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REBUTTAL TESTIMONY OF

ERIC W. GRAESSLEY, MICHAEL R. LINN, AND JAMES H. VANDEN BOS
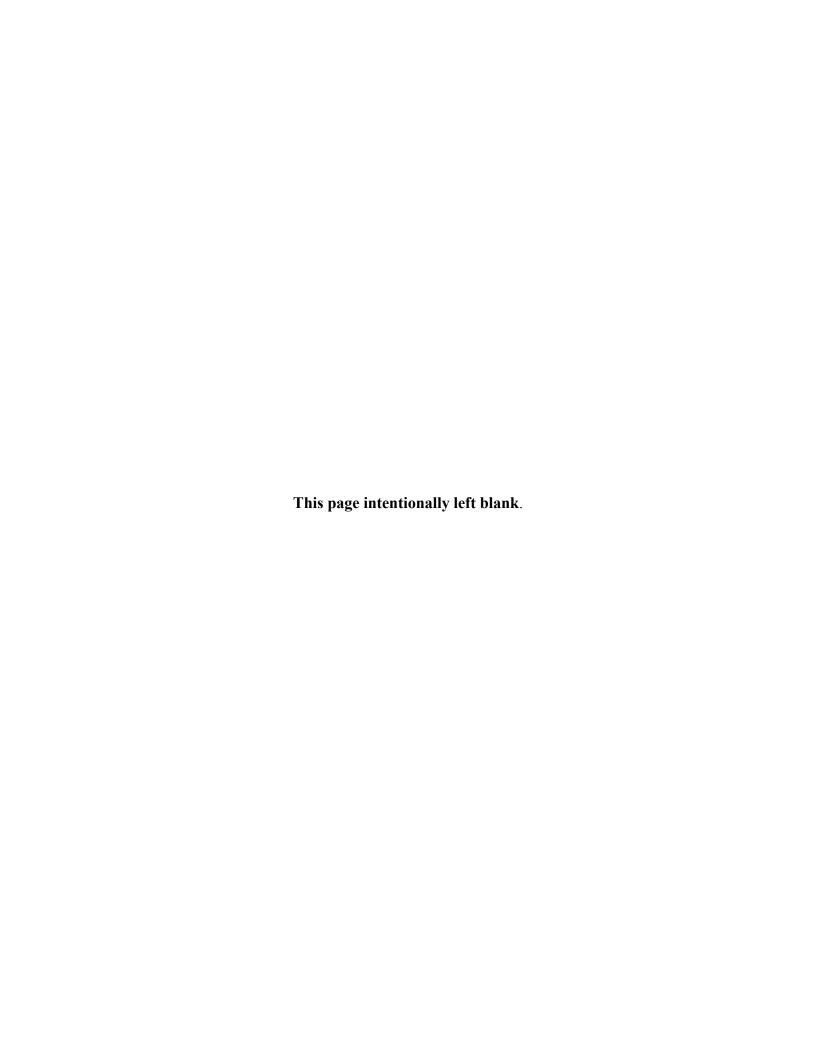
Witnesses for Bonneville Power Administration

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2	ERIC W. GRAESSLEY, MICHAEL R. LINN, AND JAMES H. VANDEN BOS
3	
4	**SUBJECT: SOUTHERN INTERTIE HOURLY RATE: RESPONSE TO ECONOMIC**
5	**ANALYSIS OF JOINT PARTY 1**
6	
7	**Section 1: Introduction and Purpose of Testimony**
8	Q. *Please state your names and qualifications.*
9	A. My name is Eric W. Graessley, and my qualifications are contained in BP-20-Q-BPA-13.
10	A. My name is Michael R. Linn, and my qualifications are contained in BP-20-Q-BPA-24.
11	A. My name is James H. Vanden Bos, and my qualifications are contained in
12	BP-20-Q-BPA-39.
13	Q. *What is the purpose of your testimony?*
14	A. The purpose of this testimony is to address Joint Party 1's (JP01) testimony (Parker &
15	Peters, BP-20-E-JP01-02) concerning its economic analysis of alleged effects on
16	electricity prices from the BP-18 rate for hourly transmission service[1] on the Southern
17	Intertie. JP01 consists of the Sacramento Municipal Utility District (SMUD), the Turlock
18	Irrigation District (TID), and the Transmission Agency of Northern California (TANC).
19	According to JP01, its economic analysis examined whether the BP-18 increase in
20	the Southern Intertie hourly rate depressed energy prices in the Pacific Northwest at the
21	Mid-C trading hub during Fiscal Year (FY) 2018. Parker & Peters, BP-20-E-JP01-02,
22	at 2. JP01 performed this economic analysis by first developing an expectation of
23	impacts on prices and flows using simplistic economic theory, and then attempted to use
24	regression analysis to support its expectations.

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[1] For simplicity, throughout this testimony we will refer to it as the "hourly rate."

