



A Renewable Energy System Performance Analysis Report For Kansas City Power & Light



April 21, 2008

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1 Introduction

The Energy Savings Store has been commissioned to prepare 12 renewable energy systems performance models for Kansas City Power & Light. The information provided is to be used in the preparation of tariffs for offering renewable energy rebates.

1.1 Deliverables

The following project deliverables have been provided.

- Two (2) Wind energy models illustrating the production of wind systems small and medium sized, with two site locations Northeast and Southwest of Kansas City.
- Two (2) Solar Photovoltaic project models sized as 2kW and 3 KW systems, with two site locations Northeast and Southwest of Kansas City.
- Two (2) Solar Hot Water System project models with two site locations Northeast and Southwest of Kansas City.
- Two (2) Solar Air Heating System or Trombe wall projects with two site locations Northeast and Southwest of Kansas City.
- All models will illustrate an estimate of installed cost, with a report on the monthly kWh saved, peak demand kW and typical load profile and financial analysis from a customer's perspective. When possible an hourly break down analysis of energy produced will be shown for a weekday and weekend.

1.2 Approach

This renewable energy systems performance report was prepared using pricing information from actual renewable energy systems installed by The Energy Savings Store over the last three (3) years in the Kansas City area. The analysis tools used in preparing this report are used in preparing project designs.

The financial analysis performed illustrates a simple payback and Return-on-Investment analysis. The current federal solar tax credit of 30% capped at \$2,000.00 is used as an incentive for Solar PV and Solar Hot Water Heating Systems installed in residential settings.

Pending federal and state legislation offering new incentives will improve the financial benefits available from investing in renewable energy systems. This will result in significantly shorter payback period and very attractive Return-on-Investments.

1.3 Analysis Tools

The following tools were used in preparing the analysis:

HOMER, developed by the National Renewable Energy Laboratory (NREL), is a renewable energy system design optimization software design tool.

HOMER is a computer model that simplifies the task of evaluating design options for both off-grid and grid-connected power systems for remote, stand-alone, and distributed generation (DG) applications. HOMER's optimization and sensitivity analysis algorithms allow you to evaluate the economic and technical feasibility of a large number of technology options and to account for variation in technology costs and energy resource availability. HOMER models both conventional and renewable energy technologies:

Power sources:

- solar photovoltaic (PV)
- wind turbine
- run-of-river hydro power
- generator: diesel, gasoline, biogas, alternative and custom fuels, coal fired
- 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 was used to create the analysis models for the wind turbine and solar PV systems.

The RETScreen International Clean Energy Project Analysis Software is a unique decision support tool developed with the contribution of numerous experts from government, industry, and academia. The software, provided free-of-charge, can be used worldwide to evaluate the energy production and savings, life-cycle costs, emission reductions, financial viability and risk for various types of energy efficient and renewable energy technologies (RETs). The software also includes product, cost and climate databases, and a detailed online user manual.

RETScreen International is managed under the leadership and ongoing financial support of Natural Resources Canada's (NRCan) CANMET Energy Technology Centre - Varennes (CETC-Varennes).

1.4 Rate Schedules Used in Analysis

The following rate schedules were used in preparing this analysis.

Rates for all projects NE of KC

Assume a 2.04 cent buy back rate (net metering) and this customer tariff rate schedule.

RESIDENTIAL GENERAL USE:

Customer Charge (Per Month) \$7.46

Energy Charges....

Summer Season, Energy Charge (Per kWh) = \$0.0904

For all energy blocks

Winter season, Energy Charge (Per kWh)

First 600 kWh per month = \$0.0813

Next 400 kWh per month = \$0.0487

Over 1000 kWh per month = \$0.0407

Summer season runs May 15 to Sept 15.

Rates for all projects SW of KC

Assume a 2.04 cent buy back rate (net metering) and this customer tariff rate schedule.

RESIDENTIAL GENERAL USE:

Customer Charge (Per Month) \$7.93

Energy Charges....

Summer Season Season, Energy Charge (Per kWh) = \$0.08811

For all energy blocks

Winter season, Energy Charge (Per kWh)

First 1000 kWh per month = \$0.08661

Over 1000 kWh per month = \$0.07731

Summer season runs May 15 to Sept 15.

2 Solar PV System Analysis 2.16 KW – Northeast Kansas City

The following assumptions were used in preparing this system performance with **HOMER**:

- **2.16 KW Grid-tied** system using 10 Sharp 216 Watt Solar PV Panels and SMA SB 3000 inverter;
- System install price **\$26,900.00** includes all cost and tax;
- Primary Load **25 KWH/Day** and a daily **7.3 KW** Peak;
- The financial analysis assumes cash purchase;
- Energy escalation rate of **8%**;
- The federal Solar PV Tax Credit of **\$2,000** is treated as an incentive.

