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MEMO

To: NM ES Technical Working Group
From: Eric Williams (CCS/Nicholas Institute) and Ken Colburn (CCS)
Re: Modeling Approach and Options
Date: January 9, 2006

The approach we will take to analyze and/or model policy options will depend on each particular option and the kind of information the TWG and CCAG is interested in seeing. The analytical method we use for each policy option will emerge in the process of filling out individual policy templates. We anticipate developing spreadsheets that will have supporting information for all options. In some cases, it may be possible to do the full analysis within the spreadsheets. For options that we want to see more detail on (e.g., impact on electricity prices, impact on electricity imports/exports in and out of the region, detail on changes in existing and new capacity relative to the base case, etc.), we will use spreadsheets to account for details not captured by the model (e.g., the direct cost of policies modeled as demand reductions or policies that reduce direct fuel consumption in addition to electricity, etc.) and to develop inputs that will go into the model.

The model that we have available is the National Energy Modeling System (NEMS) developed and used by the US Energy Information Administration (EIA) for publishing the *Annual Energy Outlook*, an annual forecast of energy demand and supply out to 2025. EIA also uses NEMS for policy analysis, particularly climate policy. NEMS has a number of advantages. Because it is the official model of the EIA, it is well known and in the public domain. NEMS has also been used by Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, Tellus Institute, and others. Although NEMS is not "user-friendly," it is transparent in that the model has been fully documented. EIA has published on its website many hundreds of pages of documentation, both in terms of current assumptions like the cost of particular technologies and the equations that form the structure of the model. The model code, in fact, is available and can be viewed by anyone. However, NEMS is a complex model, and it would be difficult for many to delve into and understand the inner workings of the model.

There are many assumptions within NEMS that can be left alone and accepted as a default or can be altered to reflect different views on issues such as the cost of new technologies or the availability of renewable resources. Almost any relevant parameter or data can be changed. We would expect that the TWG may want to make some changes to the default assumptions, and we

will attempt to accommodate as many as feasible. Because of the complexity of NEMS, some changes will be simple and others will be difficult and perhaps not feasible.

One of the downsides to using NEMS is that it was designed as a national model with 13 subregions. Except for California, which is a region unto itself, no state is individually represented within NEMS. Not having state-level representation may not be a significant problem with respect to analysis of the electricity system, which is inherently regional by nature. One of the regions within NEMS covers all but the southeastern corner of New Mexico, all of Arizona, a small portion of Southern Nevada, and Colorado. The region that includes Texas also includes the portion of New Mexico not in the other region. There are two approaches we can employ for adapting NEMS to state level analysis. One is that we assume that a policy implemented in New Mexico is applied incrementally to the regions that contain New Mexico and then the changes to emissions (and other variables) within the region will be assumed to be attributable to New Mexico (in reality, those changes may occur in other states within the region or even beyond the region). The other option is to scale up a state policy to a level as if it were implemented fully in the region by all states, then scale the results back down to New Mexico. For certain policies, one approach may be better than another.

From initial discussion in the TWG, there are some policies, such as cap and trade, which would be most likely considered at a regional or national level and not at a state level. For these policies, the regional representation in NEMS is an advantage.

NEMS has a simple representation of electricity transmission compared to detailed electricity dispatch models often used by utilities. NEMS has no representation of the distribution system.

Although the version of NEMS used by EIA has national level economic feedback, the version we will use does not. Additional modeling using other tools would be needed to evaluate the state level macroeconomic impact of policies.

The following table is a first order characterization of how ES TWG policies could possibly be analyzed and/or modeled. The last two columns represent either/or options.

Policy No.	Policy Name	Spreadsheet (essential)	Analytical Options	
			Spreadsheet (analysis)	NEMS
Renewables				
ES-1	RPS	Capacity, timing, cost by year	Assess displaced generation, estimate emissions	Model renewables directly
ES-2	Renewable tax credits & incentives	Levels & timing	Estimate market response based on existing programs	Change cost variables to reflect incentives and run model
ES-3	Renewable energy transmission & storage	?	?	?
ES-4	Biomass	Capacity, timing, cost by year	Assess displaced generation, estimate emissions	Model renewables directly
ES-5	Centralized renewables	Capacity, timing, cost by year	Assess displaced generation, estimate emissions	Model renewables directly
ES-6	R&D including energy storage	Qualitative assessment		
ES-7	Wind power siting	Qualitative assessment		
Centralized Non-Renewables				
ES-8	Advanced Coal/Fossil Technologies including carbon capture	Capacity, timing, cost by year	Assess displaced generation, estimate emissions	Model IGCC directly; account for CCS in spreadsheet
ES-9	Nuclear licensing	Capacity change, if any, by year	Assess displaced generation, if any; estimate emissions	Model additional capacity, if any
Grid and Demand-Side Policies				
ES-10	Distributed Generation (CHP and distributed renewables); incentives and barrier removal	Capacity, timing, cost, heat & generation by year	Assess displaced generation and fuel; estimate emissions	Translate operation of DG into demand reduction and model it; track displaced fuel and costs in spreadsheet
ES-11	Net metering	Supporting policy incorporated into (ES-10, ES-3?)		

Policy No.	Policy Name	Spreadsheet (essential)	Analytical Options	
			Spreadsheet (analysis)	NEMS
ES-12	Broad demand management (efficient use of electricity & natural gas)	Link to RCI TWG; include demand reduction scenarios from RCI TWG, which include costs, timing, reductions in generation	Assess displaced generation, estimate emissions	Model reduced demand
ES-13	Transmission capacity & corridors	Supporting policy incorporated into (ES-1, ES-2, ES-4, ES-5, ES-7, ES-8)		
Oil & Gas				
ES-14	Carbon capture and storage or reuse (includes power sector CO2)	Cost and capacity assessment of storage (input to ES-8); cost and capacity for reuse	Assess capture cost for O&G	N/A
ES-15	Methane reductions in O&G operations	Cost and potential for reductions		N/A
ES-16	CO2 reductions from combustion in O&G operations	Cost and potential for reductions		N/A
Emission Policies				
ES-17	CO2 Cap & Trade including offsets policies	Levels & timing	N/A (can look at national studies for likely carbon price ranges and do simple analysis)	If national, cap & trade is done directly as model option; if regional, iteration on carbon tax adder until cap is met (final adder = carbon price)