



## PROXY BACKGROUND INFORMATION

### Shareholder Proposal:

#### Report on Plan and Progress in Reaching Goals to Reduce Exposure to Coal Risk

#### **UTILITIES ARE EXPOSED TO SIGNIFICANT FINANCIAL AND REGULATORY RISK FROM RELIANCE ON COAL BUT DO NOT DISCLOSE TO INVESTORS PLANS TO MITIGATE THESE RISKS**

As You Sow, on behalf of shareowners, filed resolutions requesting that board of directors of Ameren, Duke Energy, and FirstEnergy:

“report to shareholders, at reasonable cost and omitting proprietary information, on plans to reduce our company’s exposure to coal-related costs and risks, including progress toward achieving specific goals to minimize commodity risks, emissions other than greenhouse gases, costs of environmental compliance, and construction risks.”

*Investors with holdings in coal-fired electric utilities face significant financial risks.*

1. Increasing price pressures and price volatility of coal;
2. Competition from low-cost natural gas and alternative generation sources;
3. Increasing capital costs for emissions control;
4. Construction costs for retrofits and new builds; and
5. Cost and technical feasibility of carbon capture and storage.

#### **Introduction:**

The three companies with which As You Sow filed this resolution (Ameren, Duke Energy, and FirstEnergy) have been identified by Fitch Ratings as among the top five owners of coal plants lacking SO<sub>x</sub> controls that are at-risk of retirement.<sup>1</sup> Each of the companies has acknowledged that one or more of the above coal-related risks is having or will have an impact on the financial performance of its generation fleet. Each of the companies has already announced coal plant retirements and taken asset impairment charges ranging from \$34 million<sup>2</sup> to \$444 million<sup>3</sup>.

Despite the fact that all of these companies will remain heavily dependent on coal even after their announced retirements, not one has disclosed to investors the company’s plans to reduce the financial risks to its coal fleet. A report on plans to reduce risk is critical for shareholders to be assured that the companies are prepared to navigate and mitigate risks related to continued reliance on coal combustion.

In 2010, 88% of domestic coal produced was consumed by U.S. power plants.<sup>4</sup> In 2011, 42% of U.S. net power output was generated from coal, down from 52% in 2000, and 25% from natural gas units, up from 16% in 2000.<sup>5</sup>

Today 60% of the U.S. coal fleet is at least 40 years old.<sup>6</sup> These plants are less efficient than newer plants and require significant investments for maintenance and emissions reduction. Industry analysts have shown that it is not economical to make capital expenditures in older coal plants or in some smaller, younger units.<sup>7</sup>



Profile of U.S. Coal Fleet<sup>8</sup>

Unit Age	Unit Count	% of All Units	Capacity (MW)	% of U.S. Capacity	Avg. Unit Size (MW)	Lack Environmental Controls (Scrubber, SCR, SNCR)
>60 years	122	10%	5,416	2%	44	85%
51-60 years	371	29%	47,099	15%	127	65%
41-50 years	254	20%	72,034	22%	284	50%
31-40 years	235	18%	115,318	36%	491	29%
11-30 years	242	19%	63,584	20%	263	23%
<10 years	49	4%	20,813	6%	425	10%
<b>TOTAL</b>	<b>1,273</b>		<b>324,265</b>			<b>47%</b>

In November 2011, Fitch Ratings concluded that, “approximately 83 gigawatts (GW) of capacity is at risk for retirement as a result of the new EPA rules, versus an estimated 51 GW in the earlier report. Approximately 39 GW, or 47%, of this capacity is operating without adequate SO<sub>x</sub> control.”<sup>9</sup>

Utility analysts agree that older, smaller, plants without control technology are uneconomical.<sup>10</sup> Even without new emissions control standards, Fitch found plants smaller than 400MW and older than 40 years to be “less economical to operate.”<sup>11</sup> An MJ Bradley report lists 40 plant closing announcements (of which seven plants were above 250 MW and two were less than 40 years old) demonstrating that utilities have concluded this type of plant is not worth investing in.<sup>12</sup> Fitch sees “a reduced dispatch of coal units is likely to occur as an interim compliance measure in addition to fuel switching. The utilization rate of natural gas-fired units is expected to increase as a consequence.”<sup>13</sup>

