Scenario Analysis – Assumptions on Characteristics of Power Plant Technologies in the Scenarios

Scenario Analysis –
Technology Assumptions for Supply-Side Resources

- **Power plant technology characteristics (in-region power plants)**
  - Operating parameters
  - Capital and variable costs
  - Air emission rates and allowance prices
  - CO_2 sequestration costs
  - Water use and land area requirements

New Power Plant Assumptions

Technology	MW	Heat Rate (Btu/hr)	Avail %	Capital Cost $/kW	Sources
IGCC w/o CO_2 Capture	600	8,000	80	1600-2000	EPA, EPRI
IGCC w/ 90% CO_2 Capture	500	9,750	80	1900-2300 (plus sequestration costs)	EPA, EPRI
NG Combined Cycle	400	6,500	90	800-1000	GE
NG Comb Turbine	100	8,500	90	500-700	GE
Nuclear	1080	10,000	90	2000-3000	Westinghouse, NEI
Fuel Cell*	1	8,000	95	3500-4000	Fuel Cell Energy
Biomass	40	14,000	90	2000-2500	NE Plants, NH DES
Landfill Gas	5	10,500	90	2000-2500	NE Plants
CHP*	5	9,750	90	1000-1500	Solar Turbines
Photovoltaics	1	20%**	N/A	6000-8000	UMASS RERL
Wind On-shore	2.5	N/A	48***	1500-2000	UMASS RERL
Wind Off-shore	3.5	N/A	48***	2000-2500	UMASS RERL

*Data is for electric production only **Conversion Efficiency: sunlight to AC power ***Based on wind energy profile

Power Plant Emission Rates – Existing Units

- **Data input sources:**
  - Emission data are from US EPA, same as used in RSP06 for SO_2, NO_x and CO_2
  - Based on existing emission rates and adjusted to reflect implementation of recent CT and MA SO_2 and NO_x regulations
- **Note:**
  - Emissions rates for existing plants remain constant across cases
  - Given high-level nature of scenarios exercise, expect system-wide metrics rather than reporting of results at individual plants

Power Plant Emission Rates – New Units

- **Sources of information and assumptions:**
  - Assumed current state-of-the-art technology
  - Various public sources: EPA, EPRI, DEPs, vendors, reports, NE plants
  - Environmental Advisory Group input for SO_2, NO_x and CO_2
- **Mercury issues – calculated using modeling results in conjunction with:**
  - Coal assumptions re: mercury content of fuel
    - **Imported coal 2.7 – 5.5 lb / Trillion Btu**
    - **Appalachian coal 15.4 lb / Trillion Btu**
  - Mercury reduction – calculation of mercury from power plant output at coal-fired plants, and compare with state Hg limits:
    - **CT: 0.6 lb / Trillion Btu**
    - **MA: 0.0025lb / GWh**
    - **NH: 80% reduction**

New Power Plants – Emission Rate Assumptions

Technology	MW	Heat Rate (Btu/kWh)	SO_2 (lb/MBtu)	NO_x (lb/MBtu)	CO_2 (lb/MBtu)	Sources
IGCC w/o CO_2 Capture	600	8,600	0.1	0.03	210	EPA, EPRI
IGCC w/ 90% CO_2 Capture	500	9,750	0.1	0.03	21	EPA, EPRI
NG Combined Cycle	400	6,500	0.0006	0.01	120	GE
NG Combustion Turbine	100	8,500	0.0006	.03	120	GE
Nuclear	1080	10,000	0	0	0	Westinghouse, NEI
Fuel Cell*	1	8,000	0.0006	0.0088	120	Fuel Cell Energy
Biomass	40	14,000	0.02	0.075	0**	NE Plants, NH DES
Landfill Gas	5	10,500	0.2	0.03	0	Solar Turbines
CHP*	5	9,750	0.0006	0.028	120	Solar Turbines
PV and Wind, on and off-shore			0	0	0	

*Data is for electric production only

**Biomass cycle is carbon neutral

* Considered carbon neutral

SA Assumptions – 2020 Allowance Prices (2006$)

Type Emission	Allowance Price ($/ton)	Source
SO_2	969	EIA AEO 2006
NO_x	2,345	EIA AEO 2006
CO_2	5, 10, 20	RGGI, EU CO_2 market
Mercury	[not considered in the dispatch]	

New Power Plants – Total Variable Costs: Fuel & Emission Allowances

Technology	Size MW	Heat Rate Btu/kWh	Fuel Prices $/MWh	Emissions Allowances $/MWh	Total Fuel & Emissions $/MWh
PV and Wind, on and off-shore			0	0	0
Landfill Gas	5	10,500	0	1.4	1.4
Nuclear	1080	10,000	17.0	0	17.0
IGCC w/ 90% CO_2 capture	500	9,750	19.5	1.8	21.3
IGCC w/o CO_2 capture	600	8,600	16.0	9.4	25.4
NG Combined Cycle	400	6,500	40.1	4.1	44.2
Biomass	40	14,000	46.6	1.4	48.0
Fuel Cell*	1	8,000	49.3	4.9	54.2
NG Comb Turbine	100	8,500	52.4	5.6	58.0
CHP*	5	9,750	60.1	6.4	66.5

*Data is for electric production only

Other Environmental Assumptions– still under development

- **CO_2 Sequestration costs**
  - IGCC $15 – $55 / Mton avoided (Carnegie Mellon, 2006)
  - $5 – $50 / Mton (Bechtel, 2002)
- **Cooling water requirements – gpm/MW consumed**
  - Nuclear
  - IGCC
  - NGCC
- **Land requirements – acres/MW**