Office of Utilities Regulation

DECLARATION OF INDICATIVE GENERATION AVOIDED COSTS

OFFICE OF UTILITIES REGULATION

June 2008

Office of Utilities Regulation
Estimation of Generation Avoided Costs
Document No. Ele 2008/06

DOCUMENT TITLE AND APPROVAL PAGE

DOCUMENT NUMBER: Ele 2008/06

1. DOCUMENT TITLE:

Office of Utilities Regulation Declaration of Indicative Generation Avoided Costs

2. **PURPOSE OF DOCUMENT**

This document sets out the Declaration of Indicative Generation Avoided Costs which is intended to be used as the basis of gauging the price at which alternative sources of electricity may be sourced, and to define the market values of electricity generated by various sources.

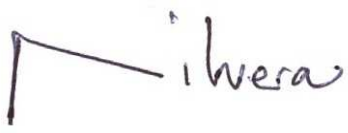
3. RECORD OF REVISION

Revision No.	Description	Date

APPROVAL

This document is approved by the Office of Utilities Regulation and the Declarations therein become effective as of **June 13, 2008**.

On behalf of the Office:



Raymond A. Silvera
Deputy Director General

June 13, 2008

Table of Contents

Office Utilities Regulation

Indicative Generation Avoided Costs Declaration

Background

Consistent with its mandate to ensure the provision of a reliable supply of electricity to consumers at least cost, the Office of Utilities Regulation (OUR/the Office) has undertaken a review of the generation options available to determine the best strategy to address the capacity requirements for the public grid going forward. The review is based on recent assessments carried out by the OUR, and makes use of recent and, in the most part, conservative assumptions on the respective input parameters (fuel prices, capital costs of the various generation technologies, etc.).

The Office's Regulatory Policy for the addition of generating capacity (Ele 2005/08.1) requires the OUR to provide sufficient data concerning avoided costs to allow the owner or operator of a qualifying facility (QF), to estimate with reasonable accuracy, the revenue it could receive from JPS if the qualifying facility went into operation under any of the purchase agreements provided for in the policy. This draft paper sets out the methodology used to derive the generation avoided costs estimates based on the determination of the least cost expansion trajectory of the system over the long run. The actual estimates of avoided costs, using the methodology described herein are provided.

Qualifying Facilities (QF) are alternative resources that are:

- Non-conventional producers, including cogeneration, renewable sources such as wind, solar, geothermal, biomass, etc.

The calculation of avoided costs is used as the basis for establishing the price at which alternative sources of electricity may be sourced, and to define the market values of electricity generated by various sources.

Where policy dictates that a particular generation option should be used, rather than competitive bidding, the payment to the operator will be based on the avoided cost plus any premium stipulated.

Additionally, cogeneration by virtue of its design should result in prices that are lower than the avoided cost published from time to time by the Office.

While the planning tools will provide a good guide for the estimation of the avoided costs, a more precise estimate should be achieved when the required capacity is subjected to competitive bids.

1. Definition of Avoided costs

The definition of avoided cost applicable to our analysis is adopted from the United States Public Utility Regulatory Policy Act (PURPA). According to the definition of PURPA, avoided cost is the fixed and running costs of an electric utility system which can be avoided by obtaining energy or capacity from qualifying facilities.

Avoided costs for the JPS electric grid can be defined as the costs to the electric utility of energy or capacity or both which, but for the purchase from the qualifying facility or qualifying facilities, the utility would generate itself or purchase from other sources. Avoided costs, therefore, incorporate projections of future year-by-year JPS system costs.

2. Avoided cost calculation for various types of contracts

2.1. Long Term contracts with guaranteed capacity

Components of generation avoided costs

The pertinent costs considered for the avoided costs calculation are:

(i) generation fixed costs (capacity costs);

(ii) generation variable costs (energy costs).

Generation fixed costs (capacity) include capital costs for new generation capacity to be installed over the planning period, depreciation of the investment and the fixed operation and maintenance costs for these facilities. All these costs are dependent on the characteristic of the generation plants. Variable (energy) costs include fuel costs and variable operation and maintenance costs.