Continuing uncertainty regarding pending or proposed Environmental Protection Agency (EPA) regulations, and/or the risk of litigation that may change or delay regulatory requirements, is a significant risk to coal-dependent utilities. Given the 2014 deadline for compliance with the new mercury emissions standards, utilities are faced with immediate decisions regarding retirement or reinvestment in their coal-fired generating assets. Moreover, pending regulation of air, water, and waste and the prospect of more stringent enforcement of existing regulations make it highly likely that additional capital expenditures will be needed in the coming years to meet environmental standards for operating coal plants.

The risks of reliance on coal persist independent of actions taken by EPA because the economics of coal as a commodity have significantly changed, driven by both low natural gas prices and coal price volatility. The price of natural gas makes it often more economical to dispatch gas-rather than coal-fired generation and, in some markets, wind power undercuts gas as the price setter, pushing coal further down in the dispatch order.



### 1. Increasing price and price volatility of coal

Increasing price and price volatility of coal put low-cost electricity and the long-term competitiveness of coal-based projects into question. One coal industry report concluded that “the existence of coal reserves does not guarantee that the coal will be economical to produce or competitive with other regions.”<sup>14</sup>

Price: Part of the changing dynamics in the price of coal is related to supply. Historically, the Central Appalachian (CAPP) coalfields dominated domestic production. In 2008, the U.S. Geological Survey (USGS) determined that the methods traditionally used to determine the size, quality and economic utility of our existing coal reserves are not reliable.<sup>15</sup> In a quarterly assessment, Arch Coal, one of the biggest CAPP coal producers, determined that “based on historical trend, most of the supply reduction is likely to be permanent.”<sup>16</sup> The company further stated that “the 2008-2010 drop [in Central Appalachia] is shaping up to be the largest fall-off in production yet.”<sup>17</sup>

The pinch of diminished reserves in CAPP coal has been balanced by increased demand for low-sulfur coal from the Powder River Basin (PRB) in order to meet stricter air pollution rules. The demand for low-sulfur coal will result in more production from western states, potentially 1% more a year between 2015 and 2035.<sup>18</sup> However, USGS found that total U.S. recoverable reserves in the country’s most prolific coalfield, the PRB’s Gillette coalfield, are only 47% of previous estimates.<sup>19</sup>

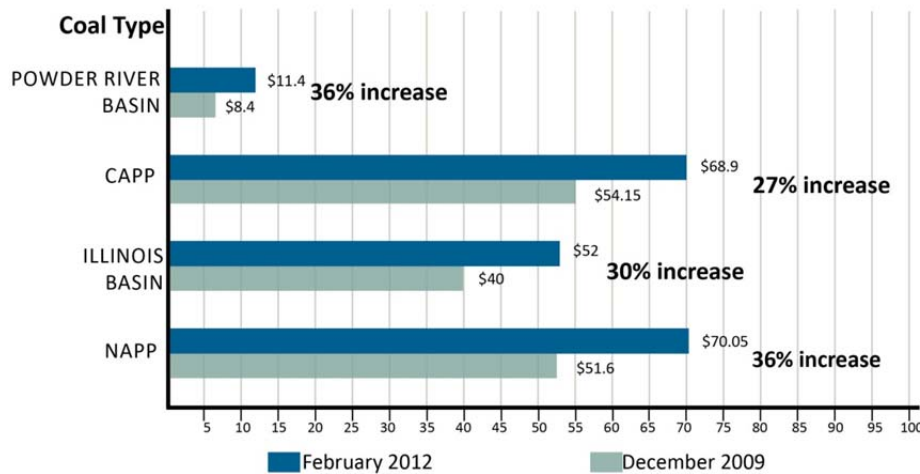
Domestic coal is no longer captive of domestic demand and U.S. utilities will be paying prices that increasingly reflect global demand for coal. Currently, U.S. coal mining companies are seeking to improve profits by selling CAPP and PRB coal at the highest price in metallurgical coal markets and to utilities overseas.<sup>20</sup> Although CAPP coal recently plunged to a two-year low of \$58 per metric ton, U.S. mining companies are shoring up profits by exporting more coal to take advantage of international markets where prices are considerably higher, with Japanese utilities paying as much as \$115 per metric ton.<sup>21</sup>

