STATE OF IOWA
BEFORE THE IOWA UTILITIES BOARD

IN RE: INTERSTATE POWER AND LIGHT COMPANY	))))))	DOCKET NO. RPU-2017-0001

DIRECT TESTIMONY
OF
PAUL CHERNICK

On Behalf of

Environmental Law & Policy Center, Iowa Environmental Council,
Natural Resources Defense Council, Vote Solar, and Solar Energy Industries Association

Resource Insight, Inc.

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APPENDICES

I. IDENTIFICATION & QUALIFICATIONS

Q: Please state your name, occupation, and business address.

A: My name is Paul L. Chernick. I am the president of Resource Insight, Inc., 5 Water St., Arlington, Massachusetts.

Q: Summarize your professional education and experience.

A: I received a Bachelor of Science degree from the Massachusetts Institute of Technology in June 1974 from the Civil Engineering Department, and a Master of Science degree from the Massachusetts Institute of Technology in February 1978 in technology and policy.

I was a utility analyst for the Massachusetts Attorney General for more than three years, and was involved in numerous aspects of utility rate design, costing, load forecasting, and the evaluation of power supply options. Since 1981, I have been a consultant in utility regulation and planning, first as a research associate at Analysis and Inference, after 1986 as president of PLC, Inc., and in my current position at Resource Insight. In these capacities, I have advised a variety of clients on utility matters.

My work has considered, among other things, the cost-effectiveness of prospective new electric generation plants and transmission lines, retrospective review of generation-planning decisions, ratemaking for plant under construction, ratemaking for excess and/or uneconomical plant entering service, conservation program design, cost recovery for utility efficiency programs, the valuation of environmental externalities from energy production and use, allocation of costs of service between rate classes and jurisdictions, design of retail and wholesale rates, and performance-based ratemaking and cost recovery in restructured gas and electric industries. My professional qualifications are further summarized in Appendix PLC-1.

Of particular relevance to my testimony in this proceeding, I co-authored a critique of demand charges, "Charge Without a Cause? Assessing Electric Utility Demand Charges on Small Consumers," Electricity Policy, August 2016, attached as Appendix PLC-2.

Q: Have you testified previously in utility proceedings?

A: Yes. I have testified over three hundred times on utility issues before various regulatory, legislative, and judicial bodies, including utility regulators in thirty-four states and six Canadian provinces, and two U.S. Federal agencies. This testimony has included many reviews of utility avoided costs, marginal costs, rate design, and related issues.

II. INTRODUCTION

Q: On whose behalf are you testifying?

A: I am testifying on behalf of the Natural Resources Defense Council, Environmental Law & Policy Center, Iowa Environmental Council, Vote Solar and Solar Energy Industry Association.

Q: What is the scope of your testimony?

A: I review the optional demand rate pilots that Interstate Power and Light (IPL) proposes for Residential and Non-Residential General Service (GS) customers, presented in the testimony of David Vognsen (at 19–20), in Vognsen Revised

Schedules E and F, and in the tariffs.[1] IPL describes these rates as "demand rate pilots" (ibid at 19), as "experimental" (in the tariffs themselves) and simply as "new rates" (Vognsen Revised Schedules E and F), raising questions about IPL's actual plans for these rates.

Q: How is your testimony structured?

A: The next section describes IPL's proposals. Section IV describes problems with legacy demand charges in general. Section V describes specific concerns I have with IPL's "experimental" demand rate pilots for Residential and GS customers. Section VI lays out alternative rate designs that I recommend IPL consider as part of its experiments to reduce peak demands through rate-design pilots.

Q: Please summarize your conclusions and recommendations.

A: The demand-charge rates that IPL has proposed are unlikely to benefit customers or reduce rates, because, among other problems:

- They not designed to reflect the costs driven by customer power consumption.
- The rates would charge customers for their consumption at the wrong times.
- The demand charges would often not charge them at all for consumption in high-cost hours.
- They would impose the same demand charge for a customer who hits a maximum demand once at any time in the very broad peak period of a month as for a customer who has that same maximum demand in all the month's high-load hours.

[1] IPL filed amended versions of Vognsen Schedules E and F and the proposed tariffs on June 9, 2017. My references to those documents refer to the revised versions.

- Even a single demand spike could eliminate any incentive to control usage for the rest of the billing month.
- The proposed rates would encourage increased electric use, some of which would likely occur in the peak period.
- Demand charges would be difficult for small customers to understand or avoid.
- Customers who spend the money and effort to shift their loads to reduce their demand charges may increase IPL's costs and hence rates.
- The proposed pilots are not designed to provide the Iowa Utilities Board (the "Board") with significant information regarding broader rate design innovations for these classes.
- The proposed pilots would not even provide customers with information on their current and historical load levels.

