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MAR 31 2008  
PUBLIC SERVICE  
COMMISSION

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March 31, 2008

Re: *The Application of Kentucky Utilities Company for a Certificate of Public Convenience and Necessity to Construct Flue Gas Desulfurization Systems and Approval of Its 2004 Compliance Plan for Recovery by Environmental Surcharge* – Case No. 2004-00426

Dear Ms. Stumbo:

Enclosed please find an original and ten (10) copies of Kentucky Utilities Company's *Update to the 2004 SO<sub>2</sub> Compliance Strategy* ("*Update Strategy*") and a presentation entitled "SO<sub>2</sub> Compliance Strategy – E.W. Brown FGD – Kentucky Public Service Commission Update." These two documents were presented by Company representatives at the March 19, 2008 meeting with the Commission Staff and the Attorney General in the above-referenced matter; a copy of the attendee list is attached. This information is being filed pursuant to the direction of the Commission Staff following the meeting.

Also enclosed are an original and ten copies of a Motion for Confidential Treatment regarding certain information provided in the *Update Strategy*.

Should you have any questions concerning the enclosed, please do not hesitate to contact me.

Sincerely,

Robert M. Conroy

Name

Organization

Marti Hall	PSC
Allyson K Sturgeon	EON US
Robert M. Conroy	EON U.S.
Larry Cook	OAG
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Lonnie Bellar	EON-US

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MAR 31 2008

PUBLIC SERVICE  
COMMISSION

*Update to the 2004 SO<sub>2</sub>  
Compliance Strategy*

*For*

**e-on** | U.S.

*Subsidiaries*

*Kentucky Utilities and  
Louisville Gas and Electric*

*March 2008*

**Sulfur Dioxide Compliance Strategy**  
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## Executive Summary

The purpose of this document is to update the 2004 SO<sub>2</sub> Compliance strategy including the cost estimates of the flue gas desulfurization (“FGD” or “scrubber”) systems being built at Kentucky Utilities Company’s (“KU’s”) Ghent and E.W. Brown stations, along with both quantitative and qualitative explanations that support the changes in cost. A Certificate of Public Convenience and Necessity (“CPCN”) was granted and environmental cost recovery (“ECR”) treatment approved by the Kentucky Public Service Commission (“Commission”) on June 20, 2005 as Project KU-21 in Case No. 2004-00426. However, since Commission approval, and despite the efforts of KU to control capital costs, the cost estimate of the KU FGD program at the Ghent and E.W. Brown (“Brown”) stations has increased from \$658.9 million to \$1,182.4 million, primarily driven by market prices for materials, equipment and labor, a significant scope increase for the ductwork routing of Brown units 1 and 2, and problems with the ID fans purchased for Ghent 3, Ghent 4 and Brown 3. In addition, it has been determined that the optimal construction schedule at Brown is one year longer than originally planned, with an in-service date in 2010.

The changes in capital cost, combined with the changes in the forecasted prices of SO<sub>2</sub> allowances and fuel necessitate a re-evaluation of the Companies’ 2004 least-cost SO<sub>2</sub> compliance plan. On December 22, 2006, the Commission approved in Case No. 2006-00493 an application for changes to the Ghent FGD CPCNs that also included an update to the Ghent FGD project<sup>1</sup> in general and demonstrated that the addition of FGDs at Ghent continues to be the least-cost next step in environmental compliance. In April 2007, the Commission was presented with a further program update that demonstrated that the plan to construct an FGD on Brown Units 1, 2 and 3 continued to be economical. The purpose of this review is to evaluate whether the continued construction of wet FGD systems on Ghent Units 1, 3 and 4 and Brown Units 1, 2 and 3 and the simultaneous switching of these units to high sulfur coal is the least-cost plan for continued environmental compliance.

The scrubbing and fuel switching of the remaining units at Ghent and the construction of an FGD system at Brown in conjunction with purchasing SO<sub>2</sub> allowances on an as-needed basis, remains the least-cost SO<sub>2</sub> compliance plan. Though the addition of the FGD systems does not eliminate the need to purchase SO<sub>2</sub> allowances, the installation of environmental controls significantly reduces the need to purchase SO<sub>2</sub> allowances and is required for continued economical compliance with the SO<sub>2</sub> emission reduction requirements of the Clean Air Act Amendments of 1990. Over the 20-year analysis period, completing KU’s FGD program should:

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<sup>1</sup> *In the Matter of: Application of Kentucky Utilities Company to modify certain Certificates of Public Convenience and Necessity to construct ductwork for two flue gas desulfurization units at the Ghent power station, Order dated December 22, 2006, finding 4 at Page 4 - “KU’s updated PVR analysis demonstrates that constructing three new FGDs at the Ghent Station continues to be the most cost-effective means for KU to comply with the relevant emission limits imposed by the CAIR.”*

1. Decrease the cost of SO<sub>2</sub> compliance by approximately \$224 million in PVRR compared to not scrubbing Ghent 1 and by \$99 million compared to not scrubbing the Brown units;
2. Delay exhausting the Companies' SO<sub>2</sub> allowance bank until 2021 and reduce the allowance shortfall to approximately 173,000 tons through 2028;
3. Increase fuel procurement flexibility;
4. Position the Companies for the SO<sub>2</sub> reduction requirements associated with the CAIR and future regulations targeting fine particulates and mercury; and
5. Increase typical residential customers' bills (1000 kWh/month) by \$2.17/month, which equates to a 3.5% increase in ECR billing factor above KU's original estimate in Case No. 2004-00426.

The Companies will continue to construct an FGD for Ghent 4 in 2008, for Ghent 1 in 2009, and for Brown 1, 2 and 3 in 2010, while purchasing allowances on an as-needed basis and continuing the practice of environmental dispatching. The Companies will also evaluate additional environmental technologies for existing generating assets.

## **Background**

The Clean Air Act Amendments of 1990 ("CAAA") sought to reduce the effects of acid deposition through a phased reduction in SO<sub>2</sub> and NO<sub>x</sub> emissions from 1980 levels in the 48 contiguous states. Subsequently, the Clean Air Interstate Rule ("CAIR") was finalized by the Environmental Protection Agency in March 2005. CAIR requires significant additional reductions/limits in phases for NO<sub>x</sub> and SO<sub>2</sub>. With regard to SO<sub>2</sub>, CAIR will reduce the allowable SO<sub>2</sub> emissions of Kentucky Utilities Company ("KU") and Louisville Gas & Electric Company ("LG&E"), (collectively "the Companies") by approximately 50% in 2010 and 65% in 2015.

In order to comply with these regulations, the Companies have constructed flue gas desulfurization ("FGD") systems on many of the fleet's coal-fired units (Ghent 1, Trimble County 1, Mill Creek 1-4 and Cane Run 4-6). By increasing the FGDs' SO<sub>2</sub> removal efficiency where economically feasible, LG&E is expected to meet CAAA Phase II requirements and provide a bank of SO<sub>2</sub> allowances. The Companies' joint planning process assumes that allowances banked by either utility can be utilized by either Company, thereby mitigating the combined Companies' exposure to the volatile SO<sub>2</sub> allowance market.

On December 20, 2004, the Companies filed with the Commission an application for a Certificate of Public Convenience and Necessity ("CPCN") and environmental cost recovery ("ECR") treatment for additional wet FGD systems on E.W. Brown ("Brown") units 1, 2 and 3 and the remaining un-scrubbed units at Ghent. On June 20, 2005, the Commission approved these projects under Project KU-21 in Case No. 2004-00426. Since that time, the Companies have proceeded with the construction of these projects. On November 16, 2006, the Companies filed an application for changes to the Ghent FGD CPCNs. That application, which also included an update on the Ghent FGD project in general, was approved as Case No. 2006-00493 on December 22, 2006. On April 26, 2007, the Commission was presented with a further program update of market impacts on the program total projected cost that demonstrated that the plan to construct an FGD on Brown Units 1, 2 and 3 continued to be economical. The purpose of this document is to provide a further update on KU's FGD program.

KU's total program expenditures and commitments to date at the Ghent station are \$522 million of the total \$682 million in capital, where commitments means KU has approved major purchase orders. The Ghent 3 FGD was placed into service in 2007 as planned and the Ghent limestone preparation facility is currently being commissioned as planned. The Ghent 4 FGD is nearing completion and will be commissioned in late spring 2008 as planned, and the Ghent 1 FGD is on schedule for the spring 2009 commissioning. The Ghent 1 FGD is the only construction activity that remains at risk of increasing costs due to market influences (i.e., labor and consumable materials prices). Although all major equipment and large purchase orders have been awarded on Ghent 1, a significant amount of field construction remains to complete the FGD.

KU's total program expenditures and commitments to date at the Brown station are \$182 million of the total \$500 million in capital, where commitments means KU has approved

major purchase orders. Recent photographs of this construction can be found in **Appendix 1**. Since 2004, several factors impacting the cost of the Brown FGD project have changed, as discussed in the following section. The goal of this revised evaluation is to identify the current least-cost plan, given the impact of these new factors.

### **Significant Changes since 2004 Filing**

Since the *2004 SO<sub>2</sub> Compliance Strategy for Kentucky Utilities Company and Louisville Gas and Electric Company* was finalized and submitted to the Commission in Case No. 2004-00426, significant changes have occurred that have impacted the following key drivers of least-cost environmental evaluations.

- SO<sub>2</sub> allowance market
- Fuel price forecasts
- FGD capital costs and the construction schedule for the FGD at Brown.

### **SO<sub>2</sub> Allowance Prices**

Previous testimony documented the change in expectations since the 2004 ECR Application regarding the higher cost of SO<sub>2</sub>-related CAIR compliance over the longer term.<sup>2</sup> This expectation of higher SO<sub>2</sub> emissions allowance costs supports a strategy of FGD construction rather than purchasing allowances from the allowance market.

The following graph highlights the change in SO<sub>2</sub> allowance cost projections since the original ECR filing, as previously noted in the April 2007 update. Though the near-term price forecast has weakened slightly, the long-term forecast remains high. This robust projection of longer-term SO<sub>2</sub> allowance costs stems from a fuller understanding of the long-run marginal cost of complying – through retrofitting existing generation capacity – with a tightening constraint on physical emissions. The following recent developments in construction and commodity markets have intensified the challenge of meeting reduction targets for emissions:

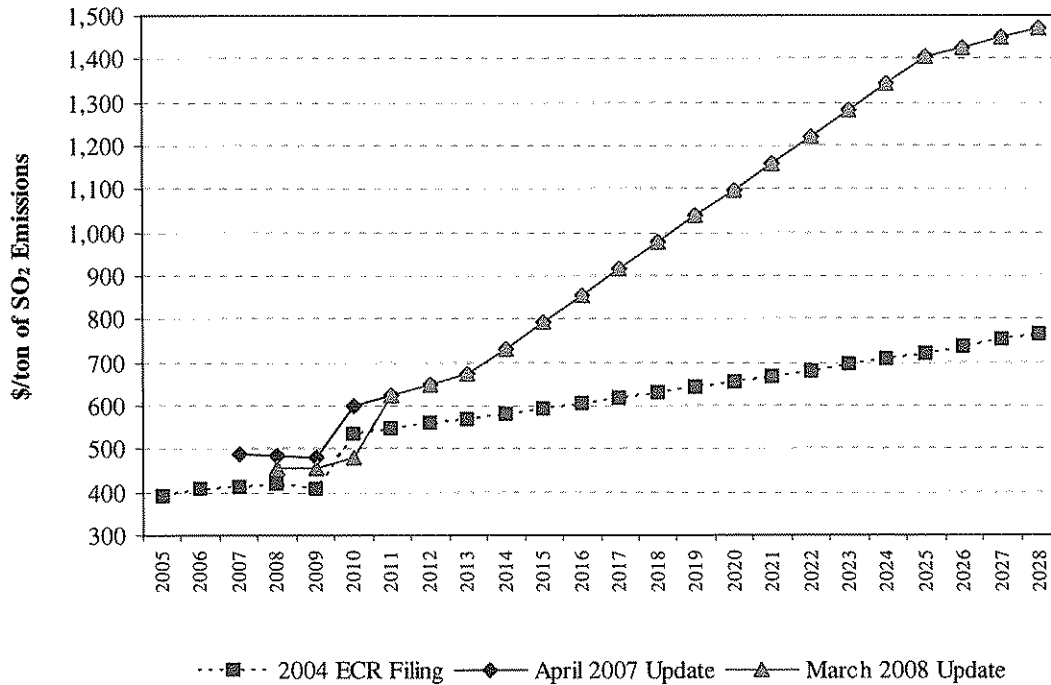
- Construction costs for building FGDs have increased, due in part to materials, labor, and contractor availability issues;
- Higher natural gas prices encourage continuing reliance on coal-fired generation, slowing the trend in physical reduction of emissions and thereby adding upward pressure to the SO<sub>2</sub> allowance market;
- Similarly, plans for coal-fired generation capacity additions in excess of the level underlying the 2004 forecast add further upward pressure to the SO<sub>2</sub> allowance market; and
- Recent increases in the price-spread between low-sulfur and high-sulfur coals have created incentives to switch fuels, where operationally feasible, contributing to the challenge of reducing emissions and supporting higher prices for SO<sub>2</sub> allowances.

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<sup>2</sup> See Case No. 2006-00493, Testimony of John P. Malloy (page 11, beginning line 6)



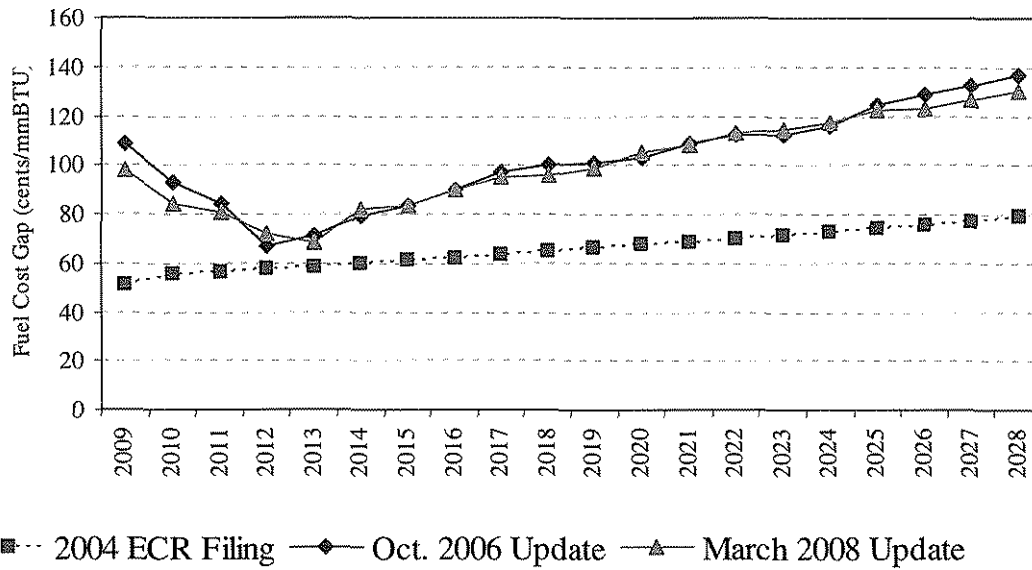
## Forecasted SO<sub>2</sub> Emissions Allowance Prices



### High and Low Sulfur Coal Prices

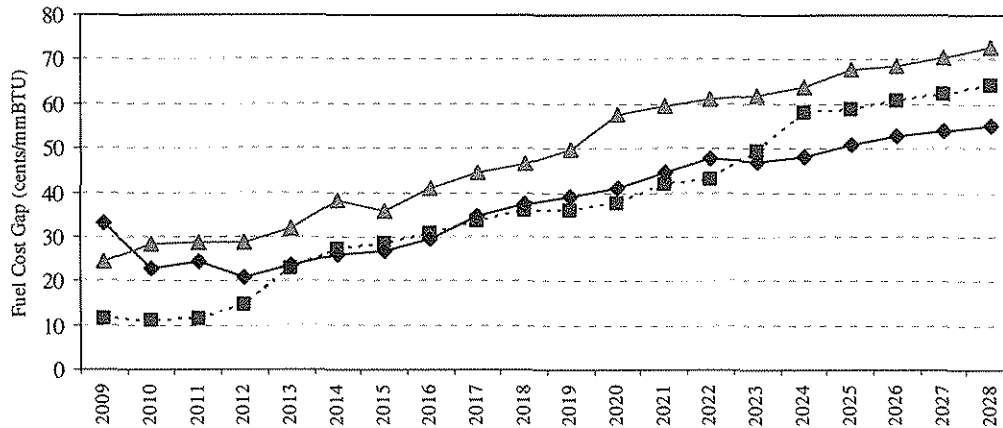
The most recent coal forecast for deliveries to the Ghent Station continues to show that high sulfur coal will be delivered at a significant discount to low sulfur coal. As shown in the figure below, a comparison of the current forecast to the forecast used in the October 2006 Update shows that the low/high sulfur fuel price gap has remained generally unchanged. When compared to the fuel price gap used in the 2004 ECR Filing (Case No. 2004-00426), the price gap has increased in the near term as a function of current market conditions and in the long term as a result of an expected depletion of low sulfur eastern compliance coal in Central Appalachia. This comparison also reflects a belief that this gap will decrease through 2013 as more FGDs are installed and some low sulfur coal demand shifts to high sulfur.

## Fuel Price Gap Between Low and High Sulfur Coal at Ghent



In the April 2007 update, the near-term forecasted price for Eastern Kentucky low sulfur coal, which is currently burned at Brown, was shown to have increased relative to the forecast that was used in the 2004 ECR Filing (Case No. 2004-00426). This increase resulted in a significant increase in savings for 2009-2012 of 10-20 cents/mmBtu, when switching from low sulfur fuel to high sulfur coal. Due to recent transportation cost increases for low sulfur coal and decreases for high sulfur coal, the forecasted low/high sulfur fuel price gap and the resulting increase in savings is currently forecasted to continue through the study period as demonstrated in the following graph.

## Fuel Price Gap Between Low and High Sulfur Coal at Brown



---■--- 2004 ECR Filing    —◆— April 2007 Update    —▲— March 2008 Update

At both the Ghent and Brown stations, the increases in the forecasted low/high sulfur fuel price gaps continue to make physical compliance with CAAA and CAIR a more economic alternative than financial compliance through reliance on the allowance market. As the fuel price spread increases, fuel savings associated with scrubbing increase, which reduces the overall cost of compliance. As a result the Companies' customers receive the benefit of relatively lower fuel prices through the calculation of the monthly Fuel Adjustment Clause.

### Capital Costs

Since Commission approval, and despite the efforts of KU to control capital costs during an unprecedented construction market, the cost estimate of the KU FGD program at the Ghent and Brown stations has increased from \$658.9 million to \$1,182.4 million. This increase is primarily driven by the extraordinary escalation of market prices during 2006 and 2007 for materials, equipment and labor. In addition to market influences, scope refinements have been required to account for geological conditions and vendor equipment issues *unforeseen in the original project planning*. The subsections below describe the significant market and scope drivers for Ghent and Brown.

### Ghent

The original estimate performed in early 2004 to construct three wet FGDs on Ghent Units 1, 3 and 4 was \$425 million. By October 2006, market impacts from unprecedented escalation of labor, equipment and material costs in the construction industry worldwide, as well as furthering of engineering on scope finalization had increased the projected costs to \$525 million.

In April of 2007, the estimated cost to complete the Ghent project had increased to \$569 million to capture the cost impacts of revised forecasts from project contractors. The contractor forecasts had been adjusted to reflect actual expenditures to date, change orders received, and revised forecasted trend to final costs that incorporated then-current market prices and labor retention incentives.

In addition to the increases in labor, equipment and material costs described above, the estimated completion cost for the Ghent project is being impacted by issues associated with the installation of the Flakt Woods' Induced Draft ("ID") Fans on Ghent 3. Ghent 3's ID fans have experienced substantial failures since being placed into service in 2007. Identical fans have been purchased for Ghent 4 and Brown 3 from Flakt Woods. Resolution of these fan issues is described in detail later in this paper; however, current projections of impacts to the Ghent budget are estimated at \$30 million.

In summary, the cost impacts from market impacts, ID fan problems and final scope determinations are:

• <b>Market Impacts (Labor, Material, Equipment)</b>	<b>\$109m</b>
• <b>ID Fans</b>	<b>\$ 30m</b>
• <b>Scope Refinements (Limestone System/Balance of Plant)</b>	<b><u>\$ 82m</u></b>
	<b>\$221m</b>

The current estimate for the Ghent FGD program is \$682 million.

Approximately 68% of the Ghent Program dollars have been spent to date. Unit 3's FGD was placed into service in 2007, while the Ghent Limestone Preparation Facility will be completed by April 2008 and Unit 4's FGD commissioned in June 2008. The Unit 1 foundation is complete, absorber tower and chimney erection is in progress, and all major equipment contracts and subcontracts have been awarded. Therefore, the remaining risks lie in the potentially greater escalation in the costs of construction labor, materials used during construction (excluding major purchase orders), consumables and rental equipment as compared to the escalation rates used in the estimate.

