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TO: Mayor Ron Payne and the Owensboro City Commission

FROM: David Schlissel, Director of Resource Planning Analysis

DATE: June 13, 2016

SUBJECT: The Economics of Continued Operation of Owensboro Municipal Utilities' Elmer Smith Station Coal-Fired Power Plant

The Institute for Energy Economics and Financial Analysis has reviewed a number of publicly available documents on the economics of the continued operation of Owensboro Municipal Utility's coal-fired Elmer Smith Station ("ESS").

These documents include:

- The Draft 2015 Integrated Resource Plan Update, presented at a Utility Commission work session on September 3, 2015.
- The Executive Summary for the 2015 Integrated Resource Plan.
- A February 4, 2016 presentation on its recent Power Supply Analysis.

Our observations from the reviews of these limited OMU documents, as well as other reviews of the forward energy market prices in PJM and MISO, include the following:

1. OMU's retail annual peak loads and energy sales have been relatively flat since at least 2004. As a result, the Elmer Smith Station (ESS) is generating more power than Owensboro needs.
2. OMU has become heavily dependent on selling the excess power from Elmer Smith Station to off-system wholesale customers. However, the prices that OMU has been receiving, and expects in future years to receive, for these wholesale power sales do not fully cover all of the fixed and variable costs of providing power from Elmer Smith. As a result, OMU customers end up subsidizing the sale of the power to customers outside of the city.
3. OMU currently intends to shut down Elmer Smith Station Unit 1 in 2019.
4. Unit 2 should be shut down sometime in or around the year 2022 unless there is a dramatic change in natural gas and wholesale energy market prices. OMU's recent Power Supply Analysis PSA Presentation shows clearly that its electric rates would be lower as early as 2017 if a decision were made to retire ESS Unit 2 in 2022.

5. Given our expectation (and OMU's as well) that natural gas and wholesale energy market prices will remain low for the next ten years, it may be economic to shut down Unit 2 even before 2022.

6. The prices of new solar photovoltaic resources (both utility-scale and distributed rooftop) have declined dramatically in recent years, and are expected to continue to decline in coming years. The installation prices of new wind-powered capacity also have declined sharply, at the same time that wind resources have achieved improved operational efficiencies. This has led to significant drops in the prices for new wind Power Purchase Agreements (PPAs). The price of saving power through energy efficiency has remained low, as well, and is expected to remain low in coming years. For these reasons, OMU should explicitly analyze the costs and benefits of including significant investments in solar and wind capacity and energy efficiency as part of the portfolio of alternatives to the continued operation of ESS Units 1 and 2. Solar and wind capacity also could be added in small increments. As a result OMU could avoid a repeat of the current situation where its customers are burdened with the costs of the excess generating capacity from Elmer Smith Station.

7. Given the current expectations that energy market prices will remain low for at least the next ten years and the declining solar and wind energy prices, it would be prudent for OMU to not rush into any commitment to build or purchase an equity investment in an existing or a new natural gas (combined cycle gas or CCGT) plant and, instead, buy power from the wholesale market or enter into a short- to mid-length PPA (or a series of PPAs) to buy power from a gas-fired combined cycle plant. This would give OMU the flexibility to address changes in market conditions, regulations, and resource options and prices. OMU also should investigate the economics of making energy efficiency a major component of its future resource mix.

Note: Owensboro Municipal Utilities has declined to release its full Integrated Resource Plans, which may contain information that provides further information in support of these findings and recommendations.

IEEFA ANALYSIS OF ELMER SMITH STATION

Elmer Smith Station is OMU's only generating asset. According to OMU's February 4, 2016 presentation on its recent Power Supply Analysis, ("2016 Power Supply Analysis") ESS provides 405 megawatts (MW) of net capacity, which is considerably more power than OMU needs.[1]

OMU has cited the 40-50 year old age of ESS as one of its power supply "challenges." Unit 1 went into service in 1964 and is 52 years old. Unit 2 went into service in 1974 and is 42 years old.

As shown in Figure 1, below, OMU's peak demands (in MW) have essentially been flat since at least 2004, with only minor annual increases and decreases.

[1] 2016 Power Supply Analysis, at page 3.

