

BEFORE THE
ARKANSAS PUBLIC SERVICE COMMISSION

IN THE MATTER OF A FINDING THAT)
ENTERGY ARKANSAS, LLC'S LARGE)
POWER HIGH-LOAD DENSITY ("CRYPTO) DOCKET NO. 22-032-TF
MINING") TARIFF IS IN THE PUBLIC)
INTEREST)

DIRECT TESTIMONY
OF
D. ANDREW OWENS
DIRECTOR, REGULATORY RESEARCH
ENTERGY SERVICES, LLC

ON BEHALF OF
ENTERGY ARKANSAS, LLC

JULY 28, 2022

1 **I. INTRODUCTION AND BACKGROUND**

2 Q. PLEASE STATE YOUR NAME, TITLE, AND BUSINESS ADDRESS.

3 A. My name is D. Andrew Owens. My business address is 639 Loyola Avenue,
4 New Orleans, Louisiana 70113. I am employed by Entergy Services, LLC
5 (“ESL”)¹ as Director, Regulatory Research.

6

7 Q. ON WHOSE BEHALF ARE YOU TESTIFYING?

8 A. I am submitting this direct testimony to the Arkansas Public Service
9 Commission (“APSC” or the “Commission”) on behalf of Entergy Arkansas,
10 LLC (“EAL” or the “Company”).

11

12 Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND
13 PROFESSIONAL EXPERIENCE.

14 A. In 1991, I earned a Bachelor of Science degree in Chemical Engineering
15 from Iowa State University. In 1998, I was awarded a Master of Science in
16 Management degree from Georgia Institute of Technology (“Georgia
17 Tech”). I am a registered Professional Engineer in Georgia and have my
18 license as a Certified Public Accountant in Louisiana. Between 1991 and
19 1996 prior to entering graduate school at Georgia Tech, I worked for an
20 environmental consulting firm that specializes in air pollution issues such as

¹ ESL is a subsidiary of Entergy Corporation that provides technical and administrative services to the Entergy Operating Companies. The Entergy Operating Companies include EAL; Entergy Louisiana, LLC (“ELL”); Entergy Mississippi, LLC; Entergy New Orleans, LLC; and Entergy Texas, Inc.

1 permitting and computer simulations.

2 After receiving my master's degree from Georgia Tech, I joined ESL
3 in 1998 and have held various roles of increasing responsibility in Sales and
4 Marketing (both regulated and unregulated), and Regulatory Affairs. From
5 early 2000 through the end of 2004, I was employed by Entergy Solutions,
6 Ltd. and was responsible for marketing to the commercial and industrial
7 segments within the Electric Reliability Council of Texas competitive retail
8 market. From 2005 until early 2007, I was responsible for developing new
9 regulated electric sales opportunities in Louisiana. In 2007, I was named
10 Manager, Regulatory Projects for ELL and was promoted to Director of
11 Regulatory Affairs in April 2009. While serving in that role, I participated in
12 numerous projects involving resource acquisitions, Louisiana Public
13 Service Commission rulemakings, and other matters on behalf of ELL. In
14 January 2014, I assumed the role as Director, Regulatory Policy providing
15 support to all of the Entergy Operating Companies with respect to various
16 regulatory and ratemaking matters. In October 2015, I transitioned to a
17 newly created role within ESL as Director, Regulatory Research. My team's
18 role principally involves providing regulatory and policy support to the
19 Entergy Operating Companies as well as helping to formulate strategy
20 related to ratemaking and the potential impacts of and opportunities of new
21 and emerging technologies like renewable energy, electric vehicles, grid
22 modernization and advanced metering infrastructure ("AMI"), energy
23 storage, etc.

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2 Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE A REGULATORY
3 COMMISSION?

4 A. Yes. I have testified multiple times before retail regulators including before
5 the APSC in various dockets related to net-metering and AMI deployment.

6

7 Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?

8 A. My direct testimony describes the unique characteristics of customers
9 hosting or directly involved in cryptocurrency mining operations² (“Crypto
10 miners”) that necessitate the development of a new tariff, Rate Schedule
11 No. 69, Large Power High Load Density Service (“LPHLDS” or “Crypto
12 Mining tariff”) that meets these new customers’ particular needs while
13 providing the necessary safeguards to protect all of EAL’s customers and
14 ensure EAL has the ability to continue providing safe, reliable, and
15 affordable electric service.

16

² Crypto miners use computer hardware and sophisticated software to solve very complex computational blockchain validation problems. Cryptocurrency that uses such “proof of work” for validation include highly energy-intensive operations. In return for validation, a Crypto miner receives cryptocurrency such as Bitcoin that can be used in trade to purchase goods and services or converted to traditional currency like the U.S. Dollar.