Ghent ID Fan Issues – In October 2006, the purchase order for the ID fans to be used at Ghent 3, Ghent 4 and Brown 3 was issued to a Swedish vendor, Flakt Woods. The fans were installed on Ghent 3 in May 2007. Problems such as motor oil leaks and motor bearing issues were experienced in June 2007. These issues were quickly followed by blades sticking, ID fan bearing failure, and galling of the main blade drive shaft. To date, the fans on Ghent 3 have caused numerous outages and de-rate incidents. The fans continue to be unreliable and continuing problems are anticipated going forward. Though the Company's preference for long-term resolution is to resolve the bearing failures, a realistic forecast includes the need to replace the Flakt Woods fans with new fans. Implementation of either option will impact project costs.

As a result of lessons learned on Ghent Unit 3's ID fans, KU re-bid replacement fans for Ghent 3, Ghent 4 and Brown 3. The short-term resolution for Ghent 4 to avoid the

unreliability of the Flakt Woods fans is to use the existing ID Fans for the FGD start-up in 2008. Unit 4 will experience a 5-10% de-rate at maximum capacity as a result of using the existing lower capacity fans; however, unit reliability will be maintained and fuel savings and allowance bank preservation will approach planning levels as the FGD goes in service. The derate will only occur when the unit is required to generate within 5%-10% of its maximum capacity.

Long-term options for the Ghent 3 ID fans include resolving the bearing failure issues and implementing those solutions on the Unit 4 fans, or replacing the Ghent 3 fans with new fans. The current forecasted cost to completely resolve the ID fan issues includes \$30 million to replace the existing Flakt Woods fans with fans from other vendors.

Brown

The original November 2004 estimated cost for the Brown FGD Program was \$235 million. This estimate was increased to \$359 million in April 2007 primarily due to increases on ductwork, market impact for materials and labor and changes to the limestone system.

Current estimates for the Brown FGD total \$500 million. Primary drivers in the cost increases remain material, equipment and labor cost escalations, as well as finalization of scope and resolution to the ID fan issues on Brown 3.

In summary, the cost impacts from market impacts, ID fan problems and final scope determinations are:

• <b>Market Impacts (Labor, Material, Equipment)</b>	<b>\$116m</b>
• <b>Ductwork and ID Fans</b>	<b>\$ 74m</b>
• <b>Scope Refinements (Limestone System/Balance of Plant)</b>	<b><u>\$ 54m</u></b>
	<b>\$244m</b>

Currently the Brown FGD Program has \$182 million committed or 36% of the estimated total cost of \$500 million. The FGD portion of the project is 37% committed with the FGD foundations, technology and module under construction and awarded through lump sum contracts. The balance of plant scope is 95% committed and nearly completed, including the completion of the warehouse, training building and fire suppression system. The limestone system is 24% committed and includes use of the original Ghent limestone equipment to control overall impacts to the Brown cost. The majority of major equipment has been committed for all scopes listed above. The most significant risks continue to be escalation of construction labor, materials used during construction (excluding major purchase orders), consumables and rental equipment beyond those estimated. The contractor has included in the current estimate \$33 million in contingency to account for potential escalations.

Brown's Schedule Change - The Brown FGD was originally expected to be placed in service in 2009, with a tie-in to Unit 3 in the spring of 2009 and to Units 1 and 2 during the fall of 2009. The Brown FGD is now expected to be in service in 2010, with a Unit 3

tie-in during the spring of 2010 and a tie-in to Units 1 and 2 during the fall of 2010. Contributing factors to this altered schedule are the contractor's revised labor estimate and the receipt of ID fan delivery lead times quoted in the ID fan replacement bids. Lead times in the Brown ID fan bids indicated 60 weeks from the date of order, making the original in-service date impossible. This one-year extension will allow the Company greater flexibility to optimize the construction plans, as well as to implement alternative contracting plans where feasible.

**Brown Station's Unique Characteristics** - A significant driver in Brown's overall cost is the unique features at Brown that are significantly different from the Ghent FGD projects as well as most other FGD projects throughout the United States.

**Absorber** - Having multiple boiler units at the Brown Station served by a single FGD absorber module necessitates having a larger absorber vessel and equipment for associated systems, as compared to those for the single Ghent units. The increased cross-sectional area of the larger absorber drives an increase in the quantities of mist eliminator panels, mist eliminator wash nozzles and piping, recycle nozzles and piping and in heavier support structure for those components. The Brown FGD also has an additional recycle spray header level and associated equipment to scrub the additional units.

**Duct** - The Brown Units are confined on three sides by existing roads, railroads, fuel yard, cooling towers and associated piping, and overhead electrical lines. Due to the lack of available space, the FGD was located on the open side, next to Unit 3. This location was the only viable location; however, it required a long duct run from Brown 1 and 2. The additional ducting results in additional costs for expansion joints, support structure, foundations, and insulation and lagging. This additional cost is magnified by the fact that Brown 1 and 2 are arranged inverted to Unit 3, thus requiring longer duct length. Additional cost beyond a single FGD unit is caused by additional dampers and controls, which are necessary to isolate each unit to optimize Station operations.

**Site Topography and Geology** - In order to make room for the FGD, the existing training building and warehouses in the area had to be demolished and replaced. Then, the area available for the FGD and limestone systems required extensive blasting and excavation to level the limestone hillside. Upon completion of the blasting and excavation, Karst features that were known to exist were investigated and final scoping of the excavation, geology remediation and foundation designs were finalized. This final scoping was not possible until final FGD sizing, location and excavation were completed.

**Terrain** - The Brown terrain results in more difficult excavation and increased excavation quantities. The shallow limestone rock requires blasting for deep foundation excavations, as well as frequent hoe-ramming or rock trenching for shallow excavations. The terrain and rocky soil conditions result in high unit

rates for underground utilities, foundations, as well as the electrical grounding grid when compared to similar scopes at Ghent.

Balance of Plant (BOP) - The lack of existing capacity for utilities such as service water, fire protection systems, compressed air and quench water cause the project to have to upgrade existing systems or install new utility systems. Final impacts to the balance of plant systems are now known. In addition to these balance of plant scopes, the handling and dewatering of the gypsum, produced as an FGD process byproduct, will be a new system at Brown where Ghent's existing system required only modifications.

### **Economic Analysis**

The June 2005 Order<sup>3</sup> issued by the Commission approving both the CCN and ECR cost recovery of the proposed FGD projects at the Companies' Ghent and Brown stations was based on supporting analytics that the FGDs represented the most reasonable least-cost plan for continued environmental compliance. A revised present value revenue requirements ("PVRR") evaluation of the economics of constructing FGDs at Ghent and Brown has been completed with the previously mentioned changes regarding fuel prices, project timing, and capital costs. The purpose of this updated evaluation is to identify the current least-cost plan, given the revised forecasts. To do so, individual alternatives were compared to the Base Case which represents the Companies' current plan to complete two FGDs at Ghent and build one FGD for all three Brown units (in-service in 2010). In all cases, only a wet FGD with a 98% SO<sub>2</sub> removal efficiency is considered.

The Cases were evaluated using the PROSYM<sup>TM</sup> detailed hourly production costing computer model and the Strategist Capital Expenditure and Recovery module. Used together, these tools have the capability to simulate the hourly production costs (e.g., fuel, fixed and variable operation and maintenance, and emissions costs) and to quantify the revenue requirements impact associated with each capital project. **Appendix 2** contains economic and forward-looking assumptions used in this analysis. Each alternative was independently evaluated within PROSYM<sup>TM</sup> using the Companies' base price forecasts for fuel and SO<sub>2</sub> and NO<sub>x</sub> allowances and the estimates for capital construction costs as previously discussed.

The total PVRR for each Case has been categorized into four areas:

1. Production Costs represent the revenue requirements associated with fuel, fixed and variable operation and maintenance expenses and purchased power expenses.
2. NO<sub>x</sub> Allowances represents the revenue requirements associated with the use of any NO<sub>x</sub> allowances less the sale of excess NO<sub>x</sub> allowances. Note that NO<sub>x</sub>

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<sup>3</sup> In the Matter Of: *The Application of Kentucky Utilities Company for a Certificate of Public Convenience and Necessity to Construct Flue Gas Desulfurization Systems and Approval of its 2004 Compliance Plan for Recovery by Environmental Surcharge, Case No. 2004-00426*, Final Order dated June 20, 2005.

emission levels are quantified because the retrofitting of an SO<sub>2</sub> control technology impacts how that unit is dispatched, which in turn, affects NO<sub>x</sub> tonnage emissions.

3. SO<sub>2</sub> Allowances represents the revenue requirements associated with the use of any SO<sub>2</sub> allowances less the sale of excess SO<sub>2</sub> allowances.
4. Incremental Capital Costs represents the revenue requirements associated with any capital expenditures for the Case less the revenue requirements associated with any sunk capital costs.

The value of SO<sub>2</sub> and NO<sub>x</sub> allowances used are calculated as the net annual difference between the Companies' allocated and used allowances at the respective market prices, thereby including the economic value of using banked allowances. It is assumed that unlimited allowances are available from the market at the forecasted allowance price.

### Ghent Evaluation

In order to identify the least-cost compliance strategy at Ghent, the Base Case was compared to a "Without Ghent 1 FGD Case" in which the FGD at Ghent 4 is completed as scheduled in May 2008 and the FGD at Ghent 1 is not completed. No further construction is assumed to take place and current contractual commitments are fully satisfied, resulting in a nominal capital expenditure savings of \$52.2 million. The Brown FGD is assumed to be completed in both cases.

#### **SO<sub>2</sub> Compliance Strategies Evaluated for Ghent**

<u>Case</u>	<u>Construct FGDs at</u>	<b>Ghent FGD Capital Cost<sup>1</sup> (\$M)</b>
Base Case	Ghent 1,3,4	\$682.5
Without Ghent 1 FGD	Ghent 3,4 only	\$630.3

<sup>1</sup> Total FGD Capital Costs are the sum of annual (nominal dollars) construction expenditures.

The Ghent Case Summary table below summarizes the four main cost categories and compares the resulting PVRR of the "Without Ghent 1 FGD Case" to that of the Base Case. The table is a summary of the annual data contained in **Appendices 3 and 4**. **Appendix 3** presents the annual results of each Case compared to the Base Case while **Appendix 4** details the SO<sub>2</sub> emissions associated with each Case.



### Ghent Case Summary

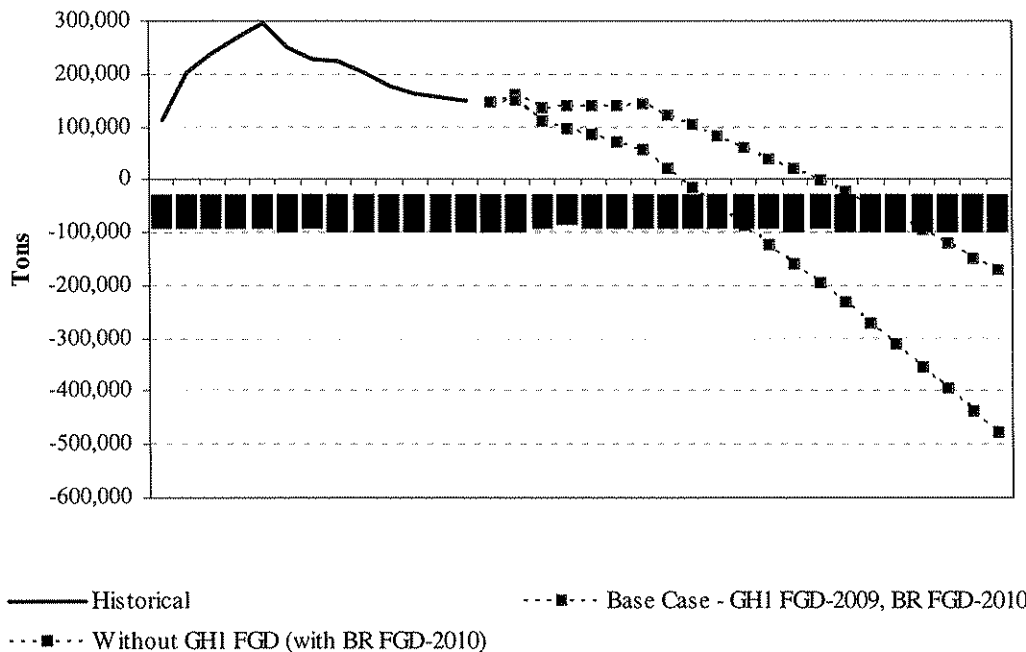
Case	Production Cost	NO <sub>x</sub> Allowances	SO <sub>2</sub> Allowances	Incremental Capital Cost	Total PVRR	Incremental Cost over Base
Base Case-Ghent 1 FGD in 2009	13,810	-1	129	64	14,001	Base
Without Ghent 1 FGD	13,965	3	258	0	14,225	224

*2008 PVRR \$ millions; Production & allowance costs estimated 2008-2028; Both cases include Brown FGD in 2010; 8.02% discount rate*

As can be observed in the table above, the approved current plan (Base Case) to build an FGD on Ghent 1 with an in-service date of 2009 (in addition to completing the FGD on Ghent 4 in May 2008) remains the least-cost option at Ghent by a sizeable margin. This plan results in a PVRR that is \$224 million lower than the “Without Ghent 1 FGD” option. Though the “Without Ghent 1 FGD Case” requires less capital, the savings are not sufficient to offset the resulting increased production and SO<sub>2</sub> allowance costs.

Beginning in 2000, it became necessary for the Companies to begin using banked SO<sub>2</sub> allowances for compliance. As the figure below shows, the Companies’ combined banked SO<sub>2</sub> allowances, once in excess of 297,000 tons (during 1999) had declined to just over 147,000 tons by year-end 2007. The number of banked credits for the Base Case is projected to be fully depleted before the end of 2021. The Base Case delays the need to purchase SO<sub>2</sub> allowances by five years compared to cancelling the Ghent 1 FGD, which requires an additional 304,000 tons over the study period.

### SO<sub>2</sub> Allowance Bank (Combined Company)



### Brown Evaluation

In order to identify the least-cost compliance strategy at Brown, the Base Case which includes building one FGD for all three Brown units with an in-service date in 2010, was compared to a one-year delay scenario (in-service in 2011). In addition, a “Without Brown FGD” Case was included in which the FGD would not be completed at the Brown station and no further construction would take place, although the Company would satisfy current contractual commitments at an estimated capital expenditure of \$174 million, plus \$120.2 million for the ash pond. The Ghent FGDs are assumed to be completed in all cases. The table below summarizes the three SO<sub>2</sub> compliance strategies at Brown that were evaluated in this update.

### SO<sub>2</sub> Compliance Strategies Evaluated for Brown

<u>Case</u>	<u>Construct FGD at</u>	<u>In- Service Date</u>	<u>Brown FGD</u>	
			<u>Capital Cost<sup>1</sup> (\$M)</u>	<u>Ash Pond Cost<sup>1</sup> (\$M)</u>
Base Case	Brown Units 1,2,3	2010	\$499.9	\$153.0
Delay Case	Brown Units 1,2,3	2011	\$533.5	\$156.2
Without Brown FGD	None (Purch. Allowances)	n/a	\$174.0	\$120.2

<sup>1</sup> Total FGD Capital Costs and Ash Pond Costs are the sum of annual (nominal dollars) construction expenditures.

The Brown Case Summary table below summarizes the primary cost categories and compares the resulting PVRR of each Case to that of the Base Case. The table is a summary of the annual data contained in **Appendices 3 and 4**. **Appendix 3** presents the annual results of each Case compared to the Base Case while **Appendix 4** details the SO<sub>2</sub> emissions associated with each Case.

**Brown Case Summary**

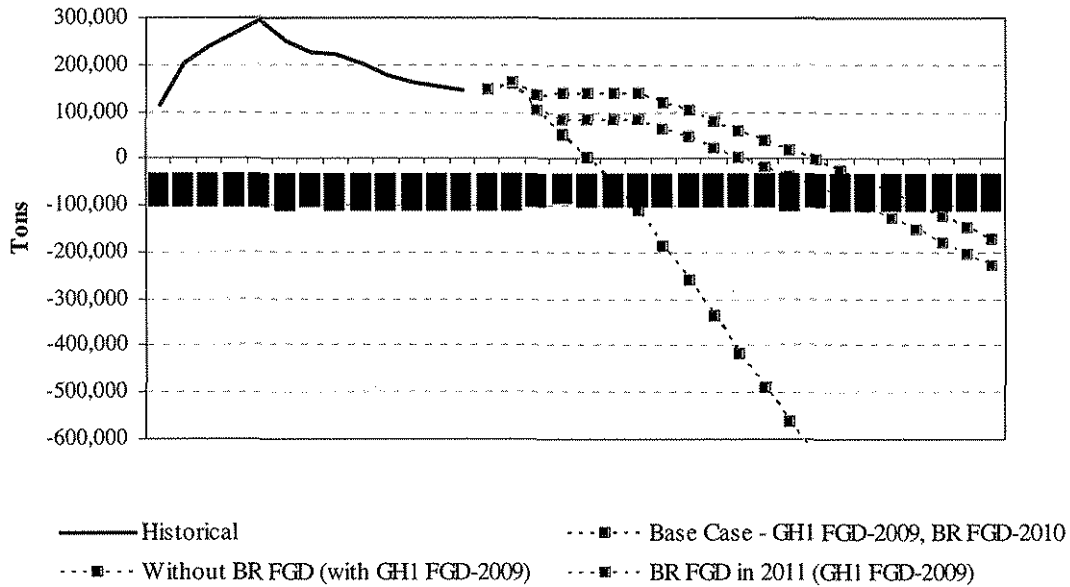
Case	Production Cost	NO <sub>x</sub> Allowances	SO <sub>2</sub> Allowances	Incremental Capital Cost	Total PVRR	Incremental Cost over Base
Base Case - BR123 FGD in 2010	13,810	-1	129	552	14,490	Base
Delay Case - BR123 FGD in 2011	13,805	-1	155	589	14,547	58
Without Brown FGD	13,885	-3	567	140	14,588	99

2008 PVRR \$ millions; Production & allowance costs estimated 2008-2028; All cases include Ghent 1 FGD in 2009; 8.02% discount rate  
Incremental capital cost includes the Brown ash pond

As can be observed in the table above, the current plan (Base Case) to build an FGD on Brown Units 1, 2 and 3 for an in-service date of 2010 is the least-cost option and results in a PVRR that is \$58 million lower than the second least-cost option of completing the FGD in 2011. Though the “Without Brown FGD” Case requires less capital, the savings are not sufficient to offset the resulting increased production and SO<sub>2</sub> allowance costs, resulting in a PVRR that is \$99 million higher than the Base Case.

As shown in the figure below, the Base Case delays the need to purchase SO<sub>2</sub> allowances by two years compared to the second least-cost Case (Delay Case – Brown FGD in 2011) which requires an additional 56,000 tons over the study period. The “Without Brown FGD” Case necessitates purchasing SO<sub>2</sub> allowances starting in 2012 and significantly increases SO<sub>2</sub> allowance market exposure by requiring 1.2 million total tons to be purchased over the next twenty years.

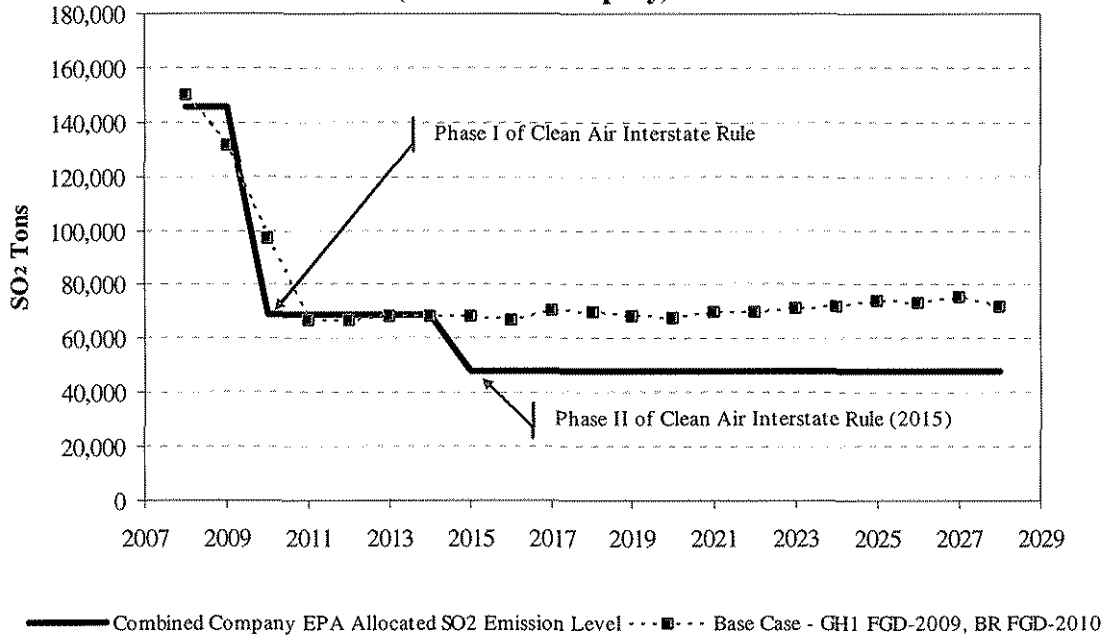
## SO<sub>2</sub> Allowance Bank (Combined Company)



### Discussion of Base Results

Each of the FGD build alternatives allows the postponement of the Companies' initial SO<sub>2</sub> allowance purchases. However, no alternatives allow for all of the SO<sub>2</sub> allowances required to comply over the twenty-year study period to be provided without purchasing allowances from the SO<sub>2</sub> allowance market. With the Base Case, exposure to the volatile SO<sub>2</sub> market is mitigated, but the market is still relied on for approximately 173,000 tons to supply the allowance shortfall over the period. The figure below illustrates the difference between the Companies' projected annual Base Case SO<sub>2</sub> emissions and the Companies' anticipated annual allowable emission level. The difference between SO<sub>2</sub> emissions and allowance allocations is currently being covered by banked allowances. The implementation of Phase II of CAIR significantly widens the gap between the allowable emission level and forecast emissions. Though the annual allocation of SO<sub>2</sub> allowances does not change with the implementation of Phase I and Phase II of CAIR, allowed emission levels in tons are reduced dramatically. This is because the CAIR requires, beginning in 2010 (Phase I), that each ton of emitted SO<sub>2</sub> be matched with two allocated or purchased SO<sub>2</sub> allowances. The implementation of Phase II of the CAIR further limits allowed emissions by requiring that each ton of emitted SO<sub>2</sub> be matched with three allocated or purchased SO<sub>2</sub> allowances.

