BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Grain Belt Express	)	
Clean Line LLC for a Certificate of Convenience and	)	
Necessity Authorizing it to Construct, Own, Operate,	)	
Control, Manage, and Maintain a High Voltage, Direct	)	Case No. EA-2016-0358
Current Transmission Line and an Associated Converter	)	
Station Providing an interconnection on the Maywood-	)	
Montgomery 345 kV Transmission Line	)	

MOTION OF MISSOURI LANDOWNERS ALLIANCE TO STRIKE CERTAIN PRE-FILED EVIDENCE ON THE BASIS OF SECTION 536.070(11) RSMo

COMES NOW the Missouri Landowners Alliance (MLA) and respectfully asks the Commission to strike certain portions of the pre-filed testimony and Schedules in this case, as designated in paragraphs 4 through 9 below, on the ground that (with two exceptions) the evidence is inadmissible under the terms of § 536.070(11) RSMo. In support of this Motion, the MLA states as follows:

1. The statute which forms the basis for this Motion, § 536.070(11) RSMo, provides in relevant part as follows:

> The results of statistical examinations or studies, or of … compilations of figures … or examination of many records, or of long or complicated accounts, or of a large number of figures, or involving the ascertainment of many related facts, shall be admissible as evidence of such results, if it shall appear that such examination, study, audit, compilation of figures, or survey was made by or under the supervision of a witness, who is present at the hearing, who testifies to the accuracy of such results, and who is subject to cross-examination, and if it shall further appear by evidence adduced that the witness making or under whose supervision such

> examination, study, audit, compilation of figures, or survey was made was basically qualified to make it. All the circumstances relating to the making of such an examination, study, audit, compilation of figures or survey, including the nature and extent of the qualifications of the maker, may be shown to affect the weight of such evidence but such showing shall not affect its admissibility;

2. The above statutory provision is applicable to proceedings of this Commission. S*ee Big River Telephone Company v. Southwestern Bell Telephone Company*, 440 S.W.3d 503, 511 (Mo App 2014)

3. The evidence identified in paragraphs 4 through 9 below fails to meet the standards of admissibility set forth in § 536.070(11), *supra*, in either of two ways: (1) the evidence itself constitutes the "compilations of figures" or the "examination of many records or of long or complicated accounts", or "of a large number of figures", or involve "the ascertainment of many related facts", and was not compiled by a witness to this case who is available for cross-examination; or (2) the evidence sought to be stricken is derived from evidence meeting the first of these two criteria. In the second situation, the evidence is analogous to the fruit of a poisonous tree.

4. <u>Wind Speed Maps and Related Testimony of Mr. David Berry.</u> Schedule DAB-4 to Mr. Berry's direct testimony is a color-coded map of the United States, depicting wind speeds in different regions of the country. As indicated on the face of Schedule DAB-4, the map was prepared by a company named AWS Truepower.[1]

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[1] The box in the bottom-right corner states: "Source Wind resource estimates developed by AWS Truepower, LLC …."

The process whereby AWS Truepower generates its wind maps is highly complex, using a wide array of data gathered from various sources. The process is described by Mr. Berry in a response to data request DB.43, which is attached to this motion as Exhibit A. As is apparent from that description, the wind map itself clearly falls within the parameters of Section 536.070(11).

Mr. Berry discusses the data depicted on the map, and the conclusions he draws from that data, at the following pages of his direct testimony: page 25, l. 17; page 25 line 21 to page 26 line 5; page 27 lines 9-12; page 32 lines 7-14; and page 41 lines 12-13.

Accordingly, the MLA asks that Mr. Berry's Schedule DAB-4 be stricken, as well as the testimony referred to in the preceding paragraph.

5. <u>Footnote 1 to direct testimony of Mr. David Berry</u>

In footnote 1 at page 6 of his direct testimony, Mr. Berry summarizes the results of a study conducted by the Brattle Group, and filed by Grain Belt on April 13, 2015 after the close of the hearings in the 2014 case as Supplemental Exhibit 14 with their "Response to Order Directing Filing of Additional Information", EFIS No. 508. As indicated in footnote 1 of Mr. Berry's testimony, the study addressed the variability introduced by integrating wind from the Kansas wind farms into the MISO system; the potential for additional reserve requirements from the addition of the Project into the MISO system; and the potential cost impact from the addition of the Project.

The study consists of 29 pages of highly technical, complex information and conclusions, written by five different individuals at the Brattle Group. The cover page and pages 9 and 10 from that study[2] are attached hereto as Exhibit B, and clearly demonstrate that the study falls within one or more of the parameters of Sec.

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[2] Using the numbers from Supp Exh 14 at the lower left corner of the pages.

536.070(11). Accordingly, the MLA moves to strike footnote 1 to Mr. Berry's direct testimony.

6. Material from the rebuttal testimony of MJMEUC witness Mr. Grotzinger. Schedule JG-2 to Mr. Grotzinger's rebuttal testimony is a lengthy document titled "Regional Market Report." The document is marked as "HC", and so without discussing the contents of the document, it was prepared by a firm named Leidos, Inc.[3] The report was clearly prepared by someone other than Mr. Grotzinger, and based on the contents of the document is inadmissible under Section 536.070(11).[4] Accordingly, the MLA moves to strike Schedule JG-2. The MLA also moves to strike page 3, lines 12-17 of Mr. Grotzinger's rebuttal testimony, where he addresses Schedule JG-2.

In addition, Schedule JG-6 to Mr. Grotziner's rebuttal testimony consists of a list of seven alternative sources of power, the prices for which he compares to the prices provided for in MJMEUC's contracts with Grain Belt and Infinity Wind. As indicated in Mr. Grotzinder's response to data request JG.39, which is attached hereto as Exhibit C, all eight of the sources of power (including the Grain Belt alternative) incorporate assumptions about energy prices which were derived from Schedule JG-2, the Leidos report.[5] Therefore, the cost data of the eight alternatives shown at Schedule JG-6 constitute the fruit of a poisonous tree (Schedule JG-2) and the analysis for all eight alternatives shown at Schedule JG-6 are therefore inadmissible and must be stricken.

Finally, the MLA moves to strike the testimony from Mr. Grotzinger which address the results and conclusions derived from Schedule JG-6; i.e, his rebuttal testimony from page 7 line 19 to page 8 line 6.

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[3] See cover page and unnumbered page 4 with a reference to the copyright of the report.

[4] See, e.g., pages 2-16 to 2-25, and 3-6 to 3-32.

[5] See also the notes at the bottom of Schedule JG-6 itself.

7. Material from the rebuttal testimony of Mr. Alan Spell. Mr. Spell was responsible for the compilation of the Economic Impact Study which was submitted as Schedule MOL-7 to Mr. Lawlor's direct testimony.[6] Included as Schedule AES-2 to Mr. Spell's rebuttal is a copy of a lengthy, complex study which indicates on its cover page that it was compiled by Dr. David Loomis.[7] The contents of the Loomis study clearly come within one or more of the parameters of Section 536.070(11). Accordingly, the MLA moves to strike Schedule AES-2, the Loomis study, on the ground that it is inadmissible under the provisions of that statute.

In addition, as Mr. Spell testifies, he used data from the Loomis study (AES-2) in compiling the results of the Economic Impact Study submitted as Schedule MOL-7.[8] Accordingly, if Schedule AES-2 is not admissible, then the Economic Impact Study submitted as Schedule MOL-7 is also inadmissible, as fruit of a poisonous tree. Accordingly, the MLA moves to strike Mr. Lawlor's Schedule MOL-7 and the following portions of Mr. Spell's rebuttal testimony which address the Economic Impact Study submitted at Schedule MOL-7: page 2 line 13 to page 4 line 5; and page 7 lines 7 to 18.

In addition, the MLA moves to strike the following testimony which also quotes from and/or relies on the Economic Impact Study submitted as Schedule MOL-7:

The rebuttal testimony of Barbara A. Meisenheimer at page 9 lines 11-17;

the surrebuttal testimony of Mark Lawlor at page 2 lines 5-17;

the direct testimony of Mark Lawlor, p. 15 lines 4-13; and

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[6] See rebuttal testimony of Alan Spell, page 2 lines 9-10.

[7] The study by Dr. Loomis is apparently not marked as Schedule AES-2, and in fact bears the Schedule number DLG-2 from the 2014 case. However, from Mr. Spell's rebuttal testimony, at page 6 lines 15-17, it is clear that his Schedule AES-2 is intended to be the Loomis study.

[8] "Clean Line also provided Dr. Loomis's analysis, shown in Schedule AES-2, which was used to determine direct construction spending by detailed categories and by state." Rebuttal Testimony of Alan E. Spell, page 6 lines 15-17.

the direct testimony of Michael Skelly, p. 6 line 6; p. 17 lines 7-9; p. 31 lines 19-23.

8. Annual $10 million dollar savings study. At page 3 lines 15-19 of his direct testimony, Mr. Lawlor in essence says that the Grain Belt contract will save MJMEUC members at least $10 million annually compared to an existing contract for fossil fuel generation. However, as is evident from his responses to MLA data requests ML.2 and ML.49, which are set forth at Exhibit D hereto, Mr. Lawlor conducted no analysis himself to support that statement. Instead, as he indicates in the responses to the data requests, he was relying on information supposedly provided to him by MJMEUC.

The problem is, the testimony submitted by the two MJMEUC witnesses does not include any testimony or analysis which supports Mr. Lawlor's statement about the supposed savings from the Grain Belt contract compared to an existing fossil contract. Therefore, the statements from Mr. Lawlor regarding this supposed study lack any foundation, and are mere hearsay statements. Accordingly, on those two grounds the MLA moves to strike Mr. Lawlor's direct testimony at page 3 lines 15-19.[9]

In addition, the MLA moves to strike the rebuttal testimony of Barbara A. Meisenheimer at page 7 lines 9-10 which cites Mr. Lawlor's testimony regarding the $10 million in savings to MJMEUC.

9. Portions of the Rebuttal Testimony and Schedules of Mr. Michael Goggin. Five of the Schedules included with the rebuttal testimony of Mr. Michael Goggin are inadmissible on their face under the terms of Section 536.070(11). Accordingly, the

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[9] Again, this objection is not based on Section 536.070(11), but is included herein to avoid duplicate Motions to Strike.

MLA moves to strike the following Schedules and his rebuttal testimony which addresses or relies on those Schedules:

Schedule MG-2, and page 5, lines 90-95; page 7 lines 130-139; and page 9 lines 178-182.

