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COMMONWEALTH OF KENTUCKY  
BEFORE THE PUBLIC SERVICE COMMISSION

SEP 23 2011

PUBLIC SERVICE  
COMMISSION

In the Matter of:

APPLICATION OF LOUISVILLE GAS AND ELECTRIC )  
COMPANY FOR AN AMENDED ENVIRONMENTAL )  
COMPLIANCE PLAN, A REVISED SURCHARGE TO )  
RECOVER COSTS, AND CERTIFICATES OF PUBLIC ) CASE NO. 2011-00162  
CONVENIENCE AND NECESSITY FOR THE )  
CONSTRUCTION OF NECESSARY )  
ENVIRONMENTAL EQUIPMENT )

In the Matter of:

APPLICATION OF KENTUCKY UTILITIES COMPANY )  
FOR CERTIFICATES OF PUBLIC CONVENIENCE )  
AND NECESSITY AND APPROVAL OF ITS 2011 ) CASE NO. 2011-00161  
COMPLIANCE PLAN FOR RECOVERY )  
BY ENVIRONMENTAL SURCHARGE )

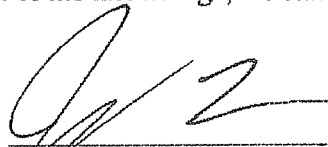
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AFFIDAVIT OF DR. JEREMY FISHER FOR DIRECT TESTIMONY  
(PUBLIC VERSION)

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Commonwealth of )  
Massachusetts )  
)


Dr. Jeremy Fisher, being first duly sworn, states the following: The prepared Direct Testimony (Public Version) and associated exhibits filed on Monday, September 19, 2011 constitute the direct testimony of Affiant in the above-styled cases. Affiant states that he would give the answers set forth in the Direct Testimony, Public Version, if asked the questions propounded therein. Affiant further states that, to the best of his knowledge, his statements made are true and correct.

  
\_\_\_\_\_  
Dr. Jeremy Fisher

SUBSCRIBED AND SWORN to before me this 22 day of September 2011.

  
\_\_\_\_\_  
Notary Public

My Commission Expires:  
7/27/18

 **MELISSA SCHULTZ**  
Notary Public  
Commonwealth of Massachusetts  
My Commission Expires  
July 27, 2018

**Commonwealth of Kentucky**

**Before the Public Service Commission**

In the Matter of: )  
)  
THE APPLICATION OF KENTUCKY )  
UTILITIES COMPANY FOR )  
CERTIFICATES OF PUBLIC ) Case No. 2011-00161  
CONVIENENCE AND NECESSITY AND )  
APPROVAL OF ITS 2011 COMPLIANCE )  
PLAN FOR RECOVERY BY )  
ENVIRONMETNAL SURCHARGE )

In the Matter of: )  
)  
THE APPLICATION OF LOUISVILLE GAS )  
AND ELECTRIC COMPANY FOR )  
CERTIFICATES OF PUBLIC ) Case No. 2011-00162  
CONVIENENCE AND NECESSITY AND )  
APPROVAL OF ITS 2011 COMPLIANCE )  
PLAN FOR RECOVERY BY )  
ENVIRONMETNAL SURCHARGE. )

**Supplemental Testimony of  
Jeremy Fisher, Ph.D.**

**On Behalf of  
Sierra Club and Natural Resources Defense Council**

**PUBLIC VERSION**

**September 23, 2011**

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1    **1. INTRODUCTION**

2    **Q     Are you the same Jeremy Fisher that submitted direct testimony in these**  
3       **doctors on September 19, 2011?**

4    **A     I am.**

5    **Q     What is the purpose of this supplemental testimony?**

6    **A     This supplemental testimony serves two purposes. First, it comments on the**  
7       **Companies' Supplemental Analyses delivered to Environmental Interveners on**  
8       **September 14<sup>th</sup>, 2011 in response to Staff Question 20, in which the company**  
9       **revisited their natural gas forecast. Secondly, it provides a correction to my direct**  
10      **testimony which was completed on Friday, September 16, 2011, and filed on**  
11      **Monday, September 19, 2011.**

12   **2. RESPONSE TO COMPANIES' SUPPLEMENTAL ANALYSES**

13   **Q     Would you briefly describe the Companies' Supplemental Analyses?**

14   **A     The Supplemental Analyses revisited the cost of controls at the Cane Run units**  
15      **and the Companies' forecasted coal and natural gas prices, and attempted to**  
16      **justify not proposing selective catalytic reduction (SCR) at the Brown 1 & 2, Mill**  
17      **Creek 1 & 2, and Ghent 2 units, and set forth a sensitivity regarding ongoing**  
18      **capital and fixed O&M costs.**

