Renewable Energy is (Mostly) Green and *Not* Inherently Capitalist

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October 1, 2023

Volume 1: Wind Power

Brief Summary

Is renewable energy actually green? Are wind, solar, and storage infrastructure projects a climate and/or environmental solution or are they just feel-good, greenwashing, false "solutions" that either perpetuate the deepening climate and environmental crisis or just represent further extractivism by the capitalist class and the privileged Global North at the expense of front-line communities and the Global South?

This document argues that, while there is no guarantee that renewable energy projects will ultimately be truly "green", there is nothing inherent in the technology itself that precludes them from being so. Ultimately the "green"-ness of the project depends on the level of rank-and-file, democratic, front-line community and working-class grassroots power with the organized leverage to counter the forces that would use renewable energy to perpetuate the capitalist, colonialist, extractivist system that created the climate and environmental crisis in which we find ourselves.

In order to do that, we mustn't fall prey to the misconceptions and inaccuracies that paint renewable energy infrastructure projects as inherently anti-green. This series attempts to do just that. This first Volume, on utility scale wind power addresses several arguments made against it, including (but not limited to) the following misconceptions:

(1) Humanity must abandon electricity completely;
(2) Degrowth is the only solution;
(3) New wind developments only expand overall consumption;
(4) Wind power is unreliable and intermittent;
(5) Wind power is just another form of "green" capitalism;
(6) The extraction of resources necessary to build wind power negates any of their alleged green benefits;
(7) Wind power is an extinction-level event threat to birds, bats, whales, and other wildlife (and possibly humans);
(8) Only locally distributed renewable energy arrayed in microgrids should be built without any--even a small percentage--of utility scale wind developments;
(9) Only nationalized and/or state-owned utility scale renewable energy developments should be built;
(10) No wind power developments will be green unless we first organize a socialist revolution, because everything else represents misplaced faith in capitalist market forces.

In fact, none of the above arguments are automatically true (and the majority are almost completely untrue). However, they're often repeated, sometimes ignorantly, but not too infrequently in bad faith. This document is offered as an inoculation and antidote to these misconceptions and misinformation.

The author welcomes feedback and suggestions. Please contact me at greensyndicalist@gmail.com if you wish to offer them.

Introduction

As the climate crisis deepens and the need to phase out dirty forms of energy intensifies, the proposed solutions are subjected to increasingly robust debate. This is entirely understandable and prudent. **After all, if we approach the problem with the same attitudes that created it**, we will solve nothing. History is replete with "solutions" that later proved to be just as much problems as the problems they purportedly addressed. **Nuclear fission power**[1] constitutes a glaring example of this phenomenon.

Does renewable energy (wind, solar, wave, tidal, geothermal, smaller-scale hydroelectric, and storage), **fall into the same category?**

I firmly believe it does *not*, but there are many who evidently think otherwise. It's a long running debate, one in which I've frequently engaged over multiple decades, and—catalyzed by the proposed development of an offshore wind farm off the northwestern California coastline, accompanied by a heavy lift terminal in Eureka adjacent to Humboldt Bay—I've finally decided to write a much needed, comprehensive defense of renewable energy, particularly wind power, from a green syndicalist, or at least, libertarian-socialist perspective.

This is the first in a multi-part series and it focuses primarily on **wind power**[2], specifically both utility scale developments of onshore and **offshore wind**[3]. Later installments will address other **renewable energy**[4] sources, including especially **solar**[5], in depth, but may rehash some of the ground covered here for the sake of thoroughness.[6]

I. Benefits of Wind Power

The benefits of a good wind power development (whether onshore or offshore) include the following:

(1) They can be a source of reliable and **clean energy**;
(2) They can **replace sources of dirty fossil energy**, nuclear fission power, or older and more destructive hydroelectric dams;
(3) They can theoretically provide **a source of local income** for the hosting communities;
(4) They can provide **good, high road, skilled, and/or often union jobs**[7];
(5) They can serve as actual opportunities to provide fair and **just transition for workers and communities**[8] that decommission fossil fuel and other dirty energy facilities and extraction;
(6) They can help lessen the possibility of **apocalyptic climate change**.

None of these things are guaranteed, of course. However, careful planning with democratic community and worker input (if not outright control), increases the chances of all of the above being true. (How to actually achieve this deserves its own, detailed article, which will be published at a later date).

In spite of these benefits, there are numerous counter arguments that wind power (and renewable energy generally) doesn't live up to its promise or potential. Some of these are made by those profiting off of dirty energy sources, and most of these are made in bad faith.

However, there are many who are sincerely dedicated to ending fossil fuel capitalism, ecological destruction, colonialism, and inequality who share genuine concerns, criticisms, and outright negative views of wind power.

Some of these are individuals who are expressing healthy skepticism. It's undeniably true that not everything lives up to its promise, though this can either be due to inherent flaws in renewable energy, including particularly wind power, or it can simply be chalked up to poor implementation of it.

Some opposition is based on legitimate criticisms based on particular issues (such as the reputation wind turbines have for killing birds), while some is dogmatically ideological and extremist.

There are some who oppose building out renewable energy[9] capacity, arguing that doing so is nei-

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[1] For background, see the list of articles linked here (listed in reverse chronological order): https://ecology.iww.org/term/nuclearpower

[2] See: https://ecology.iww.org/taxonomy/term/155

[3] See: https://ecology.iww.org/taxonomy/term/1488

[4] See: https://ecology.iww.org/term/renewableenergy

[5] See: https://ecology.iww.org/taxonomy/term/156

[6] For an excellent companion piece (not directly lined with my own piece) see this YouTube interview of Mark Z Jacobson, *Debunking the Skeptics: Real Solutions For A Clean, Renewable Energy Future* - https://youtu.be/uH2O6tuVNO4?si=y8sN5l1pL_-EIg9n

[7] In other words, **Green Unionism** - https://ecology.iww.org/term/greenunionism

[8] See: https://ecology.iww.org/term/justtransition

[9] Defined as wind, solar-electric, small and large scale hydroelectric, geothermal, tidal, and wave power as well as battery and other forms of storage for electricity and all of the above plus solar-water heating and green hydrogen for locomotive power, heat, and manufacturing. For a thorough analysis of sources which are often touted as "renewable" or "green" en-

ther really ecologically sustainable, desirable, or likely to facilitate decarbonization. They instead argue for "using less" or even "powering down". Typically (but not necessarily) these individuals have anti-technology, **primitivist**[10], anti-civilization ("anti-civ"), **degrowth**[11], Malthusian, misanthropic, and/or deep ecology perspectives, and if so, that generally explains their motivations. (A much wider swath of those in opposition don't share such views, but are often influenced by them, especially if they think it boosters their own oppositional arguments).

However, the point of this article is not to debate the merits of those perspectives (or any competing divergent tendencies), but solely to challenge some of the dubious arguments made against renewable energy buildouts.

It's also important to acknowledge that not all renewable energy projects are desirable or ecologically beneficial. There are some (though not most) that aren't based on various criteria, including any of the following reasons:

(1) The project causes more ecological damage than it prevents;
(2) The project is poorly designed and/or contributes little or no positive energy benefits (this could be due to faulty equipment, bad siting, lack of useful or beneficial grid interconnections, high maintenance costs, or numerous other factors);
(3) The project significantly desecrates sacred places, including (but not limited to) sacred indigenous lands and/or is detrimental to ongoing indigenous practices there;
(4) The project is extractivist and/or colonialist in that it only benefits an elite few and/or expropriates most or all benefits away from the local community and/or the workers that maintain the project (though it should be noted that this last problem is more often than not a factor not inherent in the project itself, but the social and economic relationships involving it, and as such, can potentially be modified to more equitably benefit those currently being denied its beneficial qualities).

There also exists a growing debate among different sections of the broader green-left (including, but not limited to **ecosocialists**[12]) over whether or not **renewable energy**[13] (and sometimes non-renewable energy as well as many sources whose "renewable" or "green" status is also the topic of debate, such as **nuclear fission**[14]) should be decentralized, utility-scale (and as such, socially owned), or both. I, personally, believe that a combination of both is essential, with the vast majority (probably at least 80%) being decentralized.

This article focuses specifically on **wind power**[15], which is primarily, though not exclusively, developed at utility scale. The *reason* for this focus is because this article is motivated by opposition to a particular **offshore wind**[16] farm development proposed for construction off the coast of northwestern California, near Humboldt Bay near Eureka, Arcata, and Samoa. While this article doesn't focus on that specific project, it does address oppositional arguments aimed at it. (I will write about that specific project elsewhere).

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ergy which actually aren't, at least from an ecological justice perspective, see the excellent resource, "Hoodwinked in the Hothouse - https://climatefalsesolutions.org/

[10] See https://ecology.iww.org/taxonomy/term/133

[11] See https://ecology.iww.org/term/degrowth

[12] See https://ecology.iww.org/term/ecosocialism

[13] See https://ecology.iww.org/term/renewableenergy

[14] See https://ecology.iww.org/term/nuclearpower

[15] See https://ecology.iww.org/taxonomy/term/155

[16] See https://ecology.iww.org/taxonomy/term/1488

II. We Can't Abandon Electricity (even if wished)

One of the frequently made statements by those who are at least skeptical of, if not outright opposed to wind power (especially if they share doubts about the latter's "greenness"), is "we need to power down instead." This statement could either mean transitioning away from using electricity altogether, or it could simply mean using substantially less electricity, perhaps reducing use to the absolute barest essentials.

While this may come as a shock for some, completely abandoning electricity altogether is impossible. In spite of the oft repeated statement, "humans lived for millions of years without it" (usually made by people who have *never* gone without it except for very brief periods, and who also likely have very romanticized views of pre-industrial humanity), most people would never consent to such drastic measures, many would die unnecessarily without the availability of electricity, and even if it were desirable to live without electricity, it's no longer possible, unfortunately. In fact, it won't be possible for at least another half-million years.

This is because of the absolute necessity of safely and securely containing radioactive waste materials generated from nuclear-fission reactors, most of which is composed of highly toxic trans-actinide elements (i.e. those heavier than Uranium) that have extremely long half-lives, some lasting as long as a half-million years. Such containment requires the use of computers and highly technical facilities, and powering those requires electricity. There is no escaping this reality.

Beyond that, it's extremely unlikely that most of humanity would willingly submit to giving up their personal use of electricity while the government (or private entities) are using electricity to contain radioactive waste, especially given the fact that electricity can be used to provide power for refrigeration, heating, air conditioning, cooking, transportation, essential healthcare (indeed, some people with severe sleep apnea require the use of breathing machines while they sleep, for example), lighting, farming, and a host of other basic survival needs.

If electricity were made unavailable, it's not as though people would just consent to "go without", let alone voluntarily die (and demanding such would amount to **ecofascism**[17]. And fascism is fascism even if shrouded in a green cloak). They would seek other forms of power generation, such as burning fossil fuels, whale fat, tallow, or wood, and the resulting ecological devastation would be even worse than the current status quo.

It also needs to be stated: it's often the case that people who make the "we must power down" argument usually aren't willing to do that *themselves* (indeed, I've seen not too few people arguing for primitivism on Facebook and other social media platforms, which is about as technologically and electricity dependent as it gets), which basically makes them sanctimonious. In essence they're declaring, "do as I say, not as I do." Indeed, nobody should be *forced* to use electricity (or any other form of energy not generated by one's own human metabolism for that matter), but likewise, nobody should be forced *not to do so*, especially if their survival depends on it.

That said, it's likely that many who declare "we need to power down instead" are actually simply arguing for reducing, not outright eliminating the use of electricity. The next section addresses that point:

[17] See https://ecology.iww.org/taxonomy/term/643

III. "We Need to Use Less"

It's true, at least to some extent. Humanity, as a whole, needs to use less. Less energy, less electricity, less raw minerals, less of everything. There's almost no disputing that. The question is just how *much* less, in what proportion, and *who among us, specifically*? The answers to those questions are complex and the devil is certainly in the details.

To begin with, forgetting for the moment the currently existing (and in many cases worsening) levels of inequality in humanity (in income, wealth, consumption, and waste, most of which correspond, albeit somewhat variably), if humanity simply chose to reduce energy consumption by a set figure, say—for example—50% (if such was even possible), a simple reduction overall would leave much of the polluting, resource-extraction heavy, climate destroying, and ecologically degrading fossil fuel infrastructure in place.

In the balance of things and all other things being equal, if humanity somehow managed to achieve that particular goal as opposed to simply replacing the current energy generation technology entirely with renewable energy, the former would actually be far *worse* than the latter, because the latter would eliminate most of the greenhouse gas emissions and extractivism involved with the *former*.

On the other hand, decarbonization *on its own* would result in a substantial increase in energy efficiency simply due to the fact that much of the energy used in internal congestion engines is lost due to waste heat (entropy). And, while there'd still be extraction of raw materials involved in the manufacture of renewable technologies, that would represent a one-time activity as opposed to the ongoing process of extraction required for the mining of fossil fuels or fissile materials.

That said, while using less overall *should* be the goal, there is almost certainly not nearly enough renewable energy generation capacity currently available to meet our needs, especially if we phase out all of the *nonrenewable* energy generation capacity. More renewable developments are going to need to be built, for certain. That basically requires that we "degrow" a substantial amount, particularly in undesirable industries and activities, but there will still be some—albeit far less—contrary growth elsewhere. However, arithmetically, adding a small amount combined with subtraction of a larger amount ultimately results in subtraction, i.e. degrowth.

The extraction of raw material needed for renewable energy isn't nothing nor does it come without some significant ecological risks and costs, particularly in the case of lithium (used in batteries), cobalt (used in solar-PV), and rare earths (used in wind turbines and some solar applications), but compared to the footprint of fossil fuel extraction, the scale is much smaller. Further, the aforementioned minerals are used in many other applications besides renewable energy (most commonly in handheld devices that are made with a high degree of built-in planned obsolescence, which is hardly necessary), and anywhere from 70-95% of those minerals can be recycled, thus greatly reducing the need for extraction of their virgin counterparts.

Given all of the above, the amount of extractivism needed for a 100% renewable energy world could be far lower than the footprint for a fossil fuel world, even in the best of circumstances for the latter.

So, by decarbonizing, humanity would *already* be using far less, but we needn't stop our reducing there.

The biggest reason this is so has to do with inequality. While something of an oversimplification, it's basically the case that those who possess the lion's share of society's wealth, capital, and power also consume the most, proportionally. Far too many "degrowth" advocates tend to ignore this fact. For example, William Catton, in his oft referenced (by Degrowth advocates, at least) book, Overshoot, calculates consumption by nation-state, lumping in all economic classes of people *and* corporations and other chartered entities—which are distinct from individuals, even if Catton refuses to acknowledge it—and simply divides that by the number of citizens as if all of this consumption is driven by individual needs and desires. The institutionalized inequalities and inefficiencies of the capitalist class's profiteering and drive to accumulate capital is simply glossed over as if it were an immutable or inescapable reality.

If it's not already obvious by now, one of the primary causes of (over)consumption is the waste inherent in the capitalist economic system and the inequalities it generates. The richest 10% of the world's population use's approximately 50% of the world's resources. Much of that consumption by the very wealthy isn't even necessary. (Just to cite one example, the amount of energy consumed by the rich in private luxury air travel alone contributes a great deal to the overall consumption totals).

However, that's just covering *individual* consumption alone. There are far *greater* inefficiencies inherent in capitalism which, if eliminated, would reduce waste and consumption far more dramatically. Consider how much energy and resource con-

sumption would be reduced if humanity made the following changes:

- Produced products locally rather than halfway across the globe (thus greatly reducing the need for global shipping and transport);
- Encouraged virtual meetings and remote work (wherever and whenever practicable) instead of traveling long distances;
- Produced things that are needed rather than for artificially manufactured wants;
- Encouraged reuse, repair, and repurposing combined with durability rather than cheap, disposable junk that's designed with planned, built in obsolescence;
- Eliminated advertising and all of the wasteful activities involved in it;
- Eliminated militarism, imperialism, and violence which (except in cases of self-defense) are inherently wasteful and destructive;
- Shortened the workweek, which has been shown to reduce energy consumption;
- Increased efficiency through better building design and urban planning as well as through the production of more efficient devices and appliances;
- Better educated everyone on conservation and efficiency techniques;
- Championed reproductive freedom which results in lower birth rates and thus less people needing to consume (though I must emphasize that Malthusianism is pseudoscience and obsessive fixation on population numbers is actually not a solution to the problem of consumption or limits to growth. Population is a factor, yes, but it's the overwhelming consumption habits of the very rich combined with capitalist inefficiency that creates most of the problem).

All of that *would* achieve the goals that are desired by those advocating "using less" energy than not building renewable energy generating capacity. Whereas, opposing (and successfully preventing) the construction of new renewable energy generation capacity will almost certainly achieve no meaningful degrowth, and—in just about 99% of the cases—actually make degrowth *less* achievable!

IV. Don't Believe the Hype!

Another article raised by critics of renewable energy, including wind power, is that it not only *doesn't* aid in decarbonization of the world's energy consumption, *it actually increases it*. This is essentially a regurgitation of a widely held belief—which I contend is a myth—in what's known as "**Jevon's Paradox**[18]".

I've written extensively about this very subject in detail already, here (**The Jevons Paradox Myth** - https://ecology.iww.org/node/5532), so I will spare readers the details, but the "paradox" is based on an anecdotal observation by economist William Stanley Jevons in which coal consumption in Britain continued to increase in spite of upgrades in efficiency that theoretically should have had the opposite effect.

There's no disputing the fact that this happened. The problem is extrapolating an immutable law of nature from it, in a glaring case of trying to prove causality from correlation. It's also supremely ironic that those opposed to renewable energy developments would cite a "paradox" that apparently "proves" that conservation (which is an essential element in Degrowth) *doesn't work* in order to argue *in favor of* those very things (conservation and Degrowth) *instead of* substituting clean energy in place of dirty energy!

This is the fundamental flaw in making arguments based on poorly understood and misapplied data and grafting them on to fatalistic predictions. There's absolutely no logical reason why substitution of one energy source for another *or* reduction in *must* result in a rebound effect. And, as I point out in the aforementioned article, previously, it's not even clear that's what was happening in Jevon's original example anyway.

