BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Application of Wisconsin Public Service Corporation for Authority to Construct and Place in Operation a New Multi-Pollutant Control Technology System for Unit 3 of the Weston Generating Station, Marathon County, Wisconsin	Docket No. 6690-CE-197

Direct Testimony of Jeremy Fisher, Ph.D. On Behalf of Clean Wisconsin

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INTRODUCTION AND PURPOSE OF TESTIMONY

Q Please state your name, business address, and position.

A My name is Jeremy Fisher. I am a scientist with Synapse Energy Economics, Inc. (Synapse), which is located at 485 Massachusetts Ave, Suite 2, in Cambridge Massachusetts.

Q Please describe Synapse Energy Economics.

A Synapse Energy Economics is a research and consulting firm specializing in energy and environmental issues, including electric generation, transmission and distribution system reliability, ratemaking and rate design, electric industry restructuring and market power, electricity market prices, stranded costs, efficiency, renewable energy, environmental quality, and nuclear power.

Q Please summarize your work experience and educational background.

A I have ten years of applied experience as a geological scientist, and four years of working within the energy planning sector, including work on integrated resource plans, long-term planning for utilities, states and municipalities, electrical system dispatch, emissions modeling, the economics of regulatory compliance, and evaluating social and environmental externalities. I have provided consulting services for various clients, including the U.S. Environmental Protection Agency (EPA), the National Association of Regulatory Utility Commissioners (NARUC), the California Energy Commission (CEC), the California Division of Ratepayer Advocates (CA DRA), the National Association of State Utility Consumer Advocates (NASUCA), National Rural Electric Cooperative Association (NRECA), the State of Utah Energy Office, the State of Alaska, the State of Arkansas, the Western Grid Group, the Union of Concerned Scientists (UCS), Sierra Club, Natural Resources Defense Council (NRDC), Environmental Defense Fund (EDF), Stockholm Environment Institute (SEI), and Civil Society Institute.

Prior to joining Synapse, I held a post doctorate research position at the University of New Hampshire and Tulane University examining the impacts of Hurricane Katrina.

I hold a B.S. in Geology and a B.S. in Geography from the University of Maryland, and an Sc.M. and Ph.D. in Geological Sciences from Brown University.

My full curriculum vitae is attached as Ex. – CW – Fisher – 1.

Q On whose behalf are you testifying in this case?

A I am testifying on behalf of Clean Wisconsin.

Q What is the purpose of your testimony?

A Clean Wisconsin proposed, and was authorized, to evaluate four areas of the application for the authority to construct a ReACT system at Weston 3, as issued by Wisconsin Public Service Corporation ("WPSC" or "Company"):

- Whether or not the Company has sufficiently accounted for long-term regulatory costs in planning, including expected capital and operational costs for air, solid waste, and water regulations (e.g., CCR, effluent quality, 316(b), tailoring, and ozone), and the potential cost of carbon dioxide;
- The reasonableness of the Company's estimated costs for mitigation equipment;
- Analysis of Present Value of Revenue Requirements (PVRR), and
- Whether or not the Company performed a thorough and reasonable analysis of alternative options.

My testimony specifically addresses (a) the Company's assumptions about long-term regulatory costs and how those costs were or were not incorporated into the planning and justification of this retrofit; (b) the Company's analysis of the cost-

effectiveness of implementing ReACT at Weston 3, including alternatives and sensitivities not considered by the Company in this application.

Mr. Ranajit Sahu, also testifying on behalf of Clean Wisconsin, addresses the reasonableness of the Company's estimated cost of ReACT and associated equipment, as well as long-term costs and risks of this technology.

In addition, in evaluating the Company's application and accompanying testimony, as well as the recent vacatur of the Cross-State Air Pollution Rule (CSAPR), Mr. Sahu addresses whether ReACT is even necessary at this time in light of ongoing settlement discussions with the EPA, and whether this system would be sufficient for meeting current and anticipated environmental regulatory requirements.

Q What are your findings?

A After adjusting for flaws, errors, and biases in the Company's model, I conclude that implementing ReACT is a net liability, rather than a net benefit to ratepayers. At best, continuing to operate Weston 3 with ReACT results in a liability of [redacted], but probably closer to a liability of [redacted]. This liability stands in stark contrast to the +$293 million benefit claimed in the initial application[1] or +$260 benefit shown in the updated modeling results, supplied October 5, 2012.[2]

To support this finding of a liability, I will first walk through a series of concerns with the Company's analysis and modeling assumptions, and then review an analysis conducted by Synapse to adjust and correct the Company's findings.

Q What is the basis of your objection to the ReACT retrofit?

A My objection is three-fold.

[1] Application p52. "EGEAS Study in PCRR Results in Millions $; Weston 3 Compliance Options: Install Emission Controls minus Replace Weston 3 12/2016". See line "Delta PVRR: ReACT vs. Replace" for Future 1. PSC REF #164270.

[2] Ex.-CW-Fisher-2c, Weston Unit 3 ReACT Economic Analysis Update. "EGEAS PVRR Comparisons - $Millions; Weston 3 Economics Update; Positive Delta PVRR Indicates Savings with ReACT" See line Delta PVRR for Future 7.

- First, as Mr. Sahu addresses in more detail, I believe that the Company should not pursue construction of ReACT in advance of a finalized settlement agreement with the EPA to remedy a notice of violation. Doing so would put ratepayers at significant risk for additional costs not currently considered or disclosed by the Company, and would risk creating redundant and unnecessary costs for ratepayers.

- Second, the analysis pursued by the Company to justify the economic viability of ReACT is functionally flawed, erroneous, and inappropriately biased against replacement of Weston 3.

- Third, the Company failed to examine other, legitimate opportunities to replace the energy and capacity from the Weston 3 unit, such as with additional energy efficiency or other demand-side management techniques.

Q What is your recommendation?

A I recommend that the Commission deny the application to construct ReACT at Weston 3 at this time. At the time that the EPA agrees to final settlement terms with the Company and other parties, the Company should re-assess the technology options available to meet the settlement terms as well as other impending or known regulatory requirements, and evaluate the cost efficacy of retaining the Weston 3 unit at that time. I further suggest that the Commission require the Company to assess all cost-effective opportunities to replace energy and capacity from non-economic coal units, including Weston 3, with energy efficiency and other demand-side management measures, where the measure of cost-efficacy includes the avoided cost of capital investments at retiring units.

BUILDING REACT RISKS ADDITIONAL OR REDUNDANT COSTS AT WESTON 3

Q In what circumstance would ratepayers be at risk for additional costs not currently considered or disclosed by the Company?

A As Mr. Sahu discusses in more depth, ReACT is unlikely to meet the definition of Best Available Control Technology (BACT) for emissions of oxides of nitrogen. Currently, only selective catalytic reduction (SCR) technology is able to meet the definition of BACT for units like Weston 3. The Company has stated that ReACT will be sufficient to meet anticipated terms of a settlement with the EPA to resolve an enforcement action (i.e. the notice of violation, or NOV).[3] However, neither the Commission nor other parties have been privy to the ongoing negotiations or the anticipated settlement terms, and are thus unable to verify this critical claim. In addition, once a settlement is published, there is a public comment period, in which it is likely that environmental interveners would strenuously object to terms any less rigorous than BACT. Finally, if another enforcement action or third-party litigation by environmental groups were to show that the Company must meet BACT, the Company would be compelled to install additional control technology, likely SCR.

The Company tested the economic condition of Weston 3 with an SCR and found that SCR plus flue gas desulfurization (FGD) resulted in a marginal (i.e. potentially non-economic) outcome for Weston 3.[4]

Building an SCR after ReACT would render much of the purpose of ReACT (i.e. NOx reduction) redundant and unnecessary, and would lead to piecemeal and inefficient investment at Weston 3.

[3] Initial Application (PSC REF #164270), page 3 and Direct – WPS - Rentmeester, p. 3c-5c, including Q&A: "Q: What are the primary regulatory drivers for the project? A: The likely resolution of EPA's Notice of Violation ("NOV"), which alleged New Source Review ("NSR") violations at the Weston and Pulliam Power Plants, is the primary driver behind the project."

[4] Initial Application (PSC REF #164270), page 52. Table: "EGEAS Study in PVRR Results in Millions $ Weston 3 Compliance Options: Install Emission Controls minus Replace Weston 3 12/2016" Cells: Delta PVRR: Dry FGD/SCR vs. Replace range from -$133 to $161 million (2011$) benefit of replacing Weston 3.

OVERVIEW OF CONCERNS

Q Would you please summarize the analysis performed by the Company to justify ReACT at Weston 3?

A The analysis used by the Company appears to have three separate and sequential modeling steps to arrive at a cost-effectiveness justification for ReACT. First, the Company uses the MIDAS model to forecast regional market energy prices based on a forecast range of fuel and emissions prices, as well as regional predictions of electricity fleet composition. Collectively, these scenarios of commodity price forecasts and fleet composition are referred to as "futures." Second, the Company uses the EGEAS model to create energy portfolios under each of the futures in scenarios where Weston 3 is retrofit and other scenarios in which the unit is retired. The Company also uses the total cost of these portfolios, as calculated by EGEAS, to determine the net benefit of retrofitting Weston 3 versus retiring the unit. Finally, the Company uses MIDAS again to test stochastic, or random, perturbations in commodity prices and possibly other variables, on the cost-efficacy of installing ReACT.

Q Do you think the general mechanism used by the Company to test the cost efficacy of ReACT is appropriate?

A I do. Generally, I agree that testing a wide range of uncertain commodity prices and regulatory futures on Company investment decisions is a sound mechanism. Using a portfolio-based approach to estimate build-out decisions under different futures is also reasonable, as is stress-testing the outcome of various decisions to estimate risk and uncertainty.