Schedule MG-3, and page 7 lines 143-147; page 24 lines 499-501; and page 25, lines 510-512.

Schedule MG-4, and page 8, lines 152-157.

Schedule MG-6, and page 22 line 461 to page 23 line 466.

Schedule MG-7, and page 26 lines 538-544.

In addition, there are numerous instances where Mr. Goggin relies in his rebuttal testimony on technical documents compiled by others, particularly in his footnotes. These documents would themselves be inadmissible under Section 536.070(11). Thus the rebuttal testimony relying on those documents should also be stricken, as fruit of the poisonous tree. While this is not a complete list of such instances, the MLA moves to strike the following rebuttal testimony from Mr. Groggin on that basis:

Page 4 lines 67-70, which rely on the material at footnote 4 (See Exhibit E).

Page 4 lines 76-81, which rely on the material at footnote 5 (See Exhibit F).

Page 13 lines 278-29, which rely on the material at footnote 13 (See Exhibit G).

Page 14 lines 289-94, which rely on the materials at footnotes 20-22 (See Exhibit H).

Page 14 line 295 to page 15 line 297, which rely on the materials at footnote 23 (See Exhibit I)

Page 20 lines 413-423, which rely on the materials at footnote 33 (See Exhibit J).

Page 24 lines 498-99, which rely on the material at footnote 47 (See Exhibit G).

Finally, the MLA moves to strike the following portions of Mr. Goggin's rebuttal testimony on the ground that it is inadmissible hearsay, without regard to Section 536.070(11): page 4 lines 84-86; page 14, line 295; page 16 lines 330-333; page 16 lines 335-336; page 20 lines 415-423; page 22 lines 451-456; page 23 lines 474-476; page 23 lines 478-479; and page 23 lines 483-485.[10]

10. Section 536.070(11) is a close, codified relative of the general rule against hearsay. And as the Commission will recall, in objecting earlier to certain of the exhibits offered at the local public hearings, Grain Belt made its position on hearsay evidence quite clear: "Hearsay to which another party objects is not admitted into evidence and is not considered competent and substantial evidence upon which the Commission can base its decision."[11] On this point, the MLA agrees with Grain Belt.

11. Some might believe that under appropriate circumstances, administrative agencies ought to have the ability to waive or relax the evidentiary restrictions of Section 536.070(11). The fact is, however, that the law gives them no such discretion. Instead, the plain language of the statute is unequivocal: if evidence does not meet the requirements of the statute, that evidence is without exception inadmissible. If one wishes to question the efficacy of this law, the place to do so is at the General Assembly.

12. Finally, the MLA should note that it filed a similar Motion to Strike in the 2014 case.[12] That motion was for the most part denied.[13]

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[10] The objection to the material in this paragraph is not based on Section 536.070(11), but is included in this Motion to avoid the filing of a separate Motion for this material alone.

[11] Reply of Grain Belt Express to the Responses of Missouri Landowners and Show-Me Concerned Landowners to Objections to Exhibits Offered at Local Public Hearings, January 3, 2017, par. 6 page 3.

[12] See Motion to Strike at EFIS No. 276 in Case No. EA-2014-0207.

[13] See hearing transcript from November 10, 2014, Tr. 24-25, EFIS No. 321.

WHEREFORE, for the reasons set forth above, the MLA respectfully asks the Commission to strike the testimony and Schedules identified and cited in paragraphs 4 through 9 above.

Respectfully submitted,

Missouri Landowners Alliance

/s/ Paul A. Agathen

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Paa0408@aol.com
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MO Bar No. 24756
Attorney for
Missouri Landowners Alliance

CERTIFICATE OF SERVICE

I certify that a true and correct copy of the foregoing Motion and the attached Exhibits were served upon the parties to this case by email this 6th day of March, 2017.

/s/ Paul A. Agathen
Paul A. Agathen
Attorney for the Missouri Landowners Alliance
Paa0408@aol.com
(636)980-6403

Exhibit A

DB.43 With reference to page 25 lines 18-25 of your testimony, please state whether the wind map at Schedule DAB-04 was compiled by AWS Truepower, and please briefly summarize the process by which that map was compiled.

RESPONSE: The wind map in Schedule DAB-04 was compiled by AWS Truepower and NREL. The map was created using AWS Truepower's MesoMap system.

The underlying model is MASS (Mesoscale Atmospheric Simulation System), a numerical weather model that has been developed over the past 20 years by Truewind Solutions partner MESO, Inc. MASS simulates the fundamental physics of the atmosphere including conservation of mass, momentum, and energy, as well as the moisture phases, and it contains a turbulent kinetic energy module that accounts for the effects of viscosity and thermal stability on wind shear. As a dynamical model, MASS simulates the evolution of atmospheric conditions in time steps as short as a few seconds. As this is computationally demanding and time consuming, MASS is coupled to a simpler but much faster program, WindMap, a mass-conserving wind flow model. Depending on the size and complexity of the region and requirements of the client, WindMap is used to improve the spatial resolution of the MASS simulations to account for the local effects of terrain and surface roughness variations. The wind map in Schedule DAB-04 was created with a spatial resolution of 2.5 km.

The MASS model uses a variety of online, global, geophysical and meteorological databases. The main meteorological inputs are reanalysis data, rawinsonde data, and land surface measurements. The MASS model itself determines the evolution of atmospheric conditions within the region based on the interactions among different elements in the atmosphere and between the atmosphere and the surface. The main geophysical inputs are elevation, land cover, vegetation greenness (normalized differential vegetation index, or NDVI), soil moisture, and sea-surface temperatures. The model translates both land cover and NDVI data into physical parameters such as surface roughness, albedo, and emissivity.

The MesoMap system creates a wind resource map in several steps. First, the MASS model simulates weather conditions over 366 days selected from a 15-year period. The days are chosen through a stratified random sampling scheme so that each month and season is represented equally in the sample; only the year is randomized. Each simulation generates wind and other weather variables (including temperature, pressure, moisture, turbulent kinetic energy, and heat flux) in three dimensions throughout the model domain, and the information is stored at hourly intervals. When the runs are finished, the results are compiled into summary data files, which are then input into the WindMap program for the final mapping stage.

Wind Integration Analysis for the Grain Belt Express HVDC Line

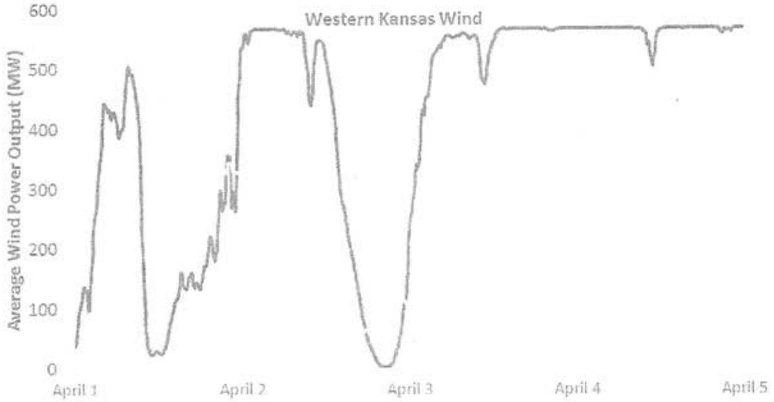
CLEAN LINE
ENERGY PARTNERS

Judy Chang
Johannes Pfeifenberger
Philip Hanser
Roger Lueken
Will Gorman

THE Brattle GROUP

EXHIBIT
B

Figure 1
Wind Generation from Western Kansas and MISO Wind, April 1 – April 5, 2009



Sources and Notes:
5-minute simulated wind generation from NREL WIND toolkit, see NREL (2015). Western Kansas wind represents an aggregation of 70 simulated sites (566 MW installed capacity) in west Kansas. MISO wind represents an aggregation of sites in Illinois, Iowa, Michigan, Minnesota, and North Dakota (566 MW installed capacity), see footnote 5

B. INTEGRATING WIND FROM WESTERN KANSAS WOULD REQUIRE LESS ANCILLARY SERVICES THAN ADDITIONAL WIND FROM MISO

Aggregating the output of many wind generators with diverse locations reduces the total variability of their generation output. Because wind generators in western Kansas are distant from the wind generators within the MISO footprint, the wind power delivered by the Project will be less correlated with existing aggregate MISO wind power than if new wind was developed inside the MISO footprint.

To estimate the correlation between the 5-minute changes in output between western Kansas wind and MISO's existing wind, we simulate adding approximately 100 MW of new wind generation from six locations: western Kansas and five states in MISO that have high quality wind resources (Illinois, Iowa, Michigan, Minnesota, and North Dakota). This means that we

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Continued from previous page

respectively of the aggregate wind capacity in these states. Therefore, Iowa, Illinois, Michigan, Minnesota, and North Dakota sites were assigned to contribute 240 MW, 34 MW, 68 MW, 144 MW, and 80 MW respectively. Clean Line anticipates that approximately 566 MW of installed wind capacity will subscribe to the Project to deliver to Missouri. The line losses on the Project are expected to reduce the amount of power delivered to MISO by about 5%–7% less than the 566 MW of maximum generation capacity we used in the analysis. A maximum of 500 MW would be delivered to Missouri at any one time. However, we have ignored the line losses in our analyses since it is not expected to affect the results in any significant manner.

compared the 5-minute variability associated with adding wind generators from western Kansas with adding *new* wind resources from the five states in MISO. These *new* wind resources are from different sites (even if from the same states) as the existing aggregate MISO wind resources. For each state, we aggregated wind generation from sites such that the simulated new generation capacity is approximately 100 MW. We then estimate the 5-minute output variability from each of the 100 MW of *new* capacity, and tested the correlation of these 5-minute changes to the 5-minute changes in aggregate MISO wind generation (see footnote 5 for details on how aggregate MISO generation was represented).

Table 1 below shows the correlation coefficients (by season) of 5-minute changes in generation between *new* wind resources and MISO's aggregate wind generation. A correlation coefficient of 1.0 would signify a perfect correlation between the 5-minute movements of the wind between western Kansas and MISO wind. A correlation coefficient of negative 1.0 would signify that the outputs from the different locations are exactly negatively correlated (or whenever the wind in one location increases, the wind from another location decreases by the same magnitude.) A correlation coefficient of 0 would signify that there is no relationship between the changes in the generation output from the two resources. We analyze the correlation of 100 MW of new wind capacity added from each of the six locations (western Kansas, Illinois, Iowa, Michigan, Minnesota, and North Dakota) to the representative bundle of existing MISO wind generation. As shown, due to geographic smoothing, the 5-minute changes of wind generation output from western Kansas is almost fully uncorrelated to the wind in MISO (with close to 0 correlation coefficient).