Figure 1: OMU Annual Peak Loads

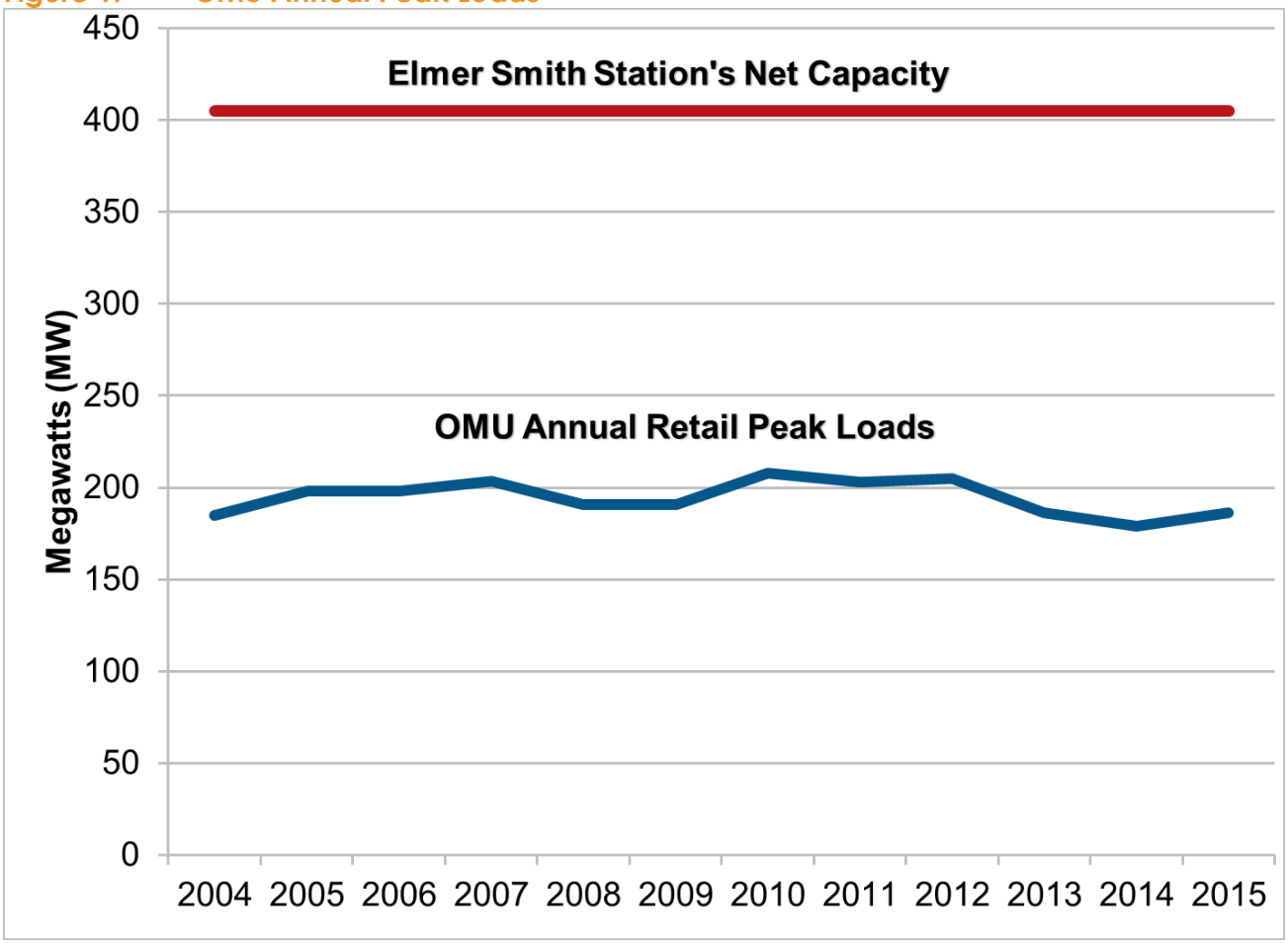