I have concerns, however, about the specific mechanism used by the Company, assumptions, and input parameters that appear to have resulted in an incorrect and inconsistent outcome in these models.

Q Why is the analysis used to justify the economic viability of ReACT problematic?

A I find six key areas of concern with the Company's modeling assumptions and execution. The first pertains to the market price futures used in the MIDAS

model, and the other five are problems with the assumptions and use of the EGEAS model. Each of these concerns significantly impacts the outcome of the Company's analysis as presented in this docket. In each individual case, adjusting or correcting assumptions results in either a significant loss of net benefit for the ReACT case, or in some cases, a complete reversal of outcome. In aggregate, correcting just some of these deficiencies reveals that ReACT is a net detriment, rather than benefit, for ratepayers.

I will describe each concern in turn, but they are summarized as follows:

1. The planning "futures" used by the Company are not representative of a reasonable range of commodity prices and electric system structure, and carry deceptive labels.

2. The stream of expected capital expenditures and variable costs required to keep Weston 3 online through the next decades do not appear to include important impending environmental regulatory costs and constraints, despite the fact that the Company has clearly considered elsewhere how these rules will impact its coal fleet. I believe that the Company has withheld from this analysis at least $[redacted] of expected spending to keep Weston 3 operational.

3. End effects, or the extension period, as calculated by the Company and forced into the EGEAS model, are unduly influential in the model outcome and appear both internally inconsistent and likely incorrect. Based on my analysis, I think that at least $[redacted] (or 50%) of the net benefit of installing ReACT is attributable to incorrectly calculated end effects.

4. The high costs for near-term capacity assumed by the Company are neither justified nor consistent with internal Company correspondence and documentation; in addition, the capacity prices in EGEAS are inconsistent with Company stipulated capacity prices in other exhibits. I calculate that about $[redacted] of the net benefit of installing ReACT can be attributed to the Company's capacity assumption.

5. The Company's modeled generation output of the Weston 3 unit shows an overly optimistic increasing capacity factor after 2017, and appears to be a result of EGEAS model limitations, rather than a likely outcome of forecast fuel prices.

Q Did you correct the concerns you just described?

A Yes. Based only on the exclusions and errors from points (2)-(4), above, the Company's net benefit of $260 million for installing ReACT should be changed into a net liability of about -$[redacted].

Changing the Company's futures and assumed market prices would have required either MIDAS or EGEAS or both. Synapse was not able to obtain either the MIDAS or the EGEAS models. However, I created a simple and conservative economic analysis to test corrections to assumptions and errors made by the Company and derived a baseline liability of about -$[redacted] for installing ReACT.[5] I will discuss this analysis after detailing the concerns.

PLANNING FUTURES ARE UNREASONABLE AND BIASED

Q Were you able to obtain the MIDAS model as used by the Company to create the planning futures or the sensitivities?

A No. Synapse attempted to obtain a quote for a license to the MIDAS model from Ventyx, but was informed by the vendor that the model is no longer supported by the Company.[6] Unfortunately, the fact that the model is no longer supported prohibits interveners from fully assessing the use and execution of the modeling supporting this case. Regardless, we are still able to assess the inputs to the model.

Q What are the planning futures used by the Company in this case?

A The Company shows three sets of planning futures, originally labeled Futures 1-3. In subsequent analysis immediately preceding the submission of this testimony,

[5] Baseline defined by a reasonable price forecast for CO_2 and the Company's base forecast for natural gas.
[6] Ex.-CW-Fisher-3, email from Ventyx to Rachel Wilson at Synapse.

the Company modified these futures and re-labeled them as 7-9.[7] Regardless of this last minute change, the nature of my concern remains.

- The first future (1 or 7) is designed to represent a "base case" as assumed by the Company, including base fuel prices, no price on carbon dioxide (CO_2), and a "base" assumption about the number of coal retirements that will result from low gas prices and environmental regulations.

- The second future (2 or 8), titled by the Company "Coal Unfriendly", includes a CO_2 price, but subsequently increases the natural gas price forecast by about [redacted] over the base forecast, and increases the assumed number of coal retirements resulting from gas prices and regulations.

- The third future (3 or 9), titled by the Company "Coal Very Unfriendly", includes the same CO_2 price but substitutes in a natural gas price lower than the base forecast by about [redacted] This forecast also increases the assumed number of coal retirements, and <u>in addition</u> reduces the coal price forecast by about [redacted]

[7]On November 1, 2012 the Company supplied an alternate set of three futures, labeled 7-9 [Weston Unit 3 ReACT Economic Analysis Update, response to WPSC DR 1.06]. In a conversation with Company planners Mr. Daavettila and Mr. Gerlikowski on October 23, 2012, the Company indicated that these futures are intended to replace, in full, futures 1-3 as originally filed. Therefore, all futures reviewed here are in reference to 7-9. Where information was not made available on data underlying futures 7-9, it is assumed that the futures share similar features to 1-3, respectively.

These assumptions are shown side-by-side in Table 1, below.

Table 1. Assumptions in Futures 1-3 (7-9, respectively)

	WPS Future 1 (7)	WPS Future 2 (8)	WPS Future 3 (9)
Coal Price Forecast	Base	Base	Low
Gas Price Forecast	Base	High	Low
CO_2 Allowance Price Forecast	None	Base	Base
NOx Allowance Price Forecast	Base	Low	Low
SO_2 Allowance Price Forecast	Base	Low	Low
Demand and Energy Forecast	Base	Base	High
Coal Unit Replacements	32 GW	65 GW	65 GW

Q Did the Company consider the potential for costs associated with carbon dioxide emissions?

A To a limited extent, yes. In sensitivities, the Company considered a price for carbon dioxide (CO_2) emissions. However, in the baseline Future 1 (7), there is no CO_2 price.

Q Is the baseline carbon price assumption made by the Company reasonable?

A No. It is my opinion that a baseline forecast of no CO_2 price is an unreasonable assumption. The state of climate science continues to strongly indicate that CO_2 contributes to detrimental global climate change, and as a scientist who studied the impacts of climate change on people, the environment, and infrastructure, it is my opinion that the current political impasse on regulating carbon emissions will not stand long in the face of increasingly dramatic evidence. I think that it is extremely unlikely that there will be no regulation governing emissions of CO_2 in the next thirty years.

Further, the CO_2 price forecast by the Company for Futures 2 (8) and 3 (9) is at the low end of forecasts used by electric utilities for planning over the last two years and does not represent a reasonable mid-case.

Q What is your recommended range of CO_2 prices that should be used in this case?

A Synapse recently produced an updated CO_2 price forecast for 2012 with a range of mid, low and high price expectations that can be used for planning purposes. Figure 1, below, shows how the Company's forecast compares against other electric utility forecasts from the last two years, and the Synapse Low, Mid, and High cases. The Synapse forecast and background document is attached as Ex.-CW-Fisher-4.

Figure 1. Company CO_2 price forecast for Futures 2 (8) and 3 (9) compared to other electric utilities from 2010-2012.

Q Are there other problems with the Company's futures aside from the CO_2 price forecast?

A Yes. The combinations of the much higher gas price in Future 2 (8) and pairing falling gas with falling coal prices in Future 3 (9) introduces a bias into the Company's sensitivity analyses.

By dramatically increasing the cost of natural gas while adding in a CO_2 price forecast in Future 2 (or 8), the Company ensures that the tradeoff between gas and coal remains favorable to coal. Indeed, the scenario is so additionally favorable to coal that the benefit of retaining Weston 3 with ReACT is bolstered by an extra

[redacted] in the Company's revised analysis.[8] By no means is this future unfavorable to coal. In addition, by raising the expected number of regional coal retirements to 65 GW from 32 GW, the Company ensures that future market prices will be highly dependent on gas prices, and thus proportionally more expensive than would be expected with fewer coal retirements.

Reviewing documents supplied by the Company and recent public forecasts, I have found no evidence that the price of natural gas would be expected to increase so dramatically, if at all, with the implementation of a CO_2 regulatory regime or price.

In Future 3 (or 9), the Company tests a lower gas price, but also drops the price of coal, again falsely mitigating the tradeoff between gas and coal resource choices. Again, reviewing documents supplied by the Company and recent public forecasts, I have found no evidence that the price of coal would be expected to drop in tandem with natural gas prices.

Q Why shouldn't the Company assume a different number of coal retirements in their market price forecast for the different futures?

A The baseline number of coal retirements assumed by the Company (32 GW) is an assumption carried over from the Ventyx-supplied dataset in the MIDAS model. The 32 GW largely represent announced retirements (i.e. Companies that have publicly disclosed that non-economic coal units will be retired within the next decade), while the 65 GW appears to be a moderately arbitrary value chosen by the Company reflecting units below a certain capacity and age are all retired in the next decades.[9] Largely, these retirements are driven by the same questions as face Weston 3 – is it optimal to retain or retire a particular unit in light of dropping gas prices and increasing costs to mitigate environmental harm?

[8] Ex.-CW-Fisher-2c. Delta PVRR of $[redacted] million in Future 8 vs. $[redacted] million in Future 7, see Weston Unit 3 ReACT Economic Analysis Update from Nov. 1 2012, PSC REF # 175782)

[9] Assumption disclosed in October 10, 2012 conversation with Company planners Mr. Daavettila and Mr. Gerlikowski.

If one believes that the coal units that have already announced retirements are the optimal solution for forward-looking planning, then it is unlikely that changes in commodity prices will drive significantly more retirements. If one believes that still more units are likely to announce retirements because they are non-economic on a forward-going basis (such as [redacted]), this will not be a function of future gas prices, but decisions made in the next few months or years by rational planners and regulators.

