

# MIDWEST GENERATION'S ILLINOIS COAL PLANTS: TOO EXPENSIVE TO COMPETE?

Unsustainable Business Model Creates Uncertainty Across Illinois



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APRIL 2013 REPORT UPDATE



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#### INTRODUCTION

For decades, Midwest Generation's coal-fired power plants have polluted communities around Illinois. The Waukegan Generating Station has been just one of many industrial polluters that have plagued the health of Waukegan and Lake County residents for years. Originally built in 1920, the Waukegan coal plant's boilers are more than 50 years old and lack any sulfur dioxide pollution controls.

Despite Waukegan's status as the largest emitter of sulfur dioxide, carbon dioxide, and mercury in all of Illinois' Lake County, Midwest Generation has so far refused to install modern pollution controls to mitigate its impact on the community and the air and water resources it pollutes. This legacy of pollution has led to the Waukegan plant earning a place on the NAACP's worst environmental justice offenders list, due to its high levels of pollution and its impact on low-income communities of color.

Midwest Generation operates five coal-fired power plants across Illinois, none of which have state-of-the-art pollution controls for air or water pollution. Rather than put its engineers to work on those controls, Midwest Generation has sought multiple delays from the Illinois Pollution Control Board to avoid important state public health laws and have more time to pollute.

This report concludes that Midwest Generation is very unlikely to continue to make money if it is finally forced to reduce its pollution now, or anytime in the next several years. Thus, the company has asked for more time to run its coal plants and maximize profits rather than shifting, as most companies have, to cleaner generating resources.

This report was originally released in April 2012. A year later, the energy price forecasts driving Midwest Generation's business decisions have not improved, and in fact, the projections are even less favorable. Midwest Generation filed for Chapter 11 bankruptcy in December 2012 and presented no concrete plans for compliance with air pollution

reduction requirements in its variance request to the Illinois Pollution Control Board.

After years of delay tactics and minimal investments in pollution controls, Midwest Generation's plants are operating at a loss. In the past year, environmental enforcement cases surrounding groundwater contamination and excessive sulfur dioxide pollution at all of Midwest Generation's plants will make operation of the company's coal plants even less financially sound. As Midwest Generation fumbles to meet its bottom line and public health deteriorates in surrounding communities, now is the time for Midwest Generation to develop a plan to phase out its Illinois coal fleet and move its business model to focus on cleaner electric generation.

#### OVERVIEW

The Sierra Club contracted with Synapse Energy Economics to provide an assessment of the market viability of Edison International's Illinois-based coal-fired power plants. This report provides an initial analysis of the forward-going economics facing Edison International's merchant coal units in Illinois (known as Midwest Generation or MWG) and addresses the reliability implications of coal retirements in Western PJM, the regional transmission organization that runs the regional wholesale electricity market

MWG's units primarily sell wholesale power and capacity into the PJM market, and are thus subject to the prices in that market. PJM power prices have been depressed in recent years and demand has been low. At the same time, coal generators are finally faced with internalizing the cost of pollution with compliance deadlines over the next several years that will require decisions about expensive retrofits to support future operations, forcing the ultimate decision whether to retire or retrofit these units.

These pressures, along with pressure from Chicago communities, citizens, and politicians advocating for a safer place to live, breathe,

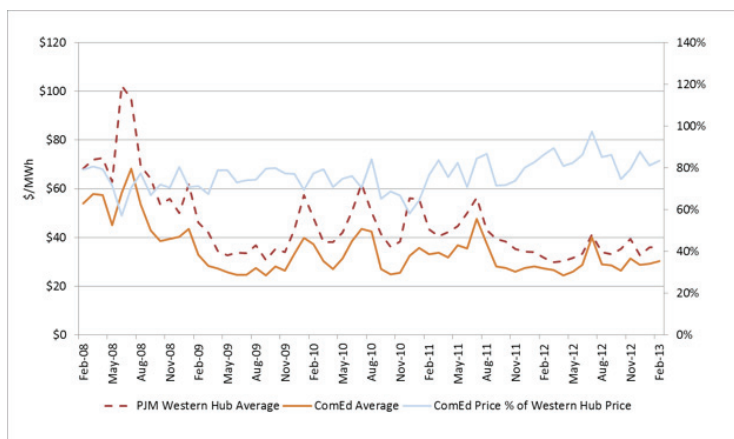
and raise their families, led MWG to retire its Chicago-based Fisk and Crawford coal-burning power plants. MWG is still waiting to make final decisions on whether to retire or retrofit other units in its fleet. According to the company's 2011 Form 10K filed with the SEC, it recognizes the "disadvantage compared with competing power plants operating in nearby states and subject to less stringent state emission limits or to federal emission limits alone."<sup>1</sup> Future emission-control investments would make it more difficult for plants to recover their costs. Since the company participates in the market on a merchant basis, it is particularly sensitive to this issue because it cannot recover investments from ratepayers.

