Questions for the Record Responses
Natural Resources Committee: Subcommittee on Indian and Insular affairs
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OFRs from Chairman Westerman:

1. How much does it generally cost for state or territory to transition to renewables?

It is hard to estimate a firm number for a variety of reasons. One, no state or territory has come anywhere close to actually transitioning to renewables if we mean wind and solar (if hydroelectric generation is included, there are a few states that get close). Two, every states' electricity situation is different: some states are members of cross-state markets, some states rely heavily on imports, some states allow natural gas to be used to backup wind and solar, and so on.

What we can say generally is that the states with the most aggressive pro-W+S mandates, regulations, and subsidies also tend to have the highest electricity rates in the country. California consistently has been at or near the top of highest electricity prices in the continental U.S., followed by all the states in the northeast. This pattern can be seen in other parts of the world like Europe, Canada and Australia where higher W+S reliance correlates with higher than average electricity rates.

2. Do you have an estimate on the impact of renewable energy transition has on utility prices here in the U.S.?

As described in the previous response, estimating a firm number is difficult for a variety of reasons, there are many factors that impact utility rates, everything from the rate setting process, consumer demand, state regulations, market design, and many more.

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It is very clear that W+S at the grid level are very expensive. At the individual turbine, electricity appears cheap when the wind is blowing. However, the extra cost to the grid of building transmission, backup capacity, and balancing intermittency makes solar and especially wind

extremely expensive at the grid level. This means higher electric rates, and these costs only increase as the percentage of renewable generation increases.

3. Why are baseload options such as natural gas and coal much more reliable and cheaper than renewables?

On reliability, both coal and natural gas are dispatchable, they can be turned on and off, and generation can be increased or decreased, in relatively short periods of time. This means that they are ideal for responding to electric load that fluctuates throughout the day. This responsiveness makes for a more reliable electricity supply in contrast to W+S which operate on their own schedule subject to the weather. It is notable that even in states and countries that have high percentages of electricity coming from W+S, these countries mostly maintain natural gas generation capacity to backup W+S intermittency.

This intermittency is also why coal and natural gas are almost always cheaper to run at a grid level. In order for W+S heavy grids to provide reliable electricity, huge additional spending on transmission, backup, and balancing are required, spending that is largely unnecessary for a coal or natural gas based grid. In order to have a heavily W+S grid, you essentially have to overbuild, replicating the grid several times: extra W+S, extra transmission, battery or natural gas backup supply. There has to be a lot of duplication to try to account for weather unreliability, and that is expensive to build and maintain.

4. Where are the minerals being used to make solar panels in the U.S. coming from? Are they from the U.S.? Allied or partner countries? Our adversaries?

It of course depends on the specific minerals needed, but the supply chains for most mineral inputs to solar panels are dominated by China, as is the supply of finished panels. Even when the mining of a mineral happens elsewhere (e.g. cobalt from Congo, or nickel from Indonesia), the processing of those minerals happens in China or are processed in other countries by Chinese companies. This dominance is similar in the supply chains of batteries, which are the posited backup for most solar projects. While some mineral input processing, for example for copper and aluminum, are relatively well distributed around the world (though China is usually the largest single processor), other minerals are heavily Chinese controlled. For example, silicon is around 80% Chinese processed, and rare earths, several of which are used in solar panels, are around 85% Chinese processed. Dominance in some battery minerals is even more significant: China controls over 90% of manganese processing and around 100% of graphite processing.

Even when the U.S. mines a mineral domestically, it is often still processed through Chinese supply chains. For example, the rare earth minerals produced at the Mountain Pass mine in California have to be shipped to China for processing.

5. Would it be fair to say that the Biden administration's restrictions on deep-sea mining and natural gas, coupled with the prioritization on renewables, are severely limiting our energy generation potential and pushing us to rely more on the People's

Republic of China?

Certainly. The Biden administration's mining restrictions eliminate any possibility of breaking Chinese supply dominance mentioned in the previous response. And restricting supply of natural gas, of which the U.S. has hundreds of years-worth of reserves, would mean that our energy needs have to be served by imports. China has heavily subsidized the development of batteries and renewables because it does not have the domestic energy reserves (other than coal) that the U.S. is blessed with. Hampering domestic mineral and energy production means relying on foreign sources of those resources.