	Fname	Lname	Organization	Unanswered Questions	Answer
1	christopher	garbacz		Can technological change be modeled in the large as a proxy for the various possible changes over the period studied?	NEEM can incorporate specific data regarding generation technology characteristics and costs, and how they change over time. Generalized technological changes which affect those characteristics and costs would be part of a scenario developed and supplied by the SSC.
2	Gregory	Carmean	MD PSC	are construction costs for generation and transmission localized	In Task #5, EIPC will provide high-level analysis of the sensitivities of interest to the SSC which will be based on a conceptual assessment made by planning engineers of transmission expansion to support the level of energy exchange identified in the macroeconomic analysis by CRA. Detailed power flow analysis will not be performed at this stage. In Tasks 7, EIPC planning engineers will develop transmission expansion options to support the three scenarios selected by the SSC for detailed analysis. In Task 8, these transmission expansion options will be subject to a detailed reliability analysis on an interconnection-wide basis. In Task 10, EIPC planning engineers with assistance from CRA will provide high-level cost estimates of the capital costs of the transmission and generation resource expansion options based upon generic cost information and not specific route selection or engineering design. These estimates will recognize, to the extent possible, regional differences that may affect such construction costs.
3	Jeff	Kaman		Can assumptions be removed/changed from the roll up, to the extent they impact scenarios?	The roll-up of existing regional plans provides a starting point for future scenario analysis. In particular, the roll-up case provides the existing system topography and identifies firm committed transmission and generation resources that are included in the regional plans developed in accordance with Order 890 for the year 2020. To the extent that less firm resources are included in the roll-up case in order to meet system reliability requirements, these resources, as well as resources beyond 2020, are subject to change as agreed to by the SSC in the formulation of future scenarios.
4	Stanton	Hadley	Oak Ridge National Lab	Can differentials from Henry Hub be changed over time e.g., expansion of shale gas resources?	See response to Q #129.
5	Doug	Hurley	Synapse Energy Economics, Inc.	Can NEEM be told to maximize only Consumer Surplus instead of Social Welfare?	NEEM maximizes overall social welfare in its optimization routine. Social-welfare maximization is the foundation for the electricity markets we would be modeling.
6	Wil	Burns	Burns Law Firm	Can the MRN regions be changed, or is it only the NEEM regions that are user-defined?	MRN regions can be changed. We would note, though, that the boundaries of MRN regions are defined by macroeconomic drivers, and are completely independent of the electric transmission infrastructure.
7	christopher	garbacz		CO2 control is assumed to generate benefits to the economy. Can those benefits be fed back into the model to show the impact on the system and the economy?	MRN will consider the effect of CO2 costs on the North American economy, and how those costs affect the economy. Neither MRN nor NEEM explicitly consider environmental externality effects arising from emissions, nor do they consider the change in economic activity that may be effected specifically by industry developing and marketing CO2 control equipment.
8	Mayer	Sasson		Discusssing slide 22, given a tranmssion addition it may make an upstream generator justifyiable. Should the transmission cost be considered as part of the upstrream generation cost?	Slide #22 is intended to illustrate the complexity of attempting to optimize transmission in a macroeconomic expansion model. That being said, the NEEM model will identify transmission constraints between regions, and the EIPC planning engineers will provide a high-level transmission assessment in response to those findings (See response to Q #2 above). For the final three scenarios selected by the SSC, EIPC will provide generic cost estimates for the transmission expansion options to support the resource futures(See response to Q #2 above)
9	christopher	garbacz		Does BAU include generators or transmission that will come online during the period over which the model is run - phased in?	Assuming that the question is referring to the future scenarios by the SSC, resources beyond those existing and firm resources included in the roll-up case may be selected by the SSC in the development of the future scenarios. (See also response to Q #3 above)
10	Joe	Bryson		Does CRA have a representation of the EPA's new proposed	Yes, NEEM does incorporate the new proposed Transport rules.
11	Deidre	Altobell		Does MRN feed NEEMS with the demand forecasts depending on economic assumptions in MRN?	The demand forecasts for NEEM are user-supplied. MRN provides adjustment factors to be applied to the demand forecasts used in NEEM, which are based on MRN's macroeconomic outputs. The demand and fuel prices in NEEM may be adjusted up or down depending on the inputs to MRN.

12	Deidre	Altobell		Does NEEMS consider spinning reserve / operating reserve when	NEEM does not model spinning or operating reserves, although GE MAPS does.
13	Steve	Chui		Does the model take into account firm power contracts between	No, NEEM does not take firm contracts into account, although GE MAPS does.
14	Mayer	Sasson	Con Edison	First sub-bullet of Task 9 references transmission option models to be evaluated. What is the process to develop these options?	The transmission options to support the three resource expansion scenarios selected by the SSC in Task #6 will be developed by the EIPC planning engineers in Task 7. (See response to Q #2 above)
15	Laurence	DeWitt		"Has NEEM been run against historical data, and, if so, how well has it predicted?"	TBD
16	Jay	Goldman		"How do you derive the incremental change in transfer capability between regions that results from a particular transmission scenario, for use in NEEM? Does this require FCITC (power transfer analysis) in power world for feeding into NEEM?"	The NEEM model used for the macroeconomic analysis will utilize the transfer limits provided by the EIPC's roll-up case for 2020 as its starting point. CRA will then proceed to analyze the resource expansion scenarios identified by the SSC and will determine whether existing system transfer limits may be exceeded. The EIPC planning engineers will develop high level analysis of transmission expansion to support these resource futures—but will not employ power flow modeling at this stage of the project. (See response to Q #2 above)
17	christop	garbacz		How do you determine the price of lignite since it is not traded in the	TBD
18	Deidre	Altobell		How do you use NEEM to identify optimal transmssion to be built?	None of CRA's models determine an optimal transmission build-out. The representation of the transmission system within NEEM may change over time, but this must be determined by the SSC. We would point the questioner towards slide 22 in the webinar presentation, where this question is addressed in greater detail, as well as question xx in this document.
19	Diane	Barney	New York State Dept of Public Service	How many MAPS runs will there be for each scenario/sensitivity? All 20 years? Year 1, 10 & 20?	The MAPS model is not used for the macroeconomic phase of the Project (Task 5). The MAPS model, will however be utilized during Task 9 to provide production cost analysis, including sensitivity analysis, on each of the three expansion scenarios selected for detailed analysis by the SSC in Task 6. In addition, in Task 3, the MAPS model will be used to conduct a production cost analysis for the roll-up case developed by the EIPC in Task 2.
20	Robert	Short	Southern Company Services	How will scenarios for GE MAPS modeling be selected from the set of CRA NEEM scenarios with sensitivities ("CRA NEEM and GE MAPS models are fully syncronized on load and generation data"? | The SSC will develop a consensus-based process to select the three scenarios for development of transmission expansion options to support each scenario, including detailed reliability and production cost modeling. To the extent that this question implies that the NEEM and MAPS models will be utilized for this purpose during Task 5—see the response to Q #19 above).
21	Samir	Succar		If the capacity expansion scenarios and powerflow characteristics are defined in the absence of transmission expansion constraints, can the proposed analyses provide sufficient guidance for the development of transmission plans and alternatives?	As noted in response to Q #2 above, the EIPC planning engineers will be providing a high-level analysis of potential transmission expansion to support the levels of energy exchange identified during the macroeconomic analysis. This information will assist the SSC to narrow down the scenarios to the final three—which will be subject to development of transmission expansion options, detailed transmission reliability analyses and production cost analyses during Phase II of the project.
22	Jeff	Kaman	Iowa Utilities Board	If there are significant differences in individual PA assumptions, that are then included in the roll up, how does this propagate through the NEEM model in ayalyzing futures/scenarios?	See response to Q #3 above.