To explore this issue further, the Sierra Club asked Synapse to analyze the potential future costs of emission controls at MWG's plants and estimate the average energy and capacity prices these units would need to receive to remain economically viable, compared to Synapse's forecasts of regional market prices.

Synapse found that for all MWG units, the increase in costs associated with even a single modest emission control (Dry Sorbent Injection or "DSI") would exceed even Synapse's "high" projection of the market revenue from energy and capacity sales, rendering all MWG units unable to recover these investments. Given this conclusion that strongly suggests MWG should retire its remaining plants, the Sierra Club also asked Synapse to determine if the retirements would have an impact on reliability. Synapse concluded that PJM's reliability analysis has found no evidence that additional MWG retirements will have an impact on overall PJM reliability, or on electric reliability generally in Illinois.

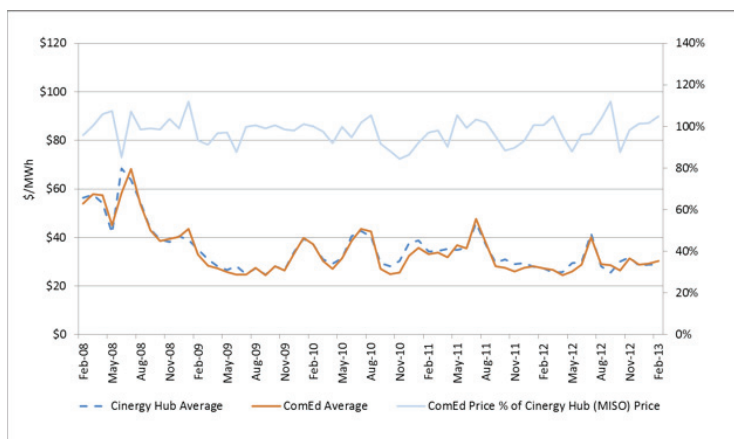
## FORECASTS OF MARKET REVENUES

Midwest Generation's Illinois plants are located in the Commonwealth Edison (ComEd) zone of PJM and thus sell into the wholesale market at this zone's Locational Marginal Price (LMP). They are also bid into the PJM forward capacity market in this location. Synapse developed a range of energy price forecasts based on the historical relationship of ComEd Zone prices with PJM Western Hub and MISO Cinergy Hub prices—where futures were available from the Chicago Mercantile Exchange (CME).



**FIGURE 1: HISTORICAL PRICES FOR COMED AND PJM WESTERN HUB (2008-2013)**

Source: PJM day-ahead prices; calculations by Synapse.



**FIGURE 2: HISTORICAL PRICES FOR COMED AND CINERGY HUB (2008-2013)**

Sources: PJM and MISO Cinergy day-ahead prices; calculations by Synapse.

Figure 1 shows the past five years of average monthly prices in ComEd compared to PJM Western Hub. During this five-year period, ComEd's energy prices were consistently lower than those at PJM Western Hub—24 percent lower on average. (The light blue line shows the historical ComEd price as a percentage of the Western Hub price, as indicated on the right axis.)

Figure 2 shows a comparison of ComEd prices with MISO Cinergy Hub prices over the past five years. ComEd prices were consistently close to Cinergy's prices—only 2 percent lower on average (as indicated by the light blue line relative to the right axis).

