Tidewalker Associates
Economic Analysis / January 2011

		HALF-MOON COVE TIDAL POWER PROJECT			
		[2010 DOLLARS]			
			2010 HYBRID HYDRO-KINETIC CONCEPT	2010 HYBRID HYDRO-KINETIC CONCEPT	2010 HYBRID HYDRO-KINETIC CONCEPT
			Option No. 1	Option No. 2	Option No. 3
1		FEATURES			
	a	BARRAGE TYPE	FLEXIBLE	FLEXIBLE	FLEXIBLE
	b	PASSAMAQUODDY BAY GATES	YES	YES	YES
	c	TURBINE MODE	RUN-OF-TIDE / REVERSIBLE TURBINES	RUN-OF-TIDE / REVERSIBLE TURBINES	RUN-OF-TIDE / REVERSIBLE TURBINES
2		PLANT CAPACITY [MW]	9	9	9
3		ANNUAL ENERGY GENERATION [THOUSAND Kw-HOUR]	40000	40000	40000
4		HOUR IN OPERATION [Ebb / Flood Production]	4.5 / 4	4.5 / 4	4.5 / 4
5		AVERAGE HYDRAULIC HEAD [FT]	5.5	5.5	5.5
6		LOW TIDE ELEVATION INCREASE [FT]	<1 ft	<1 ft	<1 ft
7		METHOD OF FINANCING			
	a	PERCENT	5	6	7
	b	TERM [YEARS]	20	20	20
8		TOTALCOST [JUNE 2009]	$40,000,000.00	$40,000,000.00	$40,000,000.00
9		ANNUAL DEBT	$3,209,703.49	$3,487,382.28	$3,775,717.03
10		OPERATION & MAINTENANCE COST	$300,000.00	$300,000.00	$300,000.00
11		INTERIM REPLACEMENT	$150,000.00	$150,000.00	$150,000.00
12		TOTAL ANNUAL COST	$3,659,703.49	$3,937,382.28	$4,225,717.03
13		ANNUAL COST ESCALATION	2	2	2
14		PRODUCTION COST [CENT/KW-HR]			
	a	YEAR 1	9.15	9.84	10.56
	b	YEAR 20	9.70	10.39	11.11
15		ANTICIPATED REVENUE			
	a	Sale Price of Electricity ($ / kw-hr)	0.100	0.100	0.125
	b	Value of Production ($ / Year)	$4,000,000.00	$4,000,000.00	$5,000,000.00
	v	Net Annual Profit (Year 1)	$340,296.51	$62,617.72	$774,282.97

Table 1: Financial Analysis for Half-Moon Cove Tidal Barrage
[Constant Cost & Energy Production / Various Interest & PPA Rates]

Table 1 illustrates the effect of terms of financing on the cost of producing tidal energy from the Half-Moon Cove site. Options No. 1, No.2, and No. 3 differ in Line # 7(a), the interest rate for project financing. In Line # 15(a) for Option No.3, a different value of electricity was used to reflect uncertainties in specifications for the sale of electricity while maintaining common parameters. Tidewalker will try to maximize the production for local consumption in order to stimulate local economic development and to obtain a better sale price for electricity. The key points in Table 1 are summarized as follows:

- Option No. 3 provides the greatest return on investment based on the highest interest rate along with the highest value of electricity; under this scenario, the debt on the project will be carried for twenty (20) years for a project with an expected physical lifetime of fifty (50) years; once the debt has been retired, the cost of electricity will be approximately 1.67 ¢ / kw-hr in Year No. 21 as opposed to 11.11 ¢ / kw-hr in Year No. 20
- Options No. 1 and No. 2 differ only in the interest rate; i.e., 5% and 6%, respectively; the cost of production for Option No. 2 is 0.69 ¢ / kw-hr higher than Option No. 1 which substantially reduces the rate of return on investment; this analysis has not included any tax benefits or institutional credits available for most investors
- Sale price of electricity normally carries an escalation clause to ensure an appropriate rate under current economic conditions; in Table 1, the variable cost of production (e.g., operation & maintenance) is assumed to increase at a rate of 2.0 % per year; Tidewalker conservatively estimates that the value of electricity will increase at a greater than 2 % / year rate; long-term projections appearing in Table 1 do not include an escalation rate for the value of electricity

The estimates for project costs are listed below in Table 2 based on an engineering analysis performed in 1980 by C.T. Main, Inc. for Half-Moon Cove with a twelve (12) megawatt capacity and with the inclusion of a rockfill dam. Estimates for 1980 have

been upgraded based on the coefficients listed in Table 3 in accordance with standard engineering practice. The original C.T. Maine estimates reflect the costs associated with a traditional tidal barrage while Tidewalker estimates represent a more environmentally responsive design rated at nine (9) megawatts and without any alteration to the basin's tidal range.