1 **II. BACKGROUND**

2 Q. WHY IS EAL SEEKING APPROVAL OF LPHLDS FOR CRYPTO MINING
3 OPERATIONS?

4 A. EAL recently has begun receiving surging customer interest from large-
5 scale Crypto miners and companies seeking to build hosting facilities
6 dedicated to crypto mining to locate and establish service in EAL's service
7 area. Because cryptocurrency mining involves large electrical loads,
8 significant system resource and grid investments may be required.
9 Additionally, as discussed below, because of the characteristics of this type
10 of new customer, there is risk that those infrastructure investments could
11 become stranded assets whose costs may ultimately be borne by all EAL
12 customers.

13

14 Q. PLEASE DESCRIBE THE CHARACTERISTICS OF CRYPTO MINERS
15 THAT NECESSITATE THIS NEW TARIFF?

16 A. First, unlike data centers, which similarly involve significant electrical load,
17 Crypto miners do not have to invest significant capital in state-of-the-art
18 facilities because they are able to place their equipment in shipping
19 container "pods", which allow them to locate almost anywhere, typically
20 close to an electric utility's substation. These portable pods allow Crypto
21 miners to relocate easily and quickly if economic conditions change, and as
22 described below they do so frequently and without notice. As an emerging
23 industry, Crypto miners often do not have credit history that demonstrates

1 their financial viability for the types of significant infrastructure investments
2 necessary to serve them. Finally, Crypto miners are able to stop their
3 operations with minimal notice and restart quickly without the adverse
4 impacts that many customers experience if their power is interrupted even
5 temporarily. This inherent operational flexibility is a key differentiator
6 between cryptocurrency mining operations and conventional data centers
7 that require a very high level of service and often invest in added
8 redundancy to maintain constant 24x7 operations. Company witnesses
9 Matthew Klucher and Caleb Bales describe how interruptibility is reflected
10 in LPHLDS.

11

12 Q. HOW WILL EAL OBJECTIVELY IDENTIFY WHAT CUSTOMERS
13 QUALIFY FOR THIS TARIFF VERSUS OTHER RATE SCHEDULES?

14 A. As described above, Crypto miners share several key characteristics such
15 as:

- 16 • High energy use density (meaning electric usage per square foot);
- 17 • High load factor;
- 18 • Highly variable load growth or load reduction as an individual
19 customer and/or in aggregate with similar customers in the
20 Company's service area;
- 21 • High sensitivity to volatile commodity or asset (e.g., cryptocurrency)
22 prices;

- 1 • Part of a new and growing industry with potential to become a large
2 concentration of power demand;
- 3 • Lack of credit history or ability to demonstrate financial viability; and
4 • Non-permanent facilities and lease terms.

5 However, some of these characteristics also could apply to data
6 centers, which do not engage in crypto mining and which do not carry the
7 same risks that crypto mining operations pose for EAL and its other
8 customers. I discuss those risks and how this new tariff is intended to help
9 mitigate those risks in more detail below. Accordingly, EAL has included
10 language in the tariff to allow EAL the flexibility to utilize the above
11 characteristics to objectively evaluate whether a particular customer is
12 engaged in crypto mining or not and therefore, whether this or another tariff
13 is appropriate.³ It is important to maintain this flexibility because this is an
14 evolving and fast-paced emerging industry, and it is not possible to
15 singularly define cryptocurrency mining operations at this time. The
16 Company has similar Commission-approved rate schedules and riders that
17 only certain customers can qualify for (e.g., Agricultural Water Pumping
18 Service, Cotton Ginning Service).

19

20 Q. ARE YOU ABLE TO QUANTIFY HOW MUCH CRYPTO MINING RELATED
21 LOAD EAL IS AWARE OF CURRENTLY?

³ I note that to the extent a potential Crypto miner customer were to believe that the criteria were misapplied, EAL anticipates that they would have the ability to avail themselves of the Commission's complaint procedures.

1 A. As of June 2022, EAL is aware of approximately 150 MW of crypto mining-
2 related interest in the Company's service territory. As I discuss later in my
3 testimony, this figure is subject to increase or decrease quickly given market
4 conditions.