Table 1
Correlation Between 5-Minute Variability of New Wind Generation Added in Six Locations to Aggregate MISO Wind

Western Kansas	0.06	0.14	0.09
Illinois	0.12	0.21	0.16
Iowa	0.60	0.72	0.63
Michigan	0.14	0.23	0.16
Minnesota	0.42	0.62	0.46
North Dakota	0.17	0.29	0.19

Sources and Notes:

This table illustrates the effect of adding 100 MW of newly installed wind capacity from each of the six locations (KS, IL, IA, MI, MN, and ND) to the aggregate existing MISO wind resources. Aggregate MISO wind generation is estimated as the combined generation from sites in IL, IA, MI, MN, and ND (566 MW total capacity). Newly installed wind capacities are from sites different than those included in the aggregate MISO wind generation capacity. For more details, see footnote 5. Wind data from NREL WIND Toolkit (NREL 2015).

Such correlation analysis shows that when combining wind from western Kansas with existing wind resources in MISO, the variability of the combined set of wind resources will exhibit less

BEFORE THE MISSOURI
PUBLIC SERVICE COMMISSION

Response provided by:	John Grotzinger
Title:	Chief Operating Officer Missouri Joint Municipal Electric Utility Commission
Company:	MJMEUC
Address:	1808 Interstate 70 Dr. SW Columbia, MO 65203
Company Response No.:	JG.39
Date of Response:	February 16, 2017

Question:

Near the bottom of your schedule JG-6 there are three assumptions regarding energy prices based on the leidos report. Please state for which of the 8 "source" options on that Schedule those assumptions were incorporated or used.

Response:

All 8 source options.

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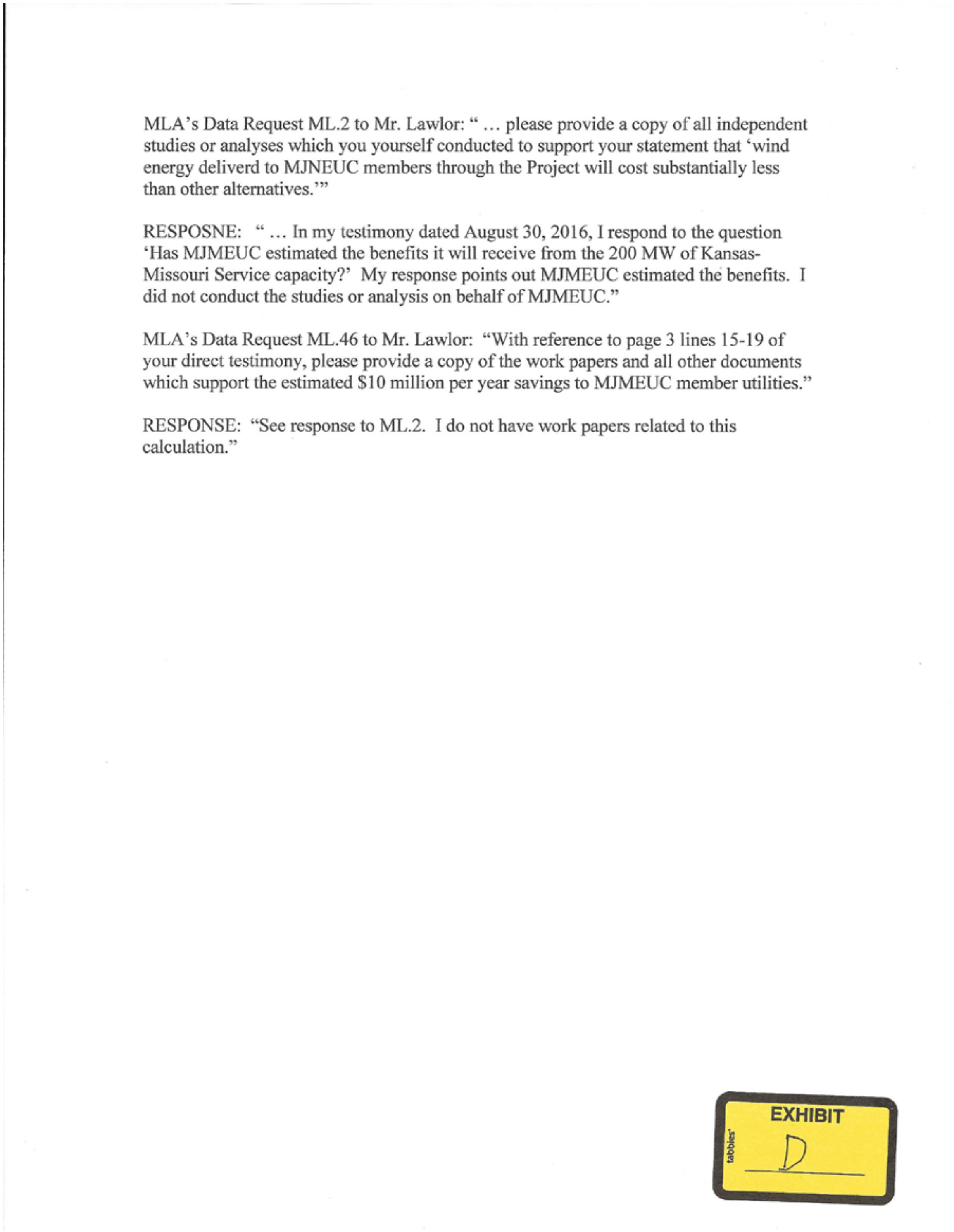

MLA's Data Request ML.2 to Mr. Lawlor: " … please provide a copy of all independent studies or analyses which you yourself conducted to support your statement that 'wind energy deliverd to MJNEUC members through the Project will cost substantially less than other alternatives.'"

RESPOSNE: " … In my testimony dated August 30, 2016, I respond to the question 'Has MJMEUC estimated the benefits it will receive from the 200 MW of Kansas-Missouri Service capacity?' My response points out MJMEUC estimated the benefits. I did not conduct the studies or analysis on behalf of MJMEUC."

MLA's Data Request ML.46 to Mr. Lawlor: "With reference to page 3 lines 15-19 of your direct testimony, please provide a copy of the work papers and all other documents which support the estimated $10 million per year savings to MJMEUC member utilities."

RESPONSE: "See response to ML.2. I do not have work papers related to this calculation."

EXHIBIT

D

Footnote 4

MARKET EFFECTS OF WIND PENETRATION IN ERCOT:

HOW WIND WILL CHANGE THE FUTURE OF ENERGY AND ANCILLARY SERVICE PRICES

By LCG Consulting, October 2016

EXECUTIVE SUMMARY

In recent years, the Electricity Reliability Council of Texas (ERCOT) Region has experienced a rapid expansion of wind generation capacity. Nevertheless, wind generation capacity in ERCOT is expected to further increase in the coming years with many new units expected to come online. The aim of this study is to provide insight into the expected impacts of further wind capacity expansion in the ERCOT market through market simulations with the UPLAN Network Power Model. LCG has developed three scenarios for the 2021 calendar year with differing wind capacity assumptions (15.8 GW, 22.9 GW, and 30 GW). With all other factors held constant, the modeling effort is able to isolate the impact that wind generation will have on energy and ancillary service prices in the ERCOT market.

The first scenario includes only 15.8 GW of wind capacity, the amount of wind capacity installed as of the end of 2015. It is intended to serve simply as a point of reference, against which the higher wind scenarios may be compared, since the installed capacity in ERCOT as of the date of this study already exceeds 16.6 GW. The second scenario includes 22.9 GW of installed wind capacity – an addition of 7.1 GW. This scenario is intended to represent a conservative estimate of the likely wind capacity to be operational by 2021. For point of reference, development projects identified in ERCOT's August 2016 Generation Interconnection Status Report (GIS) as having executed an interconnection agreement, posted financial security, and scheduled to be operational by 2019 total 23.1 GW. Comparing this scenario to the 15.8 GW scenario can give us insight into how the market may be affected as we move from current installed capacity to a level more representative of ERCOT's current GIS reports. The third scenario increases installed wind capacity by an additional 7.1 GW to 30 GW, illustrating the impact on the market of further increases in wind capacity, that could be driven by lower costs, wind turbine technology improvements leading to higher capacity factors, federal legislative limitations on greenhouse gas emissions and/or additional or extended tax incentives, transmission upgrades, or other potential driving factors.

UPLAN simulation results indicate that with higher wind energy deployment, energy prices will be lower and ancillary service prices will be higher. In the 15.8 GW scenario, the annual average load-weighted energy price is $36.30 with a load-weighted implied heat rate (IHR) of 11.3. In the 22.9 GW scenario, load-weighted energy price and IHR fall 6.5% to $33.96 and 10.6, respectively. The 30 GW wind scenario projects a further decrease in the annual load-weighted average energy price to $30.91, with an IHR of 9.7, which represents a 9.0% decrease relative to the 22.9 GW