## Annual SO<sub>2</sub> Emissions and Allocated Emissions Level (Combined Company)



### Least-Cost Plan and SO<sub>2</sub> Compliance Strategy

Completing wet FGDs on Ghent 4 in 2008 and on Ghent 1 in 2009 in addition to a wet FGD system for Brown 1, 2, and 3 for service starting in 2010 is the current least-cost Case. Since the original filing, significant increases in the project's capital costs and a one-year long construction schedule at Brown have been partially offset by increases in SO<sub>2</sub> allowance price forecasts and the near-term price gap between high and low sulfur coal.

Without scrubbing at Brown, the Companies face a significant SO<sub>2</sub> allowance shortfall of over 1.2 million tons through 2028. Not scrubbing at Ghent 1 exposes the Companies to a shortfall of 475,000 SO<sub>2</sub> tons. Though the Base Case allows the shortfall of allowances to be economically mitigated, future allowance purchases of 173,000 tons are still expected.

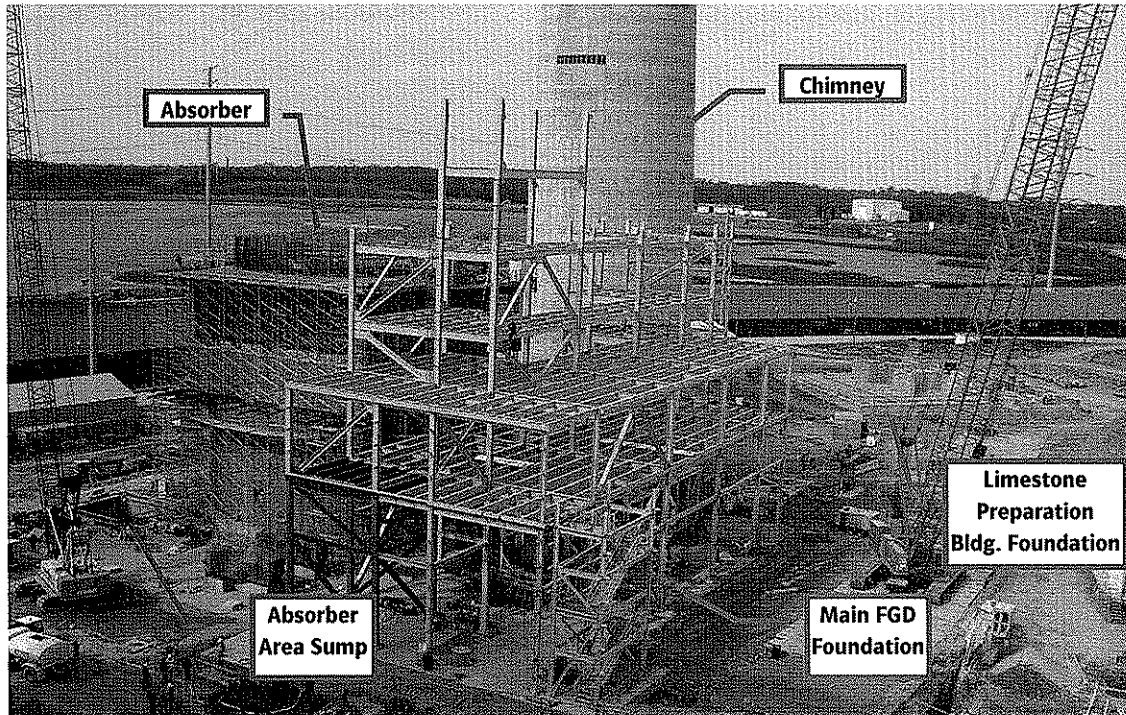
Scrubbing and fuel switching of the remaining units at Ghent and the units at Brown, in conjunction with purchasing SO<sub>2</sub> allowances on an as-needed basis, is the least-cost SO<sub>2</sub> compliance plan with the following impacts projected over the 20 year analysis period:

1. Decreases the cost of SO<sub>2</sub> compliance by approximately \$224 million in PVRR compared to not scrubbing Ghent 1 and by \$99 million compared to not scrubbing the Brown units;
2. Delays the depletion of the Companies' SO<sub>2</sub> allowance bank until 2021 and reduces the allowance shortfall to approximately 173,000 tons through 2028
3. Increases fuel procurement flexibility;

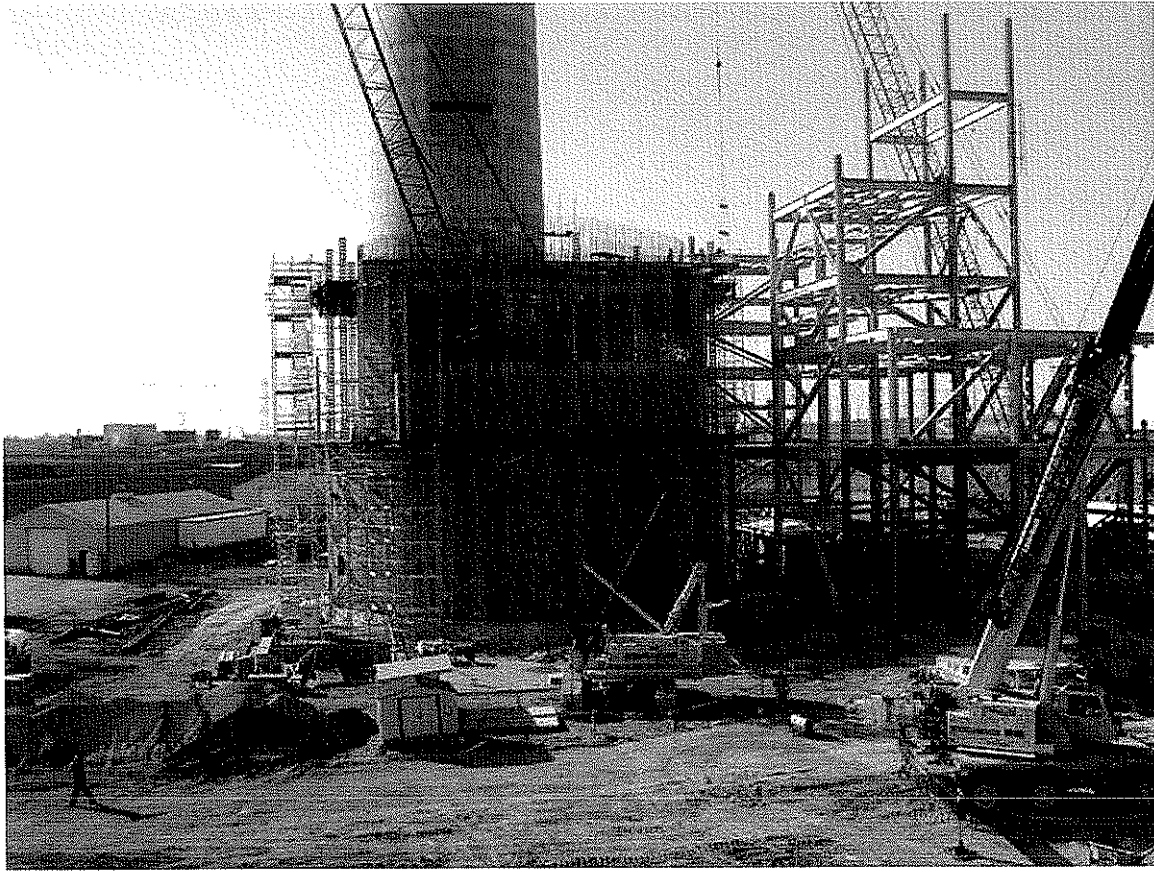
4. Positions the Companies for the SO<sub>2</sub> reduction requirements associated with the CAIR and future regulations targeting fine particulates and mercury; and
5. Increases typical residential customers' bills (1000 kwh/month) by \$2.17/month, which equates to a 3.5% increase in ECR billing factor above KU's original estimate in Case No. 2004-00426.

Overall, nothing has occurred that has changed the Companies' strategic decision to build FGDs in order to comply with SO<sub>2</sub> regulations. Therefore, the Companies plan to move forward with the implementation of the Base Case: (1) to construct an FGD for Ghent 4 in 2008, for Ghent 1 in 2009, and for Brown 1, 2, and 3 in 2010; (2) to purchase allowances on an as-needed basis; and (3) to continue the practice of environmental dispatching. Additionally, the Companies will evaluate additional environmental technologies for existing generating assets.

## **Appendix 1**

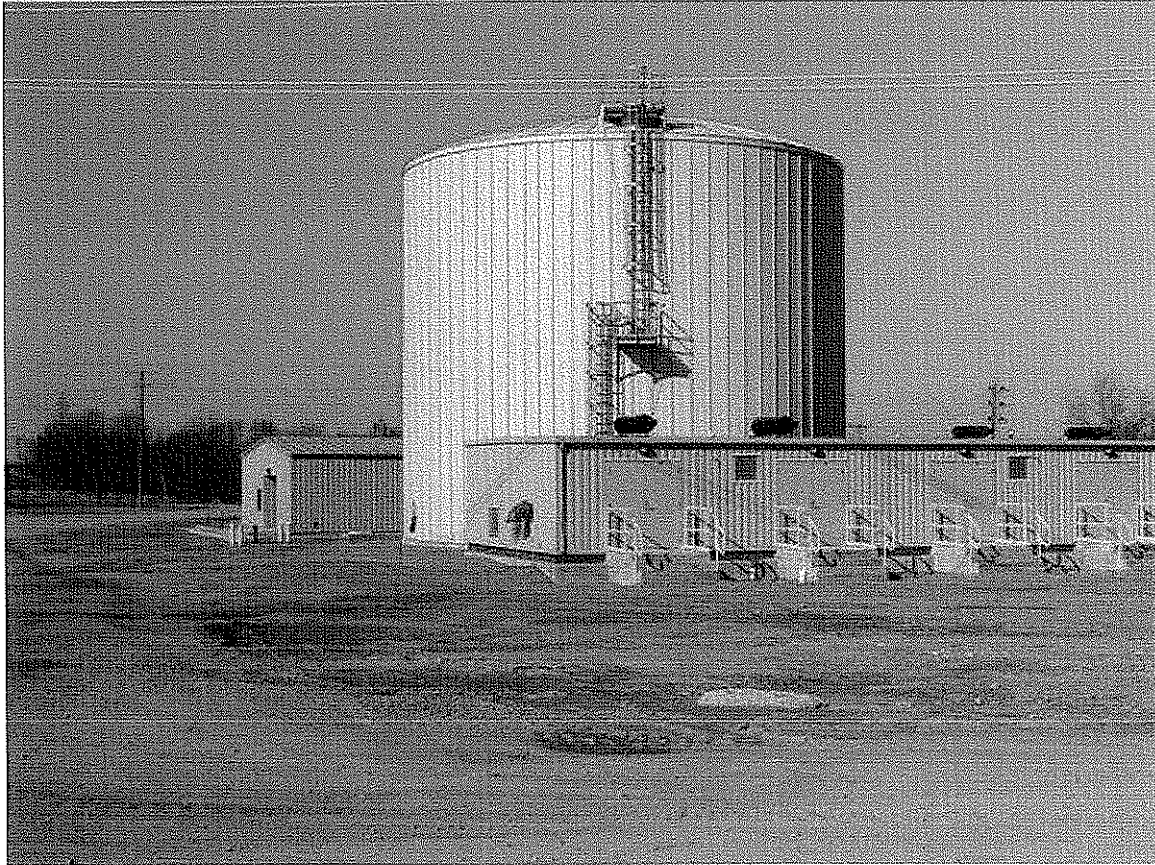


The picture above, of the Brown construction, (dated 3/14/2008) shows the main FGD foundation with the recycle pumps sitting under the partially erected steel structure next to the absorber. The absorber area sump is located in the photo immediately to the left of the absorber. The partially erected steel structure will provide support and access for the piping that will be installed in the area above the recycle pumps. The chimney can be seen in the upper center of the photo and the limestone preparation building will be built on the rectangular foundation that can be seen in the middle right of the photo.

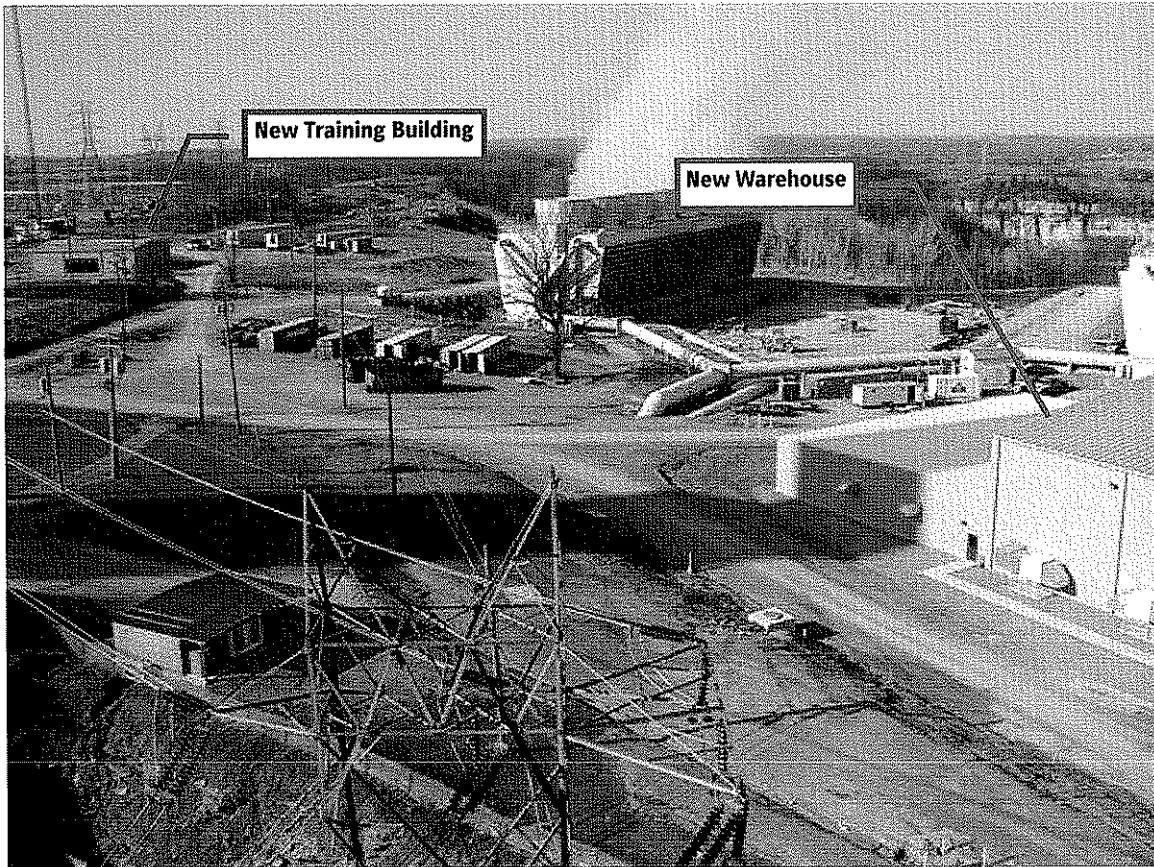


The picture above (dated 3/12/2008) shows a closer view of the FGD area from a different angle. In the background behind the steel structure, the edge of the excavated area indicates the amount of soil that was removed and the amount of rock that was blasted and excavated to prepare the site for the FGD construction.

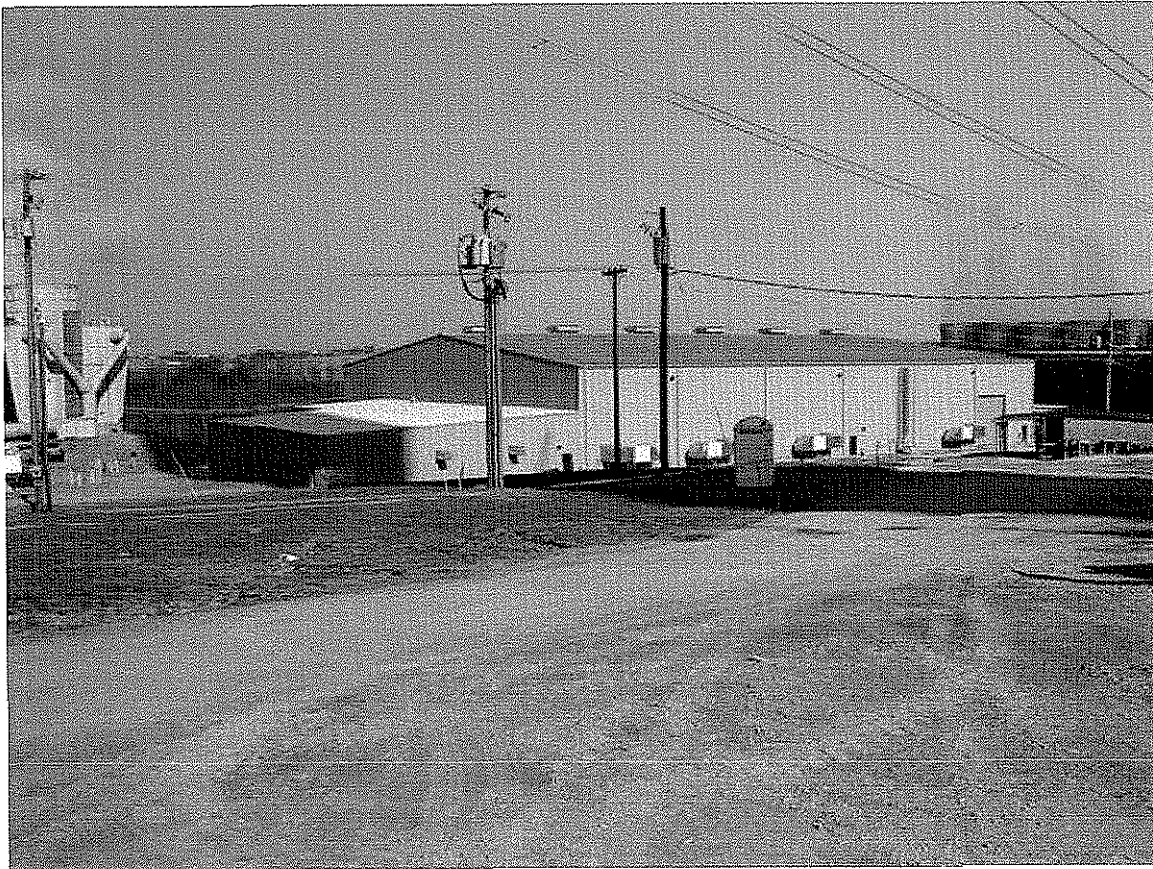




The picture above (dated 3/12/2008) shows the fire protection/quench water tank and pump enclosure. The tank will be a dual purpose tank that will hold and supply water for the fire protection system for the new items being installed as part of the FGD Project and will supply water for the quench water system that will quench the flue gas in case of a process upset where recycle pump flow is lost. Without quenching of the flue gas, the FRP mist eliminator panels would be overheated and damaged.



The above photo (dated 3/12/2008) shows the balance-of-plant work that has been done to install new electrical manholes and underground ductbanks for the conduits to contain power, controls and communications cables between the existing plant and the new FGD items in addition to new fire hydrants and new underground fire protection piping that have been installed.



The above photo (dated 3/12/2008) shows the new warehouse.

## **Appendix 2**

- **Base Case:** Scrub Ghent consistent with the Commission’s Order in Case No. 2004-00426. Scrub Brown with an in-service date in 2010.
- **Study Period:** 20-year period for Production Cost impacts (2008-2028)  
30-year period for Capital Costs impacts (2008 through book life of project).

The production costs include items such as fuel, O&M and purchase power and are estimated using the PROSYM production model. This model was run for the 2008-2028 time period.

