

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-001

Witness & Respondent: Clifton Below

REQUEST:

Page 7, line 6: Please explain how you reconcile the statement that a cost/benefit analysis does not need to be undertaken with the language in the law that directs to Commission to “defer the implementation of the statewide, multi-use, online energy data platform... if it determines that the cost of such platform to be recovered from customers is unreasonable and not in the public interest”? How should public interest be determined in the absence of a cost/benefit analysis? Please be as specific as possible with your criteria.

RESPONSE:

I reconcile my assertion that neither the Commission nor other parties to this proceeding are required to undertake a benefit/cost analysis to determine if development and implementation of the multiuse, statewide data platform is in the public interest with RSA 378:51 by reading the plain language of the statute, as is standard practice in statutory interpretation. The first section of SB 284, which was enacted as Chapter 286, NH Laws of 2019, presents a number of findings by the NH General Court that together constitute a strong finding or presumption that it is in public interest to develop and implement a multi-use online data platform, by the body that has the highest authority to make such findings or determinations.

The NH Constitution provides that “all just power possessed by the state is [] granted to the general court to enact laws . . . to control and regulate the acts of [monopoly] corporations” including to provide “for the supervision of government thereof” as well as to limit and regulate the “size and functions of all [such monopoly] corporations. (Part II, Art. 83, Constitution of New Hampshire.) Over the years the General Court has enacted laws to create and delegate much of this authority to the Commission, however the General Court does regularly provide policy and regulatory direction to the Commission through legislative findings and enactments.

In this case the General Court finds, in part,¹ that:

In order to accomplish the purposes of electric utility restructuring under RSA 374-F, to implement fully the state energy policy under RSA 378:37, and to make the state's energy systems more distributed, responsive, dynamic, and consumer-focused, it is necessary to provide consumers and stakeholders with safe, secure access to information about their energy usage. Access to granular energy data is a foundational element for

¹ with emphasis added in this and subsequent quotations.

moving New Hampshire's electric and natural gas systems to a more efficient paradigm in which empowering consumers is a critical element. (Chapter 286:1, NH Laws of 2010)

The primary purpose of RSA 374-F to restructure the electric utility industry and guide its regulation going forward is stated in the first sentence of the purpose clause – to harness “the power of competitive markets” to reduce costs for consumers of electricity. It expressly identifies as “**key** elements in a restructured industry” “[i]ncreased customer choice and the development of **competitive** wholesale and **retail electricity services**.” The work “key” in this context means “to be essential to, play the most important part in.”²

The plain meaning of “necessary” in the context of the data platform statutory findings is “absolutely needed, required.”³ The plain meaning of “foundational” in this context is “of, relating to, or forming or serving as a base or foundation.”⁴ A foundation is a base or platform on which other structures, principles, or policies are supported. The plain meaning of “critical” in this context is “indispensable, vital.”⁵

Another way to read or paraphrase the General Court’s findings, at least in part, is that they have found, as a matter of law, that in order to realize the public policy goals of RSA 374-F and RSA 378:37 [by law deemed to be in the public interest] including to achieve the **essential** goal of developing an open and competitive market for retail electricity services and customer choice it is **absolutely needed – required** – to develop a robust data platform for a multiplicity of uses related to energy data and that the development and implementation this platform provides **a base – a foundation** – for moving the whole natural gas and electric systems forward to a more efficient paradigm or structure in which it is **vital – indispensable** – to empower consumers through development of the data platform. Hence, the General Court has established a rather clear presumption that development of the data platform is in the public interest.

The implementing language of the statute reinforces this presumption that development of the data platform is in the public interest. RSA 378:51 opens by creating an unequivocal mandate in the first instance:

“The commission **shall require** electric and natural gas utilities to establish and jointly operate a statewide, multi-use, online energy data platform. The platform **shall** . . .” [and the statute goes on to specify a number of features (a)-(g) that the platform is required to have].

In the next section RSA 378:51, II requires an adjudicative proceeding to determine a number of features of the data platform grouped in subsections (a)-(c). There is nothing in this list that specifies that Commission or any party, including the utilities, are required to undertake a benefit-cost test, or even consider benefits or costs, much less make a positive determination that development and implementation of the platform is in the public interest or for the public good. If the legislature had wanted to require the Commission make an affirmative public interest

² <https://www.merriam-webster.com/dictionary/key>

³ <https://www.merriam-webster.com/dictionary/necessary>

⁴ <https://www.merriam-webster.com/dictionary/foundational>

⁵ <https://www.merriam-webster.com/dictionary/critical>

determination on any basis, including evaluation of costs and benefits, they could have easily incorporated such languages into the list of determinations that the Commission is required to undertake as part of the adjudicated proceeding, but they did not. The legislature has required that the Commission make an affirmative finding that an action is in the public interest or for the public goods many times before⁶, so they know how to write such a requirement. But they wrote no such requirement for an affirmative public interest determination and evaluation of costs and benefits as part of this adjudicative proceeding.

Instead, as a separate requirement, apart from the adjudicative proceeding requirements, the General Court wrote at RSA 378:51, III that the “[c]ommission shall defer the implementation of the . . . platform pursuant to paragraph I if it determines that the cost of such platform to be recovered from customers is unreasonable and not in the public interest.” Presumably implementation would be deferred until such time as the costs to be recovered from customers are no longer deemed to be unreasonable and not in the public interest, or perhaps until the General Court provides further direction. The language of RSA 378:51, III allows for a party, or perhaps the Commission, *sua sponte*, to make such a negative determination, if the Commission has the evidence to support a finding that the cost to be recovered from customers is unreasonable and not in the public interest. Nowhere in law is the opposite required, that the commission make a positive determination that the costs, relative to the benefits, are reasonable and in the public interest, even though that is frequently done in regulatory statutes, hence I conclude that the statute creates a rebuttable presumption that development of the data platform is in the public interest and that the burden of proof would be on the party asserting that the costs to be recovered from customers are unreasonable and not in the public interest to support a finding by the Commission that such is the case and that would only serve to defer implementation of the platform, not to eliminate the requirement.. However, at this point in the process, as Eversource and Unitil acknowledge at page 53 of their Joint Testimony, it is not possible “to provide specific cost estimates”. It is worth noting, that even without a findings or purpose statement laws are presumptively enacted for the public good and in the public interest.

As an aside, looking beyond the plain meaning of the words and sentences in Chapter 264, NH Laws of 2019, it is possible to see the enactment of SB 264 as a way for the General Court to express frustration with the lack of progress by the Commission and utilities in realizing the purposes and potential of RSA 374-F, full implementation of RSA 378:37, and progress in advancing the objectives of Grid Modernization, alternative net metering tariffs, and the energy efficiency resource standard, so taking matters more directly into their own authority, they have interceded to try to accelerate progress by mandating the development of this platform, while allowing for deferment in time if the costs charged to ratepayers to implement, presumably following a fair bit of design and specification to better determine costs, are shown to be unreasonable and not in the public interest. I do hope that this proceeding enables development of the fullest range and depth of possible functionality and benefits, now and into the foreseeable future, at a reasonable cost, without further intervention by the General Court.

⁶ Just as one example, RSA 374-G:5, II requires the Commission to make a positive public interest determination in order to authorize utility investments and cost recovery in certain distributed energy resources and includes as criteria for making such a determination evaluation of 9 factors, 3 of which expressly reference costs and benefits and 4 others reference costs, benefits, or benefits and liabilities.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-002

Witness & Respondent: Clifton Below

REQUEST:

Page 7, line 18: Do you believe a cost/benefit analysis relative to overall platform development and specific platform functionality/functionalities would be reasonable and in the public interest?

RESPONSE:

No. As explained in my response to EU 1-1, the law does not call for an overall cost/benefit analysis to determine public interest, because the General Court has created a rebuttable presumption that development of a statewide multi-use data platform is in the public interest and it is unproductive and perhaps contrary to law to try to second guess the General Court. To the extent costs and benefits are assessed it should be done holistically after the universe of use cases or user stories is established and agreed upon as stated repeatedly in response to utility questions about LGC proposed use cases found at tab 47 in the docket book for this case and incorporated by reference into the testimony of Dr. Amro Farid. For example, at p. 3 the LGC notes that the costs and benefits “from an individual use case should never be assessed individually. A given use case often accrues significant costs for “generic groundwork’ that can be shared across multiple use cases … The total benefits of a given use case are usually not realized until other use cases have been implemented as well.” These observations were made as part of the original scoping comments of the City of Lebanon, Town of Hanover, and Samuel Golding that can be found at tab 27 in the docket book and incorporated by reference into the testimony of Dr. Amro Farid. See, in particular, the elaboration on this very point at page 9, which I incorporate into my response. This issue was further explained in the attached PDF entitled “ATT EU to LGC 1-2 DE 19-197 LGC on Use Case Reconciliation” that was provided to the entire service list in this docket on 5/28/20. For additional response to this request see the discussion that starts on the 2nd page of that document on the way forward regarding “use case prioritization” that continues on to the 3rd page.

For convenient reference I restate a portion of that discussion here:

Furthermore, it is important to distinguish between prioritization of engineering implementation and prioritization of scope. In the former, the engineering scope is held fixed and engineering and financial constraints determine which parts of the scope will be built first. In the latter, the engineering scope is entirely open for discussion creating

the potential for stakeholder winners and losers. We believe strongly that “use case prioritization,” without seeing how they might all fit together and share data sources and platform technical requirements, will destine this DE 19-197 docket to a highly contentious proceeding; one that most stakeholders wish to avoid as much as possible.

Part of the reason that “use case prioritization” has been proposed is the unsupported belief that more stakeholder use cases will lead to impractical costs. First, this belief, until now, is not founded in any documented evidence. Second, it is extremely common that stakeholder use cases are overlapping. They could 1) be identical use cases but stated differently, 2) have overlapping elements, or 3) be a more specific or general version of each other. Furthermore, the data fields necessary for two entirely different use cases could be entirely the same. In all of these situations, additional use cases do not necessarily increase costs.

Moreover, additional use cases and requirements could lower costs because they add greater precision and certainty for the engineering contractor and less engineering analysis is required to determine how to fulfill the use cases. Finally, it is well known within the field of systems engineering that uses cases and requirements do NOT drive costs. Rather, it is engineering artifacts that do. Speaking of costs before the data platform has been designed is an engineering non-sequitur. Returning to the example of the road, one wouldn’t ask for the project cost before specifying the road’s length, width, thickness, material and grade. Similarly, a cost-based discussion should only occur after the data fields associated with use cases have been determined. In contrast, use cases and requirements do drive valuable benefits.

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Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-003

Witness & Respondent: Clifton Below

REQUEST:

Page 7, line 22: Please specify what you believe the costs and security measures in place would need to be in order to provide “access to raw meter data on near real-time basis”?

RESPONSE:

The LGC objects to this question as overly broad as it seeks information that the witness does not have and asks the witness to undertake additional research and analysis to develop new information as part of a data request, which is not an appropriate use of discovery.

Notwithstanding the objection, the witness provides the following response:

A basic security measure would be to make the raw data available as “read-only” so that it could not be changed or deleted in the database where it resides by unauthorized users. The cost to provide it might depend on what kind of database it is stored in (e.g. cloud based AMI data vs. legacy MDMS internal database), but seems like it might be incrementally small if similar access is provided to validated data. It is just another similar database to connect to the platform as verified meter data. The cost to store it would depend on how long it is stored for and how much space it takes such as due to the granularity of the data and the data collection interval.

If a customer (or their proxy, such as through “connect my data”) can stream such raw data in near real-time when it is collected, then storage costs for the utility shouldn’t need to be any more than what they are now, which is to say, once the raw data has been verified, then the raw data may no longer need to be retained and the verified data can take its place. For example, the EKM metering system referenced in footnote #2 on page 8 of my testimony only stores the most recent 1,000 reads (regardless of frequency or interval of data collection) before the data is compiled or pruned into 15-minute intervals for permanent storage. Purchase of the \$110 Push device that handles all communication from the meter to the cloud based storage (without need for an intermediate computer) includes lifetime storage of 15 minute interval data for up to 50 meters per Push device, including for 3 phase meters that provides separate data for each phase as well as aggregated or total load data, at no additional or recurring cost. Data includes forward and reverse kWh, watts, volts, power factor, VARs, frequency, TOU period forward and reverse kWh for up to 4 periods, pulse counts, total KVARh, resettable kWh forward and reverse, and maximum demand (by choice of interval). So from at least one vendor the cost of long-term meter data storage at a fairly high granularity appears to be minimal as the hardware with integral software may account for most of the one-time cost.

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Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-004

Witness & Respondent: Clifton Below

REQUEST:

Page 8, line 3: Please identify the “limitations and inaccuracies that might be inherent in raw or non-revenue grade data.”

RESPONSE:

This would appear to be a question that the utilities themselves would be in the best position to answer. Having worked with a few raw meter data sets, that have collected data at intervals of once per hour (on the top of the hour), once per minute, and once per every few seconds (mostly every 3 seconds), the primary limitation that I’m familiar with is missing data reads, i.e. meter reads at the specified interval that aren’t there for whatever reason, or where the time stamp is off from what is desired. If one wants to “fill in the gaps” some kind of extrapolation or estimating algorithm needs to be applied. Another possible limitation or source of inaccuracy might arise from when the metering device is exchanged and the register reports have a disruption in numerical sequence that has to be corrected for. Some meters may have a multiplier or ratio that is applied to basic units to get the reporting units, so that could be misunderstood from raw data. The raw data may also need custom software to unencrypt or translate the data into meaningful units and descriptors. Non-revenue grade data could also be inaccurate and inappropriate for revenue purposes because the underlying device has not been designed or verified to produce data within revenue grade tolerances for accuracy.

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Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-005

Witness & Respondent: Clifton Below

REQUEST:

Page 8, line 5: Please identify the FERC standards “that apply to utility operations under federal jurisdiction.”

RESPONSE:

Presumably all FERC standards apply to utility operations under federal jurisdiction as a jurisdictional matter. I am not acquainted with all of the details of FERC standards, but I would imagine that some FERC standards aren't applicable to particular operations because they only pertain to certain operations and not others.

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Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-006

Witness & Respondent: Clifton Below

REQUEST:

Page 8; line 7: Why would the referenced FERC standards relative to retail metering and distribution utility operations not be applicable to this data platform? Why would these standards not be applicable to third-party sources of data that “might be available through the platform”?

RESPONSE:

First and foremost because this data platform is being developed pursuant to state law and is under state jurisdiction and not federal jurisdiction, so FERC standards are simply not applicable, except to the extent FERC jurisdictional data from the interstate transmission grid or interstate wholesale sale of electricity might be made some part of the platform.

I’m wondering why this is even a question as I presume electric utility lawyers are aware there is a fairly bright line between state and federal jurisdiction created explicitly by the Federal Power Act and confirmed by a series of US Supreme Court decisions. Simply put, retail meters and the data produced by them, as well as distribution utility operations and DERs generally including distributed generation and storage that is less than 5 MW in capacity, not a FERC jurisdictional interstate wholesale market participant, and connected to the distribution grid are all under exclusive state jurisdiction and not under FERC jurisdiction. The General Court and the Commission in some circumstances might want apply FERC standards, such as the uniform system of accounts, to state jurisdictional matters, but they are not required to do so, as the still standing precedent of *Connecticut Light & Power Co. v. FPC*, 324 U.S. 515 (1945) makes clear, even for a non-lawyer. For readers that may not be familiar with how clearly the jurisdictional boundary has been drawn, the following excerpts from the US Supreme Court and FERC legal analysis provides a useful summary (with emphasis added)⁷:

From US Supreme Court FERC v. EPSA, 577 U. S. ____ (2016)⁸:

... this Court held in *Public Util. Comm'n of R. I. v. Attleboro Steam & Elec. Co.*, 273 U. S. 83, 89–90 (1927), that the Commerce Clause bars the States from regulating certain interstate

⁷ For additional legal analysis please see the protest of NARUC (which the NHPUC is a member of) in the petition of New England Ratepayers Association, FERC Case No. EL20-42, pp. 34 to 45 in particular, available at:

<https://pubs.naruc.org/pub/4204BA38-155D-0A36-31CE-8A05CD0AC660>.

⁸ https://www.supremecourt.gov/opinions/15pdf/14-840-%20new_o75q.pdf

electricity transactions, including wholesale sales (*i.e.*, sales for resale) across state lines. That ruling created what became known as the “Attleboro gap”—a regulatory void which, the Court pointedly noted, only Congress could fill. [p. 3]

... Congress responded to that invitation by passing the FPA in 1935. The Act charged FERC’s predecessor agency with undertaking “effective federal regulation of the expanding business of transmitting and selling electric power in interstate commerce.” *New York v. FERC*, 535 U. S. 1, 6 (2002) (quoting *Gulf States Util. Co. v. FPC*, 411 U. S. 747, 758 (1973)). Under the statute, the Commission has authority to regulate “the transmission of electric energy in interstate commerce” and “the sale of electric energy at wholesale in interstate commerce.” 16 U. S. C. §824(b)(1).

... the Act also limits FERC’s regulatory reach, and thereby maintains **a zone of exclusive state jurisdiction.** As pertinent here, §824(b)(1)—the same provision that gives FERC authority over wholesale sales—states that “this subchapter,” including its delegation to FERC, “shall not apply to any other sale of electric energy.” Accordingly, **the Commission may not regulate either within-state wholesale sales or, more pertinent here, retail sales of electricity** (*i.e.*, sales directly to users). See *New York*, 535 U. S., at 17, 23. State utility commissions continue to oversee those transactions.

... as earlier described, [FPA] §824(b) limit[s] FERC’s sale jurisdiction to that at wholesale,” **reserving regulatory authority over retail sales (as well as intrastate wholesale sales) to the States.** *New York*, 535 U. S., at 17 (emphasis deleted); see 16 U. S. C. §824(b); *supra*, at 3. **FERC cannot take an action transgressing that limit** no matter its impact on wholesale rates. [p. 17].

.. The Act makes federal and state powers “complementary” and “comprehensive,” [p.27]

Excerpts from a “Legal Analysis of Commission Jurisdiction over the Rates, Terms and Conditions of Unbundled Retail Transmission in Interstate Commerce” that FERC attached as Appendix G to its Order No. 888 (<https://www.ferc.gov/legal/maj-ord-reg/land-docs/order888.asp>):

1. Relevant Federal Power Act Provisions Section 201(b)(1) of the FPA provides: The provisions of this Part shall apply to the transmission of electric energy in interstate commerce and to the sale of electric energy at wholesale in interstate commerce **The Commission shall have jurisdiction over all facilities for such transmission or sale of electric energy, but shall not have jurisdiction over facilities used in local distribution or only for the transmission of electric energy in intrastate commerce, or over facilities for the transmission of electric energy consumed wholly by the transmitter.** 16 U.S.C. 824(b)(1) (emphasis added). Thus, the statute on its face limits Commission jurisdiction over sales of energy to sales at wholesale, but does not limit jurisdiction over transmission to transmission used only for wholesale sales. Sections 201(c) and (d) define the meaning of "the transmission of electric energy in interstate commerce" and "sale of electric energy at wholesale in interstate commerce." Section 201(c) provides: For the purpose of this Part, electric energy shall be held to be transmitted in interstate commerce if transmitted from a State and consumed at any point outside thereof: but only insofar as such transmission takes place within the United States....

In *Connecticut Light & Power Co. v. FPC*, 324 U.S. 515 (1945)(CL&P), the Court reviewed the Commission's finding that a Connecticut utility was jurisdictional because it owned transmission facilities that were used in interstate commerce. The Court generally embraced the Jersey Central standard for determining whether facilities are used to transmit electric energy in interstate commerce. The Court emphasized that whether certain facilities transmit electric energy in interstate commerce is more a technical than a legal question. The Court stated:

Federal jurisdiction was to follow the flow of electric energy, an engineering and scientific, rather than a legalistic or governmental, test. [p. 6] . . .

CL&P, which was decided two years after Jersey Central, is the leading case interpreting the section 201(b) local distribution provision. In CL&P, the Commission sought to regulate the accounting practices of Connecticut Light & Power Company [p. 18] At issue was whether CL&P was a "public utility" under the FPA. The utility's system encompassed an area solely within a single state (Connecticut) 36/ and did not interconnect with any other company that operated out of state. "Its purchases and sales, its receipts and deliveries of power, [were] all within the state." However, CL&P did purchase energy from companies that had, in turn, purchased energy from Massachusetts. The company also sold energy to a municipality that exported a portion of that energy to Fishers Island, located off the coast of Connecticut but "territory of New York." The Commission based its jurisdiction on these few transactions. The Court of Appeals affirmed the Commission, holding that the Commission's jurisdiction extended to "electric distribution systems which normally would operate as interstate businesses." The Court of Appeals found that: whether or not the facilities by which petitioner distributes energy from Massachusetts should be classified as 'local' is not relevant to this case. The sole test of jurisdiction of the Commission over accounts is whether these facilities, 'local' or otherwise, are used for the transmission of electric energy from a point in one state to a point in another. The Supreme Court reversed. It held that the statutory language in section 201(b) of the FPA providing that the Commission "shall not have jurisdiction . . . over facilities used in local distribution" is a limitation upon Commission jurisdiction that "the Commission must observe and the courts must enforce." In analyzing the statute, the Court stated: It has never been questioned that technologically generation, transmission, distribution and consumption are so fused and interdependent that the whole enterprise is within the reach of the commerce power of Congress, either on the basis that it is, or that it affects, interstate commerce, if at any point it crosses a state line. . . .

But whatever reason or combination of reasons led Congress to put the provision in the Act, we think it meant what it said by the words "but shall not have jurisdiction over facilities used in local distribution." Congress by these terms plainly was trying to reconcile the claims of federal and local authorities and to apportion federal and state jurisdiction over the industry.

The Court decided that this limitation on jurisdiction was "a legal standard that must be given effect in this case in addition [p. 20] to the technological transmission test." . . .

The Court stated that whether or not local distribution facilities carried out-of-state electric energy was irrelevant. Whatever the origin of the electric energy they carried, so long as the utility used the lines for local distribution, they were exempt from federal jurisdiction. In fact, the Court stated that local distribution facilities "may carry no energy except extra-state energy and still be exempt under the Act."

The Court concluded that the Commission's order: must stand or fall on whether this company owned facilities that were used in transmission of interstate power **and** which **were not** facilities used in local distribution.

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Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-007

Witness & Respondent: Clifton Below

REQUEST:

Page 8, lines 9-10: Other than “informed customer choice” in the competitive third-party market, what other data accuracy, timeliness, privacy, and security concerns should be required for competitive third-party entities? What qualifications should potential users of the platform have to meet in order to be granted access to the platform?

RESPONSE:

The LGC objects to this question as overly broad as it seeks information that the witness does not have and asks the witness to undertake additional research and analysis to develop new information as part of a data request, which is not an appropriate use of discovery.

Notwithstanding the objection, the witness provides the following response:

The statement referenced was specifically regarding standards for data retention. The context of the quoted text was with regard to “informed customer consent” helping to drive (or shape, if you will) requirements on third parties, so as to indicate that if a customer wants to release their data publicly, or some subset of it, or they want a vendor to retain it indefinitely, those should be options that an informed customer should be able to authorize. This would be in contrast to a policy that would require all third parties to destroy customer data within set periods of time, which would be impossible if was released publicly.

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Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-008

Witness & Respondent: Clifton Below

REQUEST:

Page 8, line 11: Please specify what the data storage cost and security issues would be “If a customer wants their individual customer data to be warehoused by a vendor indefinitely.” What quality standards would be expected of such data and who would be responsible for them?

RESPONSE:

The LGC objects to this question as overly broad as it seeks information that the witness does not have and asks the witness to undertake additional research and analysis to develop new information as part of a data request, which is not an appropriate use of discovery.

Notwithstanding the objection, the witness provides the following response:

These issues should primarily be between the vendor or third party and the individual customer, as it normally is in any open and competitive free market. Security, costs, and quality standards should all depend on the particular use case or application. The utility should not be responsible for data storage costs, security issues, and quality standards once the data is released by a customer to a third party. There could be some built in options, perhaps on top of default settings, in some these matters that a customer could select when they choose to share their data. It would probably depend on the use case.

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Date Request Received: 8/31/2020 Date of Response: 9/15/20
Witness & Respondent: Clifton Below

REQUEST:

Page 9, line 5: Please outline where in the legislation the data platform is required to support the “development of a retail/distribution system level transactive energy systems (with) near real-time access to certain data”? If this is additional functionality, please provide an estimated costs and benefits, or if cost or savings estimates cannot be provided, please explain why not, and at least provide the benefits that could be seen from this in 5 years from the launch of the data platform.

RESPONSE:

The LGC objects to this question as overly broad as it seeks information that the witness does not have and asks the witness to undertake additional research and analysis to develop new information as part of a data request, which is not an appropriate use of discovery.

Notwithstanding the objection, the witness provides the following response:

The statute does not specifically state that the data platform is required to support development of transactive energy systems, nor does it anywhere preclude such. However, the purpose statement of the law (Chapter 286:1, NH Laws of 2019) does start off by saying “[i]n order to accomplish the purposes of electric utility restructuring under RSA 374-F . . .” it is necessary to develop a multi-use online data platform. RSA 374-F is pretty much all about developing, what today is known as “transactive energy systems” at both the wholesale and retail levels.

Let’s look at the most widely accepted current definition of transactive energy systems developed by the Gridwise Architecture Council:

A system of economic and control mechanisms that allows the dynamic balance of supply and demand across the entire electrical infrastructure using value as a key operational parameter.

Value is primarily denoted in dollars. The interstate wholesale market for the supply of electricity is a transactive energy system operated by ISO New England. However, it only covers part of the electrical infrastructure in the region, mostly on the bulk supply side at the transmission system level. The demand side of the equation, load and DERs in the retail market at the distribution system level, is largely disconnected and disabled from using “value,” a.k.a. “appropriate price signals” as used in RSA 374-F:1, to help dynamically balance supply and demand. Dynamic balancing of supply and demand in electricity requires access to

consumption, production, and system data in near real time, whether done under the traditional “command and control” model of a vertically integrated regulated monopoly utility or in restructured market based approach to supplying system resource needs. RSA 374-F:1 states that the “goal of restructuring is to develop a more efficient industry structure and regulatory framework” by “harnessing the power of competitive markets” to drive down costs and increase economic efficiency. “Increased customer choice and the development of competitive markets for wholesale and retail electricity services are key elements in a restructured industry” RSA 374-F:3, XIV further provides that “[t]he market framework for competitive electric service should, to the extent possible, reduce reliance on administrative process. New Hampshire should move deliberately to replace traditional planning mechanisms with market driven choice as the means of supplying resource needs.”

As described in pp. 134-141 of Dr. Farid’s testimony “the shared integrated grid is the leading industrial concept for New Hampshire to achieve its objectives” expressed in law and development of a transactive energy system at the distribution system level “will enable animated and competitive retail electricity markets and help customers to obtain lower electric costs, reliable service, and secure energy supplies.”⁹ He completes his explanation of how the data platform enables a transactive energy system that enables a shared integration grid that best realizes the legislative objectives thus:

The statewide multi-use online energy data platform would allow for network-enabled distributed energy resources and devices to communicate the prices and quantities of electricity services that they provide or utilize in real-time. The data platform would allow customers to engage by sending and receiving their consumption and distributed generation data and reporting the status of energy storage capacity to charge or discharge, not unlike spinning reserve. The data platform would send and receive the price and quantity data inherent to the coordinated exchange of electricity at the community level. In short, there is no shared integrated grid without a data platform that engages the participation and communication of grid stakeholders. It is foundational.

Beyond enabling realization of legislative objectives what is the benefit of the data platform enabling development of a retail/distribution level transactive energy system and why don’t I have a number for that specific to New Hampshire now? First I’d say the benefit could be immense. It could allow New Hampshire to become a national leader in how to harness the power of competitive markets to dramatically accelerate the cost-effective development and integration of renewable energy resources to achieve our goals to decarbonize the electric grid and avert the worst of run away global warming. What might be the value of helping to save global eco-systems and civilization itself by providing leadership and a model of how we can actually collaboratively do this (the shared integrated grid), while at the same time helping our

⁹ Testimony of Dr. Amro M. Farid for City of Lebanon & LGC, Bates p. 14

local communities to be environmentally and economically sustainable for generations to come? Priceless I'd say.

Second, why don't I have a quantification of the value of such benefit? It's complicated as evidenced by the result of a multi-year project funded by the U.S. Department of Energy that culminated in a final report entitled *Valuation of Transactive Systems*.¹⁰ The abstract for the report states that the project was:

to formulate and test a methodology for valuation of systems where transaction-based mechanisms coordinate the exchange of value between the system's actors. Today, the principal commodity being exchanged is electrical energy, and such mechanisms are called transactive energy systems. The authors strove to lay a foundation for meaningful valuations of transactive systems in general, and transactive energy systems as a special case. The word valuation is used in many different ways. This report proposes a valuation methodology that is inclusive of many types of valuations. Many will be familiar with cost-benefit valuations, in which both costs and benefits are assessed to determine whether the assets are worth their cost. Another set of valuation methods attempt to optimize an outcome using available resources, as is the case with integrated resource planning. In the end, this report's methodology was most influenced by and most resembles the integrated-resource-planning approach.¹¹

It might be a very interesting exercise to apply the methodology in this report to a New Hampshire specific case study in the context of what this data platform could enable, but that is beyond my means to do as a volunteer in a data response, or really at any point in this proceeding. However, there are a few analyses that might give us an order of magnitude for the potential of TE. Appendix A to *Valuation of Transactive Energy* is entitled "An Estimate of the Potential Value of Supplying Grid Services Using Flexible Loads in Residential and Commercial Buildings - Summary of Results," by RG Pratt and N Fernandez, Pacific Northwest National Laboratory, 9-10-2014. At the request of DOE they "developed an estimate of \$22B/year for the potential value of continuously engaging real-time-flexible loads in both residential and commercial buildings to provide grid services if deployed at the national scale." Presumably in 2014 dollars the NH share of that would be about \$66 to \$88 million/year based on NH's proportion of US 2018 electricity load (about 0.3%)¹² or 2019 population of NH as a share of the national total (about 0.4%).

A separate analysis reported on last year by a team from the Brattle Group, including Dr. Faruqui, on "The National Potential for Load Flexibility VALUE AND MARKET POTENTIAL THROUGH 2030" estimated the annual potential savings from additional flexible load in the US

¹⁰ Hammerstrom, Donald J., Corbin, Charles D., Fernandez, Nicholas, Homer, Juliet S., Makhmalbaf, Atefe, Pratt, Robert G., Somani, Abhishek, Gilbert, Erik I., Chandler, Shawn, and Shandross, Richard. Thu . "Valuation of Transactive Systems". United States. doi:10.2172/1256393. <https://www.osti.gov/biblio/1256393>.

¹¹ *Id*, p. A.1.

¹² Computed from <https://www.eia.gov/electricity/state/>.

that could be enabled, in part, by transactive energy systems to be about \$16.4 billion/year by 2030.¹³ Again, using NH's load or population as an approximate share of total benefits, suggests potential value of \$49 to \$66 million per year.

Dr. Farid in his testimony also estimates “a very conservative” potential annual savings for New Hampshire from a fully enabled TE system in New England of about \$6.8 million based on only savings in the day-ahead or real-time markets.¹⁴

¹³ See slide 20: https://brattlefiles.blob.core.windows.net/files/16639_national_potential_for_load_flexibility_final.pdf.

¹⁴ Testimony of Dr. Farid, p. 164.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-010

Witness & Respondent: Clifton Below

REQUEST:

Page 9, line 12: Please identify the data sets described as “purely public data.”

RESPONSE:

The LGC objects to this question as overly broad as it seeks information that the witness does not have and asks the witness to undertake additional research and analysis to develop new information as part of a data request, which is not an appropriate use of discovery.

Notwithstanding the objection, the witness provides the following response:

These data sets can be determined as part of the process of use case reconciliation, data mapping and platform development.

These likely include any data that is publicly (non-confidentially) filed with the NHPUC, FERC, other government agencies or ISO New England in periodic reports or otherwise, such as in Liberty Utilities recent filing in DE 19-067 of its only slightly redacted “Salem Area Study 2020.”¹⁵ Data that is otherwise made publicly available, such as the type of system data, including topology, that is available through public web portals as described and linked to on pp. 159-160 of Dr. Farid’s testimony would be public data. Rates and market information may also be public data. Most if not all aggregated community level data should also fall into the public data bucket.

¹⁵ https://www.puc.nh.gov/Regulatory/Docketbk/2019/19-064/MOTIONS-OBJECTIONS/19-064_2020-09-02_GSEC_SALEM_STUDY.PDF

Local Government Coalition (LGC) Responses

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Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-011

Witness & Respondent: Clifton Below

REQUEST:

Page 9, lines 18-20: For data “that has been effectively anonymized or aggregated such that it cannot be associated or attributed [to] any one individual customer” what safeguards should be in place to protect that data?