Volatility: Industry analysts find that coal “price swings will be more erratic and of greater magnitude.”<sup>22</sup> This is due to several factors: depletion of economically recoverable CAPP reserves; increased demand (domestic and international) for low-sulfur PRB coal; and increasing exports. This suggests that coal supply, quality, and price problems will only increase and the growing competitiveness of alternative resources will make coal an increasingly less economical choice for electricity generation.

Price volatility is also driven by international demand that could swing widely. The International Energy Agency “warned that China’s volatile production levels make trade markets much more difficult to predict.”<sup>23</sup> The agency found that “China’s imports can either double or fall by two-thirds in the next five years.”<sup>24</sup> Several companies are currently working to expand port capacity in the Pacific Northwest as well as in the gulf from where western as well as eastern coal leaves U.S. shores.<sup>25</sup> Although the expansion is being strongly opposed by environmental groups, the impact of the potential for coal exports continues to make future prices of coal highly uncertain.



Since 2009, the price of coal from each of the major U.S. production regions increased significantly. Even with volatility and recent price decreases, each region is still seeing significant overall price increases.



#### Examples of the increasing price and price-volatility of coal:

- Peabody, the largest coal producer in the U.S., predicts that as a function of the reduction of CAPP coal, the price of PRB coal could increase upward of 293% from 2007 prices in the next 5 years.<sup>26</sup>
- A recent analysis by the Texas Independent Supply Operator, ERCOT, has set 20-year PRB prices for Texas between \$75 and \$100 per ton, thereby predicting an annual price increase of 8-12%.<sup>27</sup>

Increasing production costs: According to the U.S. Energy Information Administration (EIA), the “higher cost reserves” of CAPP have already been “extensively mined.”<sup>28</sup> As recoverable reserves decline, companies in Central Appalachia are using surface mining and/or mountaintop removal (MTR) to lower costs. MTR is a controversial practice with associated regulatory and reputational risks. “The declining competitiveness [of coal] is due in large part to the increased cost of producing coal in Central Appalachia, for both surface and underground mining.”<sup>29</sup>

#### Increasing cost of producing coal:

- Alpha reported that in “2011, the weighted-average cost rose to \$47.15/st from \$30.08/st a year ago. The greatest portion of cost increases could be attributed to Alpha’s eastern operations, where the weighted-average cost increased during Q4 to \$81.14 from \$64.18/st, and during full-year 2011, to \$80.09 from \$59.47/st.”<sup>30</sup>
- Federal prosecutors are looking into Massey executives after the 2010 explosion. Their findings could have an affect “on coal production and specifically whether it will force regulators to enact stricter laws. Tougher oversight, of course, would tend to require not just more safety standards but also stronger pollution controls, all of which would add costs.”<sup>31</sup>
- Operating costs in the PRB have doubled since 2003.<sup>32</sup>



- The cost of production required to meet Arch Coal projections for mining in the PRB exceed the market price of PRB coal by \$2.65 - \$5.45 per ton. This would require a price for coal that is 20% to 40% higher than the market can sustain.<sup>33</sup>

### **2. Competition from “unconventional” gas and alternative generation sources**

The price of natural gas makes it often more economical to dispatch gas- rather than coal-generated electricity. In some markets, wind is the benchmark, pushing coal further down in the dispatch order.