There is no reason to deploy a rate design, even in a pilot program, that is unlikely to benefit IPL customers.

More appropriate pilot rate designs should be developed that would provide better incentives for customers to reduce IPL costs. I lay out in more detail at the conclusion of my testimony a series of superior alternatives, including a range of other "demand charge" structures, time of use rates, dynamic peak pricing, and peak time rebates which would provide the Board with useful data on whether alternative rate designs would be effective and acceptable for some or all customers in the Residential and Small GS classes.

I recommend that the Board reject IPL's optional demand rates and instruct the utility to work with stakeholders on developing more appropriate and useful experiments in rate designs to reduce peak loads.

III. SUMMARY OF THE IPL PILOT PROPOSAL

Q: What pilot rate designs has IPL proposed?

A: The Company proposes one Optional Demand Rate for Residential customers and another Optional Demand Rate for Non-Residential GS, which are defined as "customers with expected usage less than 20,000 kWh for 12 consecutive billing months."[2] In these rates, IPL proposes to reduce the energy charges and recover those revenues through demand charges. The tariffs describe the rate designs as "experimental" and specify that the rates "may collectively be limited to" 100 new residential customers and 25 non-residential customers per month.

Q: How large are the proposed reductions in energy charges?

A: According to Vognsen Revised Schedule E, the reduction in energy charges for residential customers on the demand rate (compared to the proposed standard residential rate) would be as follows:

- 7.2¢/kWh in the summer (from 12.05¢/kWh to 4.82¢/kWh)
- 6.0¢/kWh for the first 500 kWh/month in the winter (from 10.06¢ to 4.02¢), and
- 3.4¢/kWh for the next 700 kWh/month in the winter (from 7.44¢ to 4.02¢).

[2] IPL Electric Tariff at Substitute Fourth Revised Sheet No. 24 (filed June 9, 2017).

In Vognsen Revised Schedule E, IPL estimates that the typical residential customer, using 640 kWh monthly in the winter, will experience an average 5.46¢/kWh reduction in its energy bill. Interestingly, the winter rate for usage over 1,200 kWh/month would increase about 1¢/kWh, from 3.03¢ to 4.02¢/kWh. A customer using more than 5,300 kWh in the winter would actually pay more for energy under the pilot rate, in addition to paying for the demand charges.[3]

For GS customers, Vognsen Revised Schedule F indicates that the demand rate would reduce their energy rates by the following:

- 8.1¢/kWh for the first 1,200 kWh/month in the summer (from 12.02¢ to 3.94¢/kWh),
- 5.9¢/kWh for usage over 1,200 kWh/month in the summer (from 9.85¢ to 3.94¢/kWh),
- 6.7¢/kWh for the first 1,200 kWh/month in the winter (from 9.18¢ to 2.49¢/kWh),
- 3.74¢/kWh for usage over 1,200 kWh/month in the winter (from 6.23¢/kWh to 2.49¢/kWh).[4]

For the typical GS customer (using 2,918 kWh monthly in the summer and 2,267 kWh monthly in the winter), the reduction in average energy rates would be 6.8¢/kWh in the summer and 5.3¢/kWh in the winter.

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[3] Very large electric-heating customers are unlikely to participate in the pilot program, given this rate structure. Large customers generally represent the greatest opportunity to shift load; small customer loads are more likely to be dominated by end uses that are difficult to control, such as refrigerators. I sympathize with IPL's desire to eliminate the declining-block energy rates in the residential rate, but that reform should apply to all residential customers, not just those on an experimental rate.

[4] See Vognsen Revised Schedule F.

Q: Is IPL proposing to charge the energy rates listed in Appendices E and F?

A: Apparently not. The tariffs indicate that "Off-peak kilowatt-hours will be billed at 50% of the above energy charges plus all other kilowatt-hours will be billed at 140% of the above energy charges."[5]

Q: What demand charges does IPL propose to replace these energy charges?

A: The Company proposes to impose the following demand charges for residential demand customers:

- $19.24/kW-month for the monthly on-peak maximum hourly load in the summer,
- $9.62/kW-month for the excess of each summer month's off-peak maximum hourly load over that month's on-peak maximum load,
- $12.36/kW-month for the monthly on-peak maximum hourly load in the winter, and
- $6.18/kW-month for the excess of each winter month's off-peak maximum hourly load over that month's on-peak maximum load.

The demand charges for the GS customers would be:

- $24.52/kW-month for the monthly on-peak maximum hourly load in the summer,
- $12.26/kW-month for the excess of each summer month's off-peak maximum hourly load over that month's on-peak maximum load,
- $14.86/kW-month for the monthly on-peak maximum hourly load in the winter, and

[5] The tariffs are not clear as to whether TOU energy billing will be standard or optional for the customers on the experimental rates.