23	christop	garbacz		In regard to wind can the future specify the impact of different levels	Yes, it is possible to do so.
24	Deidre	Altobell	Con Edison	In which task will the demand forecasts be done for each scenario?	The demand forecast, and the other key assumptions to be utilized for the macroeconomic analysis will be developed by the SSC in Task 4.
25	Deidre	Altobell		Is DSM / energy efficiency a resource option in NEEMS?	Depending on the assumptions used, DSM, demand response, or energy efficiency measures can be used as a resource in NEEM.
26	Chris	Hagman		Is it possible to import GE-MAPS input data into PROMOD?	While GE MAPS and PROMOD are functionally similar, GE MAPS data is not directly importable into PROMOD. There are no plans to supply raw GE MAPS input data files to the SSC, although all the key input assumptions will be public.

27	Dan	Hartman	NWKREC	Is the CRA integrated model weighted toward either the top-down or bottom-up concepts?	CRA's models incorporate elements of both approaches, but are weighted towards neither. NEEM operates principally as a bottom-up model, simulating the dispatch of the interconnected electrical system. It is also a model which assumes perfect foresight, and optimizes the system over its model's timeframe. MRN also incorporates elements of both approaches; different policies or targets can be specified for emissions, but MRN's output will show the impact of these policies or targets on energy-sector and macroeconomic factors without pre-determining the outcome.
28	Chris	Hagman		Is the purpose of NEEM similar to the Electric Generation Expansion Analysis System (EGEAS) and to Ventyx's Strategist models? How do they differ?	NEEM is broadly similar to these models in terms of functionality and purpose. While there are many minor differences too numerous to enumerate here, the principal difference is that through its use with MRN, NEEM considers broader macro-economic effects on the electricity industry.
29	Bruce	Biewald		It appears that many important aspects of a future are calculated WITHIN the MRN-NEEM models (e.g., generation additions, retirements, CO2 prices). Will this constrain what the SSC can specify in terms of scenario definitions? If so, how?	The SSC can specify as much or as little information as it prefers. The MRN and NEEM models will adjust those aspects of a future which are not prescribed to address constraints which are placed on the system. The SSC may, for instance, "hardcode" all capacity additions, retirements and CO2 prices for the next thirty years if it so chooses instead of allowing NEEM to determine capacity additions.
30	christopher	garbacz		Not sure how the model handles wind. Does it calculate the cost of wind to include backup power?	All resources on the system can be de-rated to represent their contribution towards reserve margins. If the question refers to incremental power that may be necessary to meet reliability criteria versus thermal generation, then the model does calculate the overall system cost of this necessary additional capacity. In system operation, the model will also de-rate wind capacity as specified, and calculate the cost of additional system generation.
31	Ed	Tatum		o NEEM does not model transmission constraints within regions. Can we model historic rather than current NEEM regions? For instance PJM (original footprint) vs. ECAR?	Yes. The SSC can choose to draw the NEEM regional boundaries differently if it wishes.
32	Erin	Hogan		On slide 21 where it describes what NEEM does, are all those features just NEEM or is it MRN and NEEMs?	Slide 21 refers specifically to NEEM.
33	David	Boguslawski		Please explain how NEEM determines specific benefits for a region's customers considering unique regional market rules, such as use of LMP's.	NEEM can be configured with rules which represent different regional market rules. It does not calculate LMPs within its regions. Benefits for different regions, or the system as a whole, may be calculated different ways, including production cost, consumer cost benefits, or other metrics.
34	christopher	garbacz		Relates to previous question. Can the future specify no subsidies for any fuel to include wind, solar, bio, geo, nuke or whatever?	The inputs developed by the SSC can specify any, or no, subsidies for different fuels or generation types.
35	christop	garbacz		Relates to previous question. Can you determine the impact of	Yes, these can be simulated in our models.
36	John	Wilson		So electric sector data not available by state but only by NEEM	NEEM aggregates its output results by state as well as by NEEM region.
37	Samir	Succar		What contraints govern the expansion of interregional power flow limits and how can those contraints be specified on a regional basis?	Inter-regional transmission capacities can be specified both on an individual basis, a one-to-many, or many-to-many basis. They can also be varied temporally. Note, however, that NEEM will not modify transmission capacities by itself; these capacities must be provided. There is no particular constraint on the expansion of inter-regional transmission limits; the system can be modeled as a "copper sheet" within NEEM if so desired.
38	Bruce	Biewald		Where are the detailed inputs to represent coming environmental regulations going to come from (transport rule? mercury? ash? water? CO2?)? Will all scenarios be designed in order to comply	CRA develops its inputs to NEEM based on the best available current outlook on environmental regulations. The design of the scenarios will be the responsibility of the SSC.
39	Bruce	Biewald	Synapse Energy Economics	Will the complete inputs and outputs for the MRN and NEEM models be available for review? Which portions of the inputs and outputs, if any, will be subject to "confidential treatment" and why?	All of the user-configurable inputs and outputs related to system data will be provided for review. Model-specific configuration data and other proprietary intellectual property may be held confidential.
40	hisham	choueiki	Ohio PUC	Will the data sources used by EIPC planners (to run the transmission analysis) and CRA (to run GE-MAPS and NEEM/MRA); such as load forecasts, current generation fleet, resource adequacy requirements, be compared for consistency?	Yes.

41	hisham	choueiki		Will the production simulation model (GE-MAPS) used by CRA incorporate all the regional differences among the 26 planning authorities; such as MISO not having a capacity market, PJM having a capacity markets, etc.......	The production-cost simulation model (GE MAPS) can incorporate many market differences and idiosyncrasies, including but not limited to price caps, capacity markets, transmission constraints, operating procedures, and operating contingencies. Our default dataset contains these input data, and will be augmented in Tasks 2 and 3 by input from PA engineers, and reviewed by SSC members.
42	Steve	Gaw		Will the SSC have the right to review the inputs on assumptions for	Yes.
43	Doug	Kallesen	NPPD	On slides 14 & 15 of CRA's Aug 30 presentation, and possibly elsewhere, Nebraska shows up as separated from SPP, whereas NE utilities joined SPP in 2009. This needs to be at least noted. Ideally NE would also be included in the models as a member of SPP, as it is the operating region, market, and transmission system that we now participate in. However, I understand that certain data is being taken from 2006 and that especially some DOE/EPA data sets which you may be using are divided SPP-N and SPP-S as separated from NE. So will you be able to properly align all the Nebraska data that is embedded in particular data regions if you make a switch? Switching regions would probably not be the right thing to do if modeling data gets messed up in the process.	Yes, we will be able to properly align the Nebraska data used in NEEM
44	Bruce	McKinnon		How does the NEEM model compute the energy price component of those US regions dependent upon the market clearing prices as compared to those regions dependent upon a direct production cost structure in producing the prices seen by the consuming public? How is this type of non-production cost driven data assimilated into the MRN model	The energy price component at a given moment in time in each region is computed as the short-run marginal cost of serving incremental demand at that time in that region. It is our understanding that power system operation in all regions is determined by optimization of production costs. the outputs from NEEM provide the data necessary to calculate the direct production cost within each region.
Additional Questions					
45	Steve	Chui	Ontario Power Authority	Page 8 (fourth bullet) - Does MRN include the dynamic of Canadian provinces as well?	NEEM has a representation of Eastern Interconnection Canadian provinces of Saskatchewan, Manitoba, Ontario and New Brunswick. However, there is no MRN representation of these provinces. As a result, the model would adequately simulate power industry in these provinces but would not account for economic interaction between power sectors and Canadian economy in the same manner as this will be done for the United States.
