The Biden administration, along with many Democratic members of Congress, is promising radical changes to the nation’s energy infrastructures. The goal of “The Biden Plan to Build a Modern, Sustainable Infrastructure and an Equitable Clean Energy Future”—the latest version of a Green New Deal—is to entirely replace hydrocarbons used to generate electricity by 2035 and put batteries on a fast track to replace internal combustion engines in most cars. The physics of energy, as well as the realities of production at an economy-wide scale, means that the administration’s plan is not remotely plausible and that attempting to implement it would lead to massive environmental disruption and increased U.S. economic vulnerability.

Hydrocarbons—oil, natural gas, and coal—currently supply 80% of the nation’s energy needs, and internal combustion engines account for 99% of all transportation passenger-miles. The proposals to upend the status quo are directed mainly at mandating and subsidizing a greater use of wind and solar power (currently 3.6% of U.S. energy supply) and electric cars (currently less than 0.5% of vehicles on the road).

Understanding the (unintended) consequences of the incoming administration’s (and other similar) green energy proposals begins with recognizing a central fact about all means for delivering energy to society. Every type of energy machine must be fabricated using materials and minerals extracted from the earth. Since machines wear out, there is nothing actually “renewable” about so-called renewable energy machines because one must engage in continual extraction of materials to continually build new ones to replace those that wear out. All this requires mining, processing, transporting, and, ultimately, disposing of millions of tons of materials. And all those activities have costs as well as environmental and geopolitical impacts.
Consider these three fundamental truths:

1. A wholesale replacement of America’s huge energy infrastructures would be prohibitively expensive and take far longer than the administration’s goals suppose.

The Biden plan proposes spending $2 trillion on “accelerated investment” across seven enormous domains, only one of which is the power sector (the others include infrastructure, mass transit, buildings, housing, the auto industry, and agriculture, as well as “innovation”). But for the power sector alone, it would cost at least $5 trillion in wind/solar and battery systems to replace all the existing machines that currently burn natural gas and coal to supply America’s electricity. That total would have to increase significantly to build enough additional power plants to fuel electric vehicles. Money aside, even if were possible to build that much capacity that fast, the outcome would reduce global carbon dioxide emissions by less than 6%. And that would have come at a total cost averaging out to roughly $50,000 per U.S. household.

Replacing, by 2035, the natural gas and coal power plants currently used to supply 65% of U.S. electricity would require a utility construction program adding “green” power plants at a continuous rate at least 600% faster than any single peak year for utility construction in the U.S., China, or Germany over the past half-century.

Instead of looking at the 2035 goal in hardware or dollar terms, consider the challenge in terms of the necessary rate of increase in green energy production. The output from America’s wind/solar sector would need to expand by at least 600% over the next 15 years to replace the energy that utilities obtain from natural gas and coal. For perspective, U.S. wind and solar energy today, combined, produce about the same amount of energy as did all of America’s oil fields in 1922. From then, it took 50 years—not 15 years—for U.S. oil production to expand by 600%.

2. The environmental impacts associated with the energy materials needed to build a hydrocarbon-free energy future are enormous, though mostly hidden from public view.

Over the years, concerns have been raised about the fact that green energy requires far more land to produce the same amount of energy output produced by hydrocarbons. As a result, aesthetic and environmental concerns have led to a steady rise in local opposition to sprawling wind/solar farms. But a more significant issue, largely hidden from sight, is the quantity of materials needed to build wind/solar and battery machines in the first place. As the World Bank has noted, the “technologies assumed to populate the clean energy shift . . . are in fact significantly more material intensive in their composition than current traditional fossil-fuel-based energy supply systems.”

The largest share of tonnage is found with conventional materials such as concrete, steel, and glass. Compared with a natural gas power plant, wind and solar farms require using at least 10 times as many total tons of those materials to deliver the same quantity of energy. For example, building a single small 100-MW wind farm requires some 30,000 tons of iron ore and 50,000 tons of concrete, as well as 900 tons of nonrecyclable plastics for the huge blades. Building a solar farm uses a 150% greater tonnage than that, in order to produce the same energy output. Thousands of such wind/solar farms will be needed to generate electricity without hydrocarbons.