EXHIBIT
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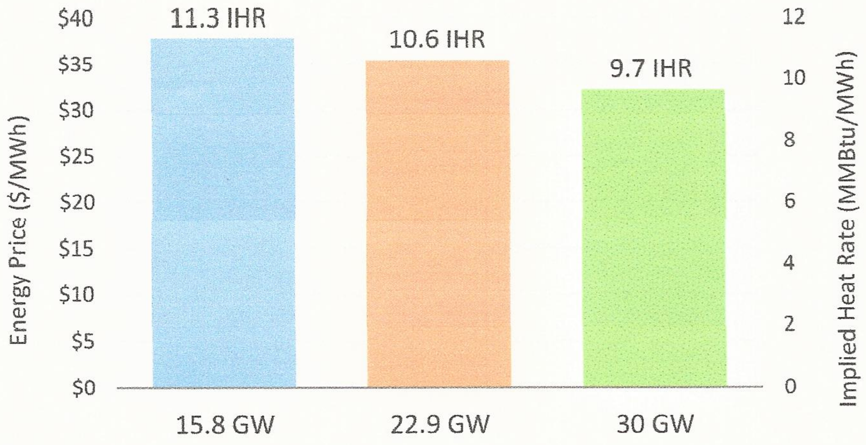
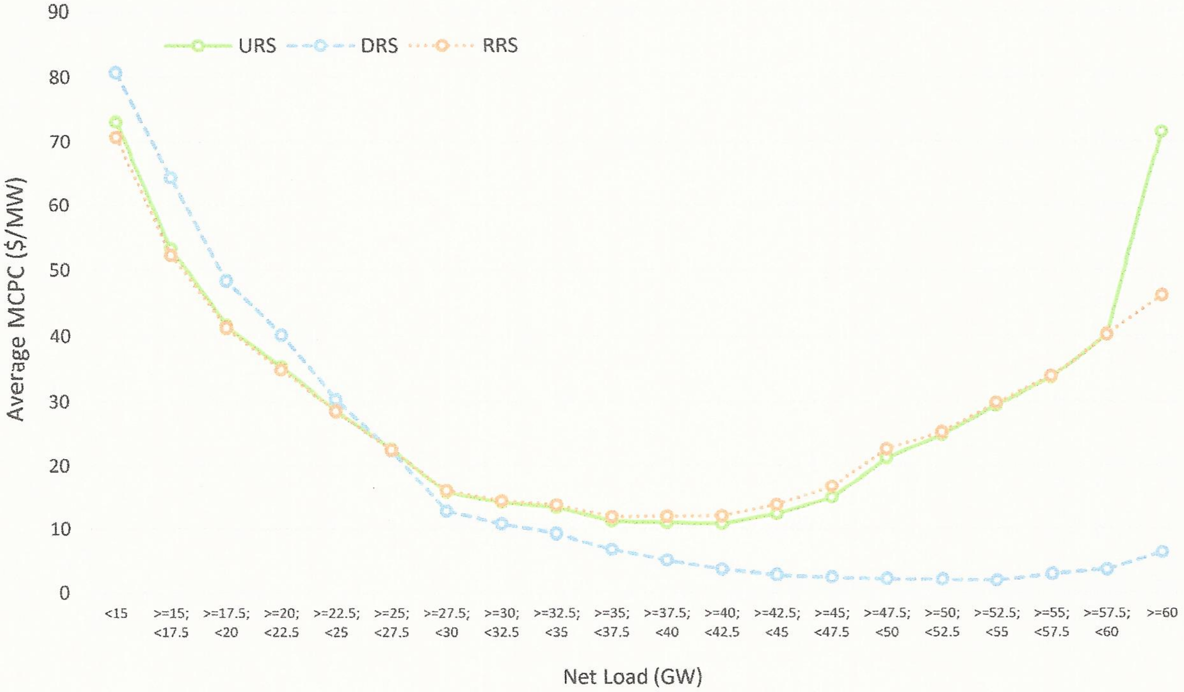
scenario. Figure ES.1 below shows annual average load-weighted system-wide energy price and implied heat rate by scenario.

Figure ES.1 – 2021 Annual Average Load-Weighted System-Wide Energy Price and Implied Heat Rate by Scenario



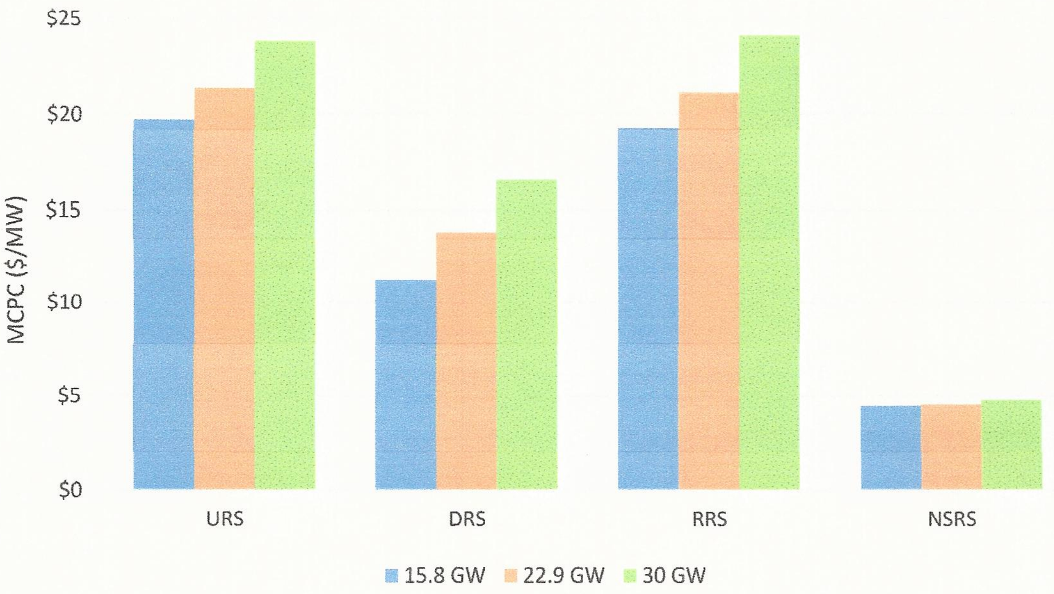
A relationship can be observed between levels of system-wide net load (defined as total customer demand less the energy provided by wind generation) and prices of ancillary service products, in particular, Regulation Up Service (URS), Regulation Down Service (DRS), and Responsive Reserve (RRS). Pictured below in Figure ES.2 are simulation results from the 22.9 GW wind scenario illustrating this relationship. As shown below, higher levels of net load have higher average prices of URS and RRS. In addition, at very low levels of system-wide net load, prices of URS and RRS are higher on average, as is the average price of DRS. In contrast, energy prices have a positive relationship with net load for all levels (higher when net load is higher and lower at low net load levels).

Figure ES.2 – 2021 Average Ancillary Service Prices by Net Load (22.9 GW Wind)



With higher levels of wind deployment, there is a greater occurrence of low net load hours. In UPLAN simulations this leads to increases in annual average ancillary service prices. Figure ES.3 below shows simulation results for average ancillary service prices for the three scenarios.

Figure ES.3 – 2021 Annual Average Ancillary Service Prices by Product



In the 2021 UPLAN simulations, the annual average Operating Reserve Demand Curve (ORDC) price adder is significantly higher than in the 2015 ERCOT market due to the expected increase in load with little thermal generation expansion. However, the ORDC price adder declines as wind generation increases across the modeled 2021 scenarios, as net load is reduced with greater wind generation.

It should be noted that this study assumes only capacity additions and retirements that are currently announced by the ERCOT ISO – with the exception of the variation in wind additions reflected by each scenario. Non-wind capacity expansion for purposes of this study includes those units that have a signed interconnection agreement and have posted financial security according to ERCOT's August 2016 Generator Interconnection Status Report. Retirements are based on scheduled retirements announced by the ISO. Further retirements would impact the energy and ancillary service markets and we leave the analysis of these impacts to future studies.

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Footnote 5 & pg 19

Grid Planning & Operations

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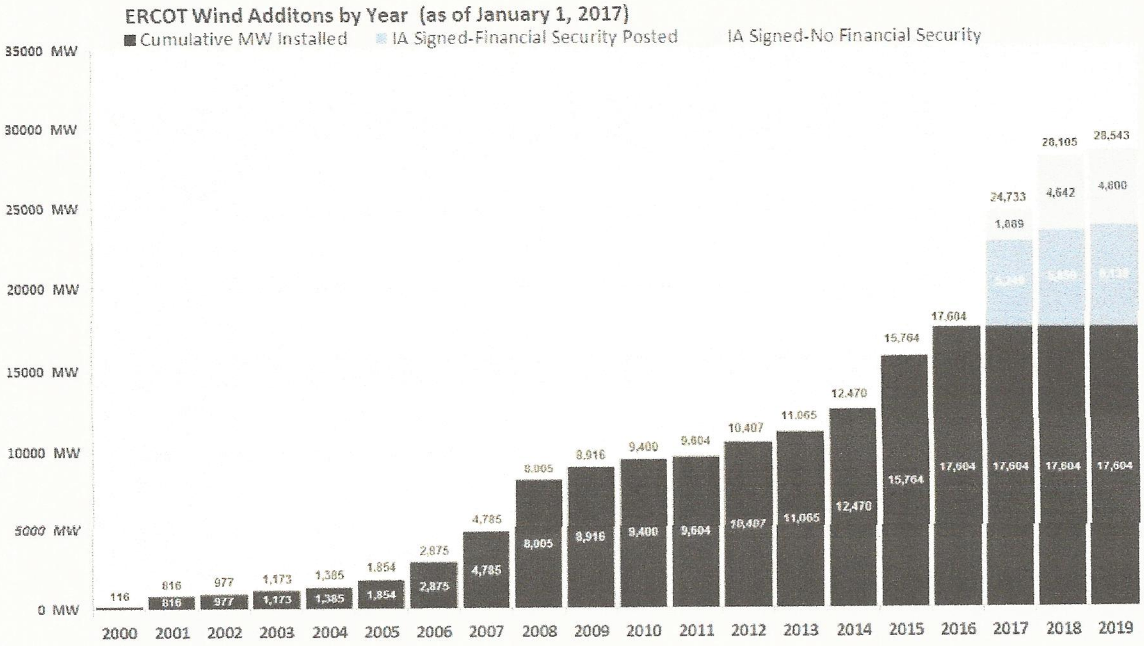
EXHIBIT

F

Wind Generation – December 2016


ERCOT Wind Additons by Year (as of January 1, 2017)

Notes:

- The data presented here is based upon the latest information provided to ERCOT by resource owners and developers and can change without notice. Resources with December 2016 projected dates that have not received commercial operation approvals appear in 2017 column.
- Installed capacities for the current year account for changes reported by the facility owners during the reporting month, and will be reflected in subsequent years' totals.
- Installed capacities include only wind facilities that have registered with ERCOT (Those larger than one megawatt and supply power to the ERCOT system.)
- This chart reports annual planned units with projected Commercial Operations Dates throughout the calendar year. In contrast, ERCOT's Capacity, Demand and Reserves (CDR) report shows planned capacity projected to be commercially available on or before the start of the Summer and Winter Peak Load seasons.
- Financial security posted for funding interconnection facilities does not include CREZ security deposits, which are refunded to the Interconnecting Entity when an IA is signed.

