



## RCI ASSUMPTIONS MEMORANDUM

**To:** Arkansas Governor's Commission on Global Warming: Residential, Commercial and Industrial Technical Workgroup (RCI TWG)

**From:** Hal Nelson

**CC:** Tom Peterson, Randy Strait

**Subject:** Assumptions used in the quantification of options for the RCI TWG

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This memo outlines proposed data sources used to quantify the greenhouse gas (GHG) impacts and costs for those RCI TWG policy options that are considered amenable to quantification. The memo will be reviewed in an upcoming TWG call so that comments on the assumptions may be made and alternative data sources recommended for TWG approval. Any changes to this memo will be incorporated and the revised memo will be used as documentation for the modeling results.

The scope of this memo only covers the major assumptions directly related to the quantification of the RCI policy options. Recall that the emissions reductions and costs in the quantification of the policy options occur against the backdrop of the inventory and forecast. The effects of the policy options are therefore incremental to the activity projected under the inventory and forecast. The assumptions embedded in the AR draft Inventory and Forecast were reviewed at during the July 1, 2008 RCI TWG call.

### Quantification Process

The assumptions delineated in the following document are for the quantification of the policy options developed by the RCI TWG. This quantification of costs and CO<sub>2</sub> reductions entails the following steps:

- Develop stand-alone cost estimates for each quantifiable option
- Once completed, the stand alone options will be adjusted to reflect existing actions such as current utility demand side management (DSM) programs.
- Options will be also be modified to reflect overlaps within RCI options and between other TWG options. For example, the RCI policies that deploy renewable energy will be adjusted for overlaps with the Energy Supply TWG

### Methodology for Avoided Carbon Dioxide (CO<sub>2</sub>) Calculations

The CO<sub>2</sub> impacts from RCI policy options are quantified according to the following formula:

$$CO_2 \text{ Reductions} = \text{Energy efficiency deployment (GWh)} * CO_2 \text{ intensity in tons per GWh}$$

To estimate emissions reductions from policy options that are expected to displace conventional grid-supplied electricity (i.e. energy efficiency) a simple, straightforward approach is proposed. Through 2012, we assume that these policy options would displace generation from a “marginal” mix of fuel-based electricity sources comprised of 50% coal and 50% gas. This would equate to an emissions intensity of approximately .69 tonnes CO<sub>2</sub>e/MWh through 2012. (We assume that sources without significant fuel costs would not be displaced, e.g., nuclear, hydro or other renewables generation). Since most of the policy options have yet to be fully implemented by 2012, this choice of marginal mixes has only modest impact on CO<sub>2</sub> emissions.

However, after 2012, we propose that the policy options are likely to avoid a mix of new fossil fuel based capacity additions for the balance of the planning period. The thermal new build mix following 2012 is estimated to be 100% natural gas combined cycle plants according to the information currently available from the ES-7 TWG option. This would equate to an emissions intensity of approximately .40 tonnes CO<sub>2</sub>e/MWh from 2013-2025.

This approach provides a transparent way to estimate emissions reductions and to avoid double counting (by ensuring that the same megawatt hours (MWh) from a fossil fuel source is not “avoided” more than once). It can be considered a “first-order” approach; it does not attempt to capture a number of factors such as the distinction between peak, intermediate, and baseload generation; issues in system dispatch and control; impacts of nondispatchable and intermittent sources such as wind and solar; or the dynamics of regional electricity markets. These relationships are complex and could mean that policy options affect generation and emissions (as well as costs) in a manner somewhat different than estimated here. Nonetheless, this approach provides reasonable first-order approximations of emissions impacts and offers the advantages of simplicity and transparency that are important for stakeholder processes.