Often the person arguing against renewable energy having any meaningful effect will point out that in spite of the growth of renewable energy capacity, fossil fuel energy generation continues to expand *also*, and that is unfortunately true, at least at present. "Therefore," they will continue, "what's happening isn't an energy transition, but, instead, an energy *expansion*."[19] Often said individual will then invoke Jevon's Paradox, if they haven't already done so. However, this is also a mistake, and yet, it's a very popular misconception (or bad faith argument) that's made quite frequently by the following constituencies:

(1) Fossil fuel capitalist apologists and true believers in nuclear fission power invoke it to "prove" that renewable energy is "unreliable" and must always be backed up by fossil or nuclear energy;
(2) Renewable energy skeptics use it as "further proof" that renewable energy "isn't green";
(3) Primitivists, anti-civers, and other anti-technology dogmatists use this argument to bolster their ideological opposition to technology in general;
(4) Dogmatic and sectarian socialists use it to argue that renewable energy will be useless, *unless and until* capitalism is overthrown and replaced by (their preferred version of) socialism or communism;
(5) DeGrowthers will of course argue that this proof that "green growth" (as they oven dismissively describe new renewable energy developments) is a false solution, and the only answer is…well…Degrowth (ignoring the points I've already made against in Section III).

All of these various factions have a point. The expansion is certainly happening, but the overall picture is far more complex:

(1) While fossil fuel energy capacity *does* continue to expand, renewable energy capacity has expanded *more rapidly*. This is hardly complicated. Even in putatively "communist" states, decision making is somewhat decentralized, and planning isn't coordinated in lockstep;
(2) The expansion of capacity isn't necessarily demand driven; often it's *investment* driven, i.e. if a company, capitalist investors, shareholders, or governments—particularly those whose politicians seek to curry favor with voters that might replace them in future elections with different candidates or parties—have money, political capital, sweat equity, and so forth invested in a project, they're wont to see it through to the bitter end, lest it become a proverbial "bridge to nowhere";
(3) The planning, approval, construction, and completion of large, centralized fossil, nuclear, and largescale hydroelectric projects can take years, or even decades from start to finish. Even in states or nation-states with limited regulatory oversight or lax regulations, delays happen. In most, political opposition, legal challenges, en-

[18] See https://ecology.iww.org/taxonomy/term/1433

[19] Trade Unions for Energy Democracy (TUED) *frequently* makes this claim, and while there is a grain of truth to it, the actual situation is far more complicated. That said, TUED is a generally excellent organization with useful resources, and readers are encouraged to visit their site at https://www.tuedglobal.org/

vironmental reviews, protests, direct action blockades, union disputes, changing market conditions, pandemics, natural disasters, and supply chain disruptions all can prolong the time to completion. While similar issues can delay the approval, implementation, and construction of largescale renewable energy projects, far fewer challenges tend to delay locally distributed energy development, however the dynamics, economics, and political realities discussed in the previous point often mean that no matter what delays occur, the big, dirty mega projects tend to get built, regardless of their (pun not intended) utility;

(4) Conversely, it's far easier to stymie renewable energy projects, even when they're in the process of being built, because the latter don't have the same degree of entrenched political muscle behind them. For example, right wing populist Ontario premier Doug Ford, a Donald Trump clone, in an act of purely performative petulance tried to cancel numerous clean energy projects in his Canadian province between 2019-20;

(5) There is also often competition for various generation sources to be sold on (often) deregulated power markets. Contrary to commonly held beliefs, not every source of power is needed 100% of the time, especially during times of the day, week, or year when demand dips, as well as unseasonal dips (such as a warm spell during winter or cold spell during summer when heating or cooling demand is lower than expected). Then, if multiple sources of energy are available, the decision over which source to use is either left up to some complex market formulae, political considerations, or other factors. It's not always done in a manner which favors the *cleanest* source (especially in regions or nation-states where green politics are disdained by those in power or where fossil and/or nuclear capitalists hold political sway). At such times, renewable energy can be **curtailed**[20] in favor of fossils and nukes, sometimes even to make the latter seem more economically desirable;

(6) Fossil fuel capitalism and nuclear fission power interests are deeply entrenched political forces, whether in liberal capitalist market economies (such as the US and many European states), bureaucratic state capitalist command economies (such as China), or authoritarian kleptocratic capitalist petro-states (like Russia under Putin), as well as their various satellite and vassal states. These forces promote climate change denialism, throw shade on renewable alternatives (in spite of farfetched claims—made by nuclear fission boosters particularly—that fossil fuel capitalists and green capitalists are in cahoots with each other), and use their political and economic clout to use state power to protect their profits by any means necessary. This includes everything from lobbying governments, regulatory capture, quid pro quo philanthropy, threats of capital flight, financing the election campaigns of political candidates most favorable to their interests, creating astroturf groups, lawsuits, and even using the officialdom of the more conservative unions that represent the workers employed by them. These capitalists will preach about "free market values" when the state and regulatory agencies (barely, at best) constrain them, but rely heavily on state protectionism when it benefits them (which represents the norm, usually).

(7) Investment in renewable energy through private financing tends to be variable, especially when politicians hostile to it gain power (and roll back government incentives), due to unpredictability of markets. State mandated minimums or direct financing can overcome this variability, but until recently, such things faced the headwinds of neoliberal austerity and market fundamentalist ideology. There are some hopeful signs (such as the adoption of the imperfect, but potentially somewhat positive European Green Deal or the passage of the **Inflation Reduction Act**[21] in the US) that this may, at long last, be abating.

In spite of all of these obstacles and impediments, however, renewable energy growth is *outpacing* the growth of dirty energy. That's likely because, in spite of the numerous vocal green critics of renewable energy, there are still far more advocates, and they consist of many grassroots organizations and rank and file people who've been organizing for years, even decades to try and counter the (predominantly capitalist) forces supporting fossil fuel and nuclear energy. Combined with the environmental and climate movements, they've grown more sophisticated and more powerful, and therefore have demonstrated the ability to chip away at the power of dirty energy. This is an example of prefigurative politics in practice.

[20] Wind and Solar Energy Curtailment: Experience and Practices in the United States - https://www.nrel.gov/docs/fy14osti/60983.pdf

[21] See https://ecology.iww.org/taxonomy/term/2072

But, is it also possible, however, that the continued growth of dirty energy sources is happening because renewable energy sources are unreliable or intermittent as critics contend?

V. Overstating the Case

Another frequently made criticism of wind power (and solar) is that it's an **unreliable** and/or **intermittent** source of energy. After all, what happens when the wind doesn't blow (or the sun doesn't shine)?

Often, one can surmise the quality of an argument by those who most often make it, and in this particular case, the loudest and most frequent voicers of it are nuclear and fossil energy advocates. The significance of this is both obvious and obscure, but more about that later.

Strictly speaking, it's absolutely true that winds and sunlight are variable. Sometimes, particularly during long duration high pressure weather patterns, which sometimes create "heat domes", the wind speed will be at or near zero knots *for days or weeks at a time*. During such periods, wind power generation in that specific location is nonexistent.

However, what must be remembered is that electricity grids are complex systems with multiple sources of electricity fed into them. When the wind doesn't blow or blow sufficiently, the sun may still be shining (in fact, the sun is *always* shining, and at every minute of every day, at least 50% of the Earth's surface is receiving sunlight. Granted that light isn't necessarily being harvested for energy, but much of it *could* be. Likewise, the wind is *always* blowing *somewhere* (if it weren't, it would be due to the Earth suddenly having been stripped of its atmosphere. Wind blows due to variations in temperature and pressure, driven by the sun, local conditions, Earth's rotation, and tidal forces). An interconnected grid has sufficient resilience to weather localized outages.

To be certain, it's not as though these outages haven't occurred prior to the introduction of renewable energy. Fossil fuel and nuclear plants are far less steadily available as their adherents (or renewable energy detractors) would have others believe. Fossil fuel and nuclear plants have very complex maintenance requirements and scheduling. Plus, the grid, in many states and nation-states is not a public utility, so procurement of power sources is often subject to the whims of spot markets which are, as one can imagine, ruled by the profit seeking, capital accumulation driven aims of shareholders and financiers.[22] This has sometimes resulted in fossil energy plants being taken offline for "maintenance", when in fact, the *actual* motivation was most likely profit maximization.

(A) The Enron Scandal

In fact, this is *precisely* what happened in California during the so-called **Enron Scandal** at the turn of the millennium. First, California lawmakers, led by neoliberal Republicans (before California became a "deep blue", i.e. supermajority Democratic Party dominated, state) lobbied heavily by investor-owned utilities (like PG&E and Southern California Edison as well as energy speculators like Enron) deregulated California's utility industry. This allowed for the aforementioned market manipulation. Then, because of such manipulations there was a series of "rolling blackouts", which were blamed on lack of capacity and—in sheer chutzpah by the same right wing hyper capitalist forces responsible for the problem—*excessively burdensome regulations!* Enron's Ponzi scheme collapsed infamously, but the damage it did was significant.

What is sometimes difficult to grasp is that electricity grids are *not* bottomless reservoirs into which an unlimited amount of electricity can be fed or stored. They have to be carefully balanced. Insufficient energy availability can lead to brownouts and blackouts. An excessive amount of available energy can overload the grid, leading to failures and plant shutdowns (also, ironically, resulting in brownouts and blackouts). Excess power must often be curtailed. The choice of what gets curtailed is sometimes made logically, sometimes it's made primarily with profiteering or politicking as the primary motivation.

(B) The Chinese Puzzle Box

China serves as a particularly interesting example of this process. Depending on who one asks, China is either a climate villain, still building massive amounts of coal fired electricity plants; or a climate champion, because they're deploying wind and solar at least as rapidly as they're building coal plants; or everything in between. Detractors of renewable energy are quick to claim that China's continued construction of coal directly results from the "unreliability" and "intermittency" of renewable energy, but reality is far more complex.

[22] Complicating matters further, there isn't a single, worldwide grid. There are many, and their scope and location are largely due to organic growth factors, often driven by politics or profit seeking or both. In the US, for example, there are *three*: the Eastern, the Western, and ERCOT. This last grid is solely Texas-based, and intentionally exists to preclude federal regulation and oversight of Texas energy policy and usage. This is a very complex and tangled subject, one worthy of its own deep dive.

In actual fact, a lot of China's excessive coal fired capacity is unnecessary, but it's being built nevertheless to satisfy political needs. Contrary to popular belief, China's "communist" economy is that in name only. In fact, the Chinese communist party apparatchiks are some of the most cutthroat and ruthless *capitalists* in the world, but being *state* capitalists are effectively able to couch this under the complex illusion of a "planned" economy.

Domestically, China's grid and power generation mix, like many others, is a very complex system, but it's anything but the utopian ideal of a planned economy classical Marxist economists envision. The party bureaucrats (comprising an at least as equally complex animal) that benefit either financially, politically, or both from coal plant construction, coal fired generation, or coal mining vie for supremacy over those that likewise benefit from renewable energy generation and production. While varying mixes of both are used, and competition for supremacy isn't (always) done by those benefiting from one type of energy generation in order to directly outdo or utterly squash the other—and to be certain some benefit from *both* in some combination—it more or less represents a decedent bureaucracy with higher ups milking their positions of political and economic power under the rubric of a "people's democratic socialist republic", which is much more mythical than reality.

In theory, renewable energy *should* reign supreme, given the Chinese state's *claims* to being "a climate leader", but it doesn't. While it's been claimed—and some figures seem[23] to confirm—that renewable energy is gaining ascendancy (and that's probably true, to an extent), coal and other dirty forms of energy persist.

There are numerous theories for why this is the case. The glibbest answer—which is that most quickly seized upon by renewable energy critics—is that this directly results from renewable energy's "unreliability", but this is actually false. That this is so is easily determined by the fact that large amounts of renewable energy capacity, particularly wind power, is routinely curtailed to favor coal and other dirty energy sources.

This is probably done deliberately because those within the party that benefit from coal mining and usage, and those communities whose economies depend heavily on coal mining and coal fired power generation have more political clout within the party and are trying to protect and consolidate their power. There may also be a bias towards coal because of the belief that it's more reliable or easily dispatchable, but there's no evidence that this is so. Quite probably, another motivating factor is the incumbency of coal mining and coal fired power generation. Such things have an enormous amount of sunk economic (as well as political) costs, therefore they tend to continue to enjoy an incumbency advantage.

Still one more factor biasing coal and other incumbent dirty energy sources is the fact that being far more capital intensive, and because of the ecological "externalities" they create, they take far longer to approve, permit, and construct, thus projects of that nature can take decades to green light, such that many coal and other dirty energy facilities are being constructed now, again because of sunk costs that would otherwise become stranded assets.

Because the party apparatchiks are also essentially acting as capitalists, using their positions in the party as cover, it gives them a great deal of power, but it's a double-edged sword. While it's basically true that China is a one-party state, the people can vote out one Communist Party incumbent and replace them with another party member. Therefore, if the incumbent official has staked their reputation on various pork barrel projects, such as coal mines, production quotas, or new power plants, they'll do as much as they can to justify their costs and investments. This makes it very difficult to cancel wasteful and unneeded projects. *That is why China has constructed entire cities with nobody living in them!*

Given all of the above, one can argue that the Chinese experience "proves" that renewable energy is "unreliable", and further argue that "either we continue to rely on coal-fired electricity generation", "embrace nuclear fission power", or "accept that 'Degrowth' is the only viable solution," but none of that is *actually* "proven". What's happening in China *isn't* a case of renewable energy being "unreliable", it's a glaring example of idealized, top-down, centralized state communism being a mythical unicorn (something those of us in the libertarian socialist camp have been arguing from the get-go).

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[23] China's published statistics are notoriously dubious and unreliable, not so much because the government is deliberately lying in order to paint themselves in a positive manner—though that happens, too, to an extent—but because, in their attempt to milk their political and economic power, party bureaucrat apparatchiks, following the profit seeking and capital accumulation that capitalist logic dictates, those who seek to benefit play fast and loose with the statistics where it benefits them, and the aggregate result is an unreliable and somewhat mysterious enigma. Independent reporting in authoritarian state-capitalist regimes often identified as "communist" is difficult and discouraged (at best) if not outright suppressed at worst, though Chinese environmental NGOs that enjoy a limited degree of autonomy *do* at least try to monitor things and offer more accurate (if incomplete and limited) counterweight, which is how the claims of unreliability are known to be genuine, even if the whole truth is extremely difficult to assess.

In actual fact, China is more proof of the sheer insanity of putting our faith in capitalism (even if everyone erroneously *calls it* or *assumes it's* communism), *especially state capitalism!* The incentives to maximize one's personal power and fortune at the expense of others and the environment are a feature, not a bug, and fossil fuels and capitalism are natural allies in that process.

(C) Grid Resiliency

The real danger isn't that wind sometimes doesn't blow or that the sun's light only reaches approximately half the Earth at any time. The problem is lack of resiliency (which represents a problem no matter what sources are available or not). The notion that "renewables are unreliable and/or intermittent" stems from a bias towards large, centralized power generation plants, such as coal, gas, oil, or nuclear fission plants or massive hydroelectric dams. The economies of scale dictate this model. By contrast, wind and solar *can* be centralized similarly, and frequently are, but unlike the other sources (except, in some instances, hydroelectric) these can also be decentralized, distributed, and modular. Put plainly, an individual home owner or housing cooperative isn't going to locate a large power plant in their backyard, nor do most people want that in their neighborhoods, but rooftop solar and small-scale wind turbines distributed here-and-there are viable and cost effective.

The "reliability" of centralized coal, gas, oil, and nuclear plants is largely relative. None of them last forever, nor do any of them operate flawlessly for 100% of their lifespans. Many of them fail from time-to-time. Sometimes, the failure is spectacular, such as the Chernobyl or Fukushima nuclear plant disasters. In more mundane situations, fossil and nuclear energy plants are sometimes taken offline for maintenance or have small scale mechanical or systems failures which temporarily limit their capacity. This happens more frequently than most people realize, because decades of accumulated knowledge, skilled workers fixing problems, and the resiliency of the electricity grid, comprised of thousands of generation sources *already* masks the problems inherent in it.

The concern about temporary lack of wind or sunlight only matters if we intend to *only* replace centralized coal, gas, and nuclear plants with centralized solar and wind farms. However, nobody is seriously proposing that!

While visions of a fully decarbonized grid vary considerably, most include a combination of decentralized wind and solar, decentralized battery, fuel cell, and other storage perhaps linked in microgrids; medium neighborhood, district, community, and municipal wind, solar, and storage; small-scale hydroelectric, combined with utility scale wind, solar, geothermal, and hydroelectric sources. All of this could be interconnected (though it doesn't necessarily *have to be* in every case), and in being so, it would ensure—in most cases—that if the wind didn't blow or the sun didn't shine *somewhere*, the wind would be blowing and the sun would be shining *elsewhere*. And, if all of that still wasn't enough, *there'd still be sufficient storage that would be instantaneously dispatch-able* in enough places to ensure reliability.

(D) Peaks and Valleys

Of course, there's a further complication to all of this, and that concerns the *dispatchability* of electricity generation, and this is an argument that critics and skeptics of fully decarbonized electricity grids—particularly nuclear fission power advocates—repeatedly make. Essentially, having spare power available at moment's notice when needed is considered a standard of a reliable electricity system. Otherwise, end users would frequently experience brownouts and blackouts. However, as previously mentioned, electricity grids are complex systems with multiple source inputs and user outputs, occasionally extra power must be fed in. This is the counterpart to curtailment.

It's not as though traditional sources of electricity generation address this problem naturally. The grid has been designed, after much trial and error combined with technical knowledge and experience that it simply seems this way to the layperson. To prevent excess power from overloading the grid, it's curtailed. To address shortages, usually "peaker plants" are used. These are electric power generation facilities, hitherto usually using natural gas, that are constructed and kept in reserve in order to provide power when a deficit occurs. However, what's often overlooked is that one can't just activate a spare power plant just by flipping a switch. These have to be run through a startup procedure when needed, which can require one to several hours. When not used, they need to be powered down. (It's not cost effective to run them 24-7 and simply curtail them during most times, although that *is* sometimes done, too). As such, peaker plants are designed for rapid startup and shutdown, but nothing of that scale starts or stops instantaneously. Since grid operators, engineers, and technicians have at least a century's experience dealing with such challenges, they're well practiced in keep-

ing electricity flowing, such that end users don't notice it.