46	Steve	Chui	Ontario Power Authority	Page 12 - There may be a need to incorporate generation additions and retirements as forced builds beyond 2020. Is there a provision for that?	The SSC can specify forced builds beyond 2020 in a scenario if it so chooses.
47	Steve	Chui	Ontario Power Authority	Page 24 (second bullet) - It was mentioned that "peak demand are based on information provided by RTO's where available" but on page 21 the presentation suggested that the demand could be adjusted by MRN/NEEM to reflect prevailing macroeconomic conditions. Please clarify the source of the final demand level feed into GE MAPS from NEEM? Would that be the original demand provided by RTOs or the modified RTO figures?	The final demand level used in Task 3 for GE MAPS will provided by the PAs from Task 2 and will not be adjusted by MRN-NEEM. However, CRA will run up to 9 sensitivities in Task 5. Some of those could have variations in demand. The demand level used for the production-cost modeling scenarios using GE MAPS in Task 9 can use the adjusted demand levels developed in Task 5. The logic of translating MRN-NEEM results to MAPS input assumptions for Task 9 is yet to be developed.
48	Steve	Chui	Ontario Power Authority	Page 24 (third bullet) -Is the model able to use load profiles as provided by RTOs in lieu of using the 2006 actual load profiles from FERC form 714?	Yes. FERC 714 represents our default data set, but can be changed by SSC inputs.
49	Steve	Chui	Ontario Power Authority	Page 26 – How are the various types of renewable generations being simulated in NEEM; such as hydroelectric, solar, biomass, etc? For instance, is hydroelectric being represented by historical profile or simulated by the traditional peak shaving logic?	NEEM utilizes seasonal energy constraints to shape hydro energy to meet demand. Wind and solar are simulated based on historical or simulated patterns. Biomass is simulated as dispatchable generation.
50	Steve	Chui	Ontario Power Authority	Page 40 (fourth bullet) - Please provide more details as to how the wind profiles are generated based on synchronization with load shapes in NREL data.	All hourly profiles are aggregated into blocks. Each time block is defined as an aggregation of a certain set of calendar hours. Load and generation profiles are averaged over hours in a set corresponding to the time block. This achieves synchronization of load and wind in NEEM. In GE MAPS, wind and load are modeled chronologically on an hourly basis.

51	Steve	Chui	Ontario Power Authority	- Does any models (MRN/NEEM/GE Maps) take into account System Operability; i.e. ramp rates, supply mix variability etc, in their deliberations?	GE MAPS is a security constrained production-cost model which accounts for numerous security constraints and contingencies, including transmission constraints, ramp-rate constraints, spinning reserve constraints, and security-constrained unit-commitment. Supply-mix variability (which may take the form of fuel-supply contingencies) can be modeled through various methods (including must-run units and nomograms) if so desired and specified. GE MAPS also co-optimizes energy dispatch with operating reserves. - NEEM is not a system operations model, and does not consider operational or security constraints beyond inter-regional transmission constraints.
52	Steve	Chui	Ontario Power Authority	- Does any modeling take into account any firm power contracts between regions as base flows?	NEEM does not take firm contracts into account. Contracts are considered to be financial instruments which do not influence physical generation dispatch and power flows. - GE MAPS is capable of modeling firm power flows between regions if such flows are specified.
53	Steve	Chui	Ontario Power Authority	- Needs better understanding of the MRN and NEEM models. Is it possible for CRA to provide some literatures on these two models?	CRA provided a narrative description of NEEM and MRN to the SSC several weeks ago.
54	Erin	Hogan	NYSERDA	NEEM does not co-optimize generation and transmission expansion because introducing transmission costs creates a serious nonlinearity conditions that cannot be solved with a simple optimization algorithm. But not accounting for the cost transmission potentially results in a generation system expansion that is not a minimum present value of total cost. Using detailed transmission costs would be ideal, but even with detailed transmission costs the model results should still be considered an approximation rather than a definitive projection due to model limitations and uncertainties of forecasts and future conditions. Ultimately the PA Engineers will develop the detailed transmission expansion to accommodate the generation build/retirement schedule from NEEM. But is there some way to create a proxy for transmission costs and include it during the NEEM optimization to reduce the concerns raised above? Perhaps a separate cost of moving power between regions (i.e., like a wheeling charge) could be added to reflect the costs of transmission expansion. This separate cost could be applied to all interfaces, adjusted to reflect the differences a	A cost of moving power between regions could be added to the NEEM model. However, CRA does not believe that a generic proxy cost for transmission can be developed, and would not be in a position to defend results based on such an approach
55	Erin	Hogan	NYSERDA	What are the wheeling charges between regions? Do the wheeling charges stay static over time? What is your rational for the value? Do the charges change with respect to volume of interchange?	The wheeling charges between regions will be an input determined by the SSC. The wheeling charges can change over time and can be modeled as monotonically increasing step-functions of inter-regional flows. Default wheeling charges (often referred to as "hurdle rates") we have used in the past represent tariff wheel-out rates as well inefficiencies of economic transactions across market seams.
56	Erin	Hogan	NYSERDA	Do generator capital costs include any costs beyond the generator step-up transformer to interconnect to the distribution/transmission system? Does it differ among regions? One would expect new generation in remote locations to have longer transmission lines to interconnect to the distribution/transmission system, how is this accounted for?	Capital costs included in NEEM represent overnight costs for different technologies. Generator capital costs can vary across regions. The SSC may include whichever cost components it chooses in specifying these overnight costs. CRA expects that capital costs of generators in remote locations would account for cost of building interconnecting transmission lines.
57	Dan	Hartman	NWKREC	Will/can the WG get a blank template of all the CRA inputs for their model and perhaps a completed run showing the outputs? I think having this information will help the WG be more focused in our driver development process?	Yes.

#	First	Last	Organization	Question	Response
58	Dan	Hartman	NWKREC	Is CRA willing to participate in our regular discussion until we have a complete enough understanding of their model and its limits/inclusions? It seems to me during all of our phone conversations questions come up regarding the CRA model inputs/outputs and this has hampered progress toward our primary goal.	The EIPC has provided two opportunities for CRA to describe and discuss their models with stakeholders: at the SSC meeting in Chicago and on a Webinar on August 30th in which there were over 150 participants. We have provided and posted responses to stakeholder questions for all to review. Another Webinar is scheduled of Sept 28th. In order to conserve resources for EIPC members, CRA and stakeholders, we believe that it is most efficient to have such discussions in combined stakeholder forums rather than within individual Working Group meetings/conference calls since there is such a large degree of interest and overlap in the questions being posed by each of the Working Groups.
59	Dan	Hartman	NWKREC	If the CRA NEEM/MRN model is determined to not serve the interests of the SSC, are there alternatives in place that can be used within the project time frame?	As noted in the final Statement of Project Objectives under the DOE Cooperative Agreement, the EIPC proposal is based upon the use of certain models for various types of analyses. Any change in these models will likely have a significant impact on the project performance, cost and schedule and would require further discussion with the DOE.
60	Doug	Hurley	Synapse Energy Economics, Inc.	Can the models output a list of input assumptions, both those that can be modified by the user and those that are implicit in the model?	See response to 57 above
61	Doug	Hurley	Synapse Energy Economics, Inc.	Does CRA have a plan in place about how to manage a situation where the CRA and NEEM models do not converge? Because they have different objective functions, this outcome is a possibility and I wonder how they would resolve this.	We are unclear on what the "CRA model" refers to. If it refers to MRN and NEEM, we run MRN and NEEM iteratively and have numerous methods to ensure convergence.