- $7.43/kW-month for the excess of each winter month's off-peak maximum hourly load over that month's on-peak maximum load.

Q: What are the on-peak hours for these rates?

A: According to the tariffs, "On-peak hours shall be from 7 a.m. to 8 p.m. CST (8 a.m. to 9 p.m. during daylight savings time), Monday through Friday."[6]

Q: How did IPL select those on-peak hours?

A: Neither Mr. Vognsen nor his Appendices provide any clear justification for selecting those hours. These hours may have been selected at some time in the past, for other purposes, but there is no evidence in the record supporting this part of the proposal.

Q: What considerations should IPL have included in selecting the peak hours for the pilots?

A: In order for the pilot or experiment to produce useful insights, the peak periods should approximate the peak periods that might be implemented more broadly. There is no point in designing rates with peak periods that include low-load, low-cost hours, or that omit high-load, high-cost hours. Customer response to a rate design based on an arbitrary peak period may not predict anything about their behavior in response to a cost-based peak period. IPL has not demonstrated that its proposed periods would capture the hours in which the equipment serving these classes experience their peak hours.

[6] IPL Electric Tariff at Substitute Original Sheet No. 21.1 and Substitute Fourth Revised Sheet No. 24 (filed June 9, 2017).

Q: What sort of metering is IPL planning on installing for the customers on the experimental rates?

A: That is not clear. The tariffs say "The metering for all customers choosing to participate under this tariff must have demand measuring capability."[7] Since the demand charge will vary by time of day, it appears that the meters will also need TOU capabilities. Since IPL is treating these rates as experiments, and thus should monitor the experimental customers' loads, the meters should also be able to record hourly loads. Curiously, IPL does not list hourly load shapes as metrics that it will gather on the participants (IPL Response to EI DR 22, 23, 48 and 49, attached as Ex. PC-2).

IV. Problems with Legacy Demand Charges

Q: Are the proposed rate designs appropriate, even as experimental pilots?

A: No. The proposed rate designs incorporate archaic demand charges, which do not provide useful price signals, do not reflect the loads that cause the bulk of IPL's costs, are difficult for customers to respond to, and encourage customers to waste effort shifting load in ways that do not reduce IPL's costs.

In the following sections, I discuss the nature of legacy demand charges, the confusing and inefficient price signals that they give customers, the difference between the loads for which demand rates charge customers and the loads that drive IPL costs, and the difference between demand allocation to classes and the use of demand charges in rate design.

[7] Ibid.

A. The Legacy

Q: What are demand charges?

A: As the term has been used for the last 120 years, a demand charge applies a rate in \$/kW (or \$/kVA) to the customer's maximum load over a short period in the month. IPL proposes to measure that maximum over an hour, which is 0.14% of the time in an average month or 0.35% of the on-peak hours, as defined by IPL.

Q: Why do you refer to these as "legacy" demand charges?

A: Demand charges represent an early attempt to reward customers with smooth loads (and hence high load factors) and penalize those with variable loads and low load factors. Demand charges were developed in the late 1800s, to provide a measure of load shape in an era prior to the development of time-of-use meters, let alone modern hourly metering.

> The Wright demand rate is such a two-charge block rate. Mr. Arthur Wright put such a rate in force in Brighton, England, and described it in 1896 before the Borough Electrical Engineers' Convention. He invented a simple meter for measuring the consumer's maximum demand, which has been extensively used on Chicago consumers. (Standard Handbook for Electrical Engineers, Fowle FS, 1915, p. 1908)[8]

The original Wright demand meter was a thermal device, consisting of a hermetically sealed U-shaped glass tube, partly filled with a liquid, with a smaller empty graduated tube hanging down from above the normal liquid level of one leg. A wire was wound around the top of the other leg. As current flowed through the wire, the wire heated up, warming the air and liquid in the tube and pushing some

[8] https://archive.org/details/standardhandbook00fowluoft. See also pages 170 and 1909 for additional context.

of the liquid into the graduated tube. When the meter reader came by, he could read the height of the liquid in the measuring tube and rotate the device to return the liquid to the U-shaped main tube.

By 1915, Wright's glass tube had been largely replaced by the General Electric demand meter, which basically used an amp-meter with one powered sweep-hand (like the needle on an odometer), opposed by magnets and springs to slow the arm so that load would need to remain high for a preset number of minutes for the hand to reach the level indicating the current. That hand pushed a second, passive hand with it; the second hand stayed at the position representing the highest load measured by the device since the last time it was reset.[9]

These legacy demand charges do not discriminate between load variations that increase system costs and those the decrease system costs, so the price signals and the equity of these demand rates is very poor. They are the product of century-old metering technology; as discussed in Section V, modern metering can support rate designs that much more effectively reflect costs.

