

Wind for Schools Software

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NWTC

Overview of HOMER

- How it works
- Case studies
- Where to get it

HOMER - computer model that simplifies evaluating design options for both off-grid and grid-connected power systems for remote, stand-alone, and distributed generation (DG) applications.

Power sources:

- wind turbine
- solar photovoltaic (PV)
- run-of-river hydro power
- generator: diesel, gasoline, biogas, alternative and custom fuels, cofired
- electric utility grid
- microturbine
- fuel cell

Storage:

- battery bank
- hydrogen

Loads:

- daily profiles with seasonal variation
- deferrable (water pumping, refrigeration)
- thermal (space heating, crop drying)
- efficiency measures

HOMER – Inputs

HOMER - [Project1 *]

File View Inputs Outputs Window Help

Equipment to consider Add/Remove

Grid
 Primary Load 1
 0 kWh/d
 0 kW peak
 Wind Turbine 1

AC DC

Resources Other

Wind resource
 Economics
 System control
 Emissions
 Constraints

Calculate
Simulations: 0 of 1 P
Sensitivities: 0 of 1 S

Sensitivity Results
Optimization Results

Double click on a system below for optimization results.

Initial Capital	Operating Cost (\$/yr)	Total NPC	Ren. Frac.

HOMER – Building your school load profile

Primary Load Inputs

File Edit Help



Choose a load type (AC or DC), enter 24 hourly values in the load table, and enter a scaled annual average. Each of the 24 values in the load table is the average electric demand for a single hour of the day. HOMER replicates this profile throughout the year unless you define different load profiles for different months or day types. For calculations, HOMER uses scaled data: baseline data scaled up or down to the scaled annual average value.

Hold the pointer over an element or click Help for more information.

Label

Load type: AC DC

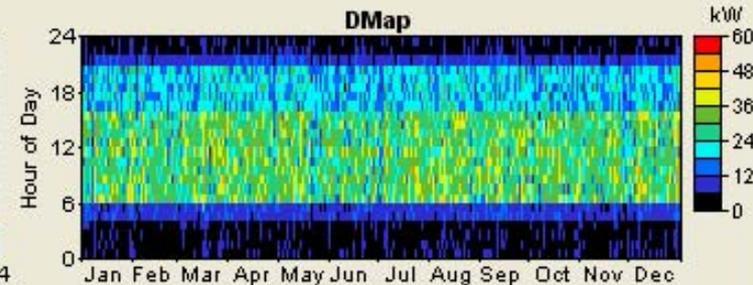
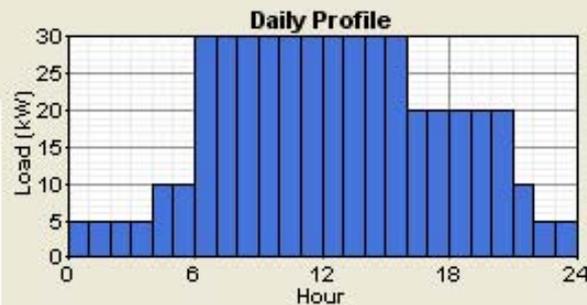
Data source: Enter daily profile(s) Import time series data file

Baseline data

Month

Day type

Hour	Load (kW)
00:00 - 01:00	5.000
01:00 - 02:00	5.000
02:00 - 03:00	5.000
03:00 - 04:00	5.000
04:00 - 05:00	10.000
05:00 - 06:00	10.000
06:00 - 07:00	30.000
07:00 - 08:00	30.000
08:00 - 09:00	30.000
09:00 - 10:00	30.000
10:00 - 11:00	30.000
11:00 - 12:00	30.000



Random variability

Day-to-day %

Time-step-to-time-step %

Scaled annual average (kWh/d)

	Baseline	Scaled
Average (kWh/d)	456	456
Average (kW)	19.0	19.0
Peak (kW)	56.2	56.2
Load factor	0.338	0.338

Add hourly load here – it does all the graphics

HOMER – Building your wind turbine profile

Wind Turbine Inputs

File Edit Help



Choose a wind turbine type and enter at least one quantity and capital cost value in the Costs table. Include the cost of the tower, controller, wiring, installation, and labor. As it searches for the optimal system, HOMER considers each quantity in the Sizes to Consider table.

Hold the pointer over an element or click Help for more information.

Turbine type: SW Skystream 3.7

Turbine properties

Abbreviation: S3.7 (used for column headings)

Rated power: 1.8 kW AC

Manufacturer: Southwest Windpower

Website: www.windenergy.com



Power curve included in listed turbines

Input cost, O&M, life, hub height

Costs

Quantity	Capital (\$)	Replacement (\$)	O&M (\$/yr)
1	1500	1500	40

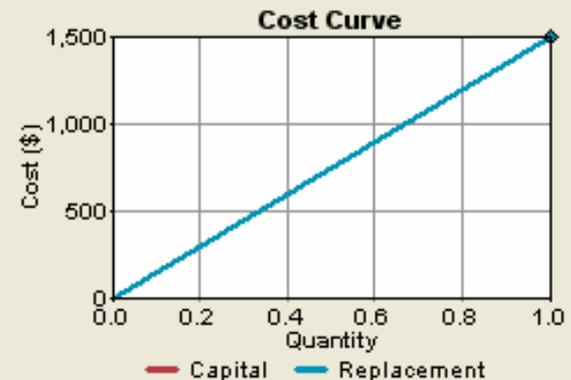
Other

Lifetime (yrs)

Hub height (m)

Sizes to consider

Quantity
0
1



Wind Turbine Inputs

Select from among a variety of turbines or add your own

File Edit Help



Choose a wind turbine type and enter at least one quantity and capital cost value in the Costs table. Include the cost of the tower, controller, wiring, installation, and labor. As it searches for the optimal system, HOMER considers each quantity in the Sizes to Consider table.