62	Doug	Hurley	Synapse Energy Economics, Inc.	(To expand on Q#25) What Loadshape is assumed for energy efficiency programs (if any), or are these programs represented as a reduction in hourly loads?	Energy conservation assumptions and load reduction should be part of SSC formulation of macroeconomic futures. The model can accommodate different structures
63	Doug	Hurley	Synapse Energy Economics, Inc.	How is the cost of energy efficiency modeled? As a lump annual sum or on a $/kWh basis? Can this value vary by region?	The cost of energy efficiency assumptions should be part of SSC formulation of macroeconomic futures. The model can accommodate different structures
64	Doug	Hurley	Synapse Energy Economics, Inc.	How is Demand Response modeled? As a reduction in peak loads at hourly prices above certain threshold?	Demand response can be modeled in NEEM and GE MAPS as price-responsive demand reduction. The price can be specified by region and can vary over time.
65	Doug	Hurley	Synapse Energy Economics, Inc.	How is the cost of Demand Response modeled? As a lump annual sum or on a $/MWh basis? Can this value vary by region?	Demand response resources can be modeled as on a $/MW overnight cost basis. The response price can be specified as a $/MW number. The values for these parameters can vary by region.N65
66	Ken	Lotterhos	Navigant Consulting	Please provide a brief description of how transmission constraints will be identified, calculated and defined/modeled at the interfaces between the regions for both the rollup case and scenarios	In regard to the rollup analysis, it is anticipated that each Planning Authority will be responsible for the identification of their respective flow gate/transfer limits. While linear (DC) thermal limits will generally be utilized, the PA may base their decision on an other known/limiting condition (i.e. – voltage, reactive supply, stability).
67	Ken	Lotterhos	Navigant Consulting	What level of granularity will be used when modeling constraints at regional interfaces (e.g., single transfer limit or multiple interfaces)?	NEEM can model inter-regional interfaces as either one-to-one constraints, many-to-many constraints, or one-to-many constraints. GE MAPS models individual transmission constraints and contingencies.
68	Ken	Lotterhos	Navigant Consulting	How will input from the RollupWG be used in addressing the above questions?	The output from Task 2 will form the input for the Task 3 analysis as well as the foundation for the inter-regional transfer limits to be specified in Tasks 4 and 5.
69	Dan	Hartman	NWKREC	We noticed that the CRA model makes no provision for any type of power storage technology. We believe either PH (pumped Hydro) or CAES (compressed Air Energy Storage) forms of bulk storage technologies will be counted by utilities as firm capacity because of their significant amount of storage and run time capability. Therefore, these two technologies should be an option in the expansion analysis for meeting future load growth. How can the CRA model be fitted to account for these options?	Both NEEM and GE MAPS include storage technology as resources. NEEM does not include storage technologies as an option for optimal system expansion.
70	Mary Ellen	Paravalos	National Grid	How does the model deal with non-economic retirements (e.g. nuclear licensing issues)?	Non-economic, or hardcoded, retirements, may be specified as an input by the SSC.
71	Mary Ellen	Paravalos	National Grid	Does the model assume a standard lifetime for thermal plants (e.g. 70 years)?	The lifetime for plants can be specified

72	Mary Ellen	Paravalos	National Grid	Can CRA describe in detail how the model will treat renewables (specifically wind)? How will it deal with intermittency? On what will it base capital cost projections (will it assume cost declines, increasing/decreasing subsidies, etc.)? How will the model locate wind and other renewables?	Capital cost projections will be based on SSC-supplied assumptions. NEEM will locate wind in different regions based on RPS constraints, capital cost assumptions, and the contribution of wind towards installed capacity requirements. Wind intermittency will result in a de-rating of wind capacity towards meeting capacity requirements; in system operations, the intermittency of wind can affect the reserves required for system operation. Neither NEEM nor GE MAPS conducts a stochastic analysis of wind intermittency.
73	Mary Ellen	Paravalos	National Grid	How transmission upgrades and costs will be modeled is still unclear. We need a detailed discussion on this.	TBD
74	Mary Ellen	Paravalos	National Grid	Can CRA provide a detailed matrix/list of specific metric inputs that the SSC needs to provide?	We will provide this shortly.
75	Mary Ellen	Paravalos	National Grid	What are the key considerations in determining how to define the MRN/NEEM regions?	The key consideration for determining the NEEM regions could be summarized in terms of the following four properties: i. 1. NEEM region must have relative homogenous structure: no significant transmission constraints within the region; no significant difference in fuel and capital costs within a region; ii. 2. Ability to identify or reference a known source of transfer limits between regions; iii. 3. A region may consist of multiple control areas but preferably no control area should be split between two or more regions; iv. 4. A reserve margin pool may consist of multiple regions but no region should be split between two or more reserve margin pools - The key factor in specifying MRN regions is the difference in macroeconomic drivers between different North American regions.
76	Mary Ellen	Paravalos	National Grid	How specific is each MRN/NEEM region? Does it reflect the specificity of the local economy – for example, New York City's economy is vastly different from most of New York State?	MRN regions reflect macroeconomic factors on a regional level; NEEM models the characteristics of the electricity industry on a regional level. In general, NEEM regions are more granular than MRN regions, and NEEM outputs have a stronger influence on the ultimate results than MRN outputs. As a specific example, MRN models New York and New England as a single region, while NEEM models New York State as five-separate sub-regions.
77	Mary Ellen	Paravalos	National Grid	While NEEM cannot co-optimize transmission and generation, could it substitute for HVDC transmission between NEEM regions by using a load-generator proxy (add load/negative generation where the HVDC line is sourcing energy and add generation where the HVDC line is sinking energy)?	No. This is the same essential problem as co-optimizing generation and transmission.
78	Mary Ellen	Paravalos	National Grid	Can NEEM include customer-based resources, such as small CHP/DG, as options in its capacity expansion planning when optimizing the present value of costs over the entire study period?	If these small customer-based resources can be appropriately specified in terms of parameters, they can be modeled as options for system expansion.
79	Mary Ellen	Paravalos	National Grid	Can NEEM utilize a different criterion other than minimization of costs in its capacity expansion, for example, minimization of emissions?	NEEM as currently designed minimizes costs, not emissions.
80	Mary Ellen	Paravalos	National Grid	Will CRA model transfer limits at thermal or dynamic (e.g. unit dependent, voltage, stability)?	CRA will utilize transfer limits in Task 3 which will be provided by PA engineers from Task 2. The choice of what type of limits to model will the decision of PA engineers. The transmission limits utilized in Task 5 will be determined by the SSC and PA engineers in Task 4.
81	Mary Ellen	Paravalos	National Grid	Will the model/results focus on 115 kV and above? 345 kV and above?	The constraint set used in Task 3 will come from the roll-up case developed in Task 2. The lowest-voltage constraints typically modeled are 69 kV.
82	Doug	Gotham	Purdue University	In CRA's discussion of the time domain for the analysis (slide 12 of the presentation), they indicate that they plan to use the results of the rollup as a given through the year 2020. Is this set in stone for all of the scenarios? I have serious concerns about potentially carrying forward biases that may be introduced in the rollup.	The roll-up case will provide key information to be utilized—or considered for use—by the SSC in developing the input assumptions for the macroeconmic scenarios. First, the solved load flow provides the topography for the existing system—both transmission and generation. In addition to existing resources, "firm" additions will be identified in accordance with each region's planning process for doing so. Finally, less firm resources that may be needed to meet reliability requirements may also be included in the 2020 roll-up case. - The future assumptions are not set in stone. The SSC can modify those assumptions when developing its future resource scenarios.