Q: What are the basic problems with the price signals from demand charges?

A: Legacy demand charges do not provide useful price signals, do not reflect how much load the customer imposes in the times that drive costs, are difficult for customers to control, and can encourage customers to shift load into IPL's high-cost hours.

[9] Ibid at 170.

B. Demand Charges and Price Signals

Q: Why are legacy demand charges not well suited to recovery of distribution or other costs, particularly in rate designs that include time-dependent rates?

A: Demand charges are a particularly ineffective means for sending price signals, for the following reasons:

- Demand charges are not generally very effective at reflecting costs.
- Demand charges do not provide appropriate incentives to conserve, even during the system's high-load hours.
- Demand charges provide little or no incentive to control (or shift) load at those times that are off the customers' peak hours but that are very much on the system's peak hours. Indeed, they may cause some customers to shift loads in ways that increase costs.
- Demand charges do not target peak demand reduction, since they apply to customer maximum demands, not to the times of system peaks or equipment maximum loads. Customer peaks occur at a wide variety of hours, on a wide variety of days, with many far from the coincident peaks on the generation, transmission and distribution equipment.
- Generation costs are driven in part by the number of hours with high system loads (even those below the peak annual load), due to the effect on reliability.
- The sizing of transformers and lines is also driven by the energy use on the equipment in high-load periods, in addition to maximum hourly loads.
- Demand charges are difficult to avoid; even a single failure to control load results in the same demand charge as if the same demand had been reached in every day or every hour.

- Demand charges are very difficult for customers to understand, let alone mitigate. It is difficult to find an example of a product for which consumers pay based on their maximum usage rate.
- Rather than promoting conservation at high-cost times, or shifting of load from system peak periods, demand charges encourage customers to waste resources on the arbitrary tasks of flattening their personal maximum loads, even if those occur at low-cost times. For instance, in order to respond to demand charges effectively, customers will need to install equipment to monitor loads, interrupt discretionary load, and schedule deferrable loads. Moreover, lower energy charges will encourage increased electric use, some of which will likely occur in the peak period.

Q: What pricing signals do demand charges give to customers?

A: The demand rate would assess the same charge on a customer who uses 10 kW once in a month, and no more than 3 kW at any other time, the same amount as a customer who uses 10 kW in 200 hours of the month, out of the 280 or so on-peak hours under IPL's proposed rate design. The latter customer is almost certain to put greater stress on the generation, transmission and distribution systems, since those 200 hours are more likely to hit the peak hours (and/or hours with operating contingencies) on the various levels of the system, and the 200 hours of load will put more thermal stress on the substation transformer, the line transformer and any underground distribution lines.

Once a customer has hit a specific load level for the month, the distribution tariffs would no longer provide any incentive to avoid additional load on the system, up to that level.

Q: How do demand charges affect customers' incentives to control or shift load at most times that are important hours for the IPL system?

A: Demand charges provide little or no incentive to control (or shift) load at those times that are off the customers' peak hours but that are very much on the generation and T&D peak hours. Consider a residential customer whose summer weekday peak demands occur in the early morning, as the household prepares for work, and late in the evening, as they turn on lights and turn up the air conditioning, in preparation for bed. That sort of customer, if they understand the operation of the demand charge, will pay little attention to usage in the afternoon, when the IPL system (see IPL Response to DR IBEC-4c, attached as Exhibit PC-1) and the MISO system reach their peak loads.[10]

Not only are demand charges ineffective at shifting loads off high-cost hours, they may cause some customers to shift loads in ways that actually increase costs. Customers can avoid demand charges by redistributing load within the peak period. Some of those customers will be shifting loads from their own peak to the peak hour on the local distribution system, on the transmission peak, or on the peak load hour. For example, if the customers whose loads typically peak in the morning or evening have programmable appliances, they may set their dishwashers, clothes washers and dryers to run in the afternoon.[11] This may cause customers to increase their contribution to maximum or critical loads on the local distribution system, the transmission system, or the utility and regional generation systems.

[10] Of course, if the customers do not understand the operation of the demand charge, it is unlikely to have any beneficial effects.

[11] Even if their appliances are not programmable, they may have the first family member who gets home start the appliances, so they will be done prior to the household peak later in the evening.

C. The Loads that Drive Costs

Q: What types of loads drive IPL's costs?

A: Cost-causal loads include the following:

- IPL's contribution to MISO's generation requirements.
- The peak load in MISO's Iowa Local Resource Zone.
- Other loads that may affect IPL's generation capacity requirements.
- The hours at which various pieces of IPL's transmission and distribution equipment are heavily loaded.
- Loads in hours with high marginal energy costs, reflecting the cost to IPL of generating or purchasing energy, or of losing the opportunity to sell energy in the wholesale market.

