

To: Washington State Building Code Council

Date: October 14, 2022

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By David Boleneus¹

This statement is directed to the building code council to address proposals for all-electric installation mandates that it may be considering. This statement shows that renewable-only all-electric systems that deny use of fossil fuels for the purpose are unworkable, and any all-renewable alternative is also unworkable, as it far exceeds reality and to is impossible to meet. The reason is simple: materials are not available from which to source materials.

1.0 Statement

A mandate to electric-only heating, cooling, cooking is irrational, unnecessary and imprudent without knowledge of impact of the change in the cost of electricity and without knowledge the impact of availability of electricity. Electric-only power will become more expensive as the mandate limits choice and quantity of energy. Electric-only power will become more expensive as renewable mandates are now in effect. Renewable power is sub-standard, experimental and part-time as it requires a second, backup source of energy that is reliable (coal, natural gas, nuclear, hydro). Mandating renewable forms implies that two power sources must be purchased because the unreliable form must have a reliable backup; this requirement increases cost by double or more.

1.1 Key Element Missing

A key factor imputed to an all-electric economy does not lie in the requirement or the mandate but the knowledge that the objective can be reached. Assessment of this objective or the finish line has never been attempted but is subject of the present discussion. This discussion centers on the limit to raw materials necessary to the task.

2.0 Proposal

The following proposals are unnecessary and irrational changes considering present circumstances and future conditions:

- To convert new-builds after 2023 to electric-only for heating, cooling, water heating and cooking
- To convert present housing to electric only heating, cooling, water heating and cooking (removing natural gas or other fossil fuel source) in the future
- To require electricity exclusively for transportation including adding in-home electric service to accommodate electric vehicle charging stations

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- The quantity of electricity demanded from home and transportation is unavailable and will not be available if fossil fuels are removed as supply options because reliance on renewables as substitutes is shown as ill-conceived and unworthy
- Total cost of present proposals to families will add these costs²

OPTION	COST	TRUE COST, 30-YEAR MORTGAGE	FAMILIES PRICED OUT OF HOUSING DUE TO COST
Electric vehicle supply	\$640	\$1,920	1,408
Heat pump heating, cooling	\$23,000	\$25,041 (GP2-065)	18,363
Heat pumps required	\$23,000	\$69,000 (GP2-073)	50,600
U-Factor Replacements	\$2,593	\$7,779	5,704
Allowed leakage rates	\$6,600	\$19,800	14,520
Wildland Urban Interface	\$31,212	\$124,056	68,666
Range Hood Ventilation	\$425	\$1,275	935

- These conversions are imprudent due to great expense and requirement for vast quantities of natural resources. These resources or raw materials are themselves unaffordable and impossible to obtain, globally.

3.0 Present circumstances

- Electricity is becoming unaffordable for low income groups so to expand need for electricity to represent a larger share will increase cost multi-fold. Further, the state requires by 2030 all electricity to come from renewable-only (non- fossil) sources will increase the cost electricity by multiples. In addition, any requirement to convert space heating by 6 to 8 times present rates (see UK, Germany, Ontario, Australia and EU experiences).
- Need to eliminate fossil fuels for any reason, including, as sources of space heating, water heating and cooking or related uses is unnecessary because factual evidence is unavailable to show fossil fuels or their resulting emissions a danger.
- A Fake Climate Emergency has been promoted by use of propaganda rather than fact. The fake climate emergency has created a real energy emergency with energy costs impacting all Washington residents. Washington's climate laws, the Clean Electricity Transformation Act, the Climate Commitment Act, other laws and Renewable Portfolio Standards are meant to avoid a climate emergency predicted yet no emergency exists and no climate emergency is at hand. Rather reasoning to pass such laws has relied on contrived data, political belief, illegal actions, actions contradicting clear guidance by federal agencies and unclear climate reasoning that remains clouded in political science rather than fact. Unfortunately, instead of recognizing that CO2 emissions are not an emergency, but a gift to producing more food and pursuing a long-term emissions-reduction policy of liberating low-carbon alternatives, our leaders declared "emergency" and started immediately restricting fossil fuels—with no viable replacement. Carbon dioxide is "greening the earth". CO2 has added two "green" continents the size of the United States in 33 years (18 million km²), that fundamentally changes water cycling making the world 14% greener in all types of vegetation while increasing crop productivity by 14%³;