1	*Q.*	*Please summarize JP01's overall contentions regarding impacts of the increase in BPA's*
2		*hourly rate on Pacific Northwest (PNW) electricity prices and flows.*
3	A.	JP01 argues that the change in the hourly rate is effectively a tax, or "barrier to trade," on
4		exports from the PNW. *Id.* at 1-4. JP01 reasons that such a trade barrier will tend to
5		reduce interregional flows of energy from the PNW to California and depress prices at
6		key PNW electric trading hubs, and JP01 provides econometric analysis that it claims
7		demonstrates such impacts occurred in FY 2018. *Id.* at 3-4; Parker & Peters, BP-20-E-
8		JP01-02-AT04.
9	*Q.*	*How is your testimony organized?*
10	A.	We first demonstrate why JP01's economic theory is incorrect about the hourly rate
11		constituting a "barrier to trade." We then devote the bulk of our testimony to discussing
12		fatal flaws in JP01's econometric analysis. We explain that 10 out of 12 of JP01's
13		regressions *support* BPA's price and flow expectations and the remaining two regressions
14		have numerous fundamental flaws. We conclude that JP01's analysis is highly unreliable
15		and not probative.
16		

Section 2: JP01's Economic Theory Regarding Barrier To Trade

18	*Q.*	*JP01 contends that the change in the hourly rates is effectively a "barrier to trade" on*
19		*exports from the PNW. Parker & Peters, BP-20-E-JP01-02, at 1-4. What is the*
20		*relationship between this theory and JP01's economic analysis?*
21	A.	This theory is the fundamental premise underlying JP01's economic analysis; that is, the
22		economic regression analysis is intended to analyze this theory and demonstrate its
23		alleged impact. *See id.* at 3 ("we explain the economic theory that helps analyze the
24		effects of tariffs, taxes . . . : barriers to trade"), 7 ("[t]he analysis shown here looks at two
25		years of data on actual daily prices and volumes . . . to isolate the impact of the 2017 rate
26		increase on market outcomes.").

1	Q.	*Do you agree with JP01's barrier to trade theory?*
2	A.	No. It is a fundamental mischaracterization of the hourly rate increase, for two reasons.
3		First, JP01 ignores the fact that there are various other transmission products available to
4		move power out of the PNW. Because JP01 has ignored the existence of these substitute
5		goods, JP01 has not established that the hourly rate is a barrier to trade.
6	Q.	*What are the problems with ignoring the substitute goods?*
7	A.	Because there are other transmission products (*i.e.*, substitute goods) available that satisfy
8		the need to export power from the PNW, JP01 is incorrect in its presumption that *every*
9		*unit* of energy flowing over the lines is subject to the hourly rate's increase in cost and
10		that there is no alternative product available. Thus, when JP01 provides the simple
11		graphical representation of supply and demand equilibrium (*see* Parker & Peters, BP-20-
12		E-JP01-02, at 5, Charts 1 & 2), it creates the illusion of the entire electricity market
13		shifting because of the change to the hourly rate. In reality, those supply and demand
14		graphs only represent the market for BPA's hourly transmission product, not the market
15		for exports as a whole.
16	Q.	*What would be the result if JP01 had not ignored the fact that there are other*
17		*transmission products (substitute goods) available to move energy from the PNW to*
18		*California?*
19	A.	If JP01 had properly included graphs representing the other products, such graphs would
20		need to show an increase in the quantity exported to California. This is because the
21		relative price difference between the hourly transmission product and the other products
22		would have decreased, encouraging a heavier usage of the other products. This
23		corresponding increase in exports, which should be expected in accordance with
24		economic theory, debunks JP01's theory that the quantity of energy in the PNW must
25		increase and, therefore, prices must fall.
26		

1	Q.	*What is the second problem with JP01's barrier to trade theory?*
2	A.	JP01 ignores the fact that BPA's hourly rate increase applies only to a very small portion
3		(1.4 percent) of transmission usage on the Southern Intertie. Because the hourly rate
4		applies to such a small amount of transmission, JP01 vastly overstates any potential
5		"barrier" effect on energy flows from the PNW to California.
6	Q.	*Because JP01's "barrier to trade" theory is incorrect, what does that mean for JP01's*
7		*overall economic analysis?*
8	A.	JP01 is relying on its barrier to trade theory to support its claims that the quantity of
9		energy exported from the PNW to California will be reduced, thereby increasing the
10		quantity of energy in the PNW and decreasing prices. Since JP01 has not shown that the
11		hourly rate acts as a barrier to trade, the analysis of that theory proves nothing.
12	Q.	*JP01 argues that economic theory and statements made by BPA itself demonstrate that*
13		*"there is no question that the 2017 increase in the transmission rate depressed spot*
14		*market energy prices at the Mid-C hub; the only question that remains is the size of the*
15		*reduction in Mid-C energy prices . . . ." Parker & Peters, BP-20-E-JP01-02, at 1-2.*
16		*Do you agree?*
17	A.	No. JP01 attempts to misuse general statements made by BPA (that increases in
18		wheeling rates between the PNW and California should tend to depress Mid-C prices,
19		holding everything else constant, *see* Attachment 1, BP-20-E-BPA-25-AT01, at 1 (Data
20		Response JP01-BPA-28-53)) as evidence supporting JP01's claim that the only remaining
21		question is the *size* of the impacts because all parties presumably agree on the expected
22		*direction* of change.
23		BPA's general statement was made in the context of the AURORA® production
24		cost model. In this context, wheeling rates are intended to reflect the marginal costs of
25		using an expected mix of transmission products on the relevant transmission lines. The
26		increase in BPA's hourly rate should shift reliance in favor of other transmission products