The introduction of storage technology has rendered peaker plants largely unnecessary. Instead of ramping up dirty, greenhouse gas emitting, polluting fossil energy plants, energy storage facilities can collect excess power and bank it until deficits occur. The beauty of storage is that it greatly reduces—if not outright eliminates—the need for both curtailment and peaker plants. Further, most storage can be dispatched almost instantaneously, unlike peaker plants. Therefore, if anyone makes the claim that renewable energy "isn't dispatchable", they're either ignorant or deliberately lying.

VI. Isn't it Just Green Capitalism or Greenwashing?

One of the frequently made arguments against renewable energy development is that such projects represent "green capitalism", and are thus undesirable.

It is unfortunately true, that many renewable energy projects, particularly the larger examples, especially utility scale developments *are indeed* built by capitalist firms and are owned by capitalist companies, including—but not limited to—investor-owned utilities (IOUs). That is unfortunately the largely inescapable reality of living in a world dominated by capitalist economies. There just aren't that many anarchist, syndicalist, or socialist collectives building and/or owning energy generating equipment, outside of publicly owned utilities (and even the latter can have a capitalistic mindset even if they're not profit seeking enterprises). Complaining about the heat in hell is sort of a waste of effort, so-to-speak.

That said, such condemnation of renewable energy development implies that viable alternatives exist, but in fact, they often don't—at least not in the short term.

While there have been some examples of campaigns to partially or even fully collectivize and/or nationalize IOUs, establish public utilities, or create community choice aggregators (CCAs), such projects take time, sustained organizing effort, and face substantial resistance and pushback from IOUs as well as market-fundamentalist ideologues. That's not to argue *against* engaging in efforts to create such alternatives or democratize existing IOUs, but there's no reason why such efforts cannot compliment support for renewable energy buildouts, *even by for-profit* businesses or even IOUs, especially because such buildouts can conceivably be brought under public control. Even if grassroots socialists and/or workers *don't* immediately succeed in doing so, in the long run, they should be able to gain leverage against the capitalist class in at least one of three ways:

(1) Renewable energy is skilled-labor intensive, as is all of the bioremediation needed to clean up the ecological damage done by capitalism; to survive climate catastrophe and reverse the ecological damage, many more people will need to be working, and labor shortages favor the working class, because they have more power to organize at the point of production, because replacement workers aren't available;
(2) As the climate and ecological crises deepen, more people will likely find themselves in opposition to capitalist class, because the latter are perpetrators of the destruction;
(3) There is and will increasingly be a major fracture in capitalist class unity as the fossil fuel capitalists and renewable energy capitalists increasingly find themselves in opposition to each other (and both will increasingly become dependent upon the workers in their employ to serve as mouthpieces for their interests against the other wing.

All of these factors make it increasingly difficult for the capitalist class to continue to manufacture consent and hoodwink the working class has interests in common with them. If the working class continues to organize and gain labor militancy, the ability of the working class to socialize currently "private" facilities and supply chains increases.

It's also the case that "public ownership" isn't *necessarily* a guarantee against the continued operation or even expansion of fossil fuel (and other non-renewable) energy generation or buildouts. Not all socialists are ecosocialists, and even some self-described "ecosocialists" sometimes favor nationalized dirty energy over privately owned "green" energy. While there may even be isolated cases where that distinction may be true, at least in the short term (especially if the dirty energy generation is preexisting and can be soon replaced by publicly owned green alternatives and the proposed private green energy buildout falls squarely under the "undesirable" criteria as outlined in Section I), most times it's not and the tradeoffs are approximately 50:50 at worst.

Another argument raised is that, instead of a large or even utility scale buildout, it's more desirable to favor locally distributed energy, such as rooftop solar as opposed to giant solar or wind farms. In many cases, that's true (though there are also cases where a both/and situation exists rather than an either/or, but more about that below).

There are many ecological considerations that can make large and/or utility scale renewable energy projects less desirable:

(A) Land-based Projects

- Large projects on land might be proposed in fragile ecosystems (and while the long-term effects after the project's completion can be mostly mitigated, the construction itself can be very disruptive);
- Large scale projects are sometimes proposed on sacred indigenous lands with no free prior informed consent (FPIC) given to the affected tribes;

- Even if the two previous problems can be mitigated, there may be conflicts over the use of the land involved, such as agricultural considerations or view sheds;
- Even if the previous three conditions are adequately assessed for the project itself, establishing a grid interconnection might not address them;

(B) Offshore Projects

- Offshore Wind (or even offshore solar) may potentially adversely affect marine wildlife, fishermen's livelihoods, or sacred indigenous territories;

(C) All Projects

- Larger projects are more conducive to private, for-profit ownership and control, especially because they tend to be capital-intensive;
- While larger projects tend to be constructed by union labor, sometimes the unions involved, often the Building Trades, need to be pushed into supporting local-hire provisions, community input, and ecological concerns;

That said, while it's likely that a 100% renewable energy system will indeed primarily consist of mostly interconnected nested microgrids. It's highly debatable that these alone can provide 100% of the needed energy reliably. There are some cases where a bank of community or larger scale renewable energy generation capacity is essential as a backbone (working in combination with the nested microgrids of distributed renewables, of course!). How much isn't known, but I would estimate that about 20% (1/5th overall) is probably close to the ideal amount. I will revisit this matter in more depth later in this text.

VII. The Resource and Energy Footprint of Wind Power

(A) Extractivism[24]

Compared to fossil fuels and nuclear fission power the ecological footprint of wind is tiny. However, that hasn't prevented many well-meaning people with ecological concerns from opposing them, nor does it preclude those with less noble intentions (such as fossil fuel capitalists seeking to retain their market dominance) from overstating the case in bad faith. It's therefore essential to take a deep dive into these arguments and address them thoroughly one-by-one:

(1) Free Prior and Informed Consent[25] - One of the frequently raised concerns, if not downright condemnations, of wind (and solar) power is the impacts of extraction of the minerals and raw materials needed to create the equipment to generate it. These include rare earths (for magnets, generators, and rotors), lithium (though mainly used in batteries, some is also used in generating equipment), cobalt (primarily but not exclusively used in solar and computer chips), copper (for wiring), steel (which includes its component materials), polymers and plastics, and various other metals.

Concerns include the extraction, processing, and refining process involved in making these materials useable for wind power, as well as their scarcity, which induces their hoarding by those with sufficient wealth and power to do so, as well as all of the profit and rent seeking capitalism engenders. Further, most mines are located in fragile and sensitive ecosystems, and none too few of them are located on (or under) sacred, or at least unceded, occupied indigenous lands worldwide. Extractivism and colonialism have long been intertwined, and the relationship is not at all easy to casually decouple.

This is a very real and challenging concern, and not one to be brushed off or taken lightly. However, it's not *necessarily* an insolvable problem.

To begin with, most indigenous tribes aren't universally always opposed to all cases and manners of extraction, and not *all* lands are considered as sacred as others. What's often run roughshod over by extractivist interests is Free Prior and Informed Consent (FPIC). This is unsurprising given the history and practice of colonialism, in which indigenous peoples were dispossessed of their lands through duplicity, dishonesty, deceit, legal trickery, and outright brutality and genocide committed by those that conquered them (predominantly Europeans). In fact, resource extractivism and land acquisition were the two primary *drivers* of colonialism, and it's no surprise therefore that the laws governing the staking of claims has historically been overwhelmingly weighted towards the wanton dispossession of indigenous peoples from their traditional lands combined with the dehumanization and invisiblization of them in the process. This constitutes the polar opposite of FPIC, and while the laws governing extraction and the consent of indigenous peoples have improved slightly (mostly due to the struggles of indigenous peoples just to be heard and recognized), they're still far short of anything resembling a just and equitable code, and profit seeking mining companies (with rare exceptions) exploit these weaknesses with undue vigor and haste when it suits them. To make matters worse, the history of colonialist powers signing "treaties" with indigenous tribes then later breaking them when it was convenient and profitable to do so is rampant.

As a result, there's an inherent and healthy distrust of resource extractivism shared by most indigenous peoples worldwide. Just repairing the damage and trauma caused by colonialism alone will be a monumental task. That said, there are examples of indigenous tribes *giving* FPIC (though sometimes it's under borderline duress, thus making it somewhat debatable that the "F" is truly genuine), but with hard work, it's certainly theoretically possible to repair the tremendous damage that's been done.

A key obstacle to this healing process is, of course, capitalism. An economic system built on the privatization of wealth (often seized by force initially) and socialization of costs (euphemistically dismissed as "externalities") is not especially conducive to the concept of FPIC without substantial collective adversarial organizational muscle to serve as counterweight to the power of capitalism, but it's not impossible. Supporting the right of FPIC therefore should be an *essential* and *primarily* condition baked in to *every* renewable energy project proposal as much as possible.

Beyond that, even with FPIC given, and community approval secured (if possible), **mining[26]** is, by nature, a very messy process, involving substantial impacts to the land and surrounding ecosystems. However utter destruction and desecration isn't necessarily inevitable. Again, because capital-

[24] See https://ecology.iww.org/term/extractivism

[25] See https://ecology.iww.org/taxonomy/term/2021

[26] See https://ecology.iww.org/taxonomy/term/79

ism demands the maximization of profit and the externalization of costs, checks against both would theoretically limit (if not eliminate) impacts.

(2) Shortages and Substitutes - Another objection, often raised to wind power in particular—and renewable energy and battery storage in general—is limited amounts of available raw, virgin material in the world. This is technically true, but a vastly overstated case.[27] Assuming that only virgin material could be used (which isn't the case, but more about that later), the "scarcity" of specific minerals is mostly illusory or misinformation.

Scarce or not, however, the *sources* of these materials are often either concentrated in Global South[28] nations, particularly Africa or Latin America, China, Mongolia, or in locations on the US with sensitive ecosystems. Most of them are also located near or on traditional and/or sacred indigenous lands, and as such, these concentrations of elements and minerals are fraught with geopolitical conflicts and disputes. Making matters worse, many of the host nations that lay claim to these lands have abysmal environmental, labor, and human rights protections. Therefore, finding substitutes is one potential solution to these challenges. Here, it's useful to address each particular set of materials specifically:

(a) **Rare Earths[29]** - in spite of their name, these elements aren't actually that rare (and their actual scientific name is "Lanthanides", due to Lanthanum, element #57, being the lightest in the series comprised of atomic elements 57-71[30]), they're just *rarer* than many of the *more common* chemical elements and somewhat more challenging to extract. While these elements, especially neodymium, praseodymium, dysprosium and terbium are essential elements used to make magnets used in wind power generators, the amount of these elements used are small, and substitutes exist[31].

(b) **Lithium[32]** - this element, while not rare at all, is nevertheless very water-intensive and challenging to extract, and often the sources of virgin lithium are found on sacred indigenous lands. However, there are other potential sources of lithium (including potentially coal ash ponds, particularly common in coal dependent states, such as Wyoming, where it's extraction could theoretically solve another problem, i.e. the waste caused by coal mining, although such efforts must *not* serve as an excuse to prolong the use of coal or its extraction) and some substitutes[33]. Lithium is primarily used in batteries.

(c) **Cobalt[34]** - like lithium, cobalt is used mainly in batteries, though it has other renewable applications. Like lithium, its extraction is a source of geological strife, as well as intensive labor exploitation and potential ecological destruction. DRC Congo is one major source of cobalt in particular, and it's infamous for being ground zero for **conflict minerals[35]**. Yet, just as lithium has potential substitutes, cobalt does as well.

(d) **Copper** - copper is relatively plentiful, but it's also widely used, and likely to become more so as high tech and renewable energy used increase its demand. Fortunately, it's one of the easiest metals to recycle or replace[36]. Aluminum, which is equally plentiful and recyclable is generally a good substitute, though not as conductive. It's also been known to overheat unlike copper, leading to increased fire hazards. Some solutions to this problem include encasing aluminum wiring with a thin copper sheathing which increases conductivity and acts as a heat-shield. Also, aluminum could be used where conductivity isn't as crucial or where the risk of fire is negligible. Other fire-proofing can also minimize the risk. Beyond that, other substitutes for copper, such as carbon nano fiber may be available.

As for concrete and steel, these are two of the more common and readily available materials in the world.

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[27] Mineral constraints for transition overstated by IEA - https://carbontracker.org/mineral-constraints-for-transition-overstated-by-iea/

[28] Challenging the Global North's "Clean Energy" Transition - https://fpif.org/challenging-the-global-norths-clean-energy-transition/

[29] See https://ecology.iww.org/term/rareearths

[30] For more details, visit https://en.wikipedia.org/wiki/Lanthanide?wprov=sfti1

[31] What Are Alternatives to Rare Earth Elements? - https://www.thomasnet.com/insights/what-are-alternatives-to-rare-earth-elements/

[32] See https://ecology.iww.org/taxonomy/term/1876

[33] 7 Lithium Battery Alternatives - https://www.thomasnet.com/insights/7-lithium-battery-alternatives/

[34] See https://ecology.iww.org/taxonomy/term/1877

[35] See https://ecology.iww.org/taxonomy/term/1878

[36] The Coming Copper Shortage: Aluminium Or Carbon Nanotubes To The Rescue? - https://hackaday.com/2021/09/30/the-coming-copper-shortage-aluminum-or-carbon-nanotubes-to-the-rescue/

(3) The Green Scapegoat? - One important aspect that's often overlooked (perhaps deliberately, in some cases) is that there are many other end-uses for the raw materials and minerals used in wind (and solar and battery) equipment, especially the conflict minerals.

Some combination of Rare Earths, Cobalt, and Lithium are used in handheld devices, computer chips, visual monitors, hard drives, military hardware, mining equipment, and even internal combustion engines. As for batteries, these are used on the order of trillions in any number of a billion different devices, most of which don't involve energy or electricity production *at all*, renewable or otherwise.

Many of these devices are designed with built in planned obsolescence and quick disposability in mind, with little or no regard for their potential reuse, repurposing, repair, or recycling. Tons of these devices are ushered into landfills of just discarded in random locations daily. Altogether the sheer volume of these devices and the constituent materials and minerals composing them vastly outweighs, outsizes, and outnumbers the grand total that comprises all of the renewable energy equipment combined with all of the batteries used primarily for excess energy storage (for direct energy use later) altogether.

Again, the real problem here is obviously capitalism. In an effort to maximize profits, the capitalists deliberately design all of these devices to be quickly discarded in favor of newer ones, which will, in turn, be discarded a few years after that, and so-on-and-so-forth. This typically happens once every two years with billions of smartphones, but it's also common with computer equipment, and many other devices. However, this isn't so much of a problem for wind power or solar equipment, which has an average lifespan of 25 years (and when it doesn't last this long, it's almost always because far more efficient and robust new equipment replaces it, and sometimes the old equipment is repurposed, reused, or recycled. Even if it's not, it could be, and relative to all of the other non-renewable energy devices, it's still significantly less in volume).

The problem, therefore, isn't renewable energy equipment, per se, though it does add weight to the problem, obviously, though not that much. However, the *popular perception* is that the transition to renewable energy (and electric vehicles) will just perpetuate all of the ecologically destructiveness that got us into this mess to begin with, adding to the "green energy isn't really green" curmudgeonliness.

This happens due to a combination of ignorance, confirmation bias, and intentional bad faith arguments.

Ignorance is forgivable, since most laypeople don't have the time or capacity to conduct the extensive research into all of the aspects of this issue, which are complex, voluminous, and multifaceted (and often the horror stories and doom porn get the most "clicks" in an age where monetized information favors clickbait). Confirmation bias, however, is a scourge that encourages those with axes to grind to cherry-pick the worst sounding accounts to "prove" their case against things they vehemently oppose. As for bad faith arguments, there are no shortage of climate change denialists, fossil fuel capitalists, and true believers in nuclear power who will make any argument that makes renewable energy seem unreliable and undesirable in hopes of making themselves seem reasonable. Likewise, there are no shortage of tech companies that would ideally hope to distract attention from themselves by shifting (all of) the responsibility onto renewable energy. Deliberately spreading falsehoods and/or telling only part of the story is a classic case of arguing in bad faith.

In truth, there are enough of the needed materials in the world, and vastly more would be available still if capitalist economic drivers were removed from the equation. Rather than needlessly planning for things—particularly mobile devices—to be obsolete in less than two years, why not simply design and program them to endure and focus the upgrades on software and code?

Further, does every single household require the private ownership of a personal automobile, even if it *is* an electric vehicle? Certainly not. **Public transit**[37] is far more efficient, and better designed and planned urban environments combined with much more fully funded public transportation would reduce the need for these conflict minerals *substantially*. Lastly, as Thea Riofrancos, et. al. have documented, the amount of conflict minerals needed for EVs could be further minimized by not emphasizing excessive range capacity[38]. So why is this not being widely discussed? The answer is that the profit motive rules that out. Obviously, capitalism is—again—the big elephant in the room.

(4) Reduce, Reuse, Recycle - There's still an-

[37] See https://ecology.iww.org/taxonomy/term/286

[38] *Achieving Zero Emissions with More Mobility and Less Mining* - https://www.climateandcommunity.org/more-mobility-less-mining; mirrored at https://ecology.iww.org/node/5325

tial problems associated with extraction of materials needed for renewable energy technology: why rely on virgin minerals and materials at all?

In fact, many—if not most—of all of the components used in wind power equipment can be sourced from recycled materials. The primary reason this isn't done is not due to technological limitations, either. Most of the rare earths, copper, lithium, cobalt, aluminum, steel, and even concrete can be recycled (in some cases up to 91%), and there's plenty of these materials that are lying around in garbage dumps and landfills (at least enough to meet a great many of the world's potential wind power needs). The problem is that recycling these materials, while technologically feasible, isn't especially *profitable*, and without profit potential, capitalists don't invest money in the effort. Fortunately, there are other financial options available, including state funding. Some such funds are now available due to the passage of the **Inflation Reduction Act**[39], and while the aforementioned law is far from perfect, it nevertheless includes some starting point from which organized grassroots ecological movements could push for further improvements if sufficiently organized.