² provided by BIAW building code briefing 2022_2

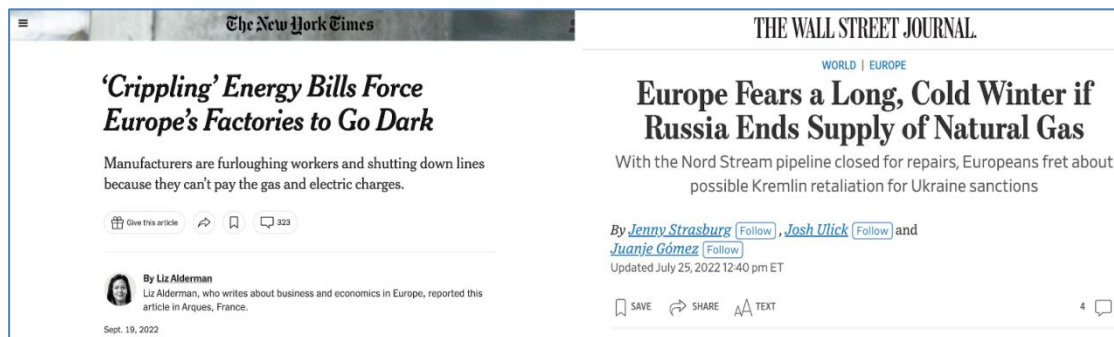
³ Zaichun Zhu, Beijing, 2016

"CO2 fertilization effects explain 70% of the observed greening trend" (*Greening of Earth and Its Drivers*. Nature Climate Change 25 April 2016, 6, 791-795)

NASA: Carbon dioxide fertilization greening Earth study finds

Indiana University: Rising levels of CO2 a key driver to dryland greening <http://wattsupwiththat.com/2016/02/16/study-increased-carbon-dioxide-is-greening-deserts-globally/>

- Restricting use of fossil fuels and mandating exclusive use of renewables as replacements is dangerous since these actions experiment with human lives, experiment with energy systems that are unproven and unfit for purpose and experiment with energy--the life-blood for society because the technology is experimental and unknown; experimentation with the backbone of society on which economies and societies rely without knowledge of impacts of actions is callous, reckless and invites unknown consequence; there is no guarantee that renewable can replace fossil fuels.
- Furthermore wide-scale reliance on renewable at a time when price of natural gas is also increasing, with natural gas the most important backup source of energy have both increased costs of electricity beyond reach of average families and stressed economies to point of de-industrializing, as in Germany. Germany's Energiewinde, the effort to replace fossil fuels by renewables, is making living more difficult, increasing the cost of electricity, and driving industry out of the country. It is a history of failure that all wishing for renewables should heed as a warning of consequences.⁴



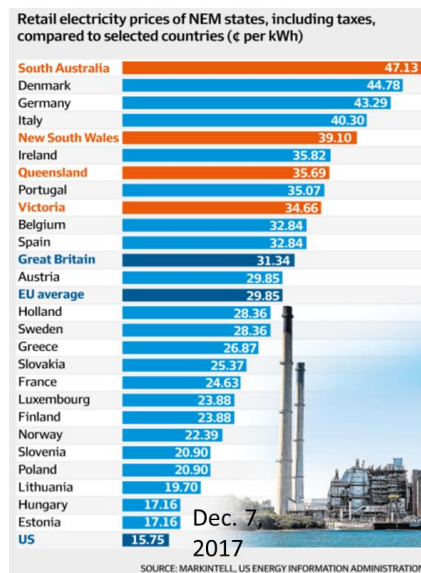
- Fossil fuels overall make us far safer from climate or climate emergencies by providing low-cost energy for the amazing machines that protect us against storms, protect us against extreme temperatures, and alleviate drought. For this reason it is irrational to abandon oil, coal or natural gas and switch to more expensive and unreliable electricity on the basis of propaganda and fake and unsubstantiated emergency. There is no truth to the idea that fossil fuels' CO2 emissions have contributed to the warming of the last 170 years. This warming has been mild—1° C, mostly in the colder parts of the world with the warming a result of multi-centuries-long