2.1 Summary of Results

The following summarizes the results of this analysis. All the detail is provided in the system production report section below.

- Annual power production from system **2,944 KWH**
- First year value of the power produced by the system for consumer **\$251.67**
- **IRR 0.7 % Simple Payback 28 years**

PV (kW)	Converter (kW)	Grid (kW)	Initial capital	Operating cost (\$/yr)	Total NPC	COE (\$/kWh)	Renewable fraction
		1000	\$0	777	\$9,936	0.085	0
2.16	3	1000	\$26,900	526	\$33,620	0.288	0.31

2.2 System Production Report

2.2.1 Sensitivity case

Primary Load 1 Scaled Average: 25 kWh/d

2.2.2 System architecture

PV Array: 2.16 kW

Grid: 1,000 kW

Inverter: 3 kW

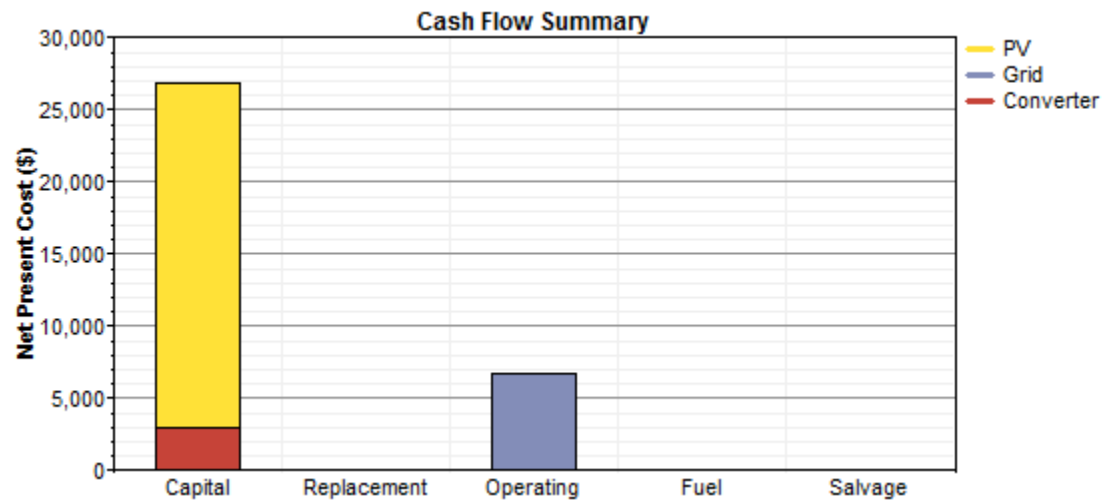
Rectifier: 3 kW

2.2.3 Cost summary

Total net present cost: 33,620 \$

Levelized cost of energy: 0.288 \$/kWh

Operating cost: 526 \$

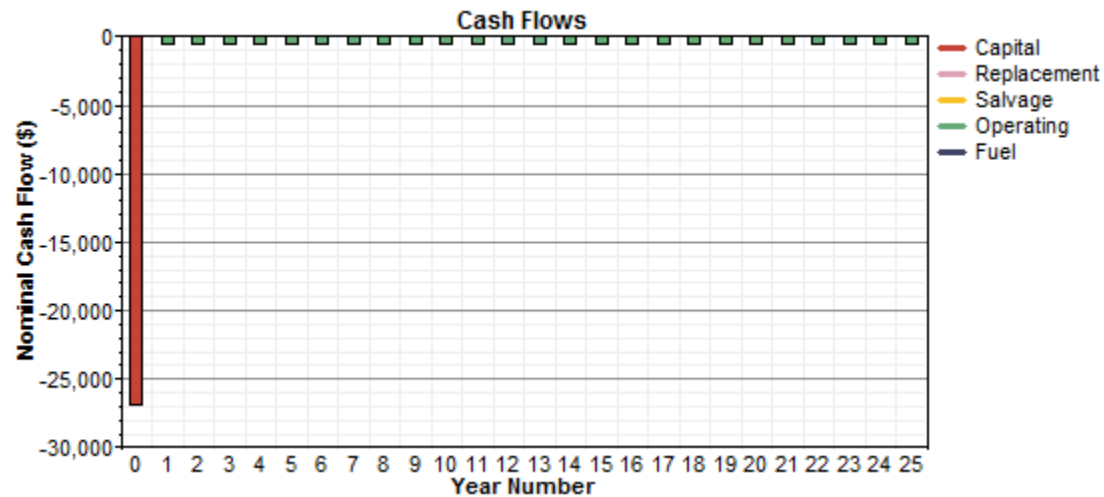


2.2.4 Net Present Costs

Component	Capital (\$)	Replacement (\$)	O&M (\$)	Fuel (\$)	Salvage (\$)	Total (\$)
PV	23,900	0	0	0	0	23,900
Grid	0	0	6,720	0	0	6,720
Converter	3,000	0	0	0	0	3,000
System	26,900	0	6,720	0	0	33,620