RESPONSE:

Generally speaking, if customer data has been effectively anonymized or aggregated such that it cannot be associated or attributed to any one individual customer then it no longer meets the definition of protected individual customer data under RSA 363:37 and so I’m not sure there needs to be extensive safe guards in place to protect that data. In theory if a user of the system could make many calls for aggregated or anonymized data that overlapped a great deal and only varied slightly, they might be able to tease out instances of individual customer data. So, limitations on the volume of overlapping data aggregation or anonymization requests might be in order. Minimum thresholds for the public release of anonymized and aggregated data would also be appropriate.

Local Government Coalition (LGC) Responses

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Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-012

Witness & Respondent: Clifton Below

REQUEST:

Page 10, line 5: Please reference any aggregation and anonymization standards you or the CPA's have considered for adoption.

RESPONSE:

I think the Illinois standard for release of anonymized data sets of customer data (not just aggregation) seem appropriate for adoption. Illinois has been an early leader in making multi-tenant energy data available to commercial building owners for benchmarking and other purposes. They have also enabled access to large quantities of anonymized AMI meter data. As I understand it their standard for the release of actual individual customer data sets, provided anonymously, is that there is required be a minimum of 15 sets of data with no one data set representing more than 15% of the load. That may be reasonable for NH. A few other states use a similar 15/15 standard for the release of anonymized data. The New York Public Service Commission found that to be too restrictive of community level commercial account data and have lowered their standard for such aggregated data, such as for publicly available community level data by rate class, to require a minimum of 6 customers in a data set with no one customer accounting for more than 40% of the total, so NY has adopted a 6/40 standard for aggregation of commercial customers, while maintaining a 15/15 standard for aggregation of residential customer data.¹⁶

For the release of whole building energy data that includes tenant meter data, the New York PSC approved a 4/50 standard where “aggregated customer usage data is considered sufficiently anonymous to share publicly if (1) the aggregated group contains at least 4 individual accounts, and (2) no one account represents more than 50% of the total load. Where a set of data fails to pass the 4/50 standard, the building owner may only receive the data with tenant consent.”¹⁷ For commercial class customers, we suggest that standard would also be appropriate for community level aggregated data, considering that small numbers of such C&I rate class customers in some New Hampshire towns. .

¹⁶ NYPSC, April 20, 2018, Order Adopting Utility Energy Registry, available at:
https://drive.google.com/file/d/1ZO-wdp2Wvb4zdHgw_Otdf1-FWLxlEec7/view

¹⁷ NYPSC, April 20, 2018, Order Adopting Whole Building Energy Data Aggregation Standard, p. 2, available at:
https://drive.google.com/file/d/1InjfbySYSwWuL_c0Dc8fov2BVfexSPz_/view.

Local Government Coalition (LGC) Responses

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Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-013

Witness & Respondent: Clifton Below

REQUEST:

Page 10, line 8: Please explain more fully what registration requirements you think should be in place that align qualifications in a manner that is “commensurate with the level of access sought”.

RESPONSE:

The LGC objects to this question as overly broad as it seeks information that the witness does not have and asks the witness to undertake additional research and analysis to develop new information as part of a data request, which is not an appropriate use of discovery.

Notwithstanding the objection, the witness provides the following response:

The referenced text was with regard to “qualifications requirements for registration to access the data platform” and argues that it should be commensurate or proportionate with the level of access sought. For instance, a user that is a utility customer should have their identity verified, but should not have other significant qualifications required to access their own data. A user that only wants publicly available data should not be subject to NDAs or cybersecurity reviews, though confirmed identity and contact information would be appropriate. A property owner or their agent that only wants aggregated data for whole building energy use likewise should not be subject to NDAs or cybersecurity reviews either, though identity confirmation is more important than for just accessing more purely public information. Private party users that want access to individual customer data or other confidential data might be subject to more rigorous registration requirements, although if a customer provides informed consent to a third party to access their data for the purpose of publicly displaying it then requirements on that third party should reflect that fact, i.e. not be contrary to a boilerplate NDA requirements.

Once a Community Power Aggregation is formed under RSA 53-E it has the same legal obligations as the utilities as a service provider under RSA 363:38, pursuant to RSA 53-E:4, VI, which also expressly exempts such information from disclosure under RSA 91-A, so no NDAs should be required for them to access data for their customers. Municipalities and counties as subdivisions of the state should not be subject to cybersecurity reviews by private monopoly utilities to use the platform. They now routinely collect, securely hold, and protect confidential personal information and individual customer data to the extent protected by RSA 91-A.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-014

Witness & Respondent: Clifton Below

REQUEST:

Page 10, line 17: Please explain whether the software products developed by mPrest and Kavala Analytics have been certified by the Green Button Alliance or are compliant and able to be certified. How would these products minimize costs if they are external applications to the data platform? Who would benefit from these possible cost reductions?

RESPONSE:

I am not aware that either referenced product has been certified by GBA or are compliant to do so, as that does not appear to have been one of their purposes to date. I suggest that these innovative developers of utility energy data platforms that already draw utility data from a large variety of different databases and systems using API interfaces that may incorporate other features of the data hub that is imagined for New Hampshire, including data privacy protection and cybersecurity features, might be able to adapt their software to meet a major portion of the software development needs of this project

This might well be less expensive than starting from scratch with vendors that are not familiar with electric utility and other energy data databases and platforms. Discussions with each party by members of the LGC suggests that they are not simply looking for customers for their software as is, but are very interested in exploring the possibility of adapting or extending their software to meet the needs of the proposed statewide multi-use energy data platform.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-015

Witness & Respondent: Clifton Below

REQUEST:

Page 10, lines 9-12: Do you believe that property owners should have access to tenant energy usage and metering data via the platform even under circumstances where the tenants have their own utility account and meter? Please explain.

RESPONSE:

Yes. If there are 4 or more tenants with their own utility meters and no one of them accounts for more than 50% of total load then the aggregate load data from such tenant meters, with ICD removed, should be made available without tenant permission as is the case in New York. If there are 3 or fewer such tenants, or if the property owner wants to see individual customer data, then those customers should be able to consent to providing their meter or consumption data to the property owner or their agent through the data platform on a one-time or continuing basis (such as through “connect my data”) for a fixed term or until permission is revoked.

This would enable the property owner to properly benchmark and understand their whole building energy use, including in conjunction with utility sponsored energy efficiency programs and calculations of before and after EUIs. The NY PSC “Order Adopting Whole Building Energy Data Aggregation Standard” referenced and linked to in the response to Request No. EU to LGC 1-012 elaborates on the need for and value of such data access.

In 2011 the Board of Directors of NARUC passed a resolution acknowledging “the need for commercial building owners and managers to access whole-building energy consumption data to support energy-efficient building operations” and encouraging “State public utility commissions seeking to capture cost-effective energy savings from commercial buildings to consider a comprehensive benchmarking policy that includes:

- Use of EPA ENERGY STAR automated benchmarking services and other benchmarking services, such as the Commercial Building Consumption Survey;
- Adopting methodologies to consistently and accurately credit program impact to benchmarking-driven energy efficiency programs; and
- Taking all reasonable measures to facilitate convenient, electronic access to utility energy usage data for building owners, including aggregated building data that does not reveal customer-specific data to protect individual customer privacy, as well as the sharing of customer-specific data to the extent provided for under State law and regulations.”

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-016

Witness & Respondent: Clifton Below

REQUEST:

Page 10, lines 12-13: Please explain why “NDAs should not be required for users who do not seek access to any ICD or otherwise sensitive or confidential data.”

RESPONSE:

If a user of system is not seeking authorization to access any ICD or other data that is not public in nature, i.e. “sensitive or confidential data,” then the remaining data that they access would be more in the nature of public data that need not be protected from release; hence no need for an NDA. It is my understand that the “Utility Data Registry” run by NYSERDA in New York state provides community level aggregated energy consumption data publicly, over a web portal, where no NDA is required, and apparently not even registration. See <https://data.ny.gov/Energy-Environment/Utility-Energy-Registry-Monthly-Community-Energy-U/m3xm-q3dw>.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-017

Witness & Respondent: Clifton Below

REQUEST:

Page 10, line 17: How might mPrest’s or Kavala Anaytics’s software products be adapted to be the “core of an energy data hub”? Does either software vendor offer Green Button Connect capability currently? Who would be responsible for ongoing management of those products? Would those companies be hired as a contractor or brought on as platform operation staff? Please provide pricing for all products and services for mPrest and Kevala.

RESPONSE:

Please see the response to Request No. EU to LGC 1-014 for a response to the first two questions. The data platform project manager or developer would be responsible for engaging and managing these companies and their products to the extent parts of them might be incorporated into the data platform hub. I do not have pricing for their products and services beyond what mPrest has publicly filed in this proceeding at tab 55 of the docket book.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-018

Witness & Respondent: Clifton Below

REQUEST:

Page 10, line 19: Please explain fully how the “the open source Volttron software” satisfies the required functionality of SB284. Does Volttron software offer Green Button Connect capability currently? Please provide Volttron’s pricing for all products and services.

RESPONSE:

I did not assert that the Volttron software “satisfies the required functionality of SB284.” I doubt that it has any Green Button Connect features, although I don’t know that one way or the other. (It is possible that has features to accept connected Green Button data.) It was developed by the Pacific Northwest National Laboratory with public funding from the US DOE and designed to be open-source software freely available, so I am unaware of any pricing. The point of the reference is that it is a software product closely related to energy data platforms that appears to offer free, and to some extent supported, access to software code that may be useful in developing code for the NH energy data hub/platform. Here is some of the information from the volttron.org website on one of its relevant features:

SECURE From the beginning, VOLTTRON™ developers actively collaborated with cyber security experts and built security *into* the technology, rather than “bolting it on” later. The commitment has continued, with developers regularly upgrading features in response to emerging requirements and VOLTTRON™ user feedback.

The platform applies a threat-model approach for determining software threats and vulnerabilities and how to reasonably reduce the attack surface and/or harm from a compromise. Through established mitigation strategies, VOLTTRON™ addresses a range of possible attack avenues and risks.

See also https://volttron.org/sites/default/files/publications/VOLTTRON_security_2017.pdf.

There may also be coding relating to interoperability that may be relevant: “Volttron makes it possible for diverse systems and subsystems, in and out of the energy sector, to interact and connect.”

Local Government Coalition (LGC) Responses

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Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-019

Witness & Respondent: April Salas

REQUEST:

Page 16, line 9: Please cite the regulatory authority mentioned that allows for a data request once per year.

RESPONSE:

See “Original Page 29” of Liberty Utilities Tariff and subsequent terms: <https://new-hampshire.libertyutilities.com/uploads/Rates%20and%20Tariffs/Electric%202020/2020-08-01%20GSE%20Tariff%20No.%2021.pdf> under § 49:

“iv. Services Provided – One per Calendar Year with No Fee

1. Usage and Billing kW Data”

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-020

Witness & Respondent: April Salas

REQUEST:

Page 16, line 11-13: Please explain why the authorization process to receive large customer data was delayed if the customers had consented to sharing their data.

RESPONSE:

This question should be directed to Liberty Utilities. Explicit approval was required and obtained, which took upwards of six months, and then for reasons unknown to the Town of Hanover, we experienced delays in receiving the requested/approved information.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-021

Witness & Respondent: April Salas

REQUEST:

Page 17, line 6-10: Please describe in detail the structure and format of the data received, the inaccuracies present in the data, how the data “immediately began to degrade with time”, and why no simple process exists to replicate this data acquisition effort.

RESPONSE:

Data requested included 15-minute interval data, recorder/location ID, date, KW and KVA. We requested this information for only the six largest electric customers in the town of Hanover.

What was received just for the six largest users was a mix of excel files with inconsistently formatted rows and columns, as well as hourly data for some accounts and 15-min interval data for others. When reviewing location/recorder ID numbers, we found overlapping dates/times with differing KW and KVA data. Additionally, we had to undertake the tedious task of combing through thousands of lines of data to parcel through recorder ID numbers and attach them to ‘rate classes’ to derive meaningful information related to our community’s electric load. For example, it should not be surprising that some entities have meters that fall within more than one rate class, such as residential, small, medium, and large commercial: G3, G2, and G1, so this data needs to be sorted. Moreover, the data that was received took nearly 6 months to receive, about a month more to ‘process’, and it was all instantly out of date due to the fact that it is a historical snapshot in time.

There is no system in place to automate the customer permissions (or revocation if it is to be ongoing open-ended permission) and/or to provide updated data to the town on a continuing and regular basis, much less to assure the consistent formatting and quality of the data or provide permission-free aggregated data. The utilities need to ask themselves the question “why no simple process exists to replicate this data acquisition effort?”

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-022

Witness & Respondent: Kat McGhee

REQUEST:

Page 22, line 14: What are the elements of the distributed energy system beyond the utility areas that you would like the data platform to portray? Given SB284’s required functionality of utility customer usage data, what other data, if any, would come from this area of the distributed energy system beyond the utilities?

RESPONSE:

The easiest way to respond to this question is to put it in terms of metered energy data. If the State of New Hampshire and the PUC are to order the design and implementation of a statewide, online, energy data hub, it would be inefficient and short-sighted, to confine it to electric utility data in front of the meter. The ability for community aggregators and municipal governments to secure and use their data to manage energy costs is a major driver of providing easier access to all our energy data in a consumable form. All energy contributing to the state’s generation must have a way of being captured so that the true ‘big picture’ of our needs and use is available in the data.

The bill called out the need for utility customer data because without the data that the utilities’ control, a centralized data hub could not be created. It should not be inferred that because the utilities were compelled to include their customer data, other contributing forms of electric generation, storage, and consumption information, nor system data, would be excluded from an energy data hub. This would defeat the purpose of having access to ‘statewide’ energy data. The bill language discusses the strategic advantages of having access to energy data that can be turned into information; that information can be used in support of ongoing PUC efforts like grid modernization and energy efficiency plans.

Distributed energy sources, behind the meter, could be required to provide whatever uniform data elements are defined in the New Hampshire Electric Energy Data Standard (NEEDS) model. Whether this is accomplished in the initial rollout or is part of a phase plan that must be implemented as technical hurdles are addressed, is an answer for those who will be assessing the technical challenges on the ground. I am not a technical person. I cannot provide the fields. But uniform energy data collection is the only way we will be able to roll up data into useful information. There is no language that excludes distributed renewable forms of energy generation, storage, load, or system data from the equation. We do not know the significance of

the role of each energy data type for our state in the near and not so near future. In order to build a hub that is ‘future proof’, we must make it capable of including whatever energy types are contributing to the overall load requirements of our communities and state.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Unitil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-023

Witness & Respondent: Kat McGhee

REQUEST:

Page 23, line 8: Please explain fully what is meant by “an automated energy data hub”?

RESPONSE:

1. I used the word ‘automated’ to describe the use of an API (a set of functions that access the features or data of an operating system, application, or other service) or series of API’s to pull energy data from various sources into a centralized database or a virtual data server.

The concept of an Energy Data Hub is just another way of saying energy data platform. The term was first coined in Clean Energy New Hampshire’s testimony. I used the term in my testimony to be consistent with that nomenclature. For the purposes of clarity, hub and platform are synonymous.

To me, automated means we are not pulling raw data from different sources manually into static spreadsheets in order to be able to manipulate it into useful information. An automated energy data hub is a centrally located software application that allows users to slice and dice their energy data in a way that makes it useful to them. Without solving for a way to include distributed energy sources in our data collection/automation, we are severely limiting the value of the project in terms of future use.

Local Government Coalition (LGC) Responses

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Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-024

Witness & Respondent: Kat McGhee

REQUEST:

Page 23, line 10: Please explain fully what is meant by “support automated reporting.” What types of reports and reporting functionality are desired? Please identify who would request the reporting and who would provide responses.

RESPONSE:

At a high level, the User Stories defined during the Technical Sessions and surrounding meetings provided a set of ‘expected outcomes’ for consumers of the hub data. Users will be able to roll up community level data, (this ideally includes all generation sources within the ‘community portfolio’ aka. ‘data aggregation’ and be viewable by a unique time period), in order to create a picture of energy use at the level needed for analysis and energy planning. This is a reporting output of the data hub and it has already been defined in the expected outcomes of the User Stories. I do not have ‘automated reporting’ requirements beyond the User Stories. There have been several conversations about User Apps being designs to leverage New Hampshire’s energy data platform as a source of energy reporting and analysis. But that is beyond the scope of the proposed project. The ability to report on ones’ own town energy picture is an example of the User Stories’ scenarios that are already included in the requirements.

The question of ‘who would provide the responses?’ is indicative of the status quo for how data is managed today. If the system is automated it is designed to support self-service of data by the user based upon their permissions to view and use the system.

Example:

The Chair of my town’s energy committee, much like April Salas of Hanover, has been diligently working to provide cost benefit analysis on solar investments to our elementary school rooftops for years. The Energy Committee is at a loss trying to get the information to quantify savings to our Board. The folks on our energy committee are technical, competent and work regularly with the utilities. But the system is not automated – so they are forced to work on manual data dumps from disparate sources and the results are still not sufficiently comprehensive to illustrate the entire picture needed to show their homework to the town selectman and budget committee. This is among the consumer problems an automated energy data hub is intended to address. They should be able to have access to their own data and be able to make sense of it.

So, the answer to your last question is, the energy data hub user would request the data and the platform would respond with that data.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Unitil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-025

Witness & Respondent: Kat McGhee

REQUEST:

Page 23, line 24: Please describe the steps stakeholders have taken to determine whether User Stories are "reasonable" and the cost of implementing them is in the best interest of ratepayers. For all such determinations please provide all reference material used and calculations used to support these claims.

RESPONSE:

The LGC objects to this question as overly broad as it seeks information that the witness does not have and asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following response:

My use of the term ‘reasonable’ was in reference to teleconferences with Unitil and Eversource where we provided access to and in some cases walked through and provided access to the User Stories developed from the Use Cases across the docket, as a set of concrete ‘outcomes’ the platform (or hub) would deliver. There were also IT people who had reviewed the User Stories and commented in those meetings that they brought greater clarity to the objective outcomes of the hub. There were no particular objections to the outcomes described for any of the user categories.

There are no reference materials that relate to the reasonableness of specific outputs and what is in the best interest for the ratepayer. The User Stories document was designed in direct response to the identified needs of the various user categories. Customer, Third Party, CPA, Grid Modernization Group, Government (PUC), utility.

https://docs.google.com/spreadsheets/d/1WSQELIC9anFVvl_Txqdih0jPTEjeuH_j-ZtjXRcTNbU/edit?pli=1#gid=1089560940

Improved energy efficiency, greater ease of use/time savings for distributed energy aggregators and municipalities, more accurate grid planning and modernization efforts are all insights into the portfolio of electric energy generations that an energy data hub can solve for the New Hampshire energy consumer, whatever their role. Someone more conversant in economics might be able to quantify value of being able to secure this information to the various electric energy consumers of New Hampshire. See also the estimate provide by Prof. Amro Farid in his testimony at Bates p. 164.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Unitil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-026

Witness & Respondent: Kat McGhee

REQUEST:

Page 24, line 18: Please define “supporting relational data-sets” in terms of required or additional functionality of the platform. Who would benefit from their inclusion?

RESPONSE:

Supporting relational data sets does not describe additional functionality. In James Brennan’s testimony for the OCA, the originating department in the State of New Hampshire, he discusses the importance of relational data sets in support of a data base structure that can roll up data, so it is useful.

The raw data in any database is just a set of ‘building blocks’. It’s the proverbial ‘gobbledygook’ without a set of defined relationships between the data being collected that tells the system how to organize and ‘inter-relate’ the data for display back to the user seeking information.

The relationships that exist between those blocks must be defined so that the information derived can be provided in a meaningful way. This is all I meant by relational data sets. It’s a tech industry term that has been referred to in other testimony, so I did not think I would have to provide further elaboration. I am not a software developer, but I have worked in the software engineering environment and I trust that this layman’s definition will suffice.

In a relational data base, which the statewide, online energy data hub would be to meet any of its objectives, relational data sets are a feature.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Unitil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-027

Witness & Respondent: Kat McGhee

REQUEST:

Page 24, lines 26-28: Please provide the definition of “state of the art security” that was discussed or shared with the User Stories and any relevant security standards referenced.

RESPONSE:

There is not such reference on Bates page 24, so assumed page 23 was intended this phrase was used as shorthand because I have no background in data security protocols or products. What I do know is that the statute requires that the energy data be secured to the level of security that is expected by the customers and stakeholders, including the utilities.

The details of those methods, (like 2-factor authentication, encryption etc.) are for the technical collaborators (including the utilities) to decide in meeting the requirement for data security. The term ‘state of the art’ simply means the best practice as it currently exists.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-028

Witness & Respondent: Kat McGhee

REQUEST:

Page 25, line 6: Do you believe the PUC should investigate cost as a consideration of the project? If so, would the PUC need to understand the scope of the platform in order to determine the initial and ongoing cost? If not, what is the justification for disregarding the method used to determine public benefit and what metrics would you replace cost/benefit analysis with?

RESPONSE:

I believe it is the responsibility of the PUC to investigate costs and determine the benefits of the project. That does not mean one can conduct a cost benefit analysis as though the value was equal to the sum of the parts. The experts in utility data API solutions will need to join in an RFI/RFP process in order to examine both the initial scope and types of maintenance models that could be pursued and their associated costs.

I have no way of assessing whether the current methods used for assessing public benefit remain sufficient for this exercise. I believe having access to energy data is the crucible for governments around the nation and around the globe, so I’m pretty sure our investment will be both timely and cost effective in the long run. This is the missing piece in being able to manage our energy resources. If all energy consumers do not benefit from improved efficiency and planning, I would be surprised because that is a primary driver of all of our efforts who work in this space. But I concede that this software project will have costs a non-technical project will not, so it may be difficult for the commissioners to put the project costs into context with the significant benefit having access to our changing energy data will provide.

Please also see the responses of witness Below to EU to LGC 1-001 and 1-002.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Unitil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-029

Witness & Respondent: Kat McGhee

REQUEST:

Page 25, line 24: Please provide examples of what is meant by elusive efficiencies.

RESPONSE:

The term ‘elusive efficiencies’ came from my notes of a keynote speech by Damir Novosel, President and Founder of Quanta, who spoke to us at the Boston Copley during the ISO-NE 10 year Regional Systems Planning conference, one year ago, on September 10th, 2019. The President of Transmission for Eversource, Katherine Prewitt was a conference panelist.

Mr. Novosel made the point in his keynote that the most elusive and essential aspect of integrating distributed generation assets successfully into the energy grid is our inability to ‘see’ the contribution of behind the meter load reducers. Or, as my friend Pat Martin puts it, you cannot manage what you cannot measure. The benefits of being able to leverage greater energy efficiency remains elusive expressly because we are unable to centralize and use our energy data today in a strategic way. Refer to my prior anecdote as to the efforts of the Hollis Energy Committee or those of fellow-LGC member, April Salas’ testimony on the experiences of the Town of Hanover. These are just 2 New Hampshire towns who have found quantifying and managing their actions toward greater energy efficiency ‘elusive’.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-030(a)

Witness & Respondent: Kat McGhee

REQUEST:

Page 26, line 21: Please provide examples of the type of companies you recommend here, and for each please provide pricing for their services.

RESPONSE:

The LGC objects to this question as overly broad as it seeks information that the witness does not have and asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following response:

The utilities participated in early Tech Session demos by companies like Utility API, Packetized Energy and later demos by mPrest and Kevala. These companies work in the utility data collection and display space.

I do not have pricing information for any of their services. Obviously, without discussing the specifics of a particular project, including the volume of data to be hosted and the amount of collaborative effort required to ready the data for use, no estimate would be reliable. The point I was trying to make is that companies who are competing in the space of energy data services are familiar with the idiosyncrasies of managing multiple utility data sources, security, permissions, change management, versioning etc. Because their services might price in these features and functionality, it is a good assumption they can offer them without the same effort it would take an in-house utility IT department to conceive, design, develop and test these from scratch.

Mr. Brennan, of the Office of the Consumer Advocate, who has a background in software management, engaged in talks with a few such vendors relatively early in the process to get some idea of pricing for a project of this type. He was able to talk about what type of model the platform would require, so that the vendors had a good sense of the project scope. As a result of those discussions, Jim was convinced that the estimates being expressed by the utilities were much higher than the cost of executing an API based service as his original diagram conceived. Larger companies (like IBM’s involvement in this space) tend to price project high because they require specialized technical expertise. They know they can command a high price because they are trusted on the technology. But, just as technology products come down in price over time, the cost of implementing utility data systems is a space with competitive players, and prices have come down.

Mr. Brennan and I, both with experience in managing IT projects, agree that leveraging the lower cost option is the right approach for New Hampshire.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-030(b)

Witness & Respondent: Kat McGhee

REQUEST:

Page 27, line 7: Why would a “fee for service model” not be appropriate when the third parties selling services to customers would receive financial benefits from the development of such a platform?

RESPONSE:

The role of distributed generation assets in the electric energy market is the rub isn’t it? Third parties may appear to the utilities to be the pesky competitors nipping at heels of traditional bulk generation supplied through the interstate transmission grid. But, those ‘financial benefits’ are a result of a market share that is being encouraged by regional grid planning goals for shaving peak, reducing load, properly integrating non-traditional generation assets and reducing emissions. So perhaps, all of these benefits are a worthy trade-off for encouraging clean energy producers work, rather than charging them, to use a system that is helping us achieve state and regional goals.

If the energy data hub is well conceived and developed, everyone involved in the energy market benefits, including regulators and utilities. If only certain stakeholders pay to access the system, it is not an equal resource to enable the desired clean energy transition.

I am of the opinion that this energy data hub should not be viewed as a utility application that other energy market participants pay for the privilege to access. The utilities will also benefit from this data access, in planning, partnering on behind the meter projects and supplying more robust data to regulators as analysis for strategic distribution investments. The utilities are playing an essential role in bringing the energy hub into being, but in my mind, that does not mean they are intended to reap greater benefit from the system, than smaller competitors or other stakeholders.

Everybody pays, or nobody pays would be how I would explain it. But then, the utilities have bigger pockets, can leverage economies of scale and depending upon the vendor relationship, may have easier direct access to data; the stakeholder relationship in using the energy data hub has many ways to become unequal. That is why I argue against a fee for service.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Unitil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-031

Witness & Respondent: Kat McGhee

REQUEST:

Page 27, lines 8-11: If parties other than the utilities are to participate and benefit from the “modern grid infrastructure” without contributing to this infrastructure, does this paradigm provide a competitive advantage?

RESPONSE:

The small renewable company owners in New Hampshire can barely eek out a living on what we are doing to incent their contributions to the distributed grid. We keep failing to pass a proper ceiling for net metering caps. I admit that getting the balance right during a transition for a changing market is not easy and will not be done without some wrangling over turf, tools and tariffs.

But, these third parties are contributing to the infrastructure; they are building the distributed piece of the state’s infrastructure and educating the public, one project at a time. It is a different model than the traditional utility model, but it is what we have chosen to pursue. We should stop sending mixed messages and simply figure out how to integrate our grid as we keep saying is our intention.

The energy data hub is not part of the physical energy infrastructure – though it will play an integral role in its management. The energy data hub is the way we will jointly engage with our infrastructure as a whole and manage it to the benefit of all customers.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Unitil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-032

Witness & Respondent: Kat McGhee

REQUEST:

Page 27, lines 13-18: Please describe the role of a “more-nimble utility API company” in building out the internal data mapping from utility backend systems to the Logical Data Model and the “behind the API” work required to get access to these disparate utility data sources. How might an external organization such as this deliver such work more efficiently and cost-effectively than the utility IT itself?

RESPONSE:

The utility can absolutely supply a clean data feed that conforms to the logical data model easier and with greater institutional knowledge than any vendor. A data project of this type has got to be a collaborative effort. If we decide to build a virtual platform that handles data from the utilities and other metered, distributed resources through a series of data handling API’s, I think just as the utilities have more knowledge of their own data handling, the utility data companies that already do this work, will be able to craft an API software solution faster than the utilities, and for more streamlined costs.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-033

Witness & Respondent: Kat McGhee

REQUEST:

Page 27, line 18: Please provide any documentation available on the services offered by non-utility providers. What is the scope of cost estimates provided?

RESPONSE:

The LGC objects to this question as overly broad as it seeks information that the witness does not have and asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following response: I do not possess any cost estimates.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Unitil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-034

Witness & Respondent: Kat McGhee

REQUEST:

Page 28, lines 15-20: Please describe what means the Commission might use to determine whether the delivered value of a platform such as this is cost beneficial, particularly with the “unknowns” described in this testimony.

RESPONSE:

All systems development involves unknowns. The nature of any systems’ project is that you are creating functionality that was previously unavailable.

The immediate benefits to energy consumers, stakeholders and planners are reflected in the User Stories’ outcomes. The tangential benefit of having insights like those described by the President of Quanta in his keynote address at the ISO-NE 10 Year Strategic Planning regional meeting were quite clear. This is where the energy sector is going and having access to our energy data is the missing piece. What price do we put on that? I believe the commissioners are more qualified to answer that question than me.

We have a golden opportunity to leverage this project to New Hampshire’s advantage as was defined in front of NH PUC Commissioners and the Governor’s Office of Strategic Initiatives, who were in attendance at that ISO/NE 10-year Strategic Regional Planning meeting. Creating data access and transparency was called out as the most significant missing piece of the puzzle to properly integrating distributed generation assets.

I guess the proper question is what will it cost us to attain our goals? Or what is the opportunity cost of failing to attain our goals. This project is not seen by non-utility stakeholders and the other intervenors on this project as another customer-utility interface. It is seen as a lynchpin for grid modernization and energy efficiency efforts.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Unitil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-035

Witness & Respondent: Kat McGhee

REQUEST:

Page 29, line 2: Please explain fully the “differing views on approach even amongst the 3 major utilities.”

RESPONSE:

In conversations with the 2 of the 3 utilities (Unitil and Eversource), it was apparent that company cultures varied and those differences boiled down to different levels of receptivity to the concept of modernizing data access in furtherance of more strategic statewide energy use. The response from Liberty Utilities was a welcomed, yet distinct perspective. I had not had an opportunity to speak with their representatives on Liberty’s position on the project.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-036

Witness & Respondent: Kat McGhee

REQUEST:

Page 29, line 5: Please explain what elements of this new paradigm you are referring to in the testimony that the utilities have not embraced. How is it in the best interest of the project to give “the autonomy to manage the project without the influence of any (or all 3), of the major utilities” who own and best understand the utility data and are considered a stakeholder and user of the platform?

RESPONSE:

This is a key question in term of stakeholder perspective. From the utilities’ perspective they are the prime stakeholders for the project. It is a valid position based upon your points above. The point I am making is that the software project is not best owned/managed/conceived by the utilities. To ensure decisions are made in an agnostic way, no stakeholder should be designing features that benefit or disadvantage their competitors. It’s just not good practice from a process standpoint and if the state were asking a solar vendor like REvision Energy to run the project, the utilities would cry foul as well. There should be distance between the software project and the utilities as stakeholders. That doesn’t mean the utilities are not prime collaborators on the project. But if this turns into a utility project, it will reflect the utilities’ stockholder’s perspective and it will resemble other projects they have undertaken for their customers. That is not the goal. The energy data hub is broader than the interests of the utilities by design and how the software project is structured needs to reflect that important distinction.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-037

Witness & Respondent: Kat McGhee

REQUEST:

Page 30, line 6: Please explain how the legislation requires “systems data” within the platform.

RESPONSE:

I never said the legislation requires systems data. I merely pointed out that it does not preclude the use of systems data. The specific references to energy data do not suggest that customer data is the only form of data to be used. I was making this point in my testimony because Eversource had started to suggest that their interpretation was that customer data was the only data called out in the bill language, that is not the case.

Multi-use Energy Data Platform

Under 378:51 Online Energy Data Platform Established.

I. The commission shall require electric and natural gas utilities to establish and jointly operate a statewide, multi-use, online energy data platform. The data platform shall:

a. Consist of a common base of energy data for use in a wide range of applications and business uses.

‘A common base of energy data’ does not determine whether system data, as necessary for the performance of certain data outputs, is to be included. The requirements in the User Stories for how ‘data seekers’ (to use OCA’s term) will use the system to perform energy stakeholder tasks, should be the driver of what the common base of data must include. The desired functionality drives the base data needed to achieve specific outcomes.

As I tried to explain in Technical Sessions and beyond, there are no bad data types or more expensive data groups that can save us money if we ignore them. Discussions around what we are trying to achieve and whether we can achieve those goals without compromising security etc., are the conversations that matter and will lead to a successful outcome. Excluding entire types of data is an untenable position when designing a data system. My point was not that system data was required. My point was that saying systems data was not specified or to be included is not accurate.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-038

Witness & Respondent: Kat McGhee

REQUEST:

Page 31, line 14: Please describe and cite the existing national energy data standard you are proposing which meets the current data platform requirements as defined.