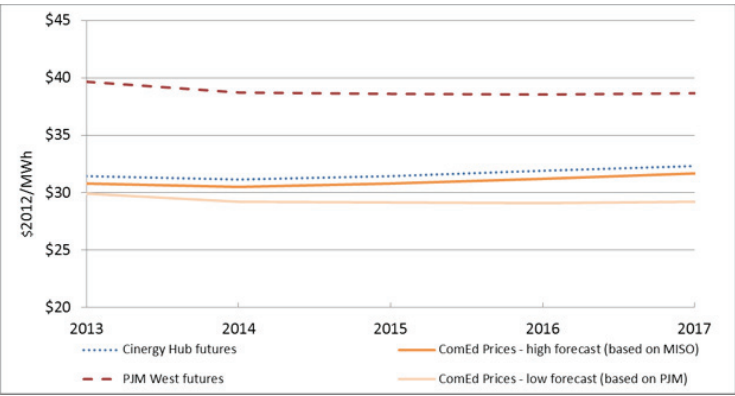
In order to forecast energy prices in the ComEd zone based on available futures data, Synapse assumed that the historical relationships shown in Figures 1 and 2 would persist. Futures for PJM

Western Hub were available through 2017 while futures for Cinergy Hub were only available through 2016. Therefore, Synapse assumed a future growth rate consistent with the previous year's growth to extrapolate to 2017 for this comparison. After converting the futures prices to constant 2012 dollars, Synapse applied the historical percentage price differential between ComEd and each hub to arrive at a low and high forecast of ComEd prices in 2017. Figure 3 shows the futures prices and the high and low ComEd zone forecasts by year. In 2017, the low forecast price for ComEd is \$29 per Megawatt-hour (MWh) and the high forecast price is \$32 per MWh.

In addition to energy revenues, the plants receive payments for capacity through the PJM forward capacity market, known as the Reliability Pricing Model or RPM. Synapse developed a high and low range of capacity prices based on previous auction results to capture a reasonable range of future capacity revenues per MWh for each plant. The high range estimate is based on the clearing price from the most recent PJM Base Residual Auction for the 2015/2016 of \$136 per MW-day (\$126 per MW-day in 2012 dollars). The low range estimate is based on the three-year average clearing price from the three most recent auctions (\$91 per MW-day in 2012 dollars).<sup>2</sup>

Table 1 shows the low and high ranges of capacity revenue for each MWG plant. Note that whereas forecasted energy revenue per MWh is the same for each plant in this analysis, capacity payments are made on a per-MW basis. These constant per-MW payments result in per-MWh payments that vary by plant, depending on each plant's capacity factor—i.e., a lower capacity factor results in higher capacity revenue per MWh.

Capacity prices have been volatile since the inception of the PJM RPM market, so it is difficult to predict what the prices will be in a given year (past the most recent auction). Although there is evidence that ample new capacity will be available in the near future and additional demand-side resources are clearing the market each year, which have continually depressed PJM load forecasts (more detail on this later in the report).



**FIGURE 3: FORECASTS FOR COMED COMPARED TO CME FUTURES FOR PJM WESTERN HUB AND CINERGY HUB (2013-2017)**  
Sources: PJM day-ahead prices and Chicago Mercantile Exchange settlements; calculations by Synapse.

	Capacity Factor (2010-2012 avg)	Low Range (\$91/ MW-day)	High Range (\$126/ MW-day)
Joliet 29 #7	48%	\$7	\$10
Joliet 29 #8	50%	\$7	\$10
Joliet 9 #6	41%	\$9	\$12
Powerton #5	56%	\$6	\$9
Powerton #6	56%	\$6	\$9
Waukegan #7	62%	\$6	\$8
Waukegan #8	61%	\$6	\$8
Will County #3	46%	\$8	\$10
Will County #4	46%	\$8	\$10

**TABLE 1: FORECAST RANGE OF CAPACITY REVENUE IN 2017 (\$2012/MWH)**  
Source: PJM FCM results, NERC GADS 2011; calculations by Synapse.  
  
Note: The capacity revenue is calculated by taking each plant's nameplate capacity, discounting the capacity based on a typical effective forced outage rate, and multiplying by the capacity price and number of days (365). This value is then divided by the average plant generation from 2010 through 2012 to arrive at capacity revenue per MWh.