83	Joe	Bryson	US EPA	How specifically would CRA go about representing a specific set of aggressive energy efficiency policies represented within one or more "Futures/Scenarios?" For instance, if we define an Aggressive EE Policy Future based upon an assumption of very stringent mandatory Appliance Standards and Building Codes (say, resulting in a reduction in load growth from 1%/yr to 0%/yr)? Or, for instance, an Aggressive EE Policy Future based upon an assumption of substantially increased spending on utility EE programs (e.g., increasing spending from current levels of $3 B/yr to $15 B/yr) that is project to reduce load growth to specific level? What kind of analysis - if any - would be needed/appropriate outside of MRN-NEEM to determine inputs for such scenarios?	We would represent the impacts of energy efficiency policies as changes in load growth and load profiles. These load profiles and levels would be part of the scenarios developed by the SSC. There are numerous ways to analyze what the effect of EE policies would be on load levels, but these would be part of the scenario development process.
84	Joe	Bryson	US EPA	Does CRA have (or can they develop) a representation of EPA's recent Transport Rule Proposal?	Yes, this can be represented in NEEM.
85	Joe	Bryson	US EPA	What control options or co-benefit effects related to mercury emissions are represented in NEEM? What are the mercury emission factors CRA uses for all combinations of emissions controls, boiler type, and coal type? Does NEEM track emissions of HCl and represent impacts of emissions controls and other factors on HCl emissions?	NEEM does not track HCl emissions. The emissions factors associated with different technologies and fuels will be provided as part of the data we will shortly supply to the SSC.
86			NGOs	Task 2/3. Will the load and demand-side resource information (both energy efficiency and demand response) that is used as the "base" case input set for Task 3 directly use information from the regional transmission plans, or will they be specifically described as an input set from the SSC?	The data used for the roll-up case in Task 3 will be provided by PA engineers, and will integrate data in the different regional plans. This information will be verified by EIPC members to assure consistency with roll-up plans.
87			NGOs	Task 2/4/5. Please confirm that the only critical piece of input from Task 2 that will be utilized in Task 5 is the 2020 transmission topology, and that all other factors (loads, resources, fuel prices, etc.) will be specified as SSC input assumptions per Task 4 macro scenarios.	The principal input from Task 2 to be utilized in Tasks 4 and 5 is the transmission topology, including the location of existing generation resources, although we expect that the roll-up case developed in Task 2 will help inform the input to Tasks 4 and 5. The transmission topology will be provided to CRA by PA engineers in the form of the solved power flow case. This power flow case would be based on a range of assumptions developed by PA engineers based upon existing regional plans. These assumptions among other things will include: future transmission and generation additions and retirements, peak load forecast and security constrained dispatch of all generators assumed to be on-line in 2020. It is anticipated that when developing macro-economic Futures, SSC would take these information into consideration.
88			NGOs	Task 3. When conducting the GE MAPS analyses of the rolled-up plans under various sensitivities, it appears that only a single transmission topology will be used, based on the results of Task 2. Is it possible, or is it planned, to undertake this analysis using different transmission topologies? Other input sensitivities are planned (e.g., fuel costs, loads, carbon cost) that will generate important differences in the output of the analyses. Since it is likely that a number of different overall EI transmission topologies could be reasonably inferred from a review of the rolled-up plans, wouldn't it serve the process and results very well to have multiple transmission topology sensitivities as well? Please discuss.	Task 3 will comprise analysis only of a single transmission topology developed in accordance with the roll-up of the existing regional plans. Multiple transmission topologies will be analyzed in Task 9 based upon the transmission options developed by the PAs in Tasks 7 & 8.
89			NGOs	Task 3. For which years is the GE MAPS model to be run? Only a single year (2020), or over a range of years (2010 through 2020)? If over a range of years, will the transmission topology used reflect the then-current status of planned transmission additions? In other words, would the model accurately capture the incremental effects of transmission additions by their year-in-service?	In Task 3, GE MAPS will be run for 2020. The transmission topology in use then will result from the roll-up case developed in Task 2.

90			NGOs	Task 3. Will construction costs for new resources (generation, demand-side, or transmission) in place in the model for 2020 be accounted for in the GE MAPS analysis? If so, how? Intrinsically? Post-processing? If not, why not? Please discuss the implications of interpreting the GE MAPS output given how these costs are, or are not, accounted for.	GE MAPS, as a production-cost model, does not incorporate construction costs; such questions are addressed in other tasks. The resource mix and system topology utilized in Task 3 will be an output of the roll-up of regional plans in Task 2.
91			NGOs	Task 3. Please provide a complete reference set of all GE MAPS input values in a spreadsheet form to allow for consultants to begin to sift through all the particular parameters that will require specification as an input assumption.	CRA will develop Task 3 input assumptions and a GE MAPS dataset derived from public sources in collaboration with PA engineers. EIPC will provide relevant input assumptions when those are prepared.
92			NGOs	Task 4/5. MRN uses a macro-economic model of circular flow of goods and services (plus foreign imports/exports) without explicit linkages to the natural world outside of the macro-economy flows. Please discuss and explain how or if potential scenario benefits, or costs, external to the model formulation (e.g., reduced global climate disruption; increased global climate disruption) will be accounted for.	The MRN-NEEM model does not model benefits of climate change. The model provides a least cost solution to meet the energy system constraints imposed by policies. Results from MRN-NEEM reflect the cost side of a cost-benefit analysis. The MRN-NEEM model could be integrated to a climate model to link temperature change feedback effects to the economic sectors of the MRN model. This would be a major undertaking which is beyond the scope of the project.
93			NGOs	Task 4/Task 5. Based on the webinar information, it appears that MRN-NEEM (or any of the other models to be used for this analysis) has the capability to simulate decisions to retire and/or mothball, and/or un-mothball, existing generators confronting large capital investment requirements (e.g., for air emissions control retrofits). Please confirm, or explain if otherwise.	NEEM has this ability.
94			NGOs	Task 4/Task 5. Please describe specifically how such a retirement/mothballing/un-mothballing capability will be used in this modeling exercise. Explain the algorithms that are in place and will be used to make these determinations.	NEEM, as described in our materials, is a forward-looking linear-programming, optimization model. The decision to retire/mothball, or re-activate a plant is based on future revenues or costs of each individual asset, as specified in SSC inputs. NEEM chooses the least cost solution to meet electricity demand, subject to resource adequacy (e.g. reserve margin) requirements, transmission constraints and environmental policies.
95			NGOs	Task 4/5. Please explain how load diversity benefits of aggregation across smaller NEEM regions would or could be accounted for in unit commitment and dispatch mechanisms in NEEM.	Load developed for NEEM regions are developed by aggregating chronological hourly loads for control areas comprising NEEM regions which accounts for load diversity. Generation is dispatched against such loads. Unit commitment constraints are not modeled in NEEM.
96			NGOs	Task 4/Task 5. Will construction costs for new transmission lines and upgrades be included in the MRN-NEEM analysis? If so, how? On an investment per mile basis? If so, how will the distances be estimated?	As explained at the webinar, construction costs for new transmission lines will not be included in the MRN-NEEM model.
97			NGOs	Task 4/Task 5. In a particular MRN-NEEM simulations will transmission upgrades beyond the roll-up be included during the simulation period? If so, on what basis will those transmission additions by determined?	In Task 4 and 5, CRA and PA engineers will work together to determine what transmission additions or changes may be necessary to support the scenarios designed by the SSC over the study timeframe. While the exact methodology used to determine the necessary upgrades will vary by region and has not been finalized yet, this analysis will not be detailed power flow analysis, but will be based upon conceptual assessments made by the PA engineers of potential interregional transmission expansion to support the magnitude of interregional energy exchanges identified in the macroeconomic analysis.
