EMF Scenario Design (Second-Round) Highlights:

Baseline case:
- Please use 2009 AEO Stimulus reference case, focusing on oil prices and real GDP.
- Link for variables reported in Annual Energy Outlook 2009 AEO stimulus reference case:
  http://www.eia.doe.gov/oiaf/servicerpt/stimulus/index.html
- Extensions beyond 2030 (end of AEO projections) will require modeler assumptions. They might be calibrated to be consistent extensions of (but necessarily equal to) the AEO trends over the last 5 or 10 years of their projection. Please discuss with EMF headquarters if you need further guidance.
- Standardize on your model's exogenous variables (maybe GDP) with this reference case.
- If oil prices are endogenous and you usually consider a range of price paths, please try to select one that is closer to AEO 2009 stimulus results.
- Please report as many fuel prices shown in the EMF model output worksheet as you can. This effort will be helpful for comparing results across models.
- EIA has included the following programs from The American Recovery and Reinvestment Act (ARRA) in its Stimulus reference case: Weatherization and assisted housing, Energy efficiency and conservation block grant programs, State energy programs, energy efficiency funding for Federal buildings, Plug-in hybrid vehicle tax credit, Electric vehicle tax credit, Updated tax credits for renewables, Loan guarantees for renewables and biofuels, Support for carbon capture and storage (CCS), and Smart grid expenditures.

Carbon tax case:
- All taxes are adjusted for inflation and are expressed in 2007$.
- All energy sources are taxed at $30 per ton of carbon dioxide equivalent in 2010.
- Tax rate is increased by 5%, inflation adjusted, each year.
- Please assume that all tax revenues are recycled back to the economy in as neutral a manner as possible. In computable general equilibrium models, this assumption means that revenues are returned to households as a lump-sum, equal dividend to each household. In models with aggregate demand macroeconomic relationships, this procedure may require that the federal deficit will not change. No specific government energy-efficiency or other targeted program should be financed with these revenues. Please discuss with EMF staff if you still have a question.

General energy sales tax case:
- All energy sources are taxed at the same 15% excise tax <u>rate</u> (approximately, $2.50 per million BTU in 2010). New price = reference price x (1.15) in 2010.
- All percent taxes (15%) are applied to delivered not primary energy.
- Please see attached Table 1 for derivation of this tax.
- BTU tax <u>level</u> is increased by 5%, inflation adjusted, each year. Tax level ($/MMBTU) in 2011 = tax level ($/MMBTU) in 2010 x (1.05), etc.
- Please use the same revenue recycling assumptions as in the carbon tax case.

Residential, Commercial and Transportation Sector Standards:
• There appears to be some merit in considering standards and equipment cost subsidies separately rather than as one "all-in" policy package. This revision is the major change between the cases discussed at the meeting.
• Building Codes increase as specified in the Waxman-Markey Bill. See attached Table 2.
• Energy-efficiency standards are improved for selected new building and equipment in the residential and commercial sectors.
• Light vehicle fuel economy standards are increased to President Obama's proposed standards that require a minimum passenger car fuel economy of 39 miles per gallon and a light truck fuel economy of 30 miles per gallon by model year 2016. The standards are ramped up linearly for model years 2012 through 2016 and held constant after 2016. Table 3 provides the CAFE standards in the form of minimum fuel economy requirements and as parameter values for NHTSA's continuous function formula that is used to determine minimum fuel economy by vehicle footprint.
• New equipment with energy efficiencies below these standards are not allowed to enter the market.
• Please contact EMF headquarters if you need additional guidance on implementing this case.

Reduced Costs for New Equipment:
• Case can be considered as either a subsidy for new capital costs or the benefits of successful RD&D.
• Reduce the capital costs of new energy-efficiency units in the residential and commercial sectors.
• For each new unit with energy efficiency that exceeds the least efficient unit available (i.e., the current standard), please reduce its cost by 50% of the difference between its cost relative to the least efficient unit available (i.e. the current standard).
• Please contact EMF headquarters if you need additional guidance on implementing this case.

Standards with Carbon Fee: Combine assumptions for carbon fee and standards.

Reduced Equipment Costs with Carbon Fee: Combine assumptions for carbon fee and reduced costs for new equipment.

7% Solution or "Magic Bullet":
• "Magic Bullet" is a diagnostic rather than a policy scenario. Since it ignores possible cost implications of reducing the discount rate, there will be no efforts to see if society's welfare improves.
• Consumers select energy equipment based solely upon costs using a 7% discount rate.
• Please do not adjust other constraints for market barriers, consumer heterogeneity and intangible costs in addition to direct equipment and energy costs. Please do not adjust other assumptions, such as payback periods, diffusion rates, etc.

Removed Scenarios:
• The addition of several new second-round scenarios has required the elimination of two first-round cases: oil taxes and non-price energy conservation programs where consumers selected the most energy-efficient units available during that year.
• Two other cases discussed at the meeting have also not been included: the flat price and frozen technology cases for evaluating the role of prices and other factors in energy intensity trends.