RESPONSE:

I am familiar with these data standards through the software engineers I've interacted with on this docket. Dr. Amro Farid has provided extensive testimony on the CIM (Common Information Model) standard as he has expertise on national and international work seeking to standardize how energy information is organized and protected.

Jim Brennan from OCA made me aware of the Green Button Alliance energy data handling protocols already established and he made sure that GBA was specified in the legislation; It is my understanding that ESPI Enhanced Serial Peripheral Interface Bus (eSPI), a synchronous serial communication protocol, is also being considered as a way of establishing a method for handling large amounts of data in an efficient way. Because software professionals in the energy space are aware of work that has already been done to develop standards for use with energy data, there is concern that we incorporate standards such as these so as to make sure our statewide efforts can ultimately be compatible with regional and national energy data efforts if and when they are needed. It is simply good practice to lift our gaze and understand that we are not building access to our energy data in a vacuum. In order to make a sound and long-lasting investment in an energy data system, we must incorporate appropriate energy data standards to ensure our investment will not become rapidly obsolete. Please refer to Dr. Farid's efforts to document his position via testimony on behalf of LGC.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Unitil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-039

Witness & Respondent: Kat McGhee

REQUEST:

Page 33, line 1: Please elaborate on the statement that the “lens through which the utilities view data access is far too narrow” to embrace the needs of the distributed energy market. Are there examples of this that can be provided? If utilities have no ownership nor decision-making authority over the platform, and are similarly excluded from platform operation and ongoing management, what is the justification for recommending performance-based rate-making (PBR) and how would it work given the governance structure and utility roles as described in your testimony? Also, as no one has provided any data or support for the premise that any data platform would be used or to what degree, and this would be a wholly untested product, what is the reasoning for including the amount of platform usage as a performance metric in cost recovery, a mechanism that is going to be established before the platform is in use?

RESPONSE:

In demonstrations from mPrest and Kevala we saw the incredible potential for the use of energy data. The kinds of strategic initiatives and efficiencies that access to energy data can enable are only limited by the imaginations of those in charge of managing them. Throughout the Technical Session proceedings, Eversource participants in particular kept stating that only customer data was involved, to the point where the PUC staff began making the same assumption. I believe that in some later calls, many of the intervenors who were working on the User Stories to help define what the system would do, conceded that they could live without system data for an initial rollout and work with the governance body on any additional data needs down the road. But the ability to define which benefits the system should provide is still an area of debate. We do not have a means of looking to any ‘system’ for energy investments, rate setting or optimization today. Is this an outcome we would like to obtain?

In a call with an Eversource representative the participants were told that entering into a discussion of systems’ data was dangerous. Unitil on the other hand focused our conversations on the particular obstacles of particular types of system data, while readily admitting that on other types of system data, they foresaw no problem.

If we are asking a distributed generation market to augment traditional generation sources, we have to allow them to be self-sufficient in accessing the data that they need to see.

The model I suggest does not remove utility ownership or decision-making – it merely structures it in a way that creates a once-removed relationship that prevents direct ownership. The utilities ultimately own responsibility for the vendor partner who operates the platform (virtual or otherwise). In that role, the utilities will collaborate to provide vendor oversight and would thus be rewarded for meeting performance metrics. This model helps prevent a circumstance fellow-intervenors on DE19-197 from other state efforts have observed in other projects around the country; namely, that the utilities lack of interest in supplying data access meant that they built a platform that was hard to use and suboptimal in features. Without performance incentives, or disincentives, the utilities did the bare minimum because they did not see the business advantage to giving competitors energy data access. It's a conflict of interest. I do not want to see that happen in New Hampshire if we can benefit from the experience of others who have gone before us.

How do we know people will use the platform? Well, we know there are people attempting to combine energy data for their community investments who cannot easily access it today. We know that even among regulatory and utility energy data consumers, having a centralized data hub for energy information would be a vast improvement to support technical meetings and energy policy planning conversations. Some consumers may wait until they hear of an easy phone app that can help them see how their solar panels are offsetting their home energy bills, but we are in both an energy and a data age, so it is like asking if those in the early years of telecommunications could envision whether the phone might catch on. Access to energy data is a hot topic globally. We have a chance to partner on something bigger than what we're doing today. This question feels like a reference to so many utility customer-interfaces that nobody takes the time to use is part of the reason I think it's a really bad idea to give the project to the utilities to design.

I was not suggesting that the example of metrics I referenced were to be the metrics used. So, I don't believe I have to defend a potential metric. The metrics are not for me to decide. I am suggesting that there be metrics, in order to incent the desired supportive behavior from the utilities.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-040

Witness & Respondent: Kat McGhee

REQUEST:

Page 38: The 13-member vision/strategic data council proposed includes 6 energy stakeholder members and a technical lead (a majority) who can financially benefit from the data platform. Please explain how you believe the costs of the energy data platform could be controlled based on this proposed governance structure.

RESPONSE:

The PUC supplies the oversight for any governing body and no major cost or functional decisions are made without their approval. The proposed model would allow for sufficient autonomy that all stakeholder members would be involved in determining maintenance and small improvements by vote; there would be an annual maintenance budget, over and above the vendor fees, so that daily operational decisions would not require bothering the PUC. But with this framework, annual costs would be a known quantity once the initial project has been completed.

Voting rules do not have to be a straight majority that is TBD and there may be non-voting members on the committee. I do believe an odd number of voting members is a requirement for getting anything done. It sounds as though the concern here is that the utilities would not be in the majority for controlling outcomes. That is true. Since the utilities have the least to gain from having an effective energy data platform that removes their current control of energy data access, I see giving the utilities a majority vote by design, as counter intuitive.

I have no problem with the utilities participating fully in all aspects of the project. I have worked in large corporations and I do not see this collaboration in terms of us and them. But, for the sake of a healthy balance of stakeholders that leads to a healthy data hub, I see no reason to tilt the voting toward those who are least interested in seeing the project succeed. If we want to see a good use of the state’s investment, we need to engage those who are most enthusiastic about doing something worthwhile in direction setting. They are not going to be building a tool for their private use and they will have fiscal parameters within which they must adhere. That is how we achieve the best outcome for the state of New Hampshire and for the ratepayer.

Most of the intervenors are in the clean energy space to reduce carbon emissions rapidly and they earn a living as a biproduct of that mission. Whether these stakeholders serve on the council or not, the features of the tool, its maintenance plan and budget allocations will not earn them any more or less income. If by the question you are referring to the ability for distributed energy

companies to more easily expand their businesses through better access to customer usage data, then that may be true. But I would argue that this expansion is long overdue and part of the impetus of the original legislation and if those goals were not achieved by this project, then it would have been derailed from its intent.

The technical lead role assumes that a qualified professional will be hired to drive the project to a successful outcome, without particular bias to any of the stakeholders. This project leader will be of value to the council in terms of objective input on the platform decisions from a technical perspective and an outcomes-based allegiance to the platform's goals. If the project outcomes are well defined, then knowing when those goals are met will not be in question. This confines the project timeline (being able to declare when done, is done) and also limits the contractual role and income of that technical lead depending upon his/her value to the council. If you are suggesting that someone who is paid to perform a project lead role is likely to prolong the project to preserve his/her own paycheck, that is an unfair projection. Any competent project manager is looking to bring their project in on time, with all features, and in budget. In this capacity, anyone hired to undertake the platform project will be a temporary resource to the council, unless it is decided that their continued participation would be of benefit to the platform maintenance and the council at large.

The functionality will be what is agreed to by the council members and put in place by the vendor partner or partners who execute the plan. The utilities will have significant input in that process and all along the way. The cost of the platform and any enhancements that will follow in subsequent years will not be determined by any stakeholder or stakeholder group alone. It will continue to be a collaboration of energy stakeholders and from this standpoint, I believe the allusion to cost containment being a problem if the utilities do not have a council majority is unfounded.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-041

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 47, lines 17-18: Please describe the “market framework” called for under New Hampshire’s Electric Utility Restructuring Act.

RESPONSE:

The Electric Utility Restructuring Act refers to the establishment of a “*market framework*” under “*Administrative Processes*”, and states that:

“The commission should adapt its administrative processes to make regulation more efficient and to enable competitors to adapt to changes in the market in a timely manner. The market framework for competitive electric service should, to the extent possible, reduce reliance on administrative process. New Hampshire should move deliberately to replace traditional planning mechanisms with market driven choice as the means of supplying resource needs.”

The law is online here: <http://www.gencourt.state.nh.us/rsa/html/XXXIV/374-F/374-F-mrg.htm>.

See also the response to Request No. EU to LGC 1-009.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-042

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 47, line 20: What rule changes do you foresee as necessary for innovation in New Hampshire’s market operations? Please cite specific administrative rules.

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

New Hampshire has failed to extend the benefits of restructuring to the mass market, its current active retail market evinces a high degree of market concentration (never a good sign), and the metrics by which one could properly assess the level of innovation and barriers to fully animating choice at a granular level remain wholly untracked.

This question asks for technical particulars on what specifically has to change to enable innovation. That may be well-intentioned, and there are undoubtedly a variety of near-term specific changes warranted (a few of which any individual stakeholder could offer), but it really is missing the point. The appropriate question to ask is how did we manage to relegate ourselves to this disadvantageous position, and how do we make better decisions going forward?

Adapting to the accelerating pace of fundamental change in technologies, market dynamics and consumer preferences necessitates a continuous rule reform process that leverages a diversity of interested, informed, localized, and specific knowledge. I know of no other way of creating, let alone sustaining, a rational economic ordering of the electric power system given such dynamic fundamentals other than a market framework.

That is why the main purpose of my testimony was to demonstrate why New Hampshire needs to implement a market framework for governance — in compliance with the Electric Utility Restructuring Act, and as an alternative to the current reliance on administrative processes — and how doing so could allow our industry to rely on the collective knowledge of all stakeholders (market participants like Community Power Aggregators in particular) to guide the rule reforms needed to allow innovation in retail customer products and services to play out freely whilst creating value for the system as a whole.

To put it bluntly: until we get governance right, I fear we will all be condemned to endlessly repaving the road to hell with our good intentions.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-043

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 50, line 11: Please define “fully restructured” relative to organized energy markets.

RESPONSE:

I believe that the section “*How should the statewide, multi-use online energy data platform be governed?*” of my Direct Testimony, which starts on Bates p. 82, along with the section “*How are fully restructured markets governed in practice?*”, which starts on Bates p. 60, and the attachments from Bates p. 99 through 128, substantially addresses this question.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-044

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 50, line 21: What elements of integration within the retail market “*structurally disadvantage retail competition and foreclose retail innovation and choice in services*” and why?

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

Please refer to the response to Request No. EU to LGC 1-042.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-045

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 50, line 21: Please explain how the current state of distribution grid operation integration by the utilities “*structurally disadvantages*” retail competition.

RESPONSE:

Page 50, line 21 references the following sentence, excerpted here in its entirety:

“However, utilities have not been quarantined to operating the distribution grid, and instead remain integrated within the retail market in ways that I believe structurally disadvantage retail competition and foreclose retail innovation and choice in services for the majority of customers.”

I am unsure what the phrase “*distribution grid operation integration by the utilities*” in the question refers to in the New Hampshire market context in general or in relation to my above-cited testimony. I did not assert that “the current state of distribution grid operation integration” structurally disadvantages retail competition.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilit (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-046

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 51, lines 3-6: What decision-making is “*carried out through administrative procedures and not through a transparent and responsive ‘market framework’?*”

RESPONSE:

As far as I can tell, substantially all of it, except for a limited amount of retail choice of a limited number of products, mostly realized by larger C&I customers. As Bates p. 51, lines 3-7 states:

“Moreover, it appears that almost all decision-making is still carried out through administrative procedures and not through a transparent and responsive “market framework” that would “enable competitors to adapt to changes in the market in a timely manner” as called for under RSA 374-F.”

Note that the emphasis is on the lack of a market framework. This relegates decision making to an administrative regime by default — which are reactive, procedural and adversarial in nature, siloed in terms of scope in relation to the whole system, and commonly bifurcated by utility as opposed to applying uniformly across the natural boundaries of the retail market.

Moreover, the current administrative regime seems to have ignored, for years, undertaking even the most basic functional operational improvements for the competitive retail electricity market. As one example, the Electric Distribution Companies’ Electronic Data Interchange (EDI) documentation on the PUC website and PUC order initially approving the EDI¹ states that they are temporary, indicate they will be soon will be finalized and implemented by rules and are more than two decades old at this point. The EDI Working Group recommended “that the Commission establish a standing working group to address the need for modifications and enhancements to the standards and processes described in the report.”² However, the working group was apparently never established, and the EDI data transaction formats, test plans, training manuals et cetera all were last updated in 1998.³ There are also apparently several fields in the Electronic Data Interchange tariffs that indicate functionality that are not, in reality, functionally available to CEPS to utilize.

¹ In Order No. 22, 919, May 4, 1998 the Commission states that “we will temporarily adopt the Working Group’s recommendations pending the outcome of a rulemaking on the implementation of EDI standards.” Web address: <https://www.puc.nh.gov/Regulatory/Orders/1998ords/22919e.html>.

² “Consensus Plan for the Transmission of Electronic Data in New Hampshire’s Retail Electric Market,” Docket DR 96-150, Electric Utility Industry Restructuring, April 2, 1998, p. 4. Web address:

<https://www.puc.nh.gov/Electric/EDI/edirev53.pdf>.

³ NH PUC “EDI Information” webpage: <https://www.puc.nh.gov/electric/edi.htm>

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-047

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 51, line 7: Please describe your view of “*a holistic, responsive and market-based decision-making framework.*”

RESPONSE:

I believe that the section “*How are fully restructured markets governed in practice?*” of my Direct Testimony, which starts on Bates p. 60, substantially addresses this question.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-048

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 51, line 7: Please provide specific examples of cases where the NH distribution utilities decision making with respect to the retail market has been “*unduly mediated by the monopoly distribution utilities*”.

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

I believe that the section “*Have distribution utilities’ recent investment decisions in the retail value chain hindered or supported the development of a competitive retail market?*” of my Direct Testimony, which starts on Bates p. 72, substantially addresses this question.

More broadly, Bates p. 51 lines 7 through 9 are as follows:

The lack of a holistic, responsive and market-based decision-making framework means that decisions regarding the functionality of the retail market remain heavily, and almost certainly unduly, mediated by the monopoly distribution utilities.

Note that the emphasis is on the lack of a market framework, and how this relegates decision making to administrative proceedings by default — which are reactive, procedural and adversarial in nature, siloed in terms of scope in relation to the whole system, and commonly bifurcated by utility as opposed to applying uniformly across the natural boundaries of the retail market. The behavior of the electric distribution companies to-date is largely a product, a logical outcome, of this administrative regime. From that perspective, such behavior underscores the need to reform the very rules by which this game is played.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil ("EU" a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-049

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 55, line 5: Please provide the referenced EIA 861 datasets.

RESPONSE:

EIA 861 datasets are publicly available online here: <https://www.eia.gov/electricity/data/eia861/>.

Please note that "Public Service Co of NH" (utility name) in the 2013 EIA861 dataset "Advanced_Meters_2013.xls" lacks any data reported under "Number Non AMR/AMI Meters". Consequently, this utility is missing about 475,000 meters. I notified EIA of the first omission on 7 January 2020 but it appears that the data is still unreported or missing. "Public Service Co of NH" could presumably provide the data directly.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilit (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-050

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 57, line 1: Please provide a comparison of market prices versus default energy prices in NH and comment on the competitiveness of 3rd Party pricing for residential customers.

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional research and analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

If you assume that residential customers only want a commodity, then you misunderstand consumer preferences in today’s retail electricity market. Those preferences are heterogenous: some may value assistance in ensuring continuity of service (e.g. backup generation) at a premium, or price stability in the form of longer-term hedged products relative to default service, or access to more granular time-varying pricing and assistance shaping their load to wholesale price or carbon emission intensity intervals, or to purchase a product with higher renewable or local generation content, or to access more convenient customer services, or bespoke advisory services regarding DER products, or help with budgeting and pre-paid or otherwise flexible payment options — the list goes on.

In a word, freedom is the most accurate metric by which to approximate the potential of a market to create value for customers: the aggregator’s freedom to innovate in offering new products and services and the customer’s freedom to choose those same products and services.

Analyzing commodity price is therefore antediluvian and altogether too narrow an accounting — specious, in fact — without first collecting a sufficiently broad array of market metrics and accounting for the above service quality and product differentiators. Such a question is motivated, in my opinion, by ignorance at best and an anti-consumer bias at worst.

Regardless, the strengthening of consumer protection depends upon maximizing long-run creation of value, in all the many forms valued by consumers. Thus, the framing that lower consumer prices of the commodity should be pursued without regard to consequences of scope or quality of service is both naïve and a threat to social welfare.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-051

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 58, lines 6-8: What do you and what does the Council of European Regulators consider as a sufficiently “*low concentration*” within a given market structure? Please explain.

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

Refer to the table on Bates p. 60 for the specific metrics the Council of European Regulators uses to track progress for this and other key properties of well-functioning markets. Refer to Bates p. 59, footnote 19 for the report from which this table was taken, refer to page 3/74 therein for documents related to the report, and refer therein to the “*2017 Handbook for National Energy Regulators How to assess retail market functioning*”, pages 11 through 17 for detailed tables summarizing the following for each metric related to this key property: Metric Name; Description; Purpose; Source of Data; Quantification; Frequency; Unit of Measure; and Data Completeness.

The aforementioned “*2017 Handbook for National Energy Regulators How to assess retail market functioning*” is available online here: <https://www.ceer.eu/documents/104400/-/840b4ce7-9e4a-5ecc-403a-fad85d6ba268>

The tables available therein are excerpted below for your convenience:

| | |
|--------------------|--|
| Metric 1 | Herfindahl-Hirschman Index |
| Description | The HHI measures the degree of concentration in a market. |
| Purpose | <p>Based on guidance from the European Commission (Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings (2004/C 31/03), a HHI above 2000 signifies a highly concentrated market. In general, a high number of suppliers and low market concentration are seen as one of the indicators of a competitive market structure.</p> <p>To accurately evaluate the degree of concentration, the NRA could use the following step-by-step approach, which is in line with that used by the Directorate-General for Competition (DG COMP) and national competition authorities:</p> <ol style="list-style-type: none"> 1. Define the relevant product markets (i.e. assess the degree of demand and supply substitution of different products): The retail supply of both gas and electricity can be divided into several categories of final customers, with different product preferences and needs: (i) households, (ii) small industrial and commercial customers (SMEs), (iii) large industrial customers and (iv) very large/energy intensive customers. We advise to, as a minimum, distinguish between household and non-household customer segments and, preferably between households, SMEs and other customer segments. In some member states, the supply of energy at regulated prices (or supply covered by a designated supplier of last resort) and the supply of energy at free prices (or the supply to customers with different metering arrangements e.g. prepayment meters, time of use and smart meters) can be considered as relevant product markets. The market for some categories of vulnerable household customers or the market for households on social tariffs can also be considered as relevant markets. For electricity, industrial/commercial customers are usually 'half-hourly metered' and often connected to high and medium voltage grids. It may however be considered that supply to large industrial consumers forms part of the wholesale market, not retail market, depending on whether industrial consumers buy energy to consume or to resell. Households and smaller industrial/commercial customers are most often non-half-hourly metered and connected to the lower voltage grids. <p>For gas, product markets can be defined on the basis of criteria such as the customers' volume of consumed gas, off take patterns (e.g. usage of gas for electricity generation) or whether they are connected to the transmission network. Finally, the possibility of a combined</p> |

| | |
|--------------------------|---|
| | <p>retail gas and electricity market for domestic customers can be considered, as some suppliers offer a single contract covering both the supply of gas and electricity (dual fuel contract) to domestic customers.</p> <ol style="list-style-type: none"> 2. Define the relevant geographic markets (i.e. identify the geographic boundaries of the area where suppliers compete against each other): The retail supply of electricity to large industrial and commercial customers can be considered to be national, provided that these markets are fully liberalised and if the conditions of competition are found to be uniform throughout the relevant territory. The retail supply of electricity to household and smaller industrial and commercial customers is generally national in scope, however, if, for example, many local energy companies (vertically-integrated DSO/supplier) exclusively serve their historical zones and no other suppliers operate, regional areas can be considered as relevant markets. For gas, retail supply markets are generally national in scope, but can also be local. 3. Calculate the HHI for every relevant market according to the quantification as suggested below. <p>The resulting relevant markets should also be considered for the completion of the other metrics contained in this handbook.</p> |
| Source of data | Information request to retailers or regulated companies. |
| Quantification | The HHI is calculated as the sum of the squares of the market shares of all firms in the market. It ranges between 0, for an infinite number of small firms, and 10,000, for one firm with a 100% market share. Market shares can be calculated on the basis of consumed volumes and number of customers or meter points. |
| Frequency | The HHI should be calculated at least annually. In particular, its development over time should be assessed to understand whether the market structure becomes more or less competitive. |
| Unit of measure | Index |
| Data completeness | Depending on the relevant market definition, the data requirement to calculate the HHI may be more or less complex. As a minimum, the NRA should be able to obtain data on supplier shares in household and non-household markets. |

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilit (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-052

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 58, lines 9-11: What do you and what does the Council of European Regulators consider as sufficiently “*low market-entry barriers*” within a given market structure? Please explain.

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

Refer to the table on Bates p. 60 for the specific metrics the Council of European Regulators uses to track progress for this and other key properties of well-functioning markets. Refer to Bates p. 59, footnote 19 for the report from which this table was taken, refer to page 3/74 therein for documents related to the report, and refer therein to the “*2017 Handbook for National Energy Regulators How to assess retail market functioning*”, pages 11 through 17 for detailed tables summarizing the following for each metric related to this key property: Metric Name; Description; Purpose; Source of Data; Quantification; Frequency; Unit of Measure; and Data Completeness.

The aforementioned “*2017 Handbook for National Energy Regulators How to assess retail market functioning*” is available online here: <https://www.ceer.eu/documents/104400/-/840b4ce7-9e4a-5ecc-403a-fad85d6ba268>

The tables available therein are excerpted below for your convenience:

3.2 Key property II: Low market entry barriers

In order to facilitate competition and innovation, barriers to market entry and growth for new market actors (i.e. suppliers and third parties) as well as barriers for innovation (including demand response) need to be as low as possible.

Metric 2: Time needed and cost of accessing well-functioning wholesale markets and licencing/balancing regimes

Metric 2

Time needed and cost of accessing well-functioning wholesale markets and licencing / balancing regimes

| | |
|-----------------------|--|
| Description | <p>Fair access to energy procurement on the wholesale market and to licencing and balancing regimes is a key pre-requisite for any supplier considering entry into the retail market. A supplier is always responsible for acquiring contracts regarding energy procurement and balance responsibilities. This can be achieved in different ways. In this respect, the NRA shall verify whether or not there are procedures to obtain such responsibilities for a new supplier.</p> <p>To ensure a level playing field to enter a market there is a need for a common denominator for market rules, such as equal and non-discriminatory access for all suppliers within the relevant market.</p> |
| Purpose | <p>Firstly, establish whether such procedures are available to all parties interested in becoming, or acting, as a supplier on the market. Secondly, establish that such procedures, and in particular their length and costs, are equal and non-discriminatory for all suppliers on the market, or suppliers wanting to access a market.</p> |
| Source of data | <p>For the first purpose, the main sources would include NRAs' knowledge of regulatory and legal entry processes, as well as the information made available by regulated companies and balancing and settlement agencies. For the second purpose, market participants may be best placed to offer (via surveys/discussions/questionnaires) a more qualitative assessment of balancing, licensing and other access costs, based on their actual entry experience.</p> |
| Quantification | <p>The metric focusses on the time and costs associated with administrative and financial rules to access wholesale markets and licensing/balancing regimes. It does not include entry IT investment and staff resources costs incurred by individual suppliers.</p> <p>In order to quantify this metric we suggest that the NRA addresses the following three sets of questions (please specify whether the answers differ at national and regional levels):</p> <p>Wholesale energy procurement</p> <ul style="list-style-type: none"> • Are there procedures to access a national or regional wholesale market? • How long does it take to gain access to energy procurement in a national or regional wholesale market? • What is the cost of accessing national or regional wholesale market? • Supplier license: Are market participants required to have a license to act in a national or regional market? • How long does it take to obtain a licence to act in a national or regional market? • What is the cost of acquiring a licence to act in a national or regional market? <p>Balancing responsibility</p> |

| | |
|--------------------------|---|
| | <ul style="list-style-type: none"> • Is it possible for market participants to become a balance responsible party (BRP) in a national or regional market? • How long does it take to become a BRP in a national or regional market? <p>What is the cost to obtain balancing responsibility in a national or regional market (e.g. bank guarantees)?</p> |
| Frequency | This metric should be monitored every one or two years. |
| Unit of measure | <p>Regarding the existence of the relevant procedures: Yes/No and qualitative explanation.</p> <p>Regarding time: Number of months (legal requirements and/or as observed in practice if data is available).</p> <p>Regarding costs: Euros as applicable in relation with the different types of procedures/licensing.</p> |
| Data completeness | NRAs should have access to such information since it is a requisite for the market functioning. As such, the data should be available at the national level. |

Metric 3: Percentage of consumers connected to “bundled” DSOs

| Metric 3 | Percentage of consumers connected to “bundled” DSOs |
|-------------------|--|
| Description | As energy networks are regulated monopolies, DSOs have exclusive access to all customers within their network area. Suppliers bundled with these DSOs have an indirect access to such information. The 3 rd Package requires legal, functional and accounting separation of DSOs and suppliers within a vertically integrated utility, although it also specifies exemptions from the requirements for smaller DSOs. This metric focusses on the existence of exempt bundled DSOs and not on other aspects of the 3 rd package requirements on unbundling. |
| Purpose | For new suppliers entering the market, both national and cross-border, equal rules are essential. Bundled DSOs and suppliers acting mutually towards customers might prevent new actors from entering a market. Therefore, there must be a sufficient level of unbundling between suppliers and associated DSOs in order to create a level playing field in retail energy markets. This is essential for all competitive actors to compete on the same terms. The existence of bundled DSOs does not immediately presuppose a problem; nevertheless, it might be a sign to further look into the matter. Through this metric the NRA can monitor the situation and must then evaluate whether the result reveals a problem or whether the market works well despite the existence of customers connected to bundled DSOs. |
| Source of data | Information request and survey to regulated companies. |
| Quantification | In order to quantify this metric we suggest that the NRA addresses four main questions: <ul style="list-style-type: none"> • Are there DSOs with bundled suppliers exempted from the legal requirements in the 3rd Package? • What is the minimum standard for being exempted? • How many customers are connected to exempt DSOs? Compare this figure with the total number of customers in the MS. • How many active⁶ rival suppliers operate in the exempt DSOs’ areas? Compare this figure with the total number of active suppliers in the MS. |
| Frequency | This metric should be monitored every one or two years. |
| Unit of measure | Regarding unbundling implementation: yes/no and qualitative explanation. Regarding exempted DSOs and their customers: number and % of total amount of customers in the MS. |
| Data completeness | NRAs should have access to such information as part of their basic market monitoring |

Metric 4: Percentage of consumers with regulated energy prices

| Metric 4 | Percentage of consumers with regulated energy prices |
|-------------------|---|
| Description | <p>By definition, an end-user regulated price is a price subject to regulation by a public authority, as opposed to an end-user price exclusively set by the interaction of supply and demand. Price regulation can take different forms, such as the setting or approval of prices, price caps, or various elements of these. Regulation can be set ex-ante (price is defined by the responsible authority on underlying information on the market, before market participants conclude contracts based on these prices) or ex-post (price is checked and possibly amended/changed by responsible authority after contracts have been concluded by market participants). The regulatory intervention can also be social, when a regulated price is set for specific consumer groups, e.g. vulnerable customers (social tariffs). Another relevant distinction is about regulation that is permanent and regulation that is designed as temporary, with a clear end date.</p> <p>Regulated energy prices distort competition in the market and might prevent new actors, both national and cross-border, to enter a market.</p> |
| Purpose | The purpose is to measure the impact of price regulation in the market, with the ultimate goal to abolish the regulated energy prices in order to remove the barrier to entry for a new supplier and to create a level playing field between competing actors. |
| Source of data | NRAs generally already provide this data for the CEER database, which is used for the ACER/CEER Market Monitoring Report (MMR). Retailers are the main source for this data but, depending on the market, bundled DSOs/suppliers may also be a relevant source. |
| Quantification | <p>In order to quantify this metric we suggest that the NRA addresses three main questions:</p> <ul style="list-style-type: none"> • Which types of price regulation apply to gas and electricity markets? |
| | <ul style="list-style-type: none"> • What is the proportion of customers (and their consumption volume) with regulated energy prices on each type of regulated price and each relevant market? • What is the proportion of customers on social tariffs? If there are different types of social tariffs, aimed at different categories of vulnerable customers, please indicate the proportion of customers on each tariff type. |
| Frequency | This metric should be monitored at least on an annual basis. |
| Unit of measure | <p>Regarding the existence of price regulation: Yes/no and qualitative explanation of what regulation exists.</p> <p>Regarding the customers: Proportion of customers and their consumption relative to the total number of customers and consumption in each considered relevant market.</p> |
| Data completeness | NRAs should have access to such information as part of their basic market monitoring. |

Metric 5: Number of common standards for consumer data and for DSO-supplier contract or existence of a national data hub

| Metric 5 | Number of common standards for consumer data & for DSO-supplier contracts or the existence of a national data hub |
|--------------------|--|
| Description | <p>Efficient, safe and secure data exchange between stakeholders is vital to ensure a well-functioning retail market and the possibility for new suppliers, both national and cross-border, to enter into a market. All suppliers, both existing and new, and other third parties (authorised by the customer) need to be able to access relevant customer meter data on equal and non-discriminatory terms.</p> <p>CEER recommends having one national common standard (CEER Advice on Customer Meter Data Management for Better Retail Market Functioning). In 2016, CEER conducted a comprehensive review of data management models in eight countries. All of the countries participating in the study reported to have a common standard for access to data for suppliers and third parties. Moreover, all but one country reported to be moving to a more centralised model of data management, either in the form of data hubs with storage, or communication hubs. The participating countries generally cited efficient data handling, fair competition and easier access to data as advantages of their more centralised future models. A summary of the reported change from current to future models is shown below. More details can be found in the CEER Review of Current and Future Data Management Models (C16-RMF-89-03).</p> <p>With a supplier centric model there is a need for agreements between DSOs and relevant suppliers. This might become a burden and even a barrier for small actors on a market.</p> <p>Where available and feasible, the existence of a data hub is an alternative option to ensure access to information on equal and non-discriminatory terms, including the implementation of a common standard. A data hub simplifies the market structure further, as suppliers only communicate with a centralised hub rather than with several DSOs.</p> <p>The roll out of smart meters may also make access to information on equal and non-discriminatory terms easier.</p> |

| | |
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| Purpose | The purpose of this metric is to monitor the possibility of accessing information easily for suppliers, aggregators and other third parties on the retail market. The lack of access to consumer data is a barrier for new actors, both national and cross-border. |
| Source of data | Possible sources of data include the following: the data hub or the metering operator regarding the common standards for historical data; the metering operator regarding the common time-of-use data; and the DSOs regarding DSO-supplier contracts. |
| Quantification | In order to quantify this metric it will be necessary for the NRA to examine whether there are set processes regarding access to customers data for authorised supplier or third party. It will be important to show the MS level of implementation of the advice on data management or if there is a functioning data hub, which meets the functionality demands set by the European Commission. More specifically, in order to quantify this indicator the NRA should consider the following questions: <ul style="list-style-type: none"> • Is there a procedure containing common standards regarding the accessibility of data for suppliers and third parties? What kind of data is covered by the procedure (in particular, is historic consumption information, defined in metric 18, included)? • Is there a procedure for contracts between DSO-supplier in a MS where a supplier centric model is applicable? • Is there a national data hub? What are its main features (e.g. who runs it and to what extent does it rely on explicit customer consent for data sharing with third parties)? |
| Frequency | This metric should be monitored every one or two years. |
| Unit of measure | Yes/no for all the questions and related qualitative explanations |
| Data completeness | NRAs should have access to such information as part of their basic market monitoring. |

Metric 6: Availability of time-of-use metering and, where applicable, additional fee paid by the consumer to be able to have time-of-use price vs. traditional metering

| | |
|--------------------|---|
| Metric 6 | Availability of time-of-use metering and – where applicable – additional fee paid by the consumer to be able to have time-of-use prices vs. traditional metering and profiling |
| Description | The availability of smart metering equipment and systems which allow time-of-use meter readings is a pre-requisite for consumers to be able to choose implicit demand response and flexibility schemes. Smart meters may also enable explicit demand response services through a dedicated standard interface, either as mandatory equipment or as an option. Availability of such metering might also include an additional fee for the customer. |

| | |
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| Purpose | The purpose of this metric is to determine if customers have the possibility to be active on the market through demand response or flexibility schemes. If the customer cannot access time-of-use meter readings then this might distort competition on the retail market for new suppliers, aggregators and third parties with innovative contracts, as well as restrict market choice for customers. Lack of time-of-use-metering, such as hourly readings, hinders innovation and development on the market as a whole. |
| Source of data | Information request to DSOs, metering operators and retailers (in those markets where retailers may be responsible for meters). |
| Quantification | <p>We suggest that the NRA answer the following questions:</p> <ul style="list-style-type: none"> • Are meters for time-of-use metering available for customers in each relevant market? • What type of time-of-use metering is available, e.g. 15 minute, half-hourly, hourly metering, day/night metering? And such meters for which the timeframe is linked to the market settlement period? Consider both electricity and gas meters. • How many time-of-use meters of each type are there in the MS? What is their number relative to the total number of metering points? • Is there an additional fee to install these meters in each relevant market? How much does it cost? |
| Frequency | This metric should be monitored at least on an annual basis. |
| Unit of measure | <p>Regarding the availability of time-of-use metering: Yes/no and qualitative explanations.</p> <p>Regarding the share of time-of-use meters, percentage: Number of installed meters relative to total number of metering points.</p> <p>Regarding the additional fee to access these meters: Euros for installation.</p> |
| Data completeness | NRAs should have access to such information as part of their basic market monitoring, although the detail on costs may be more difficult to obtain. |

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilit (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-053

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 59, line 1: Please explain what energy service components are included within “*retail prices*” as referenced.