According to the EIA, "natural gas combined-cycle units operate at higher efficiency than do older, coal-fired units, which increases the competitiveness of natural gas relative to coal."<sup>34</sup>

Aram Sogomonian, vice president of risk management for Edison Mission Energy stated that “[i]t will be tough to build something other than natural gas plants, given the current environmental rules, capacity factors and low prices.”<sup>35</sup>

Access to reserves of unconventional shale gas, through the controversial process of hydrofracking, has created a boom in natural gas supplies and a bust in gas prices that is upending the economics of “cheap” coal-fired power. Natural gas, which until a few years ago was considered too expensive and too volatile in price to be a reliable fuel for cost-competitive electric power, is now the price-setter in deregulated markets. Low natural gas prices have made old, inefficient coal plants “dead men walking” and now smaller, younger coal plants in merchant fleets are also facing early retirement.

The 2011 *PJM State of the Market Report* confirms that last year the market was good for natural gas and bad for coal. The report:

- noted that gas prices fell and coal prices rose in 2011. Gas prices decreased on average by 10% and coal prices increased on average by 19% in 2011.
- highlighted that the market results in 2011 were generally positive for gas fired units, especially new combined cycle units. Total new entrant combined cycle revenues were generally higher in 2011 and exceeded the threshold to incent new entry for most zones.
- found that the market results in 2011 were generally negative for coal fired units, especially older, smaller coal fired units. The profitability of coal units declined as a result of declining revenues and increased costs. The situation was worse for units requiring additional investments to meet environmental regulations.<sup>36</sup>

According to Deutsche Bank, when natural gas costs \$4-6/MMBtu, it is more economical to burn natural gas to generate electricity than coal.<sup>37</sup> The Energy Information Administration notes that the Henry Hub price for natural gas is \$6/MMBtu in 2025.<sup>38</sup> Brattle Group projects natural gas prices to rise by 1% or less through 2035.<sup>39</sup>

Existing natural gas plants are utilized, on average, at 20% of capacity and 40% in peak summer.<sup>40</sup> Natural gas assets make up 42% of the U.S. power sector generating potential, enabling significant electric output if plants are operated closer to capacity.<sup>41</sup>

- Bernstein Research found that the gross margin of merchant coal plants “has fallen by over three quarters since 2008, from \$20 billion to \$5 billion” and forward price curves “suggest that in 2011 aggregate unregulated gross margin will erode further, dropping by a fifth from \$5



billion to \$4 billion. This dramatic erosion in gross margin reflects the collapse in the price of natural gas [...] aggravated by continued upward pressure on the price of Appalachian coal.”<sup>42</sup>

The EIA report, “Levelized Cost of New Generation Resources in the Annual Energy Outlook 2011,” compares costs for generating technologies brought on line in 2016. Allowing for regional variation in levelized cost, EIA found that the most expensive advanced combined cycle gas plant costs less (\$70.5/MWh in 2009 dollars) than the least expensive new conventional coal plant (\$85.5/MWh in 2009 dollars).

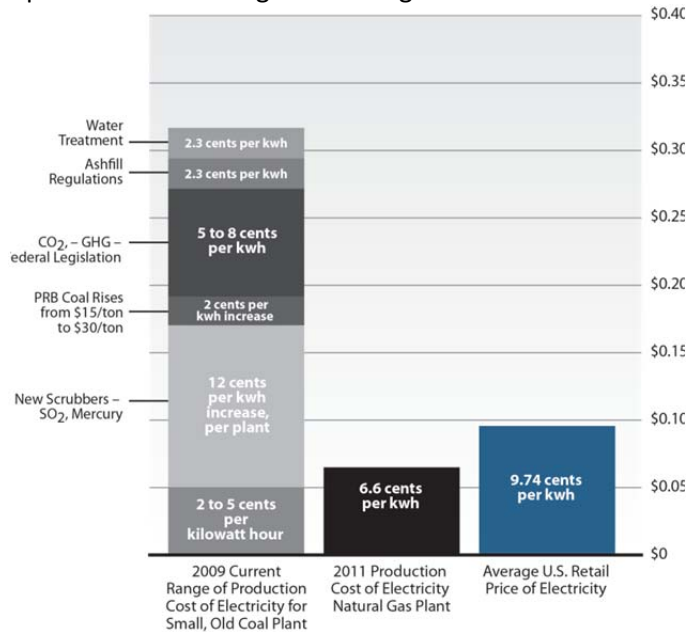
Increased reliance on renewable resources, demand management, and improved utility-scale storage capacity will eventually reduce the role of both coal and natural gas in electric power production. Energy efficiency, existing natural gas capacity, and cost competitive renewable energy provide a glide path for utilities to transition away from coal.