98			NGOs	Task 4/Task 5. Will the transmission additions be different for each of the MRN-NEEM sensitivity cases? If not, why not? If so, how will the quantitative transmission additions in each sensitivity be determined?	Each scenario selected by the SSC for analysis may have different transmission capacity needs. . CRA will work with PA engineers to determine, on a conceptual basis, what transmission additions or changes may be necessary to support the scenario developed by the SSC. (See Response to Question #12)

99				NGOs	Task 4/Task 5. The transmission control, unit commitment, and dispatch procedures that will be in place in 2020 and beyond will likely look different from today's structures, in terms of IT hardware, controls and communications capability, and geographical scope of operation. Given this, please explain if there are any internal model specification or execution constraints, or other constraints, in MRN-NEEM that would prevent scenario specification that include any combination of the following, and discuss as appropriate: a. Control area consolidation in the Eastern Interconnection, such that by 2024 (for example) the number of balancing areas in the EI may be much reduced from current levels. b. The use of demand response and energy efficiency resources that essentially level out peak electricity demand growth, or reduce growth on average, when compared to historical levels. c. Considerable improvement in intermittent resource output prediction in hour-ahead, intra-day, and day-ahead time frames using state-of-the-art and/or best-practice weather/wind/solar forecasting techniques. d. Considerable increas	a) NEEM regions may be modified if the SSC so chooses. There is no NEEM-specific constraint that would prevent greater control area consolidation. b) There are no NEEM-specific constraints on modeling energy efficiency and demand response impacts. These, for example, could be modeled as dispatchable resources. c) As noted earlier, NEEM does not incorporate unit commitment, and as such intermittency issues are not applicable to these tasks. Within NEEM, wind can be modeled using historical patterns. d) There are no NEEM-specific constraints on modeling wind resource availability. e) There are no NEEM-specific constraints on modeling technology cost changes.
100				NGOs	Task 4/5. There is currently concern in both MISO and PJM that increases in wind resource availability, particularly during overnight periods in shoulder seasons, could lead to greater instances of wind curtailment due to concerns of next-day need for capacity when wind output is projected to be lower. Please discuss how MRN-NEEM unit commitment, dispatch, and interregional transfer capability would address this issue in general.	NEEM does not simulate unit-commitment, as explained in the webinar.
101				NGOs	Task 5. Is the CO2 price for a carbon policy case determined within MRN-NEEM or input to MRN-NEEM? Please explain.	It can be specified as either, depending on what the SSC elects to simulate. The CO2 price can be specified as a specific input, or a particular policy can be specified, to which MRN-NEEM will compute a CO2 price.
102				NGOs	Task 5. Please describe in detail the unit commitment process used in NEEM-MRN. Include an explanation of how the NEEM regions will, or could, be consolidated to allow for large control / balancing area dispatch and commitment.	As detailed in our webinar, NEEM does not simulate unit-commitment.
103				NGOs	Task 5. Page 12 of the webinar handout describes the "Time domain" in MRN-NEEM for the project. Please provide complete documentation of how MRN-NEEM incorporates information about "beyond 2030".	The information "beyond 2030" is incorporated in the same manner as "before 2030." The model develops a solution over a planning horizon which extends beyond 2030. All input assumptions must be specified in the same manner over the entire planning horizon.
104				NGOs	Task 5. Is the planning period for which MRN-NEEM runs with explicit inputs equal to 20 years (2010-2030)? Please explain.	No. See response to above.
105				NGOs	Task 5. Please provide a complete reference set of all MRN-NEEM input values in a spreadsheet form to allow for consultants to begin to sift through all the particular parameters that will require specification as an input assumption.	CRA is presently preparing template data forms for specifying NEEM input assumptions. These template data forms will be provided as soon as they are ready.
106				NGOs	Task 5. What is meant by "high level transmission analysis" for the macro sensitivities? (p6, SOPO)	EIPC will provide a high-level analysis of the sensitivities of interest to the SSC which will be based on a conceptual assessment made by planning engineers of transmission expansion to support the level of energy exchange identified in the macroeconomic analysis by CRA. Detailed power flow analysis will not be performed at this stage.

107			NGOs	Task 6. Is it certain that the transmission expansion scenarios to be considered will be limited to just three? Please discuss, given that increased numbers of expansion scenarios could shed considerable light on the overall economic effect of different transmission topologies in place in the years beyond 2020.	The focus of Task 6 is for the SSC to review the the results of the macroeconomic analysis from Task 5 and narrow down the resource futures to a total of three which will be the subject of more detailed analysis during Phase II. In Task 7, EIPC planning engineers will develop transmission expansion options to support each of the three scenarios selected by the SSC. In Task 8, these transmission expansion options will be subject to a detailed reliability analysis on an interconnection-wide basis. The EIPC project plan specifies three scenarios for Task 9 to be analyzed in GE MAPS. In Task 9, the production cost analysis will be performed for each of the three scenarios as stated. This analysis will also be performed for each of the transmission options developed to support the resource expansion scenarios.
108			NGOs	Task 7. For which time periods are Expansion Scenarios with modified transmission topology (i.e., transmission additions/reinforcement) to be considered? Will there be a single "future study period", or multiple future study periods?	The transmission expansion options to support the selected resource futures will be developed for one year—probably the horizon year used for the scenario analysis.
109			NGOs	Task 9. For which years will the production cost analyses be run for each expansion scenario? Will multiple year runs be performed? If so, will the transmission additions be aligned to capture the incremental effects of each group of transmission additions?	Task 9 will analyze production-cost simulations for one year, probably the horizon year used for the scenario analysis (2030).
110			NGOs	Task 10. What will be assumed in this analysis for the rate recovery and financing of new transmission investments? What will be assumed for the return on equity?	The PAs will develop transmission costs using generic planning-type estimates referenced to the study year and will represent "overnight" costs. This assumes that facilities could be built and placed in service in a given year and does not include financing costs for construction work in progress. The ROE assumptions have not yet been determined.
111			NGOs	Slide 20 states that the "NEEM Mathematical Problem Formulation" is to "Minimize present value of total costs over a 50-70 year planning horizon." a What do you mean by "total costs"? b) Specifically, i) Does this term mean the total societal costs: all internal costs plus all external costs? ii) Does it mean the total societal costs of the overall system of generating facilities for a given scenario, i.e., the total costs of the individual facilities plus the total costs of the infrastructure that stitches them together? c) If it does not mean the total societal costs, i) Which costs will you not include in the model? To what extent will you describe the magnitude and incidence of the excluded costs? Will you develop a general estimate of the fraction of the total societal costs of the overall system that are not included in your model results? ii) Will you investigate the sensitivity of your results to different assumptions about the magnitude of the excluded costs? Specifically, will you conduct a sensitivity analysis to investigate how different assumptions about the magnitude of the transmission costs would a	a) Please refer to slide 20 which provide the list of major components of total costs. b) i) Please refer to slide 20 which provides the list of major components of total costs. ii)Please refer to slide 20 which provides the list of major components of total costs c) i) Please refer to slide 20 which provides the list of major components of total cost included in the analysis. CRA does not speculate about costs not included in the analysis. ii) A. CRA will perform up to 9 sensitivities for each macro-economic future modeled. The scope of these sensitivities will be developed by the SSC.