It's not altogether uncommon for those pointing out the potential sourcing of materials through recycling to hear responses about how "dirty" and "polluting" recycling facilities can be (as are, for that matter, the wind, solar, and battery manufacturing facilities), and that such facilities are usually located in front line, mostly BIPOC communities—the very same that typically wind up near fossil fuel capitalist infrastructure. That argument, again, has grains of truth to it, but, as usual, a lot of the dirtiness and pollution problems can be mostly eliminated through better design and mitigation measures, as well as either locating them outside of low income, frontline community neighborhoods, or establishing effective buffer zones between the facilities and the communities.

Of course, arguing against recycling or recycling facilities ignores the existence of raw extraction infrastructure and/or discarding recyclable materials in landfills or just leaving them in the open to rust and spread toxic blight. Even if there were some magic reality in which humanity could choose to end their use of electricity altogether (there isn't), all of those discarded materials would still exist. Recycling them is the most logical and cleanest option available.

Beyond even recycling, as previously mentioned, some of the aforementioned minerals can be extracted from existing mine tailing waste (such as coal ash), through a process known as **remining**[40], and, as is the case with recycling, while it's crucial to not let this become an excuse for extractivist interests to prolong their existence, those mine tailing would otherwise still exist and have to be addressed, *in any case*.[41]

(B) Footprints and Throughputs

Even if there are impacts caused by the extraction, transportation, refining, and manufacturing of the

[39] See https://ecology.iww.org/taxonomy/term/2072

[40] Extracting energy transition metals from remining sources: A review of characterization and processing approaches, resource estimates, and potential environmental effects - https://www.transportenvironment.org/wp-content/uploads/2023/09/2023_09_Earthjustice_Remining_Exec_Sum_Final.pdf

[41] For a deeper dive into the politics of extractivism, see:

- Cracking the Code on Recycling Energy Storage Batteries - https://blog.ucsusa.org/james-gignac/recycling-energy-storage-batteries/
- Critical Minerals: A Critical Look - https://miningwatch.ca/news/2023/6/29/new-report-takes-critical-look-critical-minerals
- Green Energy, Green Mining, Green New Deal? - https://youtu.be/-ue_kUN8-D0?si=FZYdtc0L_eORiw6_
- Just Minerals: Safeguarding protections for community rights, sacred places, and public lands from the unfounded push for mining expansion - https://earthworks.org/resources/just-minerals/
- A Just(ice) Transition is a Post-Extractive Transition: Centering the Extractive Frontier in Climate Justice - https://ecology.iww.org/PDF/misc/Post-Extractivist_Transition_WEB_0.pdf
- Lithium, Batteries and Climate Change: The transition to green energy does not have to be powered by destructive and poisonous mineral extraction - https://climateandcapitalism.com/2021/02/11/lithium-batteries-and-climate-change/
- A Material Transition: Exploring supply and demand solutions for renewable energy minerals - https://waronwant.org/sites/default/files/2021-03/A%20Material%20Transition_report_War%20on%20Want.pdf
- Metals in the Circular Economy - https://en.euractiv.eu/wp-content/uploads/sites/2/special-report/EURACTIV-Special-Report-Metals-in-the-circular-economy.pdf
- A New Circular Vision for Electronics - Time for a Global Reboot - https://www.itu.int/en/ITU-D/Climate-Change/Pages/ewaste/A-New-Circular-Vision-for-Electronics-Time-for-a-Global-Reboot.aspx
- Renewable Energy Materials: Supply Chain Justice - https://www.climateandcommunity.org/_files/ugd/d6378b_9f3331a1be9346b8b18fc8b7a1b37c47.pdf
- Responsible Minerals Sourcing for Renewable Energy - https://earthworks.org/resources/responsible-minerals-sourcing-for-renewable-energy/
- Where We Mine: Resource Politics in Latin America - https://www.greeneuropeanjournal.eu/where-we-mine-resource-politics-in-latin-america/

materials, effects caused by the installation of the equipment, and even some adverse effects of its ongoing operation, most of them pale in comparison to the much larger impacts of fossil fuels and nuclear power.

To begin with, whatever impacts result from extraction of raw materials needed for wind power, they almost certainly (except in rare cases where replacement parts are needed) only need to be extracted *once*, and once extracted can serve their function for a *minimum* of 25 years (claims to the contrary are mostly either lies or bad faith arguments, but more about that later). The wind power equipment generates electricity and that's (mostly) the end of the story.

With fossil fuels and nuclear power, however, the equipment to refine and utilize them might only need to be developed once, and may possess a lifespan roughly equivalent to wind power equipment, there are a vastly greater number of moving parts and systems involved in just that alone.

Beyond that, the "fuel" itself must be consumed and replaced constantly. It must be routinely mined, routinely transported or conveyed, routinely refined, routinely stored, and routinely combusted (or split apart at the atomic level), and that involves substantially more equipment, maintenance, and capital expenditure (though not necessarily more labor).

The Richard Heinbergs, Vaclav Smils, and Ozzie Zehners of the world are quick to point out that fossil and nuclear energy involves a much higher concentration of potential energy than in renewables, therefore the latter cannot as easily substitute for the former as most think, and on paper there's a grain of truth to that argument, but that (alleged) disadvantage is completely negated by the effect that the entropy resulting from combustion of fossil fuels (approximately 67% loss) or the sheer amount of water consumed (and the energy needed to convey it) for the cooling towers needed for nuclear energy.

Again, once the wind energy equipment is extracted, transported, refined, made into component parts, transported again, erected and deployed, that's it (for the most part), i.e. one-and-done. With fossils and nukes, there's a *lot* more involved *in an ongoing manner*.

As for entropy due to long distance electricity transmission losses (between 8-15%), they occur no matter *what* their generation source. Even where electricity transmission over long distances for use in electric motors (whether for transportation or other uses) substitutes for internal combustion engine locomotion is *still* more efficient, thus requiring less energy *overall*.

(C) End of Life

Since we've covered the "cradle" and main lifespan, it's only fair to cover the proverbial "grave"

As previously mentioned, the rare earths, lithium, cobalt, copper, aluminum, steel, and concrete can be *sourced* from recycled materials, and it therefore follows that these same materials can mostly be recycled at the wind turbine's *end of life*. The same is true for much of the grid connection and site facility equipment. What about the turbine blades?

There's been considerable hoopla raised about massive collections of discarded wind turbine blades lying in wait while landfills that accommodate them can be found, implying that wind turbines are far less durable than their adoring fanatics claim while simultaneously illustrating that the technology is anything but green. (In actual fact, the blades were from early generation wind turbines that had been decommissioned and replaced by much more efficient modern counterparts, and they weren't awaiting a landfill, but rather a trip to a recycling facility!) The fact is that both wind[42] and solar[43] power equipment can and is recycled.

Another glaring example is the case of the "abandoned" wind farm shown in the absolutely abominable and dishonest "documentary" produced by Jeff Gibbs and Ozzie Zehner (though popularly associated with Michael Moore), ***Planet of the Humans***[44]. In one scene (after Gibbs had already shown the "failed" SunRay 1 (in reality, decommissioned) solar farm in the deserts of California (while he ignored the much more modern and completely functional SunRays 2 and 3 which were deliberately left just out of shot), Gibbs follows it with an abandoned wind farm full of rusting derelict turbines, a genuine blight for all to see (except, of course, that all of the shuttered equipment located at said wind farm, the South Point farm on Hawaii's big island has since been deconstructed, removed, recycled, and/or discarded, and only the concrete base pads remain in a verdant green pasture frequented by munching cattle).

[42] Wind Turbine Blades Don't Have To End Up In Landfills - https://blog.ucsusa.org/james-gignac/wind-turbine-blades-recycling/

[43] Solar Panel Recycling: Let's Make It Happen - https://blog.ucsusa.org/james-gignac/solar-panel-recycling/

[44] For a thorough takedown of this abominable so-called "documentary", see *Moore's Boorish "Planet of The Humans"*: An Annotated Collection - https://ecology.iww.org/node/3612

Such misconceptions and misrepresentations are all too common and often hysterically repeated by wind power critics. The reality is, though, that the end-of-life impacts that wind turbines create are quite minimal, especially relative to fossil and nuclear energy. What impacts exist are mainly a result of the wastefulness and destructiveness of capitalism than any inherent flaws in the technology itself. Most of the equipment is recyclable, more reparable, if not repurposable, or even reusable (in some cases), and given that the amount of material pales in comparison to that used by fossil and nuclear energy, it's a drop in the proverbial bucket.

Bioremediation of the land used for wind farm development is minuscule compared to that needed for the immense and toxic footprint of fossil fuel and nuclear fission power (to say nothing of the radioactive waste created as a byproduct of the latter). Consider all of the pipelines, ships, trucks, tanks, tank farms, refineries, boilers, piping systems, waste facilities, cooling towers, chemical plants, fly ash ponds, toxic waste dumps, and so much else that (mostly) isn't used at all in the production and use of wind power that's avoided. Granted, all of the aforementioned bad things already exist from previous deployment of dirty energy, but no more need be built, and whatever impacts wind power equipment creates is and will be minor. Finally, once all of the dirty energy infrastructure is decommissioned, if it's not repurposed for more ecologically sustainable purposes, it can be deconstructed, and the ecological niches it once occupied can be bioremediated. Combined with the absence (mostly) of habitat loss and GhG emissions, wind power is a net positive *even in its end life*.

(D) Labor

Of course, with any sourcing, whether mining or recycling—no matter what the end use—under capitalism, the economic incentive to maximize profits and accumulate capital serve as pressure to seek the cheapest labor costs available. Therefore, the likelihood, barring international labor organization (socialist or otherwise) is that workers will be exploited in the process. However, this is—again—a problem inherent *under capitalist economic regimes* not a problem inherent in the technology. The drive by the capitalists to exploit workers exists *no matter what technology* is involved. Therefore, opposition to wind power (or other forms of renewable energy or storage) based on the potential exploitation of labor is misdirected. That said, there's no reason to not demand that the sourcing of materials, their transportation, their refining, and the construction and operation of the equipment be carried out under the best possible working conditions with the right by the workers to organize unions retained.

VIII. Wind Power's Threats to Wildlife (Perceived and Actual)

One of the most commonly raised objections to wind power projects in particular are the perceived threats the turbines pose to wildlife, particularly birds. What's more, many environmental organizations, including both big green NGOs as well as smaller more militant green organizations, including those specifically oriented towards avian conservation, mostly favor wind power—thus leading many of wind power's critics to declare that said organizations have been co-opted or were astroturf fronts for "big wind"[45]. These actually comprise one of the weakest and overstated set of arguments made in opposition to wind power, but they have staying power because there's a grain of truth to them, and the actual situation is complex. Further, there is a persistent and frustrating tendency among some to fixate on small imperfections posed by technology that's offered as a green solution that misses the much larger negatives associated with *not* using it *because of those small imperfections*, in other words, a classic case of tunnel vision. There are several aspects to this debate, addressed one-by-one:

(A) Altamont Pass

There is a long and persistent association between modern wind turbines and bird fatalities to the point that the technology is often derisively named "bird blenders", "bird Cuisinarts", or "bird slaughterhouses", as if these machines were almost deliberately designed to catch every passing bird within its range and grind them all into sausage like a giant garbage disposal in the sky. This is hardly the case, but it's not untrue that turbines can and do occasionally kill passing avians; it's just that the problem is vastly exaggerated.

There's some relevant history behind this belief. One of the earliest built and most infamous wind farms, particularly with regards to bird fatalities, is the Altamont Pass location in Northern California[46], on I-580 just east of Livermore in eastern Alameda County on the outskirts of the greater San Francisco Bay Area. This is, coincidentally, the very same "Altamont" which hosted the ill-fated Rolling Stones concert that featured security provided by the Hell's Angels. Talk about bad juju!

The wind farm itself was built several years after the infamous concert as part of a pilot program initiated by the Carter Administration in the mid-to-late 1970s, in which several different companies constructed sections of the wind farm often using varying designs of turbines with various different mounting structures. To complicate matters further, some of the companies were seriously interested in generating green energy and pioneering the technology required, others were primarily interested in taking advantage of tax incentives. As such, the result was a complex polyglot of multiple designs and configurations of wind turbine that lacked cohesion.

By now, it's been fairly well established that the best design for wind power is long, fairly slender, aerodynamic, three-blade, horizontal axis wind turbines (HAWTs) erected on single, steel monopole towers. That wasn't known in the mid 1970s, however. The turbines on Altamont Pass employed all sorts of variations. Some utilized as many as four, five, six, seven, or even eight blades. Some only used two. Some were long and slender, others were fat and squat, like a series of meat cleavers. Some turbines weren't even HAWTs. There was, at least then, in one of the westernmost locations (easily visible by automobile traffic in the eastbound direction on I-580), a collection of *vertical* axis wind turbines (VAWTs) which looked like giant two-blades eggbeaters which were often the turbines many people noticed *first* because of their unconventional design, if not the prominent location.

That wasn't all. Not only were the turbines themselves of widely varying designs, their supporting mounts varied almost as widely. The VAWTs spun on their mounting axis, but were supported by a tripod of cables mounted to the nearby ground. Most of the HAWTs stood atop lattice structures like the pylons used in long distance high voltage electricity transmission lines. Some stood on earlier

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[45]The very concept of "Big Wind", at least contemporaneous with this writing, is absurdly ridiculous. There is simply no comparison to the amount of clout amalgamated by fossil fuel capitalism ("Big Oil"), telecom corporations ("Big Media"), computer technology companies ("Big Tech"), Agribusiness ("Big Ag"), or military contractors (often glibly referenced as the "Military Industrial Complex", or "MIC", though it's somewhat of a misconception, because what constitutes *that* is a vast, sprawling web of "dual use" supply chains and industries which includes a great deal of things that are used for *both* military and non-military applications). At most, all of the companies involved in the wind power manufacturing and development supply chain (where they don't overlap with others) is no more than a drop in the proverbial bucket by comparison. Those invoking the specter of "Big Wind"—whatever selfish capitalist motives might be evident among some of those involved in the industry—as if it represents some nefarious and secret cabal, are basically engaging in conspiracy theory mindsets.

[46] The Altamont Pass Wind Resource Area - https://media.nationalgeographic.org/assets/file/GeographicAreaInformation_TheAltamontPassWindResourceArea.pdf

concepts of the monopoles used today. Still other variations were employed. There were also variations in the density of placement of the turbines. Some sections contained one configuration at set density of placement, but there were a few that experimented with variations within. Altogether, there were approximately 5,000 turbines spread over an area approximately the same size as the city of San Francisco (about 30,000 acres).

Perhaps the most troubling problem, however, was the chosen site itself. Altamont Pass is an excellent high-wind area, but it's also a major north-south bird migration corridor for many species of birds, including some that have previously been listed as threatened species (such as the California Condor). In fact, in terms of bird corridors, Altamont Pass was one of *the very worst* locations conceivable for experimentation with a new technology that could (and did) potentially adversely affect migratory avians. Many, many bird kills did occur at that location, entirely because of the existence of *that particular wind farm*.

To top it all off, the affects that wind turbines had on birds was then much less well understood, and this was all created before the importance of biodiversity, the effects of habitat loss, and cumulative impacts were established as mainstream science, as opposed to the pet theories of fringe environmentalists who were actually correct even if their ideas weren't widely known or accepted. Further, the impetus for the project (disparate and cobbled-together though it was) wasn't climate change but the second American oil shock, resulting from geopolitical tensions in the Arabian Peninsula and the Middle East.

The motivation for building wind power generation wasn't *green* energy, it was *an alternative source of* energy, green or otherwise. Humans, on the whole, outside of ornithologists and other bird enthusiasts—many of them tending towards the privileged bourgeois class—weren't that concerned with birds.

(B) Birds and Wind Power Today

Much has changed since then. A lot more is known about wind power and its impact on birds, including threatened and endangered species, as well as how to mitigate and minimize any potential danger wind power might cause to them[47]. Furthermore, the importance of biodiversity, habitat protection, renewable energy as a potential solution to climate change, and cumulative effects are all much better understood and accepted as mainstream science than they were a half century ago. As more wind farms have been constructed, the number of bird fatalities per turbine has substantially decreased.

A comprehensive account of all that's been learned, as well as all of the aspects still being closely studied would fill several volumes, but here are some essential points:

- Wind turbines are now almost universally erected on top of monopoles which lack the enticing locations upon which birds might try to land;
- Wind turbines are typically spaced much further apart than they were in the early years at Altamont. Less density of turbines means less obstacles for passing avians;
- Even so, improvements in technology have vastly increased the efficiency and generation capacity of each individual turbine, such that more power is generated by far less turbines;
- The modern 3-blade HAWTs spin more slowly (even though they generate more electricity per turbine), so the problem of visual smear (which causes things spinning rapidly to appear as they're spinning much more slowly and backwards, which apparently is much more pronounced for birds at slower speeds than with humans), has been greatly reduced;

- [47] See, for example:
  Analysis: Is It Possible To Have Wind Power While Keeping Birds Safe? - https://www.allaboutbirds.org/news/analysis-is-it-possible-to-have-wind-power-while-keeping-birds-safe/
- [Audubon] Wind Power and Birds - https://www.audubon.org/news/wind-power-and-birds
- Bird-friendly offshore wind is possible, National Wildlife Federation advocate says - https://yaleclimateconnections.org/2023/08/bird-friendly-offshore-wind-is-possible-national-wildlife-federation-advocate-says/
- Do wind turbines kill birds? - https://climate.mit.edu/ask-mit/do-wind-turbines-kill-birds
- Hotspots in the grid: Avian sensitivity and vulnerability to collision risk from energy infrastructure interactions in Europe and North Africa - https://besjournals.onlinelibrary.wiley.com/doi/10.1111/1365-2664.14160
- Marine birds: Vision-based wind turbine collision mitigation - https://www.sciencedirect.com/science/article/pii/S2351989423000215 (available as PDF) - https://pdf.sciencedirectassets.com/306541/1-s2.0-S2351989422X00103/1-s2.0-S2351989423000215/main.pdf
- The Realities of Bird and Bat Deaths by Wind Turbines - https://mobile.engineering.com/amp/20764.html
- [Sierra Club] Wind turbines and birds and bats - https://www.sierraclub.org/michigan/wind-turbines-and-birds-and-bats

- Most importantly, most wind farms have been sited in much less impactful (to birds, at least) locations.