- The Electric Power Research Institute (EPRI; an industry sponsored organization) estimates that energy efficiency programs, along with demand response systems, lower the growth rate for electricity consumption by 22% and the growth rate for peak demand by 46% compared to EIA projections.<sup>43</sup>
- Lazard’s “Levelized Cost of Energy Analysis” demonstrates that currently the levelized cost of electricity (LCOE) for wind is, in most cases, less than that for coal and thin-film solar, biomass, and geothermal are, in many cases, less than that for coal.<sup>44</sup>
- According to EIA, the levelized cost for the least expensive wind power is cheaper (\$81.9/MWh in 2009 dollars) than the least expensive conventional coal plant.<sup>45</sup>
- In the U.S., public policy is critical for the large-scale adoption of renewable energy technologies. The EIA links the continued growth of renewable energy to financial incentives and mandates such as Federal Tax Credits and Renewable Portfolio Standards (RPS).<sup>46</sup> Currently 37 states and the District of Columbia have renewable mandates or RPS, but in six states those standards are voluntary.<sup>47</sup>

### **3. Increasing capital costs for emissions control**

Currently, there are many elements that are not typically incorporated into discussions of the price of electricity generated from coal. Including these “externalities” paints a very different picture of coal’s competitiveness against other sources of electricity generation, particularly natural gas and wind. While coal plant operators struggle with the cost of control technology to meet the new mercury standards or the proposed coal combustion waste rules, the cost of compliance for a gas plant is nil as it emits no mercury or coal ash. Gas also has significant advantages over coal in emitting less carbon dioxide when burned, which makes carbon capture and storage a less expensive option for gas plants than for coal plants. However, on all scores, including impacts on water resources, wind energy - which is competitive economically in several markets - has lower operating costs than gas or coal.

### Competitive Disadvantage of Existing Coal-Fired Power Plants<sup>48</sup>



Pending regulation of the air, water, and waste impacts of coal plants and the prospect of more stringent enforcement of existing regulations make it highly likely that additional capital expenditures will be needed in the coming years to meet environmental standards for operating coal plants. In the absence of a national energy policy, utilities face incremental mandates and continued uncertainty over the scope and timing of environmental rules. This further elevates the risks for companies that must decide now whether or not to invest in aging coal fleets.

Several of the EPA initiatives affecting coal plants (Cross State Air Pollution Rule, mercury, cooling water intake) are proceeding pursuant to court orders, while others are tied up in litigation. Congressional efforts to stop EPA regulations have ended in stalemate. However, it is very probable that, over the decades-long expected life of these investments, coal-dependent utilities will be forced to internalize even more of their environmental damage costs. Senator Jay Rockefeller, from the coal state of West Virginia, has stated: “Greenhouse gas emissions are not healthy for the earth. It will not go away if we ignore the issue. There will be some additional regulations.”<sup>49</sup>

Air: Pollutants from coal-fired plants have been linked to human mortality and morbidity from stroke, cancers, cardiovascular and respiratory diseases, as well as causing deforestation and acidification of surface waters when precipitated in ‘acid rain.’<sup>50</sup> In order to keep these compounds from the air, utilities are forced to install emissions control equipment. EPRI estimates that installation of one SO<sub>2</sub> scrubber on a 500 MW plant in the mid-west would cost about \$420/kW, or \$210 million.<sup>51</sup> Yet these multi-million dollar investments do not always last long – many scrubbers suffer from corrosion within the first years requiring additional expensive upgrades and potential replacements.<sup>52</sup>