5

6 **III. CRYPTO MINING OPERATIONS AND RISKS**

7 Q. PLEASE DESCRIBE CRYPTO MINING OPERATIONS.

8 A. The cryptocurrency mining process involves computer hardware solving
9 complex calculations to validate cryptocurrency transactions on a
10 blockchain network. Because of the complexity of the calculations, powerful
11 computers with significant processing capabilities are used to perform the
12 calculations to validate these transactions. To maximize their ability to solve
13 these complex calculations and receive cryptocurrency such as Bitcoin as
14 compensation, Crypto miners often bundle together a large number of these
15 computers in shipping container pods, which consume a significant amount
16 of energy for computing power as well as for cooling. As an example, in the
17 New Orleans area, a 15' x 15' x 30' pod of crypto mining computers used
18 more energy than the recently opened New Orleans airport, which is located
19 less than a mile away and features 35 gates and almost 1 million square
20 feet of space.⁴

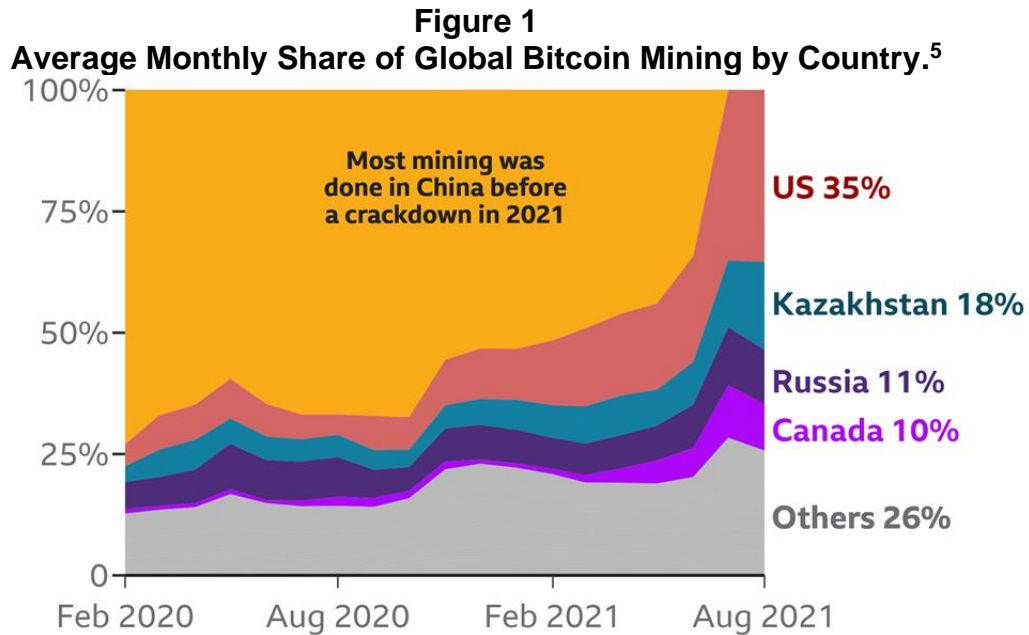
21

⁴ See <https://flymsy.com/business/capital-improvements/the-new-msy/>

1 Q. AS SIGNIFICANT CONSUMERS OF ENERGY, ARE CRYPTO MINERS
2 SENSITIVE TO ENERGY PRICES?

3 A. Yes. Because energy costs are the largest operational expense, Crypto
4 miners locate in areas where energy prices are low and where electrical
5 infrastructure and capacity is available. More importantly, as significant
6 consumers of energy, the cryptocurrency mining industry is also highly
7 sensitive to electric rates, often seeking to secure the lowest cost per
8 kilowatt-hour and showing a willingness to shut down and quickly relocate
9 their operations in pursuit of the lowest possible rate per kilowatt-hour.
10 Below, Figure 1 shows the rapid growth of crypto mining operations in the
11 United States after China announced a blanket prohibition on all crypto
12 mining and transactions in 2021.

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5 Q. ARE CRYPTO MINERS SENSITIVE TO OTHER MARKET CONDITIONS
6 BESIDES ENERGY PRICES?

7 A. Yes. Even with favorable energy prices, the profitability of Crypto miners is
8 closely related to the commodity price of the respective currency that they
9 are involved in validating (i.e., “mining”). As long as the price of the
10 cryptocurrency in question remains high relative to their input costs, mining
11 will be profitable. But the price of cryptocurrency is highly volatile.⁶
12 Significant reductions in the value of cryptocurrency could cause delays or
13 even cancellations of upcoming crypto mining developments, which pose a
14 financial risk to EAL and all of its customers if infrastructure investments
15 become stranded.

⁵ Source: Cambridge Centre for Alternative Finance; <https://ccaf.io/>

⁶ See <https://www.barrons.com/articles/crypto-stablecoins-terra-51652203094>

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2 Q. PLEASE EXPLAIN WHY CRYPTO MINERS CAN RELOCATE EASIER
3 AND QUICKER THAN TRADITIONAL INDUSTRIAL CUSTOMERS AND
4 THE ASSOCIATED RISKS?