1	on the Southern Intertie, so the key question becomes: how does the hourly rate increase
2	affect expected wheeling costs (marginal cost of the new mix of transmission products)
3	on the Southern Intertie?
4	The marginal cost of using long-term transmission products tends to be zero or
5	near zero, so to the extent the hourly rate increase results in more long-term transmission
6	products being on the margin, the rate increase could *reduce* wheeling rates on the
7	Southern Intertie. This would have the effect of *lowering* barriers to trade, and it would
8	be reasonable to expect increasing flows from the PNW to California, and therefore
9	increasing Mid-C prices.
10	Q. *Are there any other important discrepancies in JP01's analysis that demonstrate why its*
11	*"barrier to trade" theory is wrong?*
12	A. Yes. The theory conflicts with JP01's regression analysis (even if that analysis were
13	sound, which, as discussed below, it is not). Simply stated, JP01 argues that the hourly
14	rate increase and associated change in quantity of exports should *cause* Mid-C prices to
15	decline. However, JP01's regression analysis concluded that there were no significant
16	changes in flows, Parker & Peters, BP-20-E-JP01-02, at 14, and its "barrier to trade"
17	theory completely fails to explain how Mid-C prices would decline without any
18	meaningful changes in export flows.
19	
20	**Section 3: JP01's Econometric Analysis and Fundamentally Flawed Regressions**
21	Q. *Setting aside the fact that JP01's "barrier to trade" theory is unsound, what type of*
22	*analysis did JP01 perform to analyze the effects of that theory?*
23	A. JP01 performed 12 regression analyses, which JP01 believes demonstrate that BPA's
24	price and flow expectations were wrong.
25	
26	

1	*Q.* *Do the regressions support this claim?*
2	A. No. By JP01's own admission, 10 of the 12 regressions showed that the hourly rate
3	increase had impacts on flows and prices that were either statistically indistinguishable
4	from zero or were so small as to have no economic significance. Parker & Peters, BP-20-
5	E-JP01-02, at 14. In other words, 10 of the 12 regressions JP01 ran *support* BPA's stated
6	price and flow expectations, to the extent the regressions were valid.**2**
7	The two regressions that show statistically meaningful, negative price impacts at
8	the Mid-C hub each fail to establish basic, fundamental economic relationships of
9	electricity markets. They also suffer from numerous statistical errors. Consequently,
10	these regressions fail to provide reasonable support for JP01's claims. We will devote
11	the remainder of our testimony to explaining the fatal flaws in the regressions. We
12	note that many, if not all, of the flaws explained in this section also apply to the other
13	10 regressions JP01 ran, but BPA will not address those 10 regressions because, as JP01
14	acknowledges, they failed to demonstrate meaningful impacts.
15	
16	**Section 3.1: Fatal Flaws with JP01's Mid-C Price Regressions**
17	*Q.* *What is a regression analysis?*
18	A. A regression analysis is a way to provide valuable insights into relationships between
19	variables.
20	*Q.* *Please explain how.*
21	A. A basic regression evaluates relationships between changes in explanatory variables and
22	changes in a dependent variable. Typically, the regression is employed on a sample of
23	data, and the intent is to enable statistical inference concerning a broader set of data.
24	

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[2] A more statistically precise interpretation would be that JP01's regressions fail to provide evidence against BPA's expectation that the hourly rate increase would have insignificant impacts on prices and flows.

1		A well-constructed regression should be able to estimate the individual effects of
2		changing one explanatory variable on the dependent variable, in terms of direction of
3		change, magnitude of change, and statistical confidence about the relationship, holding
4		all other variables constant. JP01 claims to have created a reasonable regression that
5		explains changes in Mid-C prices and reasonably estimates the individual effects of
6		changing the hourly rate on Mid-C prices, holding all other variables constant.
7	Q.	*What is the overarching problem with JP01's regression models of Mid-C prices?*
8	A.	JP01's regression models are grossly misspecified (see definition below). As a result, the
9		regression models do not support the claim JP01 has made, namely, that the change in
10		southern intertie rates caused substantial declines in Mid-C prices.
11	Q.	*What is misspecification, and what are the general effects of misspecification on*
12		*regressions?*
13	A.	In the context of standard regressions, model misspecification occurs, among other
14		situations, when important variables have been omitted, irrelevant variables have been
15		included, or inappropriate functional forms have been applied to the variables. The
16		impacts can vary depending on the type and degree of misspecification. When important
17		explanatory variables are omitted (Omitted Variable Bias or OVB), such as omitting
18		relevant natural gas prices (as JP01 has done) when attempting to explain changes to
19		electricity prices, the resulting estimates of the coefficients on the remaining variables
20		can become biased, potentially distorting estimates of key relationships, thereby
21		invalidating any meaningful inference.
22		Other kinds of misspecification, such as including irrelevant variables or too
23		many variables that are highly correlated with one another (as JP01 has done), can affect
24		model variance and estimates of statistical significance of the relationships between
25		explanatory variables and the dependent variable. Depending on severity, these too can
26		invalidate or distort model results.

