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To: William R. Lloyd, Esq.; Pennsylvania Office of Small Business Advocate  
From: Bob Knecht; Industrial Economics, Incorporated (“IEc”)  
RE: Comments on Fuel Switching Cost-Benefit Analysis  
Date: February 11, 2010

### ***Background***

On January 7, 2010, Ms. Karen Moury, Executive Director, Pennsylvania Public Utility Commission (“Commission”), circulated an e-mail regarding a meeting held by the Fuel Switching Working Group held on January 6, 2010. The e-mail indicated that the Commission is considering whether fuel switching programs should be included as part of the energy efficiency and conservation (“EE&C”) programs of the Pennsylvania electric distribution companies (“EDCs”). The e-mail further indicated that the Working Group believed that cost-benefit analysis of fuel switching programs would be useful to the Commission in making its evaluation. A committee (“Committee”) of the Working Group was tasked to develop cost-benefit evaluations for five specific fuel switching programs.<sup>1</sup>

On January 26, 2010, Ms. Moury circulated what I understand to be the work product of the Committee. It included a January 25, 2010 letter from Mr. Mark Morrow to Ms. Moury, five undated MS Word summaries of the fuel switching programs evaluated, and nine MS Excel spreadsheets purportedly presenting the analysis prepared by the Committee.

OSBA requested that I provide comments on these materials. My comments are primarily general and methodological, and are based on an abbreviated review.<sup>2</sup> A detailed analysis of the specific numbers used by the Committee was not warranted for this assignment.

### ***Comments***

#### **1. Perspective**

The Committee’s memo begins with a perspective that electric generation involves substantial process energy losses. As a factual matter, this assertion is certainly true for fossil fuel and other thermal generating stations. The thermal efficiency (the ratio of useful electric energy out to thermal energy in) of a coal-fired generating station is generally less than 35 percent, and a combined cycle natural gas facility may achieve 50 percent. In addition, some electric energy is lost in the transmission and distribution systems. (Natural gas is also both consumed and lost in the transmission and distribution processes.)

As an economic matter, these losses are irrelevant. Coal, nuclear, and wind energy resources cannot directly run air conditioners, water heaters, dryers, or home heating

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<sup>1</sup> A copy of Ms. Moury’s explanatory e-mail is attached to the end of this memo.

<sup>2</sup> Mr. Morrow’s letter invited Working Group participants to submit questions to Mr. Paul Raab, who prepared the analyses. I was unable to take advantage of this option within the scope of my assignment.

furnaces. In a cost-benefit analysis, the issue is incremental cost. For fuel switching from electric to gas, the correct comparison is whether the incremental cost of installing and using gas-fired equipment is less than the incremental costs associated with the electric equipment.

It can, of course, be argued that the use of natural gas imposes lower environmental externality costs on society than electric supply, and that these costs are not reflected in prices. For certain forms of electricity generation, this assertion may very well be true. However, Act 129 specifies the use of a total resource cost (“TRC”) test for evaluating the economic efficiency of EE&C programs that does not consider environmental or other externality costs.

As such, I conclude that the Committee’s representations in this area are not relevant.

## **2. Incentives**

The Committee’s cover letter goes on to comment on program incentives for fuel-switching programs and the free-rider problem. A free-rider problem exists when customers are given incentives to participate in a utility-sponsored energy efficiency program when they would have made the same energy efficiency improvements without the incentives. The Committee opines that, the higher the incentives are as a percentage of program measure, the less likely is the free rider problem. I can neither agree nor disagree. Program incentives are set by program designers, and may very well be based on a rigorous analysis of the level of incentive necessary to obtain participation.

On the other hand, because utilities can recover the costs of incentives from other ratepayers (and, under Act 129, face penalties if they do not get sufficient customers to participate), the incentives may simply all be set too high. Or the incentives may be targeted at programs that are the most cost-effective, in order to ensure that mandated energy reduction targets are met, despite the fact that customers are more likely to participate in the most effective programs without incentives.

More importantly, for the TRC test, the level of incentives is irrelevant. The incentive is an economic transfer from ratepayers who do not participate in the EE&C programs to those customers who do. The net TRC test cost of the incentive is zero.

The Committee prepared its analysis assuming that the incentive for residential programs equals 100 percent of the ratepayer cost of the conversion. The Committee appears to argue that because this incentive is set high, the free-rider problem is minimized. This argument is logically backward. Setting a high incentive does not mean there are no free riders. A high incentive may possibly be necessary if customers are not making economically efficient conversions from electric to gas with lower incentives. However, the Committee offers no evidence that more modest incentives would not be equally effective.