19   **Q     Which elements of the Companies' Supplemental Analyses will you address?**

20   **A     I will be addressing the revisited natural gas price forecast employed in the**  
21      **Supplemental Analyses and the fundamentally erroneous method by which the**  
22      **Companies conducted the sensitivity analyses.**

23   **Q     Have the Companies considered additional natural gas price forecasts**  
24      **beyond those contemplated in the 2011 Compliance Plan?**

25   **A     Yes, although it is not clear from this analysis the extent to which the Companies**  
26      **regard these third-party forecasts as serious alternatives. The Companies indicate**  
27      **that one of the three alternative forecasts shown here, a composite between the**

1 Wood Mackenzie and PIRA forecasts “contains price forecasts that are updated  
2 versions of the forecasts used in the 2011 Compliance Plan” (p5). Although the  
3 Companies provide the Wood Mackenzie natural gas forecast, it is not clear that  
4 they actually used this lower price in their revised forecast. Indeed, the only  
5 information about the new natural gas forecast is that “the longer-term portion of  
6 the gas price forecast was developed by PIRA;” however, neither the new forecast  
7 nor the PIRA forecast were made available for analysis or critique.

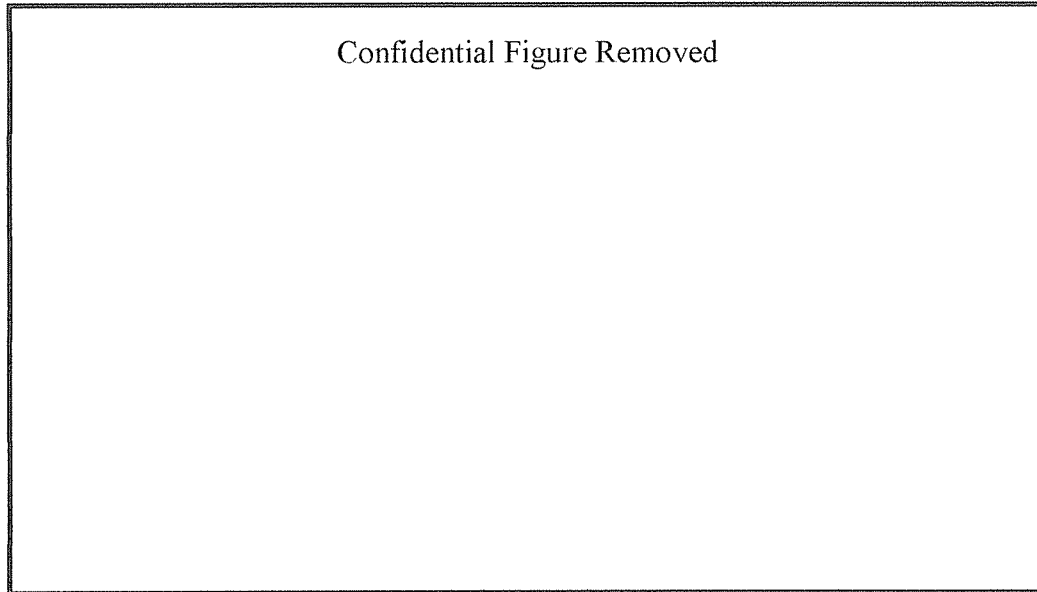
8 **Q How does the new forecast compare against the older forecast used in the**  
9 **2011 Compliance Plan?**

10 **A** It appears that the new natural gas forecast is lower than the forecast used in the  
11 Companies’ initial filings. In Table 5 of the Supplemental Analyses, the  
12 Companies show the “PVRR of Installing Controls vs. Retiring and Replacing  
13 Capacity” with their new forecast (“2011 Wood Mac / PIRA”), as well as two  
14 independent forecasts from Wood Mackenzie and IHS CERA. In all cases, the  
15 relative economic merit of maintaining any of the existing coal plants decreases  
16 relative to estimates in the initial docket (the “Base Case”). As explained in my  
17 direct testimony, the lower gas prices forecasted by multiple parties would reduce  
18 the relative merit of retaining existing coal plants.