## COMPARISON TO ENVIRONMENTAL COMPLIANCE COSTS

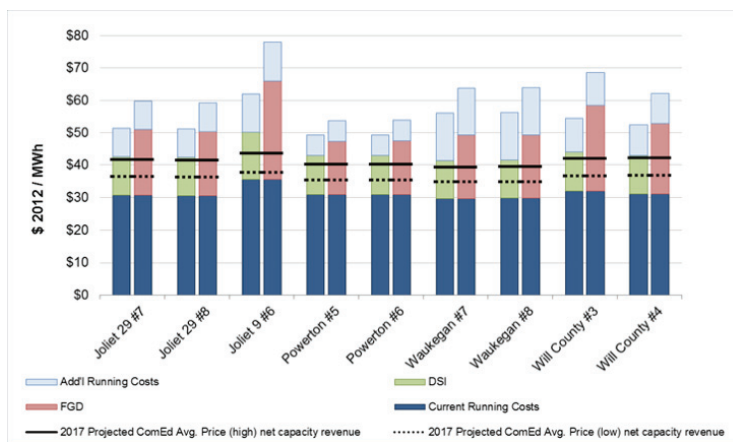
MWG's coal units are vulnerable to current and impending environmental regulations. Synapse analyzed the estimated environmental compliance costs for each unit in addition to the current running costs, assuming each of the following controls would be needed if it did not already exist at a given unit:

- Dry Sorbent Injection (DSI) or Flue Gas Desulfurization (FGD), which both reduce sulfur dioxide emissions. (Since these are substitutes, units would install one or the other.)
- Selective Catalytic Reduction (SCR), which reduces nitrous oxide emissions<sup>3</sup>
- Activated Carbon Injection (ACI), which reduces mercury emissions
- Baghouse filtration, which reduces particulate matter
- Water cooling upgrade costs<sup>4</sup>

Figure 4 shows the cost scenarios by unit, compared to the low and high forecasts of energy and capacity revenue for each plant in 2017. The costs for each unit are broken into current operating costs (i.e., with no new investments) and levelized environmental upgrade costs. For each plant, two cost scenarios are shown—one with DSI and one with FGD, since these are substitutes for one another. FGD is more expensive, but also more effective at mitigating sulfur dioxide than DSI. The low and high ranges of market revenue per MWh represent the addition of the low and high energy and capacity revenue forecasts, respectively.

The message of this chart is that if any unit shown requires either DSI or FGD, they will be unable to fully recover these investments in the future market—even before considering other environmental upgrades. When all environmental compliance costs are combined, the units' costs run between \$49 per MWh (Powerton unit 5) and \$62 per MWh (Joliet 9 Unit 6), respectively, assuming DSI is installed; and between \$54 and \$78 at the same units, respectively, assuming FGD is installed.

Figure 4 demonstrates that all MWG units are uneconomic in the face of compliance with environmental and public-health regulations. Edison has undoubtedly reached a similar conclusion, and revealed in its 2011 10K filing that the company “may ultimately decide to



**FIGURE 4: COMPARISON OF COSTS FOR EDISON COAL UNITS WITH PROJECTED COMED MARKET REVENUE IN 2017**

Notes: (1) Current costs include fixed and variable operation & maintenance costs and fuel costs. DSI, FGD, and other control costs include fixed and variable operation & maintenance costs and capital costs amortized over a 15-year period. (2) This chart omits the Crawford and Fisk plants since they have been retired. Sources: (a) Current Running Costs: EIA Form 923 2012, NERC EPA Analysis 2010 Assumptions (b) DSI, FGD, and Add'l control costs: EIA Form 860 2010, EPA IPM v4.1 Appendix 5-1a, 5-2a, 5-3, 5-4, 5-5 (Sargent & Lundy), EPA Technical Development Document for 316(b)

shut down the Waukegan Station and Joliet Unit 6, and possibly other units, rather than make improvements.” In fact, the “current running cost” values shown here may be conservative since—again quoting the 2011 10K—the company expected average costs of coal to increase by “approximately one-third in 2012” due to transportation issues. Financial institution UBS predicts many of Midwest Generation’s plants are at risk under a “low” cost retrofit scenario, with all of its plants at risk under a “high” scenario.

An April 2013 UBS study released following the Illinois Pollution Control Board’s decision to grant Midwest Generation’s latest variance request projects a likely retirement of the Waukegan plant, along with units at other Midwest Generation coal plants.