1	*Q.*	*What indicates that JP01's models are misspecified?*
2	A.	The most straightforward demonstration that JP01's Mid-C price regressions are
3		misspecified is that they fail to capture basic relationships between changes in
4		fundamental drivers (such as loads and natural gas prices) and changes in Mid-C prices.
5	*Q.*	*Please explain.*
6	A.	JP01's regressions on Mid-C prices suggest that increases in PNW loads of *any*
7		magnitude will have *no* significant impact on prices. *See* Parker & Peters, BP-20-E-
8		JP01-02-AT04. To be clear, JP01 omits explicit PNW loads in its regression, but
9		includes the "midctemperature" variable that captures major PNW load centers' absolute
10		values of temperature departures from mild temperatures—JP01 appears to be using it as
11		a proxy for PNW loads. However, JP01's load proxy variable lacks statistical
12		significance, and therefore the models should be interpreted as suggesting that PNW
13		loads do not have meaningful (different from zero) impacts on Mid-C prices.

Another straightforward indication that JP01's Mid-C price regressions are misspecified is the fact that JP01's regressions on Mid-C prices imply that changes in natural gas prices (at either the national benchmark, *i.e.*, the "henryhub" variable, or the local level, *i.e.*, by virtue of omitting Stanfield and Sumas gas prices from its models, *see* Section 3.1.2 on gas prices below) will have no meaningful impact on Mid-C prices.

A correctly specified model should be able to detect the relationships between loads and electricity prices and natural gas prices and electricity prices. Both variables should have positive coefficients (indicating that higher loads and higher gas prices are correlated with higher electricity prices) and statistical significance.

JP01's findings (that changes in Henry Hub gas prices, local gas prices, and/or loads will have no meaningful impact on Mid-C prices) are wholly inconsistent with the basic understanding of common drivers of electricity market prices, and demonstrate that

1	JP01's models cannot reasonably explain changes in Mid-C prices, and therefore fail to
2	support JP01's claims.
3	Q. *Apart from these indicators that JP01's regressions are misspecified, can you identify*
4	*any of the actual misspecifications?*
5	A. Yes. There are many misspecifications with JP01's regressions; however, we will limit
6	our discussion to the key misspecifications, which fall into two categories. First, the
7	main dummy variable that JP01 relies on to represent the impacts of the rate increase is in
8	actuality a representation of the intertwined, cumulative impacts of *all* FY 2018 changes.
9	Second, JP01's models are misspecified because they omit PNW gas price hubs.
10	We will discuss these problems in the following sections. As JP01 notes, a
11	regression can only reasonably explain variation and isolate impacts "by careful
12	statistical analysis that controls for the effects of other changes in the relevant market."
13	Parker & Peters, BP-20-E-JP01-02, at 7. JP01's regressions have failed to achieve this
14	level of rigor.
15	
16	**Section 3.1.1: Fatal Flaws with JP01's Transmission Rate Dummy Variable**
17	Q. *What is the primary dummy variable in JP01's Mid-C price regressions?*
18	A. The core of JP01's econometric analysis revolves around a dummy variable. JP01
19	misleadingly claims this variable represents the change to BPA's hourly transmission
20	rate, and labels it "bpahourlytransmission rate." Thus, the variable supposedly provides
21	the sole evidence to support JP01's assertion that the hourly rate increase impacted
22	Mid-C prices.
23	However, the actual impact of a dummy variable in a regression is to pick up the
24	influence of *any* event (that is not explicitly included in the regression) that occurs
25	differently before and after the date of the change in the dummy variable. JP01's dummy
26	variable has the same value for every date prior to October 1, 2017, and a different value