19 While I can infer that the Companies have lowered their forecast, it is not clear  
20 what their new forecast actually is or how it compares against other analysts’  
21 projections—even in confidential documents, the Companies have redacted their  
22 gas price.

23 It appears, however, that the Companies’ new gas price is probably still higher  
24 than many other analysts’ projections. In Table 5 of the Supplemental Analyses,  
25 the Companies show the results of their PVRR analysis for two other gas price  
26 forecasts – the 2011 Wood Mackenzie and 2011 CERA forecasts. In both of these  
27 cases, the relative economic merit of all of the coal plants are again depressed,  
28 and in these cases the merit is depressed further than with the 2011 Wood Mac /  
29 PIRA price.

1 While the Companies did not provide the PIRA or CERA prices, it did provide  
2 the Wood Mackenzie forecast, which I have shown in **Figure 1** below and in  
3 confidential **Exhibit JIF-S1**.



4

5 **Figure 1. Henry Hub Natural Gas Price Comparisons, including the Companies' Base Case**  
6 **(KU/LGE HH Price) and the Wood Mackenzie forecast.**

7 The 2011 Wood Mackenzie natural gas price forecast falls at the high end, but  
8 within the bounds of forecasts by other analysts.

9 In order, the relative economic merit of coal decreases from (a) the Company's  
10 Base Case (2011 Compliance Plan in the original docket) to (b) the 2011 Wood  
11 Mac / PIRA case (the new forecast) and then to (c) the Wood Mackenzie price.  
12 Therefore, I would infer that the Companies' new, non-disclosed, gas price  
13 forecast is between their Base Case and the Wood Mackenzie forecast.

14 Roughly interpolating from the NPVRR results, I estimate that the new natural  
15 forecast is closer to the Companies' Base Case than the Wood Mackenzie  
16 forecast. As the Wood Mackenzie forecast is at the high end of the gas prices  
17 contemplated here, it appears that the Companies' new forecast is probably also  
18 well above the bounds of most other analysts.

1 **Q How does your recommended gas price compare against the forecasts shown**  
2 **by the Companies in these Supplemental Analyses?**

3 **A** The forecast I recommended in direct testimony nets a very similar PVRR result  
4 as the results from the 2011 IHS CERA price shown in Table 5 of the  
5 Supplemental Analyses. I therefore infer that our recommended price is probably  
6 similar to the CERA forecast. However, what we consider a “middle” estimate of  
7 gas price forecasts, the Companies show as the lowest price contemplated and  
8 dismissed.

9 **Q On what basis do you believe that the Companies use a “fundamentally**  
10 **erroneous method [to] conduct sensitivity analyses”?**

11 **A** The Supplemental Analyses provided by the Companies on September 14<sup>th</sup> is the  
12 second “sensitivity” provided by LG&E/K. The first,<sup>1</sup> dated July 2011, suffered  
13 from similar fundamental flaws. In both cases, the Companies have evaluated  
14 critical sensitivities independently, rather than in concert. Individually, the  
15 Companies have claimed that any given higher capital or operating expense, or  
16 any lower gas price, or any higher coal price would not trigger a different  
17 investment decision, and yet it is eminently clear from the Companies’  
18 Supplemental Analyses that combinations of these sensitivities would result in  
19 completely different decisions on the Companies’ part. The Companies, however,  
20 never looked at these sensitivities in concert, severely underestimating the  
21 cumulative costs of keeping these units compliant with environmental regulations.

22 With the Companies’ new gas price forecast in this Supplemental Analyses  
23 (comparatively still high) the cost of an SCR unit (\$195 million PVRR) renders  
24 Brown 1 & 2 non-economic (from a net benefit of \$153 million to a net loss of  
25 \$42 million). Any lower gas price, as suggested by many other analysts (ourselves  
26 and CERA included) would render Brown 1 & 2 non-economic even in the  
27 absence of an SCR requirement.

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<sup>1</sup> Provided in response to SC/NRDC Production of Documents Question 16

1 This simple comparison does not even contemplate the Companies' uncertainty in  
2 future capital and O&M expenses or the absence of a CO<sub>2</sub> mitigation cost,  
3 combinations of which impose dramatically higher costs on the Companies' fleet  
4 that should alter their decision-making process. I would strongly recommend that  
5 the Commission deny Certificates of Public Convenience and Necessity (CPCN)  
6 and environmental surcharges for the Brown 1 & 2 units and require the  
7 Companies to run these sensitivities in concert to better characterize the risks  
8 facing their fleet, especially Mill Creek 1 & 2.

