the possibility graves will be moved. "Local people don't have a veto over the project at any stage … essentially

[83] Vaclav Smil, "Halfway Between Kyoto and 2050: Zero Carbon is Highly Unlikely Outcome," Fraser Institute, May 2024, p. 23, https://www.fraserinstitute.org/sites/default/files/halfway-between-kyoto-and-2050.pdf?utm_source=substack&utm_medium=email.
[84] Jeffrey Winters, "Infographic: Electric Vehicles Need Imported Minerals," The American Society of Mechanical Engineers, April 4, 2023.
[85] "Alternative Fuels Data Center," Department of Energy, https://afdc.energy.gov/vehicles/electric-emissions.
[86] Tilly Armstrong, "The Dirty Secret Behind Your Electric Vehicles Exposed: How the TIRES Produce 20% More Pollution Than Their Gas Equivalents," Daily Mail, July 16, 2023.
[87] "Ilana Hartlief, Luis Scungio, et al, "Who is Paying for Your Electric Car?" SOMO, October 11, 2023, https://www.somo.nl/who-is-paying-for-your-electric-car/.

consultants working as the liaisons telling local people what the company's plans are."

Perhaps the most egregious human and environmental impacts take place in the corrupt and poverty-stricken Democratic Republic of the Congo (DRC), the location of more than half the world's supply of cobalt reserves.[88] Described as a "horror show" by Cobalt Red author Sidharth Kara, "people are working in subhuman, grinding, degrading conditions." Entire displaced populations are forced to dig with their bare hands for a few dollars a day because they are left with no alternative after their villages have been demolished. Human trafficking and child labor are rampant; an estimated 25,000 children work in DRC mines.[89] Cobalt is toxic to the touch and the fumes permeate the air and water supply. Tens of thousands, including young children, die or lose limbs from collapsing tunnels. Just like the Uyghur camps taint the solar industry, these human rights violations tarnish the EV supply chain.

Disposal and Waste

Similar to a solar panel, the EV car battery will lose its efficiency and effectiveness by degrading about 2.3 percent per year.[90] The average battery should last 8 to 10 years, sometimes more.

Even though there are precious metals that can be retained from a used car battery, currently only five percent of them are actually recycled.[91] This is mainly due to the expense and complicated nature of the process. Just like wind and solar panels, the technology is nowhere near available to handle the current and upcoming volume of retired EV batteries.

Dismantling the battery is complex and even dangerous. Certain processes subject the materials to extremely high temperatures and/or chemical solutions which often results in toxic emissions, ash, and other byproducts, in particular carcinogenic emissions.[92] Burning fluorinated polymers in batteries can also generate per- and polyfluoroalkyl substances (PFAS), also known as 'forever chemicals.' Because of PFAS risks that threatened to poison not only workers but the town itself, a grass roots effort in Endicott, New York successfully closed a recycling plant just a few years ago.

For every ton of battery processed for recycling, approximately four tons of CO_2 are emitted during the smelting process.[93] This is known to also generate carbon tetrafluoride, a compound that is estimated to be 6630 times more potent than CO_2.

[88] Terry Gross, "How 'Modern-day Slavery' in the Congo Powers the Rechargeable Battery," NPR, February 1, 2023.
[89] "From Cobalt to Cars: How China Exploits Child and Forced Labor in the Congo," Congressional Executive Commission on China, November 14, 2023.
[90] How Long Does an Electric Car Battery Last? EVConnect, November 8, 2023, https://www.evconnect.com/blog/how-long-does-an-electric-car-battery-last.
[91] Maja Stefanik, "Second Life: What You Need to Know About EV Battery Recycling," EVConnect, August 18, 2023, https://www.here.com/learn/blog/ev-battery-recycling.
[92] Doun Moon and Lien de Brouckere, "EV Battery Recycling: Burning Batteries is Not the Way to Go," Lead the Charge, April 18, 2024, https://leadthecharge.org/resources/ev-battery-recycling-burning-batteries-is-not-the-way-to-go/.
[93] Ibid.

The 95 percent of batteries that don't get recycled are slated to end up in landfills, where unfortunately, their hazardous components can leak into the soil and groundwater. Landfills are also a major contributor of greenhouse gas emissions.

Perhaps the worst part about EV batteries going to landfills is the increased fire risk they pose for waste management facilities.[94] Not only does this put workers' life in danger, but the fumes from fires release additional toxins and ghg emissions into the atmosphere. The last several years have seen an increase in these types of fires in landfills all over the world, and they can be extremely difficult to extinguish.