The revenue requirements associated with capital costs are determined via the Capital Expenditure and Recovery module of the Strategist production and capital costing software. Capital projects with a 20 year book/tax life and an in-service date after 2008 would have the last years of their life excluded from the revenue requirement calculation if capital costs impacts were halted at 2028. Doing so would have the effect of underestimating the capital cost of alternatives and would favor construction of new projects. Therefore, to completely account for capital projects costs over their lifetime, the revenue requirements associated with new capital projects were extended through the end of their book life.

- KU/LGE continues as a regulated entity subject to the oversight of the Kentucky Public Service Commission and the Commission continues to require the Companies to implement the least reasonable-cost strategy to the benefit of the native load customers.
- Capital costs, O&M costs, and the costs of increased emissions (both NO<sub>x</sub> and SO<sub>2</sub>) associated with the addition of new environmental projects will be subject to recovery through the Environmental Cost Recovery mechanism.

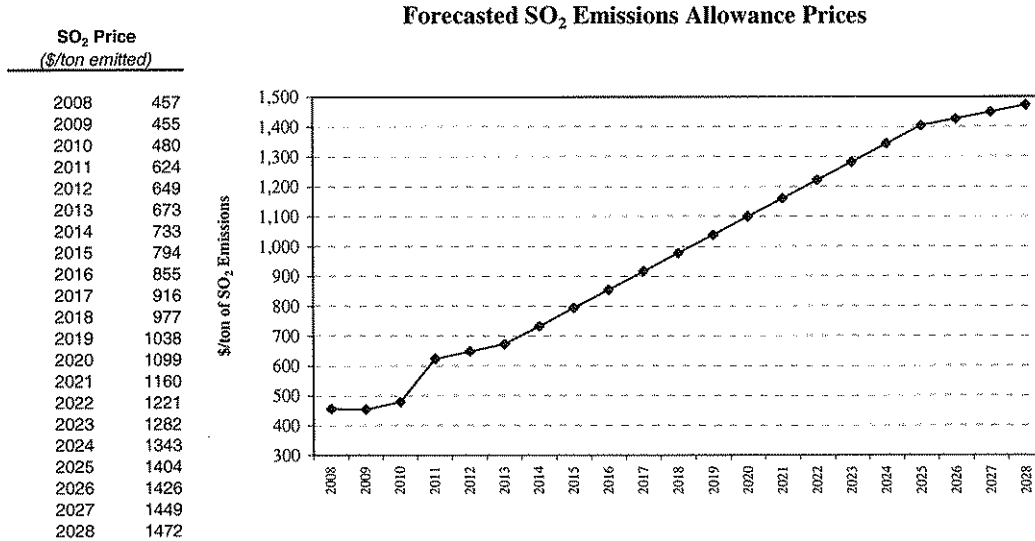
- **Financial Data**

➤ Discount Rate (%):	8.02 %
➤ Federal Income Tax Rate (%):	38.9 %
➤ AFUDC Rate (%):	8.02 %
➤ Insurance Rate (%):	0.07 %
➤ Property Tax Rate (%):	0.15 %
➤ Percentage of Debt in Capital Structure (%):	44.05 %
➤ Debt Interest Rate/Weighted Cost of Debt (%):	4.88%
➤ Desired Return on Rate base (%):	8.02%
➤ Capitalized Interest Debt Rate (%):	4.88%
➤ Environmental Projects Book Life (years):	20 years
➤ Environmental Projects Tax Life (years):	20 years
➤ Annual Fixed O&M escalation rate (%):	1.6% (prorated for mid-year installs)
➤ Annual Variable O&M escalation rate (%):	1.6%

- No unit retirements occur on the Companies’ generating system within the study period.

- SO<sub>2</sub> Emission Costs (Base Assumption)

Note that the effects of CAIR are reflected in the forecasted price of SO<sub>2</sub> emissions allowances.



- Fuel Forecast (Base Assumptions) – Confidential information redacted
  - Fuel cost savings associated with serving native load will be returned to the ratepayer through the Fuel Adjustment Clause mechanism.



**Appendix 3**



U.S.

Cost Comparison of Alternative SO <sub>2</sub> Compliance Plans																	
All Costs in 2008 PVRR \$ x1000																	
Base Case - GH1 FGD in 2009 (Brown FGD in 2010)								Without GH1 FGD (Brown FGD in 2010)								Price Curve Multipliers	
Fuel Forecast: Base				Cap Cost Sensitivity %:				Fuel Forecast: Base				Cap Cost Sensitivity %:				SO <sub>2</sub>	1.00
Load Forecast: Base								Load Forecast: Base								NO <sub>x</sub>	1.00
SO <sub>2</sub> Price Forecast: Base X 1								SO <sub>2</sub> Price Forecast: Base X 1									
NO <sub>x</sub> Price Forecast: Base X 1								NO <sub>x</sub> Price Forecast: Base X 1									
Other Description: Brown 123 FGD in '10				0				Other Description: Walkaway from GH1 FGD				0					
<b>Environmental Controls:</b>								<b>Environmental Controls:</b>									
Unit	SO <sub>2</sub> Rem %	SO <sub>2</sub> Tech	SO <sub>2</sub> In-Serv	NO <sub>x</sub> Tech	SCR In-Serv	NO <sub>x</sub> Tech Cost (M\$)		Unit	SO <sub>2</sub> Rem %	SO <sub>2</sub> Tech	SO <sub>2</sub> In-Serv	NO <sub>x</sub> Tech	SCR In-Serv	NO <sub>x</sub> Tech Cost (M\$)			
Brown 1	98%	Wet FGD	2010	LNB (1993)	0			Brown 1	98%	Wet FGD	2010	LNB (1993)	0				
Brown 2	98%	Wet FGD	2010	LNCFS I (1994)	0			Brown 2	98%	Wet FGD	2010	LNCFS I (1994)	0				
Brown 3	98%	Wet FGD	2010	LNCFS III (1992)	2012			Brown 3	98%	Wet FGD	2010	LNCFS III (1992)	2012				
Ghent 1	94% / 98%	Existing FGD	1992	LNCFS II	2003			Ghent 1	94%	Existing FGD	1992	LNCFS II	2003				
Ghent 2	94%	FS HS+Wet FGD	2009	LNCFS III (2000)/SCR (2009)	2015			Ghent 2	0%	FS HS+Wet FGD	0	LNCFS III (2000)/SCR (2009)	2015				
Ghent 3	98%	FS HS+Wet FGD	2007	LNB & OFA (1998)	2003			Ghent 3	98%	FS HS+Wet FGD	2007	LNB & OFA (1998)	2003				
Ghent 4	98%	FS HS+Wet FGD	2008	LNB & OFA (1999)	2003			Ghent 4	98%	FS HS+Wet FGD	2008	LNB & OFA (1999)	2003				
SO <sub>2</sub> Allowances Purchased: 172,908				SO <sub>2</sub> Tons Emitted: 1,632,776				SO <sub>2</sub> Allowances Purchased: 476,493				SO <sub>2</sub> Tons Emitted: 1,936,355					
Largest Annual SO <sub>2</sub> Purchase (as a % of EPA Allocation): 56%				Ann+Oz Seas NO <sub>x</sub> Allow Purch: 4,838				Largest Annual SO <sub>2</sub> Purchase (as a % of EPA Allocation): 90%				Ann+Oz Seas NO <sub>x</sub> Allow Purch: 7,357				DIFFERENCE	
Ann+Oz Seas NO <sub>x</sub> Allow Purch: 4,838				Ann+Oz Seas NO <sub>x</sub> Tons Emit: 734,601				Ann+Oz Seas NO <sub>x</sub> Allow Purch: 7,357				Ann+Oz Seas NO <sub>x</sub> Tons Emit: 737,929				CALCULATIONS	
Year	Emission Price (Nominal \$/ton emit)		Production \$	Combined Company Allow. Value		Capital \$	PVRR Total \$	Emission Price (Nominal \$/ton emit)		Production \$	Combined Company Allow. Value		Capital \$	PVRR Total \$	Total \$	Cumulative Total \$	
	NO <sub>x</sub>	SO <sub>2</sub>		NO <sub>x</sub>	SO <sub>2</sub>			NO <sub>x</sub>	SO <sub>2</sub>		NO <sub>x</sub>	SO <sub>2</sub>					
2008	988	457		1,039	982	821		988	457		1,039	982	-	821	821		
2009	951	455		2,632	(6,752)	7,298		951	455		2,352	(2,060)	-	(5,054)	(4,233)		
2010	2366	480		2,846	11,069	7,262		2366	480		2,667	17,362	-	(10,523)	(14,756)		
2011	2369	624		3,069	(1,105)	6,432		2369	624		3,038	6,403	-	(11,771)	(26,527)		
2012	2372	649		(6,687)	(1,001)	5,695		2372	649		(6,898)	5,630	-	(7,770)	(34,297)		
2013	2274	673		(4,900)	(321)	5,039		2274	673		(5,169)	6,606	-	(8,603)	(42,900)		
2014	2250	733		(4,021)	(263)	4,456		2250	733		(4,206)	6,682	-	(11,399)	(54,299)		
2015	3098	794		(3,925)	9,311	3,938		3098	794		(3,548)	16,466	-	(12,412)	(66,711)		
2016	3092	855		(2,283)	8,702	3,477		3092	855		(1,396)	15,679	-	(13,015)	(79,726)		
2017	3086	916		(729)	10,137	3,063		3086	916		(16)	17,301	-	(13,284)	(93,010)		
2018	3122	977		(469)	9,724	2,691		3122	977		151	16,774	-	(13,156)	(106,165)		
2019	3149	1038		(1,542)	8,823	2,357		3149	1038		(1,052)	15,416	-	(10,700)	(116,865)		
2020	3177	1099		(2,331)	8,443	2,059		3177	1099		(1,833)	15,078	-	(13,486)	(130,352)		
2021	3250	1160		(1,063)	9,270	1,791		3250	1160		(730)	15,784	-	(12,947)	(143,298)		
2022	3282	1221		2,125	8,971	1,552		3282	1221		2,410	15,617	-	(13,242)	(156,541)		
2023	3281	1282		2,060	9,180	1,339		3281	1282		2,388	15,603	-	(12,352)	(168,893)		
2024	3123	1343		2,579	9,256	1,149		3123	1343		2,757	15,484	-	(12,332)	(181,225)		
2025	2970	1404		2,371	9,731	979		2970	1404		2,546	15,815	-	(11,953)	(193,178)		
2026	3018	1426		2,819	8,831	829		3018	1426		2,923	14,199	-	(10,155)	(203,332)		
2027	3066	1449		3,016	9,071	696		3066	1449		3,098	14,550	-	(10,950)	(214,283)		
2028	3115	1472		1,855	7,369	578		3115	1472		2,055	12,150	-	(9,334)	(223,617)		
2029						106								-	106	(223,511)	
2030						-								-	-	(223,511)	
2031						-								-	-	(223,511)	
2032						-								-	-	(223,511)	
2033						-								-	-	(223,511)	
2034						-								-	-	(223,511)	
2035						-								-	-	(223,511)	
2036						-								-	-	(223,511)	
2037						-								-	-	(223,511)	
2038						-								-	-	(223,511)	
<b>Totals</b>			13,809,531	(1,479)	129,426	63,607	14,001,086			13,964,500	2,575	257,521	-	14,224,597	(223,511)		
Delta (PVRR \$000)																	
(154,969) (4,054) (128,095) 63,607 (223,511)																	





U.S.

Cost Comparison of Alternative SO <sub>2</sub> Compliance Plans																				
All Costs in 2008 PVRR \$ x1000																				
Base Case - Brown FGD in 2010 (GH1 FGD in 2009)										Without Brown FGD (GH1 FGD in 2009)					Price Curve Multipliers					
Fuel Forecast: Base					Cap Cost Sensitivity %:					Fuel Forecast: Base					Cap Cost Sensitivity %:					SO <sub>2</sub> 1.00
Load Forecast: Base										Load Forecast: Base										NO <sub>x</sub> 1.00
SO <sub>2</sub> Price Forecast: Base X 1										SO <sub>2</sub> Price Forecast: Base X 1										
NO <sub>x</sub> Price Forecast: Base X 1										NO <sub>x</sub> Price Forecast: Base X 1										
Other Description: Brown 123 FGD in '10					0					Other Description: Brown 123 FGD in '11					0					
Environmental Controls:																				
Unit	SO <sub>2</sub> Rem %	SO <sub>2</sub> Tech	SO <sub>2</sub> In-Serv	NO <sub>x</sub> Tech	SCR In-Serv	NO <sub>x</sub> Tech Cost (M\$)	Unit	SO <sub>2</sub> Rem %	SO <sub>2</sub> Tech	SO <sub>2</sub> In-Serv	NO <sub>x</sub> Tech	SCR In-Serv	NO <sub>x</sub> Tech Cost (M\$)	SO <sub>2</sub> Tons Emitted:	DIFFERENCE					
Brown 1	98%	Wet FGD	2010	LNB (1993)	0		Brown 1	98%	Wet FGD	2011	LNB (1993)	0		1,632,776						
Brown 2	98%	Wet FGD	2010	LNCF3 I (1994)	0		Brown 2	98%	Wet FGD	2011	LNCF3 I (1994)	0		56%						
Brown 3	98%	Wet FGD	2010	LNCF3 III (1992)	2012		Brown 3	98%	Wet FGD	2011	LNCF3 III (1992)	2012								
Ghent 1	94% / 98%	Existing FGD	1992	LNCF3 II	2003		Ghent 1	94% / 98%	Existing FGD	1992	LNCF3 II	2003								
Ghent 2	94%	FS HS+Wet FGD	2009	LNCF3 III (2000)/SCR (2009)	2015		Ghent 2	94%	FS HS+Wet FGD	2009	LNCF3 III (2000)/SCR (2009)	2015								
Ghent 3	98%	FS HS+Wet FGD	2007	LNB & OFA (1998)	2003		Ghent 3	98%	FS HS+Wet FGD	2007	LNB & OFA (1998)	2003								
Ghent 4	98%	FS HS+Wet FGD	2008	LNB & OFA (1999)	2003		Ghent 4	98%	FS HS+Wet FGD	2008	LNB & OFA (1999)	2003								
SO <sub>2</sub> Allowances Purchased: 172,908					SO <sub>2</sub> Tons Emitted: 1,632,776					SO <sub>2</sub> Allowances Purchased: 229,275					SO <sub>2</sub> Tons Emitted: 1,689,143					
Largest Annual SO <sub>2</sub> Purchase (as a % of EPA Allocation): 56%					Ann+Oz Seas NO <sub>x</sub> Allow Purch: 4,838					Largest Annual SO <sub>2</sub> Purchase (as a % of EPA Allocation): 56%					Ann+Oz Seas NO <sub>x</sub> Allow Purch: 4,860					DIFFERENCE
Ann+Oz Seas NO <sub>x</sub> Tons Emit: 734,601										Ann+Oz Seas NO <sub>x</sub> Tons Emit: 734,601										
Year	Emission Price (Nominal \$/ton emit) NO <sub>x</sub>	SO <sub>2</sub>	Production \$	Combined Company Allow. Value NO <sub>x</sub> \$	SO <sub>2</sub> \$	Capital \$	PVRR Total \$	Emission Price (Nominal \$/ton emit) NO <sub>x</sub>	SO <sub>2</sub>	Production \$	Combined Company Allow. Value NO <sub>x</sub> \$	SO <sub>2</sub> \$	Capital \$	PVRR Total \$	Total \$	Cumulative Total \$				
2008	988	457		1,039	982	13,545		988	457		1,039	982	13,609		(64)	(64)				
2009	951	455		2,632	(6,752)	34,610		951	455		2,632	(6,752)	26,571		8,039	7,975				
2010	2366	480		2,846	11,069	57,479		2366	480		3,978	23,956	35,909		18,717	26,692				
2011	2369	624		3,069	(1,105)	57,998		2369	624		2,319	11,291	58,672		(19,101)	7,591				
2012	2372	649		(4,900)	(321)	51,374		2372	649		(6,687)	(1,001)	58,972		(7,598)	(7)				
2013	2274	673		(4,021)	(263)	45,487		2274	673		(4,900)	(321)	52,225		(6,228)	(6,235)				
2014	2250	733		(3,925)	9,311	35,603		2250	733		(4,021)	(263)	46,233		(6,450)	(12,685)				
2015	3098	794		(2,223)	8,702	31,472		3098	794		(3,925)	9,311	40,907		(5,304)	(17,989)				
2016	3092	855		(729)	10,137	27,801		3092	855		(2,223)	8,702	36,180		(4,708)	(22,697)				
2017	3086	916		(469)	9,724	24,510		3086	916		(729)	10,137	31,980		(4,179)	(26,876)				
2018	3122	977		(1,542)	8,823	21,555		3122	977		(469)	9,724	28,251		(3,741)	(30,617)				
2019	3149	1038		(2,331)	8,443	18,902		3149	1038		(1,542)	8,823	24,907		(3,352)	(33,969)				
2020	3177	1099		(1,063)	9,270	16,525		3177	1099		(2,331)	8,443	21,902		(3,000)	(36,969)				
2021	3250	1160		2,125	8,971	14,396		3250	1160		(1,063)	9,270	19,207		(2,682)	(39,651)				
2022	3282	1221		2,060	9,180	12,493		3282	1221		2,125	8,971	16,790		(2,394)	(42,045)				
2023	3281	1282		2,371	9,731	9,276		3281	1282		2,060	9,180	14,628		(2,135)	(44,180)				
2024	3123	1343		2,819	8,831	7,925		3123	1343		2,579	9,256	12,693		(1,901)	(46,081)				
2025	2970	1404		3,016	9,071	6,845		2970	1404		2,371	9,731	10,965		(1,689)	(47,771)				
2026	3018	1426		1,855	7,369	5,141		3018	1426		3,016	8,831	9,425		(1,500)	(49,271)				
2027	3066	1449						3066	1449		2,819	8,831	9,425		(1,328)	(50,599)				
2028	3115	1472						3115	1472		3,016	9,071	8,173		(1,170)	(51,769)				
2029											1,855	7,369	8,337		(1,014)	(52,783)				
2030													6,155		(4,151)	(56,934)				
2031													5,095		(936)	(57,870)				
2032													936		-	(57,870)				
2033													-		-	(57,870)				
2034													-		-	(57,870)				
2035													-		-	(57,870)				
2036													-		-	(57,870)				
2037													-		-	(57,870)				
2038													-		-	(57,870)				
Totals			13,809,531	(1,479)	129,426	552,095	14,489,574			13,805,108	(1,096)	154,710	588,722	14,547,444	(57,870)	(57,870)				
Delta (PVRR \$000)																				
4,424 (383) (25,284) (36,627)																				



U.S.