In fact, after much arguing, legal wrangling, and advocacy, the wind farm at Altamont Pass has itself been updated. All of the early generation technology has been replaced with modern, state of the art turbines (on single tower monopoles), albeit far less of the latter, perhaps on the order of approximately one new turbine replacing 25 old ones, and not surprisingly, the number of bird fatalities there has decreased significantly.[48]

Further mitigations that typically occur in many wind farms include occasionally curtailment of the turbines (i.e. shutting them down) during (usually brief) periods of intense migratory bird activity, increased monitoring, and taking steps to deter birds from entering (if possible).

One deterrent, or at least a mitigation, which shows promise, is painting a section the blades of each turbine black, contrasting with the typically off-white color of most turbines, to greatly reduce the amount of "visual smear". Another technique that shows promise is AI technology which detects heavy concentrations of specific species of potentially threatened birds (in particular) that is programmed to briefly and temporarily curtail the wind turbines until the birds have passed.

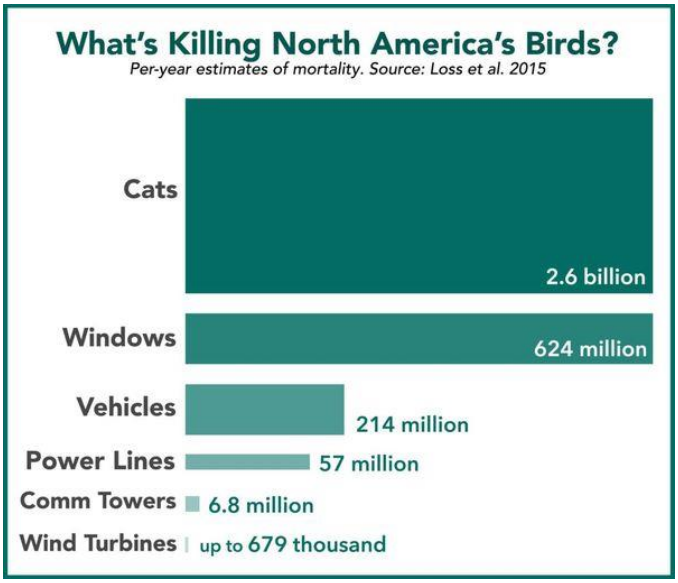
A great deal of effort at reducing the amount and risk of bird fatalities has been made by environmentalists, regulators, designers, utilities, and renewable energy companies. While one should always possess a healthy degree of skepticism that such measures will always be made in good faith or guarantee success, the evidence shows that many such efforts *have* been sincere and—to a degree—successful.[49]

(C) Bird fatalities in context

There's no denying that wind turbines result in some fatalities. The real question is how significant is the problem relative to other sources of bird fatalities and in the context of global warming and habitat loss.

Strictly tallying identifiable causes of avian deaths reveals that, on average, the best estimates (given the reality that an exact count is next to impossible to determine) place the number of fatalities due to direct collisions with wind turbines at between roughly 400,000 annually at the low end to approximately 1,500,000 at the high end. Best estimates place the number at approximately 680,000. That sounds like a lot, but relatively to other anthropogenic causes (i.e. causes that wouldn't exist without the indirect and direct actions by humans) of fatalities, the number is actually very low.

The following graphic puts the numbers in perspective.



As one can plainly see, ten times as many birds die each year from collisions with communications towers, almost 83 times as many birds die annually from collisions with automobiles. Nearly 1000 times as many birds die from crashing into *windows*, but that's nothing compared to the biggest direct scourge of avian life, the "bad ol' puddytats!". Yes, cats (both domestic and feral) wipe out an estimated whopping 2.6 *billion* birds each trip the Earth completes in its orbit around the Sun. For those not doing the arithmetic, those cute cuddly sweet adorable purring meowing fur balls are al-

[48]Towering new turbines spinning in the winds of Altamont Pass - https://www.mercurynews.com/2021/09/25/revamped-wind-farm-altamont-pass-provide-renewable-energy-47000-homes/amp/

[49]See, for example:

- Finding Innovative Solutions to Reducing the Threat of Wind Turbines to Bats - https://www.batcon.org/our-work/research-and-scalable-solutions/wind-energy/
- How New Technology Is Making Wind Farms Safer for Birds - https://www.audubon.org/magazine/spring-2018/how-new-technology-making-wind-farms-safer-birds
- What's black and white and spins? Wind turbines that don't kill birds - https://news.mongabay.com/2023/03/whats-black-and-white-and-spins-wind-turbines-that-dont-kill-birds/
- Wind Farms and Birds Are Learning to Coexist - https://reasonstobecheerful.world/wind-farms-safe-for-birds-ai-technology/

most *3830 times* as lethal to our avian buddies as all of the worlds wind turbines *combined!*

Granted, this is from 2015, and the number of wind turbines has grown since then, and the number is likely to grow by a substantial amount, so the problem could worsen, but even if wind farms grow by a factor of 100[50], it doesn't automatically follow that bird fatalities (from direct collisions at least) will likewise increase by a factor of 100 (though even if it did, cats would remain 38 times as lethal).

A more salient point is the danger wind turbines pose to specific types of birds, including threatened or endangered species. Raptors particularly are prone to collisions from wind turbines, apparently since their migration routes and wind farms tend to coincide. However, there's no reason to believe that wind turbines and raptors cannot coexist.

From time to time, well-intentioned supporters of wind power who're equally concerned with minimizing bird fatalities will find promising sounding accounts of "bladeless" wind turbines (usually these consist of vertical metal poles with some sort of alleged internal mechanism or "wind vibration" driven generation principle). Sadly, these are scams, hoaxes, and/or snake oil, peddled by con artists seeking to take advantage of naive, but well-meaning people seeking to solve a problem that vastly overstated. The fact is that the reason why the three-blade HAWT monopole design has become dominant is precisely because it's the most effective, most efficient, and most economic design, and in spite of its much-maligned reputation, it remains the best design for the purpose of minimizing adverse effects to wildlife.

For the amount of fatalities that still result, better siting, more monitoring, better technology, and engineering bird deterrents should substantially reduce the number of fatalities due to direct collisions.

Of course, all of these theoretical calculations have thus far ignored the even bigger elephant (or cat, perhaps?) in the room, and that's the loss of avians (including some entire species) due to habitat loss and climate change. While the construction of wind farms may indeed contribute to a small amount of habitat loss—at least temporarily—for some birds, the amount is small, and the effects can be minimized, again mostly through careful siting of wind developments and careful construction practices. Further, if wind farms result in the shuttering of fossil fuel extraction activities as well as the substantially larger footprint that goes with it, *and* the effects of climate change, the result is an overwhelming net *plus*.

It is for *those* reasons *in particular* that environmental organizations, including both big green NGOs (their numerous flaws and reformist limitations acknowledged) as well as most, smaller, scrappy, more progressive and more militant adversarial green organizations (NGOs and otherwise) all generally *favor* wind power (often with specific reservations over each project's fixable shortcomings, but an otherwise favorable opinion). It has nothing whatsoever to do with absurd and paranoid delusions of conspiracies and back room deals by "Big Wind."

The simple fact is that these greens haven't "sold out". The fact is that wind power is an overwhelmingly positive alternative. In fact, according to a 2009 study, "Contextualizing avian mortality: A preliminary appraisal of bird (and bat) fatalities from wind, fossil-fuel, and nuclear electricity" for every one bird killed by a wind turbine, *nuclear and fossil fuel powered plants killed 2,118 birds.*[51] And to be certain, those same green organizations that often get denounced as sellouts are the very same organizations fighting like hell to insist that wind farms are carefully sited, periodically curtailed, meticulously monitored, and properly outfitted to minimize bird fatalities as much as humanly possible.[52]

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[50] At the beginning of 2023, the total installed nameplate capacity of wind worldwide stood at 906 GW. A hundredfold increase would yield slightly less than 91 TW. The *total* installed capacity in the world stands at less than 10TW, so a 100-fold increase in installed wind capacity is probably not going to happen any time soon. A *ten*fold increase could *conceivably* happen in the coming decades, but in *that* case, cats would remain almost 400 times more lethal than wind power even in the worst-case scenarios. A more robust increase in installed wind capacity is possible, but a hundredfold increase wouldn't happen until the distant future, if at all.

[51] Wind farms are hardly the bird slayers they're made out to be. Here's why - https://theconversation.com/wind-farms-are-hardly-the-bird-slayers-theyre-made-out-to-be-heres-why-79567 and Contextualizing avian mortality: A preliminary appraisal of bird and bat fatalities from wind, fossil-fuel, and nuclear electricity" - https://www.sciencedirect.com/science/article/abs/pii/S0301421509001074

[52] See, for example: As Climate Impacts Loom, Audubon Calls for Rapid Expansion of Well-Sited Clean Energy Transmission - https://www.audubon.org/news/climate-impacts-loom-audubon-calls-rapid-expansion-well-sited-clean-energy-transmission

(D) Bats

The potential adverse impacts of wind on bats are similar, in most cases, to the impacts on birds, with two important differences:

(1) The knowledge surrounding bats in general as well as the impacts of wind power on them is far less studied than that of birds, and
(2) bats are prone to "barotrauma"; specifically, when fast rotating wind turbine blades spin, they create vortices in their wakes. Bats passing through such vortices experience sudden air pressure changes, to which they're highly sensitive. Injuries or even death to the bat can result, so—in addition to direct collisions with the turbines themselves, bats are at risk from this other potential problem.

While there's a lack of comprehensive knowledge on whether wind power equipment is a significant threat to the existence of numerous species of bats, some studies have shown that the same measures used to mitigate bird fatalities are sufficient to greatly limit bat injuries and fatalities, including especially curtailment during heavy migration periods, or governing turbine blades so that their rotation speed isn't too high, thus limiting the risk of barotrauma. Careful siting of wind farms also goes a long way in limiting or eliminating the risk to bats.

Finally, what's true for birds—that their greatest threat is the combination of habitat loss and/or climate change (either independently or in concert)—is almost certainly true for bats. The amount of risk caused by wind power pales in comparison.

And, likewise, just as most of the same green organizations that support wind power, in spite of the potential risk to birds (because *not* supporting it is a less desirable alternative, ultimately) give the same consideration with regard to bats, and just as they do in the case of birds, nevertheless fight like hell to make sure the risk to bats is minimized as much as possible.[53]

(E) Offshore Wind and Whales

There are two aspects of offshore wind said to potentially affect whales: (1) disruptions due to the construction phase; and (2) disruptions to seasonal migrations due to the ongoing presence of the wind farms once constructed.

(1) Construction Effects - these include everything from initial site surveys (which can include the use of radar, sonar, and other scanning and mapping equipment), to deployment of construction vessels, to actual construction (which includes pile driving or deployment of sea anchors for floating offshore wind platforms), to project completion. The biggest impacts are the heavy presence of marine vessels (and their emissions, including particulates if fueled by diesel) and the noise made by pile-driving, which can disrupt whale song, especially during periods of migration and mating.

Commercial maritime vessels, in US waters at least, and certainly those under a US flag (which, in operations under US jurisdiction is required by the Jones Act) are regulated by the US Coast Guard. The latter agency closely monitors marine vessel traffic (including noncommercial vessels), much like air traffic controllers monitor all aircraft. The presence of whales is routinely included in vessel traffic reporting.[54] Collision with a whale is not only life threatening to the cetacean, it's almost as damaging to the man made vessel and potentially life-threatening to the human crew and passengers (if any), plus the risk of a fuel spill (even if just carried and used for the vessel's own propulsion), and the damage that could cause (not to mention the risk to the vessel master's license and career) provide ample incentive to avoid them. Given all of these factors, the risk of collision—even due to the presence of increased maritime traffic—remains low. Nevertheless, there are protections that can be enforced to minimize the risk of collisions or noise disturbances further, such as declaring a moratorium on construction during seasonal migration periods. Such an agreement was reached between the National Wildlife Federation, Natural Resources De-

[53] See for example:
- Finding Innovative Solutions to Reducing the Threat of Wind Turbines to Bats - https://www.batcon.org/our-work/research-and-scalable-solutions/wind-energy/
- The Realities of Bird and Bat Deaths by Wind Turbines - https://mobile.engineering.com/amp/20764.html
- [Sierra Club] Wind turbines and birds and bats - https://www.sierraclub.org/michigan/wind-turbines-and-birds-and-bats
- Wind energy in Australia is killing thousands of bats, but there is a solution - https://cosmosmagazine.com/nature/bats-wind-turbines/
- Wind Turbine Interactions with Birds, Bats, and their Habitats - https://www1.eere.energy.gov/wind/pdfs/birds_and_bats_fact_sheet.pdf

[54] As a professional mariner with over a quarter century of experience, I can personally attest to this fact.

fense Council, Conservation Law Foundation, Ørsted, and Eversource in June of 2022.[55]

(2) Ongoing Long-term Impacts - Some offshore wind opponents have made claims that offshore wind, post construction, continues to have adverse effects on whales, including the disruption of seasonal migration (apparently due to the "vibrations" caused by the spinning wind turbine blades and/or alterations made to wind patterns due to the harvesting of the energy from them), and there was even a case made about such effects being the cause of some beached whales near New Jersey. This claim has been thoroughly debunked, however, and there is no evidence whatsoever that offshore wind farms have any significant impact on whales or their migration.[56]

In general, the effects of offshore wind on whales is negligible, and there is substantial evidence that supports this contention, and—as in the case with birds and bats—green NGOs are often the entities pointing this out, (while nevertheless diligently campaigning to ensure that potential impacts are minimized).[57]

(F) Potential Impacts of Offshore Wind on Fish and Other Marine Life

(1) Marine Life Itself - Just as in the case with whales, while there may be potentially adverse effects on other marine life during construction (or—similar to the cases with birds and bats—due to poor citing of offshore wind farms), there is no conclusive evidence suggesting any significant negative long-term effects on such life due to offshore wind equipment. Several studies have been conducted. The results vary, but none showed any negative long-lasting effects. Some actually suggested that offshore wind might actually be a boon to various marine species of life, including oysters, seaweed, mollusks, bivalves, shellfish, and other similar creatures and plants, and the increased presence of those could further be a boon to some species of fish. While the long-term effects of that *could* potentially alter the local marine environment (and have residual effects on land), barring the presence of deeply invasive species, the increased biomass and biodiversity *probably* represents a net positive to the environment. However, the impacts, thus far, were monitored, have been fairly small, and certainly don't constitute a *loss* of marine habitat.

Of course, there are some in the deep ecology camp who will argue that even a localized increase in biomass, and even, in some instances, biodiversity *could* lead to an overall *loss* in both on a macro scale, and technically this is correct, but also extremely unlikely. Generally speaking, increased biomass and biodiversity in more than 99% has positive benefits on a global scale (or at worst, they're nominal). True, the effects will change the balance of things, but nature doesn't exist in stasis. It's dynamic or it's not living. There is, also, a rather sordid history of association between deep ecology and misanthropy. Even in the most generous and charitable assessments of misanthropic mindsets, any changes brought on by humans, even if done inadvertently and ignorantly, are to be regarded with a deep dose of pessimism. However, recent studies suggest such pessimism is unwarranted and unscientific at best (and perhaps racist and elitist at worst). Indeed, there's growing evidence that Traditional Indigenous Knowledge largely consists of deep symbiosis between humans and their environment which enhances biodiversity, increases biomass, deepens natural resiliency, and generally benefits the local and global environment. There's absolutely no reason to think wind farms couldn't be built in such a manner.

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[55] South Fork Wind, LLC – NGO Agreement for the Protection of North Atlantic Right Whales - https://orstedcdn.azureedge.net/-/media/www/docs/corp/us/south-fork-wind/south-fork-wind-right-whale-agreement.ashx

[56] Offshore wind turbines not cause of whale strandings, deaths, says URI ocean engineering professor - https://www.uri.edu/news/2023/03/offshore-wind-turbines-not-cause-of-whale-strandings-deaths-says-uri-ocean-engineering-professor/

[57] See, for example:

- [DOE] Addressing Misinformation on Offshore Wind Farms and Recent Whale Mortalities - https://www.energy.gov/articles/addressing-misinformation-offshore-wind-farms-and-recent-whale-mortalities
- [Greenpeace] How to Stop Whale Deaths from Real Threats, Not Lies About Wind Energy - https://www.greenpeace.org/usa/how-to-stop-whale-deaths-from-real-threats-not-lies-about-wind-energy/
- Humpback Whales And Floating Offshore Wind Farms - https://www.boem.gov/about-boem/humpback-whales-and-floating-offshore-wind-farms
- [NOAA] Frequent Questions—Offshore Wind and Whales - https://www.fisheries.noaa.gov/new-england-mid-atlantic/marine-life-distress/frequent-questions-offshore-wind-and-whales
- Protecting North Atlantic Right Whales and Advancing Clean Energy - https://blog.nwf.org/2022/06/protecting-north-atlantic-right-whales-and-advancing-clean-energy/
- [WWF] Protecting North Atlantic Right Whales and Advancing Clean Energy - https://offshorewind.nwf.org/2022/06/protecting-north-atlantic-right-whales-and-advancing-clean-energy/

In general, the biggest potential adverse effects aren't to the marine life. The biggest impact to fish and other non-cetacean marine life is that on fishermen, both commercial and recreational.

(2) Recreational Fishing (Anglers) – In spite of concerns that offshore wind developments could adversely impact recreational fishing, most studies show that recreational fishing benefits from the presence of offshore wind turbines.[58]

However, commercial fishermen, whose livelihoods depend on their catch are another story.

(3) Small Commercial Fishing Interests - Heavy opposition to offshore wind often comes from commercial fishing interests, usually small operators. This has very little to do with potential adverse effects to the fish themselves and far more to do with the potential limits or barriers to *access* to fisheries due to short term construction impacts as well as the long-term barriers imposed on offshore wind due to perceived potential security threats.[59]

This is a problem to be sure, but hardly a one-sided problem.[60] While it's certainly true that there are doubtless adverse impacts on access to fisheries during the construction phase (just as construction of anything on land involves temporary limitations and detours, some of which can potentially negatively impact those affected by them), the longer-term effects are complicated.