Setting incentives that high will (a) almost guarantee that free rider problems exist, because the incentives are likely set higher than they need to be to induce conversion, (b) create a large negative impact on non-participating ratepayers, and (c) make the fuel switching programs look quite attractive for participants relative to other options.

Since the analysis submitted by the Committee is prepared for a single customer, I think the issue of the incentive should be dropped. This will focus the comparison on the economics

of the comparison, rather than who is paying for it. Such an approach would be consistent with the TRC test mandated by Act 129.

### 3. Alternatives Analyzed

As I understand it, the objective of this analysis is to inform the debate as to whether fuel switching programs should be components of EDCs' EE&C plans. It therefore would seem appropriate to prepare an analysis of the relative economic efficiency of fuel switching programs with other EDC EE&C options. If the fuel switching options are materially more economically attractive than other EE&C programs, an economic case can be made to include them in the EE&C plans.<sup>3</sup>

For the most part, the documentation from the Committee does not directly state what options the cost-benefit analyses are intended to compare.<sup>4</sup> For example, is the water heater test a comparison of a conversion from an average or low efficiency electric water heater to a high efficiency gas water heater? If so, it is not clear to me that the analysis is addressing the correct question. A more useful analysis would be a TRC analysis of whether the conversion from an existing electric water heater to a high efficiency gas water heater is more or less attractive than a conversion to a high efficiency electric water heater. If conversion to high efficiency gas appliances is much more efficient on a TRC basis than conversion to high efficiency electric appliances, the Commission may deem fuel switching to be a viable option for achieving the goals of Act 129. If, however, the benefits of converting to either type of high-efficiency appliance are similar, the Commission may be concerned about including a fuel switching option that may serve to benefit gas ratepayers and NGDCs at the expense of electric ratepayers.

In light of the limited explanatory materials, I attempted to review some of the underlying assumptions in a few of the analyses, including hot water heaters, dryers and space heating. While I am not certain I fully understand the details, it appears that a comparison is not being made of high efficiency options, but rather a comparison of standard efficiency electric versus standard efficiency gas. In addition, the analysis does not appear to contemplate *conversion*. Instead, it appears to include the avoided cost of standard efficiency electric equipment as a savings.<sup>5</sup> If the electric equipment is being replaced,

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<sup>3</sup> I cannot comment on the legal requirements of Act 129. However, from a lay perspective, Act 129 mandates a reduction in electricity consumption, and does not impose a similar mandate on gas consumption. Moreover, energy efficiency gains typically involve the substitution of capital and labor for energy, wherein customers purchase new, more efficient and more expensive equipment to reduce energy costs. Finally, Act 129 mandates that an economic test be used to evaluate the programs. Because both substitution and energy efficiency are integral components of Act 129, a credible economic argument can be made that substitution to an alternative fuel is not inconsistent with the legislation.

<sup>4</sup> Mr. Morrow's letter indicates that the Micro-CHP program is compared to a standard efficiency furnace.

<sup>5</sup> For example, in the water heater comparison, the Committee reports that the cost of a new gas hot water heater is \$900, and the gas fuel costs have an NPV of \$2,510. The benefits, in terms of avoided costs, are \$8,758 in avoided NPV electricity costs plus \$800 as the cost of a new electric water heater.

there is no savings (at least immediately), unless the only replacements that are occurring are those that would otherwise take place.

I recommend that the Working Group provide a clear explanation as to what options are being compared in the cost-benefit analysis. I also recommend that the economics of the fuel switching option be (a) based on the adoption of high efficiency gas equipment, and (b) be compared to the next best all electric option. Furthermore, the comparison should be clear about what is assumed with respect to avoided electric equipment costs.

#### **4. Alternative Benefits Tests**

Rather than only providing the TRC test results (which is the metric mandated by Act 129), the Committee offers five other tests. For the most part, I do not believe that these tests provide useful information for evaluating fuel switching. They also appear to contain a variety of assumption and calculation errors.

*Participant Test:* This test compares the benefits and costs to the participant. The result of this type of analysis seems obvious without the need for a test, particularly with the incentive assumption used by the Committee. If a heavily-subsidized program is not economically attractive to the participant who receives the subsidy, it is most unlikely that the program will be economic on a TRC test basis.

*Rate Impact Test:* The impact of a fuel switching program on rates is not easy to calculate. By definition, fuel switching will reduce electric consumption and increase gas consumption. From the perspective of electric ratepayers, near-term rates will increase to (a) accommodate lost distribution revenue related to the downturn in consumption, and (b) pay for the incentives. Gas ratepayers may see a near-term rate decrease related to increased distribution revenues, if incremental distribution costs are not incurred. The Committee's analysis appears to address this complexity by assuming most of the problems away. The Committee does not appear to distinguish between marginal rates (i.e., the energy-related charges in utilities' tariffs) and marginal costs (i.e., the actual variable cost associated with utility supply). With these assumptions, the rate impact test should simply boil down to the cost of the incentive program, because marginal costs and marginal rates would offset. However, the Committee appears to have excluded increased marginal cost that the gas utility would incur as a result of the program, for reasons I do not understand and are not explained.