Finally, the commonly accepted mechanism for predicting coal unit retirements is not a simple threshold of age and size, but a more complex calculation estimating forward-going costs for existing coal units against replacement power options. There are a number of studies that have used reasonable mechanisms for looking at broad scale impacts of falling gas prices and increasing stringency of environmental regulations, including by the North American Electric Reliability Council (NERC), the Brattle Group, and Edison Electric Institute. These reports review the economic viability of each individual coal unit, assuming standardized sets of minimum emissions controls.

By changing the number of coal unit retirements, the Company has added an unconventional and unnecessary complication to the test of if Weston 3 should be retrofit or retired.

Q If the Company's futures are not reasonable, what should the futures have looked like instead?

A The key uncertain variables influencing the decision to retain or retire a coal unit are fuel prices (particularly gas prices), expectations for CO_2 prices, and the stringency of emerging and contested environmental regulations. Therefore, it would seem that testing bookends of these three variables would have been an important mechanism for the Company. If the Company believes that coal prices are uncertain, futures should have reviewed a range of these prices as well.[10] A

[10] The Company, in fact, does have a forecast for high coal prices. While high gas prices were represented in the Company's analysis, high coal prices were not. The Company's high coal price forecast can be found in Ex.-CW-Fisher-5c.

baseline reasonable test would be a simple matrix of gas prices (low to high) and CO_2 prices (low to high) as variables that influence the market price of electricity, while individual scenarios should have tested the stringency of environmental regulations (i.e. capital and operating costs) that directly impact Weston 3. In no case should these variables be correlated (i.e. tied together) on an *a priori* basis without significant evidence and documentation.

I will discuss the additional environmental regulations of concern in the next section.

Q Did you test a range of natural gas and CO2 prices as you have suggested here?

A I have. As noted earlier, I do not have access to the MIDAS model, but later in this testimony I will describe how I backed out the relationship between gas, CO_2, and market prices to test a wider range of non-correlated assumptions.

EMERGING AND EXPECTED ENVIRONMENTAL REGULATIONS ARE NOT FACTORED INTO ANALYSIS

Q Is it your opinion that there are environmental compliance obligations that will not be met by the installation of ReACT?

A Yes. There are regulations governing air emissions, water effluent, and solid waste created at electric generating facilities that may not or will not be mitigated by ReACT. Therefore, it is my belief that the Company will have significant future expenditures above and beyond those described here to keep Weston 3 in compliance with EPA rules.

Q What are the primary regulatory drivers for the Company's request to install emissions controls at Weston 3?

A In the initial application, the Company stated that it would install controls to comply with the now vacated Cross State Air Pollution Rule (CSAPR) [Application, p. 16], the federal Mercury and Air Toxics Standards (MATS) [Application, p. 19], the Wisconsin Mercury Rule [Application, p. 19], and meet

the potential resolution of a Prevention of Significant Deterioration (PSD) / New Source Review (NSR) settlement with EPA.

Q What is the status of the Company's compliance with these four drivers?

A The CSAPR rule is vacated. There is no current new obligation that would drive an investment such as ReACT.

According to Mr. Sahu, the Company is now in compliance with the Wisconsin Mercury Rule even without ReACT in place.

Also according to Mr. Sahu, the Company would not be in current compliance with the MATS rule without additional controls for SO_2 emissions reductions. ReACT could provide the level of reductions required to meet the MATS rule, as might other, less expensive technologies such as dry sorbent injection (DSI). The timeline proposed by WPS for the installation and operation of ReACT, however, is not in accordance with MATS requirements. According the Company ReACT would not be installed until the "end of 2016."[11] That the end of 2016 is actually December is confirmed by the case names for the installation of ReACT.[12] Mr. Rentmeester indicates that ReACT would be "[redacted]."[13]

The MATS rule requires that the standard be met by April 2015, with a potential extension to April 2016 at the discretion of the EPA.[14] Even assuming that WPS is able to obtain EPA permission to extend their compliance by a year, it is unclear how Weston 3 will be able to stay in operation from April 2016 to the end of year without ReACT. If ReACT is installed earlier than the end of 2016, the analysis should represent the costs of operating the unit at that time. They do not;

[11] Direct testimony of Mr. Gerlikowski and Mr. Daavettila, Direct-WPS-Planners-3c, lines 19-20.
[12] See Exhibit 1 of Appendix C. Cases 8, 12 and 14 are named "Install ReACT on Weston 3 12/2016"
[13] Direct-WPS-Rentmeester-3c, lines 19-20.
[14] "Existing sources may be provided up to 3 years after the effective date to comply with the final rule; if an existing source is unable to comply within 3 years, a permitting authority has the ability to grant such a source up to a 1-year extension, on a case-by-case basis, if such additional time is necessary for the installation of controls." 77 Fed.Reg 9304, 9407 (Feb. 16 2012). In this case the "Effective date is April 16, 2012" 77 Fed.Reg 9304. Therefore, the latest possible compliance date, with the one-year extension, is April 16, 2016.

variable O&M costs only increase in 2017. If Weston 3 is idled for that time, the projected capacity factor of Weston 3 in 2016 should be well under 30%.[15] It is not; the EGEAS output from Future 7, Case 1 shows a capacity factor of 69%, an increase over the year before of about 7%.

The status of the settlement agreement is the only current significant driver. Mr. Rentmeester states that "the likely resolution of EPA's Notice of Violation ("NOV"), which alleged New Source Review ("NSR") violations at the Weston and Pulliam power plants, is the primary driver behind the project."[16] Despite the importance of this ongoing settlement, parties aside from the Company have not been privy to the settlement documents or even the status of the discussion.[17] As the Company acknowledges, "WPS has been in extensive settlement discussions with EPA in an attempt to amicably settle the matter,"[18] and the settlement is not yet finalized. The settlement is likely to result in a consent decree between EPA and WPS, and that settlement is then opened for public comment before it is finalized. Mr. Rentmeester lays out the "likely" settlement terms,[19] but cannot guarantee that the final terms will be favorable to WPS, or that other parties will allow the settlement to pass without significant comment or suit.

Q Are there other environmental obligations faced by the Company beyond the four drivers discussed by the Company?

A. Yes. There are number of existing and emerging regulatory requirements facing coal-fired power plants today, which Mr. Sahu discusses in more detail, including:

[15] A 30% capacity factor would assume a (generous) 90% capacity factor held from January to April (1/3rd of the year).
[16] Direct-WPS-Rentmeester-3c, lines 2-4.
[17] As of this writing, the Company has rejected all attempts to review any component of the settlement terms or negotiations siting objections that discovery "seeks the production of documents and information constituting or related to settlement communications that are protected from disclosure and neither relevant nor likely to lead to the discovery of admissible evidence." (Ex. – CW – Sahu – 5c, Response to RFP 3-CW-4)
[18] Direct-WPS-Rentmeester-3c, lines 15-16
[19] Direct-WPS-Rentmeester-3c to 5c

- New National Ambient Air Quality Standards (NAAQS) for sulfur dioxide (SO_2);
- Expected NAAQS for ozone;
- Expected NAAQS for fine particulate matter ($PM_{2.5}$);
- A re-issuance of the Cross State Air Pollution Rule (CSAPR) or similar rule;
- Reasonable progress goals under the Regional Haze Rule;
- Proposed rules governing the storage, transport, and disposal of coal combustion residuals (CCR);
- Effluent limitation guidelines to protect waterways from toxic plant wastes.

Q Has the Company taken any of these rules into consideration in the evaluation of ReACT?

A Not to my knowledge. I would have expected that for the air regulations listed here, and particularly those regarding NOx emissions, the Company would have evaluated if the ReACT technology would be likely to meet all of those regulatory standards individually. If the Company were under any doubt whatsoever that the plant could be targeted under a State Implementation Plan for ozone or $PM_{2.5}$, or be required to meet a stricter level of NOx reduction under a re-issued CSAPR rule or even the reasonable progress provision of the regional haze rule, I would have expected a detailed evaluation.[20] This evaluation would have included the risk of non-compliance with known or expected regulations, and the options, opportunities and costs of installing more stringent controls instead of, or in addition to, ReACT. The Company did evaluate the cost of installing Selective Catalytic Reduction (SCR) and flue gas desulfurization (FGD), but rejected these more effective controls as too costly. I have seen no evidence that the Company has evaluated how the new NAAQS, a re-issued CSAPR rule, or reasonable progress goals may impact their decision to install ReACT.

For the two non-air rules, coal combustion residuals and the effluent limitation guideline, I would have expected the Company to evaluate the impact of these rules on the forward-going costs of continuing to operate Weston 3. These rules are not yet finalized, but other utilities have developed reasonable proxy costs to assist in evaluations of economic merit for existing coal units.

Q Is the Company aware of the impact of the coal combustion residuals rule and the effluent limitation guidelines?

A Yes. With regards to the Effluent Limitation Guidelines, the Company makes reference to the guidelines noting that wet FGDs could incur additional regulatory costs due to a requirement to control liquid wastes. [Application p30-31]. The Company also turned over emails from a Mr. Mark Metcalf at Integrys (to Mr. Rentmeester, among others) regarding the likely course of EPA action and implications for the WPS fleet (see Ex.-CW-Fisher-6).

With regards to the Coal Combustion Residuals (CCR) rules, the Company turned over several documents indicating correspondence on this topic with the Wisconsin Department of Natural Resources (DNR) from late 2010 (see Ex.-CW-Fisher-7c) and further documentation indicating the likely cost impacts of CCR regulation on their fleet.

Q Has the Company estimated costs for these two non-air regulations?