5 A. As explained above, Crypto miners do not require significant capital
6 investments in traditional “brick and mortar” facilities to operate. They can
7 house a large number of high-power computers in shipping containers that
8 they can locate anywhere -- from abandoned warehouses to open spaces.
9 These containers or “pods” can be loaded and moved easily and quickly
10 and require little in the way of traditional infrastructure (beyond electrical
11 infrastructure).⁷ By comparison, a new large industrial facility requires
12 massive investment, various permits and often takes years to construct and
13 bring on-line.

14 This ability to relocate at a moment’s notice in search of more
15 favorable electric rates is a credit risk to EAL and its customers. Additional
16 safeguards are necessary to ensure the infrastructure investments
17 necessary to serve new Crypto miners’ operations are not stranded in the
18 event they decide to move their business elsewhere. In fact, it is EAL’s
19 understanding based on discussions with a planned crypto mining hosting
20 entity, that it also requires various security measures of the mining
21 operations it hosts for similar reasons as I have noted.

⁷ See <https://www.bloomberg.com/news/features/2021-07-13/bitcoin-miners-building-rigs-must-navigate-world-of-crypto-power-hunting>

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2 Q. HAVE ANY OF THE CREDIT RATINGS AGENCIES OPINED ON THE
3 RISKS PRESENTED BY CRYPTOCURRENCY MINING?

4 A. Yes. For example, Fitch Ratings issued a brief report⁸ in January 2022
5 noting “Digital asset or crypto currency mining in the US could pose power
6 supply risks to public power utilities unless they are sufficiently mitigated.
7 Crypto mining operations are price-sensitive entities that may be quickly
8 scaled back or shut down if mining becomes uneconomical. To date, Fitch's
9 rated public power utilities have successfully limited their risk by restricting
10 the scope of crypto mining operations in their service area or by defining
11 their power procurement commitments in a way that protects the utility from
12 nonpayment, including due to a sudden closure of the mining facility.” The
13 Fitch Ratings report goes on to describe various ways that these risks can
14 be mitigated including certain actions taken by publicly-owned utilities in the
15 State of Washington.

16

17 Q. WHY WOULD A CUSTOMER DEPOSIT PURSUANT TO THE
18 COMMISSION’S GENERAL SERVICE RULES⁹ (“GSRs”) NOT BE
19 SUFFICIENT TO MITIGATE THIS RISK?

20 A. This is best answered by providing a real-life example. While I was not
21 directly involved, it is my understanding that around 2019 EAL began to

⁸ See <https://www.fitchratings.com/research/us-public-finance/crypto-mining-poses-challenges-to-public-power-utilities-24-01-2022>

⁹ See, GSR Section 4. Deposits.

1 serve a new Crypto miner, which required significant facility upgrades. The
2 Crypto miner in question elected not to make a Contribution in Aid of
3 Construction (“CIAC”) payment and instead pursued a monthly minimum
4 under EAL’s Commission-approved Extension of Facilities (“EOFP”) policy.
5 EAL also collected a two-month deposit in accordance with APSC rules and
6 EAL’s tariffs. Shortly after taking service, virtually overnight, the Crypto
7 miner in question moved its mobile shipping containers housing all of the
8 computer equipment doing the mining – effectively disappearing. EAL was
9 unable to locate the customer, and the customer’s two-month deposit was
10 insufficient to cover the investments made to serve this new load and the
11 energy consumed in the operations.

12

13 Q. HOW IS EAL PROPOSING TO SAFEGUARD ITSELF AND ITS
14 CUSTOMERS AGAINST THESE RISKS?

15 A. Because Crypto miners are expected to rarely have sufficient credit history
16 to demonstrate financial viability, EAL’s proposed LPHLDS tariff will require
17 a three-month deposit. Additionally, because even a three-month deposit
18 will not be sufficient to cover the infrastructure investments necessary to
19 provide service in the event a Crypto miner relocates, the proposed tariff
20 requires Crypto miners to pay for all network upgrades upfront via a
21 mandatory CIAC payment rather than over time under the EOFP. These
22 additional safeguards included in LPHLDS are intended to protect EAL’s
23 customers from the financial risks posed by Crypto miners.

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2 Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

3 A. Yes, at this time.

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CERTIFICATE OF SERVICE

I, J. David Palmer, do hereby certify that a copy of the foregoing has been served upon all parties of record by forwarding the same by electronic mail and/or first-class mail, postage prepaid, this 28th day of July 2022.

/s/ J. David Palmer
J. David Palmer