

Subcommittee on Energy
Hearing on
“Generating Equity: Improving Clean Energy Access and Affordability”
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The Honorable Bill Flores (R-TX):

1. In testimony before the Senate Energy and Natural Resources Committee in April 2019, you asserted that:
 - Electricity is the world’s most important and fastest-growing source of energy.
 - Electricity production accounts for the biggest single share of global carbon dioxide emissions: about 25 percent.
 - Third, regardless of what happens in the future –whether the global climate gets hotter, cooler, or more extreme – we are going to need vastly more electricity than what is currently being consumed around the globe.

In that same testimony you also assert that (1) “renewables are not enough;” and (2) “natural gas and nuclear offer the best “no-regrets strategy.”

- a. Would you elaborate on those two points, paying particular attention to the costs and resources required for each?

RESPONSE:

Renewables are not enough.

Numerous analyses have found that renewable energy sources cannot, will not, be able to provide the vast scale of energy required by the American economy at prices consumers can afford.

The fundamental, incurable problem with wind and solar energy is that they require too much land and too many other resources, including steel, concrete, copper, and other minerals. Thus, trying to deploy wind and solar at the terawatt scale (one trillion watts) will require more land and minerals than can possibly be set aside for them. Add in the problem of intermittency and the challenge becomes more obvious.

I will focus on two issues: Land-use and cost.

Over the past few years, numerous papers have been published by academic and environmental groups that claim the United States can run its entire economy solely on renewables. However, all of these analyses rely on the vacant-land myth – the faulty notion that there is an endless amounts of unused, uncared-for land out there in flyover county that’s ready and waiting to be covered with forests of renewable-energy stuff. The truth is quite different. Rural communities – even entire states – are resisting or rejecting wind, solar, and high-voltage transmission projects and that opposition is already slowing the growth of new renewable capacity in the US, Canada, and Europe.

Since 2015, I have been tracking rural opposition to wind energy projects. By my count, more than 280 government entities from Maine to California have moved to restrict or reject wind projects.

This can easily be seen in California, which has a 60-percent renewable electricity mandate by 2030.¹ But wind energy is so unpopular in California that the wind industry has nearly given up trying to site any new turbines in the state. In 2019, California’s wind energy capacity was about 5,973 megawatts. That’s essentially the same amount as the state had in 2013.²

In 2019, San Bernadino County banned large-scale renewable projects. San

¹ <https://www.npr.org/2018/09/10/646373423/california-sets-goal-of-100-percent-renewable-electric-power-by-2045>

² http://www.energy.ca.gov/almanac/electricity_data/electric_generation_capacity.html

Bernadino County is the largest county, by land area, in the country. It covers more than 20,000 square miles.³ It's already home to two big thermal-solar projects, including Ivanpah and Abengoa Mojave.⁴ The county's new regulations prohibit new renewable projects if more than half of the energy produced from them is to be exported out of the county.⁵ In other words, San Bernadino County doesn't want to be an energy plantation for people who live in other places. Furthermore, In March, the Santa Barbara County Board of Supervisors rejected plans that called for 29 wind turbines to be built near the town of Lompoc.⁶

Or look at New York, where Gov. Andrew Cuomo has mandated that the state be obtaining 50 percent of its electricity from renewables by 2030.⁷ But wind energy in New York is so unpopular the state has implemented a regulation that allows state officials to override objections from local communities and effectively force them to accept large wind projects.⁸ Opponents of this regulation recently wrote that the new measure shifts "approval power away from the local government where the project will be built, giving that power to Albany and the developers, eroding home rule... we are concerned about the impacts of centralized energy project siting and the erosion of local control over the use of our land."⁹

Now let's consider the cost of attempting to rely solely on renewables. Last year, the energy consultancy Wood Mackenzie estimated that "full decarbonization of the U.S. power grid" would cost about \$4.5 trillion. The firm said that "From a budgetary perspective, the cost is staggering at US\$35,000 per household – nearly US\$2,000 per year if assuming a 20-year plan."¹⁰

Recall that Wood Mackenzie's \$4.5 trillion figure only accounts for eliminating carbon dioxide emissions from electricity generation, and does not include the untold trillions that would have to be spent decarbonizing industry and

³ <https://pv-magazine-usa.com/2019/03/01/san-bernardino-county-bans-large-scale-solar-wind-in-some-areas/>

⁴ https://www.drecp.org/counties/factsheets/San_Bernardino_county.pdf

⁵ <http://cob-sire.sbcounty.gov/sirepub/cache/2/petc1qzvuo3i5mxrzm02tmst/234561403062019051717204.PDF>

⁶ https://syvnews.com/news/local/govt-and-politics/santa-barbara-county-supervisors-deny-appeal-of-lompoc-area-wind-project-design/article_989f95c3-0ca4-59ba-b40f-d410c78040ab.html

⁷ Kit Kennedy, "New York Adopts Historic '50 by 30' Renewables Goal," NRDC.org, August 1, 2016, <https://www.nrdc.org/experts/kit-kennedy/new-york-adopts-historic-50-30-renewables-goal>

⁸ <https://www.governor.ny.gov/news/governor-cuomo-announces-new-proposed-regulations-part-accelerated-renewable-energy-growth-and>

⁹ https://buffalonews.com/opinion/another-voice-home-rule-s-under-siege-in-state-s-energy-siting-act/article_21952caa-1994-11eb-89ad-13e232c8d5e4.html

¹⁰ https://www.woodmac.com/news/feature/deep-decarbonisation-the-multi-trillion-dollar-question/?utm_source=gtmarticle&utm_medium=web&utm_campaign=wmpr_griddecarb

transportation.