112			NGOs	Slide 20 states that the minimization of the present value of total costs will include "(1) fixed and variable nonfuel operating costs for all units" and "(2) fuel costs." a) Will your modeling results reflect the total societal costs for each of these components? b) Specifically, i) Will the nonfuel operating costs include not just the internal costs to the owner/operator but also the external costs, including the environmental costs? ii) Will the fuel costs include not just the internal costs to the owner/operator but also the external costs, including the full, lifecycle, environmental costs of fuel production? c) If not, which components of the nonfuel operating costs and fuel costs will you not include in the model? To what extent will you describe the magnitude and incidence of the excluded costs?	A. Our modeling results will not include externality costs. B) i) Non-fuel operating costs by generation technology are model inputs. CRA will conduct analysis and implement input assumption with respect to these costs, as specified by the SSC. ii) A. Fuel costs are model inputs. CRA will conduct analysis and implement input assumption with respect to these costs, as specified by the SSC. NEEM does not calculate full lifecycle costs for technologies. c) See response to item b. above

113			NGOs	Will your analysis account for all the external costs associated with emissions of SO2, NOX, Hg, and CO2? a) If not, which external costs will it exclude? b) Specifically, i) Will your analysis account for all externalities associated with the impacts of these emissions on land, water, fish and wildlife, threatened and endangered species, and other components of the ecosystems exposed to the emissions? ii) Will your analysis account for the externalities associated with impacts on ecosystems arising from factors other than emissions of SO2, NOX, Hg, and CO2, such as, but not limited to, mountaintop mining, roads, polluted runoff, pollution of aquifers, disruption of fish/wildlife migration, and adverse modification of fish/wildlife habitat? c. If you currently intend that your analysis will not account for these externalities, what steps would be required to modify the analysis so that it would do so?	A) The EIPC analysis will not analyze externality costs associated with airborne emissions. i) Consideration of externality costs is outside the scope of this project. B) i) No. ii) No. c) CRA does not have requested information. Such an analysis is outside of the scope of this project.
114			NGOs	Slide 8 says "NEEM fills the need for a flexible model of the North American electricity market that can simultaneously model both system expansion and environmental compliance." Will the results from the NEEM model represent full compliance with all environmental laws? a) If not, which laws will the results ignore? b) Do you intend to provide any description of the environmental laws that are ignored? c) Do you intend to describe how the results of your analysis would be different if you considered compliance with a broader suite of environmental laws?	No. a) In this analysis, CRA will model environmental policies which the SSC find essential to include for the purpose of this analysis. CRA has no way of knowing which, if any, environmental laws will, or will not, be included in the analysis in that process. b) Please refer to response to a above c) Please refer to response to a above.
115			NGOs	Slide 9 says the "MRN develops a Business as Usual (BAU) case: it simulates the dynamic growth path into the future in the absence of major changes to policies that are 'on the books' today." To what extent will the BAU case account for changes that might occur in the future as policies remain unchanged but their interactions with and impacts on the economy and on the environment change? a) Specifically, i) Will you account for the possibility that, even as environmental laws, e.g., the Endangered Species Act and the Clean Water Act, remain unchanged, the shadow prices of the protected resources will rise (e.g., more species will be listed as threatened or endangered, and society will place higher values on protecting clean water), and the societal costs of facilities that harm these resources will rise? ii) If yes, what data and methods will you use to estimate the changes in shadow prices, and how will you incorporate the changes into your analytical results? iii) If no, to what extent will you describe how the omission will affect your results? b) Will you employ the BAU case consistently to estimate the	The MRN baseline is calibrated to the EIA's Annual Energy Outlook forecasts (AEO) such that the energy and the macro-economic forecasts are internally consistent. The EIA generally assumes that current laws and regulation are maintained throughout its' projection period. The projections are, thus, policy neutral baselines and do not include policies that might be enacted in the future. Alternate baseline assumptions can be analyzed as separate scenarios. a) i) No. Those would be new, future regulations that are not "on the books" and thus not a part of the EIA's baseline projection ii) Not applicable.iii) This assessment goes well beyond the scope of this analysis. b) Yes. All scenarios, and hence cost estimates, will be done against the identical BAU.c) Transmission line costs are not included in the MRN-NEEM analysis.
116			NGOs	Will your analysis allow quantification of terrestrial and aquatic resources directly used and/or degraded by various generation and transmission actions? Will it provide spatial identification and measures of the value of the resources utilized or otherwise impacted? For example, will it account for the footprint of different generating technologies and fuels? For the footprint of transmission lines? If your current framework does not include this capability, what would be required to develop the capability?	MRN-NEEM estimates how changes in costs and availability of energy resources and technologies affect the U.S. economy. This provides a useful comparative measure of the financial costs and economic system impacts of various energy policies. To the extent that policies have additional impacts, such as more or less impact on aquatic resources, or more or less aesthetic impact , those could be quantified separately and incorporated into the evaluation of policy alternatives in a multi-attribute or multi-objective evaluation process.

117			NGOs	To what extent will your analysis identify and account for the indirect effects on aquatic and terrestrial resources, e.g., via the deposition of atmospheric pollutants? If your current analytical framework does not include this capability, what would be required to develop the capability?	The MRN-NEEM model does not take into account indirect effects on aquatic and terrestrial resources. It produces estimates of pollutant emissions from the power sector, and of greenhouse gas emissions from all economic activities. The pollutant emissions could be used as inputs to an atmospheric fate and transport model, to predict altered pollutant loadings across the U.S., and from there into biological process models to assess indirect effects on the ecosystem. This kind of integrated assessment is a major undertaking and is beyond the scope of this project.
118			NGOs	Will your analysis identify the distribution of effects by stakeholder groups (e.g., internal vs. external, current vs. future generations, or residents of areas proximate to fuel sources vs. those proximate to facilities)? Will it provide information that would allow identification of the spatial and temporal distribution of costs imposed external to the management of generation and transmission facilities?	The MRN-NEEM model would be able to quantify macro-economic effects, such as, economic costs and labor effects at a broad regional and sectoral level as a result of the policy. It also produces costs spread by time period through 2050. It does not provide income distributional impacts.
119			NGOs	To what extent are IMPLAN fixed-coefficient production functions and multipliers driving the model's operation and results? How does your analytical framework account for the generally-accepted limitations of IMPLAN models: Overstated multiplier effects? Omitted input and output variables? Omitted accounting for the economic importance of consumption amenities associated with natural-resource public goods? Omitted accounting for environmental externalities? If your current analytical framework does not fully account for these limitations, what would be required to do so?	The model structures of MRN-NEEM and IMPLAN model are different. MRN-NEEM model is a fully dynamic computable general equilibrium (CGE) model, which stands in stark contrast to a fixed-coefficient input-output model like IMPLAN. In the CGE modeling framework the substitutability of goods, induced by the relative price changes, is governed by the elasticity of substitution parameter between the goods; while in the input-output framework demand for intermediate goods changes in the fixed proportions. The inter-linkages of all economic agents within the model in the CGE framework enable it to take into account a complete set of feedbacks within the economy and addresses limitations of the input-output approach for standard economic analysis. The social accounting matrix provided by IMPLAN is a basis for the general links for non-energy material inputs across sectors of the U.S. economy, but excessive multiplier effects are eliminated by the fact that this matrix is embedded in a fully substitutable set of relationships for the production of all inputs, including capital, labor, energy, as well as materials. Similarly, demands can shift among goods and services as a result
120			NGOs	Much of the MRN-NEEM model is based on structural input-output and CGE modeling. To what extent have you empirically validated the structural relationships between parameters implicitly assumed in the model? Which relationships do you feel are impossible to empirically validate, and why? Which model dependencies are based on empirical evidence, and which are based solely on theory? Are there model assumptions necessary for practical reasons that differ from empirical evidence? Have you or others conducted any sorts of program evaluations for assumptions crucial to the model's functionality?	The underlying equations of the models are derived from economic theory based on the theoretical concept of an Arrow–Debreu equilibrium in which macro-level outcomes are driven by the decisions of self-interested consumers and producers. The elasticity of substitution parameters are the main drivers of the results. The elasticity parameters in the model are based on empirical econometric studies where possible and on parameters developed for other similar models such as MIT's EPPA model and EIA's AEO. MRN-NEEM and related CRA CGE models using similar sets of parameters have been evaluated and peer-reviewed through the process of model intercomparison exercises, the most well-known of which is Stanford University's Energy Modeling Forum. These models have been evaluated in multiple rounds of the Energy Modeling Forum for nearly 20 years, including being involved in two of the on-going Forums.