9  
10 **Q Have you reviewed the Companies' claim that SCR will not be required for**  
11 **the Brown 1 & 2 units?**

12 **A:** I have not had the opportunity to thoroughly review this claim. However, the  
13 Companies claim that "because of their size, installing SCRs on Brown 1-2 would  
14 have a limited impact on the Companies' overall NO<sub>x</sub> emissions and would be the  
15 least desirable option for further reducing NO<sub>x</sub> emissions." (p10 Supplemental  
16 Analysis). Compliance with NAAQS is not determined on a Company-wide basis.  
17 Rather, the standard is imposed on, as the title implies, ambient air quality - or the  
18 quality of air at a specific location. Therefore, if there are counties or regions that  
19 are in non-attainment of current or future NAAQS, it is the Kentucky Energy and  
20 Environment Cabinet or the U.S. Environmental Protection Agency, not the  
21 Companies, that will determine if a stationary source contributes to the violation  
22 of the standard. In plain language, if the Brown 1 & 2 units, or any other unit in  
23 the Companies' portfolio contributes substantively to ambient air violations,  
24 the Commonwealth can require that the units control emissions to meet that  
25 standard.

26  
27 The only opportunity given to the Company to "trade" NO<sub>x</sub> allowance  
28 requirements within their own fleet is under the auspices of the Cross State Air  
29 Pollution Rule (CSAPR). The current rule was crafted, in part, to allow states to  
30 meet the less stringent 1997 ozone NAAQS, at 0.080 ppm. This rule does not



1 consider the stricter 2008 promulgated standard of 0.075 ppm (of which multiple  
2 Kentucky counties are in non attainment), or the proposed strengthening to 0.060  
3 - 0.070 ppm currently under consideration. For Kentucky to meet its own  
4 compliance obligations under the newer standards, it may have to pursue deeper  
5 NOx cuts from specific stationary sources *at specific sites*, and I would anticipate  
6 that Brown 1 & 2 are reasonable targets for NOx reductions. Therefore, it is  
7 unreasonable for the Companies to dismiss the risks of SCR requirements at  
8 Brown 1 & 2 simply on the basis of the current CSAPR allocations without  
9 reviewing the mechanisms by which the Commonwealth will meet new and  
10 impending NAAQS.

11 **3. CORRECTION TO DIRECT TESTIMONY AND NATURAL GAS PRICES**

12 **Q In your direct testimony, you noted that prior to submitting that testimony**  
13 **you had “discovered an error in our gas price input to the Strategist model.”**  
14 **Would you explain this error?**

15 **A** Yes. In our re-analysis of the Companies’ 2011 Air Compliance Plan, we inputted  
16 a new natural gas price forecast into the Strategist model, replacing the  
17 Companies’ forecast. When we extracted the delivered price of gas from the  
18 Strategist model, we erred on two counts: first, we assumed the prices were in  
19 \$/MMBtu when they were in fact in \$/MCF; second, we did not notice until later  
20 that the model gas prices represent the highest monthly price, not the annual  
21 average price (as typically represented by Henry Hub price forecasts).