Q: Which hours drive contribution to MISO's generation requirements?

A. IPL's contribution to MISO's generation requirements occur at the time of MISO's annual coincident peak demands and other high-load hours that affect the loss-of-load expectation. As explained in the annual Loss of Load Expectation Study Report from the Loss of Load Expectation (LOLE) Working Group,[12] MISO sets the capacity requirement to maintain the LOLE to less than 0.1 day/year, which is equivalent to 0.364 Loss of Load Hours (LOLH) and 937.9 MWh of Expected Unserved Energy (EUE) annually.[13] I have not found any MISO data showing which hours contribute to LOLE, LOLH, or EUE. However, as summarized in Table 1 and The MISO Loss-of-Load report for 2012 provides the data I reproduce in Table 2. Subsequent reports lack this summary.

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[12] www.misoenergy.org/Planning/Pages/StudyRepository.aspx.

[13] These probabilities and expectations reflect only load lost due to insufficient generating capacity, not local transmission and distribution outages.

Table 2, the MISO peak hours always occur in the summer (July or August), in the hours ending between 2 and 5 PM.

Table 1: MISO Projected Peak Day and Hour Ending (EST/CDT)

Study	Forecast Peak Loads			
Date	Coming Year	Later Years		
2016	8/2/17 17	7/31/19 17	8/5/26 17	
2015	8/3/16 16	8/4/20 16	8/5/25 16	
2014	8/5/15 16	8/3/16 16	8/2/17 16	7/31/24 16
2013	8/5/14 17	8/1/18 17	8/2/23 17	
2012	7/31/13 17	7/24/17 16	7/25/22 16	

Source: MISO Loss of Load Expectation Study Reports, 2013–2017

The MISO Loss-of-Load report for 2012 provides the data I reproduce in Table 2. Subsequent reports lack this summary.

Table 2: MISO Actual Peak Day and Hour Ending (EST/CDT)

2011	7/20/11 17
2010	8/10/10 16
2009	6/25/09 14
2008	7/29/08 16
2007	8/8/07 16
2006	7/31/06 16
2005	8/3/05 16:00

Source: MISO 2012 Loss of Load Expectation Study Report

Similar patterns emerge for other measures of high loads. Table 3 shows the peak load in each of the eight highest-loads in the period 2005 to 2011.[14] Of the 56 high-load days, 26 occurred in August, 21 in July and 9 in June; 34 occurred at the hour ending at 4 PM, 11 at 5 PM, 9 at 3 PM, and two at the hour ending 2 PM.

[14] The data are from the MISO Planning Year 2012 LOLE Study Report, November 2011, www.misoenergy.org/Library/Repository/Study/LOLE/2012%20LOLE%20Study%20Report.pdf, Table F1. Data for MISO peak hours reported at different times may vary, since MISO may report data for different areas (e.g., the 2005 MISO area versus the 2011 MISO area) in different tables.

Table 3: Highest Eight Daily MISO Peaks

Daily Peak Hour (CDT)	Daily Peak Load (MW)	Rank in Year
8/3/2005 16:00	109,473	1
8/2/2005 16:00	109,099	2
7/25/2005 15:00	108,558	3
8/9/2005 16:00	107,615	4
8/1/2005 17:00	106,949	5
6/27/2005 15:00	105,353	6
7/21/2005 16:00	104,998	7
8/8/2005 17:00	104,011	8
7/31/2006 16:00	113,095	1
8/1/2006 16:00	110,947	2
8/2/2006 16:00	110,499	3
7/17/2006 16:00	110,011	4
7/18/2006 16:00	102,742	5
7/28/2006 16:00	102,161	6
7/19/2006 16:00	101,744	7
7/25/2006 17:00	100,948	8
8/8/2007 16:00	101,800	1
8/1/2007 16:00	101,496	2
8/7/2007 17:00	101,306	3
8/2/2007 16:00	101,268	4
7/31/2007 17:00	98,955	5
7/9/2007 15:00	98,049	6
8/6/2007 17:00	97,435	7
6/26/2007 15:00	97,413	8
7/29/2008 16:00	96,321	1
7/16/2008 16:00	95,982	2
7/17/2008 16:00	95,592	3