A I believe so. In a spreadsheet created in July 2012 entitled "ERP Construction Budget working" provided by the Company in response to data request 3-CW, the Company laid out estimated capital budgets for environmental and related projects from 2012 through 2021 (see Ex.-CW-Fisher-8). Included in this spreadsheet are categories of:

- [redacted] in response to the proposed Clean Water Act (CWA) Rule governing intake structures;

- [redacted] presumably in response to the CCR requirements;
- [redacted] same;
- [redacted] same;
- [redacted] with costs indicative of a response to the expected effluent guidelines limitation; and
- [redacted] which may or may not be related to the CWA directly.

These projects have a total nominal expense of about $[redacted], or a net present value of $[redacted] in 2011$.

Further, an email supplied by the Company from a Ms. Stacy Brault[21] indicates that Weston plant could experience between [redacted] in capital expenses to meet the CCR rule, depending on its stringency, and [redacted] in annual disposal costs for CCR (see Ex.-CW-Fisher-9).

Q Are these capital or disposal costs included in the expected forward-going budget for Weston 3 as presented in this docket?

A No. The Company also supplied a file in response to data request 3-CW entitled "Weston Units - Operating Scenarios as of 01-2012.xlsx" which specifically breaks down the capital and O&M expectations (see Ex.-CW-Fisher-10)[22] including the individual unit fixed O&M and capital expenses attributable to Weston 3 that were otherwise available from Company Exhibit 7. It is very clear that these capital and fixed O&M expenses are simply inflated versions of 2012/2013 capital budgets, and do not include either major overhaul expenses nor any of the discrete environmental costs described above. Therefore, I would conclude that the analysis supporting the Weston 3 ReACT system is deficient in

[21] Ms. Brault is listed as "Environmental Consultant - Solid Waste and Spill Remediation" on the WPS website. http://www.wisconsinpublicservice.com/environment/coal.aspx Accessed 11/8/2012.
[22] Scenario in Exhibit is "Scenario 2 Var" which appears to have similar characteristics, and costs, to Future 1, Scenario 8 as used in the Initial Application.

not including any of the costs of these expected, impending environmental regulations.

EXTENSION PERIOD IN THE EGEAS ANALYSIS IS INCONSISTENT AND UNDULY INFLUENTIAL

Q Why have you identified the "extension period" as being a problem in the Company's analysis of the economic benefit of installing ReACT?

A As I will detail below, the extension period, usually a clarifying component of a portfolio optimization model appears to dominate the economic outcome portrayed by the Company from the EGEAS model. Rather than improving the model, I believe that the Company's use and modification of the extension period has severely encumbered the analysis of ReACT.

Q What is an extension period?

A An extension period, as used in utility planning and specifically in portfolio optimization planning, represents a time period that occurs after the formal analysis period, but in which costs are still incurred. In particular, extension periods are used to capture streams of capital and depreciation expenses that differ between portfolios for long-lived resources.

The EGEAS manual provides the following description:[23]

> An extension period is used to model the end effects resulting from unused capital. This period begins with the first year following the study period and may be finite or infinite in length. During the extension period, load remains constant at the same level as in the last study period year and no new units are installed. Any unit that retires during the extension period is assumed to be replaced with another unit whose characteristics are identical to those of the unit retired. Costs continue to escalate at the prescribed rates. [emphasis added]

[23] EGEAS User's Guide. Version 9.02. June 1999. Stone & Webster Management Consultants, Inc. Appendix D, p2.

It is important to note here that EGEAS normally assumes that any unit that retires during the extension period is assumed to be replaced in kind. I will discuss the implications of that statement later.

Q Is it necessary to use an extension period?

A Not necessarily. It can be informative to use an extension period to capture long-term implications of large-scale capital investments; particularly those incurred closer to the end of the analysis period. One way that extension periods can be avoided altogether is to use levelized fixed charges for capital expenses instead of annual fixed charges. This effectively allows the model to weigh total capital expenses evenly on a year-to-year basis instead of having these charges appear front-loaded as in annual fixed charges.[24]

Q What is the extension period used in the analysis of Weston 3 in this docket?

A The extension period used in this case extends from 2041 through 2070.

Q Why do you have concerns about the extension period as used here?

A I have no qualm with the actual use of an extension period, although as I stated above, I think much of the confusion here may have been avoided with the use of a levelized fixed charge approach. My concern is both the influence that the extension period appears to have over the analysis results, and the mechanism by which the Company calculated the financial basis of the extension period. I am also concerned that the extension period as used here under-estimates the impact that any CO_2 pricing scheme might have on emissions in out-years.

Q What is the influence of the extension period on the analysis results?

A Very significant. Of the $260 million difference that the Company finds between the ReACT and retire scenarios in Future 7 (Plan 9), I estimate that about $126 million, in net present value terms, is due to the extension period alone. In other

[24] "Levelized fixed charges" refer to a fixed charge incurred every year that incorporates all of the various costs of capital, including depreciation, taxes, and interest payments. In contrast, "annual fixed charges" refer to the actual capital expenses that go into ratebase on a year-to-year basis, with depreciation changing the value each year. The Company has used annual fixed charges in this case.

words, almost 50% of the net benefit claimed by the Company in the base-case run occurs from 2040 to 2070.

The Company estimates the book life of Weston 3 to [redacted],[25] or [redacted] years after the end of the formal analysis period in 2040. It would seem, logically, that the most significant impacts between the scenarios of "Continue to operate" and "Replace in 2017" would therefore occur between 2017 and the end of the unit's life in [redacted]. Since over [redacted]% of this significant period falls before the end of the analysis period (i.e. 2017-2040), I would expect the vast majority of the difference between plans to be captured in the analysis period – not in the extension period. Further, this massive impact of the extension period on the outcome is in net present value dollars, discounted at a 9% rate. By the time costs occur in 2040, they should only have about 1/7th the impact of costs that occur in 2017.[26] This would imply that there are tremendous differences between the replacement and ReACT scenarios in the extension period. It is illogical that [redacted] years of extension period dictate nearly 50% of the benefit of ReACT.

Q Doesn't EGEAS calculate the extension period costs?

A It does. But in this case, the Company has overridden some EGEAS functionality by forcing their own extension period costs into the analysis outside of the EGEAS framework.

EGEAS calculates extension period impacts for each scenario by holding the production cost from the end of the analysis period to the end of the extension period constant in real terms. Capital costs, if depreciated over time as in this analysis, continue to depreciate to the end of each unit's book life – or more specifically, each unit's retirement date. If a unit's retirement date occurs within the extension period (i.e. between 2040 and 2070), EGEAS assumes that the unit is replaced <u>in kind</u>, and costs begin depreciating again. In other words, if the

[25] See "Replacement Dates" on Exhibit 26 of Appendix C and descriptors for scenarios in Exhibits 28 and 29 of Appendix C.

[26] Costs that occur in 2017 are discounted to 60% of their real worth in 2011 present value dollars. Costs that occur in 2040 are discounted to 8% of their real worth in 2011 present value dollars. Therefore, costs that occur in 2040 are about 1/7th as impactful on 2011 present value dollars as those that occur in 2017.

Weston 3 unit is expected to retire in [redacted], it is assumed by EGEAS to be replaced within the extension period by a unit of a similar type and capital expense, by default. It is possible that the Company might choose to assume that a retiring coal unit would be replaced by another resource, such as market purchases or another type of unit, but these considerations go beyond the purpose of the extension period and, more importantly, were not considered by the Company.

Q Did the Company use the extension period as provided by EGEAS?

A Only in select circumstances. From the Company's output files and discussions with the Company planners (October 10, 2012), it appears that the Company overwrote some of the EGEAS extension period functionality.

Q Is it clear why the Company overwrote EGEAS extension period functionality?

A No. I hypothesize that the Company chose to overwrite the extension period functionality in EGEAS because the program, by default, would otherwise choose to replace retiring units with identical plants; the Company may have been reluctant to incur the capital expense of a new coal plant in the economic analysis at the end of Weston 3's life.

Q Is it at least clear how the Company performed the extension period calculation?

Not at all. Clean Wisconsin requested "the workbooks or workpapers used to calculate the end effects ('extension period') costs used in the EGEAS and MIDAS runs" (Data Request 4-CW-2), but were informed that the Company had provided relevant material in an earlier response. The only workpaper of relevance provided to Clean Wisconsin in response to earlier data request (3-CW) are several hard-copies with a series of fairly unintelligible values on them, and no meaningful bearing on the question at hand. These cryptic, almost entirely unlabeled worksheets, lacking any indication of methodology used or origin of rates or values used therein, appear to be a back-of-the-envelope method for

calculating a multiplier for the extension period.[27] No explanation is given for which of these multipliers is eventually used in the analysis, or how such a choice was made or why. I have attached these workpapers in Ex.-CW-Fisher-11.

The Company chose to withdraw fixed operations and maintenance (O&M) expenses from all of their existing units, and consolidated these fixed O&M expenses for the Weston and Pulliam plants into two proxy units with "common" fixed O&M costs for the entire plants. The Company further appears to have then taken the depreciation expense associated with ReACT and put those costs into Weston 3 unit's slot for fixed O&M. Finally, the Company calculated their own extension period values for fixed O&M in the "common" units (and, apparently several other units as well) and hard-coded these values into the fixed O&M slot in the year 2039.[28] The effect of this hard-coding can be seen in **Figure 2**, below with a spike in the year 2039.

Figure 2. Total annual production cost in Future 7, Scenario 1 (ReACT installed). Spike in 2039 represents end effect calculation performed by Company Weston plant costs to [redacted].

[27] It should be noted that the Company appears to have considered a range of values for this multiplier that spans an order of magnitude (i.e. from 1.37 to 10.36).

[28] The Company also did a similar calculation apparently for the Fox Energy Center, and hard coded values into 2038 instead of 2039.

If the analysis had ended cleanly in 2040, these modifications would not have made much of a difference to the end result. In the base analysis period, they simply shift the categories in which different types of costs are incurred. However, in the extension period, these categorical changes become critical. The table below illustrates the process that should happen in native EGEAS form with the fixed costs and capital of a new 759 MW CC as modeled in Future 7. In comparison, I show how Weston 3 and the Weston Common plant have been modeled.