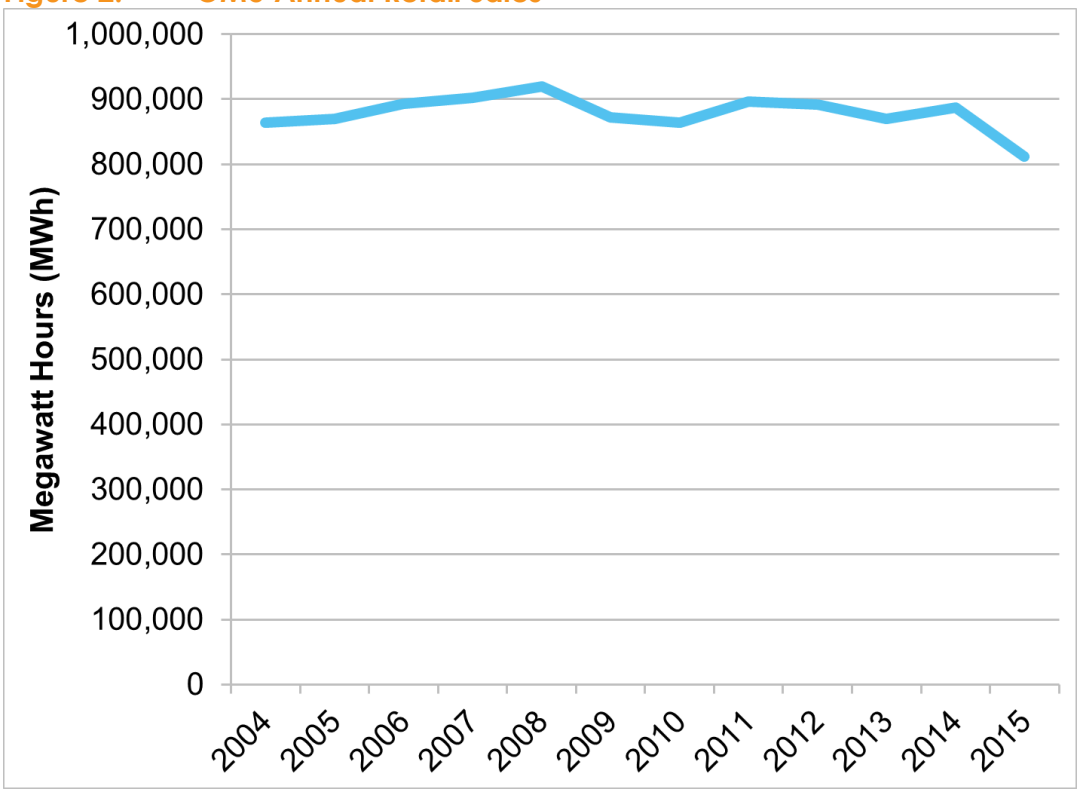