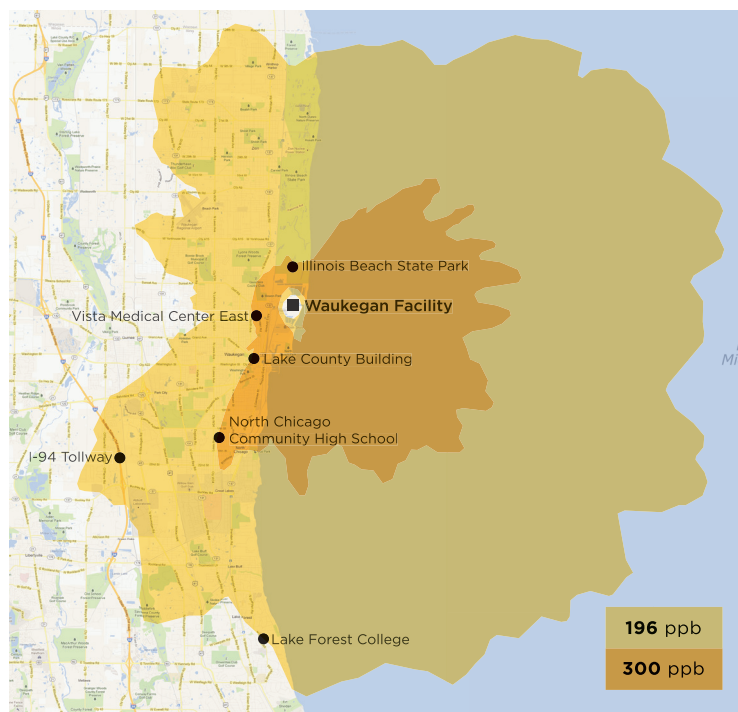
New legal liabilities since the initial 2012 release of this report highlight the expensive cleanup facing MWG’s plants. Midwest Generation faces an enforcement action to clean up groundwater beneath its coal-ash ponds, which contain unsafe levels of arsenic and other harmful toxins. In addition, the Sierra Club filed an enforcement case detailing the risk of harmful sulfur dioxide emissions from every one of Midwest Generation’s plants, which are emitting the pollution at levels the EPA has determined are unsafe. Major investments are needed to reduce pollution and get emissions down to safe levels.

## RELIABILITY

Retiring MWG's remaining units over the next several years should have no impact on regional electricity reliability. The Western PJM region has nearly 97 GW of existing capacity as of December 2012.<sup>5</sup> Of these existing resources, as of March 2013, 7 GW are slated for retirement, and a 2012 analysis by PJM deemed 3 GW were "at-risk" (including Waukegan, Will County unit 3 and Joliet 9).<sup>6</sup> Assuming no new capacity additions or non-coal retirements, this means 87 GW would remain if these "at-risk" units were to retire. Given that new demand-side resources will continue and that there are an additional 37 GW of new generation capacity in the planning queue or under-construction for this region in the coming years, the region is likely to have sufficient capacity to meet its future load.<sup>7</sup>

MWG's remaining units, after the retirements of the Fisk and Crawford plants, represent approximately 5 GW of coal capacity. When retirements are announced, PJM conducts reliability studies for individual units to determine if they will cause any regional or local reliability issues. PJM's analysis of the MWG retirements concluded that there would be "no impacts" on reliability.<sup>8</sup> In addition to the Fisk and Crawford retirements, PJM has deemed 9 GW of other coal capacity as "at-risk" (i.e., not announced to retire, but may retire in the coming years), including Waukegan 7 and 8, Joliet 9, and Will County 3, which in total represent 1.3 GW.<sup>9</sup> PJM's reliability analysis concluded that there will be little or no regional reliability implications based on the retiring units, although individual reliability studies will need to be performed for each unit to determine any possible local reliability impacts. However, there is ample reason to conclude that PJM will continue to have enough generation capacity, even if the projected retirements are higher than currently anticipated. PJM's analysis of the effects of coal-plant retirements on reliability concluded the following:

*As long as resource adequacy and local reliability are assured, the cycle of generation retirement and new resource entry are market-driven outcomes that can be reliability and efficiency enhancing. Newer, more efficient generation resources that replace retiring generation may have lower forced outage rates and thus, are more dependable than older generation resources that may be nearing the end of their useful lives.<sup>10</sup>*