Table 2. Comparison between use of fixed O&M and capital expenses category in EGEAS model between native use (759 MW CC) and Company-altered use (Weston 3 and Weston Common units).

Unit in EGEAS	Fixed O&M category contains:	Capital expenses contain:	Year 2039 fixed O&M contains:	Extension period for fixed O&M contains:
New 759 MW CC	Fixed O&M	Capital expenses.	Fixed O&M for year 2039	EGEAS calculated extension period fixed O&M, in 2040$
Weston 3	Capital expense of ReACT	None.	Depreciated capital expense for ReACT in 2039	EGEAS calculated extension period capital expense for ReACT, in 2040$
Weston Common	Fixed O&M for all Weston units	None.	Company calculated extension period fixed O&M, in 2039$**	Nothing

** Value in extension period appears to include fixed O&M expenses for Weston 3 from 2039 to [redacted], in 2039$.

Assuming that the Company performed the calculation of the extension period costs correctly, the major problem with this setup is that while it captures the extension period fixed O&M for Weston and capital depreciation for ReACT, it completely fails to capture the costs of the replacement unit for Weston 3 once it retires in [redacted].

The practical implication of this error is that the model carries all of the expenses for replacement power for Weston through 2070 in the retire scenario (Futures 7-9 Plan 1 or CW1) but only carries the costs of Weston through [redacted] in the ReACT scenario (Futures 7-9 Plan 9).

Q How did you calculate the magnitude of the Company's extension period impact?

A The EGEAS output returns an expansion plan summary with a table of total annual expenses, including production cost expenses and fixed charges. The Company appears to refer to the total cumulative present worth value in this table, including the extension period impacts. First, I simply subtract out the extension period values from the cumulative present worth. Second, I subtract out a reasonable estimate of the Company's manual extension period impact in 2039$, take the present worth of that value in 2011$ and add it to the EGEAS extension period values. For example, in Future 7 Plan 1, the EGEAS calculated extension period values for production cost, capital expenses and "detailed costs" add up to $[redacted] billion in 2011$ present value dollars. The Company's adjustment to fixed and variable O&M expenses at five units[29] amounts to $[redacted] million (nominal) around 2038/2039, or a present value of $[redacted] million. In total, the extension period amounts to a total cost of $[redacted] billion, or $[redacted] million less than the extension period cost of Future 7 Plan 9.

Q Have you corrected this error in your economic evaluation?

A Yes, although I am not privy to the Company's assumptions in the "common" costs for Weston, and the Company provided no reliable insight on how they calculated internal extension period expenses. Therefore, I think the most transparent correction that I can offer is to simply remove the Company's manual extension period calculations by finding a reasonable value that fits the trend of expenses in that time period. For consistency, I then also disregard the extension period calculations performed by EGEAS and simply end the analysis in 2040. I show the results of this correction in section 9 of my testimony.

[29] WES COMMON C, Fox 550 MW 13 FA, J31, M31 and M32

HIGH COSTS FOR NEAR-TERM CAPACITY ASSUMED BY THE COMPANY ARE NEITHER JUSTIFIED NOR CONSISTENT

Q Please describe how the Company has modeled market capacity pricing in this docket.

A The Company has set two criteria on the pricing of future capacity as used in the EGEAS model. First, with the exception of a single 50-MW capacity purchase, the only form of capacity that can be purchased prior to the year 2024 is a 10-year [redacted] for a [redacted] beginning in 2014, at the full cost [redacted]. In fact, aside from a small amount of wind, available in 2016, this is the only substantive form of capacity that can be obtained prior to 2018. Second, capacity after 2024 may be purchased in 50-MW annual blocks, at approximately half the cost [redacted].

Q What is the effect of the capacity modeling constraint used by the Company?

A The constraints put on capacity purchases mean that in order to obtain adequate capacity to allow the EGEAS program to even solve, any scenario without Weston 3 must procure the 10-year capacity [redacted]. Because the Company assumes that Weston 3 would otherwise retire in the analysis at the end of 2016, the capacity shortage occurs at the start of 2017. Because there are no other options, the model is compelled to take the 2014 [redacted], and hold that capacity until 2024. In fact, the model indicates, and the Company's modelers confirm, that EGEAS is not even offered the opportunity to take or reject this [redacted], but it is locked into the model.

Figure 3, below, shows the difference between the EGEAS capacity solution for the Weston 3 replacement scenario (Future 7, scenario 9) and the ReACT scenario (Future 7, scenario 1). The retirement of the Weston 3 unit is shown as the negative 321 MW capacity reduction in gray starting in 2017. The [redacted] is in orange, starting in 2014. When this [redacted] disappears in 2024, the capacity is replaced by a 197 MW CC unit and 150 MW of capacity purchases from the market in 50 MW blocks ("50 MW Pur 1 Yr").

[redacted]

[redacted]

Clean Wisconsin asked the Company to run an EGEAS scenario in which the [redacted] is not forced into the model (Data Request 4-CW-1). The Company provided runs for Futures 4, and 7-9. The capacity result of this model run in Future 7 is shown in **Figure 4**, below.

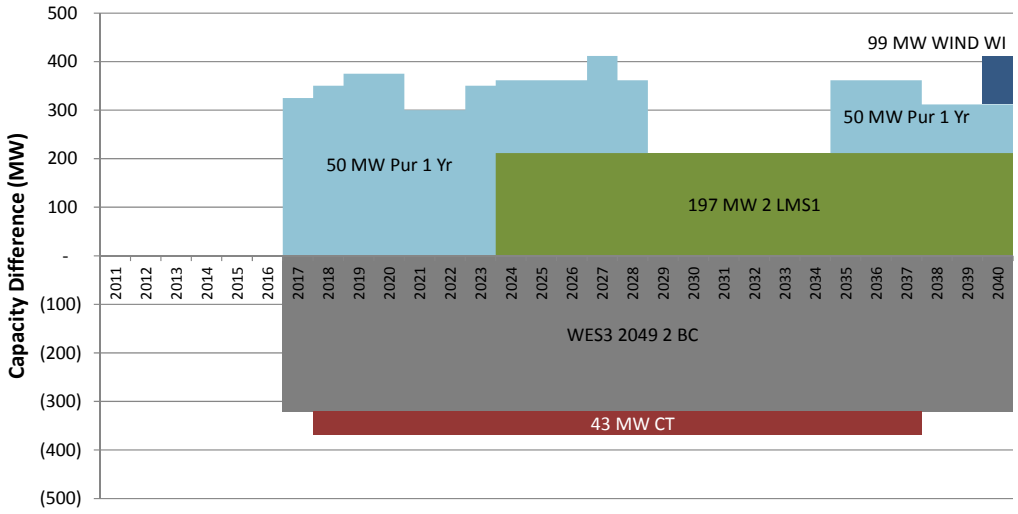

Figure 4. Difference in capacity between Future 7, Scenario CW1 (Weston 3 replaced with no [redacted]) minus Future 7, Scenario 1 (ReACT installed).

It is clear that by not requiring the commitment to the 2014 [redacted], additional capacity is not required in the 2014-2017 period until after the Weston 3 retirement.

Q What are the cost implications of the 2014 [redacted] as modeled in the Company's analysis?

A The cost of the [redacted] on a year by year basis is shown in red in Figure 5, below. In contrast, the cost of market capacity projected by the Company is in blue. The first year cost of the [redacted] is [redacted] larger than the projected market price, and by 2024 is still [redacted] higher than the projected market price.

[redacted]

Figure 5. Company assumed market capacity pricing, tracing upper bound of both charts. Nominal dollars. Source: Initial Application, Exhibit 27 Appendix C; also Exhibit 17 in CSAPR-CA Study Assumptions Exhibits.xlsx from DR 2-CW-5.

Q What effect does this high cost [redacted] have on the outcome of the analysis?

A This forced assumption in which a 10 year [redacted] resource must be purchased in 2014 if Weston 3 is retired has a disproportionate impact on the final result. The 2012 present value revenue requirement (PVRR) of holding a 350 MW block of

capacity at expected market prices from 2014 to 2024 is [redacted] million in 2011$. In contrast, the PVRR of holding the 10-year [redacted] over the same timeframe is over nearly three times greater, at [redacted] million. Overall, this assumption penalizes the retirement of the Weston 3 unit by at least [redacted] million. If we consider that the Company would not require additional capacity to make up the retirement of Weston 3 until 2017, the discrepancy expands to [redacted] million.

Q Why does the Company think that a 10-year [redacted] will be required?

A The Company's position on the requirement for the 10-year [redacted] can be summarized in two points (p48 of the Application, Company confidential):

[redacted]

Q Has the Company issued a request for proposals (RFP) for replacement capacity represented by this [redacted]?

A No. With such a significant cost only one year away (January of 2014), I would expect that the Company would have subjected this critical assumption to a market test by issuing an RFP for replacement capacity. Responses to Clean Wisconsin and Staff indicate that "WPS did not issue a formal RFP for a PPA or asset acquisition as a replacement for the energy and/or capacity for the Weston 3 Unit." (Answer to Interrogatory 3-CW-68) and that "WPS did not issue any RFPs to meet the forecasted capacity need modeled in the EGEAS and MIDAS analyses" (Response to PSCW Data Request 1.12 by Ms. Jody Arendt). However, it is clear from the response to Staff that the Company does not actually consider a high cost capacity PPA a reasonable option as [redacted]

Q Do you agree with the Company's assumptions regarding capacity?

A No. There are several reasons that the Company's assumptions are not supported.

