PARAMETRIC COST MODELING OF RENEWABLE ENERGY SYSTEMS WITH THE RENEWABLE ENERGY COST MODEL (RCM)

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In 2004, Olympic Energy Systems, Inc. released its first parametric cost model, based on the Microsoft Excel spreadsheet. The Renewable Energy Cost Model (RCM) allows the computation of system costs and related economic aspects of renewable energy systems. The RCM is intended to foster greater understanding of the costs, benefits, and financial returns possible with renewable energy systems.

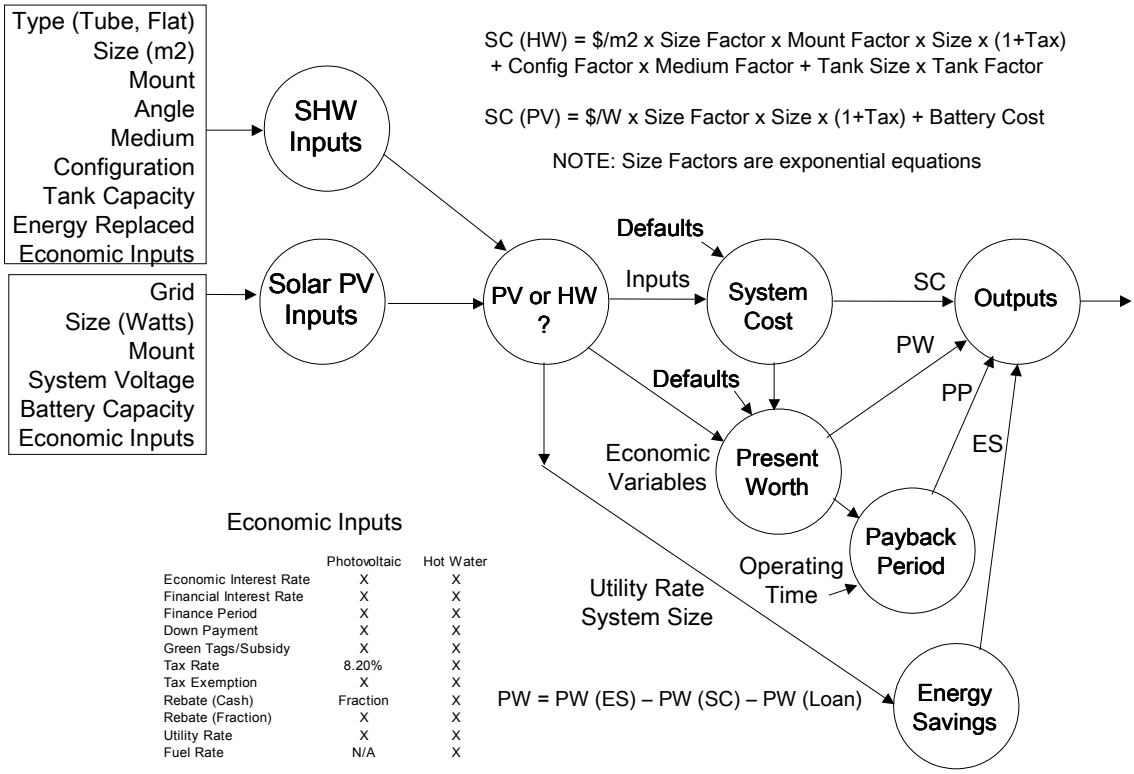
A simplified version of the RCM, SV1, was made available to the public at low cost and without undue restraint on its use. SV1 is purposefully limited in scope to Solar Photovoltaic and Solar Thermal applications, in order to address those systems with the most significant impact and demand. The general public is now inundated with numerous solar products by increasing numbers of vendors and installers, accompanied by growing news accounts of energy issues, problems, and policies. The RCM SV1 provides a tool to help potential small-scale renewable energy investors make wise decisions, minimizing cost confusion and cost uncertainty.

For the renewable energy sector to be ultimately successful with the general public, the investment in systems, from small (100 Watt) to large (100 Kilowatt), must show a positive net return. That is, the systems must "pay off". Achieving such results depends on understanding system options, costs, economics, and finance. The RCM SV1 requires the user to provide only a modest number of inputs, while not requiring the user to have more than a cursory understanding of systems.

The RCM (all versions) is a decision support tool, allowing anyone from the absolute beginner to a knowledgeable user or owner to evaluate the costs and economics of renewable energy systems. The user performs comparative analysis of various system options, without the tedious and repetitive computations and extensive research normally involved with such analysis. A user evaluates options easily and with reasonable confidence, instantly able to know whether or not a system investment pays back, either under current economic conditions or under a defined set of economic conditions.

The validation of the RCM, with respect to the documented groundrules and assumptions, and by considering several actual system applications, is hereby presented. The RCM allows reasonable confidence cost estimates above that of a Rough Order of Magnitude (ROM) estimate to that approaching a firm quote or bid. The model is applied to various system options under a varying set of economic conditions. Separate independent cost assessments are compared to model outputs. Analysis is provided to demonstrate the savings in time and effort in using the RCM cost model over other costing techniques. The RCM is thus shown to be a good basis for developing new tools to support adoption of renewable energy systems in the US and other developed or developing countries.