⁴ Vahrenholt, F., Germany's energiewinde, a disaster in the making. Global warming policy foundation

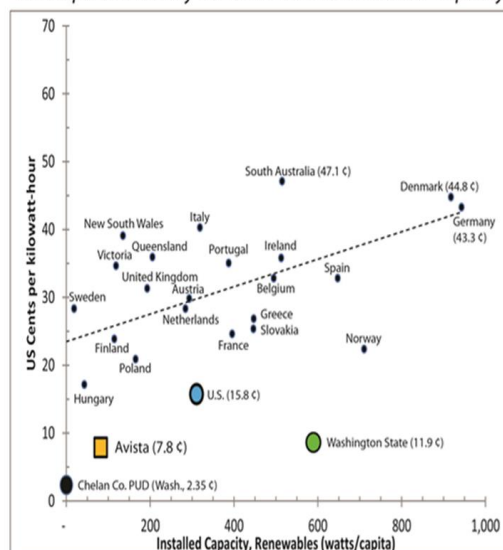
warming cycle of oceans that began before 1800. And life on Earth thrived (and was far greener) when CO2 levels were at least 5X higher than today's.⁵

- Electricity costs increase as fossil fuels become less available and increasing use of renewables. The reason for this is that renewables are unreliable and require full time backup from natural gas or coal-powered electric generation. The cost of electricity increases 20 cents per kilowatt-hour for each one kilowatt of renewable capacity added per person; the chart shows the cost of electricity in the mid-\$.40's per kwh in 2017 while costs today now exceed \$.50 per kilowatt-hour in Germany. The highest standards of living and strongest gross domestic product are achieved with greatest level of energy use, so throttling down use of electricity by requiring less reliable renewable energy while prohibiting natural gas is destructive to families and economies for the simple reason that renewables add huge costs without adding reliable benefits.^{6,7,8}

Electricity Cost vs. Pct. Renewables



Scatterplot: Electricity Costs vs. Installed Renewable Capacity



- At present, Governor Inslee and Senator Murray are considering removing the four hydroelectric dams on the Snake River. If removed, these four dams would eliminate 11 percent of the supply of cheap hydro-electricity available to Washington residents. Such a proposal threatens the supply of cheap electricity and family budgets as any proposal to increase the cost of electricity to be replaced by more expensive sources threatens livelihoods of Washington residents. Recently however this proposal has been shelved until alternatives can be developed.

A second document is appended to this comment entitled, IS OUR STATE COLLIDING WITH CLIMATE INSANITY. It provides backup information for the above comment. It is important but the key, most important message today follows which addresses resources in metal and material needs necessary to build a single (first) renewable system, and addressed in Section 4.0.

⁵ NOAA - Climate change rule of thumb: cold "things" warming faster than warm things "The best estimate of CO2 concentration in the global atmosphere 540 million years ago is 7,000 ppm, with a wide margin of error."

Patrick Moore - THE POSITIVE IMPACT OF HUMAN CO2 EMISSIONS ON THE SURVIVAL OF LIFE ON EARTH

⁶ Peter Huber and Mark Mills, The Bottomless Less, p. 136 (2006)

⁷ Bezdek, R., Carbon dioxide, social cost or social benefit, <http://www.misi-net/publications/USEA-1214.pdf>

⁸ <https://instituteeforenergyresearch.org/topic/policy/cap-trade/>

- MOST IMPORTANTLY, resources of building materials, metals, industrial commodities to build homes, industry will become unavailable to all citizens if conversion to all-electric (non-fossil sources) is required. Such a requirement is not only imprudent but also impossible and irrational. The reason for this is simple: the source commodities needed for the task from which materials are manufactured far exceeds the resources of source commodities available.