First, the Company attributes the expected capacity shortage in MISO to coal plant retirements by 2015.[30] Interestingly, most of the analyses that have resulted in the prediction of a large number of coal retirements assume a series of environmental regulations that the Company has apparently assumed do not apply to Weston 3 – including requirements to meet lower NOx levels, treat coal waste as a hazardous or special waste stream, and clean waste water effluent released from the plant site. While most of these reports do not release the names of the individual units that they expect to be retired in the face of falling gas prices and environmental regulation, it is possible that Weston 3 is among those to be slated for retirement by many analysts once all forward-going compliance costs are taken into account.

Second, internal documentation provided by the Company in response to data request 3-CW rebuts the concerns regarding a capacity shortage cited in the Application. The documentation in question is a January 13, 2012 correspondence between Ms. Jody Arendt and the planners testifying in this case.[31] The correspondence is attached as Ex.-CW-Fisher-12c. In this correspondence, Mr. Gerlikowski [redacted]

[30] Company witness Spicer states that this will be "[redacted]" (Direct-WPS-Spicer-13c lines 12-14.) Presumably this statement should read "tens of thousands of MW", as there are only about 1,400 coal fueled units in the US.

[31] Ms. Arendt, who testified in March of 2012 under WPSC docket 6690-UR-121 as the Director-WPS Power Supply states that she is "responsible for management of power supply contracts, capacity planning and compliance, short to mid-term supply planning and contract origination." [WPSC docket 6690-UR-121, Direct-WPSC-Arendt-2, lines 2-4].

[redacted]

Therefore, I believe that Ms. Arendt's statement effectively rebuts the planners' assumptions in this case.

Q Do you have any further comments about the Company's assumptions regarding capacity?

A Yes. In May 17, 2012, PJM Interconnection, the energy and capacity market of mid-Atlantic states (extending to Illinois) published the latest results from a three-year forward-looking capacity auction (i.e. the cost of capacity in PJM in 2015). The results of this auction are attached as Ex.-CW-Fisher-13.[32] The auction results for 2015/2016 cleared at $136 per MW-day, or $49.6 per kw-year in PJM as a whole. These prices are roughly in line with capacity prices in the PJM Interconnection as far back as 2007. WPS noted and commented internally on these auction results, expressing surprise that the capacity prices were not nearly as high as they would have expected due to anticipated coal unit retirements. On May 21, 2012, Mr. James Schott[33] sent an email to an internal group, including Ms. Arendt stating "[redacted]

[32] 2015/2016 RPM Base Residual Auction Results. PJM Docs #699093

[33] Mr. James Schott is listed by Integrys Energy Group as Vice President - External Affairs. See http://www.integrysgroup.com/news/executive_photos.aspx#schott. Accessed November 8, 2012.

[redacted]."[34] I would agree with Mr. Schott's conclusion regarding the capacity prices used to support ReACT.

WESTON 3 GENERATION INCREASES AFTER INSTALLATION OF REACT

Q You have stated that you think an increase in the future output of Weston 3 in the EGEAS model appears to be a limitation of EGEAS rather than a likely outcome of fuel prices. What is the nature of your concern?

A In the ReACT scenario of the base case EGEAS run (now called Future 7), the expected output of Weston 3 recovers from its current historically low output by 2017, and maintains an [redacted]% capacity factor through the end of the analysis period. I am concerned that this rapid recovery in output is not because the economics of the unit recover so quickly over the next five years, but because the EGEAS model is constrained to look only at WPS fleet requirements and availability, rather than availability of generation in MISO. An overly optimistic outlook for Weston 3's generation in the near term would lead to a bias in the Company's economic analysis in favor of retaining the coal unit.

Q Is the capacity factor of Weston 3 currently as high as the anticipated output in EGEAS?

A No. Like many other marginal coal units around the county, the output of Weston 3 has been declining in recent years, presumably due to dispatch competition from low-priced natural gas. From 2000 through 2010, the unit maintained a capacity factor near or above 90%.[35] In 2011, the output of the unit collapsed to 72%. In 2012, only nine months of generation output have been reported to the EPA, but the average capacity factor over those nine months has been about 55%. The EGEAS output roughly agrees with this trend (see figure, below), but then rapidly increases the output of the unit to an [redacted]% capacity factor by 2018 and only continues to increase from there.

[34] Ex.-CW-Fisher-14c.
[35] Source: EPA Clean Air Markets Division (CAMD) Air Markets Program Data (AMPD) query for "Gross Load" for Weston 3, 2000-2012.

Figure 6. Historic and projected generation of Weston 3 in Future 7.

Q Are company-projected fuel prices the only driver in the projected increase in Weston 3 output?

A No. Some component of the increase could be due to the changing differential in fuel prices. The very rapid rise in output, however, appears to be a function of something else entirely, and I suspect that the increase is largely due to constraints within or limitations of the EGEAS model.

The Company has modeled only their service territory in EGEAS, a not unreasonable boundary. This means, however, that EGEAS must fill in generation and capacity from existing Company resources and a limited range of resource options available to it. The Company assumes that they will lose or terminate several contracts with fairly large contributors to their energy supply by 2016, including , and in the original analysis of Futures 1-3, Fox Energy Center. As these units are taken offline, the output of Weston units 3 & 4 increases proportionally.

In fact, I can show that this early increase in output is due to a model constraint by looking at Weston 3's output in the ReACT scenarios from Futures 7 and 1. In both futures, a new large resource in a near-term year appears to suppress the model's requirement for generation from Weston 3. In Future 7, the Company secures a large amount of output from Fox in 2013; subsequently, the need for

energy from Weston 3 is suppressed in 2013. In Future 1, the Company obtains a generic PPA for combined cycle power in 2014, therefore the need for energy from Weston 3 is suppressed in 2014 (see figure, below).

Figure 7. Generation output of Weston 3 in Futures 1 and 7.

Q Would the Company be expected to make up its own energy requirements when resources are dropped or contracts terminated?

A Not necessarily. Because WPS operates within MISO, I would actually expect dispatch from a large cohort of units in MISO to make up the difference if a unit is retired from service. While the Company may have a desire to acquire new generation resources for reliability or stability purposes, there would be no reasonable expectation that the Company's own resources would be dispatched preferentially to all of the other resources in MISO when the Company terminates contracts or retires their own units.

By modeling only their own service territory, the Company models a system in which their own units would be dispatched out of merit order in MISO. I think that this is an unlikely scenario.

Finally, the Company indicated in response to data request 3-CW-24 that they do not expect the Weston 3 unit to increase in dispatch once ReACT is operational in 2017. In response to a question querying if CO_2 emissions will increase from ReACT, the Company states that:

> ReACT will impact CO2 emissions, and likely lead to a decrease in those emissions due to less unit dispatch….. installing ReACT is expected to slightly lower the dispatch of the unit, which should more than offset these projected increases. [Response to RFP 3-CW-24]

The wording of this response is important. ReACT will reduce the capacity of Weston 3 and effectively impose a de-rate on the unit, impacting generation. I would expect that adding emissions controls to this unit, however, will increase the dispatch of the unit, allowing it to operate in more hours of the year. If the operating costs are really increased enough to impact dispatch, I would not expect to see such marked increases in output over the next five years.

Q Have you corrected the increased output of Weston 3 in your economic analysis of ReACT?

A In my model, I offer an alternative future in which the output of Weston 3 does not exceed 1,828 GWh per year, or a 65% capacity factor. I do not think this is the exact future, but instead represents a reasonably likely risk that Weston 3 will not recover its former high capacity factors.

SYNAPSE WESTON 3 RETIRE / REPLACE ECONOMIC ANALYSIS

Q Were you able to evaluate the economic merit of installing ReACT against replacement outside of the Company's modeling?

A Yes. I constructed a simple cash-flow model to evaluate the simple tradeoff between Weston 3 and purchases of market energy and capacity. My analysis relied on output from the EGEAS model provided by the Company, as well as various inputs provided through various discovery responses, including WPSC 1.01 (initial EGEAS data), 1.02 (Exhibits to Appendix B), 1.03 (Futures 4 & 5),

and 1.06 (Futures 7-9), as well as 2-CW-5 (input assumptions), 3-CW-8 & 9 (additional MIDAS workpapers), and 4-CW (EGEAS scenario CW1).

Q Why did you choose to model market purchases of capacity and energy, rather than the resources chosen by the EGEAS model?

A It is important to note that I do not consider these scenarios optimal solutions; I am simply testing alternate assumptions and lifting restrictions imposed by the Company in their modeling.

First, I do not have access to the EGEAS model as used by the Company. Second, to test numerous scenarios rapidly, I wanted a framework in which the replacement option does not have convoluted impacts on the system. Third, I think that the market-based solution in this case actually results in a more expensive, and therefore conservative, solution than the optimized multiple-resource solution determined by EGEAS.

Q Were you able to replicate the Company's scenarios and futures?

A Yes. The goal of my economic analysis is to broadly match the mechanism used by EGEAS, and then replicate, as closely as possible, the net benefits (or liabilities) modeled by the Company. Once I have established this replication, I am more confident of the ability of the model to explore assumptions not used by the Company.

The results of my replication of the Company's estimated net benefit of replacing Weston 3 are shown in **Table 3**, below.[36] With the exception of Future 4, the results are within $43 million, and often much closer – particularly for the Company's "baseline" results in Futures 1 and 7.

[36] Comparative scenarios are 3 vs. 8 in Futures 1-4, and 9 vs. 1 in Futures 7-9.

Table 3. Results of Synapse economic analysis of runs replicating Company results. Negative values indicate net benefit of ReACT. Positive values indicate net benefit of replacement. Values in million 2011$.

