STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

PETITION OF DUKE ENERGY INDIANA, LLC FOR APPROVAL OF A TARIFF RATE FOR THE PROCUREMENT OF EXCESS DISTRIBUTED GENERATION PURSUANT TO INDIANA CODE 8-1-40 ET SEQ.	**)**	**CAUSE NO. 45508**

INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR

PUBLIC'S EXHIBIT NO. 1
TESTIMONY OF OUCC WITNESS
ANTHONY A. ALVAREZ

September 20, 2021

Respectfully submitted,

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TESTIMONY OF OUCC WITNESS ANTHONY A. ALVAREZ
CAUSE NO. 45508
DUKE ENERGY INDIANA, LLC

I. INTRODUCTION

Q: Please state your name and business address.

A: My name is Anthony A. Alvarez, and my business address is 115 West Washington Street, Suite 1500 South, Indianapolis, Indiana 46204.

Q: By whom are you employed and in what capacity?

A: I am employed as a Utility Analyst in the Indiana Office of Utility Consumer Counselor's ("OUCC") Electric Division. I describe my educational background in Appendix A to my testimony.

Q: Have you previously testified before the Indiana Utility Regulatory Commission ("Commission")?

A: Yes. I have testified in several cases before the Commission, including electric utility base rate cases; environmental and renewable energy Purchase Power Agreement and tracker cases; Transmission, Distribution, and Storage System Improvement Charge cases; distributed energy generation cases; and applications for Certificates of Public Convenience and Necessity.

Q: What is the purpose of your testimony?

A: My testimony addresses Duke Energy Indiana's ("DEI" or "Petitioner") request for approval of a tariff rate for the procurement of excess distributed generation ("Rider EDG") in this Cause. In particular, my testimony: 1) opposes DEI's methodology

to determine excess distributed generation ("EDG") in its case-in-chief;[1] 2) opposes DEI's use of its Day-Ahead Hourly Locational Marginal Price ("LMP") as "real-time hourly LMPs" to determine its EDG rate, 3) discusses DEI's instantaneous netting methodology,[2] 4) recommends DEI refunds any unused EDG credits to all retail customers through DEI's FAC (fuel adjustment clause) if a DG customer leaves the premises instead of DEI forfeiting the unused credits,[3] and 5) recommends the Commission deny approval of DEI's proposed EDG Rider tariff.

Q: What did you do to prepare your testimony?

A: I reviewed DEI's petition, direct testimony, exhibits and the corrected exhibit filed in this Cause. I reviewed DEI's responses to discovery in this proceeding. I also reviewed the Commission's Cause No. 45378 Order, dated April 7, 2021, regarding Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc.'s EDG rider rate request ("45378 Order"). The OUCC is appealing this decision, and the appeal is currently pending with the Court of Appeals (Case No. 21A-EX-821).

Q: To the extent you do not address a specific item in your testimony, should it be construed to mean you agree with DEI's proposal?

A: No. Excluding any topics, issues or items DEI proposes does not indicate my approval of those topics, issues, or items. Rather, the scope of my testimony is limited to the specific items addressed herein.

[1] Petitioner's Exhibit No. 1, Verified Testimony of Roger A. Flick II, p. 6, lines 14 – 15, states, "[t]he Company took notice of this finding and is proposing instantaneous netting for determining aggregate import and export positions."
[2] Corrected Petitioner's Exhibit 1-B (RAF), Definitions – Instantaneous Netting, p. 1.
[3] IURC Cause No. 45378, Order, p. 33, paragraph 2 (April 7, 2021).

II. EXCESS DISTRIBUTED GENERATION DEFINITION AND APPLICATION

Q: How does Ind. Code ch. 8-1-40 (the "Distributed Generation Statute" or "DG Statute") address EDG?

A: The definition of EDG is unambiguous as codified in Ind. Code § 8-1-40-5 ("EDG Statute"). Ind. Code § 8-1-40-5 states "excess distributed generation" means the "difference between: (1) the electricity that is supplied by an electricity supplier to a customer that produces distributed generation; and (2) the electricity that is supplied back to the electricity supplier by the customer." As identified in this section, only two components **must** be present to determine EDG: 1) the electricity that is supplied by an electricity supplier; and 2) the electricity that is supplied back to the electricity supplier. Additionally, this section explicitly defines EDG as the resulting difference between these two components. Therefore, to determine EDG, the utility or electricity supplier must first take the difference between the electricity supplied to the distributed generation ("DG") customer and the electricity supplied back by the DG customer.

Q: How does the DG Statute define the "marginal price of electricity"?

A: Ind. Code § 8-1-40-6 states, "As used in this chapter, 'marginal price of electricity' means the hourly market price for electricity as determined by a regional transmission organization of which the electricity supplier serving a customer is a member."[4]

Q: How does the DG Statute mandate the rate calculation for the procurement of EDG?

[4] DEI is a member of the Midcontinent Independent System Operator ("MISO") regional transmission organization.

A: Ind. Code § 8-1-40-17 states the rate "equals the product of (1) the average marginal price of electricity paid by the electricity supplier during the most recent calendar year; multiplied by (2) one and twenty-five hundredths (1.25)."

III. EDG RATE CALCULATION

Q: Please discuss how DEI calculated its EDG rate for the procurement of EDG.

A: DEI witness Flick states that DEI calculated the average marginal price of electricity by averaging the 2020 real-time hourly locational marginal price ("LMP") for electricity at its CIN.PSI load node.[5] First, the average was calculated by summing the hourly LMPs from the preceding calendar year and then divided the sum by 8,784 hours – the total hours in 2020 (366 days x 24 hours)[6] – to calculate the resulting average marginal price of $23.185 per megawatt-hour ("MWh").[7] Next, DEI divided the $23.185/MWh average marginal rice by 1,000 to convert it into a per kilowatt-hour ("kWh") basis of $0.023185 per kWh.[8] DEI then multiplied its average marginal price of $0.023185/kWh by 1.25 to arrive at the EDG rate of $0.028981/kWh.[9] However, the EDG rate DEI calculated was not actually based on its "average marginal price of electricity paid by the electricity supplier during the most recent calendar year," as required by the DG Statute.

