Methodology: Economic Analysis

The following subsections provide a methodology for performing the economic calculations to derive gross values in $/kWh for each of the value components.

Important note: The economic analysis is initially performed as if PV was centrally-located (without loss-saving benefits of distributed location) and with output perfectly correlated to load. Real-world adjustments are made later in the final value result by including the results of the loss savings and load match analyses.

Discount Factors

For this analysis, year 0 corresponds to the year of installation of the PV systems in question. As an example, if the calculation is performed for PV installations between January 1, 2014 and December 31, 2014, then year 0 would be 2014, year 1 would be 2015, and so on.

For each year *i*, a discount factor is given by

$$DiscountFactor_i = \frac{1}{(1 + DiscountRate)^i} \quad (6)$$

DiscountRate is the utility Weighted Average Cost of Capital.

Similarly, a risk-free discount factor is given by:

$$RiskFreeDiscountFactor_i = \frac{1}{(1 + RiskFreeDiscountRate)^i} \quad (7)$$

RiskFreeDiscountRate is based on the yields of current Treasury securities[12] of 1, 2, 3, 5, 7, 10, 20, and 30 year maturation dates. *RiskFreeDiscountRate* is used once in the calculation of the Avoided Fuel Costs.

Finally, an environmental discount factor is given by:

$$EnvironmentalDiscountFactor_i = \frac{1}{(1 + EnvironmentalDiscountRate)^i} \quad (8)$$

EnvironmentalDiscountRate is based on the 3% *real* discount rate that has been determined to be an appropriate societal discount rate for future environmental benefits.[13] As the methodology requires a

[12] See http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield

[13] http://www.epa.gov/oms/climate/regulations/scc-tsd.pdf

nominal discount rate, this 3% *real* discount rate is converted into its equivalent nominal discount rate as follows:[14]

$$NominalDiscountRate = (1 + RealDiscountRate) \times (1 + GeneralEscalationRate) - 1 \quad (9)$$

The *EnvironmentalDiscountRate* is used once in the calculation of the Avoided Environmental Costs.

PV degradation is accounted for in the economic calculations by reductions of the annual PV production in future years. As such, the PV production in kWh per kW-AC for the marginal PV resource in year I is given by:

$$PVProduction_i = PVProduction_0 \times (1 - \text{PVDegradationRate})^i \quad (10)$$

where PVDegradationRate is the annual rate of PV degradation (see assumptions below). $PVProduction_0$ is the Annual Avoided Energy for the Marginal PV Resource.

PV capacity in year *i* for the Marginal PV Resource, taking into account degradation, equals:

$$PVCapacity_i = (1 - \text{PVDegradationRate})^i \quad (11)$$

Avoided Energy Cost

Avoided energy costs are based on ISO-NE hourly real time locational marginal prices for the Maine load zone. The first year avoided cost is calculated as follows:

$$\text{AvoidedEnergyCost}_0 = \sum LMP_h \times HourlyPVFleetProduction_h \quad (12)$$

The first year Avoided Energy Cost will be calculated using 2013 Locational Marginal Price (LMP) data.

For future years, the first year cost will be escalated using a combination of NYMEX natural gas futures (first 12 years) and United States Energy Information Agency (EIA) forecast of natural gas prices for electric power between 2014 and 2038.[15]

[14] http://en.wikipedia.org/wiki/Nominal_interest_rate
[15] http://www.eia.gov/oiaf/aeo/tablebrowser/#release=AEO2014&subject=16-AEO2014&table=3-AEO2014&region=1-1&cases=ref2014-d102413a