	Synapse Result	Company Result	*Difference*	*Company Source*
WPS Future 1	**-$305**	**-$293**	*-$12*	*Application, p52*
WPS Future 2	**-$300**	**-$257**	*-$43*	*Application, p52*
WPS Future 3	**$59**	**$16**	*$43*	*Application, p52*
WPS Future 4	**-$14**	**-$82**	*$68*	*PSCW Data Request 1.03*
WPS Future 7	**-$244**	**-$260**	*$16*	*W3 ReACT Econ. Update (1.06)*
WPS Future 8	**-$303**	**-$281**	*-$22*	*W3 ReACT Econ. Update (1.06)*
WPS Future 9	**$55**	**$65**	*-$10*	*W3 ReACT Econ. Update (1.06)*

All of these scenarios assume that in the replacement case, the Company must purchase the [redacted] at full price from 2014-2024, and have attempted to replicate end effects or the extension period used by the Company.

I consider Future 7 to be the Company's baseline future, upon which they base their decision to retrofit Weston 3 with ReACT (Scenario 1) as opposed to replacing it at the end of 2016 (Scenario 9). In that case, my calculation is within 6% of the Company's "net benefit" calculation, or about 1% of the total PVRR of operating Weston 3 with ReACT through [redacted]. In other words, I believe that, despite the fact I am not using the EGEAS model, I have still produced results commensurate with those used by the Company.

Q What changes do you then make to the Company's set of assumptions in your economic analysis?

A I made the following changes:

1. Remove the extension period from the analysis;
2. Remove the high cost capacity [redacted] from the analysis and substitute in the Company's capacity price forecast;
3. Review a reasonable range of futures, including mid-CO_2 price forecast and a mid-gas forecast.

Q How did you remove the extension period from the analysis?

A I found that in order to replicate the results of the Company, I had to assume that the extension period did not model a replacement for Weston 3 after 2049. I've called this extension period assumption "No replacement end of life." We can correct this extension period error by assuming that the energy and capacity from Weston 3 are replaced by market purchases in [redacted] ("Market replacement end of life"). However, to simplify this analysis, I believe that the best option is to simply end the analysis period in 2040 and remove excess extension period costs assumed by the Company in the 2038/2039 timeframe ("No extension period").

Q What was the impact of removing the extension period from the analysis?

A The effect of removing the extension period is shown in **Table 4**. In the Company's baseline scenario (Future 7), the net benefit of installing ReACT drops by half from $244 million to $126 when removing or correcting the extension period error alone.

Table 4. Results of Synapse economic analysis changing and removing extension period effects. Negative values indicate net benefit of ReACT. Positive values indicate net benefit of replacement. Values in million 2011$

	No Replacement End of Life	Market Replacement End of Life	No Extension Period
Future 7	-$244	-$94	-$126
Future 8	-$303	-$69	-$234
Future 9	$55	$167	$60

Q How did you remove the high cost [redacted] from the analysis?

A To remove the high cost [redacted], I simply (a) removed the 10-year [redacted] requirement imposed by the Company, allowing the capacity purchase to be taken in 2017 instead of 2014 and (b) scaled the cost of the [redacted] to be the long-term forecast provided by the Company in Exhibit 17 (see blue bars in Figure 5 on page 32).

Q What was the result of removing the high cost [redacted] from the analysis?

A The effect of removing the high cost [redacted] from the analysis is to universally make the retrofit look less desirable. I show the results of my analysis and the Company's estimate of the benefit of retirement in Table 5, below.

Table 5. Results of Synapse economic analysis removing [redacted]. Negative values indicate net benefit of ReACT. Positive values indicate net benefit of replacement. Values in million 2011$

	Includes Company Extension Calculation			*No extension Period*	
	With [redacted]	Without [redacted]	Company Result*	With [redacted]	Without [redacted]
Future 7	-$244	-$74	-$85	-$126	$44
Future 8	-$303	-$133	-$103	-$234	-$64
Future 9	$55	$225	$310	$60	$230

* Company result from 4-CW-1. Request involved removal of 10-year [redacted]. Results comparable to "Without [redacted]" column.

The first section (left three columns) shows the difference in results when the extension period is left in place. The first column replicates the Company's EGEAS findings, inclusive of both extension period and the [redacted]. The second column removes the [redacted] from my economic analysis, dropping the net benefit of installing ReACT from $244 million to $74 million – or a departure of $170 million, nearly 70% of the supposed benefit of maintaining Weston 3. The third column verifies my results with a Company EGEAS run in response to discovery request 4-CW-1, where the Company also shows a decrease in the net benefit of installing ReACT to $85 million, or a $175 million departure (67% of the initial benefit).

The second section (right two columns) shows the change in net benefit of installing ReACT when both the erroneous extension period is removed and capacity is priced along the Company's forecast: the net benefit turns into a liability of $44 million.

Q How did you review alternative futures for CO_2 and gas prices in your model?

A Testing a different set of alternative futures required deconstructing the Company's estimated market prices for electricity. As I noted earlier, the Company used the MIDAS model to construct regional market energy prices, based on a number of input assumptions for fuel prices, emissions prices, and the amount of coal power expected to be retired in the next decades. I do not have access to the MIDAS model as used by the Company,[37] and the Company only ran a limited selection of Futures.

To test alternative CO_2 projections and a range of gas prices, I made the assumption that the marginal cost of energy is primarily a function of the cost of natural gas, coal carbon allowances. I also assumed that the Company's use of the MIDAS model remained unchanged between runs, only changing fuel and emissions prices, and estimated retirements. I constructed an Analysis of Variance (ANOVA) test to derive the influence of gas, coal, and CO_2 prices on market energy prices, testing all years simultaneously (i.e. n=30). I found that both peak and off-peak energy prices in all of the futures were well predicted by gas and CO_2 prices, and that the relationship between energy prices and these two variables were consistent across Futures 1,2,4,7, and 8 (r^2 values ≥ 0.98). I used de-trended versions of both the dependent and independent variables across all of the futures together (i.e. n=150) to estimate the relationship between market prices and gas and CO_2 prices.

Overall, I derive an equation for on and off-peak market energy each year from the gas price, CO_2 price, and year. The actual equations are shown in Ex.-CW-Fisher-15. Using these equations, I can estimate a MIDAS-equivalent market price for on-peak and off-peak energy for a range of gas and CO_2 prices.

[37] Moreover, the Company supplied little data or support for their use of the MIDAS model to create market prices, citing only the use of Ventyx assumptions in the base data, aside from modifying fuel and emissions prices, and expected coal retirements.

Q Why would you want to change the Company's set of Futures?

A As I described earlier, I think the Company's Futures are deficient and biased. I believe that a more informative way of looking at the cost and benefit of retrofitting or retiring a marginal coal plant like Weston 3 is to evaluate the net benefit under a reasonable range of uncertain prices, without pre-judging the expectation or outcome by, for example, calling a Future "coal unfriendly" when it is in fact, quite friendly to the continued use of coal. I think at least looking at a reasonable baseline and then bookends is more informative than cherry-picking futures.

Q What is the impact of altering gas and CO_2 prices on the net benefit of ReACT?

I tested three gas price futures – those disclosed by the Company in Exhibit 17 to the Appendix of the initial Application. I labeled these low, base, and high, respectively. I also tested four CO_2 price futures – zero, and then three trajectories recommended by Synapse in our most recent CO_2 price forecast. The "base" CO_2 price forecast used by the Company, derived from a [redacted] forecast, is similar to the Synapse "low". All of these forecasts, like the Company's, start in 2022.

I derived estimated market prices for each combination of gas and CO_2 price forecast. I first ran an analysis with the Company's version of the extension period intact and the Company's high price [redacted] also intact. The results of this analysis are in Table 6, below.

Table 6. Results of Synapse economic analysis testing alternative gas and CO_2 price futures, with WPS assumptions for both end effects and capacity prices. Negative values indicate net benefit of ReACT. Positive values indicate net benefit of replacement. * = value indicates closest analog to Company-estimated baseline benefit of ReACT.

PVRR(d) Benefit of Retiring Weston 3

CO_2 Price \ Gas Price	Low	Base	High
None	($83.88)	($350.21)*	($673.75)
Synapse Low	$259.72	($6.61)	($330.15)
Synapse Mid	$505.09	$238.75	($84.79)
Synapse High	$793.34	$527.01	$527.01

Cells in Table 6 are color-coded by relative net benefit of replacing Weston 3, with blue cells indicating a positive net benefit of replacement and red cells indicating a negative net benefit (i.e. install ReACT). The cell with a zero CO_2 price and base gas price, with a value of -350 million (i.e. a net benefit to install ReACT) is the closest analog to the Company's base case in Future 7. It is my opinion that the Synapse Mid case is a reasonable CO_2 price forecast. Using the Company's "Base" gas price, I find that, even using the Company's capacity and extension period assumptions, that ReACT is a net liability of about $240 million.

Removing the extension period and high priced [redacted], there are few circumstances in which the ReACT installation is economically beneficial as shown in **Table 7**, below. In the Mid CO_2 and "base" gas price scenario, ReACT poses a net liability of about $337 million. I believe that this is a reasonable mid-range forecast for the liability posed by retrofitting Weston 3.

Table 7. Results of Synapse economic analysis testing alternative gas and CO_2 price futures, with no end effects and WPS projected capacity prices (no [redacted]). Negative values indicate net benefit of ReACT. Positive values indicate net benefit of replacement.

CO_2 Price \ Gas Price	Low	Base	High
None	$169.19	($48.13)	($295.08)
Synapse Low	$403.25	$185.94	($61.02)
Synapse Mid	$554.73	$337.42	$90.46
Synapse High	$764.75	$547.43	$300.48

Only in the circumstance that there is no CO2 price and that gas prices are extremely high, does the retrofit of Weston 3 look at all economically advantageous. Under all other circumstances, the unit is a significant liability and is not in ratepayers interest.