Q: Do you have any concerns regarding DEI's methodology for calculating its EDG rate for the procurement of EDG?

[5] Flick Direct, p. 5, lines 7 – 9.
[6] Flick Direct, p. 5, lines 9 – 11.
[7] Flick Direct, p. 5, lines 9 - 11. The amount of "$23.185/kWh" that appears in Flick Direct, p. 5, line 11, should read "$23.185/MWh" (or per megawatt-hour) instead.
[8] Flick Direct, p. 5, lines 15 – 16.
[9] Flick Direct, p. 5, lines 17 – 18. The amount of "$0.23185per kWh" that appears in Flick Direct, p. 5, line 17, should read "$0.023185 per kWh"

A: Yes. DEI claims it used its "2020 real time hourly LMPs at the CIN.PSI load node"[10] to calculate its average marginal price for electricity it paid during the previous year. However, DEI used the Day-Ahead Hourly LMPs at the CIN.PSI load node, found in Workpaper 1 (RAF), instead of the "real time hourly LMPs" described in the testimony.[11]

Q: Please explain.

A: DEI is a member and market participant of the Midcontinent Independent System Operator ("MISO") markets.[12] MISO operates energy markets where energy is sold or purchased in real time for immediate delivery ("Real Time Market") and "in preparation for the future" or day-ahead ("Day-Ahead Market").[13] The MISO Real Time Market is a process of balancing energy supply and demand with resulting LMPs cleared every five minutes.[14] The MISO Day-Ahead Market is a forward-looking market and serving as a "planning phase" for the next operating day[15] with financially binding settlements.[16] MISO calculates the LMP values of the Day-Ahead Market on an hourly basis based on offers and bids for the next operating day.[17] There is a distinction between day-ahead hourly and real-time LMPs and MISO performs separate accounting settlements for the Day-Ahead and Real-Time

[10] Flick Direct, p. 5, lines 7 – 9.
[11] Flick Direct, p. 5, lines 20 – 21, offered Workpaper 1 (RAF) as support to its EDG rate calculation.
[12] *See* MISO Certified Market Participant List. Website: https://www.misoenergy.org/markets-and-operations/market-participation/#t=10&p=0&s=FileName&sd=asc. Accessed: 09/01/2021.
[13] *See* MISO Market Basics, Buying and Selling Energy, Day Ahead Market. Website: https://www.misoenergy.org/stakeholder-engagement/training2/learning-center/market-basics/. Accessed: 09/01/2021.
[14] *See* MISO, Energy and Operating Reserve Markets, Business Practices Manual, Section 8.2 – MISO Activities, BPM-002-r21, Effective Date: October 15, 2020. Website: https://www.misoenergy.org/legal/business-practice-manuals/. *See also* MISO Market Basics.
[15] *See* MISO Market Basics.
[16] *See* MISO, BPM-002-r21, Section 7.2 – MISO Activities.
[17] *Id*. MISO, BPM-002-r21, Section 7.2 – MISO Activities.

Markets, resulting in each settlements with their own respective (data) set of LMP values.[18] This means, the 2020 Day-Ahead Hourly LMPs found in Mr. Flick's Workpaper 1 (RAF) were not the "real-time hourly LMPs at the CIN.PSI load node" described in this testimony.

Q: Did the OUCC bring the discrepancy to DEI's attention during the discovery period in this Cause? Please explain.

A: Yes. The OUCC issued discovery and in response, DEI stated it "will change the reference on page 5, line 8[of Mr. Flick's testimony] from 'real time' to 'day ahead' to be consistent with the workpaper and Mr. Flick's intended reference."[19]

IV. METERING AND BILLING METHODOLOGY

Q: Please briefly discuss DEI's metering for EDG customers.

A: DEI will provide an EDG customer an advanced metering infrastructure ("AMI") electric meter "capable of measuring the flow of electricity in two (2) directions" (or bidirectional capability) to capture "periodic energy imports and exports."[20] DEI's proposed EDG tariff defined the following:[21]

a. Excess Distributed Generation (Exports) – The difference between the electricity that is supplied by the Company to a customer that produces distributed generation and the electricity that is supplied back to the electricity supplier by the customer.

b. Imports – The monthly aggregation of instantaneous measurements of energy supplied to customer from Duke Energy Indiana.

c. Instantaneous Netting – The shortest period of time Duke Energy Indiana's AMI technology measures and records the directional flow of energy, currently thirty (30) minutes.

[18] *See* MISO, BPM-002, Section 2.1 – Energy Operating Reserve Markets Operation and Settlements.
[19] Attachment AAA-1 – DEI Response to OUCC DR Set No. 3.
[20] Corr. Pet. Exh. 1-B (RAF), p. 2.
[21] Corr. Pet. Exh. 1-B (RAF), p. 1.

Q: Please briefly describe DEI's proposed methodology to determine EDG.

A: DEI proposes a methodology to determine its aggregate import and export positions—DEI's metering and billing components for EDG—wherein its AMI electric meter will measure and record the "directional flow of energy" for periods of thirty (30) minutes.[22] DEI indicates "[e]nergy netting is not being performed by the Company's metering equipment."[23] DEI accumulates the energy amounts for imports and exports in the respective channels, as shown in 30-minute intervals.[24]

Q: Does DEI's methodology allow for measuring the two values required in the statute to determine "excess distributed generation," and thus, comply with the statutory definition?