1		for every date from October 1, 2017, and onward. Therefore, a more accurate and
2		transparent name for JP01's dummy variable would have been "Fiscal Year 2018
3		Effects."
4		This would properly indicate that JP01's dummy variable is influenced by all
5		kinds of things that happened in FY 2018. Anything that was not captured in the actual
6		data of the other explanatory variables in the regression had an influence on JP01's
7		dummy variable.
8	Q.	*Please discuss JP01's second dummy variable and how it illustrates that JP01 is*
9		*misusing its first dummy variable.*
10	A.	JP01 witnesses developed a second dummy variable for a major event that occurred
11		during the timeframe of its analysis. On October 1, 2017, the same date as the
12		implementation of BPA's transmission rate increase, Portland General Electric (PGE)
13		joined the Western Energy Imbalance Market (EIM). A PGE dummy variable is listed in
14		JP01's data set, shown in Parker & Peters, BP-20-E-JP01-02-AT03, at 7. Both of these
15		dummy variables developed by JP01, one labeled as BPA's transmission rate, and the
16		other as PGE entering the EIM, served essentially the exact same function. If the
17		variable labeled PGE entering the EIM had been left in the regression instead of the one
18		labeled BPA's transmission rate, the interpretation of the results would have been exactly
19		the same, except for attributing the impact associated with the dummy variable to PGE's
20		action (entering the EIM) instead of BPA's action (the hourly rate increase).
21		This is because such a dummy variable, regardless of the text used to label it,
22		captures the impacts of both events, and more. In JP01's model, it is not possible to
23		disentangle the impacts of one event from the other. Thus, it is patently false when JP01
24		attempts to claim its first dummy variable represents BPA's hourly rate increase, and that
25		the significance of the variable, the direction of the change, and the magnitude of the
26		change, are all solely attributable to BPA's hourly rate increase.

1	*Q.*	*What conclusion do you draw from examining JP01's dummy variables?*
2	A.	The crux of JP01's claims about the impacts of BPA's hourly rate increase on Mid-C
3		prices is based on a false premise. Whenever a reader comes across JP01 making a claim
4		about its analysis, whenever JP01 speaks to its variable representing the "BPA
5		transmission rate increase," the reader should interpret that variable as "the intertwined,
6		cumulative, and joint impacts of BPA's transmission rate increase, PGE joining the EIM,
7		and the influence of every other thing that happened in FY 2018 that was not explicitly
8		included in one of the other input variables." Thus, JP01's regression analysis cannot be
9		used to generate any credible inference about the impacts of BPA changing its hourly
10		rate.
11	*Q.*	*How do the problems with JP01's dummy variable impact JP01's ultimate conclusion?*
12	A.	In Parker & Peters, BP-20-E-JP01-02, at 13, the JP01 witnesses conclude, "[t]he 2017
13		BPA transmission rate increase caused price reductions at the Mid-C hub: $7.87/MWh in
14		the day-ahead market and $5.18/MWh in the real-time market. These price reductions
15		are statistically significant at the 95 percent confidence levels, respectively." This
16		statement is not credible. Given the intertwined events represented within JP01's dummy
17		variable, the corrected way to read JP01's statement is "some combination of the 2017
18		BPA transmission rate increase, PGE joining the EIM, and a multitude of other
19		uncontrolled events and/or changes that occurred in FY 2018, caused price reductions at
20		the Mid-C hub: $7.87/MWh in the day-ahead market and $5.18/MWh in the real-time
21		market. It is not possible, using our [JP01's] regressions, to determine which of these
22		events may have applied upward or downward pressure on the Mid-C price, or what their
23		respective magnitudes may have been. These price reductions are statistically significant
24		at the 95 percent confidence levels, respectively."
25		
26		

| 1 | Q. | *Are there any other issues with JP01's data or events whose influence BPA believes* |
| | | *could have been inappropriately attributed to JP01's dummy variable?* |

1   Q.   *Are there any other issues with JP01's data or events whose influence BPA believes*

2   *could have been inappropriately attributed to JP01's dummy variable?*

3   A.   Yes. The variable 'midcwindsolaretc' included in JP01's regression analysis is a sum of

4   hydro, wind, nuclear, and thermal generation in the BPA balancing authority area (BAA).

5   During FY 2018, after BPA's hourly rate increase went into effect, roughly 2000 MW of

6   wind capacity, as well as the Centralia coal plant, left the BPA BAA. When these plants

7   left the BPA BAA, their generation was removed from the data JP01 relied on. But while

8   the output of the generators was no longer included in the data set, *the actual output of*

9   *the plants continued to affect the Mid-C price*. Therefore, JP01's reliance solely on

10   BPA's generation data significantly biased JP01's analysis because the analysis does not

11   appear to control for the large change in resources that are included in the data. JP01's

12   reliance on incomplete data biases its analysis and applies inappropriate downward

13   pressure on the "bpahourlytransmission rate" dummy variable's coefficient, at the very

14   least making the impact of the rate increase look larger than it should.

15   Q.   *Is there anything else BPA expects might be influencing JP01's dummy variable?*

16   A.   Yes. JP01's Mid-C regression for hour-ahead prices has an R-squared value of only

17   0.430, and the day-ahead fares even worse, at 0.189. This means that the explanatory

18   variables included in the regressions could not explain 57 percent and 81.1 percent of the

19   variation in Mid-C prices, respectively. If any of the things causing the unexplained

20   variation in Mid-C prices were at all correlated with the passage of time, or FY 2018,

21   they could also be influencing JP01's dummy variable.