**MIDWEST GENERATION WAUKEGAN COAL PLANT'S DANGEROUS SO<sub>2</sub> PLUME**  
All shaded areas represent the plant's permitted air emissions that are in violation of the EPA's one-hour SO<sub>2</sub> limit, which is 75 parts per billion (ppb)

While certain zones in the east of PJM have had reliability issues, the western zones are typically unconstrained for several reasons, including: less energy demand compared to the east; greater access to transmission; and closer access to the MISO grid.<sup>11</sup> In addition, PJM has historically been very conservative in forecasting energy efficiency (EE) and demand response (DR), while being aggressive when forecasting load growth. These trends have contributed to an oversupply system-wide. Figure 5 shows the most recent forecasts of demand-side resources (EE and DR) in Western PJM,<sup>12</sup> which have continually shifted upward with each passing year. These conservative forecasts stem from PJM's pessimistic assumption that only EE and DR resources that have cleared the most recent forward capacity auction (three years in advance) will be available thereafter—despite the fact that a significant quantity of new demand-side resources have cleared the market each year.

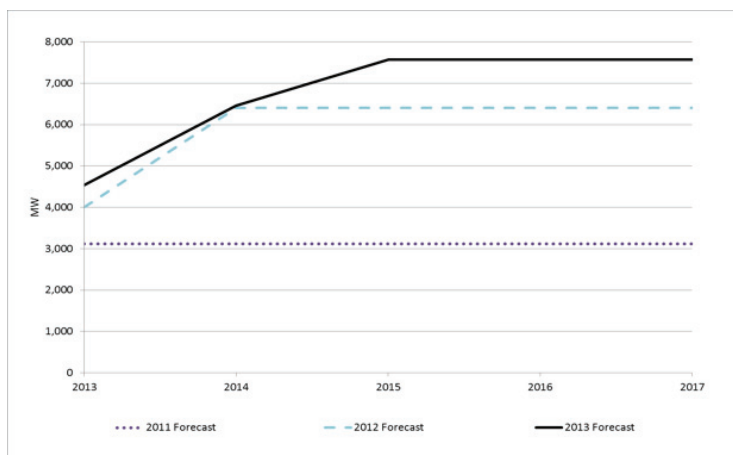
Figure 6 shows the declining trend in Western PJM load forecasts over the past several years, illustrating PJM's persistent overestimation of future load. The forecasts have been continually revised downward each year, in part due to decreased load expectation but also new demand-side resources clearing

the market each year (as seen above). For example, the current forecast for 2017 load is 6 GW lower than in the 2011 forecast for the same year. If PJM were to include likely new EE and DR in its forecast, the anticipated load would drop even further. Also shown is an “aggressive” forecast, assuming that new EE and DR will be added at a similar rate as in past auctions. This assumption results in a projection of 4 GW lower load for 2017 than is forecast by PJM’s current (2013) analysis, and more than 10 GW lower than the expected 2017 load in their 2011 forecasts.

A remaining question involves the local reliability implications within the ComEd zone, including the implications if more units than currently expected are retired, or come to be seen as “at-risk.” It is reasonable to expect that improvements in local reliability in the ComEd territory should result from the state of Illinois’ distributed generation and energy-efficiency goals. The Illinois Renewable Portfolio Standard (RPS) requires 25 percent of energy to come from renewable sources by 2025, with interim goals for development of solar PV and distributed generation.<sup>13</sup> Illinois’ Energy Efficiency Standard calls for reductions in peak demand of 0.1 percent per year (relative to the previous year) for 10 years (2009-2019) and reduction in energy sales (relative to the previous year) increasing up to 2 percent by 2016.<sup>14</sup> ComEd also filed a plan to invest \$2.3 billion over the next decade in improvements to its grid, which is slated to “improve reliability and reduce frequency and duration of power outages.”<sup>15</sup>