Impacts of regulations of air emissions:

- Analysts estimate that the cost of compliance with mercury regulations could cause the retirement of 61- 75 GW of U.S. coal-fired generation capacity.<sup>53</sup>



- The Brattle group estimates that 50-66 GW's would be retired if the EPA imposes a scrubber mandate and provides clear economic standards that demonstrate where merchant plants and younger, large plants can be retired.<sup>54</sup>
- Moody's also considers regulatory risk to have a significant impact on the ratings of utilities. "Given the magnitude of these potential nondiscretionary environmental-related costs and the fact that electricity prices are rising throughout the country, electric utilities could face a daunting challenge in obtaining timely recovery of these costs through their respective rate-setting authorities ... Such a scenario could cause negative rating actions within the sector."<sup>55</sup>

Waste: Coal Combustion Waste (CCW), or coal ash, is the second largest waste stream in the U.S.<sup>56</sup> The toxins in coal ash have been linked to cancer, neurological damage, reproductive failure, organ failure, and other serious health problems as well as widespread damage to ecosystems.<sup>57</sup> An EPA study of 89 CCW disposal sites found that 80% either had proven or potential damage, and an EPA study of 144 additional sites released in 2011 gave 48 of the ponds, or 1/3, "poor" ratings.<sup>58</sup>

In December 2008 a dam broke at a large coal ash pond in Tennessee covering more than 300 acres in coal ash sludge. It was estimated that total cleanup costs are over \$1.2 billion and the utility, Tennessee Valley Authority (TVA), faces at least 57 lawsuits claiming property damage, health problems, and other damages.<sup>59</sup>

Since the spill, the EPA has revisited regulating coal ash as hazardous waste and is currently reviewing nearly 500,000 comments on coal ash regulation. Adopting a hazardous waste designation for coal ash (Subtitle C) will have upfront costs for the utilities but, according to EPA's Regulatory Impact Analysis (RIA) of the proposed rules, the regulation would save an estimated \$5.3 to \$16.7 billion in avoided future coal combustion residues impoundment catastrophic failure cleanup costs, in addition to avoiding significant additional costs related to litigation, contamination of surface water, and human health as a result of exposure to chemicals in the ash.<sup>60</sup> In the interim, HR 2273 passed the House and S1751 was introduced in the Senate. The bills attempt to limit EPA's ability to address CCW and make a determination on either Subtitle C or D even though studies show that regulations would create 28,000 new jobs each year and prevent further contamination of groundwater from arsenic, lead, and other toxic metals.<sup>61</sup> Lack of federal regulation increases utilities' risks related to CCW.

#### **4. Risk of carbon capture and storage as a GHG control technology**

Plans to invest in carbon capture and storage (CCS) puts utilities at further financial risk. The General Accounting Office found that CCS technology within the U.S. is 10-15 years away from wide scale commercial deployment and it will increase the cost of coal-fired electricity by 30% to 80% above current levels.<sup>62</sup>

Investment in CCS has been cancelled due to fears that regulators would reject increasing rates in order to recover company costs and Congressional inaction on climate change. The original FutureGen project, a near zero-emissions coal-fired plant using CCS, was cancelled in 2008 after congressional Republicans objected to CCS as an expensive and largely unproven technology.<sup>63</sup> In July 2011, then AEP chairman and chief executive officer Michael Morris said, "...at this time it





doesn't make economic sense to continue work on the commercial-scale CCS project beyond the current engineering phase."<sup>64</sup>

The FutureGen 2.0 project<sup>65</sup> to demonstrate CCS technology at Ameren's Meredosia plant was set back when Ameren, citing fiscal concerns, withdrew from the project.<sup>66</sup> The estimated cost to retrofit one unit at the Meredosia plant is \$1.65 billion.<sup>67</sup>