In short, whenever policymakers are considering climate-related measures that require changes in the energy and power mix, they must be attentive to the issue of cost as any major increases in the cost of electricity, natural gas, or motor fuel will hurt low- and middle-income consumers.

Natural gas and nuclear offer the best no-regrets strategy.

Any effort to reduce the carbon intensity of the American economy must acknowledge the need for energy sources that are scalable, low-carbon, and affordable. Natural gas and nuclear fit those criteria.

Natural gas is the cleanest of the hydrocarbons. Its use can help reduce the growth of carbon dioxide emissions. The reasons for this are obvious: gas is scalable, relatively low-carbon, and it can be used to replace coal in the electricity sector and oil in the transportation sector. Substituting gas for those fuels helps reduce air pollution and greenhouse gas emissions. During combustion, gas emits almost zero sulfur dioxide and it produces about half as much carbon dioxide as coal and about 30 percent less than diesel fuel or fuel oil.¹¹

Thanks to the shale revolution, which combines innovations in horizontal drilling, hydraulic fracturing, and related technologies, the US has become the world's biggest and most important gas producer. Indeed, the growth in domestic gas production has been nothing short of astonishing. Since 2005, US gas production has roughly doubled and the United States has become a major exporter of the fuel. Continuing to utilize natural gas here at home will help further reduce domestic emissions. In addition, the export of American LNG will help other countries reduce their emissions.

We also need more nuclear energy. There is no credible pathway toward decarbonization that doesn't include nuclear. That is the consensus among the world's top climate scientists and energy analysts.

In 2013, James Hansen and three other climate scientists wrote an open letter to environmental groups encouraging them to support nuclear. They wrote that

¹¹ NaturalGas.org, "Natural Gas and the Environment," undated, <http://naturalgas.org/environment/naturalgas/>

“continued opposition to nuclear power threatens humanity’s ability to avoid dangerous climate change...Renewables like wind and solar and biomass will certainly play roles in a future energy economy, but those energy sources cannot scale up fast enough to deliver cheap and reliable power at the scale the global economy requires.”¹²

In 2015, the International Energy Agency declared that “Nuclear power is a critical element in limiting greenhouse gas emissions.”¹³ It went on, saying that global nuclear generation capacity, which in 2018 totaled about 375 gigawatts, must more than double by 2050 if the countries of the world are to have any hope of limiting temperature increases to the 2-degree scenario that is widely agreed as the acceptable limit.¹⁴

Despite these facts, the domestic nuclear sector continues to shrink as more plants are prematurely shuttered in several states, including New York and California. Earlier this year, one of the two operating reactors at the Indian Point Energy Center in New York was prematurely shuttered. The remaining reactor is slated for closure next April.¹⁵ More plants in Illinois and elsewhere are also slated for premature closure.¹⁶

Nuclear reactors are emissions-free. They emit no carbon dioxide, no air pollutants such as sulfur dioxide, oxides of nitrogen, and no particulates, all of which are linked to adverse health and environmental impacts.¹⁷

In addition, nuclear energy has very high power density, meaning it doesn’t need much land.¹⁸ For example, the Indian Power Energy Center in Buchanan, New York, sits on about one square kilometer of land. Prior to the closure of Unit 2, the plant could generate 2,060 megawatts of electricity. Thus, the power density of the nuclear plant was about 2,100 watts per square meter (W/m²). For comparison, the

¹² Ken Caldeira et al. November 3, 2013, <https://plus.google.com/104173268819779064135/posts/Vs6Csiv1xYr>

¹³ IEA, “Taking a fresh look at the future of nuclear power,” January 29, 2015, <http://www.iea.org/newsroomandevents/news/2015/january/taking-a-fresh-look-at-the-future-of-nuclear-power.html>

¹⁴ World Nuclear Association data: <http://www.world-nuclear.org/info/current-and-future-generation/nuclear-power-in-the-world-today/>

¹⁵ <https://nypost.com/2020/04/29/indian-point-nuclear-reactor-shutdown-a-huge-blow-to-nys-environment/>

¹⁶ <https://www.forbes.com/sites/robertbryce/2020/08/31/nuclear-plants-in-illinois-are-slated-for-closure-will-the-states-democratic-politicians-save-them/?sh=74cfa4d811ef>

¹⁷ U.S. EPA, “Health and Environmental Effects of Particulate Matter.” <https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm>

¹⁸ For an exhaustive discussion, see Vaclav Smil, *Power Density* (Cambridge, MA: MIT Press 2015).

power density of wind energy is about 0.5 and 1.5 W/m².¹⁹ That paltry power density means generating large amounts of energy from wind turbines will require enormous quantities of land. That was made clear by author Vaclav Smil in his 2010 book, *Energy Myths and Realities: Bringing Science to the Energy Policy Debate*. Smil wrote that relying on wind turbines to supply all US electricity would “require installing about 1.8 terawatts of new generating capacity,” which he explained, “would require 900,000 square kilometers of land.”²⁰ For perspective, that’s a land area twice the size of the state of California.

Finally, nuclear energy provides baseload energy. Unlike renewable sources, which must be backed up with other fuels, and in particular, natural gas-fired generators, nuclear units provide stable, always-on power. That always-on power helps assure grid stability and assures that electricity is always available in large cities and industrial facilities.

In summary, the US leads the world in natural gas production. It also produces more nuclear energy than any other country. If the US wants to reduce its emissions while keeping energy prices low, it should prioritize the use of natural gas and nuclear.

END

¹⁹ Vaclav Smil, *Energy Myths and Realities: Bringing Science to the Energy Policy Debate*, (Washington, DC; The American Enterprise Institute for Public Policy Research, 2010), 64-68.

²⁰ *Ibid*, 125.