In general, I believe a rate impact test has some merit for evaluating EE&C programs. Many of these programs are economically efficient in aggregate (under the TRC test), but involve significant transfers from non-participating ratepayers to participating ratepayers. However, for EE&C programs, the General Assembly did not require a rate impact test. Some protection for non-participating ratepayers is embodied in the provision that the EE&C program costs cannot exceed 2.0 percent of EDC annual revenues, although EDCs have virtually no incentive to keep total program costs below that cap.

Furthermore, while a rate impact test may have merit, I do not believe that the version presented by the Committee is sufficiently accurate to add value.

*Program Administrator Test:* The program administrator test appears to be similar to the TRC except that it excludes costs borne directly by plan participants. I see little reason for

ignoring the cost impact on plan participants when evaluating whether fuel switching is a reasonable conservation program. It is like looking at half of the economic equation.

*Primary Fuel Utility Test:* This test purportedly measures the impact on the EDC, comparing avoided costs to the incentive costs of the program. For example, Mr. Morrow says that this test when applied to water heaters “suggests that the costs incurred by EDC customers as a result of the proposed incentive will be greatly outweighed by the energy cost savings.” Based on my interpretation of the analysis presented by the Committee, I do not believe Mr. Morrow’s interpretation is correct. This test appears to demonstrate that when a customer is paid to convert to gas, the reduction in electric costs experienced by the EDC is greater than the cost of paying the customer to convert. This test appears to ignore the impact on EDC revenues, the impacts on the NGDC, and the impacts on the ratepayers. Based on my understanding, I see no relevance to this test.

*Alternate Fuel Utility Cost Test:* This test appears to simply measure the increased costs incurred by the gas utility. It also ignores revenue changes, impacts on the EDC and impacts on all ratepayers. As with the Primary Fuel Utility Test, I see no relevance to this test.

## **5. Analytical Assumptions**

As noted earlier, I have not reviewed the analysis in detail. However, I make the following notes based on my limited review.

At least for the hot water heater and dryer analyses, the Committee appears to use 13.6 cents per kWh for electric service (both marginal rate and marginal cost), and \$9.03 per mmbtu for natural gas in 2010. No citations support these values that I found in my limited review. Moreover, it appears that the electric rate increases by 135% in inflation-adjusted terms over 15 years, while the gas rate increases by 48%. (This differential appears to be related to an extraordinary jump in electric costs between 2019 and 2020, which is unexplained.) I am unsure why such a divergence between electric and gas rates is assumed.

Also, the Committee assumes that the cost of capital for both a utility and a customer are the same, at 9.0 percent nominal or 5.8 percent real. Neither assumption appears to be reasonable. Marginal utility costs of capital are likely to be below that figure, while marginal small business costs of capital are likely to be higher.

### ***Summary***

1. Philosophically, I believe that consideration of high-efficiency gas appliances as an alternative to electric appliances can have a place in an EE&C program. Act 129 mandates that the economic evaluation of options be based on the TRC test. The TRC test considers incremental actual costs, and it ignores offsetting transfers (e.g., the incentive paid by EDC ratepayers to participating customers). It should serve as the basis for evaluating fuel switching options.
2. To the extent that the Commission does permit fuel switching as an option within EE&C plans, I do not believe that the Commission should either encourage or discourage fuel switching. Instead, each specific fuel switching proposal should compete against the other potential EE&C programs considered by the EDC. The competition should be based on the

TRC test result for the fuel switching proposal in comparison to the TRC test results for each of the other potential EE&C programs.

3. Unless and until the legislature mandates some kind of social welfare test, neither the btus of fuel consumed nor the tons of carbon emitted are relevant to the analysis, except to the extent they are already reflected in incremental costs. Cost-benefit analyses should be based on actual costs and benefits, consistent with the TRC methodology.
4. In the TRC test, incentives are irrelevant, and I suggest that they be dropped from this analysis. Moreover, by setting the incentives at 100 percent of the participant's cost, the Committee's analysis may be inflammatory and counter-productive. To the extent that the Commission allows fuel switching programs, incentives should be established in the same way other EE&C program incentives are established. Preferably, these incentives would be limited to those necessary to get customers to participate.
5. I believe that the analysis would be more credible if cost-benefit comparisons were made between (economically efficient) high-efficiency options, not standard efficiency options. A comparison of average efficiency gas versus average efficiency electric does not appear to be consistent with the spirit of Act 129. The Committee's approach is only reasonable if the economics of standard efficiency replacement equipment are better than those of high efficiency replacement equipment.
6. The various tests posited by the Committee other than the TRC test do not add value. A properly constructed ratepayer impact test may have theoretical merit, but the analysis presented thus far by the Committee is inadequate to the task.
7. The parameters used in the analysis provided thus far are simplistic and appear to contain significant and unexplained biases in favor of the fuel switching option.