Cost Comparison of Alternative SO <sub>2</sub> Compliance Plans																																																																																																																																	
All Costs in 2008 PVRR \$ x1000																																																																																																																																	
Base Case - Brown FGD in 2010 (GH1 FGD in 2009)								Without Brown FGD (GH1 FGD in 2009)																																																																																																																									
Fuel Forecast: Base Load Forecast: Base SO <sub>2</sub> Price Forecast: Base X 1 NO <sub>x</sub> Price Forecast: Base X 1 Other Description: Brown 123 FGD in '10 0								Fuel Forecast: Base Load Forecast: Base SO <sub>2</sub> Price Forecast: Base X 1 NO <sub>x</sub> Price Forecast: Base X 1 Other Description: Walkaway from BR FGD Recovery on \$174M								Price Curve Multipliers SO <sub>2</sub> 1.00 NO <sub>x</sub> 1.00																																																																																																																	
<b>Environmental Controls:</b> <table border="1"> <thead> <tr> <th>Unit</th> <th>SO<sub>2</sub> Rem %</th> <th>SO<sub>2</sub> Tech</th> <th>SO<sub>2</sub> In-Serv</th> <th>NO<sub>x</sub> Tech</th> <th>SCR In-Serv</th> <th>NO<sub>x</sub> Tech Cost (M\$)</th> </tr> </thead> <tbody> <tr><td>Brown 1</td><td>98%</td><td>Wet FGD</td><td>2010</td><td>LNB (1993)</td><td>0</td><td></td></tr> <tr><td>Brown 2</td><td>98%</td><td>Wet FGD</td><td>2010</td><td>LNCFS I (1994)</td><td>0</td><td></td></tr> <tr><td>Brown 3</td><td>98%</td><td>Wet FGD</td><td>2010</td><td>LNCFS III (1992)</td><td>2012</td><td></td></tr> <tr><td>Ghent 1</td><td>94% / 98%</td><td>Existing FGD</td><td>1992</td><td>LNCFS II</td><td>2003</td><td></td></tr> <tr><td>Ghent 2</td><td>94%</td><td>FS HS+Wet FGD</td><td>2009</td><td>LNCFS III (2000)/SCR (2009)</td><td>2015</td><td></td></tr> <tr><td>Ghent 3</td><td>98%</td><td>FS HS+Wet FGD</td><td>2007</td><td>LNB &amp; OFA (1998)</td><td>2003</td><td></td></tr> <tr><td>Ghent 4</td><td>98%</td><td>FS HS+Wet FGD</td><td>2008</td><td>LNB &amp; OFA (1999)</td><td>2003</td><td></td></tr> </tbody> </table> SO <sub>2</sub> Allowances Purchased: 172,303 SO <sub>2</sub> Tons Emitted: 1,632,776 Largest Annual SO <sub>2</sub> Purchase (as a % of EPA Allocation): 58% Ann+Oz Seas NO <sub>x</sub> Allow Purch: 4,838 Ann+Oz Seas NO <sub>x</sub> Tons Emit: 794,601								Unit	SO <sub>2</sub> Rem %	SO <sub>2</sub> Tech	SO <sub>2</sub> In-Serv	NO <sub>x</sub> Tech	SCR In-Serv	NO <sub>x</sub> Tech Cost (M\$)	Brown 1	98%	Wet FGD	2010	LNB (1993)	0		Brown 2	98%	Wet FGD	2010	LNCFS I (1994)	0		Brown 3	98%	Wet FGD	2010	LNCFS III (1992)	2012		Ghent 1	94% / 98%	Existing FGD	1992	LNCFS II	2003		Ghent 2	94%	FS HS+Wet FGD	2009	LNCFS III (2000)/SCR (2009)	2015		Ghent 3	98%	FS HS+Wet FGD	2007	LNB & OFA (1998)	2003		Ghent 4	98%	FS HS+Wet FGD	2008	LNB & OFA (1999)	2003		<b>Environmental Controls:</b> <table border="1"> <thead> <tr> <th>Unit</th> <th>SO<sub>2</sub> Rem %</th> <th>SO<sub>2</sub> Tech</th> <th>SO<sub>2</sub> In-Serv</th> <th>NO<sub>x</sub> Tech</th> <th>SCR In-Serv</th> <th>NO<sub>x</sub> Tech Cost (M\$)</th> </tr> </thead> <tbody> <tr><td>Brown 1</td><td>0%</td><td>n/a</td><td>0</td><td>LNB (1993)</td><td>0</td><td></td></tr> <tr><td>Brown 2</td><td>0%</td><td>n/a</td><td>0</td><td>LNCFS I (1994)</td><td>0</td><td></td></tr> <tr><td>Brown 3</td><td>0%</td><td>n/a</td><td>0</td><td>LNCFS III (1992)</td><td>2012</td><td></td></tr> <tr><td>Ghent 1</td><td>94% / 98%</td><td>Existing FGD</td><td>1992</td><td>LNCFS II</td><td>2003</td><td></td></tr> <tr><td>Ghent 2</td><td>94%</td><td>FS HS+Wet FGD</td><td>2009</td><td>LNCFS III (2000)/SCR (2009)</td><td>2015</td><td></td></tr> <tr><td>Ghent 3</td><td>98%</td><td>FS HS+Wet FGD</td><td>2007</td><td>LNB &amp; OFA (1998)</td><td>2003</td><td></td></tr> <tr><td>Ghent 4</td><td>98%</td><td>FS HS+Wet FGD</td><td>2008</td><td>LNB &amp; OFA (1999)</td><td>2003</td><td></td></tr> </tbody> </table> SO <sub>2</sub> Allowances Purchased: 1,207,820 SO <sub>2</sub> Tons Emitted: 2,667,690 Largest Annual SO <sub>2</sub> Purchase (as a % of EPA Allocation): 179% Ann+Oz Seas NO <sub>x</sub> Allow Purch: 4,427 Ann+Oz Seas NO <sub>x</sub> Tons Emit: 731,616								Unit	SO <sub>2</sub> Rem %	SO <sub>2</sub> Tech	SO <sub>2</sub> In-Serv	NO <sub>x</sub> Tech	SCR In-Serv	NO <sub>x</sub> Tech Cost (M\$)	Brown 1	0%	n/a	0	LNB (1993)	0		Brown 2	0%	n/a	0	LNCFS I (1994)	0		Brown 3	0%	n/a	0	LNCFS III (1992)	2012		Ghent 1	94% / 98%	Existing FGD	1992	LNCFS II	2003		Ghent 2	94%	FS HS+Wet FGD	2009	LNCFS III (2000)/SCR (2009)	2015		Ghent 3	98%	FS HS+Wet FGD	2007	LNB & OFA (1998)	2003		Ghent 4	98%	FS HS+Wet FGD	2008	LNB & OFA (1999)	2003		<b>DIFFERENCE CALCULATIONS</b> SO <sub>2</sub> Allowances Purchased: 172,303 SO <sub>2</sub> Tons Emitted: 1,632,776 Largest Annual SO <sub>2</sub> Purchase (as a % of EPA Allocation): 58% Ann+Oz Seas NO <sub>x</sub> Allow Purch: 4,838 Ann+Oz Seas NO <sub>x</sub> Tons Emit: 794,601	
Unit	SO <sub>2</sub> Rem %	SO <sub>2</sub> Tech	SO <sub>2</sub> In-Serv	NO <sub>x</sub> Tech	SCR In-Serv	NO <sub>x</sub> Tech Cost (M\$)																																																																																																																											
Brown 1	98%	Wet FGD	2010	LNB (1993)	0																																																																																																																												
Brown 2	98%	Wet FGD	2010	LNCFS I (1994)	0																																																																																																																												
Brown 3	98%	Wet FGD	2010	LNCFS III (1992)	2012																																																																																																																												
Ghent 1	94% / 98%	Existing FGD	1992	LNCFS II	2003																																																																																																																												
Ghent 2	94%	FS HS+Wet FGD	2009	LNCFS III (2000)/SCR (2009)	2015																																																																																																																												
Ghent 3	98%	FS HS+Wet FGD	2007	LNB & OFA (1998)	2003																																																																																																																												
Ghent 4	98%	FS HS+Wet FGD	2008	LNB & OFA (1999)	2003																																																																																																																												
Unit	SO <sub>2</sub> Rem %	SO <sub>2</sub> Tech	SO <sub>2</sub> In-Serv	NO <sub>x</sub> Tech	SCR In-Serv	NO <sub>x</sub> Tech Cost (M\$)																																																																																																																											
Brown 1	0%	n/a	0	LNB (1993)	0																																																																																																																												
Brown 2	0%	n/a	0	LNCFS I (1994)	0																																																																																																																												
Brown 3	0%	n/a	0	LNCFS III (1992)	2012																																																																																																																												
Ghent 1	94% / 98%	Existing FGD	1992	LNCFS II	2003																																																																																																																												
Ghent 2	94%	FS HS+Wet FGD	2009	LNCFS III (2000)/SCR (2009)	2015																																																																																																																												
Ghent 3	98%	FS HS+Wet FGD	2007	LNB & OFA (1998)	2003																																																																																																																												
Ghent 4	98%	FS HS+Wet FGD	2008	LNB & OFA (1999)	2003																																																																																																																												
Year	Emission Price (Nominal \$/ton emit)		Production \$	Combined Company Allow. Value		Capital \$	PVRR Total \$	Emission Price (Nominal \$/ton emit)		Production \$	Combined Company Allow. Value		Capital \$	PVRR Total \$	Total \$	Cumulative Total \$																																																																																																																	
	NO <sub>x</sub>	SO <sub>2</sub>		NO <sub>x</sub> \$	SO <sub>2</sub> \$			NO <sub>x</sub>	SO <sub>2</sub>		NO <sub>x</sub> \$	SO <sub>2</sub> \$																																																																																																																					
2008	988	457		1,039	982	13,545		988	457		1,039	939	13,062		(152)	(152)																																																																																																																	
2009	951	455		2,632	(6,752)	34,610		951	455		2,852	(6,084)	16,453		18,028	17,876																																																																																																																	
2010	2366	480		2,846	11,069	57,479		2366	480		4,014	23,330	14,582		40,889	58,766																																																																																																																	
2011	2369	624		3,069	(1,105)	57,998		2369	624		2,748	25,624	12,919		18,213	76,979																																																																																																																	
2012	2372	649		(6,687)	(1,001)	51,374		2372	649		(6,243)	24,062	11,439		12,892	89,871																																																																																																																	
2013	2274	673		(4,900)	(321)	45,487		2274	673		(4,311)	25,447	10,122		6,973	96,845																																																																																																																	
2014	2250	733		(4,021)	(263)	40,255		2250	733		(3,624)	25,929	8,951		315	97,159																																																																																																																	
2015	3098	794		(3,925)	9,311	35,603		3098	794		(3,609)	35,316	7,908		(2,732)	94,427																																																																																																																	
2016	3092	855		(2,223)	8,702	31,472		3092	855		(2,227)	32,980	6,973		(4,270)	90,157																																																																																																																	
2017	3086	916		(729)	10,137	27,801		3086	916		(941)	36,118	6,132		(9,170)	80,987																																																																																																																	
2018	3122	977		(469)	9,724	24,510		3122	977		(706)	35,327	5,378		(11,692)	69,295																																																																																																																	
2019	3149	1038		(1,542)	8,823	21,555		3149	1038		(1,899)	32,307	4,703		(10,676)	58,619																																																																																																																	
2020	3177	1099		(2,331)	8,443	18,902		3177	1099		(2,652)	31,886	4,098		(15,070)	43,549																																																																																																																	
2021	3250	1160		(1,063)	9,270	16,525		3250	1160		(1,554)	32,913	3,557		(16,702)	26,847																																																																																																																	
2022	3282	1221		2,125	8,971	14,396		3282	1221		1,855	32,783	3,073		(18,669)	8,178																																																																																																																	
2023	3281	1282		2,060	9,180	12,493		3281	1282		1,652	31,837	2,642		(18,525)	(10,347)																																																																																																																	
2024	3123	1343		2,579	9,256	10,792		3123	1343		2,109	31,637	2,258		(19,840)	(30,187)																																																																																																																	
2025	2970	1404		2,371	9,731	9,276		2970	1404		1,928	31,631	1,916		(20,727)	(50,914)																																																																																																																	
2026	3018	1426		2,819	8,831	7,925		3018	1426		2,369	28,391	1,613		(18,508)	(69,422)																																																																																																																	
2027	3066	1449		3,016	9,071	6,845		3066	1449		2,584	28,873	1,344		(19,318)	(89,340)																																																																																																																	
2028	3115	1472		1,855	7,369	7,167		3115	1472		1,590	24,673	964		(15,366)	(104,707)																																																																																																																	
2029						5,141									5,141	(99,566)																																																																																																																	
2030						944									944	(98,622)																																																																																																																	
2031						-									-	(98,622)																																																																																																																	
2032						-									-	(98,622)																																																																																																																	
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2037						-									-	(98,622)																																																																																																																	
2038						-									-	(98,622)																																																																																																																	
<b>Totals</b>			13,809,531	(1,479)	129,426	552,095	14,489,574			13,884,815	(3,226)	566,519	140,087	14,588,196	(98,622)	(98,622)																																																																																																																	
																Delta (PVRR \$000) (75,284) (1,747) (437,093) -412,008 (98,622)																																																																																																																	

**Appendix 4**



Base Case - GH1 FGD in 2009 (Brown FGD in 2010)		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028			
<b>FUEL SO<sub>2</sub> Commit (MMBTU)</b>																								
Brown 1	KU	2.7	2.7	117.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8			
Brown 2	KU	2.7	2.7	107.5	5.9	5.9	5.9	5.9	5.8	5.8	5.9	5.9	5.8	5.8	5.8	5.9	5.8	5.8	5.9	5.8	5.9			
Brown 3	KU	2.7	2.7	38.7	5.9	5.8	5.9	5.9	5.8	5.8	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1			
Ghent 1	KU	6.1	9.0	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1			
Ghent 2	KU	1.2	8.7	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1			
Ghent 3	KU	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1			
Ghent 4	KU	18.2	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1			
Green River 3	KU	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1			
Green River 4	KU	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1			
Tyrone 3	KU	1.5	1.5	1.5	1.5	1.4	1.4	1.5	1.4	1.4	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4			
Cane Run 4	LGE	5.8	5.8	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.9	5.8	5.8	5.9	5.8	5.9			
Cane Run 5	LGE	5.8	5.8	5.8	5.8	5.9	5.9	5.9	5.8	5.8	5.9	5.9	5.8	5.8	5.8	5.9	5.8	5.8	5.9	5.8	5.9			
Cane Run 6	LGE	5.9	5.8	5.9	5.8	5.9	5.9	5.9	5.8	5.8	5.9	5.9	5.8	5.8	5.8	5.9	5.8	5.8	5.9	5.8	5.9			
Mill Creek 1	LGE	5.8	5.9	5.8	5.8	5.9	5.8	5.9	5.8	5.9	5.8	5.9	5.8	5.8	5.8	5.9	5.8	5.8	5.9	5.8	5.9			
Mill Creek 2	LGE	5.9	5.9	5.9	5.8	5.9	5.8	5.8	5.9	5.9	5.8	5.9	5.8	5.8	5.8	5.9	5.8	5.8	5.9	5.8	5.9			
Mill Creek 3	LGE	5.8	5.9	5.9	5.8	5.9	5.8	5.8	5.9	5.9	5.8	5.9	5.8	5.8	5.8	5.9	5.8	5.8	5.9	5.8	5.9			
Mill Creek 4	LGE	5.9	5.8	5.8	5.9	5.9	5.8	5.8	5.9	5.9	5.8	5.9	5.8	5.8	5.8	5.9	5.8	5.8	5.9	5.8	5.9			
Trimble County 1	KU	5.9	5.9	5.9	5.8	5.8	5.9	5.8	5.9	5.9	5.8	5.9	5.8	5.8	5.8	5.9	5.8	5.8	5.9	5.8	5.9			
Trimble County 2	LGE	0.0	0.0	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9			
Trimble County 2	KU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
GFCU 1	KU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
GFCU 1	LGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
<b>SCRUBBER REMOVAL EFF</b>																								
Brown 1	KU	0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%			
Brown 2	KU	0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%			
Brown 3	KU	94%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%			
Ghent 1	KU	0%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%			
Ghent 2	KU	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%			
Ghent 3	KU	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%			
Ghent 4	KU	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%			
Green River 3	KU	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
Green River 4	KU	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
Tyrone 3	KU	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%			
Cane Run 4	LGE	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%			
Cane Run 5	LGE	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%			
Cane Run 6	LGE	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%			
Mill Creek 1	LGE	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%			
Mill Creek 2	LGE	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%			
Mill Creek 3	LGE	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%			
Mill Creek 4	LGE	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%			
Trimble County 1	KU	0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%			
Trimble County 2	KU	0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%			
Trimble County 2	LGE	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
GFCU 1	KU	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
GFCU 1	LGE	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%			
<b>SO<sub>2</sub> EMISSIONS (TONS)</b>																								
Total		149,646	131,151	96,529	66,518	66,550	68,049	68,181	68,201	69,945	70,236	69,604	67,936	67,466	69,864	69,713	70,855	71,759	73,804	72,899	75,184	71,490		
<b>ALLOWANCES</b>																								
KU EPA Allocated SO <sub>2</sub> Allowances		83,343	83,343	38,768	38,768	38,768	38,768	38,768	27,110	27,110	27,110	27,110	27,110	27,110	27,110	27,110	27,110	27,110	27,110	27,110	27,110	27,110		
LGE EPA Allocated SO <sub>2</sub> Allowances		62,456	62,456	29,983	29,983	29,983	29,983	29,983	20,967	20,967	20,967	20,967	20,967	20,967	20,967	20,967	20,967	20,967	20,967	20,967	20,967	20,967		
Total KUL/GE EPA Allocated SO <sub>2</sub> Allowances		145,799	145,799	68,751	68,751	68,751	68,751	68,751	48,077	48,077	48,077	48,077	48,077	48,077	48,077	48,077	48,077	48,077	48,077	48,077	48,077	48,077		
KUL/GE Extension		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
KUs Portion of Omu Surplus/Shortfall		1,698	1,382	972	0	0	0	0	0	0	0	0	0	0	3,746	21,636	22,778	23,682	25,727	24,821	27,106	23,413		
Combined Company Purchases		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Sell		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
<b>TOTAL KUL/GE ALLOWANCES</b>		147,497	147,181	69,722	68,751	68,751	68,751	68,751	48,077	48,077	48,077	48,077	48,077	48,077	51,823	69,713	70,855	71,759	73,804	72,899	75,184	71,490		
<b>EOY Increase (4)/Decrease in Bank</b>		-2,149	16,030	-26,307	2,232	2,101	702	570	-20,123	-18,867	-22,159	-21,527	-19,858	-19,336	-18,040	0	0	0	0	0	0	0		
<b>ALLOWANCE BANK</b>																								
Total KUL/GE Allowance Bank (End of Year)		147,384	145,235	161,265	134,338	136,590	138,691	139,393	139,362	119,839	100,972	78,413	57,287	37,429	18,040	-	-	-	-	-	-	-		
Allocated Allowances		147,384	147,497	147,181	69,722	68,751	68,751	68,751	68,751	48,077	48,077	48,077	48,077	48,077	48,077	48,077	48,077	48,077	48,077	48,077	48,077	48,077		
Emissions		(149,646)	(131,151)	(96,629)	(66,518)	(66,650)	(68,049)	(68,181)	(68,201)	(69,945)	(70,236)	(69,604)	(67,936)	(67,466)	(69,864)	(69,713)	(70,855)	(71,759)	(73,804)	(72,899)	(75,184)	(71,490)		
<b>NET OF ALLOCATIONS - EMISSIONS</b>		147,384	(2,149)	16,030	(26,307)	2,232	2,101	702	570	(20,123)	(18,867)	(22,159)	(21,527)	(19,858)	(18,336)	(18,040)	(21,786)	(21,636)	(22,778)	(23,682)	(25,727)	(24,821)	(27,106)	(23,413)



Update to the 2004 SO<sub>2</sub> Compliance Strategy  
Appendix 4- SO<sub>2</sub> Emissions of Various SO<sub>2</sub> Compliance Plans

Without GH1 FGD (Brown FGD in 2010)		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
<b>FUEL SO<sub>2</sub> Content (M/MTU)</b>																						
Brown 1	KU	2.7	2.7	115.7	5.8	5.8	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.9	5.8	5.8	5.8	5.8	5.9	5.9	5.8	5.8
Brown 2	KU	2.7	2.7	107.5	5.9	5.9	5.8	5.9	5.9	5.8	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	5.9	5.9	5.8	5.8
Brown 3	KU	2.7	2.7	38.0	5.8	5.8	5.9	5.9	5.9	5.8	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	5.9	5.9	5.8	5.8
Ghent 1	KU	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Ghent 2	KU	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Ghent 3	KU	19.2	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Green River 3	KU	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Green River 4	KU	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Tyrone 3	KU	1.5	1.4	1.5	1.4	1.4	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.5	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.4
Cane Run 4	LGE	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Cane Run 5	LGE	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Cane Run 6	LGE	5.9	5.9	5.9	5.9	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.9	5.9	5.9
Mill Creek 1	LGE	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Mill Creek 2	LGE	5.9	5.9	5.8	5.8	5.8	5.8	5.9	5.9	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Mill Creek 3	LGE	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Mill Creek 4	LGE	5.9	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Trimble County 1	LGE	5.9	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Trimble County 2	LGE	0.0	0.0	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
GFUCU 1	KU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GFUCU 2	LGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>SCRUBBER REMOVAL EFF.</b>																						
Brown 1	KU	0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Brown 2	KU	0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Brown 3	KU	0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Ghent 1	KU	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%
Ghent 2	KU	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Ghent 3	KU	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Ghent 4	KU	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Green River 3	KU	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Green River 4	KU	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tyrone 3	KU	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Cane Run 4	LGE	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Cane Run 5	LGE	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Cane Run 6	LGE	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%
Mill Creek 1	LGE	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Mill Creek 2	LGE	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Mill Creek 3	LGE	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%
Mill Creek 4	LGE	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
Trimble County 1	LGE	0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Trimble County 2	LGE	0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
GFUCU 1	KU	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
GFUCU 2	LGE	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<b>TONS SO<sub>2</sub> EMITTED</b>																						
Brown 1	KU	7,829	7,829	5,947	337	340	338	338	319	346	347	358	337	323	367	377	381	392	406	406	342	342
Brown 2	KU	14,539	13,211	11,526	638	637	702	708	712	616	708	705	710	689	700	711	638	708	705	714	719	670
Brown 3	KU	38,281	36,294	10,158	1,775	1,620	1,801	1,824	1,790	1,718	1,722	1,770	1,583	1,731	1,791	1,818	1,825	1,819	1,845	1,651	1,857	1,760
Ghent 1	KU	6,870	6,729	6,689	6,501	6,575	6,646	6,605	6,658	6,640	6,640	6,654	6,667	6,662	6,570	6,637	6,656	6,637	6,659	6,676	6,676	6,676
Ghent 2	KU	16,890	16,545	15,342	15,763	13,820	15,658	16,151	16,391	15,765	16,448	16,346	16,089	16,095	16,760	17,594	16,326	17,244	17,332	16,015	17,517	16,426
Ghent 3	KU	2,424	2,406	2,080	2,334	2,337	2,334	2,339	2,343	2,293	2,091	2,220	2,227	2,249	2,232	2,235	2,239	2,109	2,349	2,347	2,567	2,313
Ghent 4	KU	5,929	2,345	2,285	2,275	2,283	2,290	2,305	2,063	2,269	2,296	2,283	2,285	2,286	2,277	2,061	2,294	2,295	2,255	2,301	2,311	2,258
Green River 3	KU	12,819	12,134	7,040	5,502	5,817	5,583	5,014	5,562	4,799	5,580	5,834	4,474	4,958	5,407	5,038	5,534	5,456	6,306	6,439	5,322	5,322
Green River 4	KU	6,824	6,771	7,900	7,900	7,139	8,025	8,235	8,734	8,114	9,503	9,533	7,899	8,277	9,145	9,369	9,610	9,420	10,769	9,424	10,939	9,057
Tyrone 3	KU	2,701	3,207	2,707	2,498	2,556	2,557	2,589	2,584	2,797	2,744	2,874	2,585	2,915	3,096	3,046	2,847	3,174	3,357	3,345	2,893	2,893
Cane Run 4	LGE	3,959	3,959	3,872	3,175	3,533	3,479	3,620	3,337	3,590	3,589	3,243	3,720	3,590	3,687	3,695	3,784	3,839	3,501	3,932	3,980	3,749
Cane Run 5	LGE	3,789	4,147	4,034	3,562	3,608	3,625	3,702	3,032	3,684	3,772	3,773	3,555	3,611	3,897	3,477	3,595	3,300	3,956	4,078	4,101	3,537
Cane Run 6	LGE	4,197	3,892	4,220	3,720	3,780	3,652	3,744	3,826	3,801	4,403	4,327	4,482	4,343	4,464	4,484	4,130	4,675	4,723	4,750	4,753	4,592
Mill Creek 1	LGE	4,092	4,261	3,535	3,746	3,974	3,700	3,876	3,515	3,765	3,257	3,784	3,505	3,779	3,577	3,804	3,638	3,890	3,385	3,930	3,596	3,596
Mill Creek 2	LGE	1,101	1,016	962	976	1,040	978	1,052	966	969	961	1,001	946	994	946	1,011	961	1,030	890	1,044	987	1,018
Mill Creek 3	LGE	9,177	8,918	9,512	8,203	9,539	8,969	9,524	8,904	9,436	8,897	9,445	8,124	9,415	8,878	9,452	8,923	9,531	8,958	9,544	8,235	9,457
Mill Creek 4	LGE	9,536	10,208	9,582	10,105	9,492	10,099	8,715	10,044	9,930	10,028	9,336	9,973	9,311	9,965	8,605	10,036	9,515	10,356	9,898	10,139	9,366
Trimble County 1	LGE	650	544	646	592	648	593	646	592	646	542	646	592	646	546	590	646	590	646	544	648	595
Trimble County 2	KU	0	0	182	345	363	361	362	362	362	362	362	362	362	362	362	362	362	362	362	362	361
Trimble County 2	LGE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,024
GFUCU 1	KU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GFUCU 2	LGE	0	0	0																		