Hold the pointer over an element or click Help for more information.

Turbine type: S/W Skystream 3.7 [Details...] [New...] [Delete]

- Turbine proper: BWC XL.1
- Abbreviation: Enercon E33
- Rated power: Entegriety eW/15
- Manufacturer: Fuhrländer 100
- Website: Fuhrländer 100 (2)
- Fuhrländer 100 (3)
- Fuhrländer 250
- Fuhrländer 30
- GE 1.5sl
- Generic 10kW
- Generic 1kW
- Generic 20kW
- Generic 3kW
- Jacobs 29-20
- New S/W Skystream 3.7
- Northern Power NW100/
- Northwind 100
- PGE 11/35
- PGE 20/25
- S/W AIR X
- S/W Skystream 1.8
- S/W Skystream 3.7**
- S/W Whisper 100
- S/W Whisper 200
- S/W Whisper 500
- Ventura V10-30G 10kW
- Vergnet 275
- Vestas V82
- WES 18
- WES 30
- WES 5 Tulipo
- Windside 2A

headings)

Costs

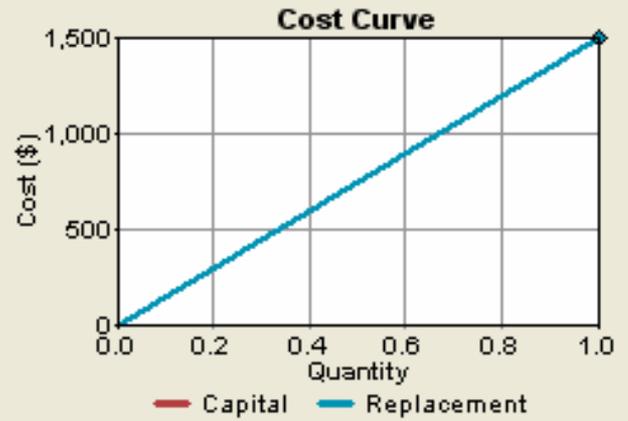
Quantity
1

O&M (\$/yr)

40

Sizes to consider

Quantity
0
1



[Help] [Cancel] [OK]

HOMER – Adding grid interface

Grid Inputs

File Edit Help



Click Add to add as many rates as necessary. Select a rate and click on the diagram to indicate when each rate applies.

Hold the pointer over an element or click Help for more information.

Rates | Emissions | Advanced | Forecasting

- Scheduled rates
- Real time prices

Rate schedule

Step 1: Define and select a rate

Rate	Price (\$/kWh)	Sellback (\$/kWh)	Demand (\$/kW/mo)
Rate 1	0.092	0.000	0.000

Add

Remove

Edit...

Step 2: Select a time period

All Week

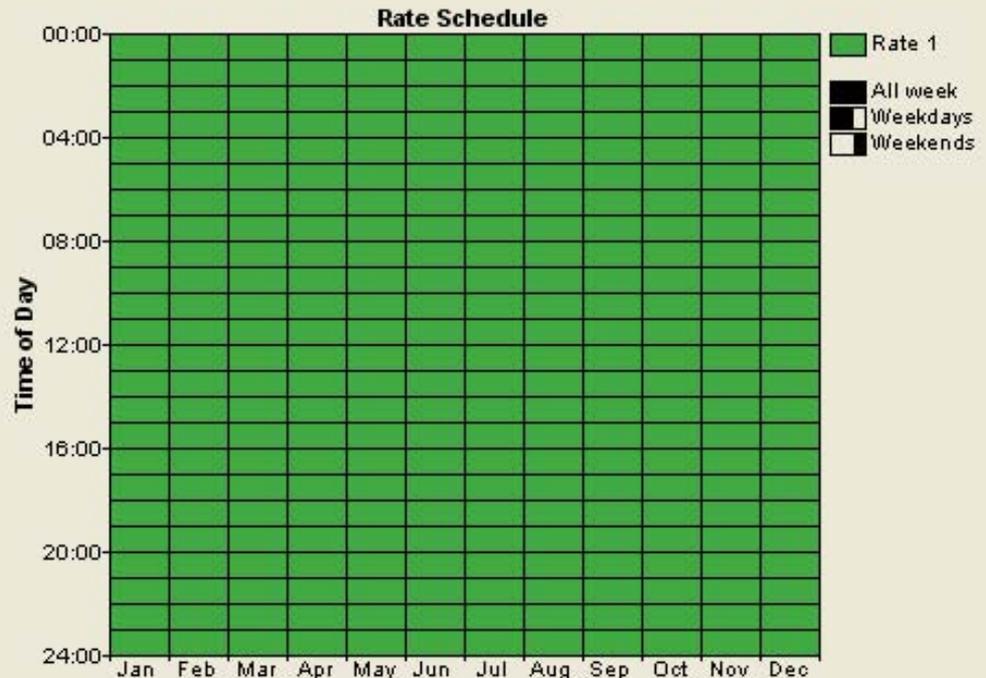
Weekdays

Weekends

Step 3: Click on the chart to indicate when the selected rate applies.