4.0 Sourcing of Materials to Build All-Electric Society

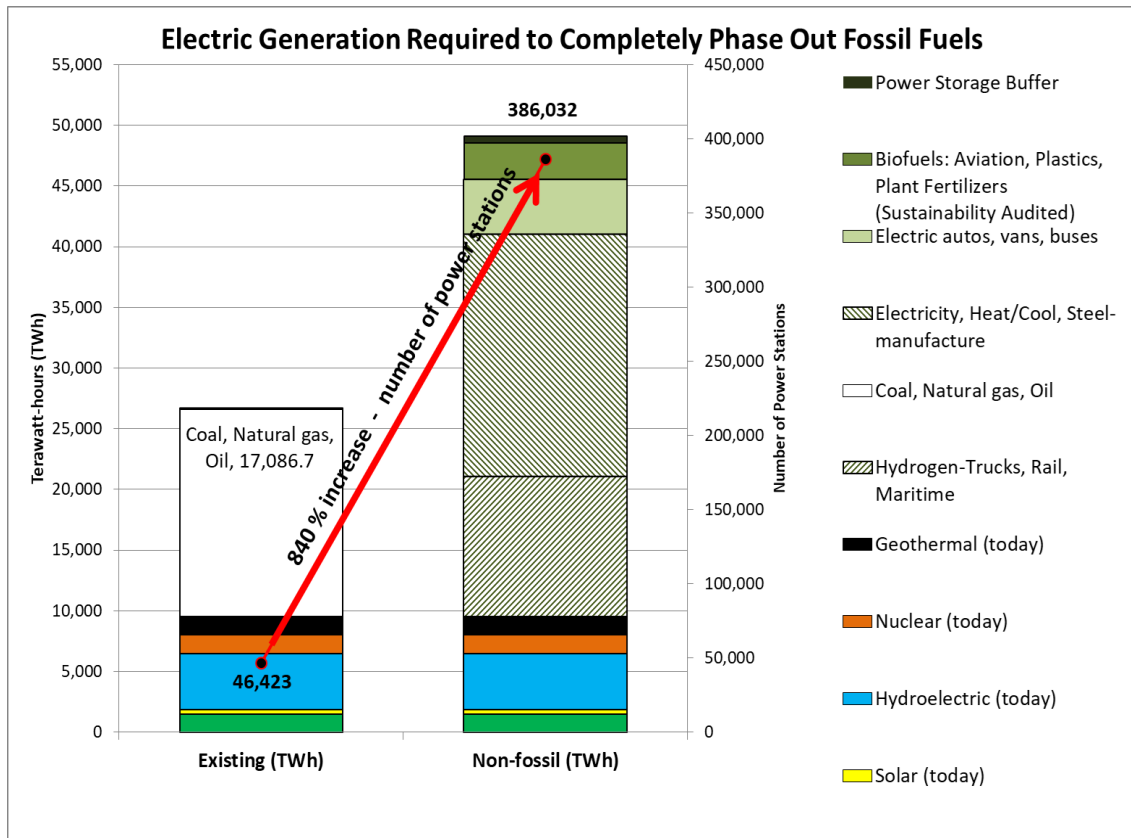
The following explains the cost and availability of raw materials required to build and all-electric society and economy. All-electric is taken to mean transportation, homes, industry, power generation, power storage that is fully electric without need of fossil fuels. Before requiring that all society become electric, society must plan and understand if the finish line is within reach. Such planning and understanding is missing in today's hurried mandates to electrify.

Important discussions have been undertaken by geologists and engineers with a competent contribution published by Professor Simon Michaux⁹¹⁰ with the thorough analysis entitled The Quantity of Metals Required to Manufacture Just One Generation of Renewable Technology to Phase Out Fossil Fuels. Michaux addresses what is required to eliminate fossil fuels for all uses in auto, truck, rail and maritime transportation, homes, industry, manufacturing, power generation, power storage, batteries, including a hydrogen economy and the new power generating facilities envisioned as replacements, globally. This is an all-encompassing global assessment of what must be replaced and what is needed for the task. The objective for transportation is to replace 695 million passenger autos, worldwide with about 40% of those found in the U.S., but also buses, heavy and light trucks, trains, and ocean shipping.

The following chart (Electric generation required to completely phase out fossil fuels) shows the coal, natural gas and oil that must be eliminated (17,086 terawatt-hours) by sourcing the materials and building power storage, biofuels, electric transport, electric infrastructure and a hydrogen economy. Existing geothermal, nuclear, hydroelectric, wind and solar remain in place with fossil fuels eliminated. Less than 10,000 TWh must expand to nearly 50,000 TWh with the number of power stations increasing from 46,423 today to 386,032 power stations when complete, an increase of 840% to represent only a first generation replacement.