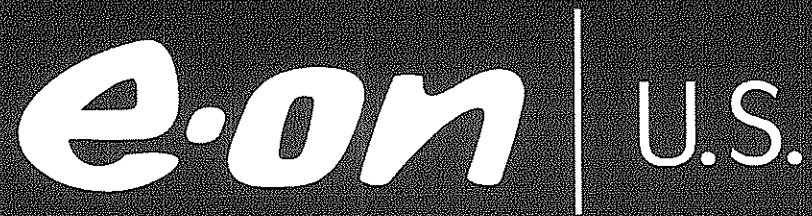


**Brown EGD in 2011 (GH1 EGD in 2009)**

FUEL SO <sub>2</sub> Content (#MBTU)	Owner	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
Brown 1	KU	2.7	2.7	2.7	126.0	5.8	5.9	5.8	5.8	5.8	5.8	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	
Brown 2	KU	2.7	2.7	2.7	121.6	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	
Brown 3	KU	2.7	2.7	2.7	90.4	5.8	5.9	5.8	5.8	5.8	5.8	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	
Ghent 1	KU	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	
Ghent 2	KU	1.2	3.7	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	
Ghent 3	KU	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	
Ghent 4	KU	19.2	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	
Green River 3	KU	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	
Green River 4	KU	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	
Tyrone 3	KU	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	
Cane Run 4	KU	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	
Cane Run 5	LGE	5.8	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	
Cane Run 6	LGE	5.9	5.8	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	
Mill Creek 1	LGE	5.8	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	
Mill Creek 2	LGE	5.9	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	
Mill Creek 3	LGE	5.8	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	
Mill Creek 4	LGE	5.9	5.8	5.8	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	
Trimble County 1	LGE	5.9	5.9	5.8	5.9	5.8	5.9	5.8	5.9	5.9	5.8	5.9	5.8	5.9	5.8	5.9	5.8	5.9	5.8	5.8	5.8	5.8	5.8	5.8
Trimble County 2	KU	0.0	0.0	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	
Trimble County 2	LGE	0.0	0.0	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	
GFCU 1	KU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
GFCU 1	LGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
<b>SCRUBBER REMOVAL EFF.</b>																								
Brown 1	0%	0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	
Brown 2	0%	0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	
Brown 3	0%	0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	
Ghent 1	94%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	
Ghent 2	0%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	
Ghent 3	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	
Ghent 4	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	
Green River 3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Green River 4	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Tyrone 3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
Cane Run 4	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	
Cane Run 5	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	
Cane Run 6	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	
Mill Creek 1	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	
Mill Creek 2	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	
Mill Creek 3	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	
Mill Creek 4	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	
Trimble County 1	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	
Trimble County 2	0%	0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	
GFCU 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
GFCU 1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
<b>TONS SO<sub>2</sub> EMITTED</b>																								
Brown 1	KU	7,829	7,794	6,842	5,598	323	312	304	324	313	340	338	350	326	318	358	362	367	373	395	393	326	326	
Brown 2	KU	14,639	15,106	14,234	11,769	687	687	693	699	603	695	691	699	676	685	659	624	692	689	700	704	649	649	
Brown 3	KU	36,261	35,366	37,905	7,156	1,887	1,759	1,779	1,748	1,654	1,716	1,719	1,535	1,672	1,736	1,766	1,768	1,621	1,625	1,621	1,625	1,704	1,704	
Ghent 1	KU	6,870	3,142	2,237	2,192	2,249	2,231	2,011	2,239	2,233	2,235	2,232	2,242	2,237	2,311	2,239	2,239	2,239	2,235	2,237	2,239	2,239	1,976	
Ghent 2	KU	16,880	7,563	5,209	5,756	4,967	5,738	5,809	5,809	5,963	5,963	5,963	5,963	5,963	5,963	5,963	5,963	5,963	5,963	5,963	5,963	5,963	5,963	5,748
Ghent 3	KU	2,424	2,392	2,095	2,329	2,317	2,307	2,212	2,318	2,292	2,292	2,292	2,292	2,292	2,292	2,292	2,292	2,292	2,292	2,292	2,292	2,292	2,292	2,235
Ghent 4	KU	6,824	6,994	6,711	5,765	5,868	5,643	6,100	5,611	4,773	5,595	5,523	5,663	4,511	5,024	5,396	5,050	5,651	5,868	6,519	6,424	5,306	5,306	
Green River 3	KU	12,819	12,371	10,662	5,152	7,271	8,182	8,347	8,324	8,333	9,604	9,693	7,936	8,444	9,217	9,486	9,701	9,544	10,378	9,459	11,935	9,029	9,029	
Green River 4	KU	2,701	3,263	2,687	2,755	2,585	2,594	2,675	2,631	2,626	2,795	2,748	2,898	2,628	2,959	3,094	3,094	2,857	3,204	3,358	3,384	2,976	2,976	
Tyrone 3	KU	1,219	1,012	959	977	1,032	968	1,043	956	980	985	955	942	966	943	1,007	937	1,025	886	1,041	984	1,013	984	
Cane Run 4	LGE	3,959	3,951	3,815	3,181	3,322	3,185	3,405	3,174	3,314	3,410	3,692	3,592	3,641	3,468	3,634	3,411	3,753	3,820	3,874	4,012	4,064	3,827	



Without GH1 FGD (Brown FGD in 2010)		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
<b>FUEL SO<sub>2</sub> Content (#MBTU)</b>																								
Brown 1	KU	2.7	2.7	115.7	5.8	5.8	5.8	5.8	5.9	5.9	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Brown 2	KU	2.7	2.7	107.5	5.9	5.9	5.8	5.9	5.9	5.9	5.8	5.8	5.8	5.9	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Brown 3	KU	2.7	2.7	99.0	5.8	5.9	5.8	5.9	5.9	5.8	5.8	5.8	5.8	5.9	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Ghent 1	KU	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Ghent 2	KU	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Ghent 3	KU	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Ghent 4	KU	19.2	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Green River 3	KU	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Green River 4	KU	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Tyrone 3	KU	1.5	1.4	1.5	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Cane Run 4	LGE	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Cane Run 5	LGE	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Cane Run 6	LGE	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Mill Creek 1	LGE	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Mill Creek 2	LGE	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Mill Creek 3	LGE	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Mill Creek 4	LGE	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Trimbale County 1	LGE	5.9	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Trimbale County 2	KU	0.0	0.0	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
Trimbale County 2	LGE	0.0	0.0	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9	4.9
GFUCU 1	KU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GFUCU 1	LGE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
<b>SCRUBBER REMOVAL EFF.</b>																								
Brown 1		0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Brown 2		0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Brown 3		0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Ghent 1		94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%	94%
Ghent 2		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Ghent 3		98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Ghent 4		98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Green River 3		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Green River 4		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Tyrone 3		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Cane Run 4		85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Cane Run 5		85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%	85%
Cane Run 6		90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Mill Creek 1		93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%	93%
Mill Creek 2		98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Mill Creek 3		89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%	89%
Mill Creek 4		91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%
Trimbale County 1		99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%	99%
Trimbale County 2		0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
Trimbale County 2		0%	0%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%	98%
GFUCU 1		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
GFUCU 1		0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
<b>TONS SO<sub>2</sub> EMITTED</b>																								
Brown 1		7,829	7,658	5,947	337	340	330	328	335	319	346	347	358	367	377	381	392	406	426	446	466	486	506	526
Brown 2	KU	14,639	13,211	11,926	698	697	702	708	712	618	708	705	710	689	700	689	700	711	1,818	1,825	1,819	1,845	1,861	1,877
Brown 3	KU	36,281	35,294	10,158	1,775	1,620	1,801	1,824	1,730	1,718	1,778	1,770	1,583	1,733	1,791	1,818	1,825	1,819	1,845	1,861	1,877	1,893	1,909	1,925
Ghent 1	KU	6,870	6,729	6,669	6,501	6,675	6,646	6,605	6,568	6,540	6,503	6,466	6,429	6,392	6,355	6,318	6,281	6,244	6,207	6,170	6,133	6,096	6,059	6,022
Ghent 2	KU	16,890	15,546	15,342	15,138	15,059	15,011	15,011	15,011	15,011	15,011	15,011	15,011	15,011	15,011	15,011	15,011	15,011	15,011	15,011	15,011	15,011	15,011	15,011
Ghent 3	KU	2,404	2,406	2,349	2,354	2,337	2,334	2,339	2,343	2,293	2,290	2,287	2,289	2,286	2,283	2,285	2,285	2,277	2,061	2,294	2,295	2,295	2,301	2,311
Ghent 4	KU	6,824	6,771	7,040	5,502	5,583	6,014	5,582	4,799	5,542	5,580	5,534	4,774	4,958	5,407	5,399	5,334	5,340	5,340	5,340	5,340	5,340	5,340	5,340
Green River 3	KU	12,819	12,134	10,452	7,993	7,133	6,025	6,236	6,734	8,114	9,503	9,533	7,899	4,277	9,145	9,369	9,610	9,420	10,769	9,424	10,339	9,424	10,339	9,424
Green River 4	KU	2,701	3,207	2,707	2,498	2,556	2,552	2,557	2,559	2,554	2,797	2,744	2,574	2,585	2,915	3,096	3,046	2,847	3,174	3,357	3,245	3,367	3,245	3,367
Tyrone 3	KU	3,959	3,969	3,872	3,175	3,533	3,479	3,520	3,537	3,550	3,580	3,584	3,772	3,773	3,855	3,611	3,807	3,477	3,895	3,900	3,996	4,078	4,101	3,837
Cane Run 4	LGE	3,769	4,147	4,034	3,552	3,608	3,625	3,742	3,826	3,801	4,403	4,327	4,482	4,482	4,482	4,443	4,484	4,130	4,675	4,723	4,750	4,763	4,552	4,552
Cane Run 5	LGE	4,197	3,852	4,220	3,720	3,780	3,652	3,744	3,826	3,801	4,403	4,327	4,482	4,482	4,482	4,443	4,484	4,130	4,675	4,723	4,750	4,763	4,552	4,552
Cane Run 6	LGE	4,052	4,261	3,536	3,953	3,746	3,974	3,760	3,876	3,515	3,766	3,257	3,784	3,505	3,779	3,357	3,804	3,538	3,690	3,359	3,359	3,359	3,359	3,359
Mill Creek 1	LGE	1,101	1,016	962	976	1,040	978	1,052	956	989	881	1,001	946	994	945	1,011	951	1,030	890	1,044	987	1,018	987	1,018



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*SO<sub>2</sub> Compliance Strategy  
Ghent & Brown FGD Program*

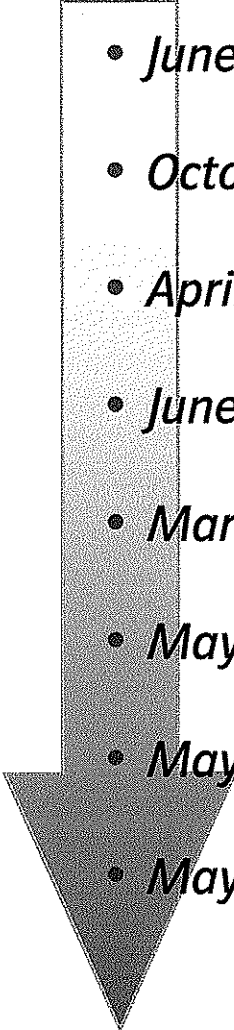
*Kentucky Public Service Commission  
Update  
March 19, 2008*



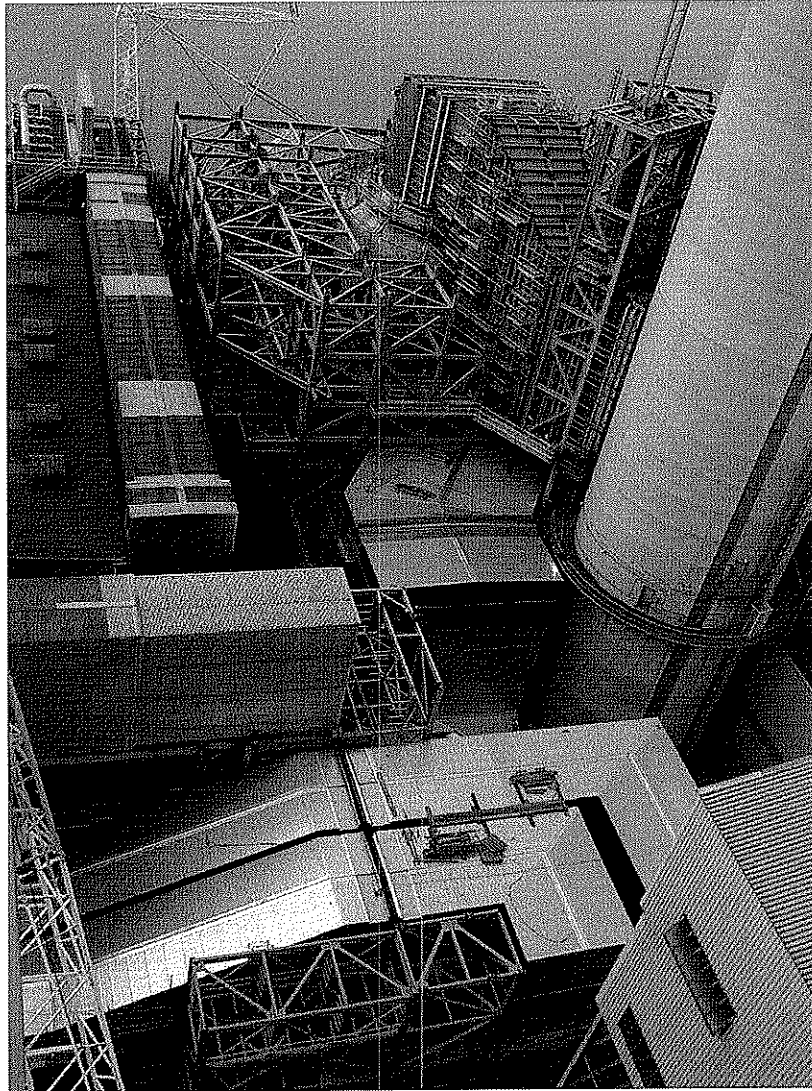
## **Executive Summary**

- *The KU FGD Program has experienced cost increases beyond those previously discussed*
  - *Labor and material costs have continued to escalate*
  - *Projects continue to be aggressively managed, supported by competitive bidding process*
- *Completing the KU FGD Program remains a part of the Companies' Least Cost SO<sub>2</sub> Compliance Strategy*
  - *Projected fuel savings have increased at E.W. Brown and are unchanged at Ghent*
  - *SO<sub>2</sub> allowance price forecasts for 2010-2027 are unchanged from previous analyses*
- *Project Timing has been reviewed*
  - *Ghent FGDs should be completed as originally planned*
  - *E.W. Brown FGD analysis supports an additional year in the construction schedule*

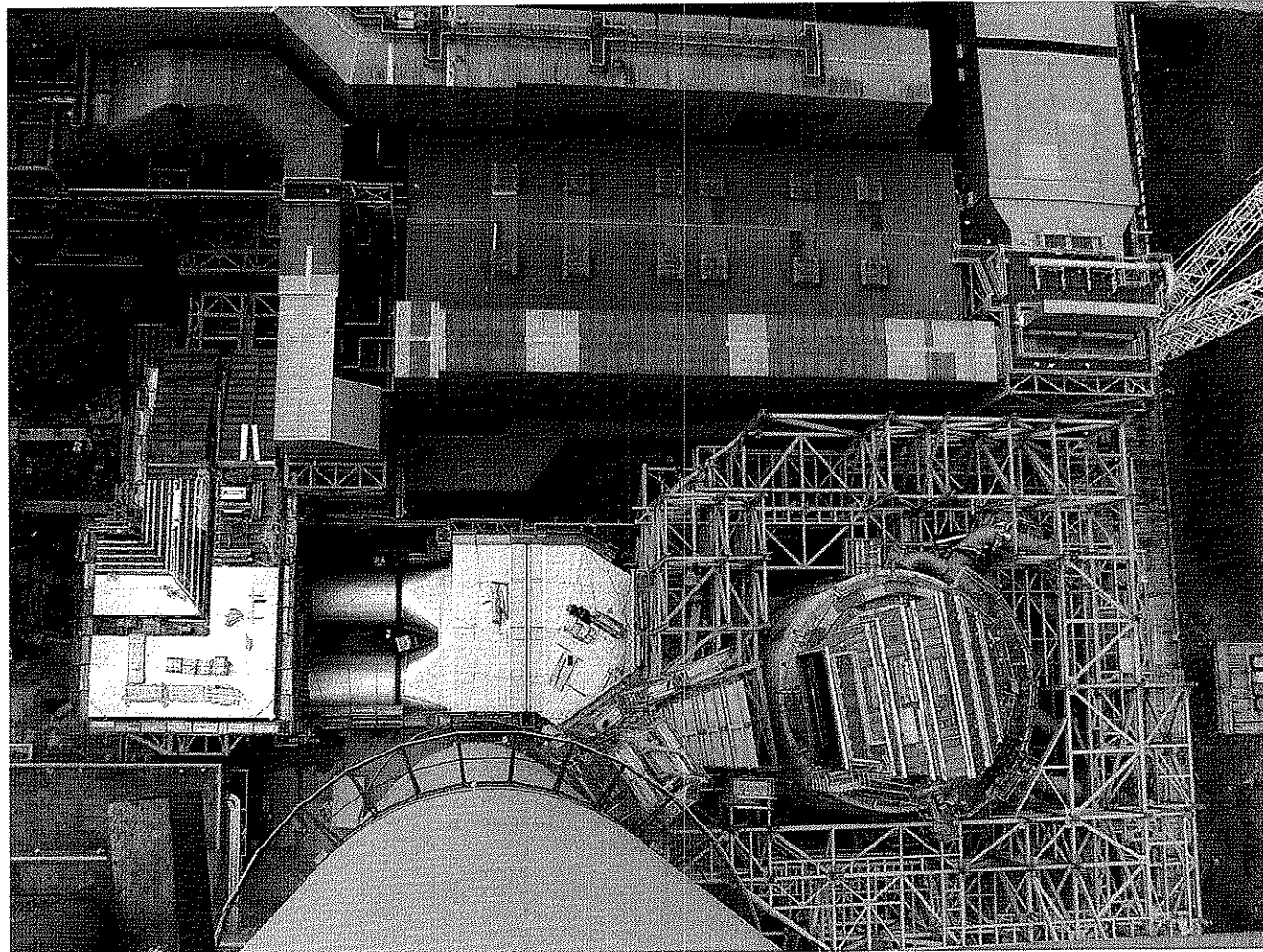
## Key Program Dates

- 
- *June 20, 2005*      *CCN granted for FGDs at Ghent and E.W. Brown*
  - *October 31, 2006*      *Program update presented to KPSC (Ghent)*
  - *April 26, 2007*      *Program update presented to KPSC (E.W. Brown)*
  - *June 5, 2007*      *Actual in-service date for Ghent Unit 3 FGD*
  - *March 19, 2008*      *Program update presented to KPSC (entire project)*
  - *May 2008*      *Expected in-service date for Ghent Unit 4 FGD*
  - *May 2009*      *Expected in-service date for Ghent Unit 1 FGD*
  - *May 2010*      *Expected in-service date for E.W. Brown FGD*