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

Refer to the table on Bates p. 60 for the specific metrics the Council of European Regulators uses to track progress for this and other key properties of well-functioning markets. Refer to Bates p. 59, footnote 19 for the report from which this table was taken, refer to page 3/74 therein for documents related to the report, and refer therein to the “*2017 Handbook for National Energy Regulators How to assess retail market functioning*”, pages 11 through 17 for detailed tables summarizing the following for each metric related to this key property: Metric Name; Description; Purpose; Source of Data; Quantification; Frequency; Unit of Measure; and Data Completeness.

The aforementioned “*2017 Handbook for National Energy Regulators How to assess retail market functioning*” is available online here: <https://www.ceer.eu/documents/104400/-/840b4ce7-9e4a-5ecc-403a-fad85d6ba268>

The tables available therein are excerpted in the response to Request No. EU to LGC 1-054 for your convenience.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilit (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-054

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 59, lines 1-4: If retail prices do not closely reflect wholesale market prices, is it your opinion that customers are not “*paying a fair price*”?

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

As a foundational matter, it is important to keep in mind that there are eight key properties of well-functioning markets here, which are as follows: low concentration within a relevant market; low market-entry barriers; a close relationship between wholesale markets and retail prices; a range of offers, including demand response; a high level of awareness and trust; the availability of empowerment tools; sufficient consumer engagement; and appropriate consumer protections. These are accompanied by a matrix of 25 metrics used to track progress within each of the eight key properties (Bates p. 60.). The point is that no one metric, narrowly considered in isolation from the others, could credibly suffice to indicate a well-functioning market.

The question references one of the above eight key properties but does so in a way that seemingly misconstrues my testimony. The lines in question from my testimony (Page 59, lines 1-4) state:

“A close relationship between wholesale markets and retail prices to ensure that consumers receive correct price signals, which is an important incentive for demand response. In addition, the mark-up between wholesale and retail prices reveals whether consumers are paying a fair price.”

Referring to the above, I do not consider the wording “*close relationship*” in the above metric to be synonymous with the phrase “*closely reflect*” as used in the question; the latter brings to mind a direct comparison in a narrow sense, while the latter does not. Furthermore, the metric refers to “*wholesale markets*” and not “*wholesale market prices*” per se; again, the latter is a much narrower conception than the former. Last but not least, the key property clearly refers to the “mark-up between wholesale and retail prices” as providing a measure of insight into whether or not consumers are “*paying a fair price*” — not whether retail prices “*closely reflect wholesale market prices*”.

These distinctions are rather critical, considering that retail pricing structures in fully restructured markets reflect what the customer has agreed to with their retailer, and therefore naturally encompass an appropriate range of price-risk structures and product options serving a diversity of customer preferences and capacities, and within those, a range of correlations between retail price-risk structures and wholesale price-risk dynamics. Put another way: different retail

products offer a variety of price-risk structures relative to underlying wholesale price-risk drivers and price movements, and a credible analysis must appropriately capture this reality. In this way, the key property as cited in my testimony appropriately countenances this real-world complexity, while the question seems oblivious to it.

If you refer to the table on Bates p.60, you will see that this key property is actually composed of two metrics: the first is “Metric 7: Correlation between wholesale and retail energy prices” while the second is “Metric 8: Mark-up between wholesale and retail energy prices”.

The question has created a chimera by conflating two distinct metrics of this key property — managing to doubly-misconstrue the key property in question as a consequence.

For a detailed description regarding both of the metrics, refer to the “2017 Handbook for National Energy Regulators How to assess retail market functioning”, available online here:
<https://www.ceer.eu/documents/104400/-/840b4ce7-9e4a-5ecc-403a-fad85d6ba268>

There you will find detailed tables containing the following fields for each metric: Metric Name; Description; Purpose; Source of Data; Quantification; Frequency; Unit of Measure; and Data.

Note that “Metric 7: Correlation between wholesale and retail energy prices” is on page 18/44 to 19/44, and “Metric 8: Mark-up between wholesale and retail energy prices” is on page 19/44 to 20/44.

The tables available therein are excerpted below for your convenience:

3.3 Key property III: Close relationship between wholesale markets and retail prices

Well-functioning retail energy markets are dependent on well-functioning wholesale energy markets. Organised and transparent wholesale markets set the market value of energy as a commodity, thereby providing the foundation for the prices that consumers pay in retail energy markets. These metrics only concern the energy component of the total retail energy price.

Suggested analysis to accompany metric 7 and 8: Break down of the cost components of the total retail energy price

Accompanying these metrics should be a table with a breakdown of the total retail energy price, showing the shares that the energy component, network tariff, taxes and other components (e.g. capacity component, RES-charge) respectively constitute of the total price that consumers pay. This is important because it puts metrics 7 and 8 in perspective. In addition to this it is essential to clarify the right consumption profile, because it affects the breakdown of the total retail energy price.

| Metric 7 | Correlation between wholesale and retail energy prices |
|-----------------------|--|
| Description | Well-functioning retail energy markets depend on well-functioning wholesale energy markets. Organised and transparent wholesale markets determine the price of energy as a commodity. The relationship between the energy component of the total retail price and the wholesale price is important, as it reveals what consumers are paying for their energy relative to the underlying wholesale market price. This metric concerns only the energy component of the total retail price, which is separate from network tariffs, taxes and surcharges. |
| Purpose | <p>Close correlation between wholesale and retail prices can ensure that consumers receive correct price signals from wholesale markets. Price signals may function as an incentive for demand response. Consumers may receive price signals from wholesale markets through the energy component of the retail price, if the pricing of this component follows variations in the wholesale price. This depends largely on the price structure of the contract the consumer has agreed with the retailer. Price structures may vary from hourly pricing set against wholesale markets at one end, to fixed prices at the other.</p> <p>The ability of retailers to offer contracts that have a close correlation to wholesale markets depends on their ability to access and procure energy in a well-functioning wholesale market. This analysis therefore presumes that wholesale markets are well functioning, organised and transparent.</p> <p>Given that consumers can choose different pricing options with different degrees of correlation, e.g. hourly wholesale pricing, standard variable pricing or fixed pricing, this analysis should use aggregate price <i>per contract type</i> for comparison with wholesale markets. Both flexible and fixed price contracts should correlate with wholesale markets at the time of offering, reflecting the inherent price-risk structure of the contracts, to different extents. For example, with a wholesale-based contract the customer carries the risk of the price variation, whereas with a fixed-price contract the supplier could carry the risk of the price variation.</p> |
| Source of data | Information request to retailers, price comparison tools or other parties (e.g. statistical bureaus) that collect price data for retail energy contracts. The data should differentiate between different types of contracts offered to households and business consumers, e.g. wholesale-based price, standard variable price, fixed price. The wholesale price data should be day-ahead and forward prices from power/gas exchange/hubs. |
| Quantification | Retail and wholesale price data should be monthly average data, for a minimum of three consecutive years. If the data is weighted, the method of weighting must be clearly specified. Only the energy component of the retail price can be used for comparison against wholesale price data. The data should be placed in a time series graph. The energy component should be separated from bundled products. |

| | |
|--------------------------|---|
| | <p>Monthly average retail price data for each contract type should either be prices effectively paid (e.g. what suppliers actually billed consumers) or prices on contract offers (e.g. what is listed in a price comparison tool), weighted at consumption values that are representative for each country. For example, the ACER/CEER MMR uses 5,000 kWh/yr for electricity and 15,000 kWh/yr for gas. In the absence of retail price details by contract type, the methodology used by the ACER/CEER MMR may be used.</p> <p>Wholesale prices should be quantified as the monthly average hub/exchange prices, where available. A nationally specific quantification of the wholesale price may be added to transparent market data.</p> <p>The source and type of all price data used for the analysis, and any method of quantification used, must be clearly specified.</p> |
| Frequency | This metric should be monitored at least on an annual basis. |
| Unit of measure | Unit prices should be expressed in terms of Eurocent/kWh |
| Data completeness | Foreseeable issues include availability of retail price data by contract type as well as the availability of wholesale prices in the absence of transparent wholesale markets. |

| Metric 8 | Mark-up between wholesale and retail energy prices |
|--------------------|---|
| Description | Well-functioning retail energy markets depend on well-functioning wholesale energy markets. Organised and transparent wholesale markets determine the price of energy as a commodity. The relationship between the energy component of the total retail price and the wholesale price is important as it reveals what consumers are paying for their energy relative to the underlying wholesale market price. This metric concerns only the energy component of the total retail price, which is separate from network tariffs, taxes and surcharges. |
| Purpose | <p>Mark-ups are not precisely comparable to the suppliers' final profits. Suppliers have to pay operational costs and taxes out of this margin. Mark-ups represent the gross margin, while the actual or net margin will depend significantly on operating costs and consumption levels. However, the evolution of mark-ups may serve as an indication of the level of retail competition and the "responsiveness" of the retail to wholesale prices over time.</p> <p>The mark-up between wholesale and retail prices reveals whether consumers are paying a fair price for energy relative to the underlying wholesale price. The responsiveness of the mark-up relative to rising or falling wholesale prices is essential for this analysis. The level of the mark-up will depend on the price structure of the contract the consumer has agreed with the retailer. Price structures may vary from hourly pricing set against wholesale markets at one end, to fixed prices at the other.</p> <p>This analysis presumes that wholesale markets are well functioning, organised and transparent.</p> |

| | |
|--------------------------|---|
| | <p>By analysing the mark-up based on different contract types, e.g. wholesale-based or fixed pricing, the analysis reveals which contract types are the most beneficial for consumers. Different contract types should have different levels of mark-up to wholesale markets, reflecting the differences in the inherent price-risk structure of the contract type. For example, with a wholesale-based contract the customer carries the risk of the price variation whereas with a fixed-price contract the supplier could carry the risk of the price variation.</p> |
| Source of data | <p>Information request to retailers, information available on PCTs or from other institutions (e.g. statistical bureaus) that collect price data for retail energy contracts. The data should differentiate between contracts offered to households and business consumers. The wholesale price data should be day-ahead and forward prices from power/gas exchange/hubs. Where transparent market data is not available, the methodology of the ACER/CEER MMR should be used.</p> |
| Quantification | <p>Retail and wholesale price data should be monthly average data, for a minimum of three consecutive years. If the data is weighted, the method of weighting must be clearly specified. Only the energy component of the retail price can be used for comparison against wholesale price data. The mark-up is quantified as the monthly difference between the retail price and the wholesale price, expressed in eurocent/kWh. The data should be placed in a time series graph. The energy component should be separated from bundled products.</p> <p>Monthly average retail price data for each contract type should be either prices effectively paid (e.g. what suppliers actually billed consumers) or prices on contract offers (e.g. what is listed in a price comparison tool), weighted at consumption values that are representative for each country. For example, the ACER/CEER MMR uses 5,000 kWh/yr for electricity and 15,000 kWh/yr for gas. In the absence of retail price details by contract type, the methodology used by the ACER/CEER MMR may be used.</p> <p>Wholesale prices should be quantified as the monthly average hub/exchange prices, where available. A nationally specified quantification of the wholesale price may be added <i>in addition</i> to transparent market data. The source and type of all price data used for the analysis, and any method of quantification used, must be clearly specified.</p> |
| Frequency | This metric should be monitored at least on an annual basis. |
| Unit of measure | Unit prices should be expressed in terms of Eurocent/kWh |
| Data completeness | Foreseeable issues include availability of retail price data by contract type as well as the availability of wholesale prices in the absence of transparent wholesale markets. |

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-055

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 59, line 5: What is a sufficient range of offers, including demand response services, for a well-functioning market? Please explain.

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

Refer to Bates p. 64, footnote 24: for a list of innovative retail products, refer to page 25 of this report: Dr. Philip R. O'Connor, “Restructuring Recharged,” Retail Energy Supply Association. April 2017. Available online:

https://www.resausa.org/sites/default/files/RESA_Restructuring_Recharged_White%20Paper_0.pdf

The table referenced is excerpted below for your convenience:

TABLE 6 - INNOVATIVE PRICING, PRODUCTS & SERVICES IN CHOICE MARKETS

| | |
|---|---|
| Fixed-Price Multi-Year Contracts | In monopoly states, utilities generally decide when to file for rate changes. In choice states, customers can choose multiyear price guarantees that in some markets may be as long as five years. Among other things, a business can lock in a key budget item for a known period of time. |
| Index Pricing | In choice markets, some customers will choose to buy power supply under various index-pricing arrangements. Options may include pricing on a monthly, daily or even hourly basis. Such deals may or may not include the cost of capacity, transmission or other ancillary cost values depending on the type of program selected by the customer. |
| Mixed Fixed & Index Pricing | Some customers will choose a mix of fixed and floating or index-based pricing. Some businesses also choose to purchase fixed-price "blocks" similar in shape to those acquired in the wholesale market in order to mitigate risk and achieve cost savings. A business may adjust its operations to control its usage and demand to save money. |
| Blend & Extend Pricing | Customers who have chosen a fixed-price or a mix of fixed- and index-pricing may choose to extend the duration of a supply contract if market prices move downward or if there is a concern about possible upward movement in price. This gives the customer the opportunity to have a more favorable price going forward under an existing contractual relationship based on their view of the market and their company's unique risk profile. |
| Real-Time Pricing | Real-time pricing is available for nearly all C&I customers and some residential customers in competitive jurisdictions from competitive suppliers, the local wires utility or the RTO. Some monopoly utilities provide real-time supply options to some C&I and residential customers under highly restricted conditions, including limiting the favorable prices to only a portion of supply or requiring payment of procurement charges or latent capacity fees. In choice markets, customers can simply access the real-time energy price, while not paying for capacity. Customers therefore can choose to bear the unhedged risk of short-term high prices in order to take advantage of both low on-peak and off-peak prices that can lead to overall cost savings on average. |
| Demand Response (DR) | Retail competitive markets allow customers to contract directly with RTOs, through wires-only utilities and/or through competitive suppliers. Demand reductions during peak periods are compensated on the same basis as supply. DR is less prevalent under monopoly models because participation is controlled by utilities that own generation against which DR competes. ²⁴ |
| Renewable & Green Supply Blends | Customers in competitive states can usually choose the portion of supply that is produced by renewable (green) resources, rather than being limited to minimum levels mandated by state government policies that may prevail in some monopoly or competitive states. |
| Market Data, Analytics & Budget Reports | Many C&I customers receive energy market data and additional analytics in order to facilitate purchase decisions and budget planning. Such services operate in tandem with options for customers to blend and extend their contracts, for example. Some suppliers will work with customers to provide ongoing reports that integrate with firm budgeting when electricity is a key business expense. |
| Energy Efficiency Options & On-Bill Financing | Although many traditional vertical monopoly utilities offer energy efficiency programs, including on-bill financing, there can be inherent conflicts due to ownership of rate-based generation assets. In choice markets, while suppliers sell power, they have incentives to help customers achieve efficient energy use as a means of customer retention and as a business in and of itself. Many competitive suppliers enable efficiency project financing with charges for this service added to competitive supplier's commodity bills or through energy savings. |
| Distributed Energy Resources (DER) | Customers interested in locating DER on their premises can often work with competitive suppliers to optimize the value of the resources, unhindered by local monopoly tariffs and regulations which may limit customers in selling output into the market. |
| Integrated Home Solutions | Suppliers are offering residential customers smart thermostats, smart home automation and various applications to facilitate home energy and appliance management in order to optimize the value of market signals. |

Refer to the table on Bates p. 60 for the specific metrics the Council of European Regulators uses to track progress for this and other key properties of well-functioning markets. Refer to Bates p. 59, footnote 19 for the report from which this table was taken, refer to page 3/74 therein for

documents related to the report, and refer therein to the “*2017 Handbook for National Energy Regulators How to assess retail market functioning*”, pages 11 through 17 for detailed tables summarizing the following for each metric related to this key property: Metric Name; Description; Purpose; Source of Data; Quantification; Frequency; Unit of Measure; and Data Completeness.

The aforementioned “*2017 Handbook for National Energy Regulators How to assess retail market functioning*” is available online here: <https://www.ceer.eu/documents/104400/-/840b4ce7-9e4a-5ecc-403a-fad85d6ba268>

The tables available therein are excerpted below for your convenience:

3.4 Key property IV: A range of offers, including demand response

A well-functioning market is characterised by innovation and the range of products and services offered to consumers. In general, retailers' ability to offer a significant number of commercial options - coupled with consumers' ability to compare the offers and take informed decisions - is a sign of healthy competition and innovation.

20/44



Ref: C16-SC-52-03

2017 Handbook for National Energy Regulators: how to assess retail market functioning

Demand response can be defined as the capacity to change electricity usage by end-use customers (including residential) from their normal or current consumption patterns in response to market signals, such as time-variable electricity prices or incentive payments, or in response to acceptance of the consumer's bid, alone or through aggregation, to sell demand reduction/increase at a price in electricity markets or for internal portfolio optimisation. The valuation of demand response can be done explicitly or implicitly: explicit demand response is sold as a product on a market and therefore requires a specific control (ex-ante and/or ex-post). Implicit demand response does not need such a process since it is not sold to anyone and remains only for the benefit of the final consumer and the corresponding retailer or the Balance Responsible Party (BRP)⁷ as an optimisation respective of its sourcing costs or imbalances (e.g. via a payment organised between the independent flexibility service provider and the supplier).

| Metric 9 | Availability of a variety of pricing and billing options |
|-------------|---|
| Description | <p>This metric describes two ways of differentiating an offer (pricing and billing) in retail energy markets. Retailers may offer different products based on the way in which they are priced or billed. The consumers' bill contains key information, and may consist of information about the energy component price, the network tariff and taxes paid. This metric is aimed at the household market and possibly SMEs when and where applicable.</p> |
| Purpose | <p>Various options of pricing and billing can present innovation in the market and create benefits for the customer. Examples of various pricing options may be fixed pricing, variable pricing, or wholesale-based pricing. Wholesale pricing may be hourly (based on time-of-use metering), or monthly (based on an arithmetic mean, or load profile adjusted day-ahead price for the previous month, where time-of-use metering is not available). With wholesale pricing, the supplier earns its margin through an add-on per kWh or a monthly fee. Consumers should have the option to choose to be exposed to time-varying electricity prices, which reflect the value and cost of electricity and transportation at the moment of consumption. Equipped with this information, consumers can make conscious choices – or automate the decision – to use less electricity at times of high prices and thereby reduce their energy bill.</p> <p>Variations of billing options could be many, falling essentially under two broad categories: advance payments or post-meter reading payments. Post-meter reading billing should be advocated for consumers with time variable pricing, as this ensures that consumers are billed for the actual energy consumed during the billing period. As such, advance payments may be a barrier to demand response unless a correct settlement takes place after each consumption period.</p> <p>Opportunities for a variety of pricing and billing options should enable new suppliers with innovative ideas on pricing and billing to enter a market. If such opportunities are severely restricted, this might distort competition.</p> |

| | |
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| Source of data | <p>Information requests to retailers and information available on PCTs are the most common sources of this data. The ACER/CEER MMR already provides an overview of the main pricing options for most capital cities MSs, based on PCT information.</p> |
| Quantification | <p>This metric aims to capture the variety of pricing and billing options available to customers in a relevant market. It does not require a detailed monitoring of the offers at each supplier level, although this could provide a useful piece of complementary information to understand the pricing and product strategies followed by different suppliers. Another relevant piece of complementary information could be the number of customers on each pricing and billing option.</p> <p>In order to quantify this metric the NRA should address the following two sets of questions:</p> <ol style="list-style-type: none"> 1) Is there a variety of pricing options? Tick boxes for the yes or no options below. <p>Variable price set, and announced, ahead of time (ex-ante). Example: Price is changed every month and announced before the start of the month.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Variable price that changes 4-12 times per year <input type="checkbox"/> Variable price that changes more than 12 times per year <p>Wholesale-based price announced ex-post plus fee and/or mark-up announced ex-ante. Example: The wholesale price changes every month and is announced after the month has ended, when the supplier knows what it paid on average during the previous month.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Price settled against monthly average wholesale <input type="checkbox"/> Price settled against daily/weekly average wholesale <input type="checkbox"/> Price settled against hourly average wholesale <p>Fixed price stipulated in the contract ahead of time. Example: Price and fee for the following 12 months are announced in the offer before the customer signs the agreement.</p> <ul style="list-style-type: none"> <input type="checkbox"/> Fixed 3-11 months <input type="checkbox"/> Fixed 1-3 years <input type="checkbox"/> Fixed 4 years or longer |

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| | <p>Mixed price based on both fixed and variable components. Example: 50% of the consumption is billed according to fixed rate (winter) and 50% according to a variable price (summer) component.</p> <p><input type="checkbox"/> Mix of variable and fixed price</p> <p><input type="checkbox"/> Pricing method varies between seasons</p> <p>Other price that does not fit description above</p> <p><input type="checkbox"/> Other pricing 1 (specify) _____</p> <p><input type="checkbox"/> Other pricing 2 (specify) _____</p> <p><input type="checkbox"/> Other pricing 3 (specify) _____</p> |
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| | <p>2) Are there a variety of billing options? Tick boxes for the yes or no options available below.</p> <p><input type="checkbox"/> Direct debit</p> <p><input type="checkbox"/> Bank transfer</p> <p><input type="checkbox"/> SEPA⁸</p> <p><input type="checkbox"/> Credit card</p> <p><input type="checkbox"/> Cash</p> <p><input type="checkbox"/> Pre-payment</p> <p><input type="checkbox"/> Other (specify) _____</p> <p>All pricing and billing options should refer to viable options, i.e. it should be possible for the addressed consumer to utilise these options.</p> |
| Frequency | The frequency for the monitoring of this metric may range from monthly to yearly, depending on the relevant market circumstances. |
| Unit of measure | Yes/no for all the questions and any relevant qualitative explanations |
| Data completeness | NRAs should have access to such information as part of their basic market monitoring, although the level of detailed breakdown may vary. |

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| Metric 10 | Availability of value added services for implicit demand response and self-generation |
| Description | This relates to the availability of contracts containing price mechanisms, and/or added services that allow consumers to reduce their load or shift it from peak to off-peak periods, as well as to self-generate. Availability of market infrastructure, e.g. smart meters, and procedures enabling consumers to receive the correct price settlement are essential to make implicit demand response and self-generation an established viable option for consumers. |

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| | <p>The availability of demand response offers and flexibility services can indicate an innovative, competitive and diversified market. It can offer consumers the opportunity to lower energy costs by adapting to time varying prices that reflect price formation on well-functioning wholesale market e.g. settlement against hourly prices.</p> <p>For customers it is essential to get clear information regarding the conditions when a contract is bundled e.g. with energy-efficiency services, products, maintenance services or other add-ons such as value added services.</p> <p>A second purpose of this metric is to determine if the customers have the possibility to self-generate their electricity and also to feed the surplus into the system. Fair access to market mechanisms and systems through which prosumers can feed energy into the energy networks are essential.</p> <p>It is, however, crucial that the contract terms for the market arrangements, mentioned above, do not disadvantage the customer or limit customer benefits.</p> |
| Purpose | <p>Source of data</p> <p>Survey to retailers and energy service companies</p> <p>In order to quantify this metric the NRA should address the following questions:</p> <ul style="list-style-type: none"> • Are there contracts available for implicit demand response such as time-of-use contracts or flexibility contracts? • What kind of value added services or products that contribute to demand flexibility are available for customers? <p>(Automatically controlled or supplied with demand response switch)</p> <p><input type="checkbox"/> Hot water heaters</p> <p><input type="checkbox"/> Storage – batteries</p> <p><input type="checkbox"/> Smart thermostat</p> <p><input type="checkbox"/> Gas heater</p> <p><input type="checkbox"/> Air conditioning</p> <p><input type="checkbox"/> Washing machines</p> <p><input type="checkbox"/> Refrigerators</p> <p><input type="checkbox"/> Electric car chargers</p> <p><input type="checkbox"/> Maintenance services</p> <p><input type="checkbox"/> Other</p> <p>Specify other:</p> <p>Questions regarding the conditions for self-generation.</p> <p>Questions regarding whether the surplus from self-generation can be fed into the system</p> <ul style="list-style-type: none"> • How many consumers participate in implicit DR through a contract? • How many customers have contracts, which include feed in from electricity, and/or gas from self-generation? • Are there appliances with demand response switches or other connections available on the electricity and gas market? |

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| Frequency | The frequency for the monitoring of this metric may range from monthly to yearly, depending on the relevant market circumstances |
| Unit of measure | Yes/No and a qualitative elaboration, multiple choice. On self-generation: number of customers relative to the total amount of customers. |

24/44

Ref: C16-SC-52-03
 2017 Handbook for National Energy Regulators: how to assess retail market functioning



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| Data completeness | This is an area of the market that is developing and that NRAs may not have started monitoring yet, hence data may not be complete. |
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| Metric 11 | Availability of online offers, bills, contracts and online customer service. |
| Description | The European Commission's Digital Agenda proposes to better exploit the potential of Information and Communication Technology (ICT). The availability of different user-friendly channels through which a customer can interact with the market actors is a sign of innovation in the retail market. |
| Purpose | <p>The purpose of this metric is to monitor innovation related to the use of ICT. If customers can interact with market actors in executing key contractual processes such as comparing different offers, signing up to an offer and receiving a bill online, as well as getting online customer service (i.e. the 'customer journey'), this can be seen as a sign of innovation and progress in the market. The focus should be on identifying whether retailers provide these options and whether these options are available to all categories of consumers (there may be some that, for geographical or technical issues, may not have access to these online offers).</p> <p>This metric is closely related to metric 17, which refers to the access to an independent and verified PCT.</p> |
| Source of data | PCTs, and information requests to retailers. |
| Quantification | <p>In order to quantify this metric the NRA should consider the following questions. These questions are linked to the 'customer journey'.</p> <ul style="list-style-type: none"> • Are offers comparable online and/or through digital applications for all MS customers? If not, please indicate why and for what proportion of customers this is not the case. • Can contracts be signed online through the PCT or otherwise for all MS customers? If not, please indicate why and for what proportion of customers this is not the case. Is management of energy contracts online and/or through digital applications available to all MS customers? • Are bills available online? • Is customer service available through online channels |
| Frequency | The frequency for the monitoring of this metric may range from monthly to yearly, depending on the relevant market circumstances. |
| Unit of measure | All questions: yes/no and possible number of customers and qualitative explanations (especially if a "no" answer is provided). |
| Data completeness | This is a relatively new monitoring area and NRAs may not have developed it yet, hence data may not be complete. |

Metric 12**Availability of contracts guaranteeing the origin of energy**

25/44

Ref: C16-SC-52-03

2017 Handbook for National Energy Regulators: how to assess retail market functioning



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| Description | This metric measures the availability of specific contracts, for each relevant market, containing information on the source and origin of the electricity and/or gas procured by the supplier. The contracts should specify the source(s) of energy as well as the supplier's commitment on how to obtain this [e.g. by acquiring Guarantees of Origin (GO)]. |
| Purpose | The purpose of this metric is to assess whether products with a specific origin and source, mostly renewable sources, are available for consumers. The availability of such contracts is a sign of innovation on a market. . |
| Source of data | PCTs, and information requests to retailers. |
| Quantification | In order to quantify this metric the NRA should consider the following questions: Are there contracts with a specific source guaranteed for each relevant market (e.g. contracts guaranteeing the source to be from wind, water or solar)? Is it possible for customers to sign contracts such as those listed below? Tick the box if the option is available. Guarantees for energy sources (exclusively) <input type="checkbox"/> Hydro <input type="checkbox"/> Wind <input type="checkbox"/> Solar <input type="checkbox"/> Biomass <input type="checkbox"/> Nuclear <input type="checkbox"/> Fossil (any) <input type="checkbox"/> Specific plant (any type, such as a specific wind farm, etc.) <input type="checkbox"/> Other (specify) |

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| | <p>Guarantees for energy sources (in combination)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Hydro <input type="checkbox"/> Wind <input type="checkbox"/> Solar <input type="checkbox"/> Bio <p>What is the share of the above contracts that are available in the market and how many suppliers offer them? This should give an indication of whether the availability is actually meaningful.</p> |
| Frequency | The frequency for the monitoring of these offers may range from monthly to yearly, depending on the relevant market circumstances. On the other hand, the update of the Guarantees of Origin registry will generally happen once per year. |
| Unit of measure | All questions: yes/no and possible qualitative explanations (especially if a “no” answer is provided). |
| Data completeness | NRAs may already collect this data as part of the implementation of the renewable directive and disclosure of the source of electricity sold to end-users by suppliers, though this does not necessarily imply that there are contracts with specific origin and/or that these are supervised. Some MSs also have guarantees of origin and disclosure for gas sold to end-users by suppliers. |

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| Metric 13 | Availability of explicit demand response offers |
| Description | This metric monitors the availability of products that provide explicit demand side flexibility in the market. In explicit demand response the “freed-up-shifted” electricity is traded in electricity markets or used for other purposes. Consumers receive specific remuneration to change their consumption upon request (using more or using less), e.g. triggered by activation of balancing energy, differences in electricity prices or a constraint on the network. |
| Purpose | The purpose of the metric is to assess if there are explicit demand response opportunities available and to which customers. In particular, it aims at identifying what, if any, market arrangements exist, allowing customers to free up or shift electricity usage and trade it in a market place. Moreover, it is of particular interest to monitor the flexibility capacity that is available on the market through these products. |
| Source of data | <p>Information is likely to come from different entities according to the use of flexibility and the related main market body:</p> <ul style="list-style-type: none"> • For balancing and reserve markets: TSOs, as already required by European regulation (article 17 of Commission Regulation (EU) No 543/2013 of 14 June 2013 on submission and publication of data in electricity markets) • For local system support services: DSOs. • For wholesale markets: reporting by different market actors may be necessary, based on clear rules protecting sensitive information. |
| Quantification | In order to quantify this metric, the NRA should address the following questions: <ul style="list-style-type: none"> • Are explicit demand response opportunities available in each relevant market? • How much capacity/volume is available through the use of explicit demand response contracts on an annual basis? Use a metric based on capacity for market mechanisms essentially based on availability (balancing and ancillary services, and system adequacy mechanisms) and a metric based on volume for flexibility sold into the market annually for the wholesale market and some reserves market where energy is traded. |
| Frequency | The frequency for the monitoring of this metric may range from monthly to yearly, depending on the relevant market circumstances. |
| Frequency | The frequency for the monitoring of this metric may range from monthly to yearly, depending on the relevant market circumstances. |
| Unit of measure | <p>Regarding explicit demand response opportunities:</p> <input type="checkbox"/> Possible <input type="checkbox"/> Not possible <input type="checkbox"/> Possible but contracts not available <input type="checkbox"/> Possible and contracts available |