A: No. DEI admits that "netting" is not being performed by the meter.[25] At any given instant, electricity can only flow in one direction, either in towards the customer from the utility or out towards the utility from the customer, but not both. DEI's AMI electric meter has the bidirectional capability of measuring and recording the directional flows of electricity. One channel will record the flow of electricity one way, or another channel will record if the flow of electricity is the other way. However, on an instantaneous basis, when electricity is flowing in one direction, it is not physically possible for electricity to flow in the opposing direction, so there is nothing to "net" against when measuring directional flow on an instantaneous basis. If electricity is flowing to or from the customer, it is not possible for there to be an "opposing" flow from the opposite direction, and therefore the meter is not

[22] Corr. Pet. Exh. 1-B (RAF), p. 1. See also Attachment AAA-3, Duke's Revised Response to OUCC 2A.5, Question 8.
[23] Attach. AAA-3 - Duke's Revised Response to OUCC 2A.5, Question 8.
[24] *Id*.
[25] Attach. AAA-3 - Duke's Revised Response to OUCC 2A.5, Questions 7 and 8.

"netting" or taking the difference of any electricity flow as required by Ind. Code § 8-1-40-5.

Q: Would DEI's proposed methodology conform with the metrology of DEI's own electric AMI meters? Please explain.

A: No. DEI's proposed methodology would not conform with the metrology of its own electric AMI meters. At any given instant one channel will measure and record the "kWh delivered" if electricity flows from DEI to the DG customer, or another channel will measure and record the "kWh received" if the electricity flows to DEI from the DG customer, but not both in the same instant.[26] In response to discovery, DEI admitted its electric AMI meters "do not net the power flows"[27] and "energy netting is not being performed by the Company's [DEI's] metering equipment."[28] Finally, DEI also admitted "the delivered and received kWh energy is captured on individual channels."[29]

Q: DEI equates "Excess Distributed Generation" to "Exports" in its proposed EDG tariff. Do you agree? Please explain.

A: No, I do not agree with the manner DEI equates "Excess Distributed Generation" to "Exports" and making the two terms share the same definition ("EDG/Exports") in its proposed EDG tariff.[30] DEI brought more confusion by restating the statutory definition of EDG then simultaneously equating it to "Exports." As stated earlier, DEI's electric AMI meter is bidirectional with one channel recording the flow of

[26] Attachment AAA-3 – DEI's Revised Response to OUCC DR Set 2A.5(4).
[27] Attach. AAA-3 – DEI Rev. Response to OUCC DR Set 2A.5(7), states "…the OpenWay meters do not net the power flows…"
[28] Attach. AAA-3 – DEI Rev. Response to OUCC DR Set 2A.5(8), states "[e]nergy netting is not being performed by the Company's metering equipment….
[29] Attach. AAA-3 – DEI Rev. Response to OUCC DR Set 2A.5(8), states "…[i]n short, the meter is not netting any energy – the delivered and received kWh energy is captured on individual channels."
[30] *Id*. Corr. Pet. Exh. 1-B (RAF), p. 1.

electricity one way, or another channel recording if the flow of electricity is the other way. If the "kWh delivered" meter channel is dedicated to "the electricity that is supplied by an electricity supplier to a customer that produces distributed generation," it naturally follows that the (other) "kWh received" meter channel should be dedicated to measure and record "the electricity that is supplied back to the electricity supplier by the customer." Based on the metrology of DEI's electric AMI meter, it has the capability to precisely measure and record the two values required in the statute to determine EDG, although this cannot be done on an instantaneous basis, as DEI proposes. Therefore, to conform with the statute's definition of EDG, DEI must take the difference between "kWh delivered" and "kWh received" as measured and recorded by its electric AMI meter to determine EDG.

Q: Do you agree with DEI's billing methodology description of EDG/Exports and using "instantaneously determined" in the description?

A: No. I do not agree with the manner DEI described the billing methodology of EDG/Exports and used the term "instantaneously determined" in the description. As stated earlier, on an instantaneous basis, there is nothing to "net" against because it is not possible to record the two values required in the statute to determine EDG. Therefore, the language describing the EDG/Exports billing methodology, as stated in the proposed tariff, does not conform with the EDG Statute.

Q: What is the appropriate methodology to determine EDG?

A: The Commission should retain a monthly interval, or "billing period" as stated in Commission rule 170 IAC 4-4.2-7(2), over which to take the difference as required in Ind. Code § 8-1-40-5.

Q: Does the DG Statute set this period?

A: No, the statute is silent on the period over which to take the difference.

Q: How does the silence of the statute on this issue provide direction for the Commission?

A: The use of the billing period as the interval over which to take the difference was in the Commission rule for net metering customers when the DG Statute was enacted. The DG statute focuses on determining the rate for EDG and is silent on the period over which to determine the amount of EDG. If the Legislature had wanted to address this period, it had the opportunity to do so when the DG Statute was enacted. Because the Legislature did not address this time period in statute, the Commission should follow the rule that is already in place, 170 IAC 4-4.2-7(2), and apply this to EDG customers.

Q: Does the Commission have the authority to use other periods to determine EDG?

A: Yes. Because the statute is silent, the Commission has discretion to determine time periods other than the billing period. However, as explained above, there must be a time period over which the difference is determined, as required in Ind. Code § 8-1-40-5. Additionally, because the Commission has already determined that the billing period is appropriate in its rule and statute does not provide direction on what time period to use, the Commission should use what it already has in place: using the billing period to determine EDG.

V. UNUSED CUSTOMER EDG CREDITS

Q: DEI "proposes that when/if a customer leaves his/her premise [sic] any unused credits at the time of a customer leaving expire."[31] Please explain your concern.

A: If a customer leaves its premises with unused EDG credits, DEI should not let the unused EDG credits expire.[32] DEI should refund any unused EDG credits to all retail customers through DEI's FAC (fuel adjustment clause) if a DG customer leaves the premises instead of DEI forfeiting the unused credits.

VI. CONCLUSIONS AND RECOMMENDATION

Q: What do you conclude based on your review?

