Scenario Analysis – Metrics

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ISO new england

Metrics – Overview

- **To provide helpful results to stakeholders, there will be various means to compare Scenarios:**
  - Economic metrics (system-wide production cost, system-wide average prices, etc.)
  - Reliability metrics (exposure to loss of fuel source, dependence on fossil fuel, etc.)
  - Environmental metrics (emissions of various air pollutants, water consumption, etc.)
  - Other metrics (associated fuel delivery or transmission infrastructure requirements, etc.)
- **ISO-NE worked with stakeholders to develop set of metrics to use in comparing scenarios**

Metrics – Overview

Economic	Reliability	Environmental
System-wide Production costs	System-wide energy mix (% by fuel)	System-wide emissions of SOx, NOx, CO2
LSE Expense for wholesale energy based on hourly New England LMP	System-wide capacity mix (% by fuel)	Total system-wide NOx emissions for the fifteen highest peak load summer days
Average wholesale LSE expense for wholesale energy	Total units of fossil fuel burned	CO2 emissions compared to RGGI cap
Capital cost net of energy revenues	Exposure to fuel supply disruption	Mercury emissions – total and compared to regulations
Price duration curve for LMP		Water use
Conceptual incremental transmission infrastructure cost		Amount of land used
Conceptual incremental distribution infrastructure cost		% renewable energy
Conceptual incremental gas delivery infrastructure cost		Renewable compared to RPS % requirements

Economic Metrics

Metric	Definition	Basis	Unit
Production Cost	Total cost of fuel plus allowances. Variable O&M ignored	Output of IREMM	Billion $ for system Cents/kWH for system Million $ for expansion unit Cents/kWH for expansion unit Annually Seasonally Hourly (as price duration curve)
LSE Expense	Total LSE expense for wholesale energy based on hourly New England LMP	Output of IREMM	Billion $ Cents/kwh Annually Seasonally Hourly (as price duration curve)
Average wholesale energy cost (LMP)	LSE expense per MWH	Output of IREMM	$/MWh (c/kwh) • Annually • Seasonally • Hourly (as price duration curve)

Economic Metrics

Metric	Definition	Basis	Unit
Capital cost net of energy revenues Net revenue by fuel type Capital cost Annual Revenue Requirements Capital costs net of energy revenues	Follow these steps 1. Determine net revenue by fuel type from the production cost simulation (expansion technology gross energy revenues minus the technology production cost) 2. Determine the range of capital costs ($/kW) for different technologies 3. Determine the range of annual revenue requirements (proxy of 15% to 25% to cover such things as capital cost, financing, taxes, etc.) 4. Compute capital costs net of energy revenues by subtracting the annual revenue requirements from the net revenue by fuel type (Result from step 1 minus the result from step 3.) 5. Notes: 1. FCM range is currently in the range of $4.50 to $15.00/kW-mo (translates into $54- 180/kW-year) 2. There are other factors, such as income from Renewable Energy Credits, Tax credits, etc. that we will not be including in these calculations	Output of IREMM plus side calculation	Billion $ and $/kW-yr 1. $ (also show cents per kWH) 2. $/kW 3. $/yr 4. + /- $ 5. Text explanation

Economic Metrics

Metric	Definition	Basis	Unit
Wholesale c/kWH duration curve	Wholesale c/kWH duration curve (may be covered by additions above) Take each expansion units production cost and divide by its energy contribution, plot on LDC to match annual energy contribution (Post processingc/kWH	Post-processing c/kWH LDC	Wholesale c/kWH duration curve
LMP c/kwh duration curve (may be covered by additions (above)	Same as above but utilizing LMP prices c/kWH LDC	Post-processing c/kWH LDC	c/kwh LDC

Reliability metrics

Metric	Definition	Basis	Unit
Energy mix	% energy from each fuel type and energy resource	Output of IREMM with post processing for renewables and EE/DR	Pie or bar chart in %
Capacity mix	% capacity by fuel and resource type	Separate calculation based on scenario	Pie or bar chart in %
Loss of fuel source	Remaining operable capacity after loss of all of a single fuel source	Separate calculation based on scenario	MW of capacity shortage to meet peak (demon-strates need for dual fuel, etc.)

Environmental Metrics

Metric	Definition	Basis	Unit
Annual SO2	Total system SO2 emissions based on current regulations	IREMM output	Tons Lbs/MWHr
Total NOx	Total system NOx emissions assuming current regulations	IREMM output	Tons Lbs/MWHr
Highest NOx days	NOx emission on fifteen highest peak load days	Summarize from IREMM output	Tons Lbs/MWHr
Total CO2	Total system CO2 emissions based on current regulations	IREMM output	Million tons Lbs/MWHr
RGGI CO2 Cap	Comparison of total CO2 emissions with RGGI cap for New England	Model output compared to RGGI cap	Complies or not.

Environmental Metrics

Metric	Definition	Basis	Unit
Mercury	Total system mercury emissions based on current regulations	Calculation based on coal plants MWH from IREMM times their mercury emissions rate	Lbs Lbs/MWHr
Water use	Increase in water consumption assuming cooling towers for new capacity	Calculation based on typical cooling tower requirements for new capacity types	Daily gallons consumed for cooling towers
Land amount	Increased land required for new generation and transmission	Calculation based on typical generation sites required plus transmission	Acres Acres/MW
Renewable energy contri-bution	Renewable energy MWH as % of total MWH. (proxy for meeting RPS in the NE region)	Calculation based on IREMM output	% Compare Renewable Energy Credits (MWhrs) with RPS requirements (similar to RSP)

Other metrics

Metric	Definition	Basis	Unit
Costs for conceptual transmission expansion	Rough generic cost estimates for transmission 1) Imports from Quebec or Labrador 2) Imports from the west 3) On-shore wind 4) Off-shore wind 5) Nuclear expansion	Results of TO/ISO WG	$/MW-mile $ for specific projects c/kwh for expansion units
Costs for conceptual distribution expansion	Rough changes in the generic cost estimates for distribution expansion due to EE and DR.	T.O.s' input	$/MW load c/kwh for expansion units
Need for expansion of natural gas system	Rough generic cost estimates	Levitan study	$ c/kwh expansion units