- Net metering
 - Net purchases calculated monthly
 - Net purchases calculated annually

Can add multiple rates and schedules, sellback rates and demand charges



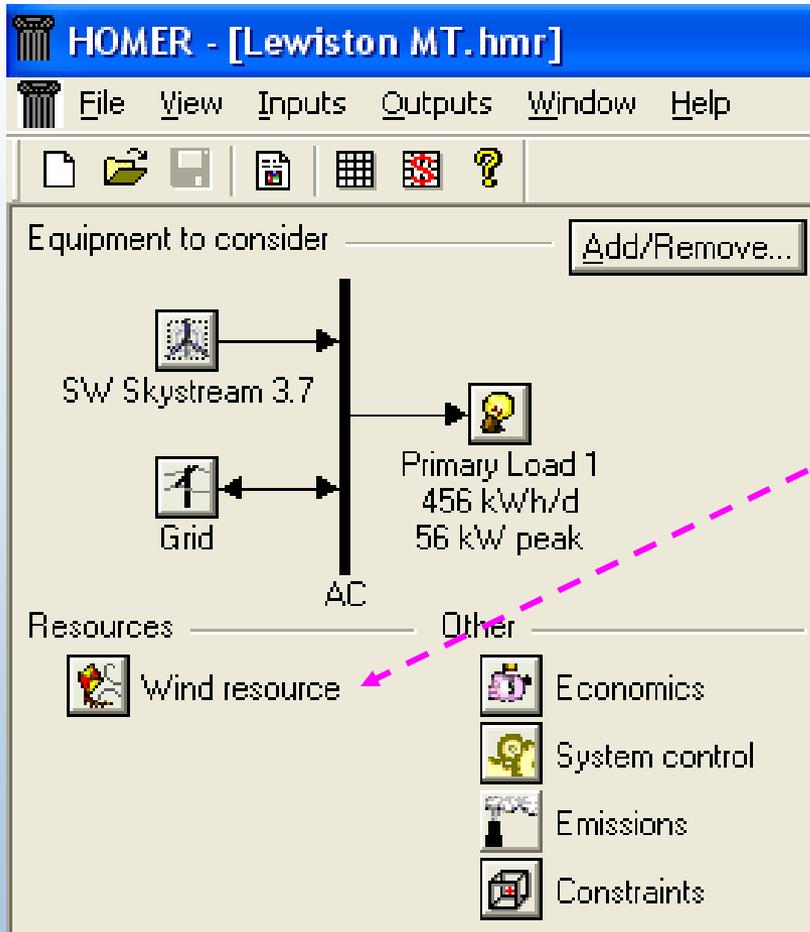
And add in net metering

Help

Cancel

OK

HOMER – Load, turbine and grid are in



- now look at wind resource

Wind Resource Data Sources

WIND ENERGY RESOURCE ATLAS OF THE U.S.

- <http://rredc.nrel.gov/wind/pubs/atlas/tables/tablec1/mt.html>

WIND POWERING AMERICA – STATE WIND MAPS

- http://www.eere.energy.gov/windandhydro/windpoweringamerica/wind_maps.asp

MONTANA RENEWABLE ENERGY RESOURCES

- http://www.energyatlas.org/PDFs/LowRes/atlas_state_MT.pdf

Wind resource – use collected data – either monthly averages or 8760

Wind Resource Inputs

File Edit Help

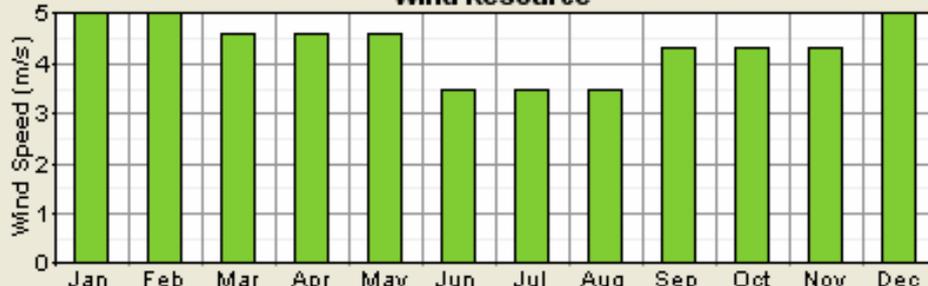
HOMER uses wind resource inputs to calculate the wind turbine power each hour of the year. Enter the average wind speed for each month. For calculations, HOMER uses scaled data: baseline data scaled up or down to the scaled annual average value. The advanced parameters allow you to control how HOMER generates the 8760 hourly values from the 12 monthly values in the table.

Hold the pointer over an element or click Help for more information.

Data source: Enter monthly averages Import time series data file Import File...

Baseline data

Month	Wind Speed (m/s)
January	5.000
February	5.000
March	4.600
April	4.600
May	4.600
June	3.500
July	3.500
August	3.500
September	4.300
October	4.300
November	4.300
December	5.000
Annual average:	4.347



Wind Resource

Other parameters

Altitude (m above sea level)

Anemometer height (m)

Variation With Height...