A: I conclude:

1. DEI's application of EDG does not comply with the EDG Statute.
2. DEI's application to "instantaneously determine[]" EDG does not conform with Ind. Code § 8-1-40-5.
3. DEI's manner of capturing, measuring, and calculating EDG on an instantaneous basis will not record the two values required in the statute to determine EDG.
4. The language DEI used to describe the EDG/Exports billing methodology does not conform with the EDG Statute.
5. The Commission should retain the "billing period" from 170 IAC 4-4.2-7(2) as the interval over which to determine EDG as required in Ind. Code § 8-1-40-5.
6. DEI should refund any unused EDG credits to all retail customers through its FAC.

[31] Fields Direct, p. 7, lines 4 – 5.
[32] Unused EDG credits after applying any appropriate EDG credits to the customer's final bill.

Q: What do you recommend?

A: Based on my conclusions above, I recommend the Commission deny DEI's proposed EDG Rider tariff.

Q: Does this conclude your testimony?

A: Yes.

APPENDIX A

Q: Please describe your educational background and experience.

A: I hold a Master of Business Administration degree from the University of the Philippines ("UP"), in Diliman, Quezon City, Philippines. I also hold a Bachelor of Science degree in Electrical Engineering from the University of Santo Tomas ("UST"), in Manila, Philippines.

I joined the OUCC in July 2009 and have completed the regulatory studies program at Michigan State University sponsored by the National Association of Regulatory Utility Commissioners ("NARUC"). I have also participated in other utility and renewable energy resources-related seminars, forums, and conferences. Prior to joining the OUCC, I worked for the Manila Electric Company ("MERALCO") in the Philippines as a Senior Project Engineer responsible for overall project and account management for large and medium industrial and commercial customers. I evaluated electrical plans, designed overhead and underground primary and secondary distribution lines and facilities, primary and secondary line revamps, extensions and upgrades with voltages up to 34.5 kV. I successfully completed the MERALCO Power Engineering Program, a two-year program designed for engineers in the power and electrical utility industry.

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Received: August 27, 2021

OUCC 3.1

Request:

Refer to the direct testimony of Roger Flick, p. 5, lines 7 – 9, and Workpaper of Roger A. Flick, II, Workpaper 1 (RAF), tab "DA LMP." Please reconcile the statement of "averaging the 2020 real time hourly LMPs at the CIN.PSI load node" with the use of "Day Ahead Hourly LMPs" data in his workpaper.

a. Please explain why DEI used the "Day Ahead Hourly LMPs" data in Workpaper 1 (RAF), tab DA LMP, to calculate the average marginal price of electricity.

b. Please explain the difference between DEI's real time hourly LMPs and day ahead hourly LMPs at CIN.PSI load node. Please provide support to your response.

c. What is DEI's resulting "average marginal price of electricity," in dollars per megawatt-hour ("$/MWh") and dollars per kilowatt-hour ("$/kWh"), using its 2020 Real Time Hourly LMP data at CIN.PSI data instead of the data found in Workpaper 1 (RAF)? Please show all calculations, formulas and data used in an Excel electronic spreadsheet format to support your response.

Objection:

Duke Energy Indiana objects to subpart (b) of this request on the grounds that it seeks information that is not calculated by Duke Energy Indiana, thus making it difficult for Duke Energy Indiana to fully respond.

Response:

Subject to and without waiving or limiting its objections, Duke Energy Indiana responds as follows: The cited testimony was intended to align with the referenced Workpaper and refer to Day Ahead LMPs at the CIN.PSI load node. A correction will be made at the hearing to the testimonial reference. At the hearing, Duke Energy Indiana will change the reference on page 5, line 8 from "real time" to "day ahead" to be consistent with the workpaper and Mr. Flick's intended reference.

a) The vast majority of the Company's energy transactions with MISO are priced in the Day Ahead ("DA") market. Only the Company's deviations from DA positions are subject to Real Time ("RT") pricing. In addition, differences to annual average LMP rates between markets *(which can be*

positive or negative) have been historically small, which lead the Company to conclude using DA LMPs were a reasonable basis for the calculation.

b) See objection. MISO uses highly complex models for LMP determination, making it difficult for Duke Energy Indiana to specifically identify drivers (particularly over long periods of time).

Answering further, the Company is aware that there are some differences owed to the passage of time and realized differences in load and generation expected from the previous day. Examples of things that can drive deviations are weather and unplanned generation forced outages.

c) $0.0273 per kWh or less than 2% different than the DA price. See Duke Energy Indiana's Attachment OUCC 3.1-A for detail.

Witness: Roger A. Flick, II

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OUCC 3.2

Request:

Please refer to Workpaper of Roger A. Flick, II, Workpaper 1 (RAF). Please identify the source of the data and information in Workpaper 1 (RAF). Please provide support to respond and define the following terms:

a. "Day Ahead Hourly LMPs"

b. "PeakFlag"

c. "MEC"

d. "MCC"

e. "MLC"

f. Please explain what the values "0" and "1" denote under column "PeakFlag."

g. Is the value of "LMP" equal to the sum of "MEC," "MCC," and "MLC" (LMP=MEC+MCC+MLC)? If no, please show how to derive the values under the column "LMP."

Response:

a. "Day Ahead Hourly LMPs" are the locational marginal prices calculated by MISO for the day-ahead energy market.

b. "PeakFlag" designates whether an hour is a peak hour as defined by NERC. "1" is a peak hour and "0" is an off-peak hour.

c. "MEC" is the marginal energy component of the locational marginal price.

d. "MCC" is the marginal congestion component of the locational marginal price.

e. "MLC" is the marginal loss component of the locational marginal price.

f. Please see response to OUCC 3.2 b. above.

g. Yes.

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OUCC 3.3

Request:

Please refer to Flick, Workpaper 1 (RAF), row 3, Date: 1/1/2020, Hour Ending: 1; LMP: $22.44. Is the Day Ahead Hourly LMP of $22.44 an average for the first hour of that day? Please explain and respond to the following:

a. Does the Midcontinent Independent System Operator ("MISO") post the LMP price more than once every hour in the MISO Day Ahead Market? If yes, please explain why and provide support to your response.