⁹ The Quantity of Metals Required to Manufacture Just One Generation of Renewable Technology to Phase Out Fossil Fuels <https://www.youtube.com/watch?v=MBVmnKuBocc&t=2611s>

¹⁰ Assessment of the extra capacity required of alternative energy electrical power systems to completely replace fossil fuels, Simon Michaux https://tupa.gtk.fi/raportti/arkisto/42_2021.pdf (full version report)



This task involves these additions:

	Terawatt-hours	Number of stations	Size, each MW
Hydroelectric	4,809	3,628	151
Nuclear	2,701	211	1,461
Wind	13,800	169,867	9.3 MW
Solar	13,800	393,840	4 MW
Geothermal, tidal	266	442	68.7
Biowaste	624	18,044	3.9
Storage (battery)	549	15, 635,478	100 (129 MWh)

The topic of stationary battery storage is an interesting topic to address. Prof. Michaux estimates 549 TWh are required. Tesla's Elon Musk supplied the Hornsdale battery storage to South Australia several years ago for a cost of approximately \$150 million. The 100 MW Hornsdale battery is backup for the Hornsdale 100 MW wind turbine system. The battery storage considered in the plan discussed requires 15,635,478 Hornsdales. Experience during a power outage in South Australia soon after completing construction in January 24-28, 2019 showed that Hornsdale provided a little power (few percent) before discharging after 2 hours, after the wind turbines fell quiet from 1929

MW to 76 MW (3.8%) at 8 pm proving that battery systems are unfit for purpose¹¹¹²¹³. Following this 200,000 homes went dark, power prices spiked to \$14,400 per MWh (\$14.40/kwh). Australia's operator ordered all private solar panels shut down to avoid supply shocks, the Alcoa aluminum and Whyalla steelworks shut but failed to order diesel generators turned on. Finally on day 4, the market operator ordered diesel generators turned on