It's unfortunately true that small commercial fishing is a very cutthroat business that, while regulated to a degree, is subject to intense competition between individual fishers, and being dependent upon the catch, they're not paid an hourly wage or a monthly salary upon which they can set their clocks or maintain a reliably consistent budget. Their livelihoods consist of inconsistencies, peaks and valleys (or perhaps, more appropriately, waves and crests), booms and busts. While it would be easy and simple to consider them working class (and to be certain, many have what amounts to a working-class income), many of them hire (and fire) crew members, with the latter often having precarious employment status. No shortage of these are migrant laborers.

As such, the political and economic outlook of these small, commercial fishers run the gamut, but it's safe to say that most *aren't* ecosocialists, and therefore, aren't immediately concerned with the big picture as the latter isn't immediately obviously relevant to their daily survival. That said, it would be completely unfair to simply write off these folks as unfeeling, uncaring, greedy petit-bourgeoisie capitalists, because that's often not the case either. Many of them *do* care, to an extent, about the environment.

The closest parallel to these fishers are the small contract logging firms, which the Wobblies of old referred to by the unfortunate epithet "gyppo", who were awarded contracts to cut sections or entireties of approved timber harvest plans awarded to the big timber capitalists that had title to private timber holdings or exclusive access to national forest lands. As such, these logging firms were dependent upon money paid by the board-foot. Due to the precarity and unpredictability of their income, many were easy to manipulate into scapegoating environmental regulations and environmentalists as the biggest threat to their livelihoods. In reality, it was the capitalist drive to accumulation and profiteering that was the biggest threat in the big picture, but since those capitalists are the gatekeepers, blaming them would inevitably result in the blackballing of the outspoken small contractor. The most they could do is speak anonymously or decline to bid on the contracts offered by a particular capitalist if the contractor found them especially egregious. However, since it's often a "race to the bottom", the egregiousness is widespread. Nothing short of forming a union, or a union-like association among contract firms could prevent this sort of undercutting, but since the contract logging system was created by big timber capitalists in the 1910s,

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[58] See, for example:
- Do Offshore Wind Farms Affect Fishing? - https://captainexperiences.com/blog/do-offshore-wind-farms-affect-fishing
- Do Offshore Wind Farms Affect Recreational Fishing? - https://ncseagrant.ncsu.edu/hooklinescience/do-offshore-wind-farms-affect-recreational-fishing/
- Optimistic with reservations: The impacts of the United States' first offshore wind farm on the recreational fishing experience - https://www.sciencedirect.com/science/article/abs/pii/S0308597X21000506?via%3Dihub

[59] See, for example:
- In the Race for Clean Energy, Is Offshore Wind Harming the Nation's Fisheries? - https://civileats.com/2023/04/24/in-the-race-for-clean-energy-is-offshore-wind-harming-the-nations-fisheries/
- Offshore Wind and the Fishing Industry: The Path to Co-Existence - https://kleinmanenergy.upenn.edu/news-insights/offshore-wind-and-the-fishing-industry-the-path-to-co-existence/
- RODA STATEMENT ON THE OFFSHORE WIND LEASE SALES OFF CALIFORNIA - https://rodafisheries.org/statement-on-california-auction/

[60] Such perceptions aren't always groundless either. This author can personally attest to being unable to use an EV charging station at the westbound Interstate 80 rest stop on Donner Summit in California due to an act of deliberate vandalism, apparently perpetrated by someone with a visceral hatred of electric vehicles.

specifically Weyerhaeuser, to thwart unionization (by the IWW in particular), and it engenders petit-bourgeois economic relations to capital, it's *extremely* unlikely that such an effort will unfold. Plus, since many of those logging contractors are small-time employers *themselves*, there are legal limitations on their ability to organize what amounts to a labor union.[61]

A very similar situation exists with fishermen. While they generally don't work for or contract with big fishing corporations, they *do* generally contract with big food and restaurant corporations and conglomerates, so the relationship to capital is similar. There is intensive competition from large commercial fishing corporations, of course, and the latter are—in combination with global warming driven by greenhouse gas emissions—mostly responsible for the depletion of fishing stocks and the loss of marine biodiversity, but wind farms are convenient scapegoats.

These concerns must be addressed in any offshore wind development, and there may be cases where mutually beneficial agreements can be negotiated that benefit all parties. There may, however, be instances where the differences are irreconcilable, and the local communities will have to decide whether a proposed offshore wind development is worth opposing (on the grounds that the local fishing economy is of greater importance than wind energy), and in some cases, it may be. In such cases, alternative sites for offshore wind may be available that satisfies almost everyone (there are almost always a handful of disagreeable curmudgeons who can't ever be sufficiently satisfied).

If, on the other hand, the community decides that the wind development is more beneficial than not, the fishermen aren't necessarily "lost at sea" so-to-speak. The solution to this problem is to negotiate with potentially adversely affected fishermen, and to provide either temporary financial relief or a just transition to some other occupation and livelihood. Of course, funding and political will for such things isn't always guaranteed (often it's not), but if there are sufficient organized grassroots political forces demanding it—ideally a coalition of fishermen, local communities, indigenous tribes, environmentalists, and possibly even unions working together, but failing that, at the very least *some* combination of *some of* the above, it's more likely to happen.

(4) Traditional Indigenous Cultural Fishing Practices - Unlike commercial fishing, traditional Indigenous fishing practices, often done for long held cultural and/or spiritual reasons likely doesn't face the potential loss of fish due to the presence of wind farms, but loss of access is another matter. It's also entirely possible that the very presence of wind turbines in traditionally sacred fishing spots constitutes a desecration.

If the latter is true, then there are very legitimate reasons to oppose the location and development of offshore wind farms there. After all, unless we are bonafide members of indigenous communities, we are almost certainly the children of settlers occupying unceded indigenous territory. The just and proper course of action is to respect sacred lands, no matter what the cost. Certainly alternatives are available (and honoring FPIC in a good faith effort will help identify those).

If, on the other hand, the proposed location for offshore wind *doesn't* constitute a desecration of sacred indigenous territory, it is *still* proper and just (no matter how costly or burdensome) to seek FPIC from local indigenous communities in all aspects of choosing and developing a wind power facility (whether offshore or onshore). One reason in particular is that while a project's construction may not touch any sacred territory, it may nevertheless—at least temporarily—adversely affect traditional cultural hunting or fishing practices. If so, the just course of action dictates that FPIC must be obtained and acceptable arrangements made to preserve and protect the rights of indigenous peoples to continue to engage in their traditional practices. Historically, settler-colonialist cultures ignore such things, and in doing so lose any semblance of trust, thus increasing the likelihood that wind power development will draw opposition.

(G) Wind, Land Use, and Agriculture

One of the arguments made against renewable energy as a source of clean energy is the perceived land use footprint that complete decarbonization and replacement by 100% renewable energy and storage would require. How much land would actually be required though? The answer depends on who you ask. According to Vaclav Smil and other likeminded renewable energy skeptics, the amount needed is massive, perhaps as much as the entire area of one or several US states. According to the National Renewable Energy Laboratory (NREL), the amount needed is significantly smaller, approximately 19,200 square miles, barely larger than all

[61] For a very detailed account, see, Redwood Uprising: From One Big Union to Earth First! and the Bombing of Judi Bari, by Steve Ongerth, 2014, archived at https://www.judibari.info.

of the land used for all of the existing US rail infrastructure right-of-ways and yards (and there've been a few sincerely honest proposals made to cover that entire expanse in PV solar arrays). Most experts favor NREL's assessment over Smil's, and to be certain, Smil's argument assumes that most of the needed land wouldn't include already existing urban developments, including rooftops, parking lots, streets, highways, schoolyards, railroad rights-of-way, brownfields, canals, and reservoirs—all of which can *easily* accommodate PV arrays and all of which definitely cover an expanse greater than the minimum area cited by NREL.

Furthermore, even farmland can coexist with PV solar arrays, and there is a promising concept known as agrivoltaics[62], in which solar arrays can be constructed over crop lands at sufficient height (usually between 6-12 feet or approximately 2-3.5 meters above ground) with no adverse effects to the crops, or even some beneficial effects (such as providing shade for partial-sun crops, shade for shade-crops, and cooling for crops that would otherwise need large amounts of water to keep cool on hot-dry days. Since commercial agriculture—at least the kind practiced by modern conventional industrial agribusiness interests—is usually the biggest consumer of increasingly scarce fresh water for irrigation, this potentially constitutes a *double* benefit.

Wind power is a bit of a different story, in the sense that it's not possible to erect turbines in between buildings or on top of them, at least not in most places or in a manner in which each turbine possesses a nameplate generating capacity of 3-5 MW or greater (and forget about the fantastical promise of turbines integrated into tall buildings themselves. While such things *can* generate a modicum of energy, the amount is often small and not cost effective. The swept area of the turbines just isn't large enough and the available wind itself not sufficiently plentiful. Usually, the interests promoting them are the same pushing the "bladeless" turbines which are mostly snake oil.)

While offshore wind doesn't require any sacrifice of available land, there are sometimes already discussed factors that make specific locations undesirable, but it can reduce the need for onshore land use. However, there are often many mostly favorable onshore sites, including agricultural land.

In such cases, are there potentially adverse impacts from onshore wind development to farmers and agricultural workers?

Potential adverse impacts to agricultural workers are mainly limited to falling blades from malfunctioning and falling equipment, but such instances are extremely rare, and can mostly be avoided through proper maintenance. There are also telltale signs of malfunctioning wind turbines, such as excessive blade rotation speed or fires (caused by excessive heat, usually due to the former, or electrical fires due to faulty equipment) that agricultural workers, if sufficiently trained, will easily recognize.

Locating wind farms on agricultural land *does* potentially impact farmers in the sense that *some* of the land hitherto used for crop land is sacrificed to make way for the wind turbine monopoles, and this includes not only the tower itself, but the somewhat larger base foundations, and surrounding easements and access pathways or roads. However, the percentage given over for this purpose is usually a fraction of the land available, and any responsible arrangement would compensate the farmer for lost revenue in exchange for the needed land, such as rent or user fees commensurate with the potential revenue loss (or sometimes a higher return paid to the farmland owner to sweeten the deal). Access to the land for monitoring and maintenance also has to be provided, though, and those aren't entirely always free of security concerns if disputes arise between the land owners and those responsible for maintaining the wind turbines, but such things aren't anything earthshakingly alien to multiple users of land in general, and plenty of established legal frameworks exist for resolving said disputes.

There are no known significant impacts to crops from wind turbines, other than possibly a slight dip in availability of sunlight due to shadows cast by the turbines themselves, but this is a mostly nominal effect in most cases.

To be certain, there are many instances of wind farms coexisting with productive farmlands (and one can argue about the quality of the latter and the ecological footprint and sustainability of industrial corporate monocultural agriculture, and certainly that's a legitimate argument to be made, but it's almost certainly true that what's good for the goose (i.e. the monoculture) is good for the gander (i.e. an agroecological or permaculture alternative, such as a milpa or mixed organic crops).

[62] Agrivoltaics To Save US Farmland From Buildings - https://cleantechnica.com/2023/08/28/agrivoltaics-to-save-us-farmland-from-buildings/

(H) Are There Any Potential Threats from Wind Power to Humans?

There've been no small number of claims made that wind turbines and wind farms have detrimental effects to *human beings*. These include assertions that wind turbines produce subsonic vibrations or the shadows thrown by the (slowly) spinning blades have some sort of adverse effects. It's also been claimed that radioactive metals (presumably sourced from nuclear waste materials) are used in the construction of the towers or turbines.

To be absolutely blunt, all of these claims are utter horseshit.

The "subsonic vibration" claim is particularly prevalent in Australia, due in no small part to the deliberate spreading of misinformation by the **Waubra Foundation**, a vehemently anti-wind astroturf front group that's heavily funded by donations from coal mining interests (whose motivations are easy to guess). While this organization didn't fabricate the myth whole cloth (it was likely the product of new age pseudoscience and quack theory), Waubra has shown no lack of scruples or hesitancy in spreading it. Peer reviewed scientific studies have shown, overwhelmingly, that no such subsonic activity exists, and—if anything—the claims made to the contrary are entirely psychosomatic. According to a study[63] by G James Rubin, et. al.:

> Several psychological mechanisms might account for symptoms attributed to wind turbines. First, the "nocebo effect" is a well-recognized phenomenon in which the expectation of symptoms can become self-fulfilling. Second, misattribution of pre-existing or new symptoms to a novel technology can also occur.

The other claims are equally bogus, and if people are actually offering these as reasons to oppose wind power, then either they're misinformed or deliberately misleading others.

Other than the usual, manageable risks posed by high voltage electricity transmission (electrocution and fires), falling equipment (in extremely rare cases of equipment failure), or lethal falls by construction workers or wind technicians (or trespassing humans of any occupation) there is no significant danger to humans posed by wind power technology, and such minimal risks offer no compelling reason to stand in opposition to wind power.

Ultimately, all of the potential threats to wildlife (or humans) can largely be addressed through better planning and sighting.[64]

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[63] See: https://pubmed.ncbi.nlm.nih.gov/24804716/#:~:text=Several%20psychological%20mechanisms%20might%20account,novel%20technology%20can%20also%20occur.

[64] See, for example:

- Bird + Whale + Turbine - https://www.sierraclub.org/sierra/bird-whale-turbine-offshore-wind-science
- Energy and Wildlife Publications - https://www.usgs.gov/programs/species-management-research-program/energy-and-wildlife-publications
- Hitting the Target but Missing the Mark: Unintended Environmental Consequences of the Paris Climate Agreement - https://www.frontiersin.org/articles/10.3389/fenvs.2019.00151/full
- Our Mission: Through science and collaboration, accelerate responsible deployment of renewable energy to mitigate climate change and protect wildlife and ecosystems - https://rewi.org/

IX. Other Dubious Motivations

There are other reasons given by those that oppose wind energy developments. These include the visual "pollution" of adding turbines and towers to view sheds, the spinning turbine blades, and/or the blinking red safety light beacons visible at nighttime.

In instances where this might adversely impact view-sheds of indigenous peoples in their traditional sacred practices, such as ceremonies that take place on mountaintops, these are legitimate issues that should be addressed through FPIC.

In other cases, while these issues may represent legitimate personal aesthetic reasons that individuals might oppose such developments, they may also be cases of NIMBYISM. While some may argue that their health depends entirely on being able to look out into the distance by day and not seeing slowly turning turbine blades or by night and not viewing blinking red lights, that's a subjective opinion at best. No scientific study of any merit would confirm such an argument, and it really comes down to individual quality of life considerations (though, perhaps some individuals seeking to make money from the value of their property through capitalist land speculation might hide behind such an argument, if they don't just complain about "negative impacts to their property values").

Indeed, there are many, particularly living near shorelines where offshore wind developments are proposed who argue that such developments would adversely affect their property values. While there may be isolated cases where some people are entirely dependent upon that for their livelihoods (a particularly toxic effect of capitalism in which homes aren't places to live so much as cash cow investments, but one to which retirees with limited incomes have become especially susceptible) due to the growth of FIRE (Finance Insurance and Real Estate speculation) capitalism, that is hardly a utilitarian or convincing argument against wind power developments.

In any case, each community or organization concerned about such matters will need to weigh that against the potential benefits, but it wouldn't be wrong to argue that favoring view sheds and property values over climate change, jobs, and the potential for just transition as bourgeois and elitist.

X. Local Community Energy versus Utility Scale or Both?

Next, let's attempt to address an ongoing debate between (mostly) pro-wind and solar advocates: should the future be large, centralized, utility scale renewable energy or small, community scale, distributed renewable energy and microgrids?

(A) On the Alleged Shortcomings of Decentralized Distributed Generation

To be certain, distributed energy generation has always existed. There are examples of small coal, gas, hydroelectric, and even nuclear generators, but the economies of scale and capital expenditures simply don't favor their widespread adoption or use. Plus, it's almost certain that most people don't want such things in their neighbor's backyards, let alone their own. However, renewable energy, particularly wind and solar, as well as battery storage are far more scalable. Solar photovoltaic electric panels function just as well if generated by a single panel or millions of them. The only real factors are availability of space to deploy them and the cost of doing so. Batteries have similar scalability. Wind isn't quite as such, especially since the equipment is more expensive, the permitting requirements more involved and stringent (by comparison, anyway), and efficiency favors higher, megawatt level generation capacity, but relative to any other source other than solar or battery storage, it's still far more scalable and modular. Because of this, distributed energy has become much more feasible and attractive.

Critiques of and dismissiveness towards distributed energy generation (even among renewable energy advocates) are plentiful, and often generalized and misinformed, because there are more than one model of decentralized energy. For clarity's sake, it's necessary to distinguish them[65]:

(1) "Off the Grid" (or "Offgrid") - Individuals and small groups relying on their own energy generation (which usually consists of renewable energy sources, but can include non renewable sources as well), with no grid interconnection.;

(2) Decentralized and Detached Microgrids ("Distributed-Detached") - completely decentralized and entirely organized in community level microgrids with some localized connections, but no long-distance interconnection;

[65]The terms used here are my own, and not necessarily universally accepted.

(3) Distributed but Integrated Microgrids ("Distributed-Integrated") - decentralized microgrids at the community level, with major or universal interconnection;

(4) Distributed and Centralized Hybrids ("Hybrid") - decentralized microgrids at the community level, combined with larger, including utility scale generation, with major or universal interconnection;

(5) A messy and inconsistent mix of each ("**All of the Above**")

In my personal experience, most of the less informed criticisms assume either "offgrid" or "decentralized-detached", and while there are *some* energy justice advocates who do *indeed* favor the second option, most support one of the latter three. Since the first two options are not even remotely likely or possible for the entire world—let alone desirable (outside of right-wing survivalist dystopian fantasies), there's no point wasting time repeating arguments against them, because (a) the arguments are completely valid in the truest sense, but also (b) they're either based on ignorance or straw men arguments made in bad faith.

Having said that, the most *likely* scenario would be "(5)", i.e. "all of the above", because there are numerous isolated communities located far from densely populated areas where a grid interconnection isn't feasible, or at least not cost effective, so isolated pockets of "off grid" and "distributed-detached" users will exist (as they already do now, and have for many years or even decades). The real debate is choices (3) "distributed-integrated" or (4) "hybrid" versus the status quo.