22   When considering these things all together—PGE joining the EIM, large amounts

23   of generation disappearing from JP01's data, and the high amounts of unexplained

24   variation in Mid-C prices resulting in low R-squared values—it becomes impossible to

25   make credible claims that JP01's 'bpahourlytransmission rate' dummy variable provides

26   any useful information on the actual impact of BPA's change in hourly rate.

1	Q.	*Can you provide an example of what happens to the 'bpahourlytransmission rate' dummy*
2		*variable when important explanatory variables that JP01 has omitted are included in its*
3		*regressions on Mid-C prices?*
4	A.	The impacts will depend on the variable. To illustrate potential impacts of including
5		missing explanatory variables, BPA has replicated JP01's Mid-C price regressions and
6		added monthly dummy variables to better capture the impacts of seasonality. *See*
7		Attachment 2, BP-20-E-BPA-25-AT02. Changes in season drive changes in hydro
8		generation, wind and solar generation, natural gas consumption and prices, as well as
9		loads through temperature and economic activity. These are widely considered primary
10		determinants of electricity prices. Explicitly adding variables for seasonality better
11		captures any remaining seasonality effects that were previously omitted from the
12		regressions. After including the monthly dummy variables, the sign of JP01's
13		"bpahourlytransmission rate" variable completely reverses and loses statistical
14		significance. In other words, after better accounting for seasonality, JP01's regressions
15		and variable interpretation suggest that the hourly rate increase did not have meaningful
16		impacts on Mid-C prices, either in day-ahead or real-time markets.
17		
18	**Section 3.1.2: The Omission of PNW Gas Prices**	
19	Q.	*Aside from the misspecification caused by problems with the dummy variable, what is the*
20		*other major misspecification of JP01's regression analysis?*
21	A.	JP01's Mid-C price regressions are missing other crucial explanatory variables. Namely,
22		PNW gas prices are not included as explanatory variables. *See* Parker & Peters, BP-20-
23		E-JP01-02-AT04.
24	Q.	*Is the price of natural gas a significant driver of electricity prices?*
25	A.	Yes. As explained in the Power Market Price Study and Documentation, BP-20-E-
26		BPA-04, Section 2.3.1, the price of natural gas is the primary driver of the marginal cost

1		of generation from natural gas power plants. Also, natural gas power plants are
2		frequently the marginal resource in the PNW, and so they frequently set the marginal cost
3		of electricity. Accordingly, the price of natural gas has a significant impact on electricity
4		prices. No rate case parties have disputed this relationship in the BP-20 rate case, and
5		JP01 also acknowledges that the natural gas price is a "relevant exogenous variable" in
6		the determination of the price of electricity. Parker & Peters, BP-20-E-JP01-02, at 8.
7	Q.	*Which gas prices would you expect to exert the most influence over Mid-C electricity*
8		*prices?*
9	A.	Sumas and Stanfield would be expected to exert the most influence. Considering natural
10		gas is a physical commodity that must be physically delivered to its source of demand to
11		be used, the prices of acquiring or selling natural gas at trading hubs in close physical
12		proximity to a natural gas power plant should tend to be the gas prices with the most
13		influence over the cost of the power plant's electricity. Gas plants near the Sumas and
14		Stanfield natural gas hubs are those most likely to be marketing power and setting prices
15		at the Mid-C electricity trading hub.
16	Q.	*Did JP01's Mid-C price regressions include Stanfield or Sumas gas prices?*
17	A.	No. *See* Fredrickson & Linn, Attachment 4, BP-20-E-BPA-22-AT04, at 21 (Data
18		Response BPA-JP01-28-38). Although JP01 developed multiple data sets for gas prices
19		(from hubs including Henry Hub, Stanfield, Kingsgate, Needles, Malin, and PG&E City
20		Gate) in the code for its regression analysis, ostensibly for use in its regressions as
21		explanatory variables for electricity prices, JP01 did not use the data set that included
22		Stanfield in its regressions. JP01 also did not develop a data set for Sumas.
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1	Q.	*Why would JP01 exclude the natural gas trading hubs that are expected to be most*
2		*strongly associated with Mid-C electricity prices when attempting to construct a*
3		*regression explaining variation in Mid-C prices?*
4	A.	This is unclear. In JP01's response to BPA's data request BPA-JP01-28-25, regarding
5		the impact of omitting statistically significant explanatory variables, JP01 asserts that
6		"witnesses for JP01-02 did not include, discover, and then deliberately or inadvertently
7		exclude statistically significant explanatory variables . . . ." *See* Attachment 1, BP-20-E-
8		BPA-25-AT01, at 3. Similarly, JP01 stated, in response to BPA's data request BPA-
9		JP01-28-39, that it "did not eliminate statistically insignificant variables, individually,
10		sequentially, or collectively, and then re-estimate the equations in order to reach any
11		conclusions about the final functional forms . . . ." Fredrickson & Linn, Attachment 4,
12		BP-20-E-BPA-22-AT04, at 22. By this line of reasoning, because PNW gas prices were
13		not included in the regressions supplied along with JP01's direct case, the implication is
14		that JP01 did not even test Stanfield or Sumas prices in its regressions. Omitting these
15		variables fundamentally compromises both JP01's model and its results.
16	Q.	*Why is it a problem that JP01 did not include a PNW gas hub like Stanfield or Sumas?*
17	A.	As described above, this introduces OVB. By not including a PNW gas hub, JP01 is
18		omitting a fundamental input in the explanation of Mid-C electricity prices.
19		Consequently, the regressions used by JP01 appear to have improperly assigned some of
20		the explanatory power of the omitted variable to the variables that JP01 included in the
21		regressions.
22	Q.	*Absent PNW prices, does JP01 establish any credible link between gas prices and*
23		*electricity prices?*
24	A.	Not with any consistency. Across its six regressions that predict prices, where each
25		regression included three variables representing natural gas prices (Henry Hub prices,
26		Northern California prices, and Southern California prices) for a total of eighteen chances