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| | <p><input type="checkbox"/> Possible but no knowledge if such contracts are available.</p> <p>Regarding capacity measure: kW in total or proportion of total peak-demand.</p> <p>Regarding volume measure: kWh in total or proportion of total demand.</p> |
| Data completeness | This is a new monitoring area for most NRAs. The gathering of data may prove difficult and, in the case of the capacity measure, may require estimates. |
| Metric 14 | Percentage of consumers knowing they can switch supplier |
| Description | A precondition for consumer participation in retail energy markets is awareness and knowledge about the possibility to make an active and informed choice. This includes choosing another supplier, choosing another contract with their current supplier, or deliberately staying with their current supplier. This metric focusses on switching supplier. Recent studies show that even in liberalised markets a significant share of household consumers is insufficiently aware of the possibility to switch supplier and thus reaping key benefits of market liberalisation (cheaper energy, increasing competition, etc.). While market liberalisation brings a number of rights for consumers, switching supplier can be seen as crucial. |
| Purpose | The metric is used to measure the awareness of consumers about a key consumer right and how this awareness varies over time. Widespread awareness of this right facilitates market participation, which is key to well-functioning retail energy markets. |
| Source of data | NRAs may rely on existing national consumer surveys. |
| Quantification | <p>This indicator should be the result of a survey based on a representative sample of the consumer population in terms of gender, age, location, socio-economic category. The targeted interlocutor is the person in the household in charge of electricity and gas bills payment.</p> <p>There should be different panels for gas and electricity.</p> <p>The survey questions should cover the following dimensions: factors determining the choice of supplier, the possibility to choose a supplier, etc.</p> <p>After consultation with national experts in this field (e.g. consumer survey companies), the questions could read as follows, though NRAs are welcome to use questions that would lead to similar results:</p> <p>"In your opinion:</p> <ol style="list-style-type: none"> 1. The choice of an [electricity / gas] supplier is determined by the geographic area where you live? <ul style="list-style-type: none"> <input type="radio"/> Yes <input type="radio"/> No [correct answer] <input type="radio"/> No opinion 2. Every household can choose its electricity supplier? |

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| | <ul style="list-style-type: none"> <input type="radio"/> Yes [correct answer] <input type="radio"/> No <input type="radio"/> No opinion <p>3. Can you quote the name of 3 [electricity / gas] suppliers?</p> <ul style="list-style-type: none"> <input type="radio"/> 3 or more correct answer <input type="radio"/> 2 correct answer <input type="radio"/> 1 or less correct answer <input type="radio"/> Mention companies that are not electricity / gas suppliers (e.g. DSO, TSO, etc.)" |
| Frequency | This metric should be measured annually or, at least, every 3 years |
| Unit of measure | For each question, percentage of consumers choosing the different possible answers. |
| Data completeness | N/A |
| Metric 15 | Percentage of consumers who know that DSOs are responsible for the continuity of supply and, where applicable, of metering |
| Description | A precondition for consumer participation in retail energy markets is awareness and knowledge about the possibility make an active and informed choice. It also involves some 'basic knowledge about how the market works. This metric focusses on the awareness about the role of the DSO. In particular about the responsibility of DSOs for continuity of supply, as well as the awareness that switching to another supplier has no impact on continuity of supply. Such a concern is often given by consumers as one of the main reasons for not switching supplier. |
| Purpose | The metric is used to measure the understanding of retail market functioning principles of consumers. This could help NRAs to raise consumers' awareness and therefore increasing the confidence of consumers in the market. |
| Source of data | NRAs may rely on existing national consumer surveys. |
| | This indicator should be the result of a survey based on a representative sample of the consumer population in terms of gender, age, location, socio-economic category. The targeted interlocutor is the person in the household in charge of electricity and gas bills payment. |
| Quantification | <p>There should be different panels for gas and electricity.</p> <p>Survey questions should cover the following dimensions: link between switching a supplier and changing one's meter, link between supplier switching and power cuts, entity responsible for meter reading, etc.</p> <p>After consultation with national experts in this field (e.g. consumer survey companies), the questions could read as follows, though NRAs are welcome to use questions that would lead to similar results:</p> <p>"In your opinion,</p> |

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| | <ol style="list-style-type: none"> 1. If you switch to another supplier, must you change your meter? <ul style="list-style-type: none"> <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> No opinion 2. If you switch to another supplier, do you believe that you will experience more power cuts?? <ul style="list-style-type: none"> <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> No opinion 3. If you switch to another supplier, do you believe that your new supplier will be in charge of meter reading? <ul style="list-style-type: none"> <input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> No opinion 4. Can you quote the name of the company that operates [power lines / gas pipes] to your home? <ul style="list-style-type: none"> <input type="radio"/> Correct answer [depends on interviewee location] <input type="radio"/> Incorrect answer <input type="radio"/> No opinion” |
| Frequency | This metric should be measured annually or, at least, every 3 years. |
| Unit of measure | For each question, percentage of consumers choosing the different possible answers. |
| Data completeness | N/A |
| Metric 16 | Percentage of consumers trusting the energy market |
| Description | This metric measures the level of trust in the market and in the individual suppliers. It is important for consumers to be confident that they will be treated fairly and can trust the information that suppliers provide them. A bad experience with one supplier can undermine consumers' confidence in the energy market as a whole, causing them to disengage in the long term. And, because energy is an essential service, consumers should be able to expect to receive fair treatment from their own and other suppliers. |
| Purpose | The metric is used to measure the consumer's trust in the energy markets. A high level of consumer confidence in the market allows for a more active participation. However, trust is a complex concept and when assessing the situation, an NRA must be careful to attain an accurate picture of the situation. In addition to the outcome of this metric, more background information, including the results from the other metrics, is necessary to fully understand the situation. |
| Source of data | NRAs may rely on existing national consumer surveys or on the DG Justice Consumer Scoreboard. |

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| | <p>This indicator should be the result of a survey based on a representative sample of the consumer population in terms of gender, age, location, socio-economic category. The targeted interlocutor is the person in the household in charge of electricity and gas bills payment.</p> <p>There should be different panels for gas and electricity.</p> |
| Quantification | Survey questions should cover the following dimensions: consumer evaluation of competition, consequence of competition in terms of service quality and price development, etc. |
| | NRAs are welcome to define questions that best fits their national context after consultation with experts in surveys. A large set of pilots is provided as an example of possible approaches. |
| Frequency | This metric should be measured annually or, at least, every 3 years. |
| Unit of measure | For each question, percentage of consumers choosing the different possible answers. |
| Data completeness | N/A |
| Metric 17 | Percentage of consumers having access to at least one independent and verified price comparison tool |
| Description | Percentage of consumers having access to offers through at least one independent and verified price comparison tool |
| Purpose | <p>This metric is used to measure whether the consumer has the possibility to identify the best offers. The easier the consumer can estimate available savings, the more informed their decision will be to either switch to a better offer or stay with the current deal.</p> <p>An independent and verified price comparison tool (PCT) is a powerful empowerment tool to make comparisons easier for consumers. A PCT is a tool, generally a web page, which lists all the offers available to the consumer and where they can evaluate the potential benefits of switching. Such a tool can be considered:</p> <ul style="list-style-type: none"> - Independent: as long as it is free from any commercial bias. - Verified: if the check made by the NRA, or another competent authority, shows that the tool is correct, accurate and exhaustive. <ul style="list-style-type: none"> o Exhaustiveness: all prices and products available for all customers should be shown as a first step. If not possible, the Comparison Tool should clearly state this before showing results. After the initial search, the option to filter |

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| | <p>results should be offered to the customer.</p> <ul style="list-style-type: none"> ○ Correctness and accuracy: price information used in the comparison should be updated as often as necessary to correctly reflect prices available on the market. |
| Source of data | This indicator should be the result of research made by the NRA. |
| Quantification | <p>The percentage of consumers is calculated on the basis of the number of consumers that have access to an independent and verified comparison tool, relative to the total amount of consumers. This PCT has been identified as an independent and verified tool by the NRA.</p> <p>This metric should be calculated separately for gas and electricity.</p> <p>Similarly, metric 11 should also focus on whether at least one of such PCTs lists offers that are relevant for all categories of consumers (for geographical or technical issues there may be some consumers who cannot find relevant offers on any PCTs).</p> <p>“Having access to a PCT” requires that consumers can actually find at least one alternative offer from an alternative supplier for their connection point, assuming that they can access the internet. (The intention is not to measure the possibility for consumers to access the internet.)</p> |
| Frequency | This metric should be measured annually. |
| Unit of measure | Percentage of consumers having access to relevant offers through an independent and verified price comparison tool |
| Data completeness | N/A |

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| Metric 18 | Percentage of consumers having access to online historical consumption information |
| Description | Percentage of consumers having access to online historical consumption information |
| Purpose | <p>This metric is used to measure the possibility for consumers to access their consumption data through online tools. Having access to accurate historical consumption data enables consumers to compare alternative offers available in the market and make informed choices. It is also important for a consumer to get insight into their historical consumption in relation to the impact on the bill. This may, in turn, help towards a more responsible use of energy.</p> <p>Online access seems the most convenient way to access consumption data when required, especially in the case of a large amount of data (such as hourly billing).</p> |
| Source of data | Research conducted by the NRA and, potentially, information requests to retailers and/or regulated companies. |
| Quantification | Data available to the consumer must go back at least 3 years, if such data is available to the concerned supplier or DSO (if the customer is in the supplier / DSO portfolio for less than 3 years, the data available must cover the whole period starting from the entry of the customer in the portfolio). |

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| | <p>The percentage should be broken down into four categories depending on the level of detail provided:</p> <ul style="list-style-type: none"> - annual data; - monthly data; - daily data; - all the data required by the current supplier in order to proceed to billing: consumption on each billing period (annual, monthly, peak / off-peak, hourly,...). |
| | <p>The metric should be calculated separately for gas and electricity.</p> |
| Frequency | This metric should be measured annually. |
| Unit of measure | Percentage of consumers having access to online historical consumption information relative to the total number of consumers in the member state, to be broken down, if possible, by category as illustrated above. |
| Data completeness | N/A |
| Metric 19 | Percentage of consumers having access to standardised supplier switching process (and its duration) |
| Description | Percentage of consumers having access to standardised supplier switching process (and its duration) |
| Purpose | <p>This metric is used to measure the availability of a standardised supplier switching process for consumers. An easy to use and quick switching process can spur further consumer engagement. This metric will inform NRAs about any needs for measures to improve the existing switching process.</p> <p>According to the 3rd Package, a supplier switch should take no longer than three weeks, and consumers should receive their final bill within six weeks. In the CEER Guidelines of Good Practice on electricity and gas retail market design, with a focus on switching and billing, there are three recommendations regarding the timing on a supplier switch:</p> <ol style="list-style-type: none"> 1. A switch should be executed as quickly as possible. This could be as quickly as within 24 hours and in any case within three weeks. 2. A switch should be possible any day of the week. 3. No market actor should be able to stop an initiated switch except for limited cases foreseen in the regulatory framework. |
| Source of data | Research conducted by the NRA and potentially information requests to retailers and/or regulated companies. |
| Quantification | <p>In order to quantify this metric, the NRA should first of all verify the implementation of the switching process with the DSOs.</p> <p>It should also calculate the average time between:</p> <ul style="list-style-type: none"> - the date of the switching request made by the supplier, with all required data provided; and - the date when the actual transfer of the client is completed. |

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| | The time required to resolve any legitimate disputes that prevent the transfer according to national regulations should not be included in the calculation. |
| Frequency | The duration should be measured monthly to annually. The percentage of consumers having access to a standardised switching process should be measured annually. |
| Unit of measure | Regarding the access of consumers to a standardised switching process: percentage of consumers out of the total number of consumers in the MS. Regarding the duration of the switching process: average number of working days to complete the process across all suppliers. |
| Data completeness | NRAs should have access to such information as part of their existing market monitoring of 3 rd Package indicators. |

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-056

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 59, line 12: Do you consider default energy supply options as providing customer engagement?

RESPONSE:

In the context of the question, yes. (The answer is self-evident to the degree that I’m curious how anybody could think otherwise.)

However, the context of my testimony that the question cites is rather more specific and prudent in these regards. Bates p. 59 lines 12-14 reads:

“Sufficient consumer engagement where switches, renegotiations and prosumers are assessed on a yearly basis. In general, a well-functioning market is one in which a significant number of consumers engage with the market on a regular basis.”

Refer to the table on Bates p. 60 for the specific metrics the Council of European Regulators uses to track progress for this and other key properties of well-functioning markets. Refer to Bates p. 59, footnote 19 for the report from which this table was taken, refer to page 3/74 therein for documents related to the report, and refer therein to the “*2017 Handbook for National Energy Regulators How to assess retail market functioning*”, pages 11 through 17 for detailed tables summarizing the following for each metric related to this key property: Metric Name; Description; Purpose; Source of Data; Quantification; Frequency; Unit of Measure; and Data Completeness.

The aforementioned “*2017 Handbook for National Energy Regulators How to assess retail market functioning*” is available online here: <https://www.ceer.eu/documents/104400/-/840b4ce7-9e4a-5ecc-403a-fad85d6ba268>

The tables available therein are excerpted below for your convenience:

3.7 Key property VII: Sufficient consumer engagement

A well-functioning market is one in which a number of consumers engage with the market.

Metric 20: Supplier switching rate

| Metric 20 | Supplier switching rate |
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| Description | The rate at which consumers switch or engage with energy suppliers or the wider market, measured on a yearly basis. The switching rate alone may be a crude measure of supplier engagement. In this metric the definition of switching is extended to also include another measure of consumer engagement, namely the renegotiation of contracts. |
| Purpose | This metric is used to measure the active engagement of consumers in the energy retail market. The supplier switching rate is one of these measures. It is directly linked with the level of competition, since the switching rate affects the market share of competing companies and thus puts competitive pressure on energy suppliers. Supplier switching, or the threat thereof, can stimulate companies to offer better products and services. Supplier switching must be observed over time, as only a long-term perspective can contribute to a better understanding of what triggers supplier switching and how a competitive market reacts to this. In addition to this, renegotiated contracts could be measured. Consumers who actively decide to renegotiate their contracts with their current supplier also put competitive pressure on their energy supplier. |
| Source of data | Information requests to DSOs/national point of information exchange (data hub) and retailers. Wider measures of household consumer engagement among household consumers may be gathered through survey data (the latter will be consumer perceptions of the switching experience). |
| Quantification | For completeness, the NRA should quantify both the customer switching to a new supplier and the renegotiation of contracts with the existing supplier. A switch is counted when a consumer moves from one energy supplier to a competing energy supplier. Switches are measured separately for household and business consumers. The definition of switching should follow the methodology established for data collection in the CEER database, feeding into ACER/CEER MMR. |

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| | The number of renegotiated contracts with the existing suppliers should, ideally, exclude automatic roll-overs and changes that only affect payment method or account management. Note that this measure, also defined as "internal switching", is a metric included in the DG JUST Consumer Scoreboard. |
| Frequency | This metric should be measured annually. |
| Unit of measure | For the switching rate: Percentage of meter points, supplier customer accounts, and/or consumption volume that switched supplier in a given year relative to the average number of meter points/customer accounts or total consumption volume in the relevant market. For the number of renegotiations: Percentage of number of renegotiations relative to the total number of supplier meter points /customer account (if the data is gathered from suppliers) or consumers (if the data is gathered through a consumer survey). |
| Data completeness | NRAs have access to such information normally through monitoring or through the national statistical responsible body. Issues with availability of survey data are foreseeable. |

| Metric 21 | Percentage of inactive consumers |
|-----------------------|---|
| Description | Inactive consumers are defined here as consumers who have neither switched supplier/product nor actively searched for better deals. As a proxy, consumers considered as inactive are contracted on a default contract and have not made a choice of supplier in the market. The definition of default contract depends on the national context. What constitutes a default contract should be clearly specified when undertaking the assessment. |
| Purpose | The metric is used to measure the lack of consumer involvement in the market. Inactive consumers represent the share of consumers that do not actively participate in liberalised market processes. Inactive consumers may lack the opportunity to participate in liberalised market processes altogether depending on the national context. The metric can help inform NRAs' policies aimed at improving the level of consumer engagement and stimulating competitive pressure on suppliers. |
| Source of data | Information requests to retailers (incumbents, default suppliers, or suppliers of last resort) and regulated companies. Consumer surveys can also be used. |
| Quantification | <p>Number of consumers who have not switched supplier for the last 3 years and are contracted on a default contract. What constitutes a default contract should be clearly specified when undertaking the assessment. Inactive consumers are measured separately for gas and electricity. Inactive consumers are measured separately for household and business consumers.</p> <p>Number of consumers who have never switched (based on survey data).</p> <p>Number of consumers who have <u>not</u> actively searched for better deals within the last 3 years (based on survey data).</p> |

| | |
|--------------------------|---|
| Frequency | This metric should be measured annually. |
| Unit of measure | Percentage: Number of inactive consumers relative to the total number of supplier meter points/customer accounts. Percentage: Number of consumers who have never switched relative to number of consumers. Percentage: Number of consumers who have not actively searched for better deals relative to number of consumers. |
| Data completeness | Issues with availability of survey data are foreseeable. |
| Metric 22 | Percentage of prosumers |
| Description | Self-generation of energy allows consumers to become active “prosumers”. Being able to produce and consume energy, by using different available technologies (e.g. roof solar photovoltaic panels, batteries), allows the consumer to engage actively in the market. Prosumers are consumers who produce energy on-site, behind a metering point capable of registering at least their hourly generation and consumption, making production data available ⁹ . Small generation plants connected at distribution level, for which there is not on-site production, are not typically classified as prosumers. The percentage of consumers engaging in distribution-level schemes could nonetheless be relevant to measure, e.g. community initiatives. Equally, this applies to consumers living in multi-dwelling buildings that may have come together to invest in generation capacity. |
| Purpose | This metric is used to measure the percentage of “prosumers” engaged with the market for self-consumed energy and related services. It indicates the percentage of consumers that participate actively in the energy transition, by producing energy on-site. This could include prosumers living in multi-dwelling buildings that have a metering scheme that differs from the traditional definition of prosumers as being behind one metering point. As a separate measure, the level of consumers engaged in distribution-level schemes in the local community could be measured. Where the latter is measured, this must be clearly specified. |
| Source of data | This could be DSOs/TSOs or any registers or organisations for prosumers. This list is not exhaustive. |
| Quantification | The percentage of prosumers is calculated as the share of consumers that are registered and defined as prosumers on the national level. The method of registration and definition may be subject to national specificities; however, if a definition of prosumers also includes generation beyond a consumer’s metering point this must be clearly specified. The share of prosumers engaged in schemes in multi-dwelling buildings either as a separate measure, or if specified, as part of the general definition of prosumer. The share of prosumers engaged in local schemes at distribution level. |
| Frequency | This metric should be measured annually. |

| | |
|--------------------------|--|
| Unit of measure | Percentage: Prosumers relative to the total number of supplier meter points/customer accounts. |
| Data completeness | This is a new monitoring area for most NRAs. Data availability and completeness may be an issue. |

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilit (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-057

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 59, lines 15-17: What do you consider as appropriate consumer protections? Which customer types do you consider as most vulnerable?

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

Refer to the table on Bates p. 60 for the specific metrics the Council of European Regulators uses to track progress for this and other key properties of well-functioning markets. Refer to Bates p. 59, footnote 19 for the report from which this table was taken, refer to page 3/74 therein for documents related to the report, and refer therein to the “*2017 Handbook for National Energy Regulators How to assess retail market functioning*”, pages 11 through 17 for detailed tables summarizing the following for each metric related to this key property: Metric Name; Description; Purpose; Source of Data; Quantification; Frequency; Unit of Measure; and Data Completeness.

The aforementioned “*2017 Handbook for National Energy Regulators How to assess retail market functioning*” is available online here: <https://www.ceer.eu/documents/104400/-/840b4ce7-9e4a-5ecc-403a-fad85d6ba268>

The tables available therein are excerpted below for your convenience:

3.8 Key property VIII: Appropriate protection

In well-functioning retail energy markets, consumers enjoy an appropriate level of protection and there are specific measures to protect those defined as vulnerable customers.

Metric 23: Time between notification to pay and disconnection for non-payment

| Metric 23 | Time between notification to pay and disconnection for non-payment |
|-----------------------|--|
| Description | This is the time period between the notice to pay/notice of disconnection after missing payments and the disconnection of the customer. |
| Purpose | This metric should be used to assess the level of protection against disconnections due to non-payment, in conjunction with metric 24 on number of disconnections for non-payment. In selected cases, suppliers and/or DSOs can disconnect consumers from electricity and gas networks. Specific consumer protection legislation foresees a number of provisions to mitigate disconnecting household consumers in cases of non-payment of bills. However, if those consumers continue to fail to pay their bills, suppliers and DSOs can disconnect them. Most MSs have installed a procedure for disconnections, which foresees a certain period between non-payment and disconnection, to settle due amounts. That is why this metric should be assessed in conjunction with the other metric on the number of disconnections due to non-payment. |
| Source of data | This metric should first be evaluated from a legal point of view. To evaluate this metric from a practical point of view, the NRA could submit an information request to either the retailer or the regulated company, depending on the national circumstances, to assess the minimum duration from non-payment to disconnection. The ADR/Ombudsman organisation may be considered as a source for information as well. If complaint handling is run by the NRA, this may be a source of information as well. |
| Quantification | Number of working days between the notice of disconnection after missing payments and the connection of the customer for both electricity and gas. When answering from a legal point of view, indicate the number of days fixed by law, and when answering from a practical point of view, indicate the average number of working days observed in practice. For the practical measure, consider that only households are included that do not make any payments toward the unpaid amounts (consumption in the past), nor do the households pay any upcoming instalments. It should also be assumed that the delivery of mail, notifications or similar warnings is instantaneous to make it possible to speak about an "absolute minimum" length of this duration. |
| Frequency | In case the regulated company (DSO) does not know the exact reason for a disconnection, as a proxy the total amount of disconnections by the DSO per request of the supplier, can be assessed. The metric should be measured annually. |

| | |
|--------------------------|--|
| Unit of measure | Number of working days, or days. |
| Data completeness | NRAs should have access to such information as part of their existing market monitoring of 3 rd Package indicators. |
| Metric 24 | Percentage of disconnections due to non-payment |
| Description | In selected cases suppliers and/or DSOs can disconnect consumers from electricity and gas networks due to non-payment. |
| Purpose | <p>This metric should be used to assess the level of protection against disconnections due to non-payment, in conjunction with metric 23 on disconnection notification time. Specific consumer protection legislation foresees a number of provisions to mitigate disconnecting household consumers in cases of non-payment of bills. However, if those consumers continue to fail to pay their bills, suppliers and DSOs can disconnect them. Most MSs have installed a procedure for disconnections, which foresees a certain period between non-payment and disconnection, to settle due amounts. That is why this metric should be assessed in conjunction with the other metric on disconnections</p> <p>If prepayment meters are widely distributed and used as a tool to manage debt, the proportion of new prepayment meters installed for debt (and especially if they are accompanied by a Court order) should be monitored alongside the number of disconnections for debt.</p> |
| Source of data | Retailers and/or regulated companies. The ADR/Ombudsman organisation may be considered as a source for information as well. |
| Quantification | <p>To quantify this metric the NRA should use the following step-by-step approach:</p> <ol style="list-style-type: none"> 1. Determine the number of disconnected households due to non-payment t for electricity and gas separately during a given year; 2. Determine the share of disconnections by dividing the number of disconnections by the total amount of household metering points for electricity and gas separately during the same year. <p>If applicable, determine also the number of new prepayment meters installed for debt, using the same reference year as that used for disconnections.</p> <p>In case the regulated company (DSO) does not know the exact reason for a disconnection, as a proxy the total amount of disconnections by the DSO per request of the supplier, can be assessed.</p> |
| Frequency | The metric should be measured annually. |
| Unit of measure | Percentage of total electricity and/or gas disconnections in a given year, and if available: number and percentage of prepayment meters installed for debt. |
| Data completeness | NRAs should have access to such information as part of their existing market monitoring of 3 rd Package indicators. |

| Metric 25 | Percentage of suppliers applying rules for key information in advertising and bills |
|-------------------|--|
| Description | Consumers need to be provided with the means of assessing the offers against each other in a transparent and clear manner. The proportion of suppliers using minimum standards for key information in advertising and bills ideally identified separately and based on Annex 1 of the 2009 Directive, can serve as an indicator of suppliers' compliance with this provision. Rules for key information in advertising and bills are defined as legislation and/or self-regulation. |
| Purpose | The purpose of this metric is twofold. It monitors the existence in the MS of minimum information standards, as well as the proportion of suppliers complying with them. This is a complex area and when assessing the situation an NRA must be careful to attain an accurate picture of the situation. In addition to the outcome of this metric, more background information is necessary to fully understand the situation. |
| Source of data | Most likely sources will include legislation/license conditions and research conducted by NRAs on how suppliers comply with the standards. Consumer organisations and/or ADR/Ombudsmen could also be a source of information. |
| Quantification | <p>At this point there is no one-size-fits-all approach to assess this metric. Ideally, and as a result, the outcome of the metric consists of:</p> <p>Rules for key information in advertising and bills are defined as legislation and/or self-regulation.</p> <p>For each of the rules, the proportion of active suppliers using it out of the total number of active suppliers.</p> <p>CEER encourages NRAs to explore the approach that is most suitable to the national circumstances. As a best practice example we refer to the pilot that is included in this handbook.</p> |
| Frequency | The metric should be measured annually. |
| Unit of measure | Yes/no (list of standards) and, if feasible percentage of total amount of suppliers of electricity and/or gas. |
| Data completeness | This a relatively new and complex monitoring area, for which new research by NRA will be required |

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilit (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-058

Witness : Samuel Nash Vautier Golding

Respondents: Samuel Golding and Clifton Below

REQUEST:

Page 64, lines 5-7: If a New Hampshire “*market platform facilitates transactions between the wholesale generation market, the distribution utility, and the non-utility entities that serve retail customers and manage portfolios of distributed energy resources*” would such a platform be subject to FERC regulation? Please explain.

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional research and analysis and develop new information as part of a data request, which is not an appropriate use of discovery. It is also seeking a legal opinion from someone who is not a lawyer. Notwithstanding the objection we provide the following response:

A distribution system level transactive energy system platform (or platforms), the data platform(s) supporting it, and all of the interconnected DERs and eIoT devices connected to the distribution grid, including DG and storage that is less than 5 MW in capacity⁴ and are not participants in the ISO-NE FERC jurisdictional interstate wholesale electricity market jurisdictional distribution grid should not be subject to FERC regulation. States have exclusive jurisdiction over retail and intrastate wholesale sales of electricity and the entire distribution grid (and generally things connected to that grid, especially including DERs and eIoT devices behind retail meters) per the Federal Power Act and FERC and US Supreme Court interpretations of that law. Please see the response to Request No. EU to LGC 1-006 for more detail and citations.

Of course the retail market, the state jurisdictional portion of the overall market, is and will continue to be necessarily connected to the interstate wholesale markets, like the distribution grid is connected to the transmission grid, so that interface and participation in those markets would be subject to FERC regulation. Likewise, DERs including DG less than 5 MW that voluntarily chooses to participate in the FERC jurisdictional ISO New England markets are subject to FERC regulation with regard to that participation, even if they are connected to the distribution grid and are behind a retail meter. We can't think of any good reason why a market interface, respecting jurisdictional boundaries can't be drawn just like we have a clear boundary between what is FERC jurisdictional transmission facilities and what is state jurisdictional distribution facilities with the interface jointly managed and regulated.

⁴ Any generator 5 MW or greater in capacity in New England is required to register as a FERC jurisdictional interstate wholesale market participant with ISO New England per OP No.14, so is subject to FERC regulation.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 1 9-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil ("EU" a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-059

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 64, line 9: Please elaborate on the term "permission-less innovation".

RESPONSE:

Refer to Bates p. 64, footnote 23: Refer to Lynne Kiesling and Michael Giberson, "The need for electricity retail market reforms," Regulation. Fall 2017. Available online here:

<https://www.cato.org/sites/cato.org/files/serials/files/regulation/2017/9/regulation-v40n3-4.pdf>

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-060

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 64, line 13: Does NH offer a large enough market to drive the standardization of data exchange and market innovation? Please include comparison of NH markets versus New England, Texas and California.

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

New Hampshire, as a partially restructured market, is certainly behind the curve. Its relatively small size is not of particular concern, however, in the context of the question as I understand it.

Refer to LGC 1-061. There are numerous third-party providers of Local Flexibility Markets, for example, which have developed in mature, fully restructured organized electricity markets. My understanding is that such companies, having already developed and deployed the necessary capabilities — often with substantial public and private investment — are now actively seeking opportunities to deploy their platforms in new markets at marginal cost.

In other words, New Hampshire is likely in a position to “free ride” upon the leadership and hard-won lessons learned of other markets in this regard — because in the process, they have collectively created a market of proven, innovative data platform providers, in competition with one another for market share beyond the confines of their respective native domains.

Moreover, these are software companies. As any software market matures (i.e. become standardized in terms of functionality) it becomes a commodity. As such, software companies are naturally — and keenly! — motivated to capture sufficient market share in strategic domains so as to create a ‘network effect’ as a means to foreclose their competition. As such, providers will almost certainly view the opportunity to deploy a statewide platform in New Hampshire as a “first mover” competitive advantage in capturing and thereby unifying additional state-level markets within ISO-NE.

Given such context, I would be surprised if New Hampshire were unable to extract advantageous contractual concessions beyond pure pricing dimensions from qualified bidders e.g. performance-based contracting, et cetera.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilit (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-061

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 65, line 4: Please explain “Local Flexibility Markets” referenced in simple diagram provided.

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

Local flexibility markets (LFM) are a platform approach to allowing intelligent load management devices and DERs to be autonomously coordinated in a decentralized manner that is co-optimized across all the horizontal segments of the electric power system. The platform spans multiple Electric Distribution Company territories and is naturally operated by neutral third parties.

(Note that a market framework has to be constructed to enable this flexibility because of the lack of distribution locational marginal pricing — the advent of which will obviate transaction costs while increasing market efficiency).

Particularly in the context of increasing variable renewable penetration, closure of thermal power plants, and the multi-sectoral electrification that decarbonization entails (which at-scale confound forecasting and traditional planning, resource adequacy and operating regimes), active orchestration of a growing “grid edge” asset fleet enables efficient allocation of capital across all geographic and temporal dimensions — which are, generically:

1. Over the short-term and at the regional level: lessening renewable curtailment, price volatility, high voltage network congestion and ancillary service requirements;
2. Over the short- to medium-term and at the local level: lessening operational stress on existing low-voltage network components while steering investment in retail technologies and enabling services towards specific geographies where deployments create system value;
3. Over the medium- to long-term and at both the local and regional levels: deferring and refining (i.e. minimizing stranded cost) investments in both generation capacity and low-voltage and high-voltage network upgrades.

Local flexibility markets are thus not only beneficial for retail customers, who receive an additional revenue stream in exchange for their demand flexibility and DER dispatch, but for the system as a whole.

From the perspective of an Electric Distribution Company, such markets offer the means to forego capital expenditures in favor of operational expenditures that procure products from aggregators to manage congestion on low-voltage networks. This naturally requires the utility to

become a “wires only” enterprise and the evolution of a suitable regulatory regime (e.g. RIIO in the UK being one such example).

An electric distribution company facing network capacity constraints due to the penetration of DERs could, for example, transact with aggregators managing fleets of DER and trading capacity on the local flexibility market platform so as to curtail demand during times of congestion — or publish operating envelopes around which aggregators trade capacity with one another to achieve the same operational objective. Load usage patterns are actively shaped in this fashion, within targeted geographies, to elevate the level of distributed generation interconnection that would otherwise (i.e. absent the market) require upgrades to the underlying network. Further, the development of such a platform architecture enables more granular and societally equitable marginal cost pricing approaches in comparison to cost-averaging tariff-based regimes, for example by facilitating bid-based capacity reservation tenders to manage the charging of electric vehicles (to recover the cost of the network).

In fully restructured electricity markets, it is natural to assume such a holistic perspective and to therefore plan and operate the system in relation to market activity across horizontal segments. The need for a market-based approach to unlocking operational flexibility is thus as widely established in the EU and Oceania as it is lacking in the USA (wherein state-level retail markets remain almost all vertically integrated or partially restructured).