Objection:

Duke Energy Indiana objects to this request on the grounds that is seeks information that is calculated by MISO, making it difficult for the Company to fully respond.

Response:

Subject to and without waiving or limiting its objections, Duke Energy Indiana responds as follows: MISO posts only a single day-ahead LMP for each hour. The Company does not have access to MISO's state estimator model and does not know if any sub-hourly averaging occurs.

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OUCC 3.4

Request:

Petitioner's witness, Roger A. Flick, II, Direct Testimony, p. 5, line 7 – 9, states, "[s]pecifically, the Company calculated the average marginal price of electricity by averaging the 2020 real time hourly LMPs at the CIN.PSI load node." Please define these terms and respond to the following:

a. "2020 real time hourly LMPs"

b. "CIN.PSI"

c. "load node"

d. What is the degree of granularity of the LMPs in the Real-Time Market? That is, does MISO provide LMP pricing at intervals of less than one hour? Please state the frequency of MISO's LMP postings in the Real-Time Market. Please provide support to your response.

e. If MISO provides pricing at intervals of less than one hour, is real time hourly LMP an average of the LMPs posted for that hour? Please explain and provide support to your response.

f. Please provide DEI's 2020 Real Time Hourly LMP data at CIN.PSI in an Excel electronic spreadsheet format with all calculations and formulas intact and the same (column and row) format presentation in Workpaper 1 (RAF).

Objection:

Duke Energy Indiana objects to this request on the grounds that is seeks information that is calculated by MISO, making it difficult for the Company to fully respond

Response:

Subject to and without waiving or limiting its objections, Duke Energy Indiana responds as follows:

a. "2020 real time hourly LMPs" means that average includes all hourly LMPs posted by MISO during calendar year 2020.

b. "CIN.PSI" is the MISO designation for load located within the former PSI (Public Service Indiana) balancing area.

c. "Load Node" refers to MISO designated load locations.

d. See objection. Answering further, Duke Energy Indiana is aware that MISO calculates Real-Time LMPs every 5 minutes.

e. See objection. Answering further, Duke Energy Indiana is aware that the real-time hourly LMP is an average of the 5 minute real-time LMPs within an hour.

f. See Duke Energy Indiana's Attachment OUCC 3.1-A.

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OUCC 3.5

Request:

In Corrected Petitioner's Exhibit 1-B (RAF), p. 1, "Instantaneous Netting," DEI claims the "shortest period of time" for its "instantaneous netting" is currently thirty (30) minutes." Flick Direct, p. 5, lines 7 – 9, testifies that DEI used "the 2020 real time hourly LMPs at the CIN.PSI load node" data to calculate the "average marginal price of electricity." In this regard, please state the number of times MISO posts the real time LMP in a thirty (30) minute period. Please provide support to your response and respond to the following:

a. If MISO posts real time LMPs more than once on an hourly basis, please explain how DEI would derive or calculate the average marginal price of electricity for the thirty (30) minute period. Please show all calculations, formulas and data used in an Excel electronic spreadsheet format to support your response.

Objection:

Duke Energy Indiana objects to this request to the extent it seeks a calculation or compilation that has not already been performed and that Duke Energy Indiana objects to performing. Duke Energy Indiana also objects to this request on the grounds that it seeks information calculated by MISO, making it difficult for Duke Energy Indiana to respond fully. Duke Energy Indiana further objects to this request on the grounds that it misconstrues the prefiled testimony in this proceeding, namely that the Company was proposing to calculate the average marginal price for electricity for a 30 minute period.

Response:

Subject to and without waiving or limiting its objections, Duke Energy Indiana responds as follows: Please see the Company's response to OUCC 3.4. Answering further, the Company's metering equipment measures the total amount of energy that is delivered to the customer and separately received from a customer on two (2) distinct metering channels. The reference to thirty (30) minute periods is meant to convey that the results of the channel activity are only captured every thirty (30) minutes.

The Company is not proposing to calculate the average marginal price of electricity and thus has not developed computations to do so.

Witness: Roger A. Flick, II

OUCC
IURC Cause No. 45508
Data Request Set No. 2A
Received: August 20, 2021

OUCC 2A.1

Request:

How many AMI electric meters does DEI currently have within its service territory? Please provide the AMI electric meter count for each customer class.

a. Are AMI electric meters currently deployed within its service territory without the capability of determining excess distributed generation ("EDG") as proposed by DEI? If yes, please explain and provide total count of AMI electric meter without the capability of measuring and recording EDG and total count for each customer class. Please provide support to your response.

b. Does DEI store AMI electric meters that do not have the capability of measuring and recording EDG? If yes, please explain why and provide total count in storage.

Objection:

Duke Energy Indiana objects to this request as overly broad and unduly burdensome in that it is not limited in scope to EDG customers. Duke Energy Indiana also objects to this request to the extent it seeks a calculation or compilation that has not already been performed and that Duke Energy Indiana objects to performing. Duke Energy Indiana further objects to this request as not reasonably calculated to lead to admissible evidence in this proceeding.

Response:

Subject to and without waiving or limiting its objections, Duke Energy Indiana responds as follows: Approximately 880,000 AMI meters are installed in Duke Energy Indiana's service territory. The customer class data is not available.

a. No. All OpenWay AMI meters measure and record kWh delivered, and kWh received energy flow. Answering further, see Duke Energy Indiana's Response to Solarize Indiana 2.4.

b. No.

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Data Request Set No. 2A
Received: August 20, 2021

OUCC 2A.2

Request:

How many non-AMI electric meters does DEI currently have within its service territory? Please provide the non-AMI electric meter count for each customer class.

a. Please identify the different types, makes and models of the non-AMI meters DEI deployed. Please provide the manufacturer's brochure or technical specification for a typical non-AMI meter deployed.

b. Does DEI have plans of replacing non-AMI electric meters with AMI electric meters? Please explain and provide support to your response.

c. Do the non-AMI electric meters have the capability of measuring and recording EDG? If yes, please provide the manufacturer or technical brochure and a technical explanation of the metrology or mechanics how the non-AMI meter measures EDG. Please indicate the section(s) in the brochure that correlates to and supports your response.