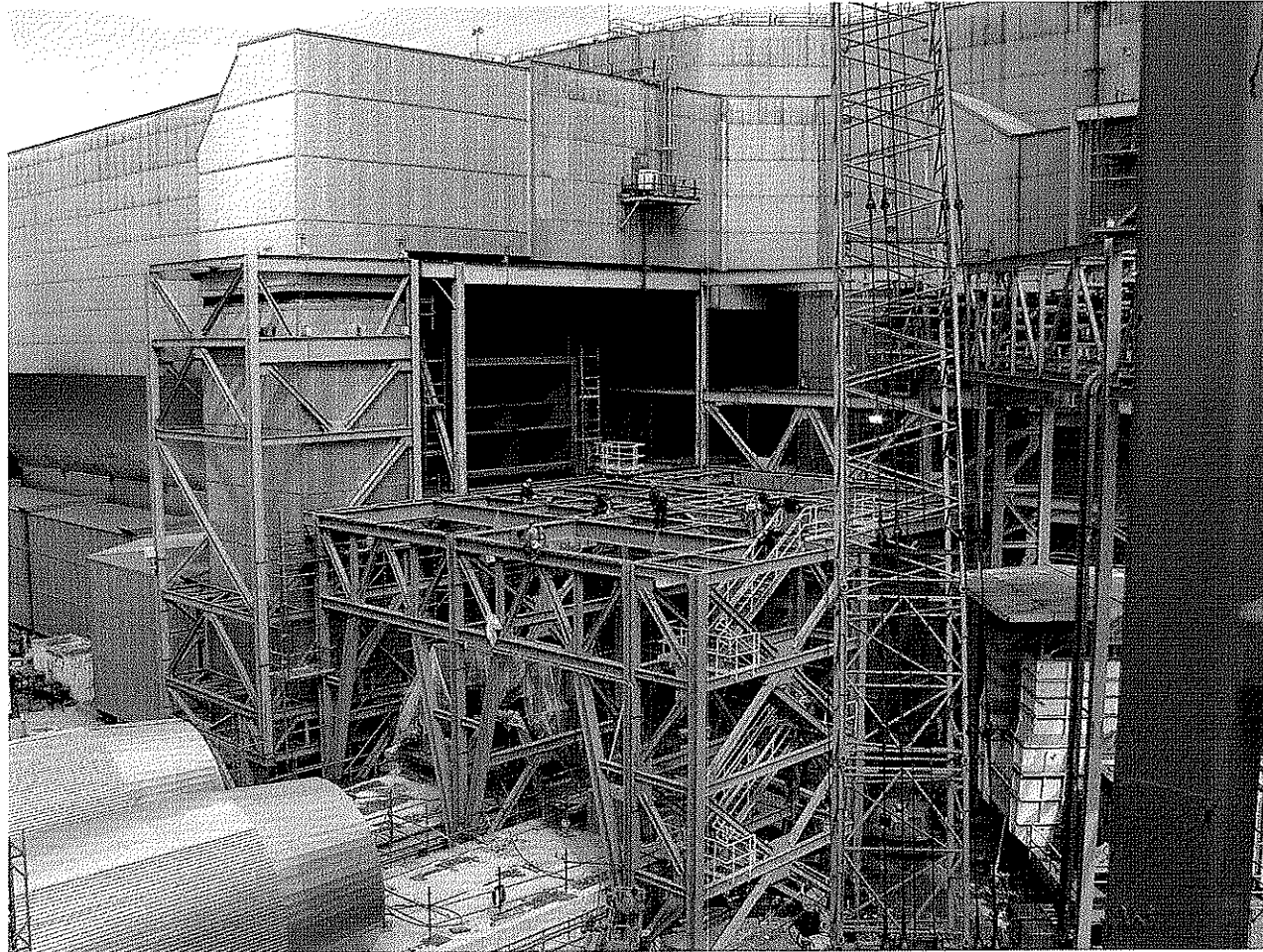
## Ghent Unit 3 FGD



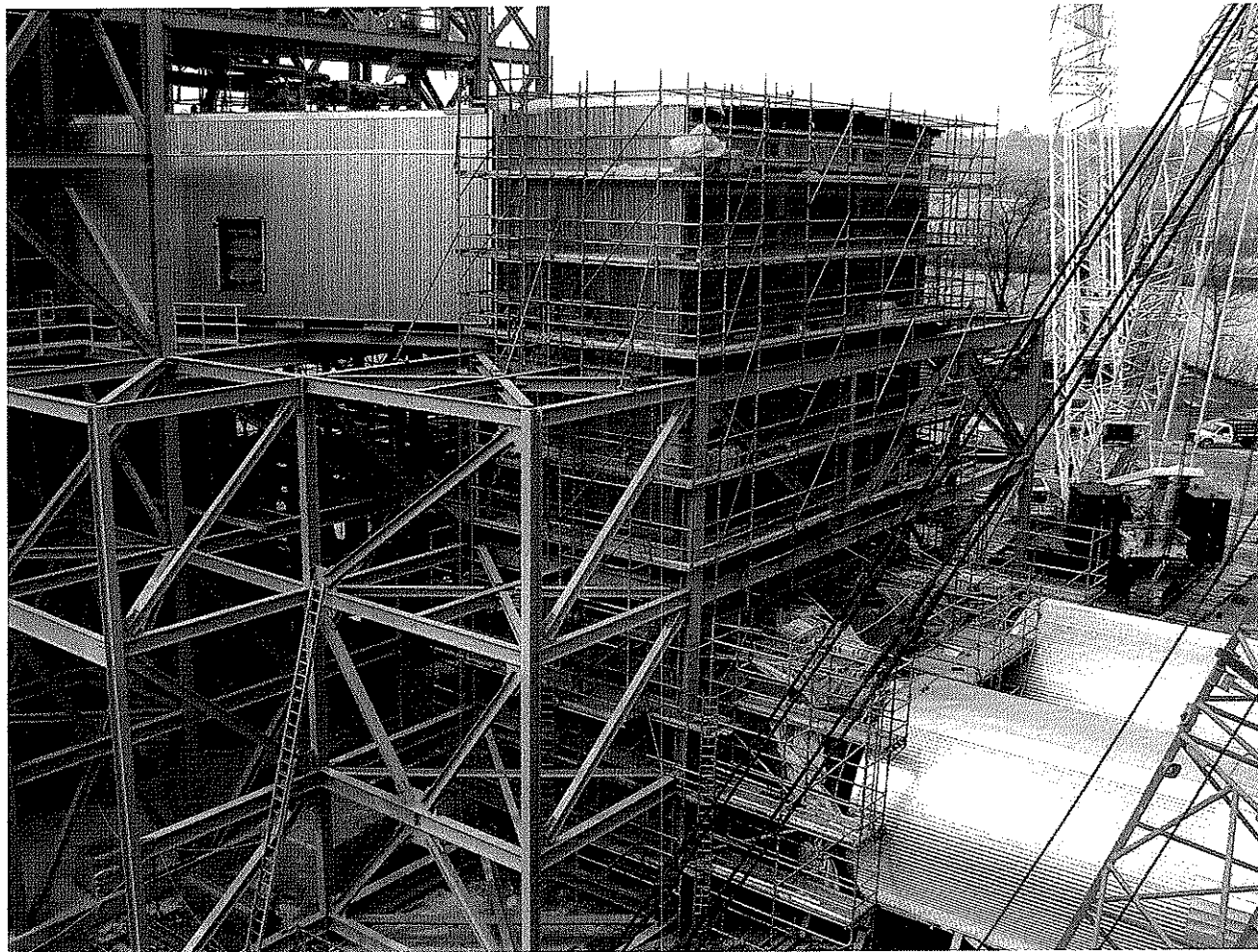
## Ghent Unit 3 FGD



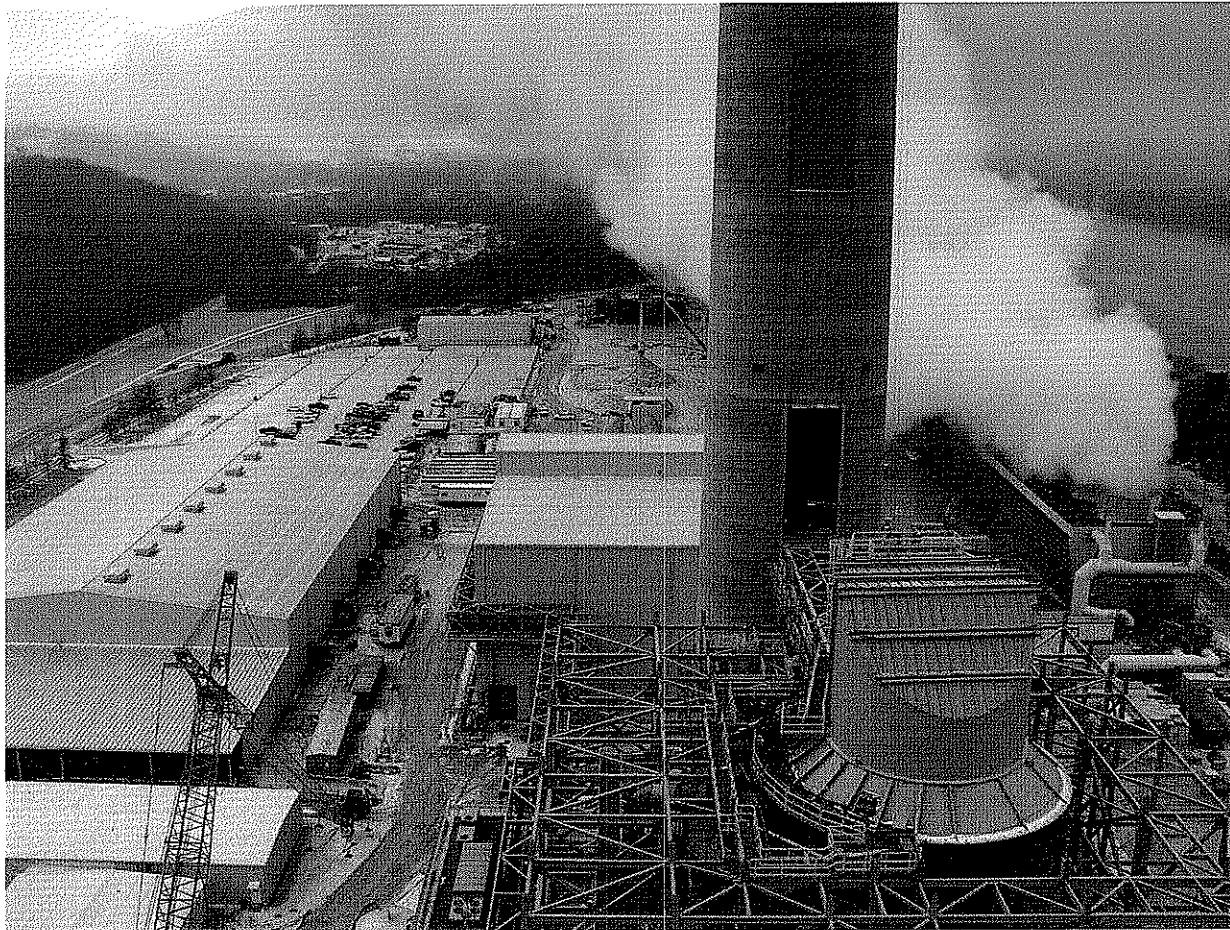
## Ghent Unit 4 FGD



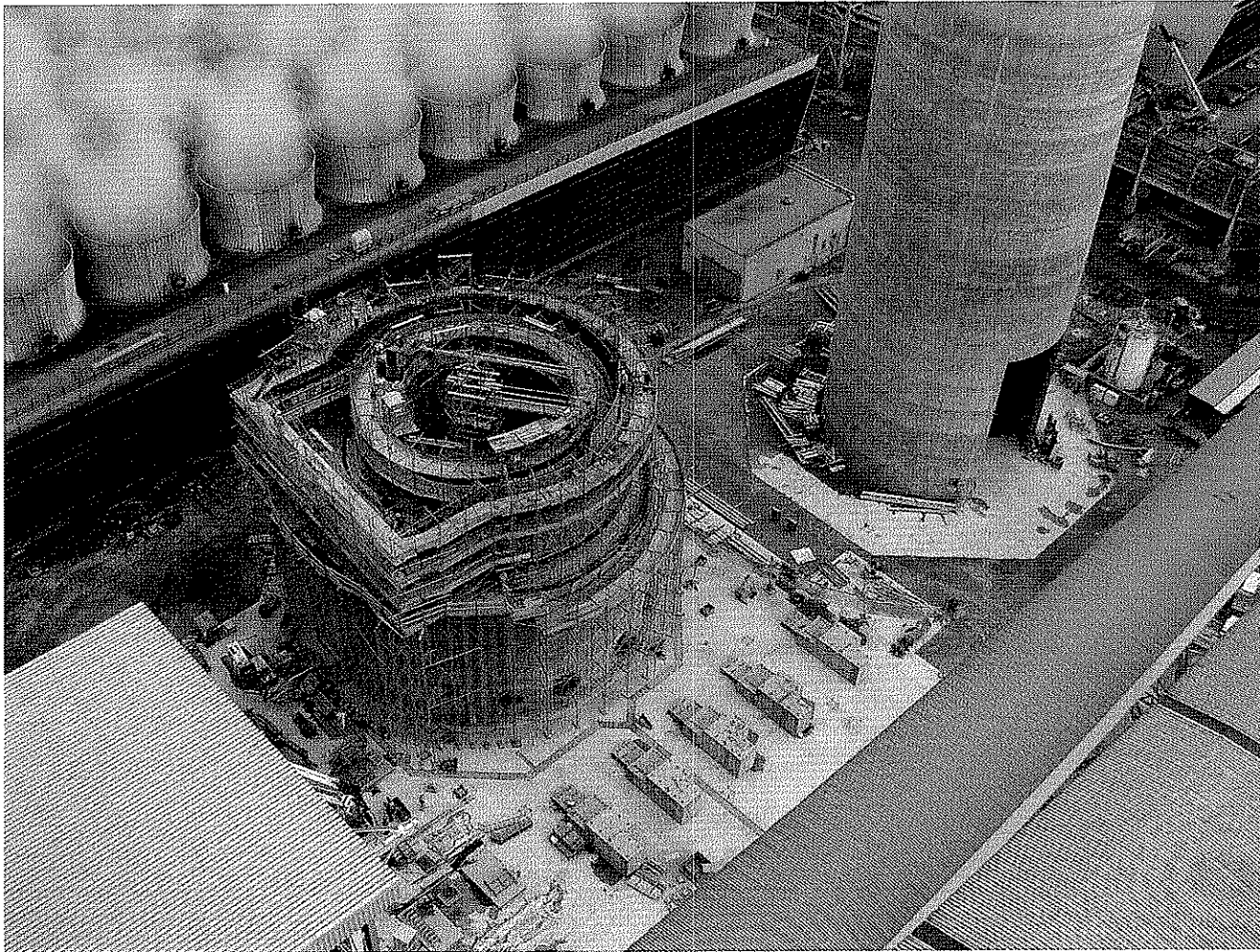
## Ghent Unit 4 FGD



## Ghent Unit 4 Chimney and FGD Absorber



## Ghent Unit 1 Absorber and Chimney





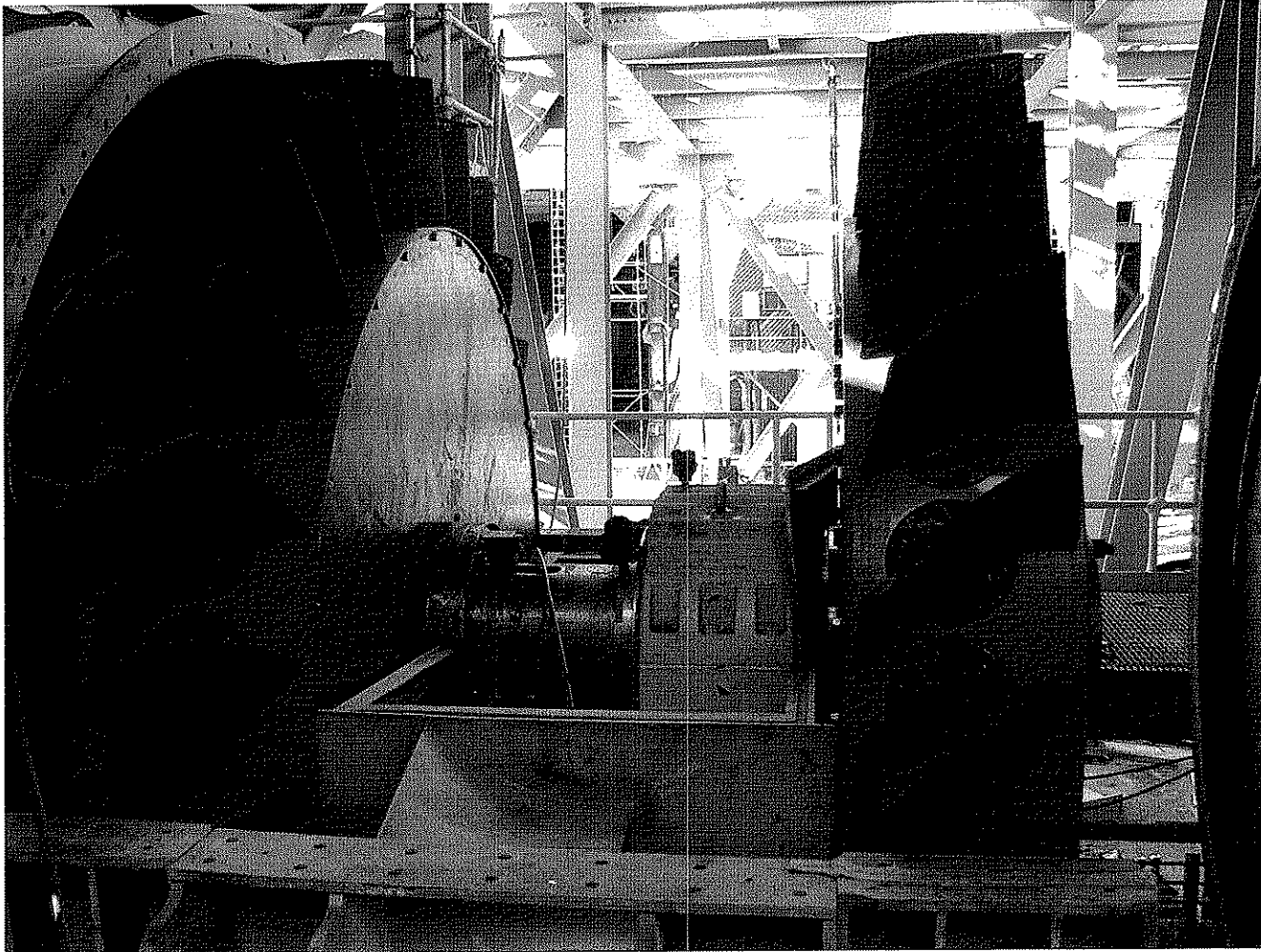
## Ghent Limestone Unloading Facility



## **Ghent 3 Operation to Date**

- *Ghent 3 FGD went in-service in June 2007*
  - *FGD operating as designed and meeting all operational parameters*
- *An issue emerged with the new ID fans following in-service; similar fans were purchased for Ghent 4 and E.W. Brown*
- *Root cause analysis continues*
- *Current estimates include cost of fan remediation*

## Ghent 3 ID Fan



## **Operational Issues – ID Fan Impact on Ghent 4 and**

### **E.W. Brown**

- *ID Fans – Short Term Actions*
  - *Continue to operate Ghent 3 FGD; service fans as necessary*
  - *Operate Ghent 4 FGD with existing (old) ID fans*
    - *Potentially reduces operational capacity and SO<sub>2</sub> removal efficiency*
- *ID Fans – Long Term Options*
- *Ghent 3 and 4*
  - *Resolve bearing issues OR*
  - *Order replacement fans, with lead time of 60+ weeks*
- *E.W. Brown Unit 3*
  - *Order replacement fans, with lead time of 60+ weeks*

