The Center for Climate Strategies
Helping States and the Nation Tackle Climate Change

Clean and Renewable Energy (CRE) Quantification Memorandum

To: Iowa Climate Change Advisory Council

From: The Center for Climate Strategies (CCS)

Subject: Brief overview of the proposed approach for the quantification of greenhouse gas (GHG) emissions reductions associated with clean and renewable policy options in Iowa

Date: June 4, 2008

This memo outlines key elements of the approach that CCS is using to quantify the GHG impacts and costs for those CRE Subcommittee policy options that are considered amenable to quantification. The Subcommittee is encouraged to suggest modifications and additions. Members of the Subcommittee who want to suggest data for the assumptions should send their recommendations to the Subcommittee and the CCS technical team. We will compile the suggestions and facilitate a discussion on them in an upcoming conference call to gain consensus on preferred assumptions.

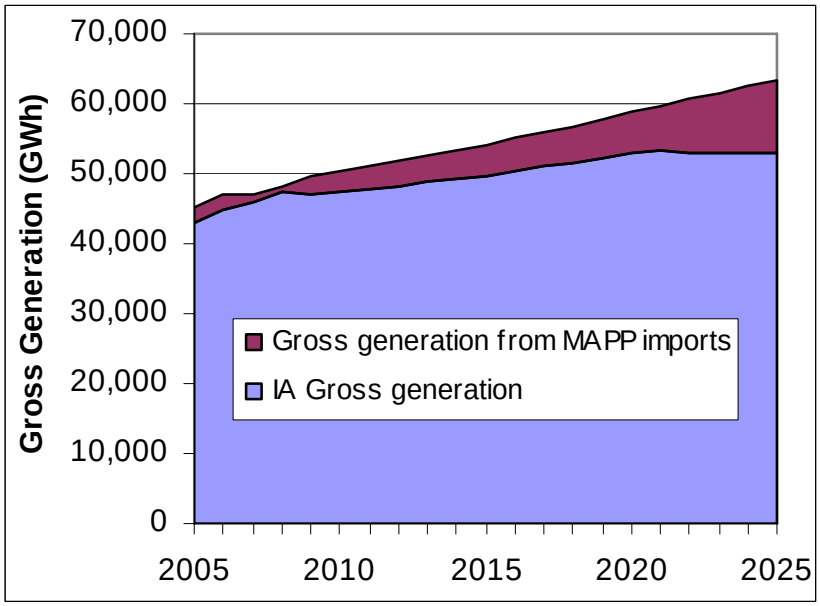
Quantifying and forecasting reductions of carbon dioxide (CO_2) from the power sector adds another layer of complexity to an already complex sector. Assumptions are important in that they are drivers of the models' cost estimates of the policy proposals. Models are representations of reality and require the best available data on likely futures. That being said, the future rarely looks like what models say it will (consider current oil prices). Thus, a premium should be placed on choosing assumptions that mesh with current conditions and near-term forecasts, as well as assumptions that are generated using local or regional data rather than national-level data.

Load growth

The most important planning variable is load growth. Load growth impounds a host of additional assumptions, including economic growth, energy efficiency deployment, migration, and others. The Annual Energy Outlook 2007 (AEO 2007) forecast shows the Mid-Continent Area Power Pool (MAPP) region demand growing at 1.1% year, while the Iowa Utilities Board (IUB) estimates for Mid-American and Interstate combined are 1.7% over the planning period. In contrast, the CRE Subcommittee is targeting energy efficiency deployment of 2% of sales by 2015 in several of its policy options. If the Subcommittee decides that it wants to do sensitivity analysis, this is one parameter that is a likely candidate for a low-medium-high range to be established.

Imports

The draft Iowa Forecast shows imports increasing from 5% to 20% of load by 2030. This is a result of the constraint in the Forecast that Iowa generation will only grow at the MAPP rate (1%). As a result, CO_2 emissions from imports climb from 1.5 metric tons in 2000 to almost 10 metric tons in 2030. The Subcommittee can discuss whether the assumed constraint on the ability of Iowa to site a new plant is congruent with current practices in the state. Similarly, does the assumption of the CO_2 intensity of .78 tons/megawatt-hour (MWh) (1,700 lbs/MWh) for imports from the MAPP region seem reasonable?



New build mix and retirements

The Subcommittee is requested to specify the mix of fossil and renewables technologies deployed to meet load growth. The Iowa Forecast shows the assumption that Iowa new build mirrors the MAPP region. The CRE Subcommittee is requested to assess this assumption under two conditions:

1. A "No Policy" case based on planned additions under business-as-usual (BAU): e.g., 50% coal, 40% gas, 10% wind.

2. The new build mix for the renewable policy options under discussion: e.g., 75% wind, 20% biomass.

Expected capacity retirements should also be reflected.