1   to establish a statistically significant correlation between natural gas prices and electricity

2   prices, JP01's models only did so three times. Even then, one of those times was for

3   Henry Hub, and the coefficient was the opposite of what economic intuition would

4   expect, implying that as gas prices went up, electricity prices fell.

5   This result regarding Henry Hub is particularly troublesome. In every one of

6   JP01's price regressions, Henry Hub had a negative coefficient, indicating an inverse

7   relationship between the national benchmark natural gas price and west coast electricity

8   prices. This is another case of JP01's models misrepresenting an important relationship

9   in the formation of electricity prices. All else being equal, the expectation, based on a

10   fundamental knowledge of natural gas and electricity markets, is that Henry Hub prices

11   should be positively correlated with any electricity hub's price in the United States.

12   While the negative relationship shown in JP01's models is statistically significant in only

13   one case, an analyst would expect the relationship, even if not statistically significant, to

14   at least show the proper direction in terms of predicted impact. The consistently

15   backward interpretation of the link between Henry Hub prices and Mid-C prices is

16   another indication that JP01's models are performing poorly, and this should cast doubt

17   on the models' results, and any attempt to interpret them.

18   If JP01's regressions cannot establish one of the central relationships in the

19   formation of electricity prices (*i.e.*, the strong link between natural gas prices and

20   electricity prices), then the specification of JP01's regression is likely fundamentally

21   flawed, and its results do not have inferential value.

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1	**Section 3.2: Other Problems with JP01's Mid-C Price Regressions**
2	*Q. Beyond the fatal flaws with JP01's regressions, discussed above in Section 3.1, are there*
3	*other problems with the variables JP01 has included that could contribute to the model*
4	*being misspecified?*
5	A. Yes. The dependent variable is limited to Electric Quarterly Report (EQR) data, not
6	Mid-C prices. This introduces measurement error and limits inferential value of the
7	regression.
8	As mentioned earlier, JP01's regressions use temperature as a proxy for loads;
9	this also introduces measurement error in regard to the true variable (load) that impacts
10	Mid-C prices.
11	Additional errors in JP01's data include counting water flows at The Dalles twice
12	in its regressions (once in the "midhydroflowsdalles" variable and once in the
13	"np15hydroflowsdalles" variable) and failing to account for spill amounts or fish
14	operations in its water flow variables for The Dalles.
15	*Q. Do the statistical tests JP01 ran for heteroskedasticity or autocorrelation demonstrate*
16	*that the regressions are correctly specified?*
17	A. No. Heteroskedasticity tests for normality in a regression's error terms, while
18	autocorrelation tests for correlation between error terms—but neither of these tests prove
19	that the model is correctly specified. An incorrectly specified model, with serious errors
20	in its data, will not provide any insight even if it passes tests for heteroskedasticity or
21	autocorrelation.
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Section 4:   EQR Data and BPA's Market Price Forecast

Q.   *JP01 implies that BPA should use "actual transaction data to calibrate, validate, or*

        adjust its own spot market price forecast." Peters, BP-20-E-JP01-01, at 38. Please

        respond.

A.   BPA does use actual transaction data to validate and adjust its market price forecast.

        Specifically, BPA Staff evaluates the market price forecasts in terms of monthly diurnal

        and hourly Mid-C prices (and other relevant electric hub prices) using industry standard

        price indices,[3] which contain actual transaction data.

Q.   *JP01 asserts it is not reasonable for BPA to "omit EQR hourly prices in the construction*

        of the price forecast." Peters, BP-20-E-JP01-01, at 38. Please respond.

A.   It is entirely unclear what JP01 means when it asserts that BPA should use EQR hourly

        prices "in the construction of" the price forecast. *Id*. JP01 offers no explanation of how

        it believes such data should be included in the price forecast. JP01 merely states that

        "EQRs are publically available information about actual market outcomes, and contain

        detailed information on hourly transactions." *Id*. Be that as it may, EQR data is not an

        input in industry-standard market price forecasts.