Figure 1 compares Elmer Smith's 405 MW of net generating capacity with OMU's annual retail peak loads. However, OMU's average loads are significantly lower than the annual peaks shown in Figure. As a result, OMU estimates that as much as 295 MW of ESS's capacity is surplus, or excess, on average.[2]

OMU's retail sales to customers in Owensboro also have been essentially flat, with a significant decline in 2015.

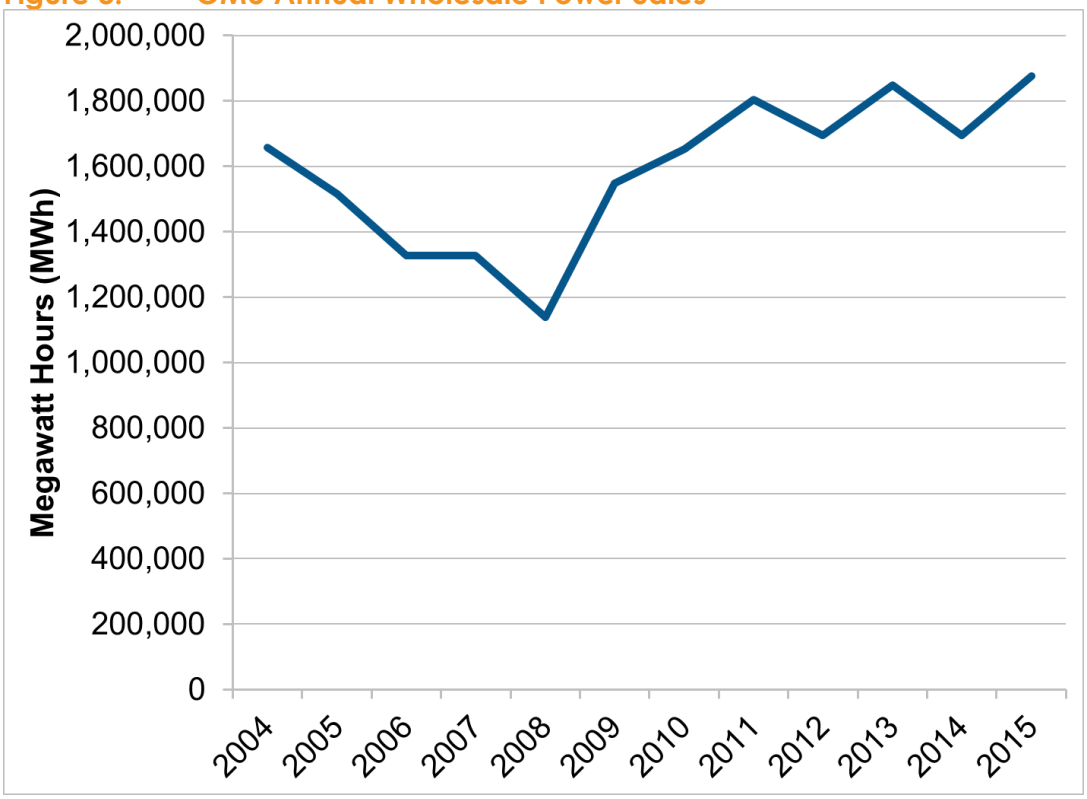
[2] Id.

Figure 2: OMU Annual Retail Sales



At the same time, OMU's dependence on selling its excess power to the wholesale market has been increasing.

Figure 3: OMU Annual Wholesale Power Sales



Consequently, 60-70% of OMU's electric sales have been to wholesale customers outside of Owensboro. However, these sales have not covered 60-70% of the cost of providing the power from ESS. OMU has said that wholesale revenues cover only 44.6% of the Elmer Smith Station's fixed costs. This means that OMU's retail ratepayers are subsidizing a large portion of the cost of the power being sold to the wholesale customers.

This conclusion is supported by a graph on page 4 of the attached OMU 2016 Power Supply Analysis that shows that the fixed and variable costs of providing the wholesale power have in some recent years been millions of dollars higher than OMU's wholesale revenues from those sales, and are expected to remain significantly higher in future years.

OMU's 2016 Power Supply Analysis lists the following challenges for the continued operation of Elmer Smith Station[3]:

- Extremely low natural gas prices, and corresponding low wholesale prices, are projected for the next 10 years. This means "less than expected cost recovery from wholesale and more requirements from retail."
- Environmental compliance investments required to continue operation:
    - Coal Combustion Residuals (CCR) - $25 million in FY 2018
    - Effluent Limitation Guidelines (ELG) - $12 million in FY 2021
    - Mercury and Air Toxics (MATs) - $7 million invested in FY 2015/2016 with $6-7 million per year in incremental operating costs.
    - Clean Power Plan (CCP) – impact unknown at this time but will increase costs in the years 2022 through 2026 as the CPP will require at least a 38% reduction in carbon dioxide emissions.
- Aging infrastructure – 40-50 year old power plant
- Remaining debt on ESS matures in 2026. Any shutdown prior to that time will result in stranded debt that must be repaid.
- Increasing costs – medical, retirement, suppliers, etc.
- Technology innovation and adoption
    - Energy efficiency lowers retail energy sales exposing OMU to more wholesale price risk
    - Demand destruction from distributed generation
    - Smart grid implementation costs.[4]

These challenges lead OMU to ask the following two key questions in the Power Supply Analysis:

- Can OMU's electric rates remain regionally competitive?
- Should OMU transition away from coal sooner to remain competitive?

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3 2016 Power Supply Analysis, at pages 4 and 5.

