

The Honorable Frank Pallone, Jr. (D-NJ)

- I. I would like to understand the potential impacts of cryptomining activities on affordability. In your testimony you said that the growth and evolution of the cryptomining industry presents “a unique set of load growth challenges” and that “not managing these risks can lead to significant cost exposure for a utility’s other customers.”

Please explain what some of those risks are.

- a. Cryptocurrency mining creates a unique problem for an electric utility to manage and recover costs due to the portability of the machines, relatively short life of the assets (the mining machines) combined with a nascent industry that is still establishing its foundation for long-term viability. The ability to leave a location on short notice due to a better price somewhere else, a regulatory change or a decline in cryptocurrency value is different from what utilities traditionally address where there would be a substantial, more permanent investment on both sides of the meter. With cryptocurrency mining the utility is financially exposed to providing transmission and distribution which generally requires a capital investment spread over a long-life asset. The utility is also financially exposed if it is either building generation that could go unutilized or underutilized or by committing generation to serve cryptocurrency load that would otherwise be sold for a higher long-term value. This is particularly a problem for a consumer owned utility where the infrastructure investments are being made in effect by the people who live in the service territory.
- II. How can communities make sure that everyday ratepayers do not find themselves bearing the cost of this industry?
 - a. In Chelan’s case, we put in place tariffs that collect upfront for capital investment necessary for transmission and distribution service. Chelan also adopted energy rates that are based on short-term spot market prices, reflecting that the customer is likely not making a long-term commitment to locating in our service territory. We believe this pricing regime leaves the rest of Chelan’s customer-owners financially neutral.

III. What were some of the hazards that your community experienced as a result of mining facilities? As the industry matured and became more sophisticated, did the hazards change in any way?

- a. Beyond the cost exposure addressed above, our community was confronted with cryptocurrency miners operating in residential and commercial locations without notifying the utility. The high intensity electric use on distribution systems not engineered to handle loads of this size or duration created unacceptable levels of fire risk. Some municipal entities within our service territory prohibited cryptocurrency mining in zoned residential areas in order to counter this risk. Chelan PUD established financial penalties for cryptocurrency mining occurring without notifying the PUD.

The Honorable Diana DeGette (D-CO)

- I. Your testimony indicated that, at least in the near term, the economics of different generation assets may actually push cryptominers toward fossil-fired resources. Can you explain why that might be and what generation assets could become more cost-effective for mining?
 - a. There are at least three reasons. First, reportedly, more than half the production costs of cryptocurrency mining are in electricity use leading miners to seek low cost electricity. The portability of mining operations and the rapid evolution of the cryptocurrency industry leads miners to be most focused on short term electric costs. Due to economic and environmental concerns, fossil fuel plants are finding it more difficult to operate and have been increasingly curtailed or shut down prior to end of life. This creates opportunities to restart or increase fossil fuel plants when they can get revenues greater than variable and fixed operations and maintenance costs. Generally, these costs are low leading to attractive rates for cryptocurrency miners. Within the fossil fuel fleet, coal plants have been the most likely to confront economic and environmental challenges and therefore would be the most likely to be available for expanded short-term use. Second, fossil fuel resources are dispatchable translating to a high probability of being available around the clock matching the load characteristics of cryptocurrency mining. Variable energy resources such as wind or solar would require a strategy for back-up generation or load curtailment resulting in additional costs or lost revenue for the miner. Third, electricity prices are driven by a combination of cost and value. The value of low or zero carbon emitting resources is increasing due to statutory and regulatory requirements to reduce carbon emissions improving the competitive position of fossil fuel fired resources when price is the driving determinant.