121			NGOs	As a follow up to unanswered question #1 from the webinar ("Can technological change be modeled in the large as a proxy for the various possible changes over the period studied?"): Are reductions in overnight construction cost for generation as a function of cumulative installed capacity governed by progress ratios / learning rates or by other means? Do these remain constant for each technology or do they change throughout the planning time horizon? If the latter, please explain.	Overnight construction costs for generation can be modeled as dynamically changing over time. NEEM does not explicitly include learning rates or progress ratios in its calculations.

#			Stakeholder	Question	Response
122			NGOs	Are the deployment rates of generation technologies constrained by exogenous "speed limits" or other means or can the model build as much of a single technology as needed to meet reserve requirements in that time step? If some speed limit constraint is imposed, please describe how this currently implemented in the model and whether it is a function of cumulative or incremental installed capacity additions.	NEEM can constrain the cumulative or incremental addition of technologies by region. These constraints will be provided as part of the SSC's scenario inputs.
123			NGOs	Related to unanswered question #25 from the webinar ("Is DSM / energy efficiency a resource option in NEEMS?"): Are investments in energy efficiency and demand response governed by a supply curve or is a fixed cost applied to these independent of the amount deployed over the planning time horizon? Is some other method used to adjust the evolution of their costs as a function of their rate of deployment?	DSM/Energy efficiency could be represented with the same modeling techniques as applied to generation resources: overnight investment costs, regional limitations, output profiles, operating costs and others.
124			NGOs	How is technological advancement in energy efficiency technologies reflected in the model?	Energy efficiency improvements are reflected in the demand forecasts used in the model. The advancement and impact of these technologies will be an input supplied by the SSC.
125			NGOs	Do financing terms in the model reflect the differences in public/private/consumer discount rates? How is this currently implemented? How many different capital charge rates govern the costs calculations in the model?	The annual money discount rate in the MRN-NEEM model is assumed to be 5% real; which is also the real interest rate. The bottom-up portion of the model, the electric sector, uses capital charge rates account for costs of debt and equity, time to build the plants, tax life, useful life and average debt-equity ratios, but also uses a real discount rate of 5%.
126			NGOs	Related to unanswered question #2 from the webinar ("Are construction costs for generation and transmission localized?"): Are availability profiles for renewables developed for each region as a function of installed capacity? Are such supply curves for wind based on Truewind/3Tier data or some other source?	Availability profiles by region for renewables are specified as an input to the model. For each region, a number of groups of renewable resources could be specified, each characterized with its overnight cost, overall potential and availability profiles. The SSC will provide the availability profiles by region.
127			NGOs	How are the contributions of wind power to system reserves handled? Webinar slide #31 mentions a user-specified de-rate is applied to discount the capacity value of wind. Does the model use a fixed fraction of the installed capacity (a mean effective load carrying capability) as an input or is some other method employed? Is it possible to allow this to vary with wind penetration and by region?	The model uses an effective load carrying capability of wind as an input. This can vary by region and by group within a regions (see response to 41).
128			NGOs	Do integration costs for renewables take into account regional heterogeneity of balancing authority size, generation mix flexibility and geographic diversity in resource meteorology? Do they vary with wind penetration and by region?	CRA does not independently develop renewable integration costs for the purpose of this project. These costs could be incorporated into the NEEM modeling framework if provided by the SSC in the context of macro-economic future to be analyzed.
129			NGOs	Related to unanswered question #4 from the webinar ("Can differentials from Henry Hub be changed over time e.g., expansion of shale gas resources?") : In response to a question during the webinar it was noted that natural gas prices are derived from EIA AEO natural gas price forecasts. Are these treated as an exogenous input to the model or does the rate of economic growth and other factors internal to the model contribute to the price evolution of natural gas? If so please explain how AEO numbers are folded into the model and how those projections are adjusted by MRN-NEEM.	CRA normally uses prices derived from EIA AEO forecasts as its reference gas price trajectory; the SSC may elect to provide a different gas price trajectory if it so chooses. Depending on other macroeconomic factors (e.g. carbon prices, other allowance prices, demand growth), MRN-NEEM may adjust the base gas price trajectory either up or down.

#			Group	Question	Response
130			NGOs	As a follow-up to unanswered questions #37, 16 and 8 from the webinar: Can the expansion of interregional transfer limits be regionally specific such that the costs for incremental transfer capacity are a function of the specific regions between which the transfer limit is increased?	In NEEM, inter-regional transfer limits are regionally specific. However, as explained at length at the webinar, NEEM does not include costs for incremental transfer capacity, because such costs are inherently site-specific.
131			NGOs	Is the location of a bus in MAPS accompanied with some geospatial information such that GIS data layers could be overlain to scale costs ($/MW-mile of transmission for example)? Webinar slide 38 makes mention of GIS data for units/buses in the model but it is unclear if that data layer can be integrated with additional GIS layers to regionally disaggregate costs in this way.	The geographic coordinates of each bus are not specific to GE MAPS. The roll-up plan developed in Task 2 will specify the transmission topology to be used for the GE MAPS analyses in Task 3. In Task 10, EIPC planning engineers will provide high-level cost estimates of the capital costs of the transmission expansion options based upon generic cost information and not specific route selection or engineering design. These estimates will recognize, to the extent possible, regional differences that may affect such construction costs.
132			NGOs	What are the assumed mercury reduction benefits associated with the various control technologies in MRN-NEEM described on slide 28 of the webinar?	CRA will provide this information together with basic input assumption as a single package when we provide a default input set.
133			NGOs	Does MRN-NEEM take environmental compliance obligations into account beyond what is listed in the model narrative (Title IV, NOx SIP Call, the Clean Air Interstate Rule (CAIR), proposed MACT rules)? For instance: cooling water intake retrofits; waste disposal & remediation obligations; waste-water treatment?	Yes.
134			NGOs	How are carbon allowance allocations reinserted into the economy? Can the model reflect the stimulus that dollars can provide to boost economic growth, increase household purchase power and raise household income levels?	Any allowance value created through creation of an emissions cap is always reinjected into the economy through some allocation assumption. Thus, there is no drain on average household purchasing power or average household income as a result of a carbon cap. Stated otherwise, the "boost" that is asked about is always already a part of every MRN-NEEM model run. The assumptions for how that allowance value would be reinserted into the economy must be specified by the user, and is a choice open to the SSC. The MRN-NEEM model is set up to allow any of a variety of allowance distribution formulas to regional average households, including based on consumption patterns, population, or historical emissions levels. This is usually done on a lump-sum basis. Any lump-sum transfer (e.g. stimulus) to the consumer increases its' income and hence household purchasing power, thus offsetting the same policy's impacts on household costs and/or income.
135			NGOs	Are measures to limit carbon price escalation (e.g. strategic reserve pool) reflected in the model? If not, how might this be implemented?	It is possible to model such policies. CRA have used MRN-NEEM to analyze such policies reflected in the American Clean Energy and Security Act of 2009, ACESA or H.R.2454 and The American Power Act. The ultimate input assumptions should be determined by the SSC.
136			NGOs	Will inputs and outputs be available (estimated or actual) by state in addition to NEEM regions?	Yes.
137			NGOs	Will the models assume that generation resources will perform according to historical norms, or will there be explicit consideration of the impact of higher temperatures due to climate change on power plant performance, transmission load losses, cooling water intake temperatures, and other similar energy performance metrics?	The models do not explicitly consider climate change effects. Generation resource performance characteristics can vary over time, and the SSC may supply such time-dependent performance characteristics if it so chooses.
138			NGOs	What is the source of and methods for using biomass resource supply curves in the modeling?	CRA models do not explicitly simulate biomass resource supply. Supply of biomass generation fuel is assumed unlimited subject to prices which are a model input to be specified by the SSC.