Advanced parameters

Weibull k

Autocorrelation factor

Diurnal pattern strength

Hour of peak windspeed

Scaled data for simulation

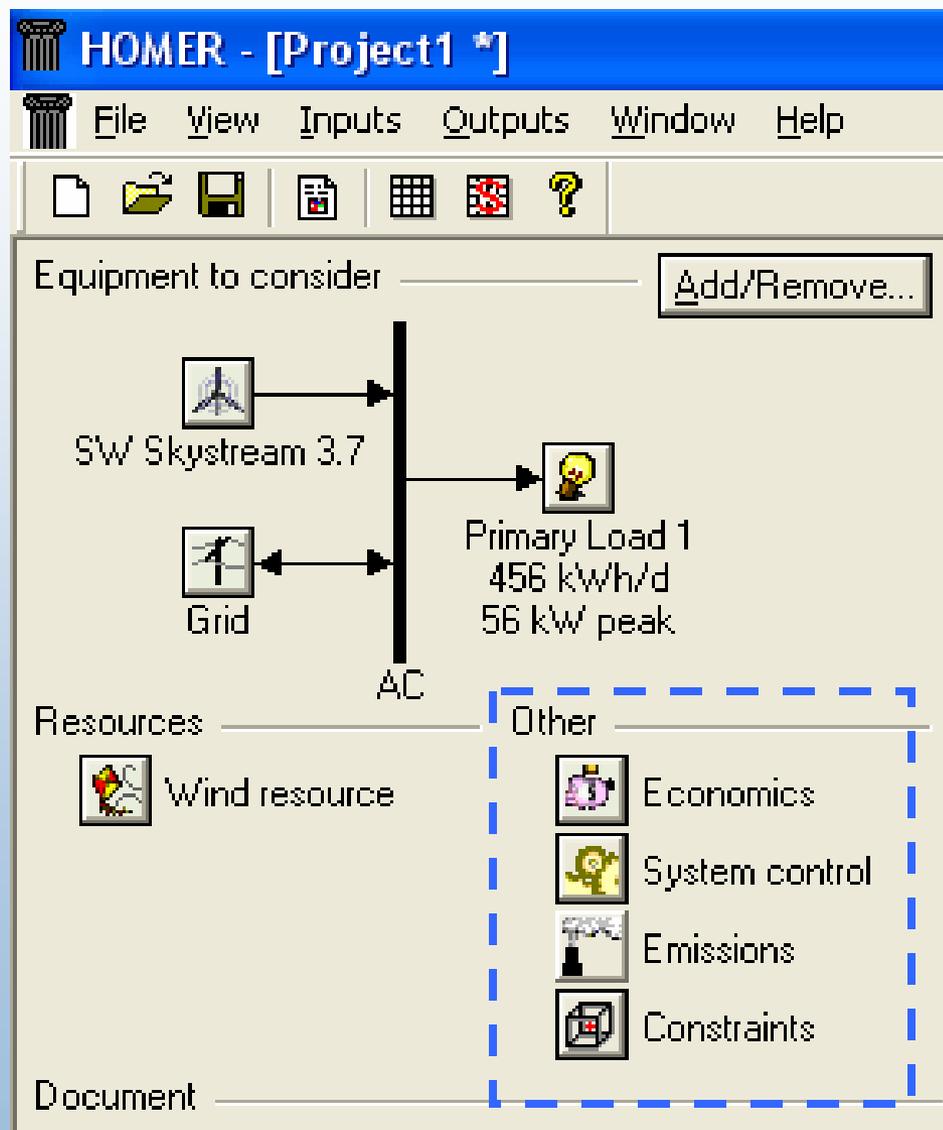
Scaled annual average (m/s) {..}

Plot...
Export...

Help
Cancel
OK

Economics, controls, emissions and constraints

Primarily used as part of decision-making process when evaluating multiple generation & storage technologies



HOMER – Outputs

Lewiston MT

The screenshot shows the HOMER software interface for a project named 'Lewiston MT.hmr'. The main window displays a project diagram on the left and simulation results on the right. The diagram shows a central AC bus connected to a SW Skystream 3.7 wind turbine, a Grid, and a Primary Load 1 (456 kWh/d, 56 kW peak). The results table shows that adding the Skystream turbine significantly reduces the total Net Present Cost (NPC) and the Cost of Energy (COE).

Equipment to consider: Add/Remove...

Simulations: 2 of 2
Sensitivities: 3 of 3
Progress:
Status: Completed in 1 seconds.