8/1/2008 16:00	93,422	4
7/18/2008 16:00	93,144	5
8/5/2008 16:00	93,089	6
7/31/2008 17:00	92,544	7
8/4/2008 17:00	92,245	8
6/25/2009 14:00	94,185	1
6/24/2009 17:00	92,402	2
6/23/2009 15:00	91,671	3
8/10/2009 14:00	89,039	4
6/22/2009 16:00	87,846	5
6/26/2009 16:00	87,355	6
8/14/2009 16:00	87,023	7
8/17/2009 15:00	85,593	8
8/10/2010 16:00	107,171	1
8/12/2010 16:00	106,653	2
8/11/2010 16:00	104,075	3
8/3/2010 16:00	103,646	4
8/9/2010 16:00	103,571	5
8/4/2010 16:00	103,527	6
8/13/2010 16:00	102,996	7
7/23/2010 16:00	102,995	8
7/20/2011 17:00	102,804	1
7/19/2011 16:00	101,076	2
7/21/2011 16:00	99,601	3
7/18/2011 15:00	98,177	4

8/1/2011 15:00	95,703	5
8/2/2011 16:00	95,169	6
6/7/2011 17:00	94,933	7
7/22/2011 16:00	93,759	8

Q: Which hours affect the peak load in MISO's Iowa Local Resource Zone?

A: The peak load in MISO's Iowa Local Resource Zone (LRZ-3) typically occur in July, in the hours ending 5 PM to 8 PM, as shown in Table 4.

Table 4: MISO Projected Iowa Peak Day and Hour Ending (EST/CDT)

Study Year	
2016	7/19/17 20
2015	7/20/16 19
2014	7/22/15 19
2013	7/23/14 20
2012	7/31/13 17

Q: What other hours might affect IPL's generation capacity requirements?

A: In addition to MISO's generation requirements, there may be other loads that IPL and the Board consider important in determining capacity requirements. IPL reports that its peak monthly loads in 2016 occurred in July to September, in hours ending at 4 PM to 6 PM (Ex. PC-1). These hours overlap both the MISO peaks and the LRZ-3 peaks.

Q: In which hours are the various pieces of IPL's transmission and distribution equipment heavily loaded?

A: IPL has not provided this information, which is not generally available from other sources. The various transmission lines, substations, distribution feeders and line transformers will experience their annual peaks in different months, seasons, days and hours. IPL has not provided any data on the timing of those peak loads, or of the hours when high peaks contribute to wear on the equipment and reduction of equipment capacity. Distribution costs are incurred in part by sizing the distribution system to meet high loads (including annual peak loads) on each piece of equipment, not the customers' individual maximum demands at disparate times.

Q: How do marginal energy costs vary by hour and season?

A: In general, energy costs at high-load hours (very broadly, the weekday daytime hours defined as on-peak for wholesale transactions) are higher than costs late at night or in the early morning. MISO prices (especially in the on-peak hours) tend to be highest in the winter months, followed by the summer, with the lowest prices in the spring and fall. These variations are usually reflected in time-of-use (TOU) energy rates, rather than a demand charge.[15] As I note in Section III, it is not clear whether IPL intends to apply TOU energy rates to all the customers on the demand rates.

Q: How do hours other than annual peak hours affect IPL's costs?

A: The generation capacity reserve margin is stated as a percentage requirement above the peak load, but as explained in MISO's annual Loss of Load Expectation Study Reports, that percentage is determined by modeling of generator performance, load-forecast uncertainty, and the entire annual load curve for each Load Resource Zone. The amount of generation that is unavailable varies randomly, as power plants fail and are repaired and as renewable resources rise and fall. Any hours that are close enough to the peak may (after accounting for outages) have tighter supply than the peak hour, contributing to the loss-of-load expectation. MISO determines the

[15] If IPL does implement additional demand charges and uses the same peak periods for energy and demand charges, the time periods should reflect energy costs, as well as capacity costs.

reserve margin required to keep the loss-of-load risk to a predetermined level, 0.1 day per year.

While maximum loading is a good general guide to time allocation of T&D equipment, specific categories of facilities are driven by other loads. For example, some portion of transformer and underground-line investments are driven by the reduction of capacity and of operating life due to heat buildup over the course of high-load days, rather than the peak hours alone; those costs should be allocated over all time periods in the critical months for the equipment.

Q: Why don't legacy demand charges reflect these costs well?

A: The demand charges in an electric bill are determined by the customer's individual maximum demand. But capacity costs are driven by coincident loads at the times of the peak loads, not by the non-coincident maximum demands of individual customers. The customer's individual peak hour is not likely to coincide with the peak hours of the other customers sharing a piece of equipment, especially since the peaks on the secondary system, line transformer, primary tap, feeder, substations, sub-transmission lines, and transmission lines occur at varying times.

D. Demand Allocation and Demand Charges

Q: Is there any reason that costs allocated on various demand measures should be recovered through demand charges?

A: No, for two basic reasons. First, demand-related costs are related to coincident peaks or other high loads on various transmission and distribution equipment, and are typically allocated on measures of coincident demands or proxies, such as class diversified annual peak loads or average-and-excess allocators. Demand charges use a measure of "demand"—monthly customer peaks, spread out over hundreds of hours every month—that is very different than the narrower demands used in cost allocation.