Below are a selection of useful resources in regard to the design of Local Flexibility Markets:

- Smart Grid Task Force (of the European Commission), “*Regulatory Recommendations for the Deployment of Flexibility*”, 2015. Available online: <https://ec.europa.eu/energy/sites/ener/files/documents/EG3%20Final%20-%20January%202015.pdf>
- CEER, “*Distribution Systems Working Group: Flexibility Use at Distribution Level*” 17 July 2018. Available online: <https://www.ceer.eu/documents/104400/-/-/e5186abe-67eb-4bb5-1eb2-2237e1997bbc>
- INTERFACE Consortium, “*INTERFACE (TSO-DSO-Consumer INTERFACE aRchitecture) to provide innovative Grid Services for an efficient power system*,” 2020. Available online: https://cadmus.eui.eu/bitstream/handle/1814/64505/INTERFACE_D2.4_v1.0.pdf?sequence=1&isAllowed=y

A refreshingly ‘matter of fact’ summary of many key concepts and mechanisms was (as usual) published by the Nordic Council of Ministers in the 2017 report “*Demand Side Flexibility in the Nordic Electricity Market from a Distribution System Operator Perspective*”, available online at: <http://norden.diva-portal.org/smash/get/diva2:1167837/FULLTEXT01.pdf>. A selection of quotes follows (note that they refer to Electric Distribution Companies as Distribution System Operators, or “DSOs”):

- “*Being a natural, regulated monopoly, the DSO cannot engage in services other than grid. Hence, to mobilise the full set of incentives to end users, the DSOs rely on other players taking a role towards end users – like energy service providers or aggregators. For DSOs, financial incentives are the most likely instruments. This may be in the form of grid tariffs, investment contributions or purchase of flexibility.*

- *It is likely that many of the measures available to end users have a low marginal loss of utility. For example, EV home charging can in most cases be done during off-peak hours at night instead of during evening peak hours. Slow loads like hot water tanks or electric cables may be switched off during peak hours with no real loss of utility.*
- *To incentivize load shifting, tariffs must include a load based element. We discuss several relevant models, and point out that dynamic models where the strength of the price signal depends on the system load, rather than the individual end user load, are more effective at producing network savings at low socio-economic costs than static models. Also, both findings from previous studies, as well as comments from DSOs, show that peak load problems in the grid can normally be addressed with targeted measures from a very limited number of end users – possibly only 10% or less than the total number of households. This means that targeted tariff and dynamic models will have significant cost efficiency advantages over static, general models.*
- *Purchase of flexibility could be organized directly between the DSO and the end user, or via a third party. From a market perspective, the two models are very different. Direct purchase from the DSO may be the most efficient model in isolation, but will also affect market prices for flexibility and the possibility to develop market-driven models with third-party players. Hence, DSO direct purchase could be negative for developing DSR for use in established and future system services markets at TSO level, or new market solutions at TSO/DSO level.”*

This provide the context to understand why:

- *“In CEER’s view, flexibility products should be developed in the markets, and the role of the DSOs would be as user of flexibility that benefits the grids, i.e. the DSO purchases flexibility from third parties, but does not provide it.”⁵*
- All four local flexibility market platforms currently deployed or under development in the EU across various member states (NODES, Piclo Flex, Enera, GOPACS) are operated by non-utility third parties to avoid the platform becoming “monopolistic by nature” and “all projects engage or tend to engage with multiple DSOs”.⁶
- Similarly, local flexibility market platforms deployed in Oceania are operated by third parties and designed to operate across multiple Electric Distribution Company territories. Greensync’s “Distributed Energy Exchange” (DeX) platform is one such example.⁷ Designed in cooperation with 60+ stakeholders as a market platform spanning multiple Electric Distribution Companies and aggregators, I understand it to be in the early stages of deployment but apparently already managing ~500+ MW of DER and retail load flexibility (based upon somewhat dated conversations i.e. about a year ago).

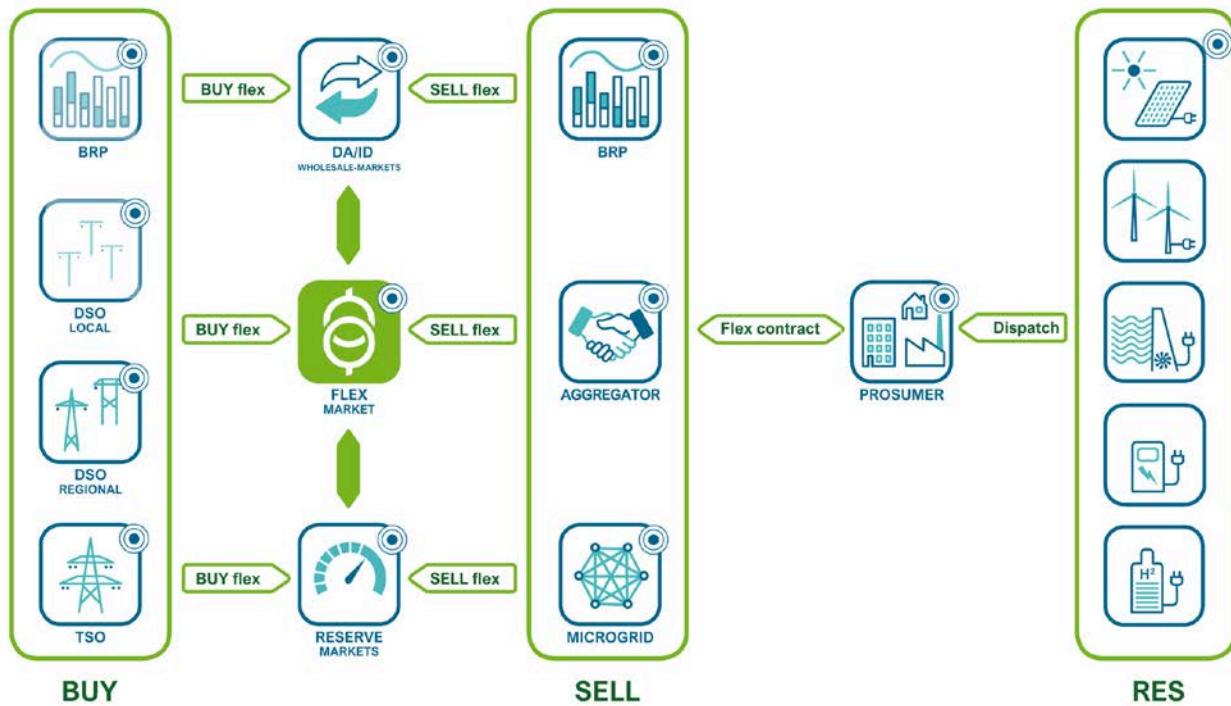
⁵ CEER, “Distribution Systems Working Group: Flexibility Use at Distribution Level” 17 July 2018 at p. 10. Available online: <https://www.ceer.eu/documents/104400/-/e5186abe-67eb-4bb5-1eb2-2237e1997bbc>

⁶ INTERFACE Consortium, “INTERFACE (TSO-DSO-Consumer INTERFACE aRchitecture) to provide innovative Grid Services for an efficient power system,” 2020, at page 43-44 and p. 50. Available online: https://cadmus.eui.eu/bitstream/handle/1814/64505/INTERFACE_D2.4_v1.0.pdf?sequence=1&isAllowed=y

⁷ Refer online to: <https://arena.gov.au/projects/decentralised-energy-exchange/> and <https://greensync.com/>

These local flexibility market platforms are deployed, and thus evidently cost effective. Piclo Flex, to provide another example, reportedly has “200+ flexibility providers” offering “4.5 GWs of flexibility” at present.⁸

Whitepapers, status reports and background materials appear generally available off of each platform’s websites. Here is a useful simplified market schema from the NORD platform:⁹



Note that these market platforms do not obviate the need for aggregators to self-provide DERMS functionality.

⁸ Refer online to: <https://picloflex.com/>

⁹ Refer online to: <https://nodesmarket.com/market-design/>

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilit (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-062

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 65, lines 5-11: Please explain the following questions:

- A. Should the utilities still offer energy supply for those customers who fall out of the competitive energy market?
- B. Who would coordinate the demand reduction and operation of the power system if the distribution utilities only engage with customers for outage and interconnection requests?
- C. Should regulators oversee these services outside “wires only” service?

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

- A) Eventually, no. Fully restructured markets confine monopoly power to the domains of natural monopolies i.e. wires only. Refer to Bates p. 68.
- B) Within a fully restructured market, demand management (“demand reduction” is an outdated concept, mind you) naturally falls to aggregators, which are entities with both the incentives and ability to do so under properly designed markets. Refer to section *“Do you expect that Community Power Aggregators will help to fully implement RSA 374-F?”* beginning on Bates p. 74. Electric distribution companies naturally maintain a role in the “operation of the power system”, which is a rather broad phrase. Refer to LGC 1-065 and LGC 1-061.
- C) Yes, though in a manner that comports with Principle XIV of the New Hampshire Electric Restructuring Act i.e. primarily by ensuring the competitive market is functioning efficiently. Refer to *“How should the statewide, multi-use online energy data platform be governed?”* beginning on Bates page 82, *“What other metrics are used to track the maturity of retail energy markets?”* beginning on Bates page 57, and *“How are fully restructured markets governed in practice?”* beginning on Bates page 60.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-063

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 77, line 4: Please elaborate on “intelligent management of distributed energy” and give examples of CPA’s currently offering these services.

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

The most advanced CPA market to date is California. The experience of municipalities there is encouraging. Nearly 200 communities have launched 15 separate agencies (most are joint action power agencies) that are self-funded and evolving rapidly while selling competitively priced electricity to 4+ million retail customers.

These agencies are collectively building more than 3,600 megawatts of renewable energy and storage. Several have creating comprehensive multi-sectoral decarbonization plans. Many are leveraging municipal authorities and collaborating with each other and with local and regional agencies, legislators, utilities, labor, developers and manufacturers to remove barriers to rooftop solar installations, electric vehicles and other retail innovations. One agency negotiated the siting of a new electric bus factory, creating local jobs and the nation’s first all-electric bus fleet in partnership with their local transportation authority. Another submitted a lease application for California’s first offshore wind project. Others are building renewable microgrids for critical facilities and business parks, and partnering with utilities and energy companies to replace a natural gas peaker plant, causing health problems in low-income communities, with storage and a virtual power plant of solar+storage deployed across low-income properties.

Below are a non-exhaustive variety of links regarding these CPA’s current offerings and initiatives specifically pertaining to the “intelligent management of distributed energy” in operations, planning and codes and standards:

- <https://cal-cca.org/cca-programs/>
- <https://cal-cca.org/wp-content/uploads/2020/05/CCA-Resilience-Iniatitives-August-2020.pdf>
- <https://www.greentechmedia.com/squared/dispatches-from-the-grid-edge/the-elusive-microgrid-tariff-begins-to-emerge-in-california>
- <https://cal-cca.org/calcca-launching-new-community-energy-innovation-webinar-series/>
- <https://cal-cca.org/ebce-launches-first-of-its-kind-home-battery-backup-program/>
- <https://cal-cca.org/inside-clean-energy-whats-a-virtual-power-plant-bay-area-consumers-will-soon-find-out/>

- <https://cal-cca.org/clean-power-alliance-approves-new-five-year-clean-energy-programs-plan/>
- <https://cal-cca.org/calchoice-associate-member-pico-rivera-innovative-municipal-energy-prime-launches-distributed-energy-resources-program/>
- <https://cal-cca.org/peninsula-silicon-valley-collaboration-recognized-for-advancing-electrification-in-building-codes-ev-infrastructure/>

Almost all of this progress in California has occurred since 2016. This is what rapid, cost-effective decarbonization and retail market innovation looks like in practice, in my opinion — and it is replicable, because we now know how to design Community Power Aggregations correctly, to a large extent based on the industry's practical experience in California.

Community Power New Hampshire is being designed based on these proven best practices, and leveraging the insights of experts like Clifton Below and Dr. Amro M. Farid (e.g. Lebanon's transactive energy pilot with Dartmouth College and Liberty Utilities).

Senate Bill 286 has given Community Power Aggregations in New Hampshire even greater authorities, and thus promises even greater ability to innovate and create value in new ways for communities going forward.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-064

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 82, line 9: Please explain who should oversee the “decentralized coordination” of the markets.

RESPONSE:

I believe that the section “*How should the statewide, multi-use online energy data platform be governed?*” of my Direct Testimony, which starts on Bates p. 82, substantially addresses this question.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-065

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 83, line 19: With regard to “technical knowledge” referenced, please provide the qualifications of those with experience in power systems operation or electrical engineering who participated in the Joint Action Summit referenced on Bates Page 80.

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

Refer to Bates p. 89 through 93. There were over 80 elected officials, municipal staff and local energy committee members in attendance at the event; while I’m unsure of — let alone in possession of — all of their qualifications, among them were all the individuals that comprise this Local Government Coalition. The keynote speaker was the CEO of Silicon Valley Clean Energy Authority (a Community Choice Aggregator in California) Girish Balachandran, who is an electrical engineer with over three decades of executive leadership experience in the public power industry.

However, I would caution against what I perceive of as a fatal conceit within the question itself: namely, that “*technical knowledge*” at a conference for Community Power Aggregations refers solely to “*those with experience in power systems operation or electrical engineering*”.

The central challenge for New Hampshire and every other market going forward is as follows:

- The effective engagement of retail customers, in terms of the shaping of their load and use of intelligent end-use devices and other DERs in a manner that preserves the core mission of the industry through a period of unprecedented and interminable fundamental change for the system driven by variable renewable generation, fleet retirements and decarbonization policy.
- The effective engagement of communities, that is to say municipal governments and regional collaborations thereof and the diverse array of interest groups their decision-making naturally and literally incorporates, in terms of re-orienting system planning under the aegis of these entities in their carrying out of multi-sectoral decarbonization activities.

In that context, I would remind all those with “*experience in power systems operation or electrical engineering*” of two considerations of paramount importance going forward that their domain of expertise often fails to consider:

- Customers are not meters; and
- Communities exercise a broader scope of democratic decision-making and relevant planning authorities that the electric utility industry needs to integrate into alignment with its own planning in order to effectuate multi-sectoral decarbonization.

The Community Power Aggregator construct is designed specifically to bridge these gaps for New Hampshire. With that in mind, refer to section “*Do you expect that Community Power Aggregators will help to fully implement RSA 374-F?*” beginning on Bates p. 74 and contrast its focus with that of section “*How would you characterize New Hampshire’s current retail market structure?*” beginning on Bates p. 68.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-066

Witness & Respondent: Samuel Nash Vautier Golding

REQUEST:

Page 84, line 4: How specifically do you recommend that the Commission structure governance based on the model in Texas? Who do you recommend as stakeholders in the governance process?

RESPONSE:

The LGC objects to this question as overly broad and beyond the scope of the testimony, as it asks the witness to undertake additional analysis and develop new information as part of a data request, which is not an appropriate use of discovery. Notwithstanding the objection, the witness provides the following responses:

I believe that the section “*How should the statewide, multi-use online energy data platform be governed?*” of my Direct Testimony, which starts on Bates p. 82, along with the section “*How are fully restructured markets governed in practice?*”, which starts on Bates p. 60, and the attachments from Bates p. 99 through 128, substantially addresses this question.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-067

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 132, line 3: Please provide the syllabus for the course referenced and provide details on how long you've been teaching this course.

RESPONSE:

Please Attachment EU to LGC 1-067 for the ENGG 199: Model Based Systems Engineering, Analysis and Simulation course. I've taught some variation of this course since 2011.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-068

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 132, line 8: Does EPECS perform active management of transmission system configuration or voltage or frequency management? Give examples of services or reports provided.

RESPONSE:

Yes, it does. Please see the following peer-review publications for details.

1. A. M. Farid and A. Muzhikyan, “The Need for Holistic Assessment Methods for the Future Electricity Grid (Best Applied Research Paper Award),” in GCC CIGRE Power 2013, (Abu Dhabi, UAE), pp. 1–12, 2013.
2. A. Muzhikyan, A. M. Farid, and K. Youcef-Toumi, “Variable Energy Resource Induced Power System Im- balances: A Generalized Assessment Approach,” in IEEE Conference on Technologies for Sustainability, (Portland, Oregon), pp. 1–8, 2013.
3. A. Muzhikyan, A. M. Farid, and K. Youcef-Toumi, “Variable Energy Resource Induced Power System Imbalances: Mitigation by Increased System Flexibility, Spinning Reserves and Regulation,” in IEEE Conference on Technologies for Sustainability, (Portland, Oregon), pp. 1–7, 2013.
4. A. Muzhikyan, A. M. Farid, and K. Youcef-Toumi, “A Power Grid Enterprise Control Method for Energy Storage System Integration,” in IEEE Innovative Smart Grid Technologies Conference Europe, (Istanbul, Turkey), pp. 1–6, 2014.
5. A. Muzhikyan, A. M. Farid, and K. Youcef-Toumi, “An Enhanced Method for the Determination of Load Following Reserves,” in American Control Conference, 2014, (Portland, Oregon), pp. 1–8, 2014.
6. A. Muzhikyan, A. M. Farid, and K. Youcef-Toumi, “An Enhanced Method for Determination of the Ramping Reserves,” in IEEE American Control Conference, (Los Angeles, CA, USA), pp. 1–8, 2015.
7. A. Muzhikyan, A. M. Farid, and K. Youcef-Toumi, “An Enhanced Method for Determination of the Regulation Reserves,” in IEEE American Control Conference, (Los Angeles, CA, USA), pp. 1–8, 2015.
8. A. Muzhikyan, A. M. Farid, and K. Youcef-Toumi, “An Enterprise Control Assessment Method for Variable Energy Resource Induced Power System Imbalances Part 1: Methodology,” IEEE Transactions on Industrial Electronics, vol. 62, no. 4, pp. 2448–2458, 2015.
9. A. Muzhikyan, A. M. Farid, and K. Youcef-Toumi, “An Enterprise Control Assessment Method for Variable Energy Resource Induced Power System Imbalances Part 2: Results,” IEEE Transactions on Industrial Electronics, vol. 62, no. 4, pp. 2459 – 2467, 2015.

10. B. Jiang, A. Muzhikyan, A. M. Farid, and K. Youcef-Toumi, "Impacts of industrial baseline errors in demand side management enabled enterprise control," in IECON 2015 – 41st Annual Conference of the IEEE Industrial Electronics Society, (Yokohama, Japan), pp. 1–6, 2015.
11. A. M. Farid, B. Jiang, A. Muzhikyan, and K. Youcef-Toumi, "The Need for Holistic Enterprise Control Assessment Methods for the Future Electricity Grid," Renewable & Sustainable Energy Reviews, vol. 56, no. 1, pp. 669–685, 2015.
12. A. Muzhikyan, A. M. Farid, and K. Youcef-Toumi, "An A Priori Analytical Method for Determination of Operating Reserves Requirements," International Journal of Energy and Power Systems, vol. 86, no. 3, pp. 1–11, 2016.
13. A. Muzhikyan, A. M. Farid, and K. Youcef-Toumi, "Relative Merits of Load Following Reserves and Energy Storage Market Integration Towards Power System Imbalances," International Journal of Electrical Power and Energy Systems, vol. 74, no. 1, pp. 222–229, 2016.
14. A. Muzhikyan, A. M. Farid, and T. Mezher, "The Impact of Wind Power Geographical Smoothing on Operating Reserve Requirements," in IEEE American Control Conference, (Boston, MA, USA), pp. 1–6, 2016.
15. B. Jiang, A. Muzhikyan, A. M. Farid, and K. Youcef-Toumi, "Demand Side Management in Power Grid Enterprise Control – A Comparison of Industrial and Social Welfare Approaches," Applied Energy, vol. 187, no. 1, pp. 833–846, 2017.
16. S. O. Muhanji, A. Muzhikyan, and A. M. Farid, "Long-term challenges for future electricity markets with distributed energy resources," in Smart Grid Control: An Overview and Research Opportunities (J. Stoustrup, A. M. Annaswamy, A. Chakrabortty, and Z. Qu, eds.), pp. 59–81, Berlin, Heidelberg: Springer, 2017.
17. S. O. Muhanji, A. Muzhikyan, and A. M. Farid, "Distributed Control for Distributed Energy Resources: Long-Term Challenges & Lessons Learned," IEEE Access, vol. 6, no. 1, pp. 32737 – 32753, 2018.
18. A. Muzhikyan, T. Mezher, and A. M. Farid, "Power System Enterprise Control with Inertial Response Procurement," IEEE Transactions on Power Systems, vol. 33, no. 4, pp. 3735 – 3744, 2018.
19. S. O. Muhanji, A. Muzhikyan, G. Moynihan, D. Thompson, Z. Berzolla, and A. M. Farid, "2017 ISO New England System Operational Analysis and Renewable Energy Integration Study," in IEEE Systems of Systems Conference, (Anchorage, AK, USA), pp. 1–6, 2019.
20. A. Muzhikyan, S. Muhanji, G. Moynihan, D. Thompson, Z. Berzolla, and A. M. Farid, "The 2017 ISO New England System Operational Analysis and Renewable Energy Integration Study," Energy Reports, vol. 5, pp. 747–792, July 2019.
21. S. O. Muhanji and A. M. Farid, "An Enterprise Control Methodology for the Techno-Economic Assessment of the Energy Water Nexus," Applied Energy, vol. 1, no. 1, p. 25, 2019.
22. S. O. Muhanji, W. C. Schoonenberg, and A. M. Farid, "Transforming the Grid's Architecture – Enterprise Control - the Energy Internet of Things and Heterofunctional Graph Theory," IEEE Power and Energy Magazine, vol. 17, no. 5, pp. 71–81, 2019.
23. S. O. Muhanji, C. Barrows, J. Macknick, and A. M. Farid, "An Enterprise Control Assessment Case Study of the Energy-Water Nexus for the ISO New England System," Renewable and Sustainable Energy Reports, vol. 1, no. 1, p. 31, 2020.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-069

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 136, lines 20-22:

- A. Please elaborate on the definition of “wire’s asset”.
- B. Please explain what communications architecture would be utilized to communicate with customer devices when controlling or indirectly controlling customer devices for the distribution benefit mentioned.
- C. Who is responsible for owning and maintaining this communications architecture?
- D. Please explain what recourse the utility has for loss of customer communications when relying on immediate demand reduction from customer equipment.
- E. Would you expect the customer devices to have local override controls to ensure operation for grid conditions?
- F. If the platform does not operate as needed for grid operations, what happens to the grid?
- G. Please compare the overall reliability of a customer-controlled device versus a “wire’s asset”?
- H. How do you expect the customer to be compensated for operation of their devices or penalized for mis-operation?

RESPONSE:

The entirety of the second paragraph on Page 136 including lines 20-22 is a direct quote from Electric Power Research Institute website and its peer-review EPRI journal. As the leading research and development organization of the electric power sector in the United States, it maintains a membership model for electric utilities. If EU are not already members, I’d encourage them to join where they will have greater access to EPRI research on the Shared Integrated Grid and more specific answers to all of these questions.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-070

Witness: Dr. Amro M. Farid

Respondents: Dr. Farid & Clifton Below

REQUEST:

Page 140, lines 4-5: Time varying rates are already available to customers in NH. Please explain “meaningful choices of time-varying rates” in the context of existing rates.

RESPONSE:

The quotation is not in specific reference to New Hampshire. The quoted language is part of a one sentence paraphrase of his recent article submitted as “ATTACHMENT D to Testimony of A Farid for LGC” from Bates page 253-259. The full sentence cited in the request is as follows:

“The distinguished energy economist Dr. Ahmad Faruqui¹ in his recent article in the journal Regulation entitled “Refocusing on the Consumer: Utilities regulation needs to prepare for the “prosumer” revolution” recounts the more than 50-year saga of trying to advance a basic building block of grid modernization: customer access to meaningful choices of time-varying rates. [Faruqui 2020]². He summarizes this saga and the current state [of] grid modernization in this way: . . .”

The reader is referred to that attachment to understand what Dr. Faruqui might consider meaningful choice of TVR as well as the wealth of articles and presentations he has made on this topic over many years, available through his website hyperlinked to in footnote 1. This EU data request calls for additional research and analysis to consider in the context of NH rates, which is beyond the purpose of a data request, but in this case we won’t object as it is a useful exercise to undertake and report thus.

Among Dr. Faruqui’s recent writings on rate design we found his co-authored article on “Expanding Customer Choices in a Renewable Energy Future” that includes a section on **“Principles for Meaningful Rate Options and Signals.”**³ This article is appended as Attachment EU to LGC 1-070 for easy reference..

¹ <https://www.brattle.com/experts/ahmad-faruqui>

² Attachment D, also found at <https://www.cato.org/sites/cato.org/files/2020-03/regv43n1-6.pdf>.

³ “Expanding Customer Choices in a Renewable Energy Future,” Ahmad Faruqui, Principal, and Mariko Geronimo Aydin, Senior Associate, The Brattle Group, in *Leadership in Rate Design, A Compendium of Rates Essays*,

Here is what we understand to exist for choices of time-varying rates in existing rates for NH investor-owned electric distribution utilities:

- Util apparently does not currently offer any choice of time-varying rates.⁴
- Eversource offers two choices of optional time-varying rates that they call “Time-Of-Use.” These are both very simple 2-part rates with a very broad definition of “on-peak”- from 7 am to 8 pm all weekdays, except holidays, with limited differentiation of overall per kWh rates. There is one rate option for residential customers, R-OTOD, and one for small commercial customers under 100kW demand, G-OTOP. While some rate components for larger C&I customers have time varying elements, others do not, and none are optional choices.
- Liberty offers two TVR options, however the choice is limited in both cases to residential customers. Most residential customers can choose the Rate D-10 option. It has a broad on-peak period of 8 am to 9 pm weekdays except holidays. It only applies TOU rates to distribution charges, though it does so with a broad differential. The other TVR option is rate D-11, the 3-part TOU rate developed for Liberty’s battery pilot, in part by LGC witness Clifton Below.⁵ The Regulatory Assistance Project characterized it this way in their recent publication “Rate Designs for Modern Grid”⁶: *[t]he Liberty storage pilot rate design accepted by the New Hampshire PUC is the most advanced modern rate design in New England, and closest to the Maryland rate designs” that they characterize as one of the most well designed TOU rates.* The battery storage pilot at this stage is limited to only 100 customers and we understand that it is fully subscribed with a waiting list, so unless someone drops out and you are at the top of the waiting list, this rate is not currently a choice for anyone. An identical 3-period TOU rate has recently been made available to residential customers for charging plug-in electric vehicles as Rate EV. However, there is an additional monthly customer charge for the separate meter and it isn’t supposed to be used for purposes other than charging EVs. The customer also has to commit to the rate for a minimum of 2 years and they would need to invest in an additional meter socket, load panel, and circuit to power a dedicated vehicle charger if they don’t already have such.

In terms of how meaningful these options are, with the exception of Liberty’s 3-part TOU rate which is only available to a very limited portion of all customers for limited purposes, the 3 other options all are conventional 2-part rates with a 13 hour on-peak period on all work week days, that is too broad to get much price response from shifting load or storage. It is not clear whether Eversource’s R-OTOD and G-OTOD rates are revenue (or customer cost) neutral compared with Rates R and G for a customer with class average load shape particularly because they have fixed customer charges that are about twice that of the standard non-TOU Rates R and G.

Supplement to Public Power Magazine, May-June, 2019. Available here:

<https://www.publicpower.org/system/files/documents/Leadership-in-Rate-Design.pdf>

⁴<https://util.com/energy-for-businesses/electric-information/tariffs>

⁵See https://www.puc.nh.gov/Regulatory/Docketbk/2017/17-189/LETTERS-MEMOS-TARIFFS/17-189_2018-11-19_GSEC_TECH_STATEMENT_TOU.PDF

⁶ See pages 10-11, “Rate Designs That Work for a Modern, Customer-Oriented Grid” by David Littell and Joni Sliger, Regulatory Assistance Project, 2/20, <https://www.raponline.org/wp-content/uploads/2020/02/rap-littell-sliger-rate-designs-modern-customer-oriented-grid-2020-february.pdf>

The meaningfulness of these limited offerings can be judged, in part, by the portion of customers that find them meaningful enough to choose these options. The Grid Modernization Working Group Final Report⁷ included this snapshot of how many customers choose these TVR rates:

Table B.7 Number of Customers for Each Rate Offering

| | Eversource | | | Unitil | | | Liberty | | |
|-------------------------|-------------|--------------|------------------|-------------|--------------|------------------|-------------|--------------|------------------|
| | Residential | Gen. Service | Outdoor lighting | Residential | Gen. Service | Outdoor lighting | Residential | Gen. Service | Outdoor lighting |
| Flat energy rates | 426,576 | - | 953 | - | 724 | - | - | - | 7,239 |
| Inclining block rates | - | - | - | 65,237 | - | - | 35,435 | - | - |
| Declining block rates | - | 75,517 | - | - | - | - | - | - | - |
| Seasonal Rate | - | - | - | - | - | - | - | - | - |
| Time-of-use rates | 38 | 159 | - | - | - | - | 1,420 | - | - |
| Critical peak pricing | - | - | - | - | - | - | - | - | - |
| Peak-time rebates | - | - | - | - | - | - | - | - | - |
| Total no. of customers: | 426,614 | 75,676 | 953 | 65,237 | 11,181 | 1,706 | 35,877 | 6,436 | 685 |

For Eversource TOU rates attracted a mere 4/100 of 1% of customers, while Liberty's 2-part TOU rate, with the same customer charge as Rate D, did about 100 times better, but still only a mere 3% of all customers found this TOU rate to be meaningful enough to choose. In contrast, Dr. Faruqui reports much higher levels of participation in more meaningful TVR rate programs⁸:

TVRs are deployed to residential customers around the world

| | Type of Rate | Applicability | Participating Customers |
|---------------------------------|-----------------------------|----------------|-------------------------|
| Oklahoma (OGE) | Variable Peak Pricing (VPP) | Opt-in | 20% (130,000) |
| Maryland (BGE, Pepco, Delmarva) | Peak Time Rebate (PTR) | Default | 80% |
| Ontario, Canada | Time-of-Use (TOU) | Default | 90% (3.6 million) |
| Great Britain | Time-of-Use (TOU) | Opt-in | 13% (3.5 million) |
| Hong Kong (CLP Power Limited) | Peak Time Rebate (PTR) | Opt-in | 27,000 |
| Arizona (APS, SRP) | Time-of-Use (TOU) | Opt-in | APS: 57%, SRP: 36% |
| California (PG&E, SCE, SDG&E) | Time-of-Use (TOU) | Default (2020) | TBD – 75-90%* |
| California (SMUD) | Time-of-Use (TOU) | Default | 75-90%* |
| Colorado (Fort Collins) | Time-of-Use (TOU) | Mandatory | 100% |
| Illinois (ComEd, Ameren IL) | Real Time Pricing (RTP) | Opt-in | 50,000 |
| Michigan (Consumers Energy) | Time-of-Use (TOU) | Default (2020) | TBD – 75-90%* |
| France | Time-of-Use (TOU) | Opt-in | 50% |
| Spain | Real Time Pricing (RTP) | Default | 40% |
| Italy | Time-of-Use (TOU) | Default | 75-90%* |

*Estimated participation based on historical trends

brattle.com | 2

⁷ At p. 39, https://www.puc.nh.gov/Regulatory/Docketbk/2015/15-296/LETTERS-MEMOS-TARIFFS/15-296_2017-03-20_NH_GRID_MOD_GRP_APP_FINAL_RPT.PDF

⁸ “Moving Ahead with Time-Varying Rates (TVR): US and Global Perspectives, 4/620, Ahmad Faruqui Presented to NARUC Staff Subcommittee on Rate Design, Slide 2:

https://brattlefiles.blob.core.windows.net/files/18500_moving_ahead_with_time-varying_rates_tv - us_and_global_perspectives.pdf

Next, we consider the legal and regulatory history in New Hampshire to consider what might be a meaningful choice of TVR rates and consider some historical touchstones:

- For 24 years NH's electric utility restructuring statute has called for the development of a competitive retail market for electricity supply and other related services, and specifically stated:

*Competitive markets should provide electricity suppliers with incentives to operate efficiently and cleanly, open markets for new and improved technologies, **provide electricity buyers and sellers with appropriate price signals**, and improve public confidence in the electric utility industry. [And that:] Customers should be able to choose among options such as . . . real time pricing.⁹*

- 22 years ago the original implementation of the EDI in New Hampshire was designed to accommodate 3 period time-of-use rates that could be differentiated by day of week and seasonally and that could be offered by competitive suppliers. The periods were characterized as on-peak, shoulder, and off-peak, with data fields for kWh usage, kW, and kVA in each period.¹⁰ At that time the anticipated business relationships, like Data Platform Use Cases, to be supported by the EDI included the following:

“Competitive Service Providers:

- “(i) Offer large customers or their authorized agents competitive metering products or services.
- (ii) Notify Distribution Company of agreements to provide metering products and services to large customers.
- (iii) Install telemetering equipment at customer locations for the purpose of replacing estimated usage data with measured usage data.
- (iv) Notify Distribution Company when telemetering installations have been completed and whenever the equipment malfunctions.
- (v) Allow Distribution Companies to access the meter for usage determination or provide usage data to Distribution Companies in electronic format in a timely manner.
- (vi) Fulfill applicable registration requirements prior to doing business in New Hampshire.
- (vii) Abide by applicable rules and/or orders issued by the Commission.
- (viii) Nominate business and technical contact persons to facilitate inter-business communications.”¹¹

- 13 years ago, the Commission took note of the fact:

. . . that ISO-New England has recommended that the conventional peak/off-peak time-of-use rate structure be modified to provide customers a reasonable opportunity to shift load from peak period. Specifically, ISO-New England recommended a structure that

⁹ RSA 374-F:1 and RSA 374-F:3, II.

¹⁰ See the totality of the documents at <https://www.puc.nh.gov/Electric/edi.htm> and the definitions in the Glossary of Terms on pages 49-50 of the “Consensus Plan for the Transmission of Electronic Data in New Hampshire’s Retail Electric Market,” April 2, 1998, DR 96-150, <https://www.puc.nh.gov/Electric/EDI/edirev53.pdf>.