Objection:

Duke Energy Indiana objects to this request as overly broad and unduly burdensome in that it is not limited in scope to EDG customers. Duke Energy Indiana also objects to this request to the extent it seeks a calculation or compilation that has not already been performed and that Duke Energy Indiana objects to performing. Duke Energy Indiana further objects to this request as not reasonably calculated to the discovery of admissible evidence.

Response:

Subject to and without waiving or limiting its objections, Duke Energy Indiana responds as follows: Approximately 99.4% of installed Duke Energy Indiana billing meters are AMI. Reaching 100% complete AMI is limited by items such as the opt-out tariff and certain remote locations where no wireless signal is available. Duke Energy Indiana does not have this information by customer class.

a. Itron Centro C1S or Itron Centron C1SR. See the manufacturer's brochure/technical specification sheet located here: https://www.itron.com/-/media/feature/products/documents/spec-sheet/100188sp06-c1s-centron.pdf

b. Yes. Duke Energy Indiana has achieved 99.4% AMI saturation of installed meters and will continue to replace non-AMI meters where possible.

c. No. Duke Energy Indiana used to use special Itron Centron C1S meters that provided single NET kWh reads. AMI meters are now required for EDG installations. See technical manual provided in subpart a. above.

OUCC
IURC Cause No. 45508
Data Request Set No. 2A
Received: August 20, 2021

OUCC 2A.3

Request:

Please identify the different types, makes and models of the AMI meters currently deployed in Duke Energy Indiana's ("DEI") service territory. Please respond to the following and provide support to your response:

a. Please provide the manufacturer or technical brochure(s) of DEI's AMI meter(s).

b. When did DEI initiate and complete deploying AMI meters (or "AMI deployment period")? Please provide the dates.

c. Was DEI's AMI deployment period longer than one (1) year? If yes, please provide the number of AMI electric meters installed on an annual basis throughout the deployment period.

d. How many AMI electric meters were installed during DEI's AMI deployment period?

Objection:

Duke Energy Indiana objects to this request as overly broad and unduly burdensome in that it is not limited in scope to EDG customers. Duke Energy Indiana further objects to this request as not reasonably calculated to lead to the discovery of admissible evidence.

Response:

Subject to and without waiving or limiting its objections, Duke Energy Indiana responds as follows:

a. Please see: openway-centron-meter.pdf (itron.com). See also the Company's prior response to Solarize Indiana 2.4.

b. Duke Energy Indiana installed AMI meters from approximately August of 2016 to approximately January of 2020.

c. Yes. The approximate number of AMI meters installed are as follows:

2016: 37,000
2017: 240,000
2018: 288,000

2019: 296,000

d. Approximately 860,000 AMI meters were installed over 3.5 years.

OUCC
IURC Cause No. 45508
Data Request Set No. 2A
Received: August 20, 2021

OUCC 2A.4

Request:

Please refer to the direct testimony of Roger A. Flick II, p. 6, lines 14 – 15, regarding the Commission's Order in Cause No. 45378, which states "[t]he Company took notice of this finding and is proposing instantaneous netting for determining aggregate import and export positions." In this context, does the term "instantaneous" mean "done, occurring, or acting without any perceptible duration of time"? (*See* https://www.merriam-webster.com/dictionary/instantaneous) If no, please define the term "instantaneous" and the following terms as used by DEI in this Cause:

a. "import"

b. "export"

c. "aggregate import position"

d. "aggregate export position"

e. "directional flow of energy"

f. "aggregation of instantaneous measurements of energy"

Response:

The Company does not take issue with the meaning of the word "instantaneous" offered above.

a. Energy (kWh) delivered to the customer from the Company.

b. Energy (kWh) received by Company from the customer.

c. The total energy delivered to the customer from the Company in a billing cycle.

d. The total energy received by the Company from the customer in a billing cycle.

e. A characteristic of electricity being in one of two states, either 1) moving across a metering point from the Company to the customer, or 2) moving across the metering point from the customer to the Company.

f. As used in the tariff in this proceeding in defining Imports see answers to a) and c) above.

Witness: Roger A. Flick, II

OUCC
IURC Cause No. 45508
Data Request Set No. 2A
Received: August 20, 2021

OUCC 2A.5

Request:

Please refer to Corrected Petitioner's Exhibit No. 1-B (RAF), Excess Distribution Generation tariff, Definitions: "Advanced Metering Infrastructure ('AMI')", p. 1. Has DEI deployed single-phase AMI electric meters in its service territory? If yes, please provide the manufacturer or technical brochure ("brochure") of the single-phase AMI electric meters. If no, please explain why not.

a. Using the single-phase AMI electric meter's manufacturer or technical brochure as reference, please provide a technical explanation of the "metrology" or mechanics of how the meter measures "the instantaneously total kWh Imported (consumed) by the customer" and indicate the section(s) in the brochure that correlates to your response.

b. Using the AMI electric meter's manufacturer or technical brochure as reference, please provide a technical explanation of the metrology or mechanics of how the AMI meter measures "Excess Distributed Generation (Exports)" and indicate the section(s) in the brochure that correlates to and supports your response.

c. Please identify the AMI meter register that measures Exports, if any, and indicate the section(s) in the brochure that correlates to and supports your response.

d. Does the AMI meter require more than one register to measure and determine Exports? Please explain and indicate the section(s) in the brochure that correlates to and supports your response.

e. If the AMI meter requires no more than one register to measure and determine Exports, please identify the single register and provide a technical explanation of the metrology or mechanics how that single register measures and determines Exports. Please indicate the section(s) in the brochure that correlates to and supports your response.

Objection:

Duke Energy Indiana objects to this request as overly broad and unduly burdensome as it is not limited in scope to EDG customers. Duke Energy Indiana further objects to this request as not reasonably calculated to lead to the discovery of admissible evidence.