Renewable Energy Cost Model (RCM)



Economic Inputs

	Photovoltaic	Hot Water
Economic Interest Rate	X	X
Financial Interest Rate	X	X
Finance Period	X	X
Down Payment	X	X
Green Tags/Subsidy	X	X
Tax Rate	8.20%	X
Tax Exemption	X	X
Rebate (Cash)	Fraction	X
Rebate (Fraction)	X	X
Utility Rate	X	X
Fuel Rate	N/A	X

General Instructions	!	**Renewable Energy Cost Model (RCM**
Choose Simplified or General Input MODEL	!	Developed by: Olympic Energy Systems, Inc.
Select New System TYPE	!	Original Date: 6/4/04
Specify New System SIZE	!	Revision History:
Specify New System Basic SPECS	!	Simplified Input Model Complete 6/10/04 jac
Enter Relevant Energy COSTS	!	Solar Hot Water Model In Work 7/12/04 jac
Enter Existing System DATA	!	Solar Hot Water Model Complete 8/25/04 jac
Specify Model PARAMETERS	!	General Input Model In Work
SOLAR PV - Simplified Input	Enter here:	Note: Sales Tax = 0.082; Peak Sun Hours = 4.5
GRID (enter 0) or Standalone (enter 1)	0	Default is 0 (Grid-tied)
SIZE (300, 600, 1200, 1500, 2000, 3000)	1500	Watts, Array (Select value)
MOUNT (Roof (0), Ground (1), Pole (2))	0	PV Install Location (Roof, enter 0)
ECONOMIC INTEREST RATE (0.xxx)	0.02	Interest on Savings, Annual
FINANCE INTEREST RATE (0.xxx)	0.06	Interest on Loan, Annual
FINANCE PERIOD (# of Years)	10	Assumes Annual Payments on Loan
DOWN PAYMENT (Fraction, ie, 0.xx or 1)	1	Fraction paid upfront; Default is all down (enter 1)
GREEN TAGS ($/Kwh paid)	0	0.10 (available in WA)
STATE SALES TAX EXEMPTION (1 or 0)	1	1 if exempt, 0 if not exempt
REBATE (Discount off System Cost, fraction)	0.5	0.20 off, if Off Grid (in WA)
UTILITY RATE (current rate, example 0.08)	0.11	$/KWh; Model assumes a 4% increase per year
If Standalone:	!	
SYSTEM VOLTAGE (24, 48)	24	Volts
BATTERY CAPACITY (350, 700, 1400)	350	Amp-hours
Solar PV SYSTEM COST (w/out Rebate)	**$10,497**	**Solar PV Model OUTPUT**
Energy Savings per Year ($)	#VALUE!	Annualized Savings plus Subsidy, if applicable
Solar PV System PRESENT WORTH	**#VALUE!**	PW of (Savings + Subsidy) at EIR - Loan at FIR
PAYBACK PERIOD (Years)	*see below*	Number of Years to get a Present Worth of ZERO
Enter **Operating Time** (Life), years n = xx	**18**	Increment/Decrement by 1 until PW = or > 0
Note: Service Life DEFAULT = n = 25	*reset default*	If done computing Payback Period, enter Default

SOLAR HW - Simplified Input	Enter here:	Note: Sales Tax = 0.082; Peak Sun Hours = 4.5
		Note: 3.3 M BTU/m2/year (tube type)
System TYPE (Evac Tube (0), Flat (1))	0	Default is 0 (Evac Tube)
SIZE (Integer number of m2)	1	1 m2 = 10 tube, typical; Enter 1,2,3,4,or 2.5, etc.
MOUNT (Roof (0), Ground (1), Pole (2))	0	Panel Install Location (Roof, enter 0)
ANGLE (Steep (70), Latitude, Shallow (22))	48	Latitutude (48 degrees), default
MEDIUM (Glycol (0), Water (1))	0	Glycol needs pump, exp tank; H2O is Drainback
CONFIG (DHW (0), Pool (1), Space (2))	0	Usage (impacts extent of hardware); Default DHW
Water Storage Tank CAPACITY (40,80, etc.)	80	Gallons; if added tank, enter total including DHW
Energy REPLACED (Electric (0), Propane (1))	0	Goes to Energy Savings
ECONOMIC INTEREST RATE (0.xxx)	0.02	Interest on Savings, Annual
FINANCE INTEREST RATE (0.xxx)	0.06	Interest on Loan, Annual
FINANCE PERIOD (# of Years)	10	Assumes Annual Payments on Loan
DOWN PAYMENT (Fraction, ie, 0.xx or 1)	1	Fraction paid upfront; Default is all down (enter 1)
SUBSIDY (Energy Production)	0	Green Tags ($/Kwh)? TBD
State Sales Tax Rate	0.082	Default is 0.082
STATE SALES TAX EXEMPTION (1 or 0)	0	1 if exempt, 0 if not exempt
REBATE (Cash Value)	0	(Dollar amount; example, 200) TBD
REBATE (Discount off System Cost, fraction)	0.2	As offered by utility or government
UTILITY RATE (current rate, example 0.08)	0.11	$/KWh; Model assumes a 4% increase per year
FUEL RATE ($ per gallon)	2	Default is $2.00 per gallon, Propane
Solar HW SYSTEM COST (w/out Rebate)	**$1,551**	**Solar HW Model OUTPUT**
Energy Savings per Year ($)	#VALUE!	Annualized Savings plus Subsidy TBD
Solar HW System PRESENT WORTH	#VALUE!	PW of (Savings + Subsidy) at EIR - Loan at FIR
PAYBACK PERIOD (Years)	*see below*	Number of Years to get a Present Worth of ZERO
Enter **Operating Time** (Life), years n = xx	**15**	Increment/Decrement by 1 until PW = or > 0
Note: Service Life DEFAULT = n = 15	*reset default*	If done computing Payback Period, enter Default