22 My colleague Ms. Wilson can speak to the discovery of these adjustment factors  
23 in the Strategist model.

24 **Q How did you correct this error?**

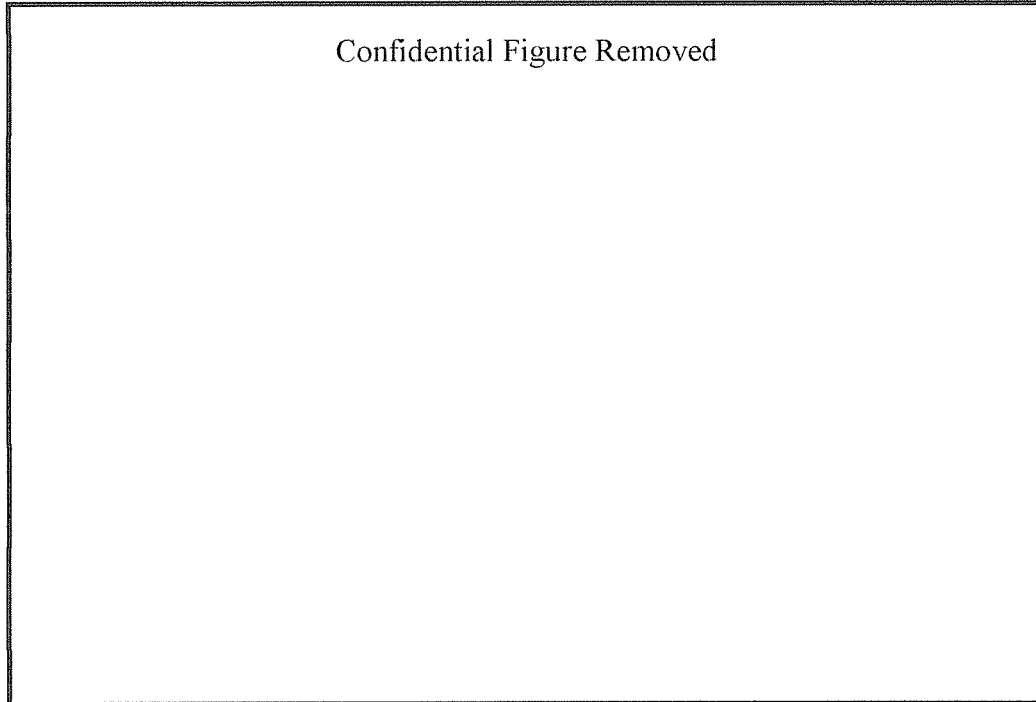
25 **A** First, we converted prices back to \$/MMBtu. Second, we extracted the seasonal  
26 gas price adjustment factors used by the Companies to adjust from the highest  
27 price month to monthly prices. We obtained the average of these factors on an  
28 annual basis (2010-2025), assuming that the average roughly represents the  
29 deflator from the highest price month to the annual average price. Next, we

1 adjusted the “high” delivered price forecast (in \$/MMBtu) to the annual average  
2 price, and examined the difference between this price and the Companies’ Henry  
3 Hub forecast (p4 of the Sensitivity Analysis). We assumed the resulting [REDACTED] to  
4 [REDACTED] adder was the local delivery cost, relative to the Hub price. This cost is  
5 similar to the premium estimated by the EIA for electric generation in East South  
6 Central region (including KY) relative to Henry Hub in 2010.

7 We then reversed this process for our recommended Henry Hub price, adding the  
8 delivery charge, dividing by the seasonal adjustment factor, and converting back  
9 into \$/MCF. This revised value was exported back to the Strategist model.

10 **Q How does your revised estimate compare to your erroneous input?**

11 **A** The answers are quite close. By virtue of having estimated a larger adder  
12 previously, in addition to the \$/MCF conversion error, we previously input a  
13 delivered gas price into Strategist approximately 1.6% to 8.3% too high, as shown  
14 in **Figure 2** below, and confidential **Exhibit JIF-S2**.



15

16

**Figure 2. Revised Delivered Natural Gas Price.**

1    **Q**    **What is the result of using this revised price in the Companies' retire/retrofit**  
2           **analysis?**

3    **A**    The resulting analysis is similar to our direct testimonies. **Exhibit JIF-S3** replaces  
4           the original **Exhibit JIF-2**. There are differences in Boxes 3 and 6-8. There are  
5           two notable shifts: first, in Box 3, Brown 1 & 2 becomes demonstrably non-  
6           economic by virtue of a revised gas price alone; second, in requiring SCR at Mill  
7           Creek 1 & 2, the net benefit at these units shrinks to a marginal \$55 million –  
8           leaving very little headroom for non-contemplated capital expenses, higher than  
9           expected operational costs, or any form of CO<sub>2</sub> price.

10           Overall, my recommendation does not change based on this revised analysis.

11   **Q**    **Does this conclude your testimony?**

12   **A**    It does.

**Net Present Value Revenue Requirement (NPVRR) of  
 Installing Controls vs. Retiring and Replacing Capacity (Million 2010\$)**  
 Supplemental Analysis - September 23<sup>rd</sup>, 2011

Original KU/LG&E Analysis

KU / LG&E Assumptions		Box 1
Original		
CPCN Results		
Tyrone 3		-13
Green River 3		-80
<b>Brown 3</b>		<b>601</b>
Cane Run 4		-88
Cane Run 5		-8
<b>Brown 1-2</b>		<b>228</b>
Cane Run 5		-58
Ghent 3		914
Ghent 1		794
Green River 4		-110
Mill Creek 4		859
Trimble County 1		993
Ghent 4		1,155
Mill Creek 3		756
Ghent 2		1,139
Mill Creek 1-2		1,022