4 OMU also notes at pages 8 and 9 of the 2016 Power Supply Analysis that other regional utilities are facing these same challenges.

OMU's 2016 Power Supply Analysis identified the following options for how OMU could achieve a "transition away from coal sooner to remain competitive."[5]

- Convert ESS Unit 2 to natural gas
- Build peaking gas capacity and rely on market energy
- Rely on market power and put ESS in reserve status
- Contract with, or buy equity in, a combined cycle natural gas plant

Thus it is not surprising that an article in the May 21, 2016 issue of the Messenger-Inquirer reported that OMU is looking at the proposed HenderSun Energy Center natural gas-fired plant as a future power source.[6] OMU also has a number of studies under way to examine the economics and viability of options to the continued operation of Elmer Smith Station Unit 2.[7]

According to the 2016 Power Supply Analysis, OMU appears to have summarily rejected solar and wind resources as not being the "lowest cost options."[8] However, the utility did not present any supporting economic analysis for this conclusion. Nor did it include any discussion of the economics of energy efficiency. Moreover, OMU's September 3, 2015 *Update to its Draft 2015 Integrated Resource Plan* suggests that OMU has not evaluated adding any significant renewable capacity or substantial energy efficiency investments as possible alternatives to the continued operation of Elmer Smith Station, not even as part of a portfolio with the addition of some natural-gas fired capacity. Nor is there any evidence in the documents that IEEFA has reviewed that OMU intends to undertake such an evaluation.

OMU's 2016 Power Supply Analysis suggests that OMU's plan is for Unit 2 to stay operational through 2030, but this is subject to revision based on the federal Clean Power Plan regulations and the state of the forward markets at the time that OMU must make commitments for addressing the new Effluent Limitation Guidelines.[9] However, the economic results presented in the 2016 Power Supply Analysis show that continued operation of Unit 2 beyond 2022 is not a low cost option. For example:

- The graph on page 20 of the Power Supply Analysis shows that there will be dramatic increases in OMU electric rates (approximately 20 percent between 2016 and 2018 and more than 80 percent between 2016 and 2025) if ESS Unit 2 continues to operate through 2030.
- The graph on page 22 of the Power Supply Analysis shows that shutting down Unit 2 in 2022 (and entering into a purchase power agreement for two years and then buying into a new gas-fired CCGT) would be less expensive than running Unit 2 indefinitely. Repowering Unit 2 in 2019 to burn natural gas would be the lowest cost option. Unfortunately, as noted earlier, OMU does not appear to have evaluated any resource portfolios as alternatives to the continued operation of Unit 2 that add significant new renewable resources and/or make substantial new investments in energy efficiency.

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5 2016 Power Supply Analysis, at pages 11 and 12.

6 http://www.messenger-inquirer.com/news/local/omu-interested-in-proposed-natural-gas-plant-in-henderson-county/article_d6588072-c8be-57fe-a991-b59cf1ac4e92.html.

7 2016 Power Supply Analysis, at pages 13, 25 and 26.