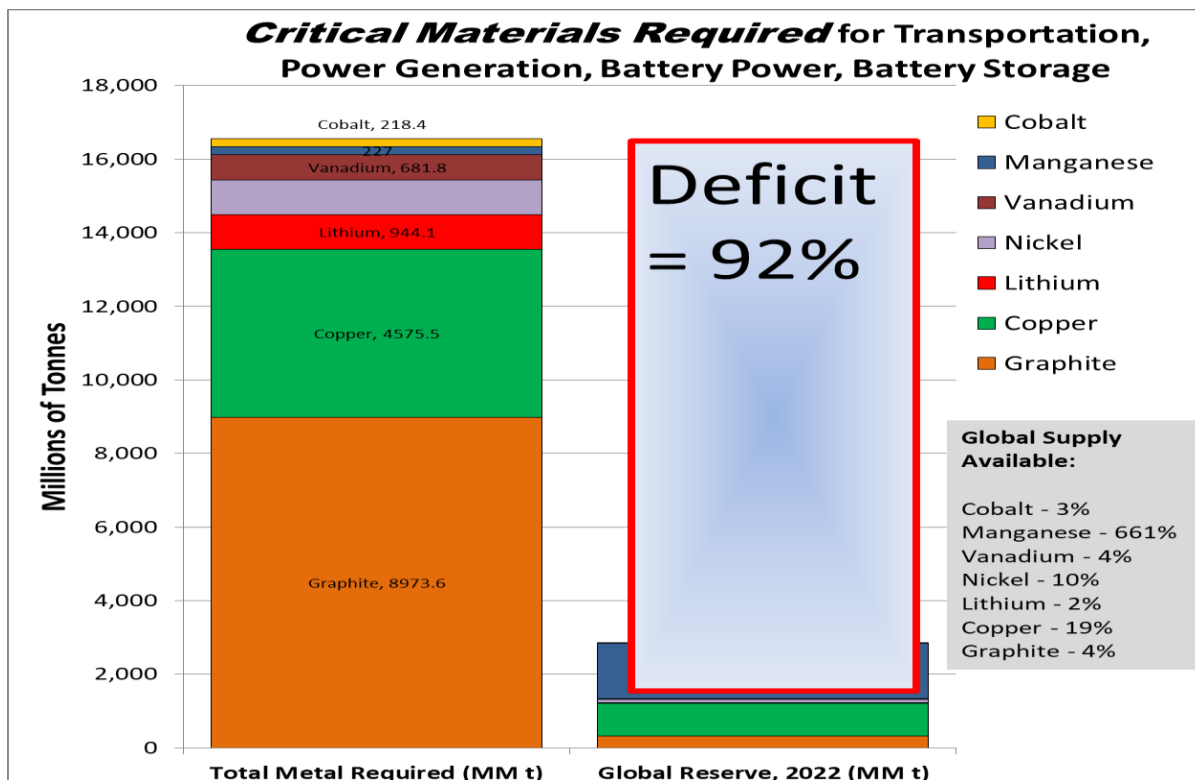


The list of the metals and materials is enormous, including steel, aluminum, copper, zinc, magnesium, manganese, chromium, nickel, lithium, cobalt, graphite, molybdenum, silicon, silver, platinum, vanadium, zirconium, and rare earth metals, neodymium, germanium, lanthanum, praseodymium, dysprosium, terbium, hafnium, and yttrium. Most notable for the quantities demanded are those underlined for these materials are limited in supply with these supplies placing limits on building needed facilities. The chart below (Critical materials required for transportation, power generation, battery power, battery storage) shows available resources globally and required quantities. More than 16,000 MM tonnes are required of this list of key materials yet less than 2,000 MM tonnes are available. For example, global cobalt resource can meet only 3% of need, vanadium, only 4%, nickel only 10%, lithium 2% of what's needed, copper only 19% of need and graphite only 4% of what's needed. Copper for example is required in wind turbines, solar panels, nuclear plants, hydroelectric plants, electric vehicles, batteries for electric vehicles and for stationary battery storage. Cobalt, vanadium, nickel, lithium, manganese and graphite are all needed for batteries for vehicles and stationary electric storage. The lack of these materials and materials places severe limits to build renewable system. In short, it cannot be done. A first generation of renewable systems is impossible given this limitation to supply.

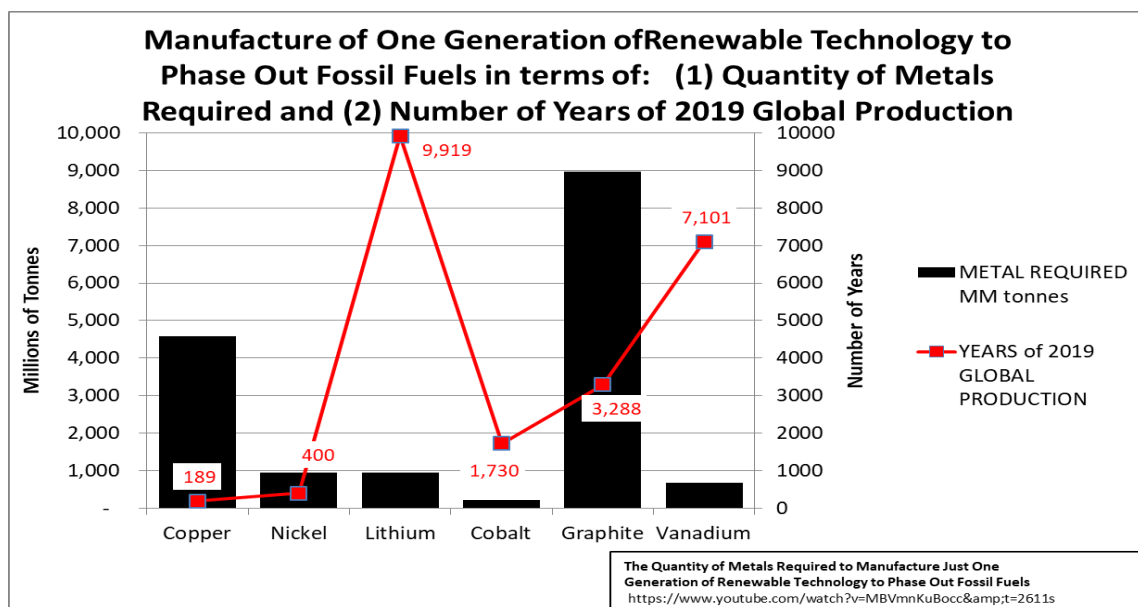
¹¹ <https://notalotofpeopleknowthat.wordpress.com/2019/01/27> Misconceptions about battery storage