According to the EIA, the levelized cost of the most expensive advanced combined cycle gas plant with CCS is \$104 per MWH while the cost of the least expensive advanced coal plant with CCS exceeds \$126 per MWH.<sup>68</sup>

The EPA, in promulgating its rules on Best Available Control Technology for greenhouse gas emissions, recognized that "at present CCS is an expensive technology, largely because of costs associated with CO<sub>2</sub> capture and compression, and these costs will generally make the price of electricity from power plants with CCS uncompetitive compared to electricity from plants with other GHG controls."<sup>69</sup>

### **5. Risks related to Construction and Cost Recovery**

Costs for both construction of new coal-fired plants and upgrades to existing plants are increasing exponentially. For example, in 2002 a 600 MW plant cost \$1500/kW to build (\$900 million) but by 2009 that same plant design cost \$3500/kW or \$2.1 billion.

Plants currently under construction are facing significant cost overruns – such as Wisconsin Power & Light, whose 300 MW Nelson Dewey 3 plant had nearly 40% increase in its estimated costs after just 18 months.<sup>70</sup> Given the risks of construction cost-overruns, coupled with market constraints and resistance from regulators to allow utilities to raise their customers' rates to cover the costs, new coal-fired facilities and investments in existing facilities present financial risk to utilities.

- Cost of upgrades to maintain operations are increasing, and implementing certain maintenance upgrades trigger laws that mandate that plants invest in environmental upgrades as well
- Cost of upgrades to meet environmental regulations are significant. On a 300MW plant, estimated costs for a SO<sub>2</sub> scrubber is \$100-120MM; Selective Catalytic Reduction (SCR) (for NO<sub>x</sub> emissions) is \$50-60MM; Activated Carbon Injection (ACI) and Baghouse (for mercury emissions) approximately \$30MM; and a Cooling Tower (for water) \$60-90MM.<sup>71</sup>
- Public Utility Commissions are increasingly not approving rate increases to cover increased construction costs for new plants and may begin to reject rate increases to recover upgrades as well.

### **Conclusion**

Reliance on coal as a source for electricity generation puts utilities at increased risk. Both the cost of coal and the costs to burn coal are rising. In addition, there is increased competition from alternative generating sources, particularly natural gas. The costs to build and retrofit coal-fired facilities are increasing, making many merchant units uneconomical and either putting undue rate increases to consumers or causing public utility commissions to reject proposals for such



projects. Carbon capture and storage has still not proven to be a viable solution for reducing emissions from coal combustion.

At a time when coal's share of the U.S. electric power market is shrinking and coal assets are losing value, investors must exercise enhanced diligence regarding investments in coal-dependent utilities. Enhanced diligence requires greater transparency from companies about their plans to mitigate the risks of reliance on coal.

Investors need for companies to disclose its plans to mitigate its coal risks, not simply disclose that they exist. Companies should provide specific goals to reduce the risks so that investors will be able to benchmark our company's progress in reducing these material risks to shareholder value.

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<sup>1</sup> B. Mehendale, D. Pidherny, P. W. Smyth, "Time to Retire II? The Update to Coal Plant Retirements," *Fitch Ratings*, November 17, 2011.

<sup>2</sup> Ameren, *2011 10-K*, accessed March 20, 2012, 47.

<sup>3</sup> FirstEnergy Corp., *2011 10-K*, accessed March 14, 2012, 48.

<sup>4</sup> Calculated from "Weekly Coal Production Report," Energy Information Administration, report released March 15, 2012, [http://205.254.135.7/cneaf/coal/weekly/weekly\\_html/wcppage.html](http://205.254.135.7/cneaf/coal/weekly/weekly_html/wcppage.html). "EIA Quarterly Coal Report," Energy Information Administration, release date January 11, 2012, <http://www.eia.gov/coal/production/quarterly/>. "EIA Electric Power Monthly," Energy Information Administration, release date February 29, 2012, <http://205.254.135.24/electricity/monthly/>. "Short-Term Energy Outlook," Energy Information Administration, release date March 6, 2012, <http://www.eia.gov/forecasts/steo/query/>.