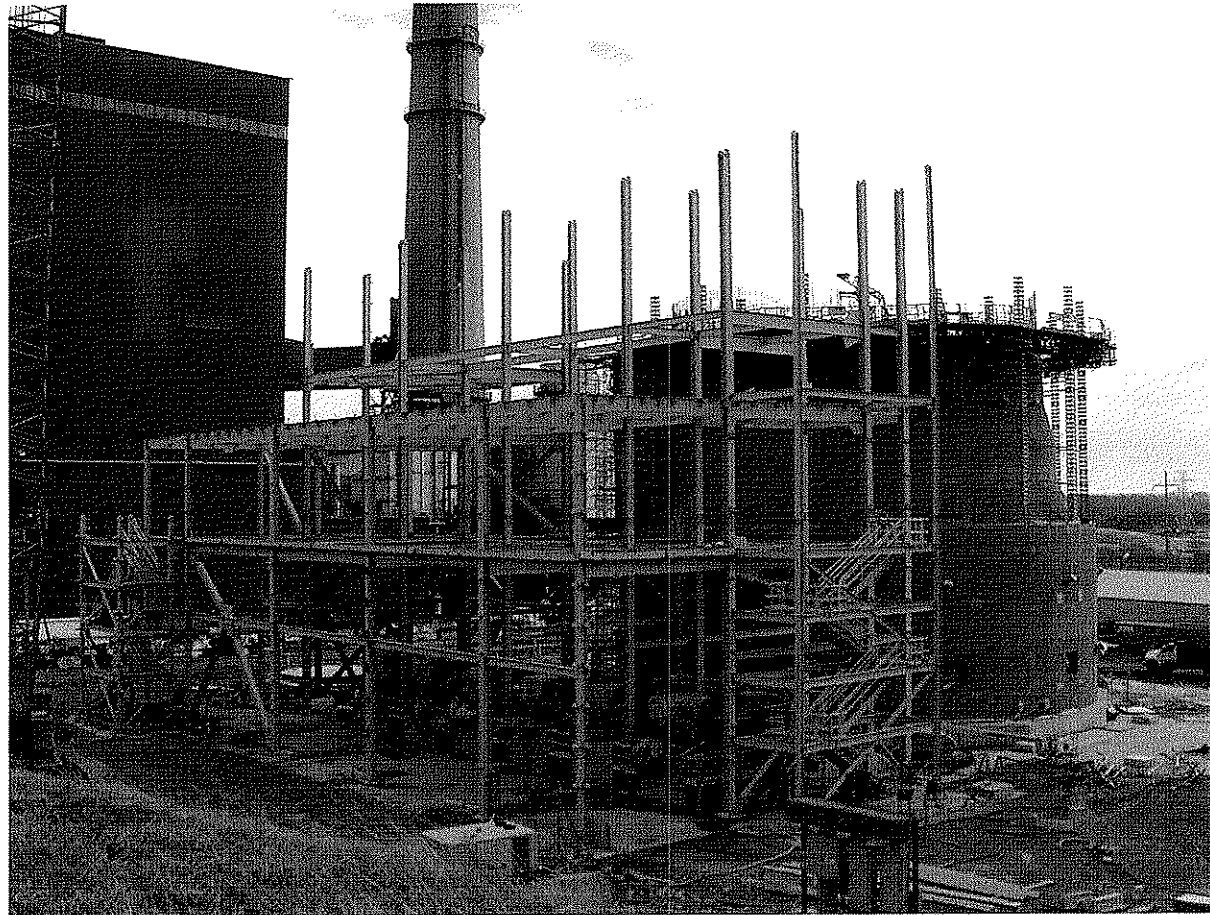
## Increased Capital Costs -- Ghent

- *Increase in estimates*

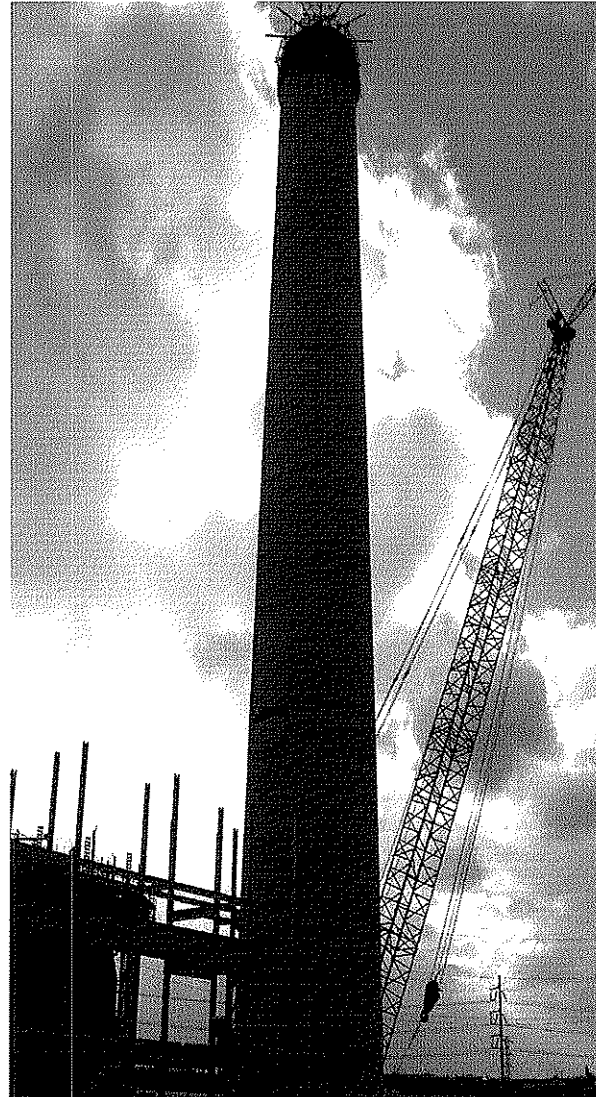
2004 Filing	\$425M
October 2006 Update	525
Current Estimate	<u>682</u>
Total Capital Increase	257
- *Most significant changes*

Market Impacts	\$109M
Scope Refinements (Limestone and BOP)	82
ID Fans	30
- *Future Capital Cost Risks*
  - *Approximately \$463M (68%) of capital spent with \$522M (77%) committed (spent + under contract)*
  - *Still subject to greater than anticipated labor increases and limited material cost increases*

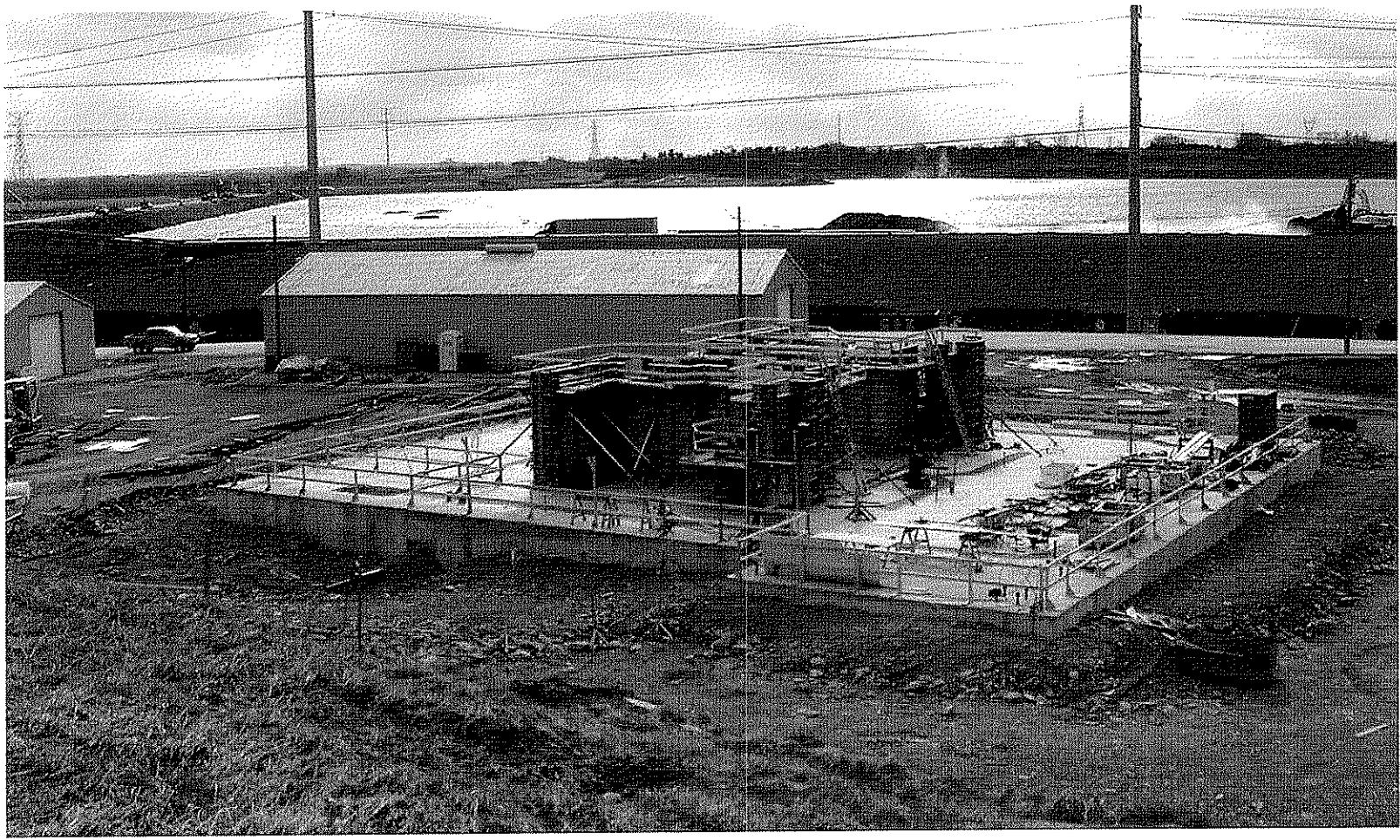
## **E.W. Brown FGD Absorber**



## **E.W. Brown Chimney**



## **E.W. Brown FGD - Limestone System**





## Increase in Capital Costs – E.W. Brown

- *Increase in estimates*

<i>2004 Filing</i>	<i>\$234M</i>
<i>April 2007 Estimate</i>	<i>359</i>
<i>Current Estimate</i>	<i><u>500</u></i>
<i>Total Capital Increase</i>	<i>266</i>

- *Most significant changes*

<i>Market Impacts</i>	<i>\$116M</i>
<i>Ductwork &amp; ID Fans</i>	<i>74</i>
<i>Scope Refinements (Limestone System and BOP)</i>	<i>54</i>

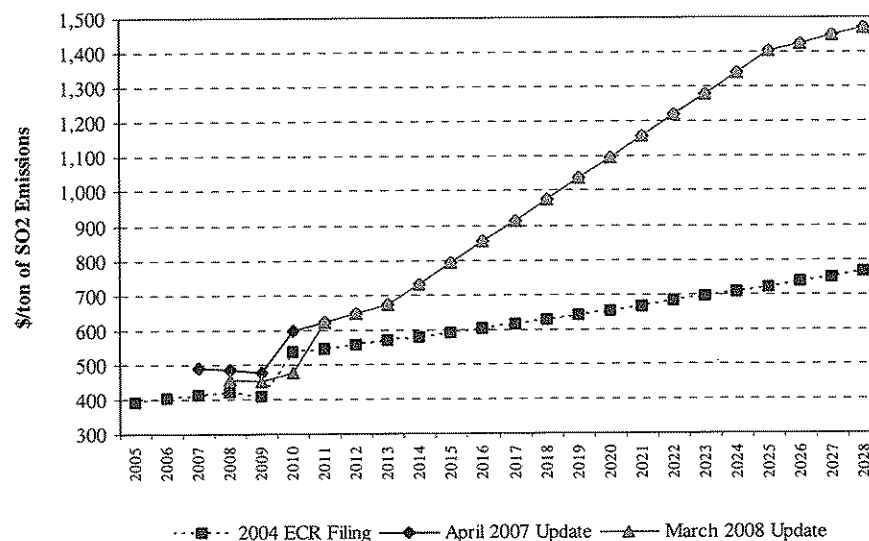
- *Future Capital Cost Risks*

- *Approximately \$126M (25%) of capital spent with \$182M (36%) committed (spent + under contract)*
- *Still subject to greater than anticipated labor increases and material cost increases*
- *Lengthening schedule by one year allows:*
  - *Completion of engineering allows for enhanced execution of procurement and construction plan (addressing Flour's schedule issues)*
  - *Certainty on ID fan solution*

## Significant Changes: Increase in Long-Term SO<sub>2</sub> Emission Allowance Prices Since 2004

- *Revision reflects greater clarity on the cost of industry-wide FGD retrofits necessary to achieve targeted emissions reductions under CAIR*
- *Current market conditions support a robust long-term price outlook:*
  - *Increasing FGD construction cost*
  - *Higher gas prices promote higher levels of coal generation and relatively higher emissions*
  - *Increasing price spreads between low and high sulfur coals encourage fuel switching which may raise SO<sub>2</sub> emissions*

Forecasted SO<sub>2</sub> Emissions Allowance Prices

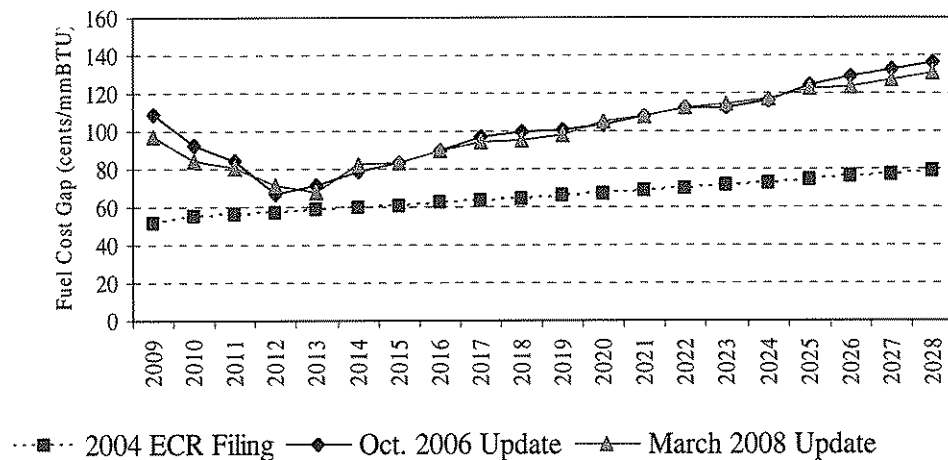


- *Higher SO<sub>2</sub> market prices make physical compliance (FGDs) more favorable than financial compliance (purchasing allowances)*

## Significant Changes: Fuel Price Gap -- Ghent

- *Gap decreases through 2013 as FGDs are installed due to CAIR*
- *Long-term gap increases as low sulfur (compliance) coal supply tightens due to depletion of reserves*
- *High sulfur coal continues to be more attractive*

Fuel Price Gap Between Low and High Sulfur Coal at Ghent

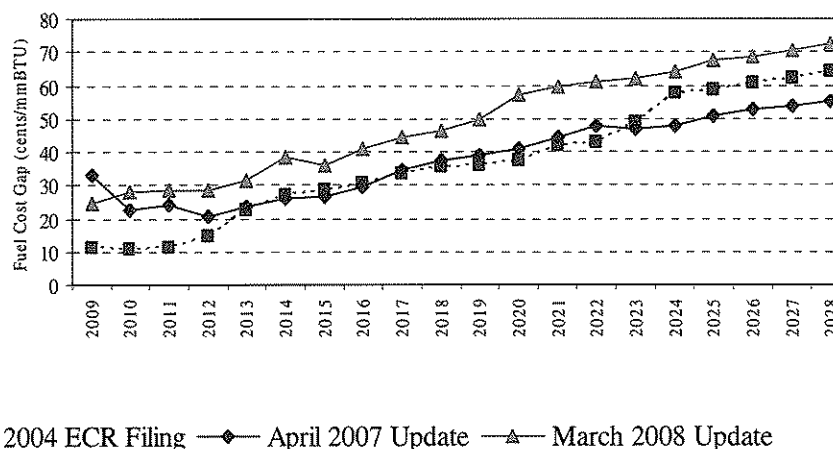


- *Initial Fuel savings of 84 cents/mmBtu as FGDs allow Ghent to continue the switch from low to high sulfur coal (\$84m/yr savings in 2010)*

## Significant Changes: Fuel Price Gap - E.W. Brown

- *Price Gap has increased from April 2007 due to transportation differential*
- *Gap lower than at Ghent due to differences in sulfur content and transport*
- *For all forecasts, long-term gap increases over time as low sulfur coal supply tightens*
- *High sulfur coal continues to be more attractive*

Fuel Price Gap Between Low and High Sulfur Coal at Brown



- *Initial Fuel savings of 29 cents/mmBtu as FGD allows E.W. Brown to switch from low to high sulfur coal (\$13m/yr savings in 2011)*

# Least-Cost Plan continues to include scrubbing Ghent and E.W. Brown

## Ghent Case Summary

- \$224M (PVRR) better than Ghent 1 FGD cancellation (financial compliance)

Case	Production Cost	NO <sub>x</sub> Allowances	SO <sub>2</sub> Allowances	Incremental Capital Cost	Total PVRR	Incremental Cost over Base
Base Case - Ghent 1 FGD in 2009	13,810	-1	129	64	14,001	Base
Without Ghent 1 FGD	13,965	3	258	0	14,225	224

2008 PVRR \$ millions; Production & allowance costs estimated 2008-2028; Both cases include Brown FGD in 2010; 8.02% discount rate

## Brown Case Summary

- \$58M (PVRR) better than the next best alternative (physical compliance completing Brown in 2011)
- \$99M (PVRR) better than FGD cancellation (financial compliance)

Case	Production Cost	NO <sub>x</sub> Allowances	SO <sub>2</sub> Allowances	Incremental Capital Cost	Total PVRR	Incremental Cost over Base
Base Case - BR123 FGD in 2010	13,810	-1	129	552	14,490	Base
Delay Case - BR123 FGD in 2011	13,805	-1	155	589	14,547	58
Without Brown FGD	13,885	-3	567	140	14,588	99

2008 PVRR \$ millions; Production & allowance costs estimated 2008-2028; All three cases include Ghent 1 FGD in 2009; 8.02% discount rate;

Incremental capital cost includes the Brown ash pond

## Least-Cost Plan: Delays procurement of SO<sub>2</sub> allowances

*Compared to Brown In-Service in 2011:*

- Delays bank depletion two years
- Requires allowance purchases of 56,000 fewer tons

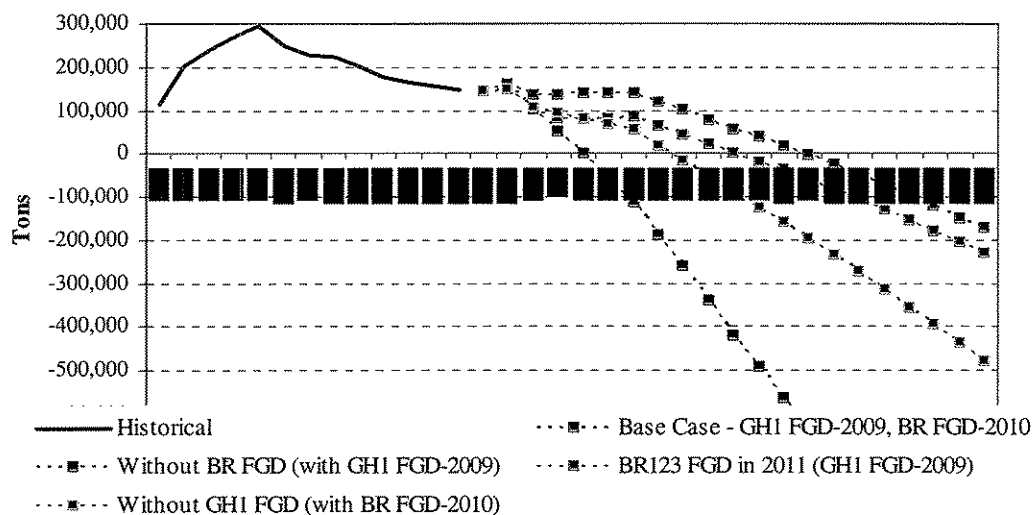
*Compared to Ghent 1 Cancellation:*

- Delays bank depletion five years
- Requires allowance purchases of 304,000 fewer tons

*Compared to Brown Cancellation:*

- Delays bank depletion nine years
- Requires allowance purchases of 1.0 million fewer tons

**SO<sub>2</sub> Allowance Bank**  
(Combined Company)



## **Least-Cost Plan: Impacts**

*The Least Cost Plan is expected to:*

- *Decrease the cost of SO<sub>2</sub> compliance by approximately \$99 million in PVRR compared to the Brown Cancellation Case or by approximately \$224 million in PVRR compared to the Ghent 1 Cancellation Case*
- *Delay depletion of the SO<sub>2</sub> allowance bank until 2021 and reduce the allowance shortfall to ~173,000 tons through 2028*
- *Increase fuel procurement flexibility*
- *Position the Companies for the SO<sub>2</sub> reduction requirements of the Clean Air Interstate Rule and future regulations on fine particulates and mercury*
- *Increase typical residential customers' bills (1000 kwh/month) by \$2.17/month, which equates to a 3.5% increase in ECR billing factor above KU's original estimate in Case No. 2004-00426.*

## **Combined Company SO<sub>2</sub> Compliance Strategy**

- *Continue with the construction of FGDs at Ghent Units 1 (2009) and 4 (2008) and a single FGD for E.W. Brown 1, 2 and 3 (2010)*
- *Purchase SO<sub>2</sub> allowances on an as-needed basis*
- *Continue the practice of environmental dispatching*
- *Continue to evaluate additional environmental technologies for existing generating assets*