KU / LG&E Assumptions		Box 2
Original, Formula Corrected		
CPCN Results, Landfill Year Corrected		
Tyrone 3		-13
Green River 3		-80
<b>Brown 3</b>		<b>603</b>
Cane Run 4		-87
Cane Run 6		11
<b>Brown 1-2</b>		<b>230</b>
Cane Run 5		-57
Ghent 3		921
Ghent 1		800
Green River 4		-110
Mill Creek 4		859
Trimble County 1		996
Ghent 4		1,161
Mill Creek 3		756
Ghent 2		1,146
Mill Creek 1-2		1,022

Key	
If NPVRR relative to no retirement scenario	
≥ \$40 M, retrofit	100
< \$40 M & ≥ \$0 M, high risk retrofit	20
< \$0 M, retire	-80

\*Revised Natural Gas Forecast

Synapse Re-Analysis  
 Single Variable Correction

Synapse Re-Analysis		Box 3
A		
Corrected Gas Price *		
Tyrone 3		-69
Green River 3		-76
<b>Brown 3</b>		<b>270</b>
Cane Run 4		-245
Cane Run 6		-159
Brown 1-2		-27
Cane Run 5		-243
Ghent 3		427
Ghent 1		300
Green River 4		-132
Mill Creek 4		321
Trimble County 1		549
Ghent 4		595
Mill Creek 3		324
Ghent 2		602
Mill Creek 1-2		315

Synapse Re-Analysis		Box 4
B		
SCR at Brown 1 & 2, Ghent 2, and Mill Creek 1 & 2		
Tyrone 3		-13
Green River 3		-80
<b>Brown 3</b>		<b>603</b>
Cane Run 4		-87
Cane Run 6		11
Brown 1-2 (+SCR)		34
Cane Run 5		-57
Ghent 3		921
Ghent 1		800
Green River 4		-110
Mill Creek 4		859
Trimble County 1		996
Ghent 4		1,161
Mill Creek 3		756
Ghent 2 (+SCR)		858
Mill Creek 1-2 (+SCR)		762

Synapse Re-Analysis		Box 5
C		
Synapse Mid CO2 Price		
Tyrone 3		-69
Green River 3		-100
<b>Brown 3</b>		<b>249</b>
Cane Run 4		-268
Cane Run 6		-260
Brown 1-2		18
Cane Run 5		-237
Ghent 3		323
Ghent 1		262
Green River 4		-128
Mill Creek 4		290
Trimble County 1		563
Ghent 4		550
Mill Creek 3		340
Ghent 2		576
Mill Creek 1-2		299

Synapse Re-Analysis  
 Multiple Variable Correction

Synapse Re-Analysis		Box 6
A + B		
Corrected Gas Price* + SCR		
Tyrone 3		-69
Green River 3		-76
<b>Brown 3</b>		<b>270</b>
Cane Run 4		-245
Cane Run 6		-139
Brown 1-2 (+SCR)		-22
Cane Run 5		-243
Ghent 3		427
Ghent 1		300
Green River 4		-132
Mill Creek 4		321
Trimble County 1		549
Ghent 4		595
Mill Creek 3		324
Ghent 2 (+SCR)		314
Mill Creek 1-2 (+SCR)		55

Synapse Re-Analysis		Box 7
A + C		
Corrected Gas Price* + CO2 Price		
Tyrone 3		-67
Green River 3		-133
Brown 3		-217
Cane Run 4		-444
Cane Run 6		-499
Brown 1-2		-267
Cane Run 5		-469
Ghent 3		-89
Ghent 1		-170
Green River 4		-191
Mill Creek 4		-245
<b>Trimble County 1</b>		<b>98</b>
Ghent 4		-145
Mill Creek 3		-97
Ghent 2		0
Mill Creek 1-2		-424

Synapse Re-Analysis		Box 8
A + B + C		
Corrected Gas Price* + SCR + CO2 Price		
Tyrone 3		-67
Green River 3		-133
Brown 3		-217
Cane Run 4		-444
Cane Run 6		-499
Brown 1-2 (+SCR)		-463
Cane Run 5		-469
Ghent 3		-89
Ghent 1		-170
Green River 4		-191
Mill Creek 4		-245
<b>Trimble County 1</b>		<b>98</b>
Ghent 4		-145
Mill Creek 3		-97
Ghent 2 (+SCR)		-288
Mill Creek 1-2 (+SCR)		-685