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**From:** Moury, Karen

**Sent:** Thursday, January 07, 2010 5:24 PM

**To:** 'Baer, Amy A.'; 'Biggica, Russell J.'; 'Bonner, Tom'; Brown, Kriss; 'Brown, Ruben S.'; 'bugattitype35@hotmail.com'; 'Clark, Donna'; 'Cleff, Pete'; 'Cochrane, Jacqueline'; 'Costlow, John'; 'Epstein, Eric J.'; 'Gallagher, Theodore J.'; 'Garfinkle, Jack'; 'Gay, Anthony E.'; 'Gerhard, John C.'; Gill, Darren; 'Godlasky, Lawrence'; 'Grabiak, Terri'; Griffiths, Daniel; Guttman, Maureen; 'Hartz, Lee E.'; 'Jack, Gary'; 'Jiruska, Frank'; 'Kolich, Kathy J.'; 'Lane, Courtney'; Lloyd, William (DCED); 'Lutz, Teri'; 'MacWilliams, Kathleen'; 'Markey, Karen'; 'Menhorn, Cindy'; 'Miller, Ed'; Miller, John; 'Mincavage, Charis'; 'Naum, Barry'; 'O'Leary, Michael'; 'Pearson, Arthur'; 'Quinn, John'; 'Reiley, Jim'; 'Robinson, Ted'; 'Rundy, Eric'; 'Saad Syed'; 'Serra, Janice'; 'Shellenhamer, Diane'; 'Smith, Mark W.'; 'Stanton, Patrick'; 'Szykman, Paul J.'; 'Terpin, Patty'; 'Tran, Thu'; 'Trufahnestock, Peter'; Williams, Wayne; Wilson, Robert; Pankiw, Bohdan; Young, Robert F; Fink Smith, Louise; Gebhardt, Scott

**Cc:** Hess, Lou Ann; Pyle, Cherie

**Subject:** Fuel Switching Working Group - Recap of January 6, 2010 Meeting

Good afternoon. This is to briefly recap the meeting of the Fuel Switching Working Group held on January 6, 2010 at 10:00 in Harrisburg.

The discussion centered on both policy and technical issues. The policy questions are whether the PUC should permit, encourage, or require electric distribution companies (EDCs) to include fuel switching programs as part of their portfolio, and if so, if a certain amount of the portfolio should be comprised of such programs. Resolution of the policy issues to some extent hinges upon technical analyses of the cost-benefits of specific fuel switching programs.

While some participants in the Working Group favor the mandatory inclusion of specific fuel switching programs in the future, replacing other programs that were approved as part of the energy efficiency and conservation programs for this year, the EDCs took the position that inclusion of such programs should be optional. Some participants suggested that incentives be offered to encourage EDCs to incorporate or expand such programs.

Since cost-benefits analyses are necessary or would at least be useful to the PUC in making policy determinations on this topic, and the EDCs expressed the consensus view that such programs be optional, a committee of the Working Group was formed to review the costs, savings, etc. for five specific fuel switching programs (water heating; heating and air conditioning; C&I combined heat and power; residential micro CHP; and one other program). The committee will identify necessary TRM and TRC additions and provide the data to support them.

The committee is comprised of representatives of UGI, The ECubed Company LLC and the Sustainable Energy Fund. CEEP will provide proxy "avoided cost data", natural gas price projections for a 15-year period, and T&D line losses average data to the committee.

The committee will provide its work product by January 22. Other members of the Working Group will have until February 12 to offer feedback or comments. We will then discuss at the next meeting on February 26.

Other outstanding issues that we will follow up on at the PUC include: (1) "Treatment of incentives as costs relative to the TRC Test," from pages 27-28 of PPL Order; and (2) Fuel Conversion Audits/Standards, i.e. First Energy Order at page 11.

The next meeting will be held on Friday, February 26, 2010, at 10:00 a.m., Keystone Building. Business casual attire will be observed. Call in information will be the same as this week's meeting: 1-866-618-6746; Access Code: 6060145.

Thanks, everyone.

Karen