Calculations of generation avoided costs for JPS must be consistent with the Least Cost Expansion Planning (LCEP) Methodologies, in order to identify the most cost-efficient resources and to minimize the cost of providing energy to consumers. To this end the Wien Automatic System Planning software, WASP, was employed to simulate the various generation options based on potentially new technology fuel type, fuel prices and projected demand growth for the

twenty-year period to 2028. One of the important outputs of the WASP programme is the incremental of generation over the long run (LRIC). This cost represents the incremental cost of providing electrical power to the system over a 20-year period in the most cost-efficient manner. The LRIC is the incremental capital, operating and maintenance and fuel costs for the twenty-year planning horizon discounted to present value by the opportunity cost of capital (12%) attributable to new plants to be added over the 20-year planning horizon divided by the expected energy (or capacity) to be supplied by these plants. The incremental energy produced by these plants is also discounted to present value at the same rate and the unit fixed and variable costs are then calculated.

Since the addition of new capacity to the system should be done to satisfy the least cost criteria, then the cost avoided when this capacity is installed by another supplier would be the same as the LRIC. ***The avoided cost therefore approximates to the LRIC.***

2.2. Long term contracts without guaranteed capacity (Energy only)

Energy only pricing contracts are applicable in situations in which the capacity provided by Qualifying Facilities cannot be guaranteed. Pricing for these contracts will take the long run avoided variable cost into consideration. This is particularly relevant in cases of some renewable energy technologies in which the availability of capacity is not certain (e.g. hydro, wind, and solar sources). Calculations of the variable avoided costs for JPS must be consistent with the Least Cost Expansion Planning (LCEP) Methodologies, in order to identify the most cost-efficiency resources and to minimize the cost of providing energy to consumers. WASP was employed to simulate the various generation options based on potentially new technology fuel type, fuel prices and projected demand growth for the twenty-year period ending 2028. The least cost output of fuel prices and variable Operating and Maintenance costs for all plants were discounted to present value by the opportunity cost of capital (12%) and divided by the discounted energy supplied by the least cost plants. The calculated values derived from this method is the long run variable (energy) avoided cost, applicable to long term contract without guaranteed capacity.

2.3. Short term Contracts

While most contracts will take the long run avoided variable cost into consideration, there will be scope for pricing based on the short term avoided cost. Under such arrangements the price per kWh will change from month to month depending on the cost of fuel to the system. The avoided cost applicable

for the pricing of these qualifying facilities will be equal to JPS system cost of fuel for the month the energy is supplied

3. Indicative generation avoided costs

The OUR's estimation of the generation avoided costs is done in the context of the development of the least cost expansion strategy for the system over the long run. The study was done on a constant dollar basis. The results arrived at are as follows:

1. ***The indicative generation avoided cost estimated for capacity and energy is 10.48 US cents/kWh for contracts with guaranteed capacity.***

2. ***The indicative generation avoided cost estimated for energy only qualifying facilities is 8.88 US cents/kWh for contracts without guaranteed capacity.***

Table 1 provides an outline of the generation avoided costs estimates

Table 1

Plant Type	Indicative Avoided cost
Conventional Technologies (capacity and energy)	10.48 US cents/kWh (5.37+5.11)
Energy only	8.88 US cents/kWh

4. Variations on the Avoided Cost

The estimation of avoided costs gives the additional capabilities of cost comparison and advantage comparison of various projects of alternative sources. It is a useful tool for decision making, especially if the avoided cost is determined through a competitive bidding process. The calculation of avoided cost is done in order to estimate the value and to define the cost of electricity generated by various alternative sources and the indicative prices to be applied in the contracts

between the market participants, i.e. JPS and IPPs. Three applicable variations are:

1. Renewable Technologies: In order to encourage the development of more environmentally friendly generation sources and to reduce Jamaica's reliance on imported fuels, the Government has established, by policy, that Independent Power Producers (IPPs) may develop facilities employing renewable technologies (wind, solar, biomass, etc.) and sell power to the grid (refer to OUR Document Ele 2005/08.1 "*Guidelines for the Addition of Generating Capacity to the Public Electricity Supply System*.") at a price up to ***15% above the avoided costs***.

2. Cogeneration Plants: The process of cogeneration enables the production of process heat and electricity to occur simultaneously thus allowing the combustion of fuel to take place at higher efficiency levels than is the case for conventional technologies. As a matter of policy, the savings derived from the process should be shared between the IPP and the end-users of electricity on the grid. The price at which power is bought from these plants is ***less than the avoided cost***. The precise price is determined by the OUR on a case by case basis after a technical evaluation of the system.

3. Short-term Arrangements: There are some small IPPs who are not in a position to commit to the long term provision of firm capacity but are capable of supplying the grid energy whenever it is available. The appropriate purchase price for operations of this type is the fuel cost avoided by other generators by virtue of the fact that energy is supplied from this source. The price of energy provided under this arrangement will be equal to JPS system cost of fuel for the month the energy is supplied.