With approximately 3.3 million EVs on the road today, and a projected 33 million to be on the road by 2030, that is potentially a lot of EV car batteries to end up in landfills.[95]

[94] Ryan Fogelman, "Lithium-ion Battery Fires Continue to be a Growing Threat to the Industry," Waste 360, February 6, 2023, https://www.waste360.com/waste-recycling/lithium-ion-battery-fires-continue-to-be-a-growing-threat-to-the-industry.
[95] "By 2030, the US Will Need 28 Million EV Charging Ports to Support 33 Million EVs," Department of Energy; Office of Energy Efficiency, March 18, 2024.

Conclusion

The realities of “green” energy technologies are that they come with some significant environmental impacts that cannot and should not be ignored.

The procedures to extract and process the various elements involved in creating wind, solar, and EV batteries are intensive and in many cases, quite damaging. All three require massive quantities of minerals and/or raw materials, which generally consume enormous amounts of energy and land. Some have the added liability of human capital.

Not only are toxins and greenhouse gases released but the earth is forever changed through mineral harvesting, land use, and waste (mis)management. Soil and water sources once corrupted may never recover.

Worse yet, lives are forever changed. It doesn’t seem right to taint water supplies, confiscate land, or encourage slave labor at the whims of clean energy advocates. It may not be happening in your backyard, but somebody else is paying the price, often in faraway lands.

The irony is lost on climate enthusiasts that we won’t mine our own vast resources here, or utilize what we do have, where environmental and human rights standards are the highest. But it is somehow acceptable to exploit third-world countries for that EV in the garage and the solar panels on the roof.

Relying on places like China for the necessary minerals not only puts us at the mercy of a hostile nation but ensures a much higher rate of pollution. Mining here would certainly help alleviate some of these negative impacts, but we are nowhere close to making that a reality.

Green energy proponents are also quick to assert the recyclability of wind turbines, solar panels, and EV batteries. Yet, recycling and reusing most of these materials is not currently happening nor realistically will it occur soon; it is very expensive, and the technology is a long way off.

In an attempt to solve one problem, climate change, many green energy policies are only creating additional problems. This is counterproductive.

Global warming has become an obsession to too many who seem to have lost sight of the big picture. Environmental studies professor Roger Pielke, Jr perhaps said it best: “Climate change has swallowed up environmentalism.”[96] In a quest to purportedly save the planet, we are destroying the planet.

[96] Roger Peilke, Jr., “The Death of Environmentalism at 20,” American Enterprise Institute, June 20, 2024, https://www.aei.org/articles/the-death-of-environmentalism-at-20/.

In response to offshore wind's potential hazard to wildlife, the Sierra Club would rather forego the usual environmental impact studies because "the environmental consequences of not speeding up offshore wind development are arguably worse than delaying it."[97] An agenda supersedes thoughtful analysis.

Green energy has been given a "green" light by leaders who either naively or purposely choose to ignore the ramifications attached. These sources aren't as clean as we are made to believe, and it is irresponsible of its proponents to pretend otherwise. Green energy deserves just as much scrutiny as the others.

Missing from most clean energy discussions is nuclear energy, even though it is an extremely clean and effective alternative that is neither land nor mineral intensive. For instance, a 1,000 MW nuclear facility needs just over one square mile.[98] (Wind farms require up to 360 times as much land to produce the same amount of electricity; solar facilities need 75 times.) With little to no significant health risks, nuclear provides a superior product for electricity needs. And yet, we are shutting down nuclear plants faster than opening them. Nuclear deserves a seat at the clean energy table of public policy.

Policy should be based not only on what is environmentally sound but also factor in costs, benefits, reliability, and geopolitical aspects. Some sources are significantly better than others for certain purposes. Several come with high costs—politically, economically, and environmentally.

Consumers also deserve to have energy options in deciding what works best for their needs. Specific forms are more practical and certainly more affordable, depending on location and usage. A rational choice for one area will not be in another. Energy policy needs to be in the best interest of consumer welfare and not a political agenda.

Each energy source, including fossil fuels, should be considered as part of an all-of-the-above strategy for supplying the necessary energy to power homes, businesses, and the U.S. economy at large. All sources have drawbacks, not just those that are petroleum-based.

It is past time to come clean on "clean" energy.

[97] Jared Brey, "How Do Ocean Wind Turbines Affect Wildlife?" Sierra Club, January 21, 2022, https://www.sierraclub.org/sierra/bird-whale-turbine-offshore-wind-science.
[98] "Land Needs for Wind, Solar Dwarf Nuclear Plant's Footprint," Nuclear Energy Institute, July 9, 2015.