Footnote 13 + 47

DECEMBER 2016

LAZARD'S LEVELIZED COST OF ENERGY ANALYSIS—VERSION 10.0

LAZARD

EXHIBIT

G

Introduction

Lazard's Levelized Cost of Energy Analysis ("LCOE") addresses the following topics:

- Comparative "levelized cost of energy" analysis for various technologies on a \$/MWh basis, including sensitivities, as relevant, for U.S. federal tax subsidies, fuel costs, geography and cost of capital, among other factors
- Comparison of the implied cost of carbon abatement for various generation technologies
- Illustration of how the cost of various generation technologies compares against illustrative generation rates in a subset of the largest metropolitan areas of the U.S.
- Illustration of utility-scale and rooftop solar versus peaking generation technologies globally
- Illustration of how the costs of utility-scale and rooftop solar and wind vary across the U.S., based on illustrative regional resources
- Illustration of the declines in the levelized cost of energy for various generation technologies over the past several years
- Comparison of assumed capital costs on a \$/kW basis for various generation technologies
- Illustration of the impact of cost of capital on the levelized cost of energy for selected generation technologies
- Decomposition of the levelized cost of energy for various generation technologies by capital cost, fixed operations and maintenance expense, variable operations and maintenance expense, and fuel cost, as relevant
- Considerations regarding the usage characteristics and applicability of various generation technologies, taking into account factors such as location requirements/constraints, dispatch capability, land and water requirements and other contingencies
- Summary assumptions for the various generation technologies examined
- Summary of Lazard's approach to comparing the levelized cost of energy for various conventional and Alternative Energy generation technologies

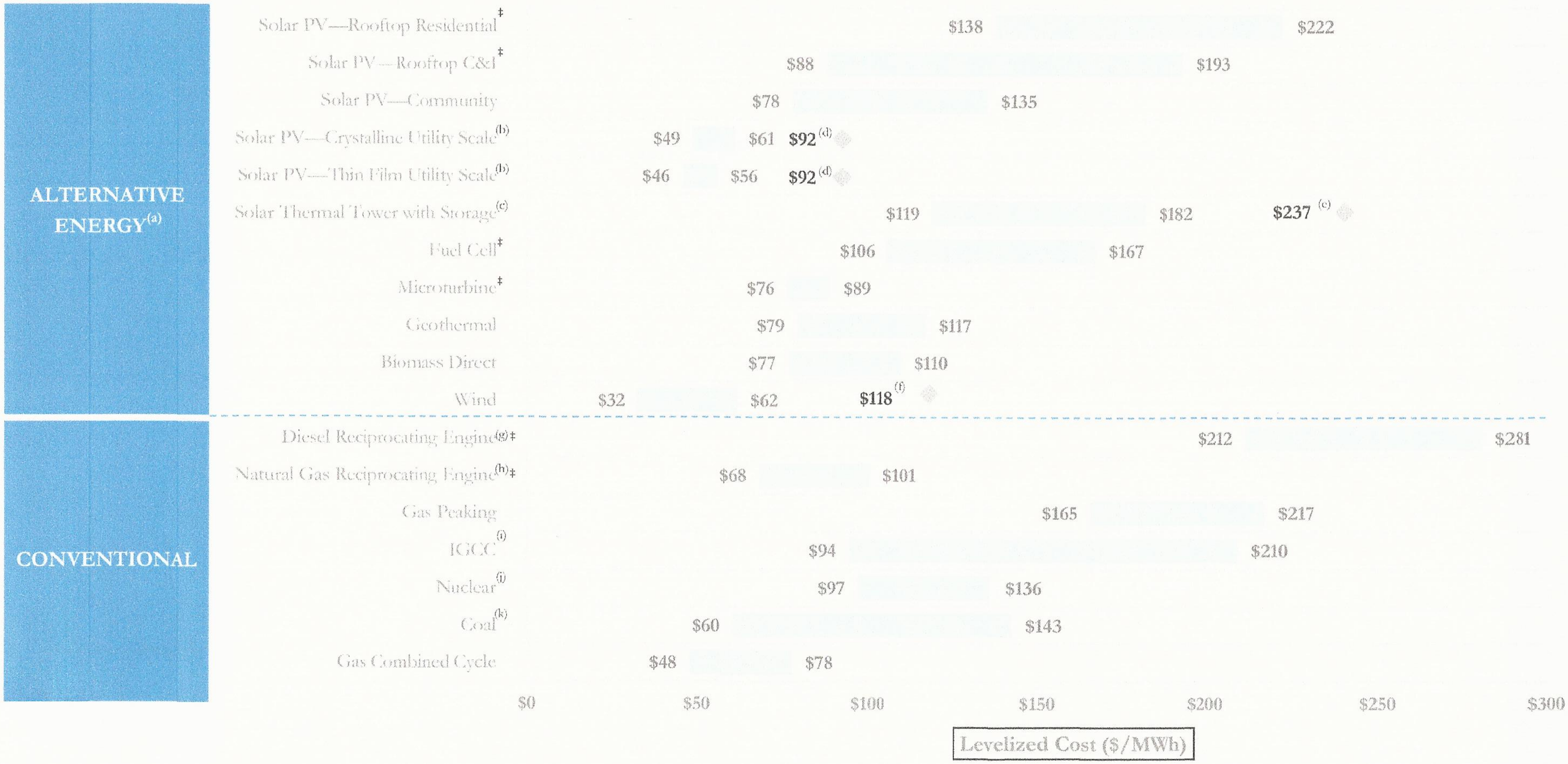
Other factors would also have a potentially significant effect on the results contained herein, but have not been examined in the scope of this current analysis. These additional factors, among others, could include: capacity value vs. energy value; stranded costs related to distributed generation or otherwise; network upgrade, transmission or congestion costs or other integration-related costs; significant permitting or other development costs, unless otherwise noted; and costs of complying with various environmental regulations (e.g., carbon emissions offsets, emissions control systems). The analysis also does not address potential social and environmental externalities, including, for example, the social costs and rate consequences for those who cannot afford distribution generation solutions, as well as the long-term residual and societal consequences of various conventional generation technologies that are difficult to measure (e.g., nuclear waste disposal, environmental impacts, etc.)

While prior versions of this study have presented the LCOE inclusive of the U.S. Federal Investment Tax Credit and Production Tax Credit, Versions 6.0 – 10.0 present the LCOE on an unsubsidized basis, except as noted on the page titled "Levelized Cost of Energy—Sensitivity to U.S. Federal Tax Subsidies"

Note: This study has been prepared by Lazard for general informational purposes only, and it is not intended to be, and should not be construed as, financial or other advice.

Unsubsidized Levelized Cost of Energy Comparison

Certain Alternative Energy generation technologies are cost-competitive with conventional generation technologies under some scenarios; such observation does not take into account potential social and environmental externalities (e.g., social costs of distributed generation, environmental consequences of certain conventional generation technologies, etc.), reliability or intermittency-related considerations (e.g., transmission and back-up generation costs associated with certain Alternative Energy technologies)



Source: *Lazard estimates.*

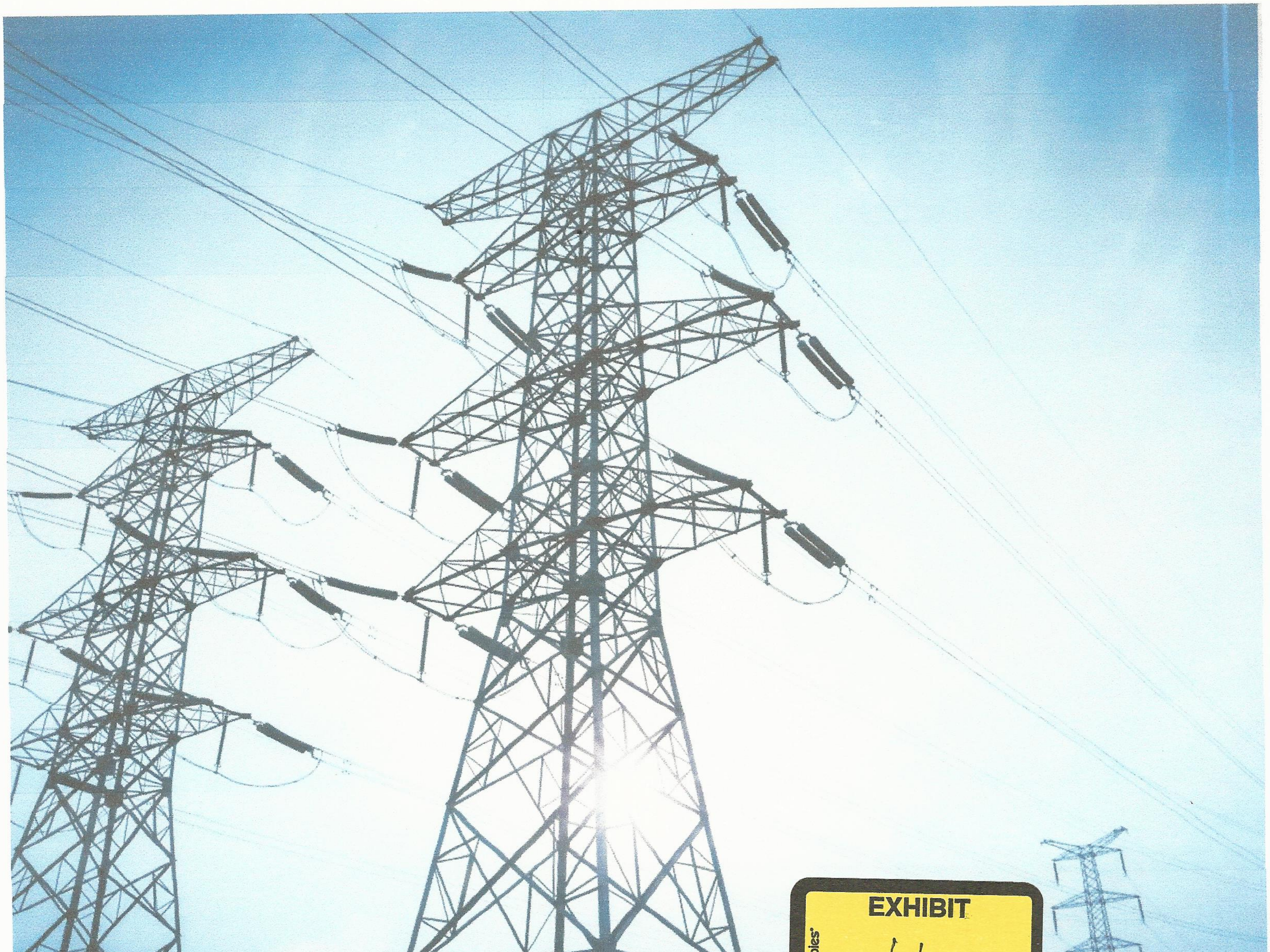
Note: Here and throughout this presentation, unless otherwise indicated, analysis assumes 60% debt at 8% interest rate and 40% equity at 12% cost for conventional and Alternative Energy generation technologies. Reflects global, illustrative costs of capital, which may be significantly higher than OECD country costs of capital. See page 15 for additional details on cost of capital. Analysis does not reflect potential impact of recent draft rule to regulate carbon emissions under Section 111(d). See pages 18–20 for fuel costs for each technology. See following page for footnotes.