Second, a similar confusion arises in the conflation of two meanings of "fixed costs:"

> Fixed Costs 1: costs invariant with respect to load or usage, and thus not avoidable by reducing load.
>
> Fixed Costs 2: costs fixed over the year, not varying in the short run.

Many costs in any particular year are largely determined by the cumulative investment and construction commitments in the past, and are hence fixed by Definition 2. However, even though IPL's plant costs are overwhelmingly fixed over the year, none of them are fixed over load, since plant is added to maintain reliability and reduce losses as load grows. Hence, they are not fixed by Definition 1 and should be recovered through rates that vary with usage and encourage customers to reduce and control the usage that contributes to the costs.

V. PROBLEMS WITH IPL'S PROPOSED DEMAND RATES AS EXPERIMENTS

Q: What problems have you identified in IPL's proposal to use the demand rates to conduct an experiment in customer response?

A: From the filed materials, it does not appear that IPL is ready to run any such experiment. For example:

- IPL has not defined the control groups for its experiments.
- IPL has not specified its goals for the demand rates.

- IPL has not specified how it will measure the effects of the experimental rate designs on customer load shape, cost reduction, or any other outcome.
- The proposed tariffs provide inconsistent descriptions of the role of time-of-use rates in the experiments, as I mention above.

Q: Why is a control group important in the design of a rate-design experiment?

A: In order to determine the effect of the experimental rate design, the utility (or other analyst) must have an estimate of how the participants would have acted without the experimental design. This comparison is generally accomplished through the use of a control group. Since load shapes vary between years, the control group must generally be a group of customers similar to the participants, observed under the standard rate in the same year(s) as the experiment.

Q: For the sort of experiments that IPL has proposed, is development of a control group a trivial exercise?

A: No. Identifying a control group is challenging for an opt-in program, such as IPL is proposing, since the volunteers for the optional rate are likely to be different from average customers, in such aspects as usage patterns, awareness of electricity usage, income, household size, and propensity to innovate. Some experiments get around this problem by separating the volunteers into treatment and control groups (which reduces the number of customers in the test group) or by carefully selecting non-volunteers who match the participants' characteristics (which would be difficult for IPL, unless it has a surprising amount of data on its small customers).

Another approach collects usage data on participants for an extended period prior to implementation of the rate change, to determine a baseline, and monitoring nonparticipants during both the pre-treatment and treatment periods, to isolate the effects of weather, the economy and other factors in changing usage during the experiment. It is not clear whether IPL has any plan for monitoring the load shapes of the experimental participants prior to implementation of the demand rates, or even during the test period. Mr. Vognsen says that "For customers who express an interest in the optional demand pilot, IPL will replace their kWh meter (measuring kWh only) with a meter capable of measuring both demand kW and energy kWh." (Vognsen Direct at 19, lines 18–20) If that information is all that IPL gathers, the utility and the Board will not know whether the participants shift their loads off the IPL system and equipment peaks or onto those peaks.[16]

Q: Why should IPL identify goals for its rate experiments?

A: In order to determine whether a change in rate design works, the utility must know what it means by "works." Mr. Vognsen does not specify any particular purpose for the pilot programs, and IPL's discovery responses (e.g., IPL Response to EI DR 22, 23, 48 and 49, attached as Ex. PC-2) indicate that the Company is not planning on collecting any data on participant load shapes, so it is not clear why IPL is undertaking these experiments. Is the objective to reduce IPL's load coincident with the MISO peak load, the LRZ-3 peak load, or something else? Is the objective to reduce peak loads on transmission lines, substations, feeders, line transformers, or other equipment? Or is IPL's objective solely to determine whether customers will tolerate legacy demand charges, which will tend to increase energy use, and

[16] This situation may change. "IPL is evaluating the potential of utilizing the Peakmap customer portal, which can provide customer hourly interval demand data for historical billing months." (EI DR 45d, attached as Ex. PC-3.) It is not clear whether IPL has those customer-specific hourly interval demand data for historical periods, or whether IPL is considering adding metering equipment to collect these values in the future (and if the latter, which customers would get that metering).

increase coincident peak loads and loadings on transmission and distribution equipment?[17]

If IPL had identified specific goals for its rate experiments, it would be possible to determine what information would need to be gathered to assess the effectiveness and cost-effectiveness of the experimental rates.

Q: What information has IPL indicated it will use to measure the effects of the experimental rate designs?