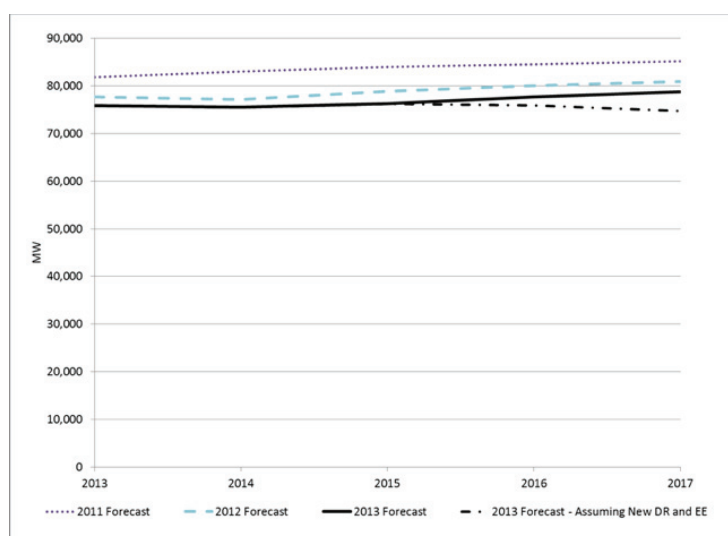
## CONCLUSION

As Midwest Generation is forced to comply with environmental regulations and face the true cost of operating its coal-fired power plants, Synapse’s analysis shows that the need for retrofits will only make MWG’s plants unable to recover the costs of emission controls from market revenues. Any additional investment in these aging coal plants—which are not needed for regional reliability—is just throwing good money after bad. The better outcome for public health and the environment, and arguably for the company, is to put the remaining MWG plants on schedule for near-term retirement.



**FIGURE 5: WESTERN PJM FORECASTS OF ENERGY EFFICIENCY (EE) AND DEMAND RESPONSE (DR)**

Source: PJM Load Forecast Reports, calculations by Synapse



**FIGURE 6: WESTERN PJM LOAD FORECASTS - NET OF FORECASTS OF EE AND DR**

Source: PJM Load Forecast Reports; “New EE and DR” forecast calculated by Synapse

## ENDNOTES

- 1 Edison International. Form 10K, Securities and Exchange Commission 2012.
- 2 PJM 2015/2016 RPM Base Residual Auction Results, Figure 2. Found here: <http://www.pjm.com/-/media/markets-ops/rpm/rpm-auction-info/20120518-2015-16-base-residual-auction-report.ashx>
- 3 Future SCR costs were excluded for those units that had Selective Non-Catalytic Reduction (SNCR) installed.
- 4 Sierra Club does not include the full cost of cleaning up the wastewater and coal ash from Edison's fleet in the analysis above that focuses primarily on air. These costs would only increase the overall forward-going cost.
- 5 Monitoring Analytics. State of the Market Report for PJM. March 14, 2013.
- 6 PJM At-Risk Machine List. Regional Transmission Expansion Plan Scenario. April 2012.
- 7 Monitoring Analytics. State of the Market Report for PJM. March 14, 2013.
- 8 PJM Transmission Expansion Advisory Committee, presentation on April 12, 2012: <http://pjm.com/-/media/committees-groups/committees/teac/20120412/20120412-reliability-analysis-update.ashx>
- 9 PJM At-Risk Machine List. Regional Transmission Expansion Plan Scenario. April 2012.
- 10 Coal Capacity at Risk for Retirement in PJM: Potential Impacts of the Finalized EPA Cross State Air Pollution Rule and Proposed National Emissions Standards for Hazardous Air Pollutants. PJM Interconnection. August 26, 2011.
- 11 As noted in the text, this is an overview of regional reliability or resource adequacy; we have not performed any analysis of the potential for local reliability issues associated with any particular retirement scenario.
- 12 This region's definition has changed over the years. For consistency and comparison, it includes AEP, Allegheny, ComEd, Dayton, Duquesne, American Transmission Systems (ATSI), and Duke Ohio. The previous version of the report did not include ATSI or Duke Ohio.
- 13 See: [http://www.dsireusa.org/incentives/incentive.cfm?Incentive\\_Code=IL04R&re=1&ee=1](http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=IL04R&re=1&ee=1)
- 14 See: [http://www.dsireusa.org/incentives/incentive.cfm?Incentive\\_Code=IL19R&re=1&ee=1](http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=IL19R&re=1&ee=1)
- 15 ComEd Press Release. "ComEd Files 10-year Plan with ICC for Implementing New Grid Modernization Program." January 6, 2012: [https://www.comed.com/newsroom/news-releases/Pages/newsroomreleases\\_01062012.pdf](https://www.comed.com/newsroom/news-releases/Pages/newsroomreleases_01062012.pdf)