‡ Denotes distributed generation technology.

Footnote 20, 21, 22
p. 97-98, 10, 11

MTEP16

MISO Transmission Expansion Plan



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developed through the regional plan. MISO and PJM have identified a number of potential projects of this type and anticipate filing Joint Operating Agreement changes along with associated regional tariff revisions with FERC near the end of the fourth quarter of 2016.[13] Along the seam with SPP, MISO has committed to a joint, multi-year study, similar to MISO's own overlay development efforts, which will address future interregional system planning needs stemming from a dramatically changing future energy landscape expected to impact both RTOs. MISO will also continue to work with the Southeastern Regional Planning (SERTP) sponsors to advance and mature interregional coordination provisions that *were accepted* by FERC in 2016.

Conclusion

MISO is proud of its independent, transparent and inclusive planning process that is well-positioned to study and address future regional transmission and policy-based needs. The valuable input and support from the stakeholder community allows MISO to create well-vetted, cost-effective and innovative solutions to provide reliable delivered energy at the least cost to consumers. MISO welcomes feedback and comments from stakeholders, regulators and interested parties on the evolving electricity system and implementation of MISO's strategic initiatives. For detailed information about MISO, MTEP16, renewable energy integration, cost allocation, and other planning efforts, go to www.misoenergy.org.

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[13] See Section 8.1 PJM Interregional study - IPSAC

Book 1
Transmission Planning Studies

2016

5.2 Futures Development

The MTEP16 generation expansion results created in 2015 cover both the North/Central and South regions. MISO completed this assessment of generation using the Electric Generation Expansion Analysis System (EGEAS) model in 2015. Using assumptions developed in coordination with the Planning Advisory Committee (PAC), MISO developed these models to identify the least-cost generation portfolios needed to meet the resource adequacy requirements of the system for each future scenario.

Detailed MTEP16 capacity expansion results are presented in Appendix E2[33].

Capacity Expansion Results

The study determined the aggregated, least-cost capacity expansions for each defined future scenario through the 2030 study year (Figure 5.2-1). This added capacity is required to maintain planning reliability targets for each region as well as identify other economic generation. This iteration of MTEP shows a long-term drive toward economically selected renewables in carbon cost futures and an increase in retirements and gas consumption. The reliability targets for MISO are defined in the Module E Resource Adequacy Assessment described in Book 2.

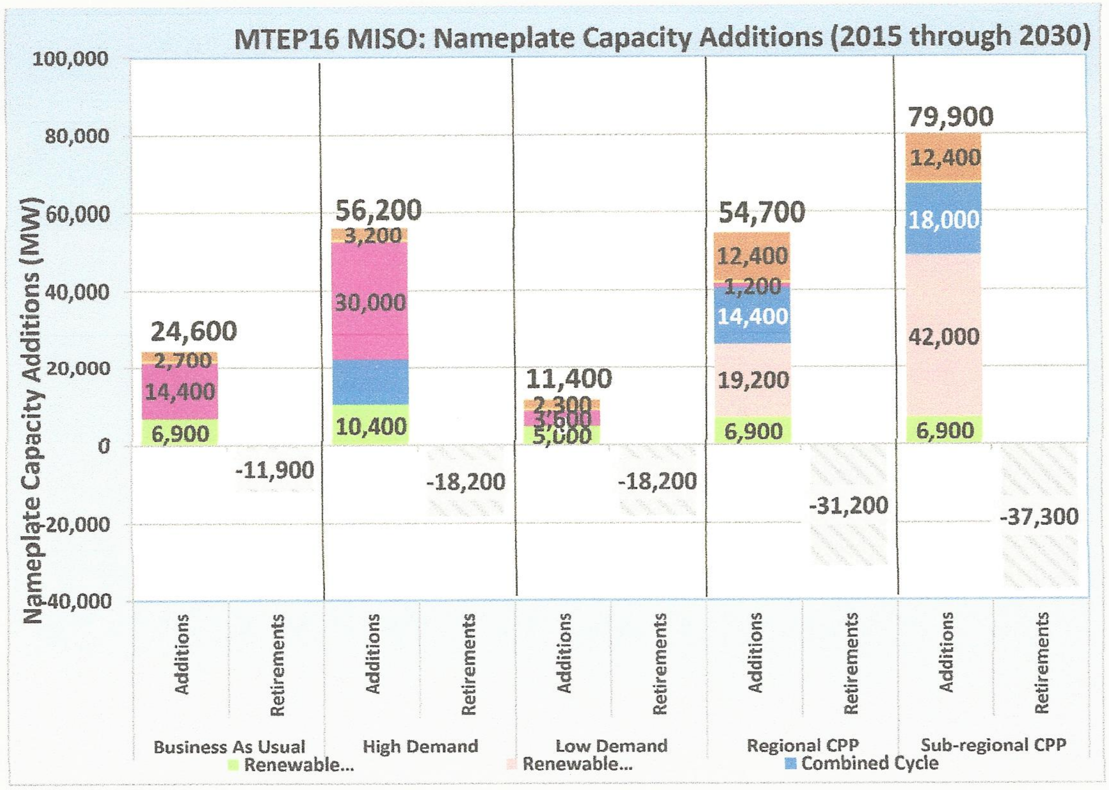

Figure 5.2-1: MISO nameplate capacity additions by future (2015-2030 EGEAS Model)[34]

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[33] Futures were developed prior to the stay of the clean power plan. Futures under development for MTEP 17 will reflect a broader range of portfolio changes not specifically tied to the Clean Power Plan.

The Business As Usual future projects 24.6 GW of additional capacity to maintain system reserves and replace retired capacity between 2015 and 2030. MISO, with advice from the PAC, models 12.6 GW of coal retirements as a minimum in all future scenarios[35] to represent the projected effects of EPA regulations, specifically, Mercury and Air Toxics Standards (MATS). The High Demand and Low Demand futures include additional age-related retirements of non-coal and non-nuclear resources. On top of the age-related and 12.6 GW of coal retirements, the Regional and Sub-Regional Clean Power Plan (CPP) futures include an additional 14 GW and 20 GW of coal retirements respectively. Future capacity expansions include demand response (DR) and energy efficiency (EE) programs, as well as natural gas combustion turbines, natural gas combined cycle units, wind and solar.

Futures Development

Scenario-based analysis provides the basis for developing economically feasible transmission plans for the future. A future scenario is a stakeholder-driven postulate of what could be. This determines the non-default model parameters (such as assumed values) driven by policy decisions and industry knowledge. With the increasingly interconnected nature of organizations and federal interests, forecasting a range of plausible futures greatly enhances the planning process for electric infrastructure. The futures development process provides information on the cost-effectiveness of environmental legislation, wind development, demand-side management programs, legislative actions or inactions and many other potential scenarios.

Future scenarios and their associated assumptions are developed with high levels of stakeholder involvement. As a part of compliance with the FERC Order 890 planning protocols, MISO-member stakeholders are encouraged to participate in PAC meetings to discuss transmission planning methodologies and results. Scenarios are regularly developed to reflect items such as shifts in energy policy, changing demand and energy growth projections, and/or changes in long-term projections of fuel prices. Previously, future scenario definitions were developed annually; however, several prior iterations of MTEP saw very similar futures with gas price and load growth variations year over year. Rather than continue to develop similar futures, MISO will implement a new futures process beginning with MTEP17[36]. Under the new process, futures will be evaluated annually and a decision made with input from stakeholders as to whether futures need to be wholly redesigned or merely updated with current fuel and demand forecasts.

Five narratives describe the MTEP16 future scenarios and their key drivers:

- The baseline, or Business as Usual (BAU), future captures all current policies and trends in place at the time of futures development and assumes they continue, unchanged, throughout the duration of the study period. All applicable EPA regulations governing electric power generation, transmission and distribution are modeled. Demand and energy growth rates are modeled at a level equivalent to the 50/50 forecasts submitted into the Module E Capacity Tracking (MECT) tool. All current state-level Renewable Portfolio Standard (RPS) and Energy Efficiency Resource

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[34] Due to coal plant retirements that have already occurred, only the additional amounts of modeled retirements are shown in the figure.

[35] MISO performed an EPA impact analysis study in 2011 in order to determine the potential of coal fleet retirements. The EPA analysis produced three levels of potential coal retirements: 3 GW, 12.6 GW and 23 GW. To capture these potential retirements in the scenario-based analysis, MISO analysts, in conjunction with the Planning Advisory Committee (PAC), chose to model a minimum of 12.6 GW of retirements in all futures, with the exception of 23 GW of retirements being modeled in the Environmental future.

[36] See September 9th PAC meeting materials process discussion: https://www.misoenergy.org/_layouts/MISO/ECM/Redirect.aspx?ID=207650

Policy Landscape Overview

The MISO generation fleet continues to evolve. Driven by both economics and environmental regulations, the MISO region as a whole is transitioning from a primarily coal-fueled fleet to a balance of coal, natural gas and renewables.

While the evolution of the fleet is generally accepted across the industry, the rate at which the transition will occur is uncertain. In the past 10 years, MISO has seen a significant increase in wind generation as well as coal retirements. Largely driven by compliance with the Mercury and Air Toxics Standards, which went into effect on April 16, 2015, approximately 10 GW of coal capacity in MISO has recently retired or converted fuel. Retired capacity has partially been replaced by natural gas and wind units; however, capacity additions have not kept pace with reductions. In the past five years, planning reserve margins[44] have dropped from 23 percent and above to 18 percent (Section 6.2).

Geographic diversity, policies (both existing and pending) as well as economics impact different areas of the footprint to different degrees. The MISO North and Central regions' fleet, which is primarily coal-based, continues to receive pressure from environmental regulations, competition from natural gas and age. Currently, the average age of the MISO North and Central regions' coal fleet is 40 years old. Analysis shows that coal plants typically retire at 65 years, meaning approximately 8 GW of currently unannounced coal retirements are expected in the next 15 years. That value could potentially triple depending on carbon regulations (Section 7.1).