Sensitivity Results Optimization Results

Sensitivity variables

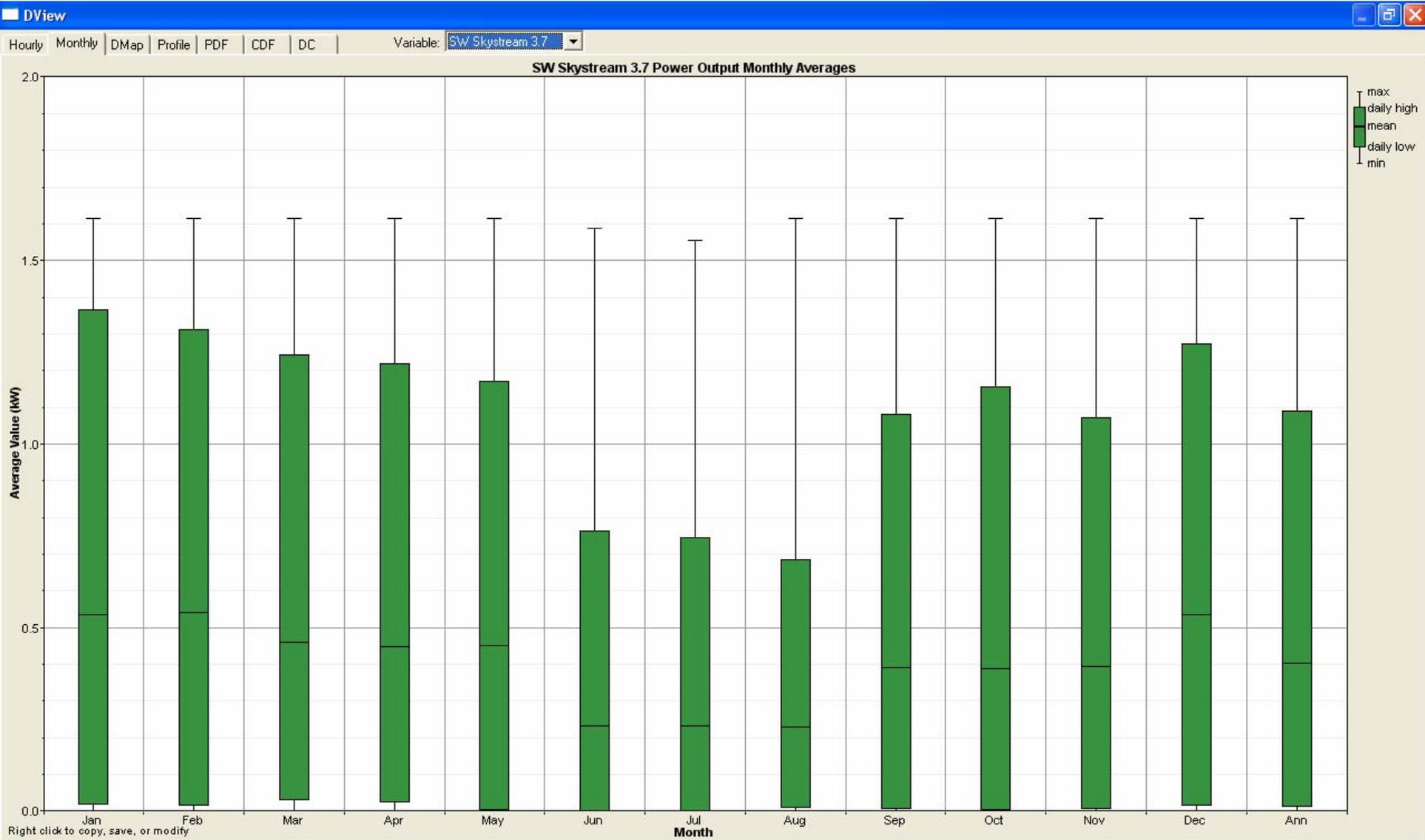
S3.7 Capital Multiplier

Double click on a system below for simulation results.

	S3.7	Grid (kW)	Initial Capital	Operating Cost (\$/yr)	Total NPC	COE (\$/kWh)	Forecast Reliability (%)	Ren. Frac.
	1	1000	\$ 1,500	15,028	\$ 173,871	0.091	0.0	0.02
		1000	\$ 0	15,312	\$ 175,633	0.092	0.0	0.00

Adding the Skystream lowers the total Net Present Cost of buying electricity over twenty years – and lowers the Cost of Energy the school purchases

Modeled monthly wind turbine production



System Report - Lewiston MT.hmr

HOMER - Outputs

System architecture

Wind turbine: 1 SW Skystream 3.7

Grid: 1,000 kW

Cost summary

Total net present cost:	176,871	\$
Levelized cost of energy:	0.091	\$/kWh

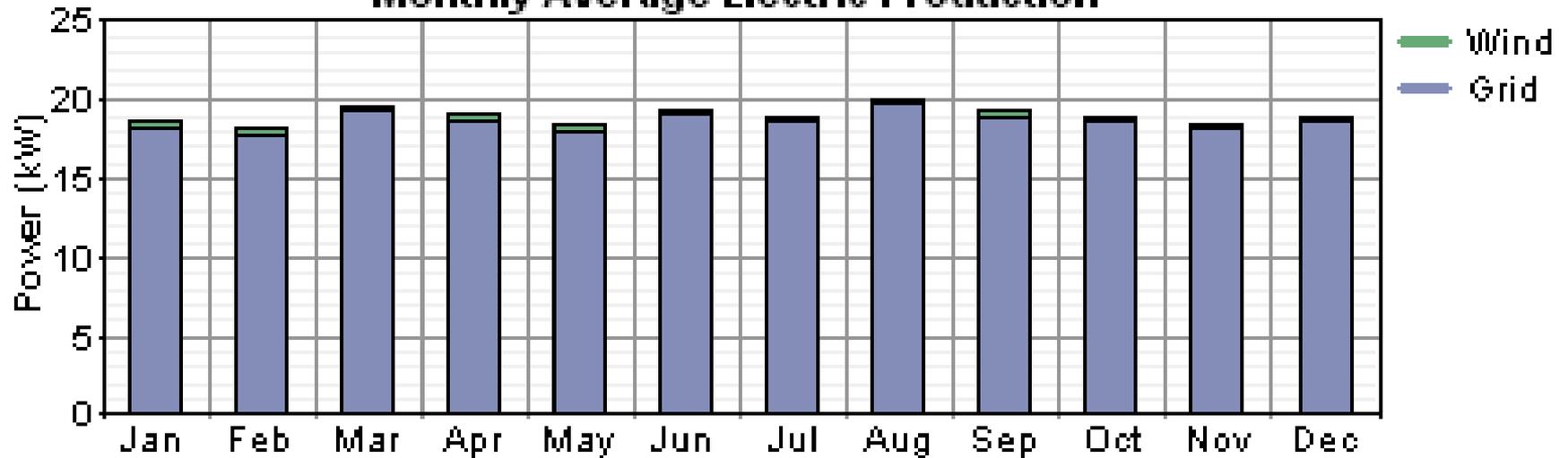
Cost breakdown

Component	Initial Capital	Annualized Capital	Annualized Replacement	Annual O&M	Annual Fuel	Total Annualized
	(\$)	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)
Skystream 3.7	1,500	131	0	40	0	171
Grid	0	0	0	14,988	0	14,988
Totals	1,500	131	0	15,028	0	15,159

Annual electric energy production

Component	Production	Fraction
	(kWh/yr)	
Wind turbine	3,526	2%
Grid purchases	162,914	98%
Total	166,440	100%

Monthly Average Electric Production



Avoided Emissions

Pollutant	Emissions (kg/yr)
Carbon dioxide	2,229
Carbon monoxide	0
Unburned hydrocarbons	0
Particulate matter	0
Sulfur dioxide	10.0
Nitrogen oxides	5.0

AC Wind Turbine: SW Skystream 3.7

Variable	Value	Units
Total capacity:	1.80	kW
Average output:	0.403	kW
Minimum output:	0.00	kW
Maximum output:	1.161	kW
Wind penetration:	2.12	%
Capacity factor:	22.4	%
Hours of operation:	6792	hr/yr