¹² Elon Musk's Giant Lithium Battery Never Designed to Deliver GridScale Power
May 28, 2019 by [stopthesethings](https://stopthesethings.com/2019/05/28/total-joke-elon-musks-giant-lithium-battery-never-designed-to-deliver-grid-scale-power/) 8 Comments<https://stopthesethings.com/2019/05/28/total-joke-elon-musks-giant-lithium-battery-never-designed-to-deliver-grid-scale-power/>

¹³ Grid Scale Battery Nonsense 2019 April 5, 2019<https://wattsupwiththat.com/2019/04/05/grid-scale-battery-nonsense-2019/>



One might ask: how long will the shortage last or how quickly can the short supply be remedied. This short answer is it cannot. The chart below (Manufacture of one generation of renewable technology...) shows that at the current rate to produce copper that 189 years are required to satisfy the first generation of renewables. The nickel, lithium, cobalt, graphite and vanadium needed for batteries requires from 400 years of production at the rate produced in 2019 (worldwide) to 9,919 years of production at the rate produced in 2019 (worldwide).



There are substantial behind-the-scene impediments to providing supply that are unseen. To build an electric auto requires 200 lbs copper, 25 lbs lithium,, 60lbs vanadium, 30 lbs cobalt, 400 lbs aluminum, and 1200 lbs steel and 60 lbs nickel with this quantity requiring mining of 528,000 lbs of metals and waste earth from which to extract the metals in addition to 17.5 M gallons fuel to operate equipment. Today, the **Biden Administration** is focusing on stopping the permitting of two copper mines in Arizona an one in Alaska that might provide supplies of copper after succeeding to stop the permitting of a cobalt-copper mine in Minnesota. Washington's **Senator Maria Cantwell** expended great effort to halt permitting of a mine in Washington for 15 years beginning in 1997 before the operator successfully opened the mine. This mine provided employment for over 600 people.

Today's electric vehicles can travel 3 miles on one kilowatt-hour of electricity. The EV can travel 100 miles on 57 lbs coal or 100 miles on 4 gallons of fuel. Today 12 states in the U.S. rely on more than 50% of electricity generated by coal. Renewables provide significantly less power at very high cost. A solar PV plant costs \$8 million per megawatt and a wind turbine costs \$5 million per megawatt to generate electricity (2017), or 1720 and 1075 times more costly, respectively, than coal or natural gas plants. A wind turbine requires 2 tonnes copper per megawatt of turbine capacity so a 2 MW turbine requires 4 tonnes copper with the amount of copper for one turbine requiring mining of 32,000 lbs of earth. A solar PV or wind turbine plants require 350X or 750X more land, with efficiencies 1/10 or 1/5, respectively, of coal or natural gas plants.¹⁴ The land area required to deploy wind turbines and solar panels, combined for the first generation of renewables as set out by Professor Michaux would require an area of 2,763,000 square miles, an area equal to all land areas of 24 of the largest states in the United States. Demand for such a large area to deploy instruments that provide only part-time, and intermittent power is simply unacceptable, foolish, and irrational.

5.0 Conclusion

To conclude, for reasons of cost, quantity of materials and unacceptable requirement for land area, one must conclude that switching to renewables is not acceptable and that the United State, the world, and the State of Washington cannot pursue mandates to require trading fossil fuels for renewables. Such a trade-off is simply untenable.

A wise decision would be that the Building Code Council not mandate any sort of all-electric system that cannot be met because it denies fossil fuels for any reason, or cannot be built or cannot occur for a simple reason: it is simply impossible as required raw materials are available, ANYWHERE IN THIS WORLD.

¹⁴ (1) Energy Infor. Admin., 2020 (2) World Bank; US Geological Survey (3) Bonneville Power Admin