Defenders of the latter tend to make the following claims (assuming they're steering clear of the aforementioned ignorant, misinformed, or bad faith arguments):

CLAIMS: Distributed Energy:

(1) is a case of mostly rich people seceding from the grid;
(2) shifts the cost burden from wealthy homeowners (who can afford rooftop solar) onto the backs of the working class);
(3) tends to be privately owned, and thus perpetuates neoliberal capitalism instead of ecosocialism and public ownership;
(4) isn't affordable for the working class and not feasible for renters or apartment dwellers;
(5) is less reliable;
(6) adds far too many complexities to the grid;
(7) tends to be installed by nonunion contractors who more heavily exploit their employees;
(8) can't sufficiently meet all of our electricity needs.

Most of these arguments are mostly false, though there's grains of truth to all of them, and some are truer than others.

(B) The Reality of (Integrated) Distributed Energy Generation

Answering each of the above arguments isn't difficult:

Claim 1: distributed energy is a case of mostly rich people seceding from the grid:

This is an argument particularly favored by socialists with anachronistic perspectives on what just and equitable socialism looks like. In their view, 1950s era, Soviet-style centralized mega projects, including especially utilities (under "democratic workers'" state ownership) represents the utopian model (as if three quarters of a century of historical evidence to the contrary can simply be ignored). While there are indeed some rich homeowners (as well as right wing individualists and/or doom preppers) who *indeed* wish to "secede from the grid", this is mostly shortsightedness on their part. It's usually more cost effective as well as reliable to remain interconnected (except in the aforementioned rare and isolated cases where it isn't), because of the variability of sunlight (even with combined battery storage capacity). Grid interconnection, especially when net energy metering or other financial incentives are available, allows individual households to generate a portion of their own electricity (and store some excess or send it back to the grid), or rely on the grid when needed. As for income levels, there are incentives and community support (to a varying degree) or organizations that assist lower income homeowners in installing distributed solar power (and sometimes wind, where feasible). It's also telling that most BIPOC energy justice organizations ardently support distributed renewable energy.[66]

[66] See, for example, Taking Back the Power (Literally) - https://www.yesmagazine.org/environment/2023/09/07/energy-democracy

Claim #2: distributed energy shifts the cost burden from wealthy homeowners (who can afford rooftop solar) onto the backs of the working class:

While there *is* a modicum of more wealthy, individual homeowners and small property owners shifting a small amount of costs (away from themselves, at least), it's the utilities who choose to decide where the "costs" are shifted. The *real* "cost shift" that the utilities are trying to avoid is mainly the loss of shareholder profits due to net metering where applicable, and it's usually the utilities and their defenders and enablers making the argument in a classic case of the proverbial pot calling the kettle "black". Self-described "socialists" who echo this argument (usually the same making claim #1) are actually serving as willing tools of the capitalists. If one is *really* concerned about cost shifting, they should organize to seize control of the IOUs and collectivize them.

Claim #3: distributed energy tends to be privately owned, and thus perpetuates neoliberal capitalism instead of ecosocialism and public ownership:

This, too, is an argument primarily made by socialists with an anachronistic vision of socialism, one that favors large, centralized, state-owned institutions. While it's entirely true that (some) advocates of so-called "libertarian" capitalism (which isn't libertarian in any meaningful way) *do* sometimes, albeit inconsistently, advocate for "decentralization", mainly in the service of privatization, monetization, and enclosure, they're generally *not* in favor of anything that has a leveling or socializing effect. The notion that distributed energy is an *anathema* to egalitarian or democratic socialist economics or social relations is to reject the core of what ideal socialism *is*: the best combination of communism and freedom. Such an ideal is based on social ownership of the means of production and subsistence. Only in dogmatic Stalinist dystopias does that automatically require centralized bureaucratic state ownership. In any case, the biggest and most outspoken opponents of distributed energy aren't usually dogmatic socialists. They're mainly the investor-owned utilities, true believers in nuclear fission power, and fossil fuel capitalists (plus, unfortunately often the officialdom of the business unions—particularly but not always or exclusively Building Trades—that represent the workers employed by them or their supporting supply chain companies). Given the history of real-world Stalinism, the affinity isn't especially surprising, but it's anything *but* "socialist".

Claim #4: distributed energy isn't affordable for the working class and not feasible for renters or apartment dwellers:

There is some truth to this argument, but only so much. As mentioned in rebuttal "(1)", there are incentives and community support (to a varying degree) or organizations that assist lower income homeowners in installing distributed solar power (and sometimes wind, where feasible). It's also becoming more common for neighborhood or low-income cooperatives to finance distributed energy installations, and there are some examples of state funded programs designed to facilitate them as well. For example, in the US, while it's not perfect legislation by any means there are numerous state and federal programs that provide some assistance for this. More such programs and funding sources could become available if—again—a sufficiently organized grassroots movement gains the leverage to make it happen. As for rental units and apartments or condominiums, laws governing them vary from nation to nation, state to state, region to region, and municipality to municipality, but this is yet another area where sufficiently organized grassroots movements can make headway.

Claim #5: distributed energy is less reliable:

This is a variation of the "renewable energy is unreliable and/or intermittent" argument, which has already been addressed, save to emphasize the point that if grid-tied and supported by storage either on-site or elsewhere, whatever risk exists is lessened further.

Claim #6: distributed energy adds far too many complexities to the grid:

The "complexity" argument is a red herring, usually invoked by those who either have a very limited understanding of electricity grids or are biased towards centralized energy generation. Even in conventional, centralized electricity grids, there is *already* a high level of complexity. Deregulation has actually made it *more so*. However, the advancement of computer technology and programming has largely rendered that problem manageable. The main issue isn't the complexity so much as who controls it. Under capitalist profiteers and/or bureaucratic states where different factions of politicians contest for power and dominance, the working class and less powerful people, particularly the

colonized and marginalized, are those usually sacrificed on the altar of power and profit.

Claim #7: distributed energy tends to be installed by non-union contractors who more heavily exploit their employees:

This is the argument that has the most merit. It's unfortunately true that most distributed energy systems—in the US, at least—are installed by nonunion contractors (and conversely, most centralized electricity generation facilities, oil refineries, coal mines, supply chains, and so forth are unionized). Not all of the nonunion contractors are necessarily intentionally undercutting unions or have selfish motivations, however. There are many minority contractors that specifically target low income BIPOC workers, including reformed formerly incarcerated youth, many of whom (until recently) haven't been especially encouraged to join Building Trades or other unions. Further, many unions—especially but not only the Building Trades—haven't, until recently, given much consideration towards *organizing* the nonunion workers. The reasons behind this are far too complex and voluminous to address in this already lengthy text, though the IWW Eco Union Caucus[67] has (and continues to) discuss that at length. There are some tentative signs that may be changing however, especially given the recent uptick in strikes and successful organizing drives in hitherto "hard to organize" jobs, such as fast-food and tech work.

Claim #8: distributed energy can't sufficiently meet all of our electricity needs:

This is probably the most debatable point. Can 100% distributed renewable generation (specifically distributed integrated, grid-tied generation) and storage meet 100% of the world's total energy demand or needs? The answer is uncertain. There are many advocates of distributed renewable energy, particularly energy justice activists who do indeed hold this view. I am personally sympathetic to that view myself, but I remain agnostic that it's *decisively and unequivocally* true. I firmly believe that *most* of the world's energy needs can and *should* be, but all of it? That's an open question, and I tend to think the answer is that we actually cannot.

The question is how far we *can* go, but more about that later. First, it's necessary to debunk the extreme opposite pole: the arguments that favor centralized energy generation.

(C) The Downsides of Centralization

In truth, to a large extent, even what is defined as "centralized" energy generation is actually *de*centralized and distributed *to a degree*. There isn't a single, solitary point of generation (unless one includes the Sun in the overall map, because—as Eric Idle correctly points out in "The Galaxy Song" in the Monty Python movie, *The Meaning of Life*, it *is* "the source of all our power"). In fact, even in the US, there isn't a single, universally connected grid. In fact, it's a messy and somewhat incoherent hodgepodge that evolved, haphazardly, over time, with much of its messiness and inconsistency stemming from profit seeking and politics (and does that sound familiar? The reader wouldn't be wrong in thinking so!)

Most agree, however, that the conventional "centralized" grid is that aforementioned messy hodgepodge that consists of predominantly centralized fossil energy (coal, gas, oil, etc.), large and small scale hydroelectric, nuclear fission, and geothermal plants, with some utility scale wind and solar farms, with a modicum of connected distributed sources and storage making up a small, but slowly growing percentage.

There are many legitimate arguments *against*, or harshly critical of centralized, utility scale renewable energy.[68] To summarize, the many arguments against centralized energy, in favor of locally distributed (renewable) energy are these:

CLAIMS: Utility Scale Renewable Projects:

(1) may be technically cleaner than fossil and nuclear energy as well as large scale hydropower, but it perpetuates the colonialist, extractivist paradigm, because large scale developments usually facilitate and/or require large organizational structures, most of which are hierarchical and top-down, an anathema to democratic community control;
(2) are capital-intensive, requiring large initial investments to finance, thus constituting an impediment to small cooperatives, struggling communities, workers' collectives with limited resources, or low-income families and individuals to control their energy generation;

[67] https://ecology.iww.org

[68] The New (Renewable) Energy Tyranny - https://nonprofitquarterly.org/a-new-renewable-energy-tyranny/

(3) are often owned and controlled by for-profit corporations, undemocratic states, or financial speculators who use them for profit seeking, capital accumulative purposes at the expense and exploitation of the nearby communities and peoples;
(4) are much bigger targets for **natural disasters**, such as earthquakes, fires, hurricanes, floods, extreme heat or cold, or **force majeures**, such as terrorist attacks, coups, wars, or insurrections. In such instances, they are much more easily harnessed or manipulated in the service of "disaster capitalism", in order to displace low-income, front-line communities for the purposes of gentrification and displacement;
(5) usually require large amounts of land (or offshore sea area), and the larger the land (or sea) area required, the greater the chances of ecological despoliation or indigenous dispossession, or the greater the chances of economically struggling landowners, particularly farmers, to be pressured into selling their lands at below-market or unjustly low exchanges;
(6) often take place at significant distances away from the biggest concentration of electricity users, thus requiring long distance, high voltage transmission lines, many of which cut across fragile ecosystems, indigenous lands, or near people's homes;
(7) are large and cumbersome, requiring far more technical expertise and operational expenditures (including labor costs) to maintain and interconnect with the grid
(8) Locally scaled, community controlled, distributed renewable energy and storage makes large scale, centralized energy unnecessary.

(D) Some Rebuttals to the Anti-Centralization Arguments

To an extent, all of the aforementioned arguments in the previous section are true, however some are truer than others, and for some of those less so, there are some legitimate counter arguments:

Claim #1: utility scale renewable projects perpetuate the colonialist, extractivist paradigm:

There's no law of nature that precludes the formation of sufficiently large enough horizontalist, democratic organizations necessary to efficiently run large utility scale installations for the greater good of all, including the workers who run them and the communities they serve. While examples of this are rare (largely because capitalist dominated societies as well as authoritarian bureaucratic "socialist" states tend to undermine or co-opt them, if not crush them outright), they *do* exist, such as the anarcho-syndicalist unions which collectivized entire industries in large regions of Spain during the 1936 revolution (until it was crushed by Franco's fascist forces after being undermined and betrayed by Stalinists who sought to bring the revolution under their control). One of these included the telephone exchange in Barcelona, which is not especially different than a utility scale power generation facility.

Claim #2: utility scale renewable projects are capital-intensive, requiring large initial investments to finance, thus constituting an impediment to small cooperatives, struggling communities, workers' collectives with limited resources, or low-income families and individuals to control their energy generation:

This has been true for many decades, but due to increasing organization and growth of grassroots green-left forces—which have popularized the concept of a "Green New Deal", combined with evolving objective conditions brought on by the decline of neoliberal austerity capitalism, which was greatly accelerated by the global COVID-19 pandemic of 2019-22–large allotments of state funding and stimulus money is available (though often with some conditions and limitations, many of which could justifiably be called "strings") and could be obtained by local communities and organizations if sufficiently organized enough to keep the control local, horizontalist, and democratic (and such sufficiently organized groups can gain enough leverage to "cut" many of the "strings").

Claim #3: utility scale renewable projects are often owned and controlled by for-profit corporations, undemocratic states, or financial speculators at the expense and exploitation of the nearby communities and peoples:

Utilities (especially investor-owned utilities), financiers, and other capitalists are still subject to some degree of regulatory oversight and democratic pressures (federal, regional, state, county or township), both from without (grassroots organizations, watchdog groups, local governments) and within (unions), though this is often limited by the ongoing drive by undemocratic and authoritarian forces (by mainly, but not limited to, capitalists and authoritarian statists). Again, this invokes the need

for organized grassroots movements to overcome such limitations.

Claim #4: utility scale renewable projects are much bigger targets for natural disasters or force majeures, and as such are much more easily manipulated in the service of "disaster capitalism":

This is true, though damaged or destroyed facilities can be repaired and rebuilt, and—as is a running theme here—sufficiently organized grassroots organizations and movements can counterbalance attempts at disaster capitalism from above.

Claim #5: utility scale renewable projects usually require large amounts of land (increasing the) the chances of ecological despoliation or indigenous dispossession, or (forcing) economically struggling landowners to be pressured into selling their lands at below-market or unjustly low exchanges:

This isn't necessarily baked in, of course—once again—the best defense against this happening is an organized, grassroots movement to oppose the potential abuses.

Claim #6: utility scale renewable projects often require long distance, high voltage transmission lines, many of which cut across fragile ecosystems, indigenous lands, or near people's homes:

Just as in the previous case, this is a matter of planning and policy, not the project itself, and again the best solution is an organized, grassroots movement to preemptively oppose the negatives.

Claim #7: utility scale renewable projects are large and cumbersome, requiring far more technical expertise and operational expenditures to maintain and interconnect with the grid:

As is the case with (1), there's no hard and fast rule that these limitations cannot be overcome. Further, jobs requiring technical skills and expertise are often better paying and more commonly unionized jobs. Having said that, there *has* been a history of such jobs being limited mainly to white males, but that's been changing in recent decades. (There's more to say about that particular issue later on, in any case).

Claim #8: Locally scaled, community controlled, distributed renewable energy and storage makes large scale, centralized energy unnecessary:

This is actually the least convincing argument among the lot. In actual fact, there's insufficient evidence to support the conclusion that humanity, even in a post capitalist, ecologically sustainable, "degrown" society can survive *entirely on electricity generation from strictly localized microgrids*. While the "intermittency" argument against renewable energy is overstated (as I've previously pointed out), it's not *entirely* false (just as it's not true that centralized, utility scale, non-renewable energy isn't lacking in unreliability or intermittency, itself). There are almost certainly times when there are deficits of wind or sunlight and high demand that can best, or only, be served by a percentage of centralized generation. There are also unexpected spikes in demand which occur, or times when unexpected disasters can incapacitate even local, decentralized generation systems, and some more distant, centralized backup source is the best possible option. There are, likewise, times when centralized power generation sources can be incapacitated, and the opposite—i.e. local, decentralized sources being the stopgap—is true. As the old saying goes, "it's best to have options". Of course, the more *decentralized* distributed generation capacity exists, the less centralized utility scale generation is required—*as long as all of those decentralized systems are linked and the grid is maintained, managed, and balanced.*

Some energy justice advocates may balk at this point, but we're better off if all of the microgrids are nevertheless interlinked. That's because the more interlinkages there are, the less likely power outages will occur or backup generators (most of which would run on fossil fuels or other combustion sources) will be required in times of need. Battery storage certainly lessens the need for backup generators, even on isolated microgrids, but it may not eliminate them entirely.

The injustice foisted upon front line, mostly BIPOC and/or working-class communities isn't the interconnection itself, it's who controls it, and that's either profiteering capitalists or undemocratic inegalitarian state bureaucracies. Both have earned a well-deserved reputation for discounting or sacrificing front line, low income, mostly BIPOC communities on the altars of power and profit. The solution to this problem is—again—a well-organized grassroots movement to counterbalance and overcome the profiteering capitalists and the bureaucratic authoritarian states that enable them.

(E) Why an Interlinked Hybrid of Nested Distributed and Centralized Nodes is Best (and most likely)

There are two further arguments that I'd like to offer in favor of a combination of (mostly) distributed renewable generation and storage and about 20% utility scale renewable generation, and both of those have to do with existing real world objective conditions:

(1) Due to the entrenched power of incumbent utilities (including, but not limited to investor owned utilities), fossil fuel capitalists, outdated electrical and building codes, and restrictive labor laws (which can make organizing currently nonunion workers into unions extremely difficult, particularly in places where unionization rates are low, such as rooftop solar installers), sometimes it's simply quicker and better to support the addition of large capacity, utility scale generation, *even if distributed sources can provide an equivalent amount* in a more ideal world. The climate crisis demands rapid decarbonization, and while ecological, energy justice, and labor considerations might slow a project somewhat, insistence on distributed energy over utility scale *in every conceivable case* might take much longer, at least to build the same capacity as would be available with the utility scale project;
(2) Due to the fact that utility scale projects are *usually* built by union workers, and local distributed energy often (but not always) *isn't*, it's very difficult to convince skeptical rank and file union members that those calling for just transition are 100% sincere and willing to put their proverbial money where their mouths are.

Yes, it's certainly true that a significant difference of opinion has emerged over the precise meaning of "just transition" between unionized (and non-union) workers employed in the construction trades and dirty energy supply chains (where the term mainly means that adversely affected workers are made completely whole) and environmental, energy, and climate justice activists (where the term is much more encompassing, including the workers in the previous definition, but also including workers *excluded from the benefits of union work*—often by institutionalized racism that the unions have sometimes unwittingly (and occasionally knowingly) enabled—as well as front line communities, mostly those of color, that have been where these polluting industries and supply chains have been located. In other words, just transition *must* include *reparations* or it's not genuinely just).