A: IPL apparently only plans to collect energy and monthly demand values from the participants.[18] IPL says that the "complete list and description of all data to be collected under the proposed demand rate pilots" consists of "the billing determinants associated with these customers" and "experience surveys" (Ex. PC-2).[19]

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[17] Demand charges have also been proposed to increase revenue recovery from solar customers, by assessing the demand charge in low-solar off-peak hours. Given IPL's proposal to inappropriately allocate demand-related costs to newly defined classes of customers with solar generation, the demand-rate pilots may represent an attempt to impose similar charges on individual customers through rate design.

[18] Since IPL is not clear whether it will be applying time-of-use differentials to all pilot-rate participants, it is possible that some or all participants' bills will show peak and off-peak maximum non-coincident demands, and peak and off-peak energy consumption.

[19] IPL's lack of plans to assess the effects of the rate-design pilots are further confirmed by EI DRs 23 and 49 (Ex. PC-2).

Q: Will these limited data provide any insight into the effect of the rate design on customer contribution to IPL generation requirements, loads on its transmission and distribution equipment or cost reduction?

A: No. As currently described, the IPL rate experiments will not provide any useful information, other than possibly whether the demand rates encourage customers to increase energy usage.

VI. ALTERNATIVE PEAK-ORIENTED RATE DESIGN PILOTS

Q: What approaches might IPL take to develop more appropriate pilot rate designs that would encourage reduction of usage in the hours that drive the utility's costs?

A: While IPL has proposed to implement rates using archaic demand charges, it has many superior alternatives, including the following:

- A "demand charge" based on the customer's average demand in the hours that are expected to contribute the most to demand-related costs, including contribution to MISO peaks, other important system peaks, and maximum loads on pieces of the transmission and distribution equipment. Those hours would be known in advance, so customers could plan to shift load on a regular basis. This approach would require two-period meters, but not demand meters.
- A "demand charge" based on the customer's average demand in IPL's actual peak hours, perhaps defined as hours with loads over 2,000 MW, or over 90% of the expected peak load for the month. Customers would not know far in advance when those conditions would occur, but IPL could publicize when load is approaching the threshold, by radio, email, text message, robocall, or other methods. This approach would require some sort of recording meters.

- A simple TOU rate would have a differential between peak and off-peak rates, reflecting the expected differences in generation-capacity costs, marginal energy prices and the portion of transmission lines, substations, feeders and line transformers peaking in each period. The time periods and the rates would likely differ among seasons. This approach would require two-period TOU meters, but not demand meters.
- A more sophisticated TOU rate might use three periods, with a portion of generation costs representing the costs of meeting peak loads (and not collected through the marginal energy prices) recovered through a super-peak charge in the summer months, probably between 1 PM and 8 PM. This approach would require three-period TOU meters, but not demand meters.
- A dynamic peak pricing (DPP) approach would vary the times and/or prices of the super-peak hours, increasing the price to a very high level in the anticipated peak hours when extreme loads or marginal energy costs are expected the prior day. These rates have been used by a number of utilities. This approach would require recording meters that either track consumption by hour, or that can respond to utility signals to switch on measurement of usage in the super peak.
- A variation on the DPP approach is the Peak Time Rebate (PTR), which uses credits, rather than high prices to influence customer behavior. Like the DPP, the critical hours are identified the previous day. But rather than paying 50¢ or $1/kWh in the critical peak period, customers receive rebates of that magnitude for any reduction from their typical usage in the critical period. In many PTR applications, customers are not penalized for higher consumption in the critical hours, and customers can be enrolled automatically without facing any additional costs. The metering requirements are similar to the DPP

rates, but customers are more comfortable with rewards than penalties. There are trade-offs between these three approaches, but any of them can provide better price signals than IPL's proposed demand rates.

Q: How should IPL design those time-varying energy rates?

A: There isn't enough information available in the record of this proceeding for me to make very specific recommendations. The information that should be examined include:

- system load shapes;
- time of peak or near-peak loads on transmission lines, substations and distribution feeders;
- marginal energy costs by month and hour;
- loads and energy costs on weekends;
- costs of transmission lines, substations and distribution feeders; and
- fixed costs of generation.

I recommend that the Board reject IPL's optional demand rates and instruct IPL to convene a stakeholder consultation, to review these data and devise one or more experimental rate designs for the Residential and GS classes.

Q: Does this conclude your direct testimony?

A: Yes.

STATE OF MASSACHUSETTS)
)
COUNTY OF MIDDLESEX)

I, Paul Chernick, being first duly sworn on oath, state that I am the same Paul Chernick identified in the testimony being filed with this affidavit, that I have caused the testimony and exhibits to be prepared and am familiar with its contents, and that the testimony and exhibits is true and correct to the best of my knowledge and belief as of the date of this affidavit.

/s/ Paul Chernick

Paul Chernick

Subscribed and sworn to before me this 31st day of July, 2017.

/s/ Dianne J. DeMarco

Notary Public in and for the State of Massachusetts