                In our experience, when market participants construct electric market price

        forecasts they do not include EQR hourly prices. By JP01's reasoning, all of these

        forecasts would be unreasonable. Yet, such forecasts are industry-standard, and utilities

        routinely rely on them.

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[3] Including Mid-C ICE and Powerdex. BPA also examines market prices from CAISO (such as NP15 and SP15), which reflect actual market clearing prices.

1	*Q.*	*JP01 argues that BPA does not use EQR data in its market price forecast because BPA*
2		*assumes that the 2017 rate increase would have no "meaningful" impacts. Peters,*
3		*BP-20-E-JP01-01, at 38. Is this accurate?*
4	A.	No. BPA's practice of evaluating the market price forecast using industry-standard
5		market prices indices rather than EQR data is based primarily on the purpose of the
6		market price forecast—forecasting market prices. BPA has pointed out other flaws with
7		relying on EQR data (*e.g.,* delayed data release, blending transactions across markets and
8		transactions, differences in entity reporting, *etc*.; *see* Fredrickson & Linn, BP-20-E-
9		BPA-22, at 19-21).
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11	**Section 5:**	**Conclusions**
12	*Q.*	*What have you concluded regarding JP01's economic theory that the hourly rate acts as*
13		*a "barrier to trade"?*
14	A.	JP01 has not established that the hourly rate is a barrier to trade, because JP01 has
15		ignored the existence of other transmission products (substitute goods) available to move
16		power from the PNW to California. Further, since the rate applies to only 1.4 percent of
17		transmission on the southern interties, JP01 vastly overstates any potential "barrier"
18		effect on energy flows from PNW to California. Since JP01 has not shown that the
19		hourly rate acts as a barrier to trade, JP01's economic regression analysis of that theory
20		proves nothing.
21	*Q.*	*Regarding the regression analysis itself, what conclusions have you drawn?*
22	A.	JP01's regression models are grossly misspecified and do not support JP01's claim that
23		the hourly rate increase caused substantial declines in Mid-C prices.
24	*Q.*	*What are the clear indicators that JP01's regressions are misspecified?*
25	A.	JP01's regressions suggest that increases in PNW loads of *any* magnitude will have *no*
26		significant impact on prices. Additionally, JP01's regressions imply that changes in

1		natural gas prices will have no meaningful impact on electricity prices. These indicators
2		demonstrate that JP01's models cannot reasonably explain changes in Mid-C prices, and
3		therefore fail to support JP01's claims.
4	Q.	*What are the actual misspecifications in JP01's regressions?*
5	A.	There are many, but we focus on two key categories. First, the main dummy variable
6		JP01 relies on to represent the supposed impacts of the hourly rate increase is in fact a
7		representation of the intertwined, cumulative impacts of *all* changes that occurred in
8		FY 2018. Thus, it is false when JP01 claims that the significance of this variable, the
9		direction of the price change, and the magnitude of the price change are all solely
10		attributable to BPA's change in the hourly rate. It is not possible, using JP01's
11		regressions, to determine which of the FY 2018 events may have applied upward or
12		downward pressure on the Mid-C price, or what their respective magnitudes may have
13		been. Put simply, JP01's regressions do not provide any useful information on the actual
14		impact of BPA's hourly rate increase.
15		The second category of misspecification is that JP01's Mid-C price regressions
16		are missing a crucial explanatory variable, namely, PNW natural gas prices. This
17		introduces omitted-variable bias into the regressions; that is, by not including a PNW gas
18		hub, JP01 is omitting a fundamental input in the explanation of Mid-C electricity prices.
19		This severely compromises both JP01's model and its results.
20	Q.	*Are there other problems with JP01's Mid-C price regressions?*
21	A.	Yes. We identify several in Section 3.2 above. We also explain why the tests JP01
22		conducted regarding heteroscedasticity and autocorrelation are not meaningful.
23	Q.	*Do you agree with JP01's assertion that it is not reasonable to omit EQR data from*
24		*BPA's market price forecast?*
25	A.	No. JP01 offers no explanation of how it believes such data should be included in the
26		price forecast. EQR data is not a typical input in market price forecasts. When market

1		participants construct electric market price forecasts they do not include EQR hourly
2		data; such forecasts are industry standard, and utilities routinely rely on them.
3	Q.	*Since the BP-18 hourly rate has been in effect, has BPA observed evidence of associated,*
4		*substantial changes in flows or prices that would cause BPA to alter its expectations*
5		*about such impacts for the BP-20 rate period?*
6	A.	No. BPA Staff has not observed discernible impacts from the hourly rate. Fredrickson
7		& Linn, BPA-20-E-BPA-22, at 16. Staff continues to expect that, given the small
8		amounts of transmission products directly impacted by the hourly rate increase and the
9		availability of alternative, low marginal cost transmission products, impacts from the
10		hourly rate increase will continue to be small over the BP-20 rate period. Likewise,
11		significant uncertainty remains as to the direction of change of average marginal
12		transmission costs. *See* Section 2 above.
13	Q.	*Does this conclude your testimony?*
14	A.	Yes.
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