Table 2 provides the purchase price per KWh for the alternatives discussed.

Table 2

Plant Type	Purchase Price per KWh
Renewable Technologies with guaranteed capacity	10.48 US cents plus premium
Renewable Technologies with energy only qualifying facilities	8.88 US cents plus premium
Cogeneration Plants with guaranteed capacity	Less than 10.48 US cents
Cogeneration Plants with energy only qualifying facilities	Less than 8.88 US cents
Short Term Arrangement	JPS monthly system fuel cost

Changes in Avoided costs

The avoided cost will change over time because of updates to the demand forecast, changes in fuel prices and capital cost as well as improvements in technology. As a result of these factors the avoided cost will have to be updated to reflect these realities. The OUR will update the avoided cost on an annual basis or as the needs dictate.

APPENDIX – Tables showing derivation of guaranteed capacity avoided cost and non-guaranteed (energy-only) avoided cost based on a range of generation options.

Energy Avoided Cost for Projects with Non-Firm Capacity (Energy Only)									
Year	**Present Value Factor**	**Capital Cost (US k$)**	**Variable O&M Cost (US k$)**	**Fuel Cost (US k$)**	**Energy (GWh)**	**Capital Cost (US k$), PV in 2008 at 12%**	**Variable O&M Cost (US k$), PV in 2008 at 12%**	**Fuel Cost (US k$), PV in 2008 at 12%**	**Energy (GWh), PV in 2008 at 12%**
2008	1.0000	_	198591.5	416745.9	4424.89	_	198591.5	416745.9	4424.89
2009	0.8929	_	198989.9	436296.2	4535.82	_	177678.1	389568.9	4050.03
2010	0.7972	_	203665.0	418542.9	4649.6	_	162361.8	333662.4	3706.66
2011	0.7118	_	204374.8	439572.6	4765.32	_	145474.0	312887.8	3391.95
2012	0.6355	_	205096.5	462003.4	4884.28	_	130338.8	293603.1	3103.96
2013	0.5674	_	89895.12	194217.4	5007.25	_	51006.5	110199.0	2841.11
2014	0.5066	_	98581.32	200050.8	5132.78	_	49941.3	101345.7	2600.27
2015	0.4523	_	56732.32	207351.7	5261.08	_	25660.0	93785.2	2379.59
2016	0.4039	_	62376.32	214516.7	5392.09	_	25193.8	86643.3	2177.87
2017	0.3606	_	68967.12	221820.0	5527.21	_	24869.5	79988.3	1993.11
2018	0.3220	_	76276.72	229380.4	5665.06	_	24561.1	73860.5	1824.15
2019	0.2875	_	84103.42	237654.9	5806.98	_	24179.7	68325.8	1669.51
2020	0.2567	_	92107.42	247059.5	5951.59	_	23644.0	63420.2	1527.77
2021	0.2292	_	63507.92	239411.7	6100.74	_	14556.0	54873.2	1398.29
2022	0.2046	_	69876.42	247723.2	6253.68	_	14296.7	50684.2	1279.50
2023	0.1827	_	77106.92	256324.7	6409.34	_	14087.4	46830.5	1170.99
2024	0.1631	_	85131.92	265599.0	6569.74	_	13885.0	43319.2	1071.52
2025	0.1456	_	50997.52	280690.4	6733.24	_	7425.2	40868.5	980.36
2026	0.1300	_	52496.92	296649.4	6901.45	_	6824.6	38564.4	897.19
2027	0.1161	_	55320.62	302964.8	7074.24	_	6422.7	35174.2	821.32
2028	0.1037	_	57051.22	320350.7	7250.69		5916.2	33220.4	751.90
		TOTALS					**1146914.1**	**2767570.6**	**44061.94**
		LRMC		**8.88**	**US c/KWH**				