<sup>5</sup> Electric Power Monthly, "Net Generation Energy Source All Sectors," *Energy Information Administration*, <http://www.eia.gov/beta/epm/>.

<sup>6</sup> Data Source: "National Electric Energy Data System v.4.10," *EPA Clean Air Markets*, last updated September 8, 2010, <http://www.epa.gov/airmarkets/progsregs/epa-ipm/BaseCasev410.html#needs>.

<sup>7</sup> H. Wynne, F. D. Broquin, and S. Singh, "U.S. Utilities: A Visit to Washington Finds Utility Lobbyists & Environmentalists Agreeing on the Grim Outlook for Coal," *Bernstein Research*, 9 March 2010. M. J. Bradley & Associates, LLC and Analysis Group, "Ensuring A Clean, Modern Electric Generation Fleet while Maintaining Electric Reliability," *M.J. Bradley & Associates, LLC*, August 2010. The Brattle Group, "Potential Coal Plant Retirements Under Emerging Environmental Regulations," December 8, 2010. Fahey, "Why Small Coal-Fired Plants Are Going Away," *Forbes*, 19 July 2010.

<sup>8</sup> Calculated from "National Electric Energy Data System (NEEDS) v.4.10," *EPA Clean Air Markets*, last updated September 8, 2010, <http://www.epa.gov/airmarkets/progsregs/epa-ipm/BaseCasev410.html#documentation>.

<sup>9</sup> B. Mahendale, D. Pidhemy, and P. W. Smyth, "Time to Retire II? The Update to Coal Plant Retirements," *Fitch Ratings*, November, 17, 2011, 1.

<sup>10</sup> H. Wynne, F. D. Broquin, and S. Singh, "U.S. Utilities: A Visit to Washington Finds Utility Lobbyists & Environmentalists Agreeing on the Grim Outlook for Coal," *Bernstein Research*, 9 March 2010. M. J. Bradley & Associates, LLC and Analysis Group, "Ensuring A Clean, Modern Electric Generation Fleet while Maintaining Electric Reliability," *M.J. Bradley & Associates, LLC*, August 2010. The Brattle Group, "Potential Coal Plant Retirements Under Emerging Environmental Regulations," 8 December 2010. Fahey, "Why Small Coal-Fired Plants Are Going Away," *Forbes*, 19 July 2010.



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- <sup>11</sup> B. Mahendale, D. Pidhemy, and P. W. Smyth, "Time to Retire II? The Update to Coal Plant Retirements," *Fitch Ratings*, November, 17, 2011, 4.
- <sup>12</sup> M.J. Bradley & Associates, LLC and Analysis Group, "Ensuring A Clean, Modern Electric Generation Fleet while Maintaining Electric Reliability," August 2010, Appendix B, Recent Coal Plant Retirement Announcements.
- <sup>13</sup> B. Mahendale, D. Pidhemy, and P. W. Smyth, "Time to Retire II? The Update to Coal Plant Retirements," *Fitch Ratings*, November, 17, 2011, 7.
- <sup>14</sup> K. Silverstein, "Coal's Woes Run Deeper than EPA Regs, Competitive, Labor Issues Hurt Production," *energybiz*, September 28, 2011, [http://www.energybiz.com/article/11/09/coals-woes-run-deeper-epa-regs&utm\\_medium=eNL&utm\\_campaign=EB\\_DAILY2&utm\\_term=Original-Member](http://www.energybiz.com/article/11/09/coals-woes-run-deeper-epa-regs&utm_medium=eNL&utm_campaign=EB_DAILY2&utm_term=Original-Member).
- <sup>15</sup> United States Geological Society, *Assessment of Coal Geology, Resources and Reserves in the Gillette Coalfield, Powder River Basin, Wyoming*, Open-File Report: 2008-102, p. 31, <http://pubs.usgs.gov/of/2008/1202/pdf/ofr2008-1202.pdf>
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