The MISO North and Central Regions continue to see a large potential for increased wind on the system. As of June 2016, approximately 16 GW of wind currently operates in the MISO footprint and another 30 GW is currently in the Generator Interconnection Queue, 10 GW of the queued wind is in Iowa. MISO's South Region is primarily fueled by natural gas units so fuel prices, age, and demand and energy growth rates are the significant factors that affect the southern fleet. Approximately 12 GW of MISO South Region natural gas and oil units are at risk of age-related retirement within the next 15 years. While the current Generator Interconnection Queue indicates that most of the aging natural gas units will be replaced with newer natural gas units, it's also expected that demand-side resources as well as solar will play a greater role in the fleet into the future.

As MISO looks forward, it expects the trends towards a lower carbon fleet to be driven by potential carbon regulations, age, sustained low natural gas prices, declining construction costs of renewables and renewable tax credits. While currently the EPA's Clean Power Plan is stayed, multiple states and companies have stated they will continue to pursue carbon reductions. Should the Clean Power Plan or equivalent regulation become active, MISO's Clean Power Plan analysis shows that approximately 16 GW of additional coal capacity is at risk of retirement (Section 7.1). The replacement plan for retired capacity includes a combination of renewables, natural gas and demand-side technologies.

Even without carbon regulations, MISO expects economics to drive the continued trends towards more renewables. The capital cost for onshore wind is projected to decline annually by approximately 0.4 percent and by approximately 3 percent for PV solar units. In addition, the Production Tax Credit extension and Investment Tax Credit are projected to make renewables more economically competitive with thermal units (especially under scenarios where carbon reduction targets are assumed). To date,

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[44] As a percentage of installed capacity

Footnote 23 pg 40, 41

MISO's Analysis of EPA's Final Clean Power Plan Study Report

June 2016

MISO Policy & Economic Studies Department

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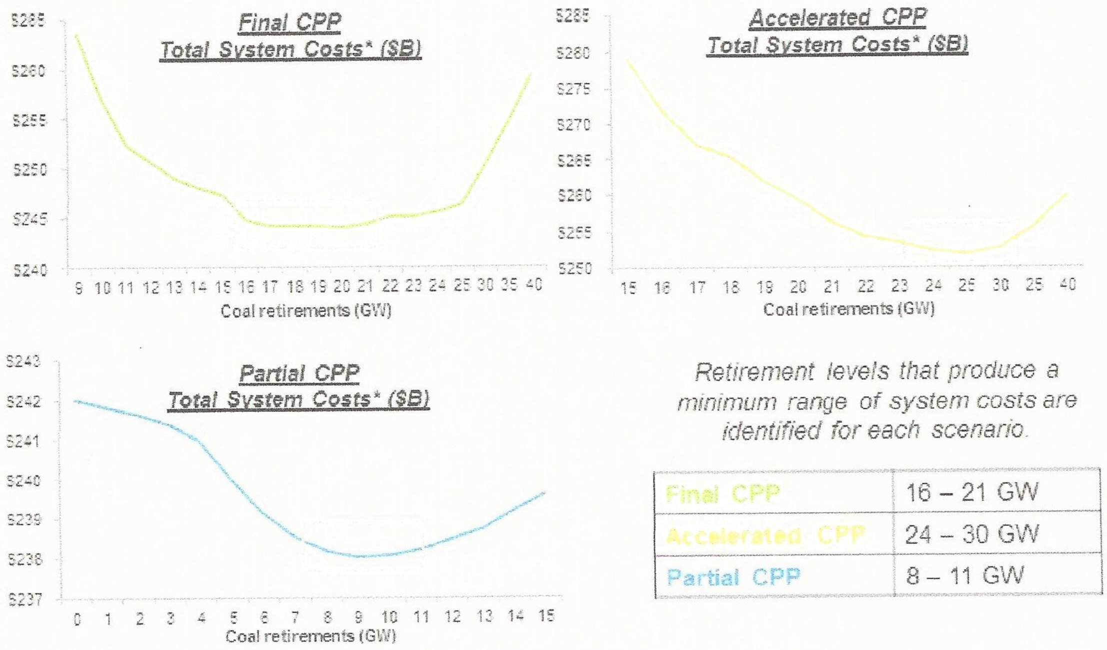
indicating that the ERC-producing ability of Fermi 3 was a source of revenue for Michigan under rate-based compliance.

While results for Michigan were affected by this change, the rest of the system modeled was not shown to experience significant change. LMPs under both rate-based and mass-based compliance increased by 1%, on average. *The CO_2 price in the rate-based model increased by 6% without Fermi 3, but the CO_2 price in the mass-based model remained constant.*

4.3 Mid-Term Analysis

After applying a range of coal retirement levels under different requirements for CO_2 reduction (described in Section 3.1) to the EGEAS model used for MISO's Mid-Term analysis, total system costs are compared in Figure 28.



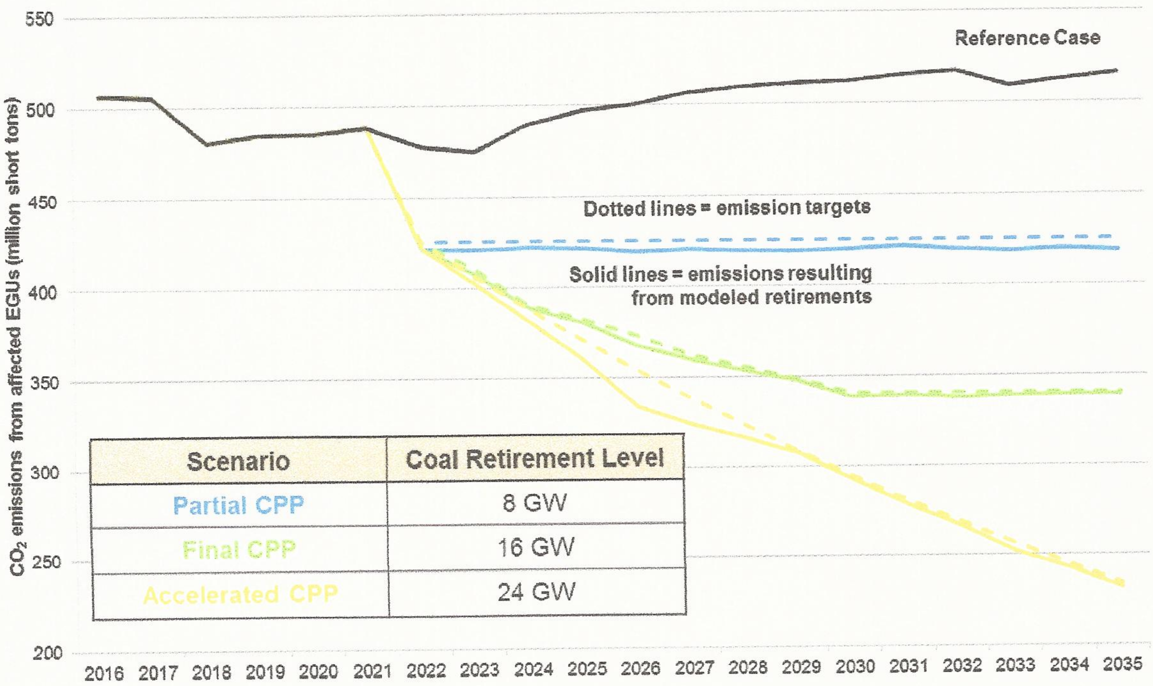
Retirement levels that produce a minimum range of system costs are identified for each scenario.

Final CPP	16 – 21 GW
Accelerated CPP	24 – 30 GW
Partial CPP	8 – 11 GW

Figure 28 Total system costs per retirement level under various constraints

**Dollar figures are 2016 USD in billions and include capital and production costs.*

Total system costs were calculated as the sum of fixed O&M costs, variable O&M costs, fuel costs and capital costs. They were based on a 20-year Net Present Value (NPV) calculation using a 2.5% inflation rate. These costs were compared from one level of retirement to the next for each CO_2 constraint scenario. A range of retirement levels that produced the lowest total system costs were identified for each scenario (indicated by tan boxes in Figure 28). From each range, the lower bound was selected for each scenario to represent a conservative estimate for how much capacity may retire. Figure 29 demonstrates that these retirement levels did achieve the required emission reduction in each scenario. Retirements above these levels achieved emission reductions well beyond the required level, as well as increased total system costs.



Scenario	Coal Retirement Level
Partial CPP	8 GW
Final CPP	16 GW
Accelerated CPP	24 GW

Figure 29 Emissions under various constraints with identified retirement levels

Using the EGEAS software, capacity expansion analysis was performed for each scenario under the coal retirement levels identified in Figure 29, along with the appropriate mass emission constraints. The resulting resources economically selected by the model are shown in Figure 30 (Solar PV – Econ and Wind – Econ). This figure also includes resources forced into each case to meet the capacity required by RPS mandates (Solar PV – RPS and Wind – RPS).

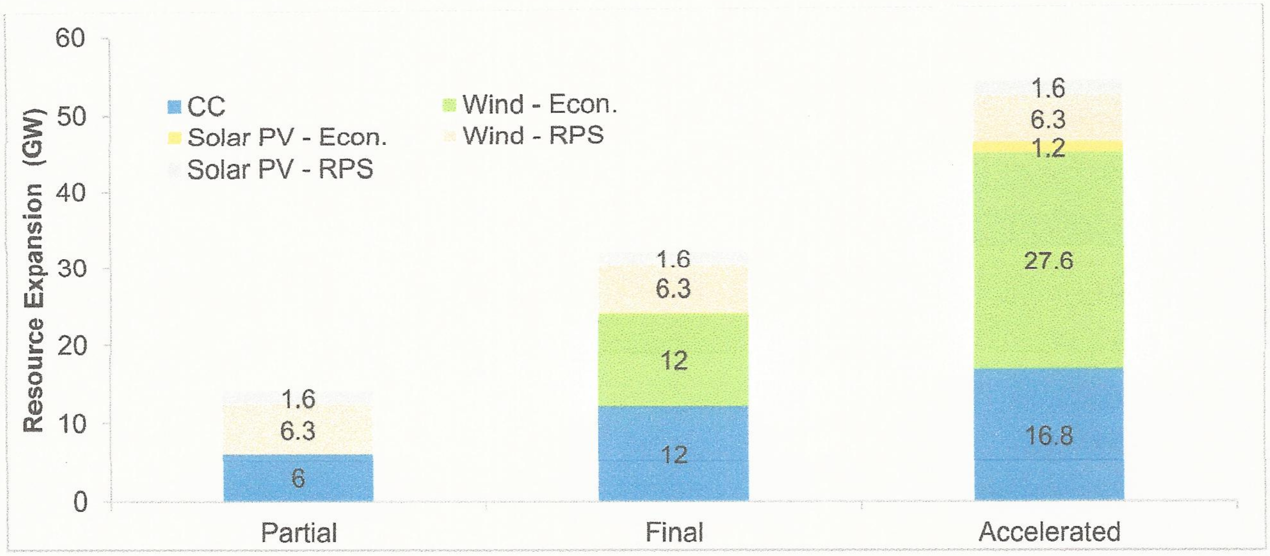


Figure 30 Economic unit selection and RPS mandated capacity

Footnote 33

PÖYRY

EWEA
THE EUROPEAN WIND ENERGY ASSOCIATION

Wind Energy and Electricity Prices

Exploring the 'merit order effect'

A literature review by Pöyry for the European Wind Energy Association

EXHIBIT
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How does wind power influence the power price on the spot market?