This says nothing about the mining necessary to extract the various minerals needed to build critical components for wind turbines and solar panels. Many different elements are essential, from the so-called rare-earth minerals (such as neodymium, which is used to build electric motors/generators) to the more familiar copper and nickel. Wind and solar power, as well as EVs, use two- to several-fold more copper per unit of energy delivered. The global push for EVs alone will drive a 200%–8,000% increase in demand for mining a wide array of critical energy minerals. Australia’s Institute for Sustainable Futures cautions that a global gold rush for these minerals will take miners into “some remote wilderness areas [that]
have maintained high biodiversity because they haven’t yet been disturbed.” Mining can be done in an environmentally responsible way, but new mines aren’t likely to open in America.

3. A massive increase in wind/solar power and battery-driven vehicles will radically increase America’s geopolitical vulnerability.

The pursuit of a hydrocarbon-free future would lead to a complete reversal of U.S. import dependencies and the creation of new geopolitical challenges. The U.S. is essentially self-sufficient in petroleum and a net exporter of natural gas as a direct consequence of the shale-fracking revolution. But virtually all the demand for critical green “energy materials” will come from imports. As it stands, America is 100% dependent on imports for some 17 key minerals and imports over half its needs for another 29.

China, for example, supplies about 90% of rare-earth elements to the world. China has also, more quietly, gained control over half of cobalt and manganese refining critical for battery chemistries. In early October 2020, the Chinese government advanced legislation to be enacted in 2021 that will “allow” the banning of exports of “strategic minerals” to companies and nations that China considers a national security threat. Some battery chemistries use less cobalt, for example, but more nickel instead; Russia is one of the world’s biggest nickel exporters. But in the near future, America won’t need to source foreign minerals as inputs to build solar/wind machines because 90% of solar panels are imported, as are 80% of the key power components for wind turbines. Similarly, Asian companies utterly dominate global battery production today and account for 80% of all planned battery factories.

In any event, policymakers who want to encourage wind and solar power, as well as storage batteries, should rather focus on removing barriers to expanding domestic mining and mineral refineries. In terms of the environment, China is now the world’s largest emitter of carbon dioxide, accounting for 30% of global emissions—twice the share as from the United States. Over the past several years, Beijing has brought online more new coal power plants than the rest of the world combined. In 2020, China’s government approved plans to build twice as many more yet.

Read more

Mills, “The ‘New Energy Economy’: An Exercise in Magical Thinking,” Manhattan Institute, March 2019
Philip Rossetti, “What It Costs to Go 100 Percent Renewable,” American Action Forum, Jan. 25, 2019
“Commodities at a Glance: Special Issue on Strategic Battery Raw Materials,” United Nations Conference on Trade and Development, 2020
Endnotes

2 “U.S. Passenger-Miles,” Bureau of Transportation Statistics.
3 “U.S. Energy Facts Explained,” Energy Information Administration (EIA), April 2020; Bureau of Transportation Statistics.
5 “The Biden Plan.”
9 Statista, “Number of Households in the U.S. from 1960 to 2020.”
11 EIA, “Petroleum & Other Liquids.”
16 DOE, “Quadrennial Technology Review.”
As President Biden assumes office, his administration and the 117th Congress face several pressing tasks. Among them: accelerating the pace of recovery from the pandemic, helping to get schools reopened and students back on track, and restoring safety to the many American cities afflicted by unrest and rising violence. In these briefs, Manhattan Institute fellows offer actionable ideas for the new government—proposals for educational pluralism, executive branch prudence, economic revitalization, evidence-based criminal justice reform, fair and efficient health care, near-term fiscal relief, and long-term fiscal discipline. Each brief contains specific recommendations for Congress or the new administration, along with links to further reading. Taken together, these recommendations represent an agenda for fostering the growth and opportunity that America desperately needs in the wake of the pandemic.