Response:

Subject to and without waiving or limiting its objections, Duke Energy Indiana responds as follows: Please see: openway-centron-meter.pdf (itron.com). Answering further, please see the Company's previous response to Solarize Indiana 2.4.

a. The OpenWay meter is capable of measuring both kWh delivered, and kWh received energy. See page 2 of the manufacturer's brochure, bidirectional metering.

b. The Openway meter will measure any excess kWh energy produced (Exports). See page 2, register capabilities.

c. The register that records kWh received from the customer generation is "kWh received". See page 2, register capabilities.

d. The OpenWay meter uses two (2) registers to record bidirectional meter data: kWh delivered and kWh received. Any kWh energy produced by customer generation not consumed by the energy demands of the premise is recorded on the kWh received channel. See page 2, register capabilities.

e. Duke Energy Indiana requires two (2) registers when it uses the OpenWay meter. See response to subpart d. above.

OUCC
IURC Cause No. 45508
Data Request Set No. 2A
Received: August 20, 2021

OUCC 2A.6

Request:

Please refer to Corrected Petitioner's Exhibit No. 1-B (RAF), Excess Distribution Generation tariff, Definitions: "Instantaneous Netting," p. 1. Please explain the use of the term "instantaneous" in the definition of "Instantaneous Netting" where the definition included and expressed a perceptible period of time passage of 30 minutes, if the definition is different from the definition provided in Q 1.4. Please provide support to your response.

a. Please provide a technical explanation of the mechanics how Duke Energy Indiana's AMI technology measures and records the directional flow of energy, if different from the responses in Q 1.5. Please identify and provide the manufacturer or technical brochure ("brochure") of the AMI electric meter and indicate the section(s) in the brochure that correlates to and supports your response.

b. Please provide a technical explanation of the "metrology" or mechanics of how the AMI electric meter measures the respective directional flow of energy for "Exports" and "Imports" and indicate the section(s) in the brochure that correlates to your response, if different from the responses in Q 1.5.

Objection:

Duke Energy Indiana objects to this request as vague and ambiguous, particularly the references to "Q 1.4" and "Q 1.5", which provide no basis from which Duke Energy Indiana can determine what information is sought.

Response:

Subject to and without waiving or limiting it objections and assuming this request seeks information regarding "Q 2.4" and "Q 2.5" in this data request set, Duke Energy Indiana responds as follows: The Excess Distribution Generation tariff filed in this proceeding contained a definition of the term "Instantaneous Netting". It effectively stated the Company will measure and record energy flows to the shortest intervals within the capability of its AMI equipment. It was meant to convey that records of its meters' measurements are not available in any more granular detail than 30-minute intervals. However, measurement of <u>all</u> the energy (kWh) that either was delivered to the customer or received from the customer will be recorded for each billing cycle. The Company; however, cannot detail that amount in intervals less than 30 minutes in month. Please also see Duke Energy Indiana's previous responses to Solarize Indiana 2.2 and IndianaDG 2.15.

a. See the links to the technical manual previously provided in Duke Energy Indiana's responses to OUCC 2A.2, 2A.3, and 2A.5.

b. The Openway AMI meter calculates energy quantities by performing direct sampling of the voltage and current waveforms thousands of times per second. Watt-hours are calculated by multiplying the instantaneous value of voltage times the current on the same phase. These values are added to the watt-hour accumulator and displayed on the face of the meter as Wh delivered and Wh received. (Itron TRG)

Witness: Roger A. Flick, II

OUCC
IURC Cause No. 45508
Data Request Set No. 2A
Received: August 20, 2021

OUCC 2A.7

Request:

Please refer to Corrected Petitioner's Exhibit No. 1-B (RAF), Excess Distribution Generation tariff, Metering, p. 2. Please provide a technical explanation of the "metrology" or mechanics of how the AMI electric meter measures "the flow of electricity in two (2) directions." Please provide support to your response.

a. Please provide a technical explanation of the "metrology" or mechanics of how the AMI electric meter captures the periodic imports and exports if different from the responses in Q 1.5. Please identify and provide the manufacturer or technical brochure ("brochure") of the AMI electric meter and indicate the section(s) in the brochure that correlates to and supports your response.

Objection:

Duke Energy Indiana objects to this request as vague and ambiguous, particularly the use of the term "Q 1.5" without further definition or explanation.

Response:

Subject to and without waiving or limiting its objections and assuming this request seeks information about "Q 2.5" in this set of data requests, Duke Energy Indiana responds as follows: See Duke Energy Indiana's Response to IndianaDG 2.14.

a. Please see the Company's response to OUCC 2.6-b.

Witness: Roger A. Flick, II

OUCC
IURC Cause No. 45508
Data Request Set No. 2A
Received: August 20, 2021

REVISED RESPONSE 9-13-21
OUCC 2A.5

Request:

Please refer to Corrected Petitioner's Exhibit No. 1-B (RAF), Excess Distribution Generation tariff, Definitions: "Advanced Metering Infrastructure ('AMI')", p. 1. Has DEI deployed single-phase AMI electric meters in its service territory? If yes, please provide the manufacturer or technical brochure ("brochure") of the single-phase AMI electric meters. If no, please explain why not.

a. Using the single-phase AMI electric meter's manufacturer or technical brochure as reference, please provide a technical explanation of the "metrology" or mechanics of how the meter measures "the instantaneously total kWh Imported (consumed) by the customer" and indicate the section(s) in the brochure that correlates to your response.

b. Using the AMI electric meter's manufacturer or technical brochure as reference, please provide a technical explanation of the metrology or mechanics of how the AMI meter measures "Excess Distributed Generation (Exports)" and indicate the section(s) in the brochure that correlates to and supports your response.

c. Please identify the AMI meter register that measures Exports, if any, and indicate the section(s) in the brochure that correlates to and supports your response.

d. Does the AMI meter require more than one register to measure and determine Exports? Please explain and indicate the section(s) in the brochure that correlates to and supports your response.

e. If the AMI meter requires no more than one register to measure and determine Exports, please identify the single register and provide a technical explanation of the metrology or mechanics how that single register measures and determines Exports. Please indicate the section(s) in the brochure that correlates to and supports your response.