### **Cost Assumptions**

The cost to implement the RCI options are the net difference between the avoided costs of energy and the cost of the energy efficiency measures where:

*Net costs (benefits): Energy efficiency deployment \* (avoided cost of energy – levelized cost of measures)*

The assumptions associated with costs calculations are:

- The 2008 avoided delivered electricity cost (\$2005) is \$58.28. The 2008 avoided peak delivered electricity cost is estimated at \$74.02.<sup>1</sup>
  - The real annual % change in electricity prices is -.2% based on change in electricity prices in the SERC region 2006-2030.<sup>2</sup>
- The 2008 avoided natural gas cost (\$2005) is \$7.28.<sup>3</sup>

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<sup>1</sup> Entergy Arkansas, Inc. Docket No. 81-071-F. Public Utility Regulatory Policies Act - Section 210. Filed on June 30, 2008. Available at: [http://www.apscservices.info/pdf/81/81-071-f\\_319\\_1.pdf](http://www.apscservices.info/pdf/81/81-071-f_319_1.pdf). Avoided cost is average of all periods. Avoided peak costs is average of summer and winter peaks.

<sup>2</sup> Source: Assumptions to the Annual Energy Outlook 2008. Table 17

- The real annual % change in gas prices is .1% based on change in gas prices for all users in SERC 2006-2030.
- The levelized capital cost of electricity energy efficiency (\$2005) is \$34.10/megawatt-hour (MWh).<sup>4</sup> This includes utility fixed costs of marketing, evaluation, and administration which adds an estimate 24% to the capital costs listed in Quantec (2008). This figure represents the total utility and participant costs that are typically figured into a total resource cost measure.
- The levelized costs of natural gas efficiency is \$5.00/million MMBtu. This includes utility fixed costs of marketing, evaluation, and administration which adds an additional 24% to capital costs. This figure represents the total utility and participant costs that are typically figured into a total resource cost measure.
- The real annual change in levelized costs of energy efficiency is an assumption that the TWG will need to come to agreement on. A range of -2% to +2% is probably valid depending on how the TWG views the costs of energy efficiency equipment. There are two competing arguments one can make for this parameter. An examination of historical energy efficiency equipment, including compact florescent lights, heat pump water heaters, and other measures shows learning curves that result in capital cost reductions over time. Conversely, an aggressive energy efficiency program needs to deploy a range of measures; presumably the cheaper ones will be deployed first, and more expensive ones later on. Since the quantification uses a single cost estimate for the levelized costs of energy efficiency measures, a positive real escalation rate imputes an upward sloping “supply curve” where measures deployed later cost more. Because the planning period reaches out to 2025, this extended time period allows for this parameter to have a relatively large impact on policy cost calculations. Table 1 shows the impacts of the range of estimates for RC1-2b:

**Table 1: Impacts of Real Escalation Rates**

	Real Cost Escalator			
	-2%	0%	2%	
	2025	2025	2025	
<b>GHG Emission Reductions</b>	3.82	3.82	3.82	MMtCO <sub>2e</sub>
<b>Net Present Value</b>	-775.8	-590.1	-354.8	\$ Million
<b>Cumulative GHG Reductions</b>	26.34	26.34	26.34	MMtCO <sub>2e</sub>
<b>Cost-Effectiveness</b>	-29.45	-22.40	-13.47	\$/tCO <sub>2e</sub>

### Other Assumptions

The quantification of each of the policy options requires additional assumptions that are germane to each option and are described in detail in the policy option document. For instance, there are many building code assumptions listed in the Xpolicy tab of the quantification spreadsheet. However, the following assumptions are generic to nearly all options:

<sup>3</sup> U.S. Department of Energy, Energy Information Administration. "Natural Gas Prices." January 2008 Arkansas City Gate Price. Available at: [http://tonto.eia.doe.gov/dnav/ng/ng\\_pri\\_sum\\_dcu\\_SAR\\_m.htm](http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_SAR_m.htm).

<sup>4</sup> Quantec LLC. Joint Assessment of Energy and Capacity Savings Potential in Iowa. February 2008. No web link available.

- T&D Electricity Losses are estimated at 8.1% which is an average of 2005 & 2006 estimated losses / retail sales.<sup>5</sup>
- Real discount rate: costs and benefits from each option is discounted at a 5% real discount over the 2009-2025 period.

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<sup>5</sup> Source: US EIA State Electricity Profiles 2006. Data for Arkansas