		ORIGINAL C.T. MAIN ESTIMATE [DEC. 1980] ESCALATED CPI COSTS	ORIGINAL C.T. MAIN ESTIMATE [DEC. 1980] ESCALATED ENR / BCI COSTS	ORIGINAL C.T. MAIN ESTIMATE [DEC. 1980] ESCALATED ENR / CCI COSTS	TIDEWALKER HMC / FLEXIBLE DAM / FLOAT-IN CONSTRUCTION / MHK TURBINES [DEC. 2010]	TIDEWALKER COMMENTS: ESTIMATES
1	**COFFERDAM**	$13,740,255.93	$17,526,185.85	$19,591,530.67	$0.00	FLEX. DAM
2	**ROCK EXCAVATION**	$319,950.95	$408,108.84	$456,201.76	$300,000.00	POWER HOUSE EXCAVATION
3	**CAST-IN-PLACE CONCRETE**	$13,386,420.41	$17,074,856.04	$19,087,014.63	$5,000,000.00	FLOAT-IN CONSTRUCTION
4	**STRUCTURAL STEEEL**	$110,849.15	$141,392.04	$158,054.15	$150,000.00	SIMILAR EXTIMATE TO OPTIONS
5	**DAM [1:2]**	$1,745,824.98	$2,226,861.94	$2,489,282.86	$0.00	FLEX. DAM
6	**DAM [1:1]**	$1,459,051.93	$1,861,072.71	$2,080,387.79	$500,000.00	FLEX. DAM / MATERIAL & INSTALLATION
7	**ROADWAY**	$353,176.73	$450,489.49	$503,576.70	$0.00	UNDECIDED
8	**MECHANICAL**	$30,760,638.97	$39,236,290.65	$43,860,027.41	$24,750,000.00	"$2750 / KW FOR 9 MW
9	**ELECTRICAL**	$2,083,964.01	$2,658,170.32	$2,971,418.07	$2,500,000.00	SIMILAR
10	**TRANSMISSION**	$1,967,572.40	$2,509,708.68	$2,805,461.21	$2,500,000.00	POTENTIAL FOR UNDERWATER CABLE
11	**TESTING**	$75,578.97	$96,403.66	$107,764.20	$100,000.00	SIMILAR
	SUB-TOTAL	$66,003,284.42	$84,189,540.22	$94,110,719.45	$35,800,000.00	
12	**ENGINEERING & ADMINISTRATION [5% SUB-TOTAL]**	$3,300,164.22	$4,209,477.01	$4,705,535.97	$1,790,000.00	ASSUMED AT 5% OF SUB-TOTAL
13	**INTEREST DURING CONSTRUCTION [10% TWO YR]**	$6,600,328.44	$8,418,954.02	$9,411,071.94	$3,580,000.00	NET 10% FOR TWO YEAR PERIOD
14	**TOTAL COST**	$75,903,777.08	$96,817,971.25	$108,227,327.37	$41,170,000.00	

Table 2: Cost Estimate (2010 $) for Tidal Barrage with Flexible Dam [Based on C.T. Main Engineering Study with Rockfill Dam]

Under this estimate, the total cost of the project is slightly higher than $40,000,000 with the inclusion of engineering and interest during construction costs which were conservatively selected to represent higher than normal rates for a project which has a most likely eighteen (18) month construction period. The placement of a road across the dam will depend on the support from local communities and funding agencies. In Table 2, the cost of a roadway has been eliminated to reduce project costs. The use of a flexible dam represents a $25,000,000 savings in construction costs in addition to reducing environmental impacts associated with a rockfill dam (e.g., intertidal footprint). The cost of turbines is the greatest individual expense for the project and has been estimated based on the difference in nameplate capacity and on the relative degree of complexity. Other notes on the estimates appear in the right-hand column of Table 2.

In summary, the technical feasibility of the project has been proven from various sources. The predictable nature of tidal power generation ensures a reliable supply without any dependence on external sources; e.g., wind. Recent power purchase agreements support assumptions appearing in Table 1. Equipment cited in the estimates is available "off-the-shelf". The major remaining obstacle refers to the acquisition of licenses and permits; however, these approvals are deemed attainable based on a mode of operation which successfully addresses environmental concerns. Table 3 below lists the standard cost escalation factors used in our analysis.

	CPI	ENR / BCI	ENR / CCI
December 2010		1888.310	3173.980
January 1981	87.000		
January 2008	211.800		
December 2010	219.179		
January 2011		6068.000	11401.380
Ratio	2.519	3.213	3.592

Table 3: Escalation Rates (CPI & ENR)

CPI – Consumer Price Index
ENR / BCI – Engineering News Record, Boston Construction Index
ENR / CCI – Engineering News Record, City Cost Index