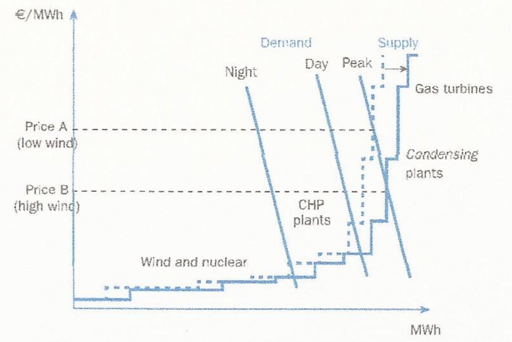
Wind power is expected to influence prices on the power market in two ways:

- Wind power normally has a low marginal cost (zero fuel costs) and therefore enters near the bottom of the supply curve. Graphically, this shifts the supply curve to the right (see *Figure 4*), resulting in a lower power price, depending on the price elasticity of the power demand. In the figure below, the price is reduced from Price A to Price B when wind power decreases during peak demand. In general, the price of power is expected to be lower during periods with high wind than in periods with low wind. This is called the 'merit order effect'.

- As mentioned above, there may be congestion in power transmission, especially during periods with high wind power generation. Thus, if the available transmission capacity cannot cope with the required power export, the supply area is separated from the rest of the power market and constitutes its own pricing area. With an excess supply of power in this area, conventional power plants have to reduce their production, since it is generally not economically or environmentally desirable to limit the power production of wind. In most cases, this will lead to a lower power price in the sub-market.

The way in which wind power influences the power spot price due to its low marginal cost is shown in *Figure 4*.

FIGURE 4: EFFECT OF WIND POWER AT DIFFERENT TIMES OF THE DAY



Source: EWEA Economics of Wind

When the supply of wind power increases, it shifts the power supply curve to the right of the figure. At a given demand, this implies a lower spot price on the power market, as shown. However, the impact of wind power depends on the time of the day. If there is plenty of wind power at midday, during the peak power demand, most of the available generation will be used. This implies that we are at the steep part of the supply curve

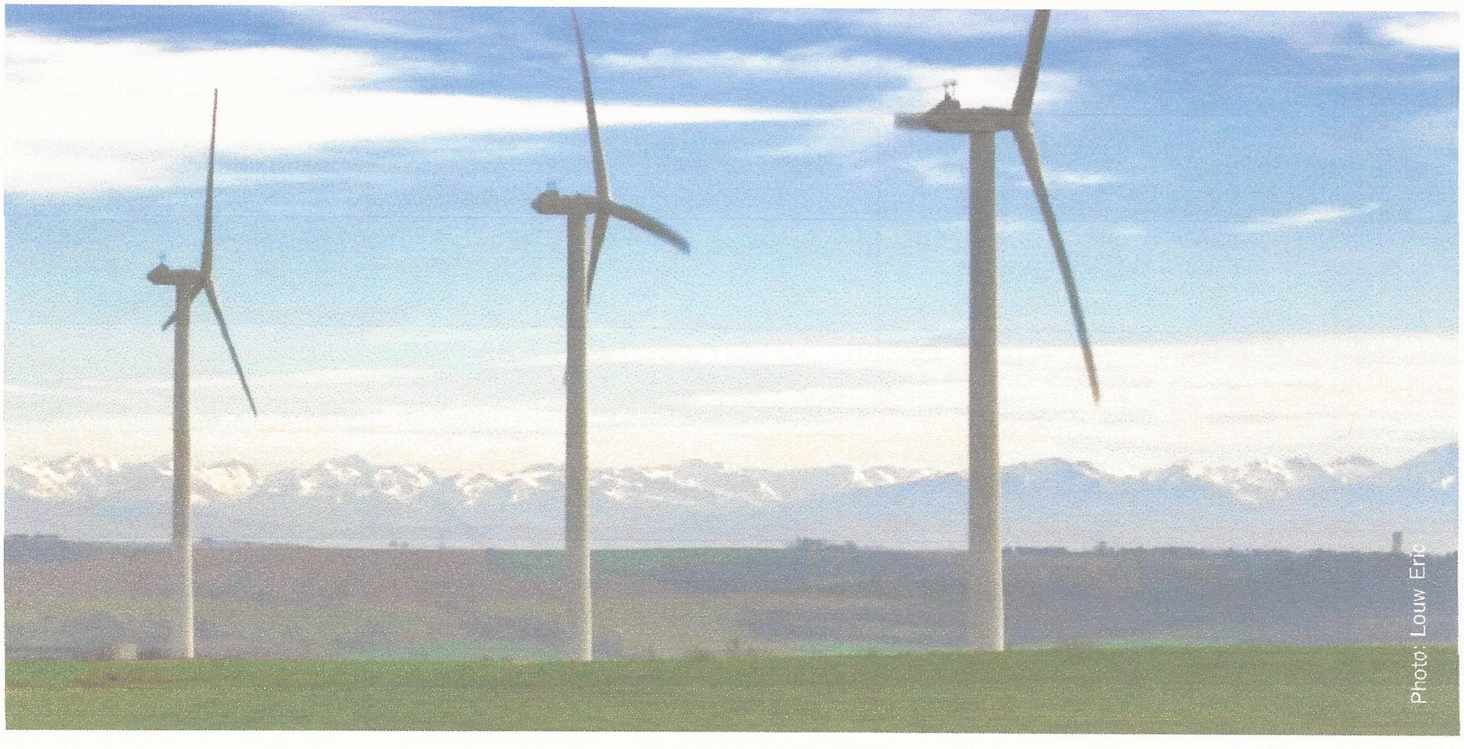


Photo: Louw Eric

(see *Figure 4*) and, consequently, wind power will have a strong impact, reducing the spot power price significantly (from Price A to Price B in *Figure 4*). But if there is plenty of wind-produced electricity during the night, when power demand is low and most power is produced on base load plants, we are at the flat part of the supply curve and consequently the impact of wind power on the spot price is low.

Impact of wind power on spot prices

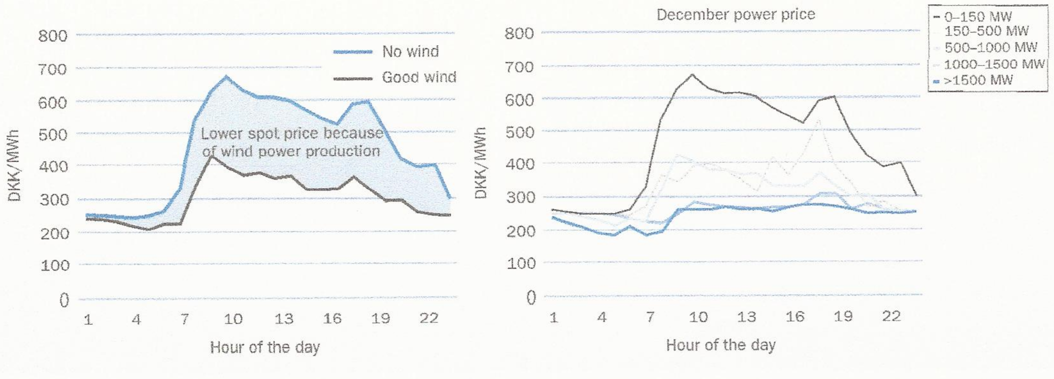
Structural analyses are used to quantify the impact of wind power on power spot prices. A reference is fixed, corresponding to a situation with zero contribution from wind power in the power system. As more wind comes onto the system the effect is calculated at different levels. This is illustrated in the left-hand graph in *Figure 5*, where the shaded area between the two curves gives an approximate value of wind power in terms of lower spot power prices.

The right-hand graph in *Figure 5* gives figures from the West Denmark area. Five levels of wind power production and the corresponding power prices are depicted for each hour of the day in December 2005. The reference is given by the '0-150 MW' curve, which includes those hours of the month when the wind was not blowing. Therefore, this line on the graph provides approximate prices for an average day in December 2005, in a situation with zero contribution from wind power.

The other lines on the graph show increasing levels of wind power production: the 150-500 MW curve shows a situation with low wind, increasing to storm levels in the >1,500 MW curve. As shown, the higher the wind power production, the lower the spot power price. At very high levels of wind power production, the power price is reduced significantly during the day, but only falls slightly during the night. Thus, there is a significant impact on the power price, which might increase in the long term if even larger shares of wind power are fed into the system. *Figure 5* is based on data from December 2005, but similar data is found for most other periods during 2004 and 2005, especially in autumn and winter, owing to the high production of wind power in these time periods.

Of course, 'noise' in the estimations does exist, as there is some overlap between curves for the different categories of wind power. Thus, a high amount of wind power does not always imply a lower spot price than low wind power production, indicating that significant statistical uncertainty exists. And of course, factors other than wind power production also influence

FIGURE 5: THE IMPACT OF WIND POWER ON THE SPOT POWER PRICE IN THE WEST DENMARK POWER SYSTEM IN DECEMBER 2005



Note: The calculation only shows how the production contribution from wind power influences power prices when the wind is blowing. The analysis cannot be used to answer the question 'What would the power price have been if wind power was not part of the energy system?'

Source: Riso DTU