HOMER – Economics - Net Present Cost

Lewiston MT

Skystream 3.7	Initial capital	Operating cost	Total NPC	Electricity from wind	COE	Renewable fraction
[# of units]	[\$]	[\$/yr]	[\$]	[kWh]	[\$/kWh]	[%]
1	\$1,500	\$15,028	\$173,871	2,272	\$0.091	2.0%
0	\$0	\$15,312	\$175,633		\$0.092	0.0%
1	\$5,000	\$15,028	\$177,371	2,272	\$0.093	2.0%
1	\$12,000	\$15,028	\$184,371	2,272	\$0.097	2.0%

Wind for Schools

Lewiston MT

ROI = $\frac{\text{total savings} - \text{total costs}}{\text{total costs}}$ = 182.1%

Simple payback = when cumulative savings equal investment

4.6 years

Total benefits	Year	1	2	3	4	5	6	7	8	9	10
Wind electricity generated [kWh]		3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526
Annual \$ savings @ \$0.092/kWh		\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324
Cumulative savings		\$324	\$649	\$973	\$1,298	\$1,622	\$1,946	\$2,271	\$2,595	\$2,920	\$3,244

Year	11	12	13	14	15	16	17	18	19	20	Totals
Wind electricity generated [kWh]	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	70,520
Annual \$ savings @ \$0.092/kWh	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$6,488
Cumulative savings	\$3,568	\$3,893	\$4,217	\$4,541	\$4,866	\$5,190	\$5,515	\$5,839	\$6,163	\$6,488	\$6,488

Total costs	Year	1	2	3	4	5	6	7	8	9	10
Turbine purchase		\$1,500									
Annual O&M		\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40
Total costs		\$1,540	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40

Year	11	12	13	14	15	16	17	18	19	20	Totals
Turbine purchase											\$1,500
Annual O&M	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$800
Total costs	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$2,300

Wind for Schools

Lewiston MT

ROI = $\frac{\text{total savings} - \text{total costs}}{\text{total costs}}$ = 11.9%

Simple payback = when cumulative savings equal investment

Total benefits	Year	1	2	3	4	5	6	7	8	9	10
	Wind electricity generated [kWh]	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526
	Annual \$ savings @ \$0.092/kWh	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324
	Cumulative savings	\$324	\$649	\$973	\$1,298	\$1,622	\$1,946	\$2,271	\$2,595	\$2,920	\$3,244

15.4 years

Year	11	12	13	14	15	16	17	18	19	20	Totals
Wind electricity generated [kWh]	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	70,520
Annual \$ savings @ \$0.092/kWh	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$6,488
Cumulative savings	\$3,568	\$3,893	\$4,217	\$4,541	\$4,866	\$5,190	\$5,515	\$5,839	\$6,163	\$6,488	\$6,488

Total costs	Year	1	2	3	4	5	6	7	8	9	10
	Turbine purchase	\$5,000									
	Annual O&M	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40
	Total costs	\$5,040	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40

Year	11	12	13	14	15	16	17	18	19	20	Totals
Turbine purchase											\$5,000
Annual O&M	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$800
Total costs	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$5,800

Wind for Schools

Lewiston MT

ROI = $\frac{\text{total savings} - \text{total costs}}{\text{total costs}}$ = -51.2%

Simple payback = when cumulative savings equal investment

Total benefits

Year	1	2	3	4	5	6	7	8	9	10
Wind electricity generated [kWh]	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526
Annual \$ savings @ \$0.092/kWh	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324
Cumulative savings	\$324	\$649	\$973	\$1,298	\$1,622	\$1,946	\$2,271	\$2,595	\$2,920	\$3,244

Year	11	12	13	14	15	16	17	18	19	20	Totals
Wind electricity generated [kWh]	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	3,526	70,520
Annual \$ savings @ \$0.092/kWh	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$324	\$6,488
Cumulative savings	\$3,568	\$3,893	\$4,217	\$4,541	\$4,866	\$5,190	\$5,515	\$5,839	\$6,163	\$6,488	\$6,488

Total costs

Year	1	2	3	4	5	6	7	8	9	10
Turbine purchase	\$12,500									
Annual O&M	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40
Total costs	\$12,540	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40

Year	11	12	13	14	15	16	17	18	19	20	Totals
Turbine purchase											\$12,500
Annual O&M	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$800
Total costs	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$13,300

BEF - Renewable Energy Grant

Last DSIRE Review: 09/21/2006

- IncentiveType:** Private Grant Program
- Eligible Renewable Technologies:** Solar Thermal Electric, Photovoltaics, Wind, Biomass, Hydroelectric, Geothermal Electric, Animal Waste-to-Energy
- Applicable Sectors:** Nonprofit, Local Government, Tribal Government
- Amount:** Up to 33% of total capital costs
- Website:** <http://www.b-e-f.org/grants/index.shtm>

HOMER – Outputs

Rapid City SD

HOMER - [Rapid City SD.hmr]

File View Inputs Outputs Window Help

Equipment to consider

Calculate Simulations: 2 of 2 Progress:
Sensitivities: 3 of 3 Status: Completed in 1 seconds.