8 Id, at page 13.

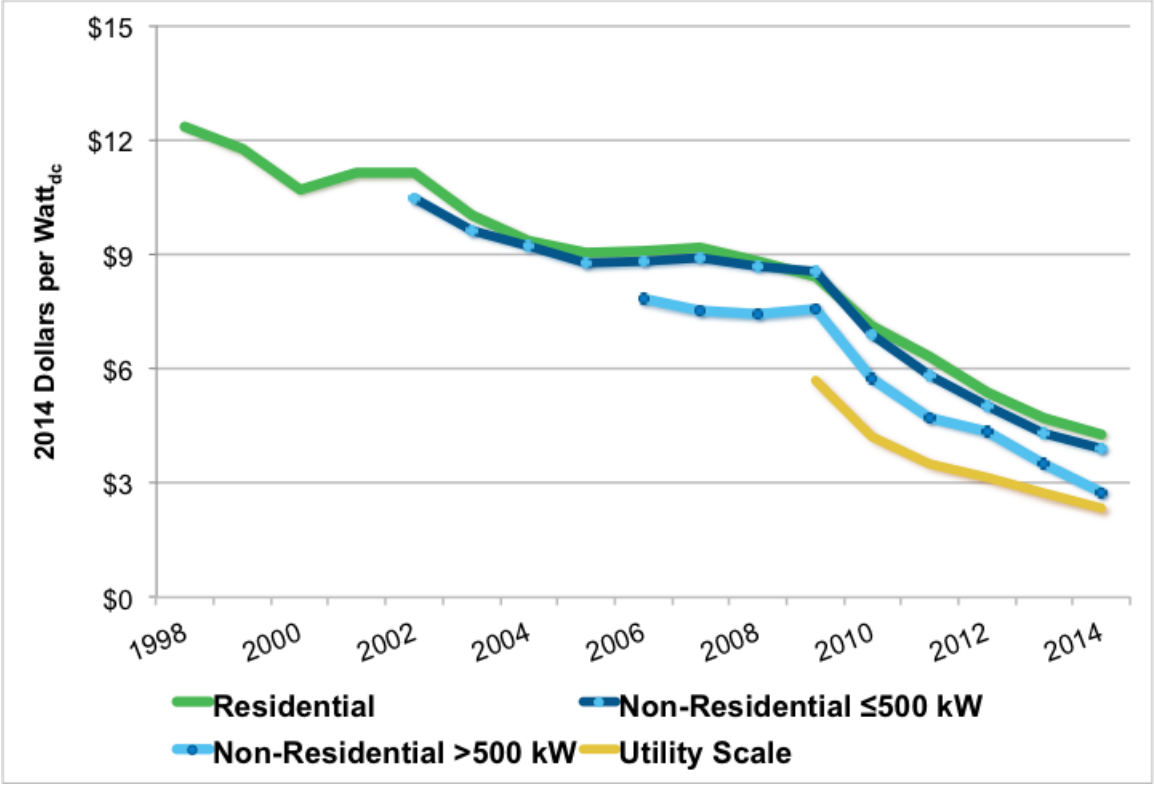
9 Id.

- The graph on page 24 of the Power Supply Analysis shows clearly that OMU's electric rates would be lower as early as 2017 if a decision were made to retire ESS Unit 2 in 2022.

OMU's Assumption That Renewable Resources Are Not Competitive Is Unreasonable and Outdated.

The prices of new solar photovoltaic resources (both utility-scale and distributed rooftop) have declined dramatically in recent years, and are expected to continue to decline in coming years.

Figure 4: Solar Photovoltaic (PV) Installation Prices (Median Values).



As a result of the decline in solar PV installation prices, the prices for long-term PPAs from utility-scale solar PV projects have fallen so dramatically since 2009 that the median PPA price in the U.S. is now just below $50 per MWh, down from prices above $100 per MWh for PPAs signed as recently as 2010.

The installation prices of new wind-powered capacity also have declined sharply, at the same time that wind resources have achieved improved operational efficiencies. This has led to significant drops in the prices for new wind PPAs.

For example, wind turbine prices have declined substantially in recent years despite increases in hub heights and larger rotor diameters. All of the changes discussed above have

combined with improved turbine technology to reduce project costs and wind power PPA prices. As a result, the prices for power from wind PPAs have dropped to all-time lows, declining from $70 per megawatt-hour ("MWh") for PPAs executed in 2009 to a nationwide average of around $23.50 per MWh for PPAs signed in 2014. As a result of the recent extension of the federal wind Production Tax Credit, further decreases in wind prices are expected in coming years.

Based on this review, IEEFA recommends the following:

1. That OMU shut down Elmer Smith Station Unit 1 in 2019, if not earlier.
2. That OMU shut down Unit 2 no later than 2022.
3. That OMU avoid any commitment at this time or in the near future to build or purchase an equity investment in an existing or a new natural gas (combined cycle gas turbine, or CCGT) plant.
4. That OMU explicitly analyze the costs and benefits of including significant investments in solar and wind capacity and energy efficiency as part of a portfolio of alternatives (possibly along with some new natural gas-fired capacity) to the continued operation of ESS Units 1 and 2.
5. That OMU make full copies of its integrated resource plans and any supporting analyses available to the public.