Finally, if it is true that the long-term outlook of Weston 3 are lower capacity factors – closer to 65% than 85% - then the outlook for the unit is even less attractive as shown in **Table 8**, below.

Table 8. Results of Synapse economic analysis testing alternative gas and CO_2 price futures, with no end effects, WPS projected capacity prices (no [redacted]) and fixed output of W3 at 1,828 GWh per year. Negative values indicate net benefit of ReACT. Positive values indicate net benefit of replacement.

CO2 Price \ Gas Price	Low	Base	High
None	$313.34	$144.04	($47.77)
Low	$493.80	$324.50	$132.69
Mid	$610.36	$441.06	$249.25
High	$772.19	$602.89	$411.08

In this case, there is but one circumstance in which retrofitting Weston 3 results in even marginal benefits, and it requires no long term CO_2 price and very high natural gas prices to be realized.

REASONABLE ALTERNATIVES – ENERGY EFFICIENCY

Q You cited a concern that the "Company failed to examine other, legitimate opportunities to replace the energy and capacity from the Weston 3 unit, such as with additional energy efficiency or other demand-side management techniques." Please explain.

A The Company is in the process of determining if they should spend nearly a quarter of a billion dollars on emissions controls at Weston 3. This level of investment warrants an in-depth examination of all potential opportunities to find more cost-effective mechanisms of meeting generation and capacity requirements in WPS's service territory. I am concerned that the Company has not given all due consideration to reasonable alternatives to investment in Weston 3, such as the procurement of additional renewable energy, or investments in energy efficiency (EE) or other demand-side management (DSM) programs.

Q Why does the Company's outlook towards energy efficiency matter in this case?

A DSM potentially offers the opportunity to offset some, or possibly all, of the requirement for the Weston 3 unit. DSM is one of the lowest cost options, is a zero-emissions technology, provides long-term benefits for WPS ratepayers, provides a buffer on commodity volatility (i.e. fuel and emissions prices), and is generally viewed favorably by the EPA – particularly as a mechanism towards lowering emissions from stationary sources. Given the opportunity to invest in DSM where it provides a lower cost of energy and capacity than continuing to invest in, fuel, and maintain the Weston 3 unit, the Company should have given those programs due consideration.

Q How should the Company have incorporated energy efficiency into their economic analysis?

A Such a consideration could have taken the form of either an avoided cost study (i.e. what level of spending on demand reduction could the Company reach by re-directing capital spending into energy efficiency) or directly into the optimization study as a resource choice with a certain cost of energy and expected capacity savings.

Q How has the Company viewed energy efficiency in this case?

A I believe that in the base-case runs, the Company simply assumed that some fixed amount of efficiency would be achieved regardless of the fate of Weston 3. The Company notes that their baseline demand forecast includes energy efficiency,[38] but this same demand forecast is used to cost out the future with ReACT and the future with replacement.

On page 52 of the initial application and Exhibit 1 of Appendix C, the Company shows the results of a sensitivity case for "low load" which is explained in total by a footnote on page 47 stating that "Future 1 will include sensitivity [sic] looking at WPS low load to address energy efficiency." The Company concludes after reviewing lower load scenarios that "a lower load forecast does not materially change the economics of ReACT compared to replacing Weston Unit 3 after 12/2016." (Application, page 22)

I disagree with the Company's findings. The results of this sensitivity are actually quite telling. While at low loads the Company finds that installing ReACT is still a net benefit relative to replacement costs, the impact of a low load scenario imparts savings that far exceed the benefit of installing ReACT.

Q Could the Company have estimated the net benefit of achieving deeper efficiency savings instead of installing ReACT?

A Yes. The Company seems to have set up this scenario quite handily, but simply failed to connect the dots. For example, Table 9, below shows the total costs of

[38] See footnote (2) to Exhibit 13 in Appendix C.

the Company's cases in which Weston 3 is replaced under both baseline and low load forecasts (Cases 3 & 13, respectively), and in which ReACT is installed under both baseline and low load forecasts (Cases 8 and 14, respectively). The Company finds that under either load future, there is a benefit for installing ReACT: $293 million and $273 million (2011$) for high and low forecasts, respectively.

Table 9. Comparison of Company Future 1 results vs. Future 1 with low load. Source: Exhibit 1, Appendix C. Values in million 2011$.

	Future 1 Baseline		Future 1 Low Load Sensitivity
Replace W3 (Case 3)	11,694	Replace W3 (Case 13)	11,077
Install ReACT (Case 8)	11,401	Install ReACT (Case 14)	10,801
Benefit of Replacement (Case 8 – Case 3)	-293	Benefit of Replacement (Case 14 – Case 13)	-276

If one were to consider directing long-term Company funding priorities to additional energy efficiency spending instead of maintaining Weston 3, however, then one might compare the outcome of replacing Weston 3 as the difference between Cases 8 and 13, as shown in Table 10, below.

Table 10. Estimate of benefit of additional energy efficiency in replacement of ReACT. Source: Values from Exhibit 1, Appendix C. Values in million 2011$.

	Future 1
Replace W3 with Efficiency (low load) (Case 13)	11,077
Install ReACT with baseline load (Case 8)	11,401
Benefit of Replacement with low load (Case 8 – Case 13)	+324

The case shown in Table 10 reviews the benefit of replacing Weston 3 with additional energy efficiency, and thus a lower load forecast, versus installing ReACT with no additional investments in energy efficiency. The net benefit of replacing ReACT becomes instead a significant liability of about $324 million.

This theoretical case clearly does not account for the actual cost of energy efficiency to achieve this lower load profile, and such costs must be taken into account. If we were to attribute every reduced MWh in the low-load forecast to Company-sponsored efficiency, we find that the Company estimates a modest savings of about 20,000 MWh per year.[39] At a conservative cost for EE of $0.04/KWh (lifetime savings),[40] the cost of EE could be estimated at roughly $800,000 per year, or a net present value of about $13 million 2011$. Using the Company's forecast difference between the baseline and low load forecast, the total cost is closer to $25 million 2011$. Deducing this value, the net present benefit of replacing Weston 3 with a portfolio that includes additional energy efficiency is about $300 million.

Q What do you conclude regarding the use of energy efficiency in the ReACT application?

A It is my opinion that the Company's application and supporting testimony is deficient without a serious review of the option of investing in additional energy efficiency to mitigate any long-term need for the energy or capacity from Weston 3. The Company's modeling indicates that there are significant system savings to be realized from reducing their load generally; if some of the funding that would otherwise be used to extend the life of Weston 3 in 2017 were otherwise diverted to reducing load starting today, then the Company could save ratepayers significant dollars in capital investments, could defer the requirement for future generation and capacity needs, and would certainly mitigate fuel and regulatory uncertainty.

[39] Difference between year-to-year growth of base load forecast and low load forecast after 2017. Data from Exhibit 13, Appendix C of Initial Application. Differences prior to 2017 are more sporadic and vary from savings of [redacted] MWh in 2012 to [redacted] MWh in 2014.

[40] See Friedrich, F., M Eldridge, D York, et al., September 2009. ACEEE U 092. Saving Energy Cost-Effectively: A National Review of the Cost of Energy Saved through Utility-Sector Energy Efficiency Programs. Range is from $0.016 to 0.033 /kWh. Available online at http://www.aceee.org/files/pdf/conferences/eer/2009/4C_Friedrich_Eldridge.pdf

CONCLUSIONS AND RECOMMENDATIONS

Q Do you think that the Company has appropriately assessed the costs and risks associated with installing ReACT on Weston Unit 3?

A No, I think the Company's application and analysis is lacking on a number of fronts.

First, in my testimony and that of my colleague, Mr. Ron Sahu, we have described why the Company should not be moving forward on investments to mitigate emissions at Weston 3 at this time. In particular, we have shown that there is significant uncertainty about the outcome of ongoing settlement discussions with EPA to resolve a series of Clean Air Act enforcement actions. Dr. Sahu has shown that ReACT is not only a high risk cost, but is very likely to be redundant with other, additional expenditures required to fully mitigate emissions.

Secondly, I have shown that the Company's analysis of the economic benefit of installing ReACT is deficient and biased. In general, the Company's framework for evaluation is generally sound, but I have significant reservations and concerns about assumptions and execution of the analysis. In my testimony, I have described five key areas of concern in the execution of the analysis, including (1) the biased definition of the planning futures, (2) the absence of the costs of compliance with emerging environmental regulations, (3) the misuse of the extension period in EGEAS, (4) unrealistically high costs of near-term capacity, and (5) a mischaracterization of the output of Weston 3 in the limited scope of the EGEAS analysis.

Finally, I show that the Company's lack of consideration for cost effective energy efficiency in the potential replacement portfolio for Weston 3 is a critical flaw in the analysis of ReACT.

Q Do you have a recommendation for this Commission?

A Yes. I recommend that the Commission deny the Company's application for a CA at this time. The Company should not be permitted to submit an application for a CA until such time that the Company is able to show definitively that (a) ReACT

is the most reasonable pollution control that meets its compliance obligations, (b) that ReACT is acceptable by EPA under the final Consent Decree that emerges from settlement discussions and public comment, and (c) it has taken into account the reasonable (likely) risk of further emissions reductions obligations.

Should the Company choose to submit a new application, any such new application should (a) present a reasonable and up-to-date range of commodity prices and reject the use of biased Futures, (b) use forward-modeling software appropriately, (c) take into account all avoidable costs that could be achieved by the retirement of an existing generator, (d) examine and cost out all known and emerging regulatory compliance obligations, (e) show the results of RFPs or other pre-contractual negotiations with potential competitive suppliers of energy and capacity, and (d) rigorously examine all cost effective energy efficiency prior to making large capital investments.

Q Does this conclude your testimony?

A It does.