Sensitivity Results Optimization Results

Sensitivity variables

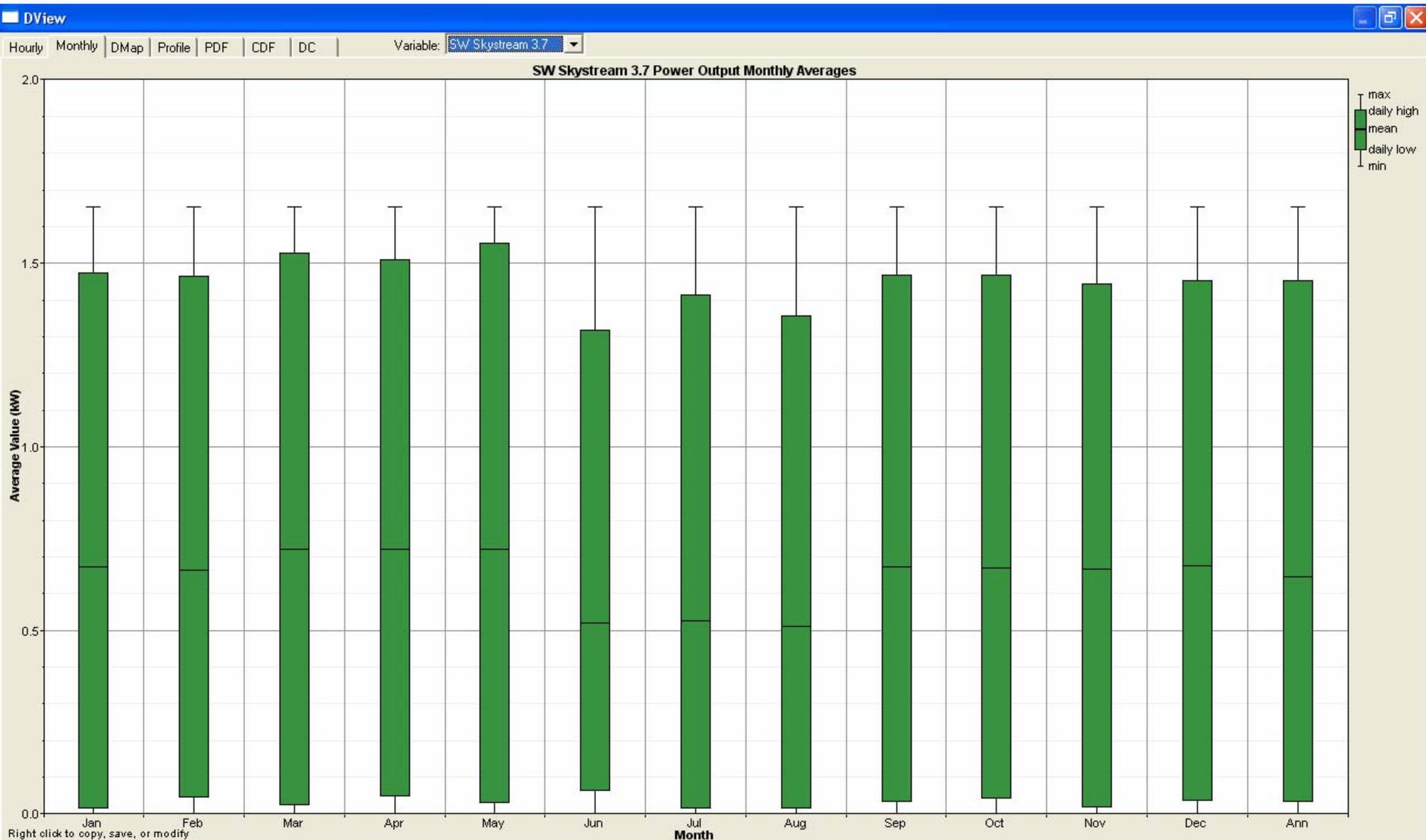
S3.7 Capital Multiplier

Double click on a system below for simulation results.

			Initial Capital	Operating Cost (\$/yr)	Total NPC	COE (\$/kWh)	Forecast Reliability (%)	Ren. Frac.
		S3.7						
		1	\$ 1,500	4,287	\$ 50,671	0.079	0.0	0.10
		1000	\$ 0	4,722	\$ 54,157	0.084	0.0	0.00

Adding the Skystream lowers the total Net Present Cost of buying electricity over twenty years – and lowers the Cost of Energy the school purchases

Modeled monthly wind turbine production



System Report - Lewiston MT.hmr

HOMER - Outputs

System architecture

Wind turbine: 1 SW Skystream 3.7

Grid: 1,000 kW

Cost summary

Total net present cost:	50,683	\$
Levelized cost of energy:	0.079	\$/kWh

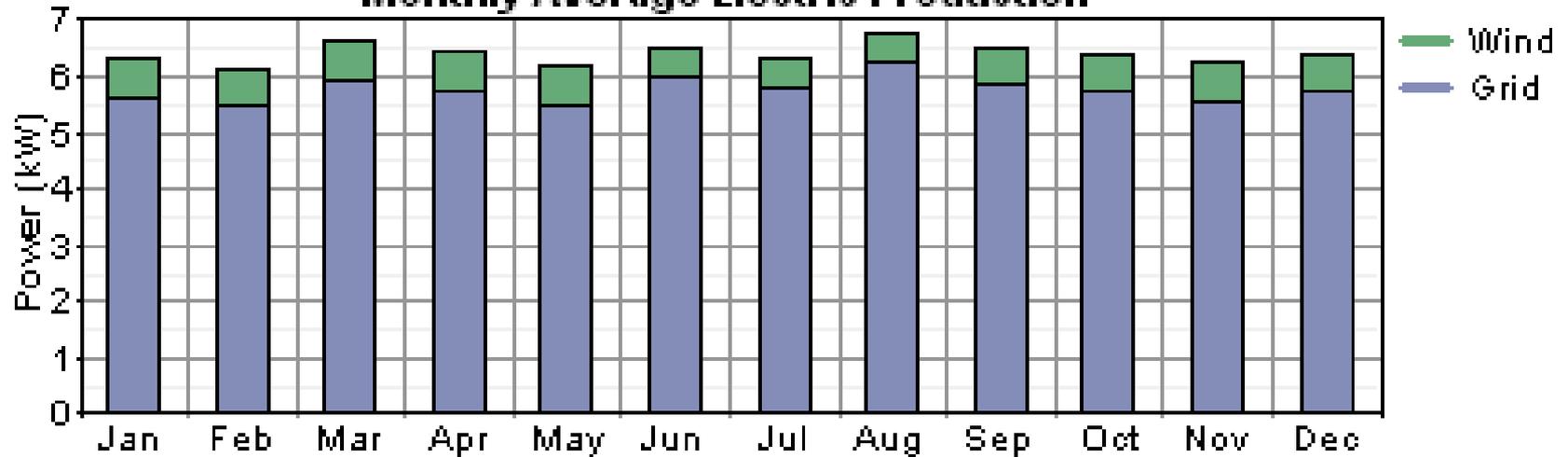
Cost breakdown

Component	Initial Capital	Annualized Capital	Annualized Replacement	Annual O&M	Annual Fuel	Total Annualized
	(\$)	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)
Skystream 3.7	1,500	131	0	40	0	171
Grid	0	0	0	4,248	0	4,248
Totals	1,500	131	0	4,288	0	4,288