Capital costs and capacity factors of new build

Estimates of capital costs and capacity factors for new generating capacity vary tremendously, and the quantification process requires some guidance as to which estimates the CRE Subcommittee prefers. Again, Iowa-specific estimates are preferred. Table 39 (page 77) from the AEO 2007 (http://www.eia.doe.gov/oiaf/aeo/assumption/pdf/electricity.pdf) shows the capital

cost and operation and maintenance (O&M) costs used by the National Energy Modeling System (NEMS) model.

Another consideration relates to the inclusion of learning curves or cost escalation factors for new capital equipment. The recent demand for wind turbines and other generation equipment has driven up their price in the short term. In the long term, some technologies are likely to continue to experience cost reductions on a kilowatt (kW) basis due to economies of scale (e.g., production doubling). Table 72 (page 142) from the AEO 2007 shows the figures used in the NEMS for learning curves.

Renewables incentives

What does the CRE Subcommittee assume is going to happen to the federal production tax credit (PTC) and should it be included in the levelized cost estimates for renewables in the Policy Options? The federal Renewable Electricity Production Tax Credit has been around in some form since 1992 but seems to always be about to expire (currently in December 2008). The existing incentive for wind, closed-loop biomass, and geothermal is $0.02/kWh. Electricity from open-loop biomass, small irrigation hydroelectric, landfill gas, and municipal solid waste resources receives a $0.01/kWh credit. Also, the Iowa Renewable Energy Tax Credits under Iowa Code Chapters 476B/C provide tax incentives for renewable electricity.

Fuel prices

The CCS analysis uses fuel prices for delivered costs in the MAPP region from the AEO 2007. The NEMS model has been criticized for its forecasts "mean reverting" or underestimating sustained fuel price increases and declines.[1] Given that oil prices are above $110 per barrel on the New York Mercantile Exchange (NYMEX) futures market through 2015, it would appear that the NEMS is still providing forecasts that understate likely future energy price volatility. The AEO 2008 should be out within the next month with updated fuel price forecasts, but other forecasts are welcome.

Assumptions specific to individual policy options

Thirteen CRE policy options have been developed for the State of Iowa. During a call on May 2, 2008, the group agreed that seven of the thirteen options were amenable to quantification. Those seven options are CRE-2 Technology Initiatives, CRE-5 Performance Standards, CRE-7 Nuclear Power, CRE-8 Grid-Based Renewable Energy, CRE-11 Distributed Generation/Co-Generation, CRE-12 Combined Heat and Power, and CRE-13 Pricing Strategies to Promote Renewables and/or Combined Heat and Power.

Draft results have been computed for all of these options, except CRE-12. The table on the next page outlines some of the important assumptions made during draft calculations. These assumptions should be considered and refined to ensure results that are representative of the Subcommittee's intent.

[1] Bolinger, M. and R. Wiser. 2005. "Memo: Comparison of AEO 2006 Natural Gas Price Forecast to NYMEX Futures Prices." Berkeley: Lawrence Berkeley National Laboratory (LBNL). Also see: http://www.eia.doe.gov/oiaf/analysispaper/retrospective/retrospective_review.html

Policy Option	Energy Source Replaced	Policy Goal	Replacement Mix	Policy Timing
CRE-2 Technology Initiatives	100% Coal	10% GHG emissions reduction	Wind – 60% Biomass – 20% Fuel cell –20%	5% in 2009, 10% by 2015
CRE-5 Performance Standards	100% Coal	50% and 90% reduction from 2005 emission rate (1,800 lbs/MWh)	Wind – 40% Biomass – 20% Solar – 20% Nuclear – 20%	Start in 2010 and fully phased in by 2050
CRE-7 Nuclear Power	100% Coal	Approved license renewal for Duane Arnold, new 1,200-MW plant	Nuclear – 100%	New plant in operation in 2020
CRE-8 Grid-Based Renewable Energy	100% Coal	20,000 MWh of grid-based renewable production annually	Wind – 50% Biomass – 10% Solar – 40%	2012 through 2020
CRE-11 Distributed Generation/Co-Generation	100% Coal	7,500 MWh of distributed generation annually	Wind – 50% Solar – 30% Fuel cell – 20%	2010 through 2050
CRE-12 Combined Heat and Power	—	None currently specified	—	—
CRE-13 Pricing Strategies to Promote Renewables and/or Combined Heat and Power	100% Coal	10% GHG emissions reduction	Wind – 35% Solar – 25% Fuel cell – 25% Biomass – 15%	1% in 2010, 10% by 2019