¹¹ Id at 11.

includes a minimum of three periods: peak, shoulder and off-peak. The peak period would be shorter than the peak period in conventional time-of-use rates, which for some utilities extends from 7:00 a.m. until 8:00 p.m., Monday through Friday.^[FN omitted]

Reducing the number of hours in the peak period and adding a shoulder period would, according to ISO-New England, provide customers a much greater incentive for customers to shift load out of the peak period because the shorter peak period produces a higher cost-based peak rate, while the shoulder period provides a convenient home for the load shifted out of the peak period.¹²

- Last month, in its “Order Determining the Appropriateness of Rate Design Standards for Electric Vehicle Charging Stations Pursuant to SB 575” while discussing Staff’s recommendation for consistent seasonal 3-period TOU rates to apply to all 3 major rate components for residential electric vehicle charging, the Commission noted Eversource’s assertion that its existing two-period TOU rates “are an appropriate starting point for serving customers with EVs”¹³ The Commission observed and concluded:

Based on December 2019 registration data, New Hampshire is home to approximately 4,200 electric vehicles. Tr. at 91. Only approximately 40 of Eversource’s more than 400,000 residential customers take service under the residential time of use rate. Staff Memo at 3. The lack of interest in Eversource’s existing two-part rate structure suggests that it may be inadequate for purposes of electric vehicle charging. We also take administrative notice of Eversource’s filing in DE 19-057 to note Eversource’s recent petition for a rate increase declined to revise its residential time of use rate despite advice from its own cost of service consultant to the contrary.

The guidelines proposed by the Commission Staff regarding a consistent framework for separately-metered residential electric vehicle charging rate designs are appropriate, subject to three clarifications. First, we agree with the City of Lebanon that the five-hour peak duration is more appropriate than the four-hour peak duration. Second, the 3:1 peak to off-peak ratio should represent an average ratio during a given year, not during any one season. Third, we note that these guidelines serve as a useful starting point and are generally consistent with the rate designed and approved for the purposes of Liberty’s Battery storage pilot, and later adopted for Liberty’s separately-metered EV TOU Rate. Liberty Utilities (Granite State Electric) Corp., Order No. 26,376 at 9. (June 30, 2020).¹⁴

-end-

¹² NHPUC Order # 24,763, 6/22/07, p. 24, <https://www.puc.nh.gov/Regulatory/CaseFile/2006/06-061/ORDERS/Order%20No.%2024.763%20%20Regarding%20the%20Adoption%20of%20Standards%20for%20Time-Based%20Metering%20and%20Interconnection%20-6-22-07.pdf>

¹³ NHPUC Order # 26,394, 8/18/20, p. 16, https://www.puc.nh.gov/Regulatory/Docketbk/2020/20-004/ORDERS/20-004_2020-08-18_ORDER_26394.PDF.

¹⁴ Id at pp. 16-17.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Unitil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-071

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 144, line 5: Please explain how the PUC would determine the reasonableness of costs before implementing the platform, if the regulatory process excludes these requirements.

RESPONSE:

My testimony on Page 144, line 5 and indeed the entirety of Q5.2 does not make any mention “reasonableness of costs”. The EU have posed a question that does not concern my testimony.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-072

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 146, lines 4-7: If the utilities are stakeholders, users of the data, and solely knowledgeable of back end systems, why should the utilities not be involved in the functional design of the platform?

RESPONSE:

The question seemingly misconstrues my testimony. My testimony does not state: “the utilities should not be involved in the functional design of the platform” as written in the question above. My testimony states: *“I do not interpret RSA 378:52,I to mean that the utilities shall exclusively conduct all technical activity related to the data platform.”* It is clear that RSA 378:52, I states: *“the utilities shall design and operate the energy data platform”* which is a statement of the necessity of the utilities’ design role. However, the law does not explicitly state that this design and operation role belongs exclusively to the utilities. Therefore, there is no explicitly stated reason for me to conclude that the utilities are sufficient to design and operate the energy data platform. Furthermore, and as my testimony states, *“I do not believe it to be in the best interest of the New Hampshire public to do so”*. Necessity is not equivalent to sufficiency.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-073

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 146, lines 14-16: Please provide representative examples of where niche engineering consultancies are less expensive.

RESPONSE:

mPrest, Kevala, and Engineering Systems Analytics provide engineering services at rates that are “often less expensive” than more “well-known” engineering organizations with expertise in requirements engineering.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-074

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 150, lines 9: Please explain extensibility of the platform with examples.

RESPONSE:

Page 150, line 9 is the third of five requirements that are summarized from the LGC scoping comments. The scoping comments at tab 27 of the Docket Book in this proceeding explains what extensibility is and how to best achieve it.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-075

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 150, line 16: Please provide a list of commercially-neutral grid stakeholders.

RESPONSE:

It's impossible to provide an exhaustive list for the simple reason that the implementation of the data platform may require a commercially-neutral non-for-profit entity to be formed as a new entity. Beyond this possibility, some commercial-neutral grid stakeholders are non-for-profit organizations. These include an Independent System Operator (e.g. ISO New England), academia (e.g. Dartmouth College or UNH), a non-for-profit customer-owned utility (e.g. New Hampshire Electric Co-Op), or a government entity such as the Public Utility Commission, Office of the Consumer Advocate, or municipality. For-profit supply-side grid stakeholders such as investor-owned utilities and demand-side consumers are not commercially-neutral.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-076

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 153, line 5: Please explain how the platform can make the same data available to all participants at the same time, if the customer may only approve access to data for a limited number of market participants.

RESPONSE:

The question seemingly misconstrues my testimony. My testimony does not state that: “*the same data available to all participants at the same time*” as the question states. My testimony states: “*First, the data housed and shared by the data platform must, by design, make sure that competing electric grid market participants have access to the same data at the same time*”. The statement is clear in its reference to competing electric grid market participants. For example, electric distribution utilities and community power aggregators are effectively competing electric grid market participants because a given electricity consumer can opt for electricity service from one or the other.

To elaborate and clarify my testimony, the electric distribution utility, by virtue of its present monopoly over distribution system assets and metering infrastructure, has access to data that other competing electric grid market participants and specifically community power aggregators do not have. Consequently, if the electric distribution utility, in this monopoly role, were to withhold data and information then it could undermine competing electric grid market participants including specifically community power aggregators from developing highly competitive electric rates and services. Furthermore, it is important to note that the relevant customer here need not even be a customer of the distribution utility. Rather, the customer could receive electricity service from a community power aggregator. Such a situation could lead to the highly undesirable market situation where the electricity distribution utility either inadvertently, knowingly, or intentionally sabotages the community power aggregator’s competitive service to its own customers by withholding data information about the community power aggregators own customer for the simple reason that the electric distribution utility has a present monopoly over distribution assets and metering infrastructure. My testimony emphasizes that the data platform enables a level-playing field for a retail electricity market.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-077

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 153, line 7: Please explain why the department of the utility that controls the operation of the platform must be isolated and provide any applicable legal requirements.

RESPONSE:

My testimony states: “Second, the department of the utility that operates the data platform itself must be isolated in their communication from the departments responsible for the purchase and sale of electricity to grid stakeholders”. Let Team A be the department of the utility that operates the data platform itself. Let Team B be the department of the utility responsible for the purchase and sale of electricity to grid stakeholders. Let Team C be a competing market participant outside the utility. In order to further the for-profit mission of the utility, Team A and Team B are incentivized to collaborate and facilitate each other’s respective jobs. It is possible and likely, for Team A to make data and information available to Team B without necessarily making that same data information available to Team C. Consequently, Team B would have disproportionate market power over Team C.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-078

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 154, line 18: Is the API based platform proposed by the utilities substantially different from the ISO example noted? If so, please elaborate.

RESPONSE:

Yes. Allow me to highlight several obvious differences. First, each Independent System Operator in the country is a non-for-profit entity tasked with ensuring an equitable marketplace for wholesale electricity transactions. Although, they have access to system data through SCADA systems, they are not transmission owners.

In the meantime, each of the distribution utilities is a for-profit entity and have no obligation to provide a level-playing field for all competing electric grid market participants. Although, they are distribution owners, they have yet to describe a solution that shares system data through their SCADA systems.

Simply having an “API” is not enough to equate the two.

Even if the technical design were identical, and they are far from it, it would be entirely careless to expect that a data platform would have a similar socio-technical market function if the entity that designs and operates works under fundamentally different laws, regulations, and governance structures.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-079

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 155, line 20: RSA 378 specifically states that the data platform be certified by the Green Button Alliance. Given your testimony that “this flow of data is not sufficient to achieve the legislative objectives of RSA 378”, how do you propose we meet the obligation of Green Button Certification for the platform?

RESPONSE:

The question seemingly misconstrues my testimony. The question seems to suggest that because my testimony states “this flow of data is not sufficient to achieve the legislative objectives of RSA 378” then the testimony is somehow advocating that we dispose with the Green Button Standard. This is categorically false. Please see my testimony in response to Q6.10 on Page 162-163. It makes it clear that the data platform should adhere to the IEC standards commonly referred to as the “Common Information Model (CIM)”. It states clearly: “The Green Button Standard is simply a subset of the CIM”.

In short, and again, necessity is not equivalent to sufficiency. The Green Button Standard is necessary but not sufficient, whereas the Common Information Model is the most sufficient group of standards available today. Implementing the CIM in no way jeopardizes the implementation of the Green Button Standard.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-080

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 156, line 17: Please provide your definition of “smart interval meters”.

RESPONSE:

In the context of this testimony, we are using the term “smart interval meters” as a layman equivalent for Advanced Metering Infrastructure or more commonly AMI.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-081

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 156, line 17: Please provide your definition of “market” and “financial data” with a list of expected data fields.

RESPONSE:

My testimony specifically states that although the term “market/financial data” is not technically precise, nor does it have a well-accepted definition in the literature, it has been used extensively in the docket’s technical sessions. Its use in testimony comes out of a desire to find commonality of language. A more technical precision definition would refer to the data fields in IEC 62325 (part of the Common Information Model). The interested reader is encouraged to read this widely accepted standard for “market/financial data” fields. It is the responsibility of the distribution utilities to design the data platform and select the specific fields from these standards in accordance with the stakeholder requirements identified by this docket.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-082

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 156, line 18: Please provide a list of expected data fields for “system” data.

RESPONSE:

My testimony specifically states that although the term “system data” is not technically precise, nor does it have a well-accepted definition in the literature, it has been used extensively in the docket’s technical sessions. Its use in testimony comes out of a desire to find commonality of language. A more technical precision definition would refer to the data fields in IEC 61970 and 61968 (part of the Common Information Model). The interested reader is encouraged to read these widely accepted standards for “system data” fields. It is the responsibility of the distribution utilities to design the data platform and select the specific fields from these standards in accordance with the stakeholder requirements identified by this docket.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-083

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 161, line 1: Is a circuit map the extent of system data being requested? If not, please provide detail.

RESPONSE:

The testimony on Page 161 Line 1 shows that system data is readily available in neighboring states. To my knowledge, the distribution utilities have yet to commit to the same here in NH.

To answer the question more specifically: No, a circuit map is not sufficient system data for the simple reason that a circuit map is not sufficient system data to enable the community power aggregation use cases that we have previously submitted as part of this docket. With regard to the specific data fields necessary to implement these use cases, the LGC objects to this question as overly broad as it effectively asks the witness to undertake additional analysis, develop new information as part of the data request which is not an appropriate use of discovery. It is the responsibility of the distribution utilities to design the data platform and select the specific fields from established international standards in accordance with the stakeholder requirements identified by this docket.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-084

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 165, line 14: Does the estimated capitalized cost of the proposed third-party platforms include integration with and mapping of the utility’s legacy data sources? How do these solutions handle vendor and customer authorization workflows as defined by the Green Button Connect My Data standards?

RESPONSE:

Neither Attachment E nor F in my testimony mentions “integration with and mapping of the utility’s legacy data sources”. Nor do they speak to “Green Button Connect My Data Standards”. Consequently, the question is outside the scope of my testimony and I do not wish to speculate. Rather my testimony does explicitly state: *“While this solution would have to be matched to the functional requirements discussed above and likely customized to New Hampshire’s needs, its current implementation as described in the attached slides is an excellent starting point from which to discuss practical avenues”*. This remains my testimony.

Consequently, the question asks the witness to undertake additional analysis and develop new information as part of the data request which is not an appropriate use of discovery.

Local Government Coalition (LGC) Responses

NHPUC Docket: DE 19-194

Development of a Statewide, Multi-use Online Energy Data Platform

Eversource and Utilil (“EU” a.k.a. Joint Utilities) Set 1 Data Requests to LGC

Date Request Received: 8/31/20

Date of Response: 9/15/20

Request No. EU to LGC 1-085

Witness & Respondent: Dr. Amro M. Farid

REQUEST:

Page 165, lines 4-12: Please explain who would operate the systems referenced and act as the data platform operator. Please explain how these systems would share data with other stakeholders with specific reference to the Green Button Connect standard.

RESPONSE:

RSA 378:52 states: “the utilities shall design and operate the energy data platform”. This language leaves open the possibility for the distribution utilities to design, build and operate the energy data platform themselves or outsource this technical activity to a vendor. The mention of mPrest and Kevala in my testimony serves to suggest investigation of the latter possibility.

In reference to the part of the question pertaining to the Green Button Connect standard, please see my response to data request # EU to LGC 1-084.

DE 19-197 Statewide Multi-Use Online Energy Data Platform Stakeholder Use Case Reconciliation: A Requirements Engineering Approach

Local Government Coalition

Amro M. Farid¹, Samuel Golding², April Salas³, Kat McGhee⁴, Pat Martin⁵, & Clifton Below⁶

I. Introduction & Motivation

This document comes out of the DE 19-197 Technical Session #6 on 05/08/2020. At that point, a wide variety of stakeholder use cases were submitted to the DE 19-197 docket. As a proposed set, it is less than clear

- 1.) how these use cases relate to each other,
- 2.) what benefits and values these use cases provide,
- 3.) how they can be used to drive the technical development of a well-architected and highly functional statewide multi-use online energy data platform,
- 4.) what are the data fields associated with such an energy data platform, and
- 5.) what is the cost for building the energy data platform.

In the course of DE 19-197 docket conversations, several ideas have been raised. We comment on two of these here.

The first idea centers around the concept of a “minimum viable product” (MVP) as a way forward. An MVP is a well-known software engineering concept that is tied exclusively to agile software engineering (ASE) methodologies. In ASE, an MVP is developed with a core set of functionalities and then validated. The functionality is then expanded and validated in another iteration. This process continues until the full functionality of the software product has been developed. In the context of the DE 19-197 docket, the authors of this document reject this idea entirely. First, we must distinguish between the technical project management process that will build the data platform from the regulatory process that is the DE 19-197 docket. The outcome of the former is the data platform itself whereas the outcome of the latter is the set of regulatory directives

¹ Prof. Amro M. Farid is serving as a technical advisor to the City of Lebanon’s intervention in DE 19-197. He is an associate professor of engineering at the Thayer School of Engineering at Dartmouth and an adjunct associate professor of computer science at the Department of Computer Science, Dartmouth College. He is also the director of the Laboratory for Intelligent Integrated Networks of Engineering Systems ([LIINES](#)).

² Samuel Golding is the President of Community Choice Partners Inc and is intervening directly in DE 19-197.

³ April Salas is the Sustainability Director of the Town of Hanover and is part of the Town of Hanover’s intervention in DE 19-197. She is also the executive director of the Revers Center for Energy at the Tuck School of Business at Dartmouth.

⁴ Rep. Kat McGhee is intervening as an Eversource customer in Hollis. She represents the towns of Hollis, Milford, Mont Vernon, and New Boston in the NH General Court where she serves on the House ST&E Committee.

⁵ Patricia Martin is a public member, Chair of the Town of Rindge Energy Commission, retired electrical engineer and participated in the PUC’s Grid Modernization Investigation.

⁶ Clifton Below is the Assistant Mayor of the City of Lebanon and Chair of its Energy Committee.

that trigger the building of the data platform. In that regard, the two processes are entirely distinct and should not be conflated in any way. Furthermore, because an MVP exists within the context of ASE, it assumes that there will many subsequent evolutions of the software product, whereas the DE 19-197 docket will only occur once. Consequently, discussion of an MVP at this stage is likely to produce data platform product that does not meet the needs of New Hampshire energy stakeholders and DE 19-197 docket intervenors. Finally, because an MVP exists in the context of ASE, it is unlikely to give adequate attention to relevant standards such as the IEC Common Information Model. Consequently, the likelihood that an MVP data platform is interoperable is quite low. In short, the minimum viable product approach in this context is neither minimal nor viable.

The second idea as a way forward is “use case prioritization”. The authors of this document reject this idea as well. NHPUC dockets usually start from the assumption that a consensus-based outcome is possible and often preferable to full litigation. Similarly, in the beginning of a (technical) systems engineering process, there is a sincere effort to determine the totality of requirements from all stakeholders and meet them all. Take the example of a city building a new road, it would soon hear from motorists, cyclists, and pedestrians that they respectively need car lanes, bike lanes, transit stops, sidewalks and crosswalks. Such a city would be ill-advised to immediately prioritize the use cases of one stakeholder group over another, especially where there is a complete streets policy of accommodating user’s choice of transportation modes. It would only consider such prioritization of some use cases over others after 1) it became abundantly clear from engineering documents that it was impractical to meet the needs of all stakeholders and 2) the methodology of prioritization of one set of use cases over another was agreed upon following the city’s governance.

Furthermore, it is important to distinguish between prioritization of engineering implementation and prioritization of scope. In the former, the engineering scope is held fixed and engineering and financial constraints determine which parts of the scope will be built first. In the latter, the engineering scope is entirely open for discussion creating the potential for stakeholder winners and losers. We believe strongly that “use case prioritization,” without seeing how they might all fit together and share data sources and platform technical requirements, will destine this DE 19-197 docket to a highly contentious proceeding; one that most stakeholders wish to avoid as much as possible.

Part of the reason that “use case prioritization” has been proposed is the unsupported belief that more stakeholder use cases will lead to impractical costs. First, this belief, until now, is not founded in any documented evidence. Second, it is extremely common that stakeholder use cases are overlapping. They could 1) be identical use cases but stated differently, 2) have overlapping elements, or 3) be a more specific or general version of each other. Furthermore, the data fields necessary for two entirely different use cases could be entirely the same. In all of these situations, additional use cases do not necessarily increase costs.

Moreover, additional use cases and requirements could lower costs because they add greater precision and certainty for the engineering contractor and less engineering analysis is required to determine how to fulfill the use cases. Finally, it is well known within the field of systems engineering that uses cases and requirements do NOT drive costs. Rather, it is engineering artifacts that do. Speaking of costs before the data platform has been designed is an engineering non-sequitur. Returning to the example of the road, one wouldn’t ask for the project cost before specifying the

road's length, width, thickness, material and grade. Similarly, a cost-based discussion should only occur after the data fields associated with use cases have been determined. In contrast, use cases and requirements do drive valuable benefits. It is entirely possible to estimate benefits for use cases and requirements.

Finally, the authors of this document are concerned about efforts to specify the data platform's data fields prior to determining and reconciling the data platform's use cases and requirements. Normally, the engineering solution is discussed only after the requirements have been determined. Doing otherwise can lead to a scenario where the engineering solution is determined before it is clear what problem it is trying to solve; dooming the engineering solution to be either ill-equipped or over-built.

The above points are well-established in the systems engineering literature. Failing to take heed of these observations could lead to either a contentious proceeding, a dysfunctional data platform, or potentially both. Given the above discussion, the authors recommend a way forward that is more consonant with the best practice of the systems engineering field. To that end, we propose the following steps be pursued even as parties prepare for testimony and seek the most productive ways forward to find common ground and understanding.

1. ***Context Awareness:*** Understand the legal context (i.e. SB 284 & SB 286). New Hampshire is in the midst of a number of concurrent and highly related regulatory reforms. Understanding the relationships between these reforms and this DE 19-197 docket is of the utmost importance. The PUC's Order No. 26,358 on May 22, 2020 regarding Grid Modernization weaves together many of these relationships.
2. ***Requirements Gathering:*** Identify stakeholder requirements & use cases from existing legislation, regulations, stakeholder needs. Collect from all stakeholders. We have now reached this point in the DE 19-197 docket.
3. ***Requirements Engineering:*** Reconcile the stakeholder requirements & use cases into a mutually exclusive & collective exhaustive set of technical requirements. In order to maintain a consensus-driven process, we assume that all use cases & requirements are equally valid. Prof. Farid has been working on this in collaboration with James Brennan, but is not done yet.
4. ***Quantify the Associated Benefits (in dollar terms).*** Requirements drive system function which drives valuable benefits.
5. ***Determine the Relevant Data:*** For each technical requirement, assure interoperability & extensibility with existing IEC Common Information Model standards
6. ***Quantify the Associated Costs*** (in dollar terms): System Form → Costs
7. ***Address Governance and Implementation Challenges, including Regulatory Requirements of RSA 378:51, et seq..***

Lesson 1 – Course Syllabus: Setting off on the Path of Engineering Complex Systems

ENGG 199: Model-Based Systems Engineering, Analysis & Simulation

Course Introduction

Prof. Amro M. Farid

Delivered: Tuesday, January 7, 2020

Last Modified: January 7, 2020

Syllabus Outline

Objective 1

To explain how we will learn to engineer complex systems ...

- Course Logistics
- Instructional Team
- Course Rationale
- Course Components
- The Learning Environment
- Expectations
- Lecture Summary

Conclusion 1

Students will have a clear understanding how ENGG 199-MBSE will proceed this term.

Lecture Logistics

Course Title & Number: ENGG 199 Model-Based Systems Engineering

Term & Year: Winter 2019

Lecture Hall: Cummings Hall. Room 202.

Class Time: 2A-Block – TR 2:25 - 4:15

X-Hours: 2AX-Block – Wed 4:35-5:25. **Note:** Many X-Hours will be used this term.



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Instructional Team

Lead Instructor

Lead Instructor: Prof. Amro M. Farid

Office Location: Maclean. Room 215.

Office Phone: (603) 646-1524

Email: amfarid@dartmouth.edu

Office Hours: Before Class. TR 1:25-2:25

**Teaching Assistant**

Teaching Assistant: Dakota Thompson

Email: dakota.j.thompson.th@dartmouth.edu



Course Rationale

Course Prerequisites

ENGG 199-MBSE, like other introductory graduate-level systems engineering courses at other universities, is meant to be taken after the student has well-established their undergraduate engineering program.

The prerequisites are:

- ENGS 20, 21, and 22
- At least 1 from ENGS 25 or 26 or 27 or 52
- Preferred 1 from ENGS 65 or 66 or 75 or 89.
- Equivalent courses allowed by permission.

Prerequisite Knowledge

1. **Scientific Computing.** Comfort in computer programs (in MATLAB or Python) that compute numerical values of several logically organized functions (ENGS 20)
2. **Introductory Design Skills.** Comfort in designing and implementing a small-scale engineered system in a small team environment (ENGS 21)
3. **Introductory Systems Analysis.** Comfort in analyzing analytically as well as numerically lumped parameter linear dynamic systems (ENGS 22)
4. **Intermediate Systems Analysis.** Comfort in analyzing analytically as well as numerically more complex systems (e.g. thermodynamic, controls-based, stochastic, or supply chains). (ENGS 25, 26, 27, 52)
5. **Intermediate Design Skills.** Comfort in designing and implementing a medium-scale engineering system in a medium-sized team environment. (ENGS 65, 66, 75, or 89)

Model-Based Systems Engineering sits upon a solid foundation of design-synthesis and mathematical analysis skills.

Without this foundation, MBSE is largely untenable in a 10-week term.

Course Description

This course is designed to introduce students to the world of model-based systems engineering. Systems Engineering is an interdisciplinary field of engineering and engineering management that enables the realization of successful complex systems over their life-cycles. Systems Engineering integrates multiple disciplines and specialty groups into a team effort forming a structured development process that proceeds from concept to production to operation to obsolescence. Systems Engineering considers the technical, social, and business needs of all stakeholders with the goal of realizing a successful system. At its core, systems engineering utilizes systems thinking principles to organize this body of knowledge.

This course will prepare students to engineer, analyze, and simulate complex systems. Such systems are characterized by a high level of heterogeneity and a large number of components. They will appreciate the physical, informatic, social and economic aspects of such systems. They will use systems thinking concepts and abstractions to manage complexity. They will learn to use model-based systems engineering techniques to model a system's form, function, and concept. They will analyze the structure of these systems using graph-theoretic approaches. Finally, they will learn to simulate social, technical, and economic systems with continuous-time and discrete-event dynamics. The systems engineering skills developed over the course are applicable to a broad range of disciplinary applications.

Course Components

Course Goal

To prepare students with the skills to engineer complex engineering systems through systematic steps of modeling, analysis and simulation.

Motivating Examples:

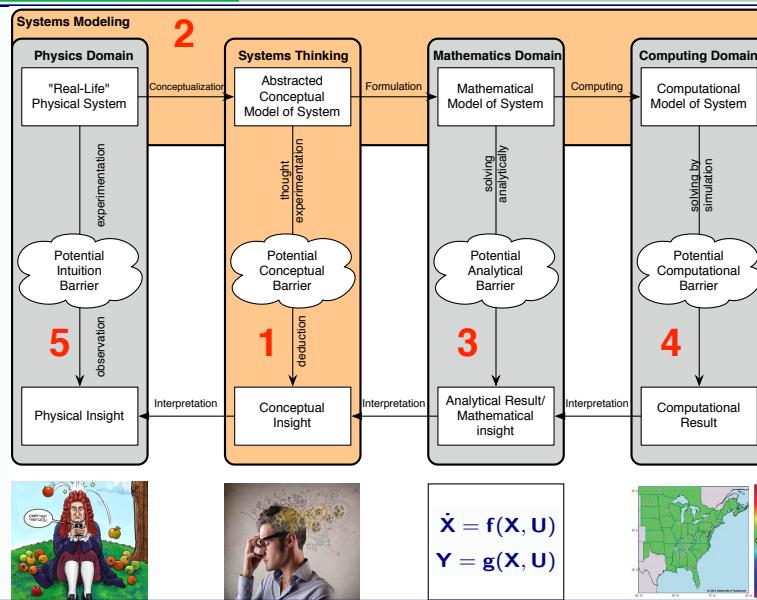
- Roving Mars 2006
- Curiosity Rover 2011
- 3 Epic Fails
- Why it is so hard?

Central Topics I

1. **Systems Thinking:** The ability to think about a question, circumstance, or problem explicitly as a system – a set of interrelated entities. *Whole Course.*
2. **Model Based Systems Engineering:** The process of translating the structure, behavior, and concept of a “real-life” system into a graphical, analytical, or computational model or representation. *Weeks 1-5*
3. **Graph Theory:** The ability to analyze the structure of systems in terms of interconnected elements. *Weeks 6-7*
4. **Systems Simulation:** “Solving by Simulation”. The ability to develop simulations of system models so as to conduct computational experiments that mimic the physical behavior of “real-life” system in the time domain. *Weeks 8-9*

But Why These Central Topics???

Why These Five Central Topics?



Learning Objectives

Upon completing this course, students will be able to:

1. Use “systems-thinking” concepts and abstractions to manage complexity in systems.
2. Use model-based systems engineering techniques to model system’s form, function, and concept.
3. Analyze the structure of systems using graph-theoretic foundations.
4. Simulate systems with continuous-time and discrete-event dynamics.
5. Exercise these skills with an engineering team.
6. Present models, analyses, and simulations in written and oral form in a professional manner.

This course is about how to think not what to think about systems!

MBSE is both an art and a science. The course will require you to exercise and develop your engineering judgement.

Course Schedule Part I

| Topic | Week | Date | Associated Reading | Homework Assigned | Homework/Lab Due |
|---|--------|-----------------------|--|---|--|
| • <input checked="" type="checkbox"/> 1 Course Introduction: Model-Based Systems Engineering, Analysis & Simulation | Week 1 | Tuesday January 7 | | Progress Check 1: The System Scope & Boundary | |
| ▼ <input checked="" type="checkbox"/> 2 Introduction to Model Based Systems Engineering | Week 1 | Wednesday January 8 | CCS Chapters 1-3 | CRQs | |
| • Q2.1 Q&A Session: Systems Thinking I | | | | | |
| • Q2.2 Introduction to SysML & System Form | Week 1 | Thursday January 9 | FMS Chapter 4 & CCS Chapter 4 | CRQs | |
| • Q2.3.1 Q&A Session: Systems Thinking | | | | | |
| • Q2.3.2 Practical Session: Systems Thinking of a Complex Engineering System | | | | | |
| ▼ <input checked="" type="checkbox"/> 4 Practical Session: Block Diagram for the Formula Hybrid | Week 2 | Tuesday, January 14 | FMS Chapter 7 & MATLAB OOP Tutorial Form | Progress Check 2: The System | Progress Check 1: The System Scope & Boundary & CRQs |
| • Q4.1 Q&A Session: Systems Form | | | | | |
| • Q4.2 Practical Session: Modeling System Form in SysML & MATLAB | | | | | |
| ▼ <input checked="" type="checkbox"/> 5 Introduction to System Function I | Week 2 | Wednesday, January 15 | CCS Chapter 5 | CRQs | |
| • Q5.1 Q&A Session: System Function | | | | | |
| ▼ <input checked="" type="checkbox"/> 6 Introduction System Function II | Week 2 | Thursday, January 16 | FMS Chapter 9 | CRQs | |
| • Q6.1 Q&A Session: Modeling Flow Based Behavior w/ SysML | | | | | |
| • Q6.2 Practical Session: Modeling System Function in SysML & MATLAB | | | | | |
| ▼ <input type="checkbox"/> 7 Activity, Sequence & State Machine SysML Diagrams | Week 3 | Tuesday, January 21 | FMS Chapter 10&11 | Progress Check 3: The System Function | Progress Check 2: The System Form |
| • Q7.1 Q&A Session: Modeling Message & Event Based Behavior w/ SysML | | | | | |
| • Q7.2 Practical Session: Modeling System Function in SysML & MATLAB | | | | | |
| ▼ <input type="checkbox"/> 8 Introduction to System Concepts | Week 3 | Wednesday, January 22 | CCS Chapter 6 | CRQs | |
| • Q8.1 Q&A Session: System Concept | | | | | |
| ▼ <input type="checkbox"/> 9 Introduction to System Architecture | Week 3 | Thursday, January 23 | CCS Chapter 7&8 | CRQs | |
| • Q9.1 Q&A Session: Introduction to System Concept & Architecture | | | | | |
| • Q9.2 Practical Session: Modeling System Architecture in SysML & MATLAB | | | | | |
| • <input type="checkbox"/> 10 Class Cancelled | Week 4 | Tuesday January 28 | | MBSE Report & Presentation | Progress 3: The System Function |
| ▼ <input type="checkbox"/> 11 Introduction to the Allocated Architecture | Week 4 | Wednesday, January 29 | FMS Chapter 13 | CRQs | |
| • Q11.1 Q&A Session: Modeling the Allocated Architecture w/ SysML | | | | | |
| ▼ <input type="checkbox"/> 12 The Mathematics of Networks | Week 4 | Thursday, January 30 | Newman Chapter 6 | CRQs | |
| • Q12.1 Q&A Session: The Mathematics of Networks | | | | | |
| • Q12.2 Practical Session: Modeling System Form as a Graph | | | | | |

Course Schedule Part II

| Topic | Week | Date | Associated Reading | Homework Assigned | Homework/Lab Due |
|--|--------|------------------------|---|--|--|
| • □13 Graph Measures & Metrics | Week 5 | Tuesday February 4 | Newman Chapter 7 | Progress Check 4: Network Measures & Metrics | MBSE Report & Presentation |
| • □13.1 Q&A Session: Graph Measures & Metrics | | | | | |
| • □13.2 Student Presentations | | | | | |
| • □14 The Need for Hetero-functional Graph Theory | Week 5 | Wednesday, February 5 | SKF Chapters 1-3 | CRQs | |
| • □14.1 Q&A Session: Need for Hetero-functional Graph Theory | | | | | |
| • □15 HFGT - System Concept | Week 5 | Thursday February 6 | SKF Chapter 4-4.1, 5-5.3 | CRQs | |
| • □15.1 Q&A Session: HFGT System Concept | | | | | |
| • □15.2 Practical Session: Modeling System Architecture as a Knowledge Base | | | | | |
| • □16 HFGT - Physical System | Week 6 | Thursday, February 11 | SKF Chapter 4.2, 5.4 | Progress Check 5: Hetero-functional Adjacency Matrix | Progress Check 4: Network Measures & Metrics |
| • □16.1 Q&A Session: HFGT Hetero-functional Adjacency Matrix | | | | | |
| • □16.2 Practical Session: Modeling System Architecture as a Hetero-functional Graph | | | | | |
| • □17 HFGT Controllers & Decision-makers | Week 6 | Tuesday, February 12 | SKF Chapter 4.3-4.4, 5-5.6 | CRQs | |
| • □17.1 Q&A Session: HFGT Controllers & Decision-makers | | | | | |
| • □18 Introduction to Discrete-Event Dynamics | Week 6 | Wednesday, February 13 | Petri-Net Tutorial | CRQs | |
| • □18.1 Q&A Session: Discrete-Event Dynamics | | | | | |
| • □18.2 Practical Session: Modeling Decision-Making Structure in HFGT | | | | | |
| • □19 HFGT Operands | Week 7 | Tuesday, February 18 | SKF Chapters 4.5-4.6, Network Analysis Report & 5-7-5.8 | Progress Check 5: Hetero-functional Adjacency Matrix | |
| • □19.1 Q&A Session: HFGT Operands | | | | | |
| • □19.2 Practical Session: Modeling HFGT Operand Behavior | | | | | |
| • □20 HFGT System Adjacency Matrix | Week 7 | Wednesday, February 19 | SKF Chapters 4.8.5 | CRQs | |
| • □20.1 Q&A Session: HFGT System Adjacency Matrix | | | | | |
| • □21 Introduction to Continuous-Time Dynamics – Simscape | Week 7 | Thursday, February 20 | Simscape Tutorial | CRQs | |
| • □21.1 Practical Session: Modeling HFGT System Structure | | | | | |
| • □21.2 Practical Session on Simscape | | | | | |
| • □22 Practical Session on Simulation Development | Week 8 | Tuesday, February 26 | Progress Check 7: Dynamic Simulation | | |
| • □23 Student HFGT Presentations | Week 8 | Wednesday, February 20 | | | Network Analysis Report & Presentation |
| • □24 Practical Session on Simulation Development | Week 8 | Thursday, February 28 | | | |
| • □25 Practical Session on Simulation Development | Week 9 | Tuesday March 3 | Final MBSE Report | Progress Check 7: Dynamic Simulation | |
| • □26 Course Conclusion | Week 9 | Thursday March 5 | | | |
| • □27 Final MBSE Report | Finals | Friday, March 13 | | | Final MBSE Report |

Course Schedule Rationale: Why does this course exist at Thayer?