Energy Avoided Cost for Projects with Guaranteed Capacity									
Year	**Present Value Factor**	**Capital Cost (US k$)**	**Variable O&M Cost (US k$)**	**Fuel Cost (US k$)**	**Energy (GWh)**	**Capital Cost (US k$), PV in 2008 at 12%**	**Variable O&M Cost (US k$), PV in 2008 at 12%**	**Fuel Cost (US k$), PV in 2008 at 12%**	**Energy (GWh), PV in 2008 at 12%**
2008	1.0000	_	0	0	0	_	0	0	0
2009	0.8929	_	0	0	0	_	0	0	0
2010	0.7972	_	6731.6	43329.2	448.77	_	5366.4	34542.05	357.76
2011	0.7118	_	6731.6	43329.2	448.77	_	4791.6	30841.74	319.43
2012	0.6355	_	6731.6	43329.2	448.77	_	4277.9	27535.72	285.19
2013	0.5674	_	31902.8	176927.8	4176.82	_	18101.6	100388.8	2369.93
2014	0.5066	_	32291.0	179306.4	4210.22	_	16358.6	90836.6	2132.90
2015	0.4523	_	35239.8	193815.5	4782.06	_	15939.0	87662.74	2162.93
2016	0.4039	_	35881.2	197574.3	4848.61	_	14492.4	79800.27	1958.35
2017	0.3606	_	36474.2	201062.3	4909.98	_	13152.6	72503.05	1770.54
2018	0.3220	_	37022.0	204294.1	4966.09	_	11921.1	65782.71	1599.08
2019	0.2875	_	37531.0	207316.2	5017.47	_	10790.2	59603.4	1442.52
2020	0.2567	_	37999.7	210126.9	5063.34	_	9754.5	53939.57	1299.76
2021	0.2292	_	40937.5	225052.1	5610.11	_	9382.9	51581.94	1285.84
2022	0.2046	_	41681.3	229332.1	5690.47	_	8528.0	46921.34	1164.27
2023	0.1827	_	42358.2	233237.9	5763.49	_	7738.8	42612.57	1052.99
2024	0.1631	_	42997.1	236964.2	5831.25	_	7012.8	38648.85	951.08
2025	0.1456	_	45473.5	249789.6	6305.93	_	6620.9	36369.37	918.14
2026	0.1300	_	46419.2	255145.8	6411.24	_	6034.5	33168.96	833.46
2027	0.1161	_	49589.1	274989.3	6661.13	_	5757.3	31926.26	773.36
2028	0.1037	_	50786.7	282104.2	6776.28		5266.6	29254.2	702.70
		TOTALS					**181288.0**	**1013920.0**	**23380.23**
		LRMC		**5.11**	**US c/KWH**				

Capacity Avoided Cost for Projects with Guaranteed Capacity							
Year	**Present Value Factor**	*** Capital Cost (US k$)**	**Fixed O&M Cost (US k$)**	**Energy (GWh)**	**Capital Cost (US k$), PV in 2008 at 12%**	**Fixed O&M Cost (US k$), PV in 2008 at 12%**	**Energy (GWh), PV in 2008 at 12%**
2008	1.0000	_	0	0	_	0	0
2009	0.8929	_	0	0	_	0	0
2010	0.7972	72073	1296.1	448.77	72073	1033.2	357.76
2011	0.7118	_	1296.1	448.77	_	922.5	319.43
2012	0.6355	_	1296.1	448.77	_	823.7	285.19
2013	0.5674	847057	16235.5	4176.82	847057	9212.5	2369.93
2014	0.5066	_	16235.5	4210.22	_	8225.4	2132.90
2015	0.4523	153150	19806.7	4782.06	153150	8959.6	2162.93
2016	0.4039	_	19806.9	4848.61	_	7999.7	1958.35
2017	0.3606	_	19806.7	4909.98	_	7142.5	1770.54
2018	0.3220	_	19806.8	4966.09	_	6377.3	1599.08
2019	0.2875	_	19806.8	5017.47	_	5694.0	1442.52
2020	0.2567	_	19806.7	5063.34	_	5083.9	1299.76
2021	0.2292	61299	23377.9	5610.11	61299	5357.6	1285.84
2022	0.2046	_	23378.0	5690.47	_	4783.6	1164.27
2023	0.1827	_	23377.8	5763.49	_	4271.0	1052.99
2024	0.1631	_	23377.9	5831.25	_	3813.4	951.08
2025	0.1456	24865	26949.1	6305.93	24865	3925.0	918.14
2026	0.1300	_	26949.2	6411.24	_	3504.5	833.46
2027	0.1161	2879	28245.2	6661.13	2879	3279.5	773.36
2028	0.1037	_	28245.1	6776.28	_	2928.1	702.70
		TOTALS			**1161322.72**	**93336.8**	**23380.23**
		LRMC		**5.37**	**US c/KWH**		

* Total construction costs less the salvage values of the plants remaining at the end of planning horizon (PV in 2008).