Annual electric energy production

Component	Production	Fraction
	(kWh/yr)	
Wind turbine	5,651	10%
Grid purchases	50,572	90%
Total	56,222	100%

Monthly Average Electric Production



Avoided Emissions

Pollutant	Emissions (kg/yr)
Carbon dioxide	3,571
Carbon monoxide	0
Unburned hydrocarbons	0
Particulate matter	0
Sulfur dioxide	15.0
Nitrogen oxides	7.6

AC Wind Turbine: SW Skystream 3.7

Variable	Value	Units
Total capacity:	1.80	kW
Average output:	0.645	kW
Minimum output:	0.00	kW
Maximum output:	1.65	kW
Wind penetration:	10.1	%
Capacity factor:	35.8	%
Hours of operation:	7,457	hr/yr

Wind for Schools

Rapid City SD

ROI = $\frac{\text{total savings} - \text{total costs}}{\text{total costs}}$ = 312.8%

Simple payback = when cumulative savings equal investment

3.2 years

Total benefits	Year	1	2	3	4	5	6	7	8	9	10
Wind electricity generated [kWh]		5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651
Annual \$ savings @ \$0.084/kWh		\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475
Cumulative savings		\$475	\$949	\$1,424	\$1,899	\$2,373	\$2,848	\$3,323	\$3,797	\$4,272	\$4,747

Year	11	12	13	14	15	16	17	18	19	20	Totals
Wind electricity generated [kWh]	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	113,020
Annual \$ savings @ \$0.092/kWh	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$9,494
Cumulative savings	\$5,222	\$5,696	\$6,171	\$6,646	\$7,120	\$7,595	\$8,070	\$8,544	\$9,019	\$9,494	\$9,494

Total costs	Year	1	2	3	4	5	6	7	8	9	10
Turbine purchase		\$1,500									
Annual O&M		\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40
Total costs		\$1,540	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40

Year	11	12	13	14	15	16	17	18	19	20	Totals
Turbine purchase											\$1,500
Annual O&M	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$800
Total costs	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$2,300

Wind for Schools

Rapid City SD

ROI = $\frac{\text{total savings} - \text{total costs}}{\text{total costs}}$ = 63.7%

Simple payback = when cumulative savings equal investment

10.5 years

Total benefits

Year	1	2	3	4	5	6	7	8	9	10
Wind electricity generated [kWh]	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651
Annual \$ savings @ \$0.084/kWh	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475
Cumulative savings	\$475	\$949	\$1,424	\$1,899	\$2,373	\$2,848	\$3,323	\$3,797	\$4,272	\$4,747

Year	11	12	13	14	15	16	17	18	19	20	Totals
Wind electricity generated [kWh]	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	113,020
Annual \$ savings @ \$0.084/kWh	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$9,494
Cumulative savings	\$5,222	\$5,696	\$6,171	\$6,646	\$7,120	\$7,595	\$8,070	\$8,544	\$9,019	\$9,494	\$9,494

Total costs

Year	1	2	3	4	5	6	7	8	9	10
Turbine purchase	\$5,000									
Annual O&M	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40
Total costs	\$5,040	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40

Year	11	12	13	14	15	16	17	18	19	20	Totals
Turbine purchase											\$5,000
Annual O&M	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$800
Total costs	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$5,800

Wind for Schools

Rapid City SD

ROI = $\frac{\text{total savings} - \text{total costs}}{\text{total costs}}$ = -28.6%

Simple payback = when cumulative savings equal investment

Total benefits	Year	1	2	3	4	5	6	7	8	9	10
	Wind electricity generated [kWh]	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651
	Annual \$ savings @ \$0.084/kWh	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475
	Cumulative savings	\$475	\$949	\$1,424	\$1,899	\$2,373	\$2,848	\$3,323	\$3,797	\$4,272	\$4,747

Year	11	12	13	14	15	16	17	18	19	20	Totals
Wind electricity generated [kWh]	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	5,651	113,020
Annual \$ savings @ \$0.084/kWh	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$475	\$9,494
Cumulative savings	\$5,222	\$5,696	\$6,171	\$6,646	\$7,120	\$7,595	\$8,070	\$8,544	\$9,019	\$9,494	\$9,494

Total costs	Year	1	2	3	4	5	6	7	8	9	10
	Turbine purchase	\$12,500									
	Annual O&M	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40
	Total costs	\$12,540	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40

Year	11	12	13	14	15	16	17	18	19	20	Totals
Turbine purchase											\$12,500
Annual O&M	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$800
Total costs	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$40	\$13,300

Web sites for more information

HOMER

<http://www.nrel.gov/homer/>

WIND ENERGY RESOURCE ATLAS OF THE U.S.

<http://rredc.nrel.gov/wind/pubs/atlas/tables/tablec1/mt.html>

WIND POWERING AMERICA – STATE WIND MAPS

http://www.eere.energy.gov/windandhydro/windpoweringamerica/wind_maps.asp

DATABASE OF RENEWABLE ENERGY INCENTIVES

<http://www.dsireusa.org/>

Questions ? ?

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