Objection:

Duke Energy Indiana objects to this request as overly broad and unduly burdensome as it is not limited in scope to EDG customers. Duke Energy Indiana further objects to this request as not reasonably calculated to lead to the discovery of admissible evidence.

Response:

Subject to and without waiving or limiting its objections, Duke Energy Indiana responds as follows: Please see: openway-centron-meter.pdf (itron.com). Answering further, please see the Company's previous response to Solarize Indiana 2.4.

a. The OpenWay meter is capable of measuring both kWh delivered, and kWh received energy. See page 2 of the manufacturer's brochure, bidirectional metering.

b. The Openway meter will measure any excess kWh energy produced (Exports). See page 2, register capabilities.

c. The register that records kWh received from the customer generation is "kWh received". See page 2, register capabilities.

d. The OpenWay meter uses two (2) registers to record bidirectional meter data: kWh delivered and kWh received. Any kWh energy produced by customer generation not consumed by the energy demands of the premise is recorded on the kWh received channel. See page 2, register capabilities.

e. Duke Energy Indiana requires two (2) registers when it uses the OpenWay meter. See response to subpart d. above.

Revised Response:

After receiving follow up questions from the OUCC regarding this request, Duke Energy Indiana is providing additional information as follows:

1. **How many measurements are performed by the meter each second?**

   Company Response: The OpenWay meter performs direct sampling of the voltage and current waveforms to compute energy quantities. This sample occurs 4,096 times per second. Please see Confidential Attachment OUCC 2A.5-A, specifically page 31.

2. **What information is measured for each measurement?**

   Company Response: The OpenWay meter uses the Hall Effect to measure metered current and voltage dividers to measure metered voltage. Please see Confidential Attachment OUCC 2A.5-A, specifically page 31.

3. **Is the data manipulated by the meter, if at all?**

   Company Response: Measurements taken by the OpenWay meter are not manipulated. Samples have precision calibration corrections applied for computations required by the meter configuration. Direct sampling and

processing are performed by metrology to make computations and then proportional voltages and currents are sent to analog inputs of the Application Specific Integrated Circuit. Please see Confidential Attachment OUCC 2A.5-A, specifically page 31.

4. **What is ultimately recorded by the meter?**

   Company Response: The OpenWay meter ultimately records kWh delivered and kWh received. Each is stored within a respective load profile channel. Each channel corresponds to an energy register and it also contains data about outages and other events. Please see Confidential Attachment OUCC 2A.5-A, specifically page 50.

5. **What does Duke do with the recorded data?**

   Company Response: The OpenWay meter load profile data is collected by the OpenWay head end and stored in the Company's energy management database to be used for billing calculations.

6. **The specification sheet referenced only has bullet-points on the capability of the meters, but we would like more detailed information on the step-by-step operation of the meter, and how Duke has programmed the meters.**

   Company Response: The OpenWay meter is programmed with kWh delivered and kWh received energy registers. These registers are calculated by direct sampling of the voltage and current, 4096 times per second. The resulting calculations performed by the meter supplies the subsequent accumulated register display values and this data is also stored in the meter load profile data. Each 30-minute load profile interval contains high-resolution data representative of that sampling period. Please see Confidential Attachment OUCC 2A.5-A, specifically pages 31, 50, 51.

7. **Related to this issue, and raised in Request 2A.5, is the 30-minute period referenced in the corrected tariff? In the tariff, the definition of "instantaneous netting" refers to measuring and recording the directional flow of energy over 30 minutes, but then the phrase is not used anywhere else in the tariff.**

   Company Response: Yes. Answering further, the OpenWay meters do not net the power flows. The reference to 30 minutes was meant to convey that the utility does not record the measurements on its channels more frequently than every 30 minutes.

8. **The response to 2A.5 states that "measurement of all the energy (kWh) that either was delivered to the customer or received from the customer will be recorded for each billing cycle." Is there any netting of the amounts of energy**

delivered and received during this 30-minute interval, or is it that the total amounts of energy delivered and received are only accumulated and only shown during in 30-minute intervals? Providing a detailed description of what the meter measures will help answer this question.

Company Response: Energy netting is not being performed by the Company's metering equipment. Answering further, please find a detailed description of what the OpenWay meters measure as follows:

The OpenWay meter will "pulse" once (1) per watt one (1) watt hour. The kWh registers on the display will not change until pulses for that register, within the load profile, accumulate to 1000 pulses. The registers of the meter are the sum of accumulated pulses for that channel divided by 1000.

Using Channel 1, delivered kWh as an example, during any given 30-minute interval, the load profile will record pulses based on the magnitude of energy flow. The more energy, the faster the pulse. If in that 30-minute interval, the customer used 1kWh of energy, the meter will have pulsed 1000 times and the display will register 1kWh of delivered energy.

In the next 30-minute interval, if the customer uses 3kWh of energy, the meter will have pulsed 3000 times, and the display will now read 4kWh.

Because the meter is sampling at such a high rate (4096 times per second), Duke Energy Indiana can capture forward/reverse energy flow in great detail. The same methodology applies to the kWh received register/load profile where a customer's generation might push energy back to the grid at different magnitudes and durations throughout the day. As such, the fast sampling and collection of pulses across each interval ensures that the meter is accurately capturing reverse energy just as it does with delivered energy. In short, the meter is not netting any energy – the delivered and received kWh energy is captured on individual channels.

CERTIFICATE OF SERVICE

This is to certify that a copy of the foregoing ***Indiana Office of Utility Consumer Counselor Public's Exhibit No. 1 Testimony of OUCC Witness Anthony A. Alvarez*** has been served upon the following counsel of record in the captioned proceeding by electronic service on September 20, 2021.

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