Table 1: Comparable CO2, BTU and Oil Taxes

	2010			
Tax				
Carbon	**$30.00**	$ per metric ton		
BTU	$1.76	$ per million BTU		
BTU-delivered	$2.46	$ per million BTU		
Expenditures	$1,217.94	$ billion		
Average Price	$16.96	$ per million BTU		
BTU-delivered %	**14.48%**			
BTU x Renew	$1.85	$ per million BTU		
Oil	**$26.85**	$ per barrel		
Levels				
CO2	5880.08	million metric tons		
BTU	99946.39	trillion BTU	99.95	quad (10^15) BTU
BTU-delivered	71820.14	trillion BTU	71.82	quad (10^15) BTU
BTU x Renew	95215.52	million barrels	95.22	quad (10^15) BTU
Barrels	6569.19	million barrels	6.57	billion barrels
Revenues				
CO2	$176,402	million dollars		
BTU	$176,402	million dollars		
BTU-delivered	$176,402	million dollars		
BTU x Renew	$176,402	million dollars		
Oil	$176,402	million dollars		
Oil				
conversion	5.80		AEO 2009 (Dec) Reference	
Qd BTU	38.10		estimates in yellow.	
B Barrels	6.57			
MMBD	18.00			

Yellow values derived from AEO 2009 Reference case.
Oil converted to million barrels and energy to trillion BTU under "Levels".
Entries under "Tax" show BTU and oil fees needed to equate "Revenues."

Table 2: Buildings Sector Standards for EMF25 Standards Case

Residential and Commercial – adopt updated building codes as described in the Waxman-Markey proposed legislation

Residential Products	Date	Level	Installed Cost ($2007)
Central AC and Heat Pumps	2016	16 SEER	$3500
Furnaces (fossil)	2018	90 AFUE	$2200
Boilers	2018	85 AFUE	$3400
Refrigerators	2014	460 kWh/yr	$650
Freezers	2014	350 kWh/yr	$450
Clothes Dryers (electric)	2014	3.48 EF	$450
Electric Water Heater	2013	.95 EF	$470
Gas Water Heater	2013	.64 EF	$475
Gas Cooktop	2012	.42 EF	$500
Dishwashers	2018	.65 EF	$750
Room AC	2014	10.8 EER	$370
Clothes Washers	2015	1.72 MEF	$750
Linear Fluorescent Lamps	2012	28 watts	$7.00
Torchiere Lamps	2016	154 watts	$2.22
Reflector Lamps	2012	50 watts	$4.10

Commercial Products	Date	Level	Typical Capacity	Installed Cost ($2007)
Centrifugal Chillers	2016	6.1 COP	350 tons	$425/ton
Reciprocating Chillers	2016	2.8 COP	100-200 tons	$465/ton
Rooftop AC	2016	11.7 EER	90,000 Btu/hr	$7800
Rooftop Heat Pump	2016	11.7 EER/ 3.4COP (heat)	90,000 Btu/hr	$7800
Gas-fired Furnace	2012	82% Thermal Efficiency	400,000 Btu/hr	$3150
Oil-fired Furnace	2012	83% Thermal Efficiency	400,000 Btu/hr	$3900
Gas-fired Boiler	2013	85% Combustion Efficiency	440,000 Btu/hr	$9000
Supermkt Display Case	2012	21 MWh/yr	20,000 Btu/hr	$6078
Supermkt Refrigeration Compressor Rack	2012	1000 MWh/yr	1,050 MBtu/hr	$122,550
Supermkt Refrigeration	2012	120 MWh/yr	1,520	$44,120

Commercial Products	Date	Level	Typical Capacity	Installed Cost ($2007)
Condenser			mBtu/hr	
Reach-in Refrigerator	2016	2400 kWh/yr	3,000 Btu/hr	$2650
Vending Machines	2012	2400 kWh/yr	700 Btu/hr	$1639
Automatic Ice Makers	2015	3750 kWh/yr	500 lbs/day	$2647
Halogen Reflector Lighting	2012	Halogen infrared (IR)	1172 system lumens	$70.60*
Linear Fluorescent Lighting ≤ 4 foot	2014	High efficiency lamps w/ High Efficiency fixture	3500 system lumens	$84.30*
Metal Halide Lighting	2015	system efficacy	system lumens	
High Bay Application		55.9 lumens/watt	16250	$321.60*
Low Bay Application		49.5 lumens/watt	9600	$352.00*

*Commercial lighting costs represent lighting system – include lamps/ballast/fixture + installation

Table 3: CAFE Standards for EMF25 Standards Case

	2012	2013	2014	2015	2016
Passenger Car	32.7	34.3	35.9	37.5	39.0
Light Truck	26.4	27.1	27.8	28.6	30.0
Parameter Values for Continuous Function Formula					
Passenger Car					
Parameter A	32.8	34.4	36.0	37.6	39.2
Parameter B	24.9	25.8	26.6	27.5	28.4
Parameter C	51.4	51.4	51.4	51.4	51.4
Parameter D	1.9	1.9	1.9	1.9	1.9
Light Truck					
Parameter A	27.9	28.7	29.4	30.2	31.0
Parameter B	21.6	22.1	22.7	23.2	23.7
Parameter C	56.4	56.4	56.4	56.4	56.4
Parameter D	4.3	4.3	4.3	4.3	4.3