The motivation for this course comes from three immediate needs:

1. The MEM program is seeking to expand its “product development” track.
This course specifically seeks to address product development of large complex systems where the tools of systems engineering are required to actively manage the complexity of the engineering development.
2. The Graduate Energy Program – as it is currently taught – exposes students to a wide variety of energy systems applications domains and then analyzes these energy systems with a wide variety of systems engineering tools. This is too much to do without prerequisite preparation. This ENGG 199 provides the underlying foundation for studying energy systems.
3. We currently do not have a graduate level systems engineering course for students in application domains other than energy.

Ultimately, 21st century engineers are facing a slew of engineering systems challenges, and MBSE sits at the heart of the solution.

The Learning Environment

Learning Environment: Overview of Learning Flow

- Independent Reading & Reflection
- In Class Q&A Sessions
- In Class Practical Sessions: Collaborative Modeling, Analysis & Simulation Time
- Independent Modeling, Analysis & Simulation Time

The practice of MBSE is ultimately conceptual & cognitive. Independent time for reflection is the key to developing these skills.

Nevertheless, the practice of MBSE is always implemented in collaborative teams. Class time will be used for interactive Q&A and collaborative modeling, analysis, and simulation exercises.

In order to ground our learning of MBSE, we will be using a complex engineering system throughout the course. (Groups of 2-3)

Independent Reading & Reflection

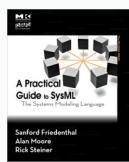
- The study of systems ultimately requires organizing the mind with **abstract** interconnected concepts.
- The books provide deeper explanations & examples of these concepts than a single in-class oral presentation.
- Reading abstract concepts requires the reader to engage more with the material than a lecture format.

In order to support Independent Reading, please prepare 5 Critical Reflection Questions on the reading for the start of every class.

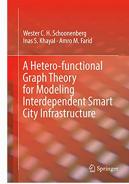
Independent Study: Required & Suggested Text Books



- **Required Text:** Crawley et. al. 2015.[1] (*purchase*)
- A new practical text focusing on learning the abstract principles of systems-thinking.
- Will be used extensively in Weeks 1-5.



- **Required Text:** Friedenthal et. al. 2011 [2] (*handout*).
- A new practical reference text on SysML and its syntax.
- Will be used extensively in Week 1-5 and then later as a reference.



- **Required Text:** Schoonenberg 2018[3]. (*purchase*)
- A comprehensive text on hetero-functional graph theory.
- Will be used extensively in Weeks 6-7.

In Class Q&A Sessions

- In addition to independent reflection, the systems thinking mind must be exercised in **engaged** collaborative discussion.
- This is a precursor to many discussions on complex engineering projects.
- We will have a structured Q&A discussion on the pre-assigned reading.
- There will be no use of lecture or powerpoint.
- Be ready to make these in-class discussions your own.

Engaged discussion requires engaged preparation prior to class.

In Class Practical Sessions

- In addition to engaged collaborative discussion, MBSE is best learned by **doing**.
- We will use class-time to initiate exercises in the MBSE of a complex engineering system of your choosing.
- Depending on class enrollment, we will break up into groups of 2-3.
- While this activity will be mostly independent, I'll be in class to steer you away from big modeling mistakes.
- These sessions will primarily focus on systems thinking skills rather than the syntax of MBSE.

Dive right in! Don't be afraid to make mistakes. Modeling is an iterative process.

Independent Modeling, Analysis & Simulation Time

- This is your chance to get it right.
- The rough draft modeling completed in class can be refined into computer-based modeling programs.
- While you will have to coordinate your efforts with others in class, ultimately much of the modeling, analysis and simulation time must be done independently.
- This will support accurate conclusions about architecture of the complex engineering system in your written reports and oral presentations.

This is where you see the large complex engineering system represented virtually.

Specific Student Needs

Religious Observances:

Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me before the end of the second week of the term to discuss appropriate accommodations.

Disabilities:

Students with disabilities enrolled in this course and who may need disability-related classroom accommodations are encouraged to make an appointment to see me before the end of the second week of the term. All discussions remain confidential, although the Student Accessibility Services office may be consulted to discuss appropriate implementation of any accommodation requested.

Expectations

Assessment

The course assessment is meant to support students in their learning of MBSE; breaking a very complex task of modeling a complex engineering system into manageable chunks.

- 22% Class Participation including submission of 5 critical reflection questions before class.
- 18% (6) Weekly Modeling Progress Checks
- 20% Model-Based Systems Engineering Report & Presentation
- 20% Network Analysis Report & Presentation
- 20% Final Simulation Report & Presentation

Dartmouth College Grade Descriptions

A Grade: Excellent mastery of course material. Student performance indicates a very high degree of originality, creativity, or both. Excellent performance in analysis, synthesis, and critical expression, oral or written. Student works independently with unusual effectiveness.

B Grade: Good mastery of course material. Student performance demonstrates a high degree of originality, creativity, or both. Good performance in analysis, synthesis, and critical expression, oral or written. Student works well independently.

C Grade: Acceptable mastery of course material. Student demonstrates some degree of originality, creativity, or both. Acceptable performance in analysis, synthesis, and critical expression, oral or written. Student works independently at an acceptable level.

D & E grades can be discussed on a case by case basis.

Conclusion 2

Every student will have the opportunity to earn an A grade.

Class Participation

The class discussion grade emphasizes the importance of independent reading, reflection and engaged in-class discussion.

- Complete the reading.
- Prepare at least 5 reflective questions noting the page(s) that inspired the question.
- Pose your questions in the class discussion
- Submit your questions to Canvas so that they can be collated into the MBSE Book of Questions.

Weekly Modeling Progress Checks

The weekly modeling progress checks are meant to give students milestones in completing the course's three reports and presentations.

- The Tortoise vs. the Hare. Steady consistent effort wins the race.
- The focus is on producing the figures, equations, and graphs that will anchor the reading of the report.
- Topic sentences and important conclusions can be bulleted.
- These checks will help you to flesh out the report and presentation straightforwardly in advance of the deadlines.

Model-Based Systems Engineering Report & Presentation

The report and presentation focuses on the MBSE of a complex engineering system using SysML as a modeling language. It must discuss:

- System boundary, context, and scope
- System Form
- System Function
- System Concept & Architecture
- The report need not be lengthy but it must comprehensively and clearly discuss the above points.
- The presentation emphasizes clarity of content and delivery.

Network Analysis Report & Presentation

The report and presentation focuses on the network analysis of a complex engineering system. It must discuss:

- Relevant Incidence Matrices
- Relevant Adjacency Matrices
- Decomposition to an “Appropriate” level.
- The report need not be lengthy but it must be comprehensively and clearly discuss the above points.
- The presentation emphasizes clarity of content and delivery.

Final Simulation Report Report & Presentation

The report and presentation focuses on the simulated behavior of the chosen engineering system. Its content will be approved in advance. It depends on the scope of your subsystem.

Academic Honor Principle Summary

The practice of MBSE is a collaborative endeavor. You are integrating a large amount of information from a wide variety of sources.

Some advice:

- Work with your peers.
- Cite early.
- Cite often.
- Give credit where credit is due.
- Ask me if you have doubts.

Syllabus Summary

Syllabus Outline

Objective 2

To explain how we will learn to engineer complex systems ...

- Course Logistics
- Instructional Team
- Course Rationale
- Course Components
- The Learning Environment
- Expectations
- Lecture Summary

Conclusion 3

Students will have a clear understanding how ENGG 199-MBSE will proceed this term.

References I

- [1] E. Crawley, B. Cameron, and D. Selva, *System Architecture: Strategy and Product Development for Complex Systems*. Upper Saddle River, N.J.: Prentice Hall Press, 2015.
- [2] S. Friedenthal, A. Moore, and R. Steiner, *A Practical Guide to SysML: The Systems Modeling Language*, 2nd ed. Burlington, MA: Morgan Kaufmann, 2011.
- [3] W. C. Schoonenberg, I. S. Khayal, and A. M. Farid, *A Hetero-functional Graph Theory for Modeling Interdependent Smart City Infrastructure*. Berlin, Heidelberg: Springer, 2018. [Online]. Available: <http://dx.doi.org/10.1007/978-3-319-99301-0>

Expanding Customer Choices in a Renewable Energy Future

BY AHMAD FARUQUI, PRINCIPAL, AND
MARIKO GERONIMO AYDIN, SENIOR
ASSOCIATE, THE BRATTLE GROUP

For three years, Hawaii stood alone among other states in its commitment to reaching 100% renewable energy. In 2018 and early 2019, several large jurisdictions followed suit: California passed into law a policy of 100% clean energy by 2045; Washington, D.C.'s city council passed a standard for 100% renewables by 2032; New Mexico passed a 100% zero carbon requirement by 2045; and Puerto Rico adopted a policy for 100% renewable energy by 2050.ⁱ Many other states are considering and moving forward with similar policies and laws. Meanwhile, the number of cities and counties committed to 100% clean energy is growing dramatically.ⁱⁱ The 100% clean electricity supply that seemed impossible 10 years ago has now become a tangible and feasible future.

Figure 1 shows the end goal of state-level (plus Washington, D.C. and

Puerto Rico) clean energy standards in terms of percent renewables or clean energy.ⁱⁱⁱ Five more states are not far behind, with clean energy goals of 50% or more. With these policies, decarbonization of electricity is making great strides, with more to come as momentum builds.

determine when and where to build renewable resources and at what size these resources will be cost-effective.

With higher renewables penetration, planning for greener electricity becomes less about building individual resources and more about building a resource portfolio and system that — as a whole — is tuned to take advantage of clean power when it is available. One key challenge is what to do about the hour-to-hour and minute-to-minute mismatch between renewables output and electricity consumption. At times, electricity supply from renewables may be higher than consumption. At other times, supply may be lower than consumption. System operators must have the resources and tools they need to match supply and demand exactly.

In this context, customer flexibility becomes increasingly valuable. Any consumption that can be reasonably shifted to

The Value of Customer Flexibility in a High-Renewables World

In the first steps toward electricity decarbonization, going green is as straightforward as adding a solar or wind plant to the resource mix. In addition to forecasting peak demand as they have always done, resource planners and policymakers must

Figure 1: End Goal of Clean Energy Standards by Jurisdiction

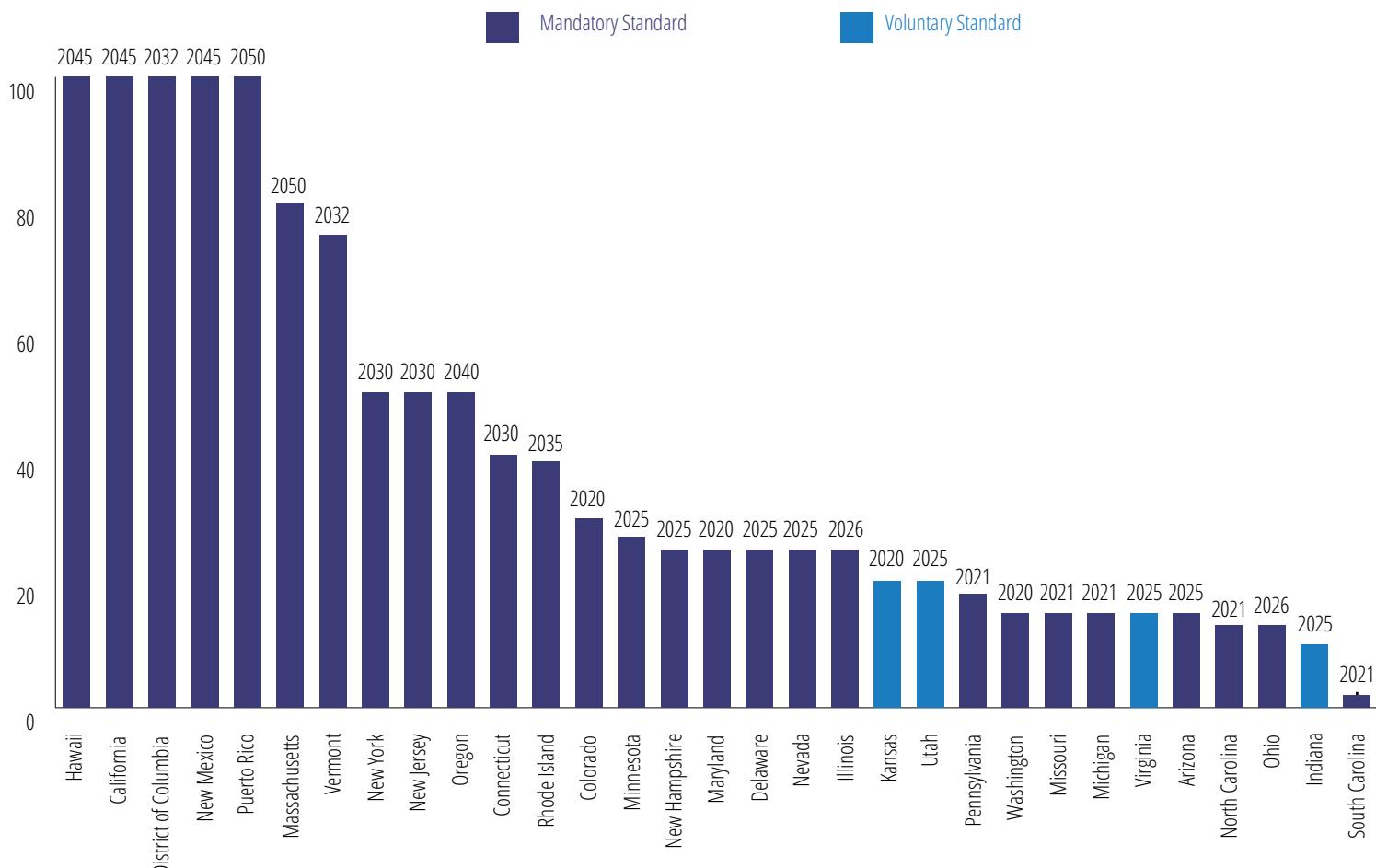
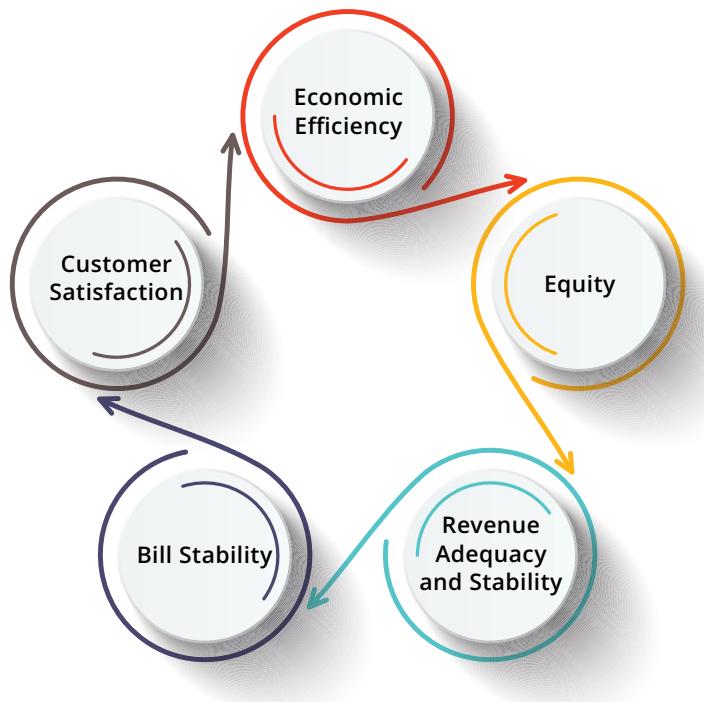


Figure 2: Objectives for Effective Retail Rates

Using customer flexibility as a resource in any and all hours is critical to getting the most out of a high-renewables system.

times when renewables-based supply is high will prevent loss or curtailment of renewables output when it is available. In doing so, customers also shift consumption away from times when renewables-based supply is lower, which can avoid the cost of power supplied by battery storage or even fossil fuel-based generation. This concept is expanding our traditional thinking about customer flexibility: from traditional “demand response” focused on moving consumption away from peak periods, to something more dynamic and including “load shift” toward low-cost periods.^{iv}

Future studies and evaluations of demand response will need to broaden the definition of demand response and the scope of benefits it can provide.^v Using customer flexibility as a resource in any and all hours is critical to getting the most out of a high-renewables system.

Principles for Meaningful Rate Options and Signals

Electricity is delivered (and sometimes produced) by a regulated natural monopoly, and customers pay for electricity through regulated retail rates. Given that framework, the principles of effective regulated rates hold true regardless of a high-renewables future. Effective rates should address and balance the regulator's high-level objectives for economic efficiency, equity, revenue adequacy and stability, bill stability, and customer satisfaction, as shown in Figure 2.^{vi}

The objectives for retail rates are interrelated, and some can represent tangible tradeoffs for customers. One customer, for example, might want to see how power supply costs vary within a day, to moderate their air conditioner on the hottest days when costs are high and save money overall. Another customer might not have the same flexibility to cut air conditioning on the hottest days, might not want to feel penalized for that flexibility, and might pre-

fer more bill stability and costs smoothed over time.

An in-between rate option with moderate cost variability over time — such as the traditional volumetric rates that dominate the industry today — might be meaningless to both customers. The first customer may feel that the cost variability they see is not a strong enough signal (or concentrated enough) to respond to. And the second customer may feel that the cost variability by month or season is not equitable nor helpful given that they can't respond to it. In either case, customers pay the total cost of service. How well rates are tailored to customers' preferences and their ability to respond can impact how effective the rates are in incentivizing customers to save money when they can reasonably do so, while increasing customers' satisfaction and sense of equity.

For customers of today and tomorrow, rate objectives need to be defined and addressed at a more granular level that is tailored to the diversity of customers and their preferences, possibly even at a customer-specific level. We now have better information technology and tools to understand customers' behaviors and preferences, and to help them receive and respond to signals so they can shape their consumption in a meaningful way.

The Diversity of Efficient Rate Options

An hourly real-time price signal... can help show customers exactly what hours contribute most (and least) to the cost to serve them.

How do customers weigh opportunities to reduce cost versus bill stability? Regulators and utilities have experimented with a wide range of rate options and signals, as demonstrated in Figure 3. Traditional volumetric rates (standard tariff) yield relatively low bill volatility. However, the potential for bill savings is limited — a customer is only empowered to reduce costs through bulk conservation (i.e., a customer reducing total kWh consumed over a month).

For even less bill volatility, utilities can offer a fixed monthly bill (e.g., budget billing plan), shown as the leftmost point in Figure 3. Under this approach, the utility estimates total seasonal or annual bills, then divides the total by the number of months, similar to a payment plan. For example, Ohio's regulated electric and natural gas distribution utilities offer annual budget billing.^{vii} Customers may like this type of bill because it is easier to financially plan for. But they must accept the tradeoff of having no signal to consume power when it is economical to do so, which theoretically will yield higher costs to customers overall.

Customers might be willing to risk more bill volatility if they have the flexibility to move consumption away from high-priced periods. An hourly real-time price signal, shown as the rightmost point in Figure 3, can help show customers exactly what hours contribute most (and least) to the cost to serve them. To date, the U.S. has relatively little experience applying real-time prices to residential customers, but experience in other parts of the world may provide some insights.

For example, in early 2017, about 12 million small customers in Spain, or about half of those eligible, were enrolled in a real-time price-based electricity rate, as part of a regulatory redesign to incentivize more efficient customer behavior and lower costs.^{viii,ix}

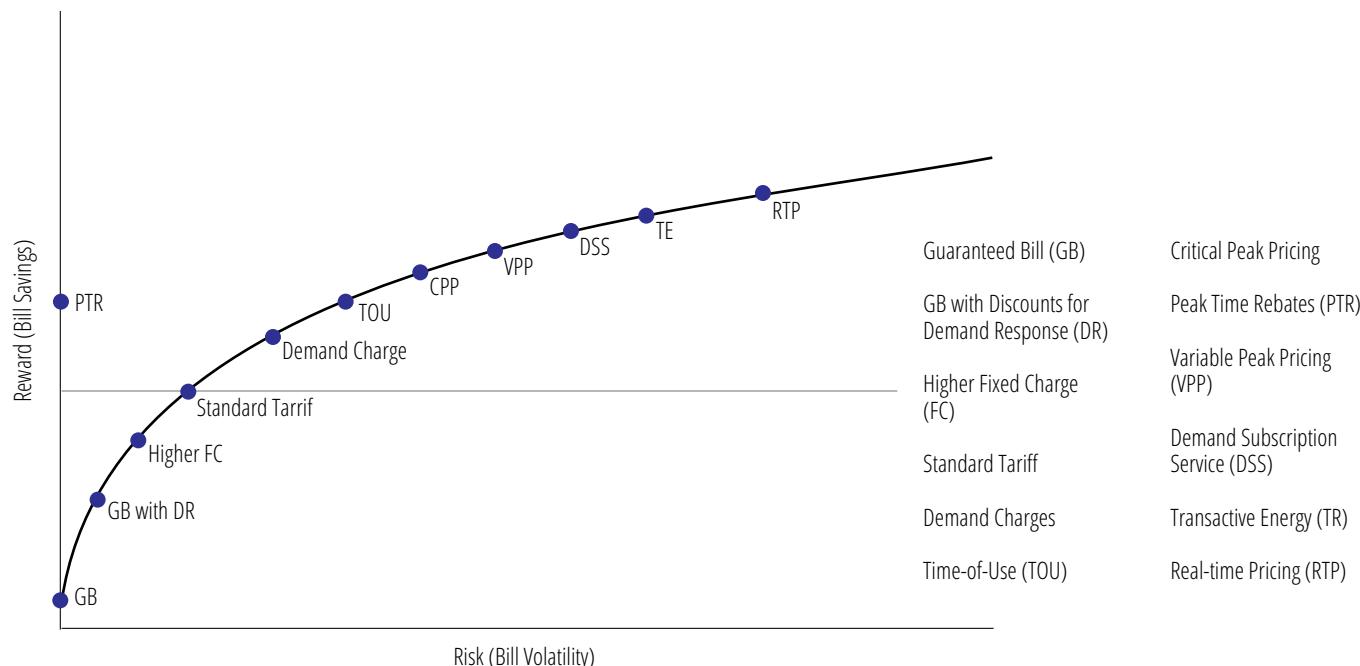
In a high renewables system in the U.S., a real-time price signal can also be simplified to indicate when fossil fuel is being burned to serve customers (relatively high cents per kilowatt-hour), versus when renewables output is plentiful (low or even negative ¢/kWh). Translating a real-time price signal into an emissions signal may be more meaningful for some customers.

The tradeoff of higher bill volatility, however, can't completely be eliminated by the customer avoiding high-priced hours and consuming more in low-priced hours. There will always be the risk that prices are sometimes high when the customer can't or doesn't want to respond. More moderate time-varying price signals, like time-of-use rates and critical peak pricing, can also be quite effective if they are designed properly.^x

Enabling Customer Flexibility through Tailored Retail Rates and Services

At its heart, traditional demand response is about giving better information to customers and letting them decide how to adjust (or not adjust) their consumption patterns. Studies on how electricity customers in the U.S. respond to cost signals — via retail rates and bills — have a history dating back to the late 1970s.^{x1} Those studies affirm that customers care about cost and that they are willing and able to adjust their consumption away from high-cost periods.

Through subsequent decades of studies and experimentation, another thing is clear — customers have diverse preferences for types of cost signals they are willing to respond to. Preferences range from a flat guaranteed bill (low granularity cost signal) to retail rates that vary by hour in real time (high granularity cost signal), and many variations in between.

Figure 3: The Efficient Rate Frontier

Customers have shown that they will only respond to cost signals that are meaningful to them, and so customer options must be tailored carefully. To date, utilities and regulators have experimented with offering a handful of electricity rate options defined across broad customer classes. However, in other aspects of their lives, customers are getting used to having a world of options at their fingertips.

Today's customers have two important attributes that can affect their consumption patterns and must be considered along with retail rate design. First, customers have a heightened awareness of the electricity supply mix, and they may have stronger preferences for green attributes and where the power comes from (such as local or onsite power) than customers of yesterday. So, beyond cost signal options, customers might want options to choose a supply mix that better suits their preferences and values. There is growing evidence that customers want more control and options to tailor their power supply mix to their preferences.

Furthermore, customers are more comfortable with using technology and tools to make informed spending decisions. They use apps, search engines, web services and other tools on a daily basis to process and simplify an enormous amount of information to make even the simplest spending decisions. Advanced equipment like smart meters can improve the quality of cost, consumption, and supply mix data available to the customer. Tools and services including apps, price and consumption reports, and smart appliances can help the customer absorb that information quickly and adjust consumption patterns with more automation. Experiments with enabling technologies such as in-home displays and smart thermostats have already shown that customers can be more flexible if they are given better resources to do so.^{xii}

The Path Forward

Electric utilities are well-poised to play a major role in providing tailored electricity services to customers in a new world where digital technologies and the internet of things are likely to be ubiquitous. To do so, utilities must continuously seek improved customer data to offer meaningful rate options and signals tailored to customer preferences. Utilities must also push forward with technology and tools that can help customers understand it all and respond with minimal effort.

The path to developing meaningful new rate structures and options for customers in a renewable energy future begins with better understanding how customer needs are changing. This can be done through focus groups and surveys that not only seek to understand preferences on cost versus bill stability, but also seek to understand preferences on power supply mix, environmental goals, and willingness to provide flexibility at different times of the day.

With customer preferences better understood, utilities can draw from the wealth of experience they already have in order to identify and test the effectiveness of differ-

ent rate options. This includes field testing new rate designs, determining their acceptance and comprehension by customers, and evaluating the impact of the new rates on energy consumption and load shapes. Experience has shown that it would be best to carry out the tests using randomized control trials or similar methods to make sure the results are statistically valid and can be generalized to the population of interest. Tests should include considerations of technologies that enable customers to easily understand their rates and any price or environmental signals they are receiving, set preferences for responding to those signals, and respond automatically in a way that does not disturb customers' quality of life.

Utilities and regulators will then need to develop an implementation plan for new rates. They must determine if the new rates should be offered on an opt-in, opt-out, or mandatory basis and how that may change over time. There are many different approaches to this and each has its pros and cons. There may be useful lessons learned from other utilities that have already rolled out similar rates.

To quell fears of unexpected impacts, it will be useful to compute the bill changes that the new rates will bring about and find ways to mitigate any adverse impacts.

Finally, continuous customer education and outreach is crucial for customers to understand the array of rate options they have, and for them to make the best use of the rate they choose. In a sense, this effort both begins and ends with a conversation with customers. Through those conversations, electric utilities and regulators can help customers make great strides in realizing the benefits of their renewable energy future.

About the Authors

Ahmad Faruqui is an internationally recognized energy economist. He has analyzed the efficacy of a variety of tariff structures and carried out a meta-analysis of experimental results. His areas of expertise include demand response, energy efficiency, distributed energy resources, advanced metering infrastructure, plug-in electric vehicles, energy storage, inter-fuel substitution, combined heat and power, microgrids, and demand forecasting. He has worked for nearly 150 clients on five continents and testified before commissions in several states and provinces.

Mariko Geronimo Aydin is an economist with almost fifteen years of experience in analyzing the policies and economics of electricity system planning, regulation and de-regulation of electricity supply, and wholesale electricity markets across the U.S. Mariko specializes in helping clients meet their potential in a changing industry, by evolving utility business models and by developing customer choice, resource planning, and wholesale market refinements that can make the best use of clean, distributed, and customer-driven power supply resources in synergy with more traditional resources.

i These policies and laws refer to the following legislative bills: HB 623 (Hawaii), SB 100 (California), B22-0904 (Washington, D.C.), SB 489 (New Mexico), and PS 1121 (Puerto Rico).

ii Note that 130 cities and counties have also committed to 100% clean energy. Sierra Club, "100% Commitments in Cities, Counties, & States," <https://www.sierraclub.org/ready-for-100/commitments>, Accessed April 2019.

iii DSIRE, "Detailed Summary Maps: Renewable Portfolio Standards (October 2018)," <http://www.dsireusa.org/resources/detailed-summary-maps/>, Accessed April 2019. Supplemented with research by The Brattle Group. Texas also has a voluntary target of 10,000 MW by 2025 for retail entities.

Massachusetts' goal of 80% by 2050 is based on its Clean Energy Standard. Massachusetts also has a separate Renewable Portfolio Standard with an implied target of 35% by 2030, and the Class I requirement growing by 1% per year thereafter.

iv Note that although the idea of flexible load shapes is gaining attention in the industry today, it is a concept that has been around for some time. See, for example, Gellings, Clark W., Pradeep C. Gupta, and Ahmad Faruqui, "Strategic Implications of Demand-Side Planning," Chapter 8 in Plummer, James L., Eugene N. Oatman, and Pradeep C. Gupta (eds), Strategic Management and Planning for Electric Utilities, Prentice-Hall, Englewood Cliffs, 1985, pp. 137-150. See also, Scheppele, Fred C., Richard D. Tabors, and James L. Kirtley, "Homeostatic Control: The Utility/Customer Marketplace for Electric Power," MIT Energy Laboratory Report MIT-EL 81-033, September 1981.

v Faruqui, Ahmad, and Ryan Hledik, "Reinventing Demand Response for the Age of Renewable Energy," December 14, 2018, http://files.brattle.com/files/15059_reinventing_demand_response_for_the_age_of_renewable_energy_12-12-2018.pdf. Accessed April 2019.

vi Bonbright, James C., Albert L. Danielsen, and David R. Kamerschen, "Principles of Public Utility Rates," Arlington, Va: Public Utility Reports, 1988.

vii See The Public Utilities Commission of Ohio, "Budget Billing for Natural Gas and Electric Service," <https://www.pucio.ohio.gov/be-informed/consumer-topics/budget-billing-for-natural-gas-and-electric-service/>, Accessed April 2019.

viii The rate is called the Voluntary Price for Small Consumers, or VPSC.

ix EURELECTRIC, "Dynamic Pricing in Electricity Supply," position paper, page 6, http://www.eemg-mediators.eu/downloads/dynamic_pricing_in_electricity_supply-2017-2520-0003-01-e.pdf. Accessed April 2019.

x Faruqui, Ahmad, Sanem Sergici, and Cody Warner, "Arcturus 2.0: A Meta-Analysis of Time-Varying Rates for Electricity," The Electricity Journal, Volume 30, Issue 10, December 2017.

xi Faruqui, Ahmad, and Mariko Geronimo Aydin, "Moving Forward with Electricity Tariff Reform," Regulation, Fall 2017, pp. 42-48.

xii Faruqui, Ahmad, Sanem Sergici, and Cody Warner, "Arcturus 2.0: A Meta-Analysis of Time-Varying Rates for Electricity," The Electricity Journal, Volume 30, Issue 10, December 2017.