However, there is a major barrier to achieving this: like it or not, just or unjust, the dirty energy infrastructure we seek to replace and phase out are run by capitalists (or bureaucrats) with an inordinate amount of political power. Dislodging them from those positions of power will not only not be easy, it may be one of the heaviest lifts the climate, energy, and environmental justice communities have to achieve in order to win. It's *extremely unlikely* that this can be achieved *without the help* of the workers employed by these capitalists, and that puts these workers and the unions that represent them in a keystone position that's simply impossible to ignore or write off. Just because something's "green" doesn't automatically mean it's "red".

Just because something's "green" doesn't automatically mean it's "red".

Having at least *some* utility scale renewable energy developments—which I contend will be necessary in any case—built and maintained by unionized workers would go a long way in providing real world examples of a just transition—even if not in the broadest sense. The more such examples exist in the real world, the more possibilities exist to convince construction trades and unionized dirty energy supply chain workers that alternative good union jobs *do* exist and are worth fighting for.

These are admittedly pragmatic reasons which, ideally, shouldn't be necessary (any more than the risk of possible bird or bat fatalities, for example), but are likely inescapable realities.

XI. Planned Economy or Market Chaos? Let's Choose the *Third* Option.

Finally, let's put to rest the hackneyed straw man accusation made by (some) socialists that renewable energy developments sans centralized "democratic" state planning equals "relying on market forces".

Frankly, this argument is ideological bullshit. In fact, it's no less absurd than the "libertarian" capitalist belief in the magic unicorn known as "the free market". The latter is a fiction. A fantasy. It *doesn't* exist.

The reality is that capitalist economies are prevalent just about everywhere, but so, too, is state intervention. Even at the height neoliberal hegemony (approximately 1989-2008), massive amounts of state intervention and protectionism propped capitalism up and prevented capitalism from eating itself (as it would instantaneously if the Ayn Rands, Murray Rothbards, Bryan Caplans[69], or other free market fundamentalists if the world had their way). This was made all too clear with the collapse of neoliberalism in 2008. The fact is that capitalism cannot exist without state intervention or centralized planning.

Conversely, socialism constitutes the ownership of the means of production by the people, not some elite managerial class that represents a tiny fraction of it. A managerial class is a managerial class whether it's bosses, shareholders, and private owners or even "elected" or appointed bureaucrats from the state or some other political elite. In other words, much of what's been called "communism" or "socialism", under states ruled by putative socialists or communists from Lenin and Stalin, to Mao, to Castro, to Hugo Chávez, has actually been state *capitalism*.

Further, it represents something of an ideologically sectarian cheap shot to be sneeringly dismissive of the rather large, growing, and deepening climate, energy, and environmental justice movements as "having faith in market forces" simply because these movements don't wrap themselves in red flags, pontificate purist interpretations of Marx, or follow a precise interpretation of Lenin's or Trotsky's gospel. The fact is that practically all of the tactics used by the climate, energy, and environmental justice movements (including speaking out at public hearings, using legal tactics, public protests, lobbying, direct action and blockades, or electoralism) are fundamentally *anti*-capitalist, in the sense that these actions are all intended to create *constraints* on capitalist activity *regardless of market conditions* (though, being pragmatic, these movements certainly welcome outcomes, including those directly resulting from their actions) that include the decline of market advantages for the products created by the industries they oppose and seek to phase out).

In fact, there's ample evidence showing that such effects are anything but insignificant. A recent study showed that indigenous led anti-pipeline movements had cost the fossil fuel industry billions in lost profits and cancelled projects. This *could* be described as "market forces" in a sense (though it's actually more accurately described as radical municipalist democratic libertarianism, as defined by the late Murray Bookchin), but it's hardly what most people's imaginations conjure up when reading classical economics textbooks. It's incredibly smug and self-defeating to sneeringly write it off as being "pro-capitalist" when clearly it isn't.

The one area where such movements have hitherto been inattentive has been the point of production, but in the past decade this has changed dramatically for the better. That is why we're now seeing environmental movements supporting workers' struggles and unions, such as the UAW's 2023 contract fight with the Detroit "Big 3" auto manufacturers, specifically pertaining to the bosses' intent to cut workforces as they transition to making electric vehicles which are less labor intensive than internal combustion engine vehicles.

So how is any of this related to renewable energy development? It's actually more relevant than one might think.

Within the last couple of years, Mexican president, Andrés Manuel López Obrador (or "AMLO" as he's well known), a hard left social democrat, made headlines by opposing wind power developments proposed for construction in Mexico on the grounds that they were to be financed, built, and owned by private capitalist interests, which included US shareholders. This seems reasonable enough, except that AMLO drew the opposition of Greenpeace (both the Mexican and US branches)[70], because the proposed alternative was the continuation of fossil fuel (oil, gas, and coal) extractivism and energy generation. Some socialists, including particularly Sean Sweeney and John Treat of Trade Unions for

[69] I was actually once next-door neighbors with this individual. See "Capital Blight - The Ghosts of Ayn Rand" - https://ecology.iww.org/node/471

[70] Elections dash Mexican President's hopes for dirty energy reform - https://www.climatechangenews.com/2021/06/09/elections-dash-mexican-presidents-hopes-dirty-energy-reform/

Energy Democracy (TUED), defended AMLO's position[71], even going so far as to suggest that Greenpeace, and by extension most green organizations are blind to the reality of capitalist exploitation, and were (at best) naively trusting in "market forces".

Sweeney and Treat aren't entirely wrong here, but their analysis is far from as deep or accurate as they'd anyone—including probably themselves—would like to think.

First of all, while it's undeniably true that capitalism is largely responsible for creating the ecological mess we're in, and it's certainly fostered a world of inequality, exploitation, and undemocratic rot which is breeding fascism, the state owned (what Sweeney and Treat, as well as most other old school socialists call "publicly owned") does *not necessarily* equate to socialism.

True, state ownership eliminates the private shareholders, but it may not eliminate either the capitalist or the boss. It may even perpetuate class stratification. There's nothing inherent in state ownership which prevents a bureaucratic class from simply expropriating the so-called "surplus value" generated by the workers' labor nor is there inevitably any check against outsourcing the costs and "externalities" to those who aren't privileged bureaucrats. The only thing preventing such exploitative behavior is well organized, grassroots, rank and file democracy. This is as true in a workplace as it is a state, a labor union, or *any* organization, even one that calls itself "socialist" or "democratic". One need look no further than the aforementioned "Chinese Puzzle Box" to see this bastardization of "communism" in practice, *specifically* pertaining to energy generation.

What's worse is that state ownership and centralized planning isn't even a guarantee that it will bring about decarbonization, ecological sustainability, or energy transition, let alone a just transition. While AMLO has pledged support for decarbonization and energy transition, there's nothing binding him to that promise (other than public pressure), and while a case could be made that it's better for the state to reap the benefits of fossil fuel profits (and theoretically use them for public good, including decarbonization) than leaving them in the hands of private profiteers, it's simply false that those are the only viable choices.[72]

Another glaring example of this dynamic was the allegedly "socialist" Bolivian president, Evo Morales (whose background as being an indigenous Bolivian made him something of a darling of Global North socialists) pushing for (state owned) fossil fuel extractivism as well as the controversial TIPNIS highway in the mid-2010s. While some socialists defended these projects (echoing Morales's rationale that such things were essential for "energy sovereignty"), ecologists opposed them (drawing some rebukes from some of the aforementioned socialists that these green groups were run or heavily influenced by Global North, "petit bourgeois" green NGOs[73] who lacked class consciousness). Evidently these same "socialists" weren't paying particular attention to the Bolivian indigenous tribes who openly expressed their feelings of betrayal by the "indigenous" Morales!

Perhaps the absolutely most egregious example of such thinking is that of the putatively US "socialist" group which publishes the *Labor Militant*. This author was invited to speak at one of their meetings about the **No Coal in Oakland**[74] campaign (which had the support of 21 unions, in spite of the export terminal developer's blatant attempts to drive a wedge between unions and environmental justice advocates). I was subjected to a barrage of pro-nuclear fission propaganda and denunciations for supporting "yuppie bourgeois environmentalism", and that "coal exports to (putatively "communist") China should be supported, because the Chinese working class deserves a Global North standard of living!" The absurdities and pretzels of illogic in that rhetoric weren't worth arguing about, so I left.

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[71] Mexico's Wall of Resistance: Why AMLO's Fight for Energy Sovereignty Needs Our Support - https://newlaborforum.cuny.edu/2021/05/17/mexicos-wall-of-resistance-why-amlos-fight-for-energy-sovereignty-needs-our-support/

[72] See: AMLO's Mexico: Fourth Transformation? - https://againstthecurrent.org/atc226/amlos-mexico-fourth-transformation/

[73] Just as "Big Wind" is an absurd descriptor, the vastly overused "NGO-Industrial Complex" framing tends towards conspiracy-theory thinking. There is, indeed, a constellation of large green NGOs with varying political perspectives leaning largely towards reformism which have hitherto been largely liberal capitalist in orientation, founded by both foundations and membership contributions who have done a power of good, but have made far too many compromises with capitalism. Some of these organizations have evolved, to a degree (largely due to the ongoing efforts of internal, BIPOC led reform movements as well as staff unions) and have become more grassroots oriented and have also become more class conscious and somewhat more critical of capitalism in general (A complete accounting of this evolution is far beyond the scope of this paper, however). However, there are hundreds, if not thousands, of smaller, working class, often BIPOC-led NGOs (many of them critical of the bigger NGOs) which often get lumped in to the same "NGO-industrial-complex" box by critics of NGOs with little nuance or qualification—as well as by bad faith actors, such as those who uncritically accept the claims made by caudillos that they are benevolent leaders of "socialist workers' paradises" when they are anything but.

[74] https://nocoalinoakland.info/

While it would be unfair and inaccurate to argue that Sweeney and Treat, or by extension, TUED are making such absurd statements (clearly, they're *not*), it *is* true that just because some nation-states *technically* practice a degree of socialism, it's absolutely not a guarantee of being ecologically sustainable. Just because something's "red" doesn't automatically make it "green".

Just because something's "red" doesn't automatically make it "green".

Secondly, while it's certainly true that renewable energy in private hands, which inevitably includes the appropriation of profit made on the backs of workers and local communities, as stated previously, this is a social relationship which isn't permanently immutable. In fact, it's not even impossible to ensure the best possible deal for the workers that build and maintain or communities that host these privately financed projects. In fact, most such developments include some or all of the following:

(1) **Project Labor Agreements**[75] (including union jurisdiction preservation, living or industry standard wages, benefits, and "no lockout" clauses—though often accompanied by "no strike" clauses potentially limiting union militancy in return);
(2) Local hire agreement (to guarantee that local workers, including particularly underserved BIPOC communities, have a fair opportunity to benefit);
(3) FPIC for Indigenous communities;
(4) Strong environmental protections, including sustainable practices and minimization of potential impacts;
(5) Community Benefits Agreements (where specific community needs, including some degree of reparations to impacted front line communities are made, some ecological bioremediation is financed, and just transition provisions are made for potentially adversely affected workers)

Granted, these are often far from perfect or ideal, but they're also representative of how organized and aligned various non capitalist, grassroots stakeholders are. The more organized the movement, the more leverage it has to ensure the best combination of benefits for the greatest number. *This would be the case if the project were state planned and owned, too.*

More long term, just because something is privately financed, or even privately owned, it doesn't mean it must always be so. Infrastructure or whole industries can be collectivized just as much as they can be privatized. If there *is* sufficient political support and will, and strong enough organized grassroots leverage to make it happen, then it will happen, if it's what the people want. In fact, the stronger and more organized the grassroots rank-and-file movements are, the more likely they'll be to ensure that "public" ownership will *actually serve the public.*

Barring such an organized movement, nationalization from above is likely to either result from capitalist desperation—for example, if such a move is the only thing standing in the way of the complete collapse of the private entity responsible for maintaining an energy generating facility or an electric grid, and no creditor or other private entity willing or interested in accumulating the capital in question—or bureaucratic state capitalism cloaked in "red" iconography. Almost certainly this would represent an empty and soulless "public" ownership with no actual public benefit, let alone counterforce to the capitalist market.

On the other hand, it's important to stress the danger in naively assuming that energy co-ops are any more of a panacea than state ownership. A comprehensive look at the record of such institutions in the United States alone will reveal the folly in such a belief. Many electrical and gas utility co-operatives, particularly (but not exclusively) rural examples, are still heavily invested in dirty energy generation and have very low rates of democratic participation (some have recorded member participation routinely below 1% in elections, to say nothing of meetings). The elected representatives of such co-op boards, particularly in rural communities also seem to consist of elderly, and often conservative, white males. Given these circumstances, it's hardly surprising that these cooperatives have not exactly stepped forward to be the vanguards of decarbonization, let alone energy justice. That's not to suggest that cooperatives are incapable of serving in that role or constitute an impediment to it. It's not even the case that such institutions are a bad idea. Clearly, they have *some* usefulness or they wouldn't exist at all, but their intended purpose wasn't to serve a revolutionary vanguards, so much as they were created as a vehicle to bring electricity and other utilities to rural communities that the urban-based equivalents would not or could not. Now that they've accomplished this purpose, they've defaulted to the state *most* such vehicles do once they've delivered their goods, that of being a mostly

[75] See https://ecology.iww.org/node/5790

somnambulant caretaker, barely stirring unless crises occur.

There is a countermeasure for this malaise, as one might expect, and—as anyone having read this far could easily predict by now—it happens to consist of a vibrant, well organized, grassroots democratic movement sufficiently motivated to making it happen.

In any case, opposition to a renewable energy development simply because it's not the product of an ideal centrally planned product of an ideal "worker's" state (to say nothing of a paradise) is *incredibly* shortsighted thinking. The stark reality is that actually existing renewable energy generation capacity is simply cleaner than actually existing dirty energy generation capacity, *regardless of who owns and controls it*, and ownership, being a social relationship (whether capitalist or socialist, or something else entirely), and can be changed in various ways, but—to paraphrase an old Earth First! slogan, "there are no social relationships on a dead planet." And, as previously stated, I don't put any stock in the argument that "it's not an energy transition happening, but an energy *expansion*," a claim that Sweeney and Treat *particularly* make (with somewhat dubious accounting of the evidence) to try and bolster their advocacy for (their vision of) "public ownership."

Indeed, it's precisely *because* of all of the movements that have successfully blocked new fossil fuel developments by various means while (usually) championing renewable energy alternatives (with some reservations and conditions where possible and appropriate) that has allowed the semblance of an energy transition to emerge.[76] Clearly, it's not *enough* of a transition, and certainly it's not happening with sufficient alacrity, but to argue that it's not happening at all (especially because it's not unfolding according to some precisely preconceived Marxist and/or Leninist playbook), or that things are actually regressing when they most certainly aren't is just wrong.

[76] Indigenous led pipeline blockades have resulted in the cancellation or billions of dollars-worth of polluting fossil fuel pipeline projects throughout North America. See "Indigenous Resistance Against Carbon" - https://priceofoil.org/2021/09/01/new-report-indigenous-resistance-disrupts-billions-tons-emissions/

XII. The Underlying Theme

At the risk of almost hypocritically invoking a vastly overused cliche, one might ask, "what is to be done?"

Clearly there are at least three things evident in each argument I've addressed throughout this lengthy dissertation that warrant repeating and emphasizing:

(1) It's usually not a good idea to let the perfect be the enemy of the good - There are, unfortunately, times when the perfect *is* the enemy of the good. There are also times when some give-and-take is called for, other times when it isn't. Where that flexibility comes in will have to be a matter of discussion and debate. However, careful readers will notice that I'm personally far *less* willing to sacrifice the concerns of indigenous peoples than I am to risk the *possibility* of a (slightly) increased risk of bird or bat fatalities (largely because, in the balance of things, in the big, global picture, birds and bats are still almost certainly better off with more wind power and less fossil energy) or the risk of a temporary lack of access for fishermen (as long as just transition, or at least economic alternatives are available for their survival needs). However, I'm neither God (nor do I wish to be) nor king of the world (ditto). I'm one person with opinions who believes in radical, direct democracy, so my opinion is only worth what everyone else is willing to grant it.

And, in most cases, imperfections can be made less so, even after a renewable energy facility is built, and what imperfections there are, often aren't inherent to the technology itself.

(2) Just about every argument against renewable energy developments, particularly (but not exclusively) utility scale wind farms, is in reaction to a problem created by *capitalism* rather than an inherent technological flaw - The careful reader who has managed to make their way through my entire chain of arguments here will have observed a common thread—if it weren't as painfully obvious as I've endeavored to make it: renewable energy's "greenness" from the extraction of its component materials, to its development and deployment, where it's located, how much the public benefits from it, how much it equalizes power (or doesn't), and it's impacts on the environment while it exists and operates, as well as what happens to the equipment and its component parts and materials at the end of its useful lifecycle largely depends on the balance of the forces that control it.

Lack of community benefits, exploited workers, growth-for-growth's sake, lack of free prior and informed consent, colonialism, extractivism, pollution, sacrifice zones, capital blight, excessive bird and bat fatalities, continued fossil fuel usage, habitat loss, loss of biodiversity, threats to the livelihoods of fishermen, you name it. All of it finds its root cause in an economic system where the wealth is appropriated and hoarded by the few in a privileged class at the expense of the many, including the workers performing the labor, the community hosting the activity, and the earth as a whole.

As I've thoroughly documented, there's not a problem associated with wind power (or renewable energy in general), that cannot be minimized, if not eliminated entirely, and usually the primary impediment is capitalist economic imperatives, particularly profit seeking and the drive towards capital accumulation.

(3) The most effective solution for the problems by imperfections as well as the flaws inherent in capitalist economics is a vibrant, rank-and-file, democratic, grassroots, working class centric movement that builds counter power to capitalism and/or bureaucratic authoritarian statism. This last point is true whether it involves renewable energy developments or anything else for that matter.

So, to answer the questions posed at the beginning:

Q: Is renewable energy (wind, solar, storage, geothermal both distributed and larger scale) actually "green" and/or ecologically sustainable?

A: Yes, under the right circumstances and conditions.

Q: Is renewable energy inevitably ultimately a green capitalist tool?

A: only if capitalists are allowed to make it such.

The answers are variable, but they ultimately depend on us.