- II. Your testimony notes that while large energy consumers that provide flexible load are a theoretical benefit for grid operators, you indicated that Chelan County did not receive any serious flexible load offers from cryptominers. Can you expand on what a truly beneficial flexible load agreement would have needed to look like and why, in your view, cryptominers might have difficulty implementing such an agreement?
- a. There is potential for an arrangement where the cryptocurrency miner offers a demand response product that could lower the cost a utility would otherwise incur for the transmission, distribution and/or energy components of its revenue requirement. The value of demand response is tied to the frequency and duration that load curtailment is allowed. Demand response has value in time sequences from 4 seconds to longer periods such as hourly, daily, monthly or seasonal. The longer duration and the greater frequency the load can be curtailed at the utility's discretion, the greater the value. This ability to curtail allows the utility to respond to periods of high prices or reliability risks on the system due to supply/demand imbalance. Cryptocurrency miners would be temporarily giving up their ability to produce revenue through cryptocurrency production. Our experience has been that cryptocurrency miners want to operate round the clock to maximize revenue production. The fundamental issue is a trade-off between shutting down mining machines for various periods of time that are producing value versus the value received in the form of a reduced electric rate. It seems likely that receiving significant value in the form of lower rates will require substantial willingness to curtail load. Whether cryptocurrency miners can cover their costs, particularly amortization costs for short-lived mining machines, with reduced operations is the key question. This is an interesting area worthy of more discussion as the power system of today, and even more so in the future, needs demand response options to manage the increased use of variable energy resources such as solar and wind on the grid.

The Honorable H. Morgan Griffith (R-VA)

- I. In your opinion, would modulating load and implementing transmission infrastructure cost-sharing make cryptocurrency mining more palatable to local electric co-ops?
- a. Yes. Modulating load has value to all electric utilities through reducing the need for high cost capacity. Up-front cost-sharing of all long-term fixed cost assets such as transmission, distribution and generation would reduce the financial risk of portable cryptocurrency mining and also likely make the mining operation more committed to staying in the utilities' service territory. So both modulating load and cost-sharing makes cryptocurrency mining more attractive for all electric utilities and particularly consumer-owned-utilities who are answerable to their local communities.

- II. Would the construction of individual customer substations mitigate potential cryptocurrency mine overload incidents like those you described in your testimony?
 - a. Getting adequate information in a timely manner from potential cryptocurrency mining loads would allow planning that should produce adequately sized infrastructure investments that alleviating the risk of overload incidents. This could include construction of substations as well as other infrastructure investments that would protect reliability and public safety.

The Honorable Michael C. Burgess (R-TX)

- I. During my time as the Chairman of the Commerce, Manufacturing, and Trade Subcommittee in the 114th Congress, now the Consumer Protection and Commerce Subcommittee, I held an educational hearing about digital currency and blockchain technology.

How far has cryptocurrency and blockchain technology come since this hearing in 2016?

- a. My testimony and knowledge is limited to understanding the impacts of cryptocurrency mining operations on electric power systems. What we have seen is a maturing of the industry that appears is attributable to a need to create scale to be economically competitive. Larger scale translates to greater capital investment that tends to be associated with more sophisticated operations that start with a better understanding of the impacts of large loads on electric power systems and the other customers on those systems. I would describe this maturing of the industry as a trend and there is still a continuum of less to more sophisticated mining operators. While some advances have been made, there is a need for more communication between the cryptocurrency and electric power industry to advance knowledge of where synergy can be created.

- II. What do you see as the role of the Federal government in these technologies?
 - a. From an electric utility perspective, the federal government has taken on a role to advance carbon emissions reductions through a variety of activities such as tax policy and support for energy efficiency. It would be useful for the federal government to identify a set of cohesive policies for how cryptocurrency mining can be integrated into federal policies to create a least cost approach to accomplishing carbon emissions reductions.
- III. How can the United States assist Bitcoin mining domestically in being cleaner and more productive?

- a. Per my answer to the previous question, an integrated set of federal tax and regulatory policies for cryptocurrency mining that incentivizes efficient production of cryptocurrency and modulation of cryptocurrency loads could help support a cryptocurrency industry that is becoming cleaner and more productive. In-depth studies about federal policy options, based on collaboration between the cryptocurrency and electric power industries, would be useful to identify the appropriate policies to achieve these goals.