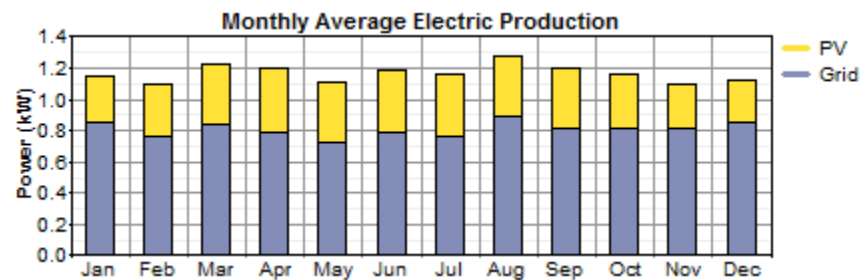
2.2.5 Annualized Costs

Component	Capital (\$/yr)	Replacement (\$/yr)	O&M (\$/yr)	Fuel (\$/yr)	Salvage (\$/yr)	Total (\$/yr)
PV	1,870	0	0	0	0	1,870
Grid	0	0	526	0	0	526
Converter	235	0	0	0	0	235
System	2,104	0	526	0	0	2,630



2.2.6 Annual electric energy production KWH Saved

Component	Production	Fraction
	(kWh/yr)	
PV array KWH Produced	3,132	31%
Grid purchases	7,098	69%
Total	10,230	100%



Month	PV KW	Grid KW
Jan	0.30114	0.84993
Feb	0.33726	0.76679
Mar	0.38612	0.83712
April	0.40610	0.78992
May	0.38599	0.72603
June	0.39494	0.79037
July	0.39588	0.76725
August	0.38163	0.89549
September	0.38788	0.81261

October	0.35164	0.81612
November	0.28856	0.81322
December	0.27311	0.85285

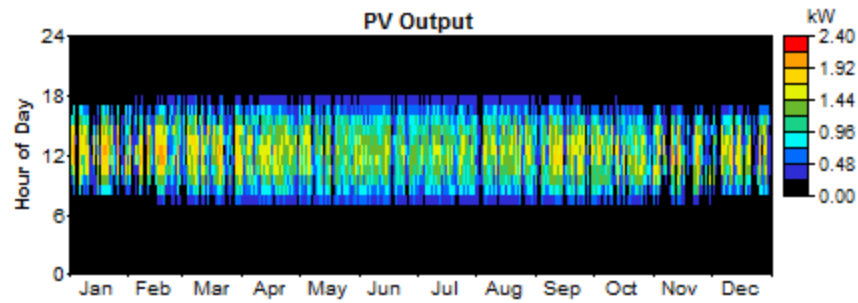
2.2.7 Annual electric energy consumption

Load	Consumption	Fraction
	(kWh/yr)	
AC primary load	9,125	91%
Grid sales	917	9%
Total	10,042	100%

Variable	Value	Units
Renewable fraction:	0.306	
Excess electricity:	0	kWh/yr
Unmet load:	0	kWh/yr
Capacity shortage:	0	kWh/yr

2.2.8 PV

Variable	Value	Units
Average output:	8.58	kWh/d
Minimum output:	0.00	kW
Maximum output:	2.14	kW
Solar penetration:	34.3	%
Capacity factor:	16.6	%
Hours of operation:	4,387	hr/yr



Monthly Solar PV Production

Month	Energy Produced	Energy Savings
	(kWh)	\$
Jan	211	17.15
Feb	213	17.32
Mar	270	21.95
Apr	275	22.36
May	270	24.41
Jun	267	24.14
Jul	277	25.04
Aug	267	24.14
Sep	263	23.78
Oct	246	20
Nov	195	15.85
Dec	191	15.53
Annual	2,944	251.67

2.2.9 Monthly Grid and Solar PV Power Sold Net Metering

Rate: Non Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	632	81	551	7	45	0
Feb	515	74	441	5	36	0
Mar	623	86	537	6	44	0
Apr	569	84	485	7	39	0
May	0	0	0	0	0	0
Jun	0	0	0	0	0	0
Jul	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sep	0	0	0	0	0	0
Oct	607	71	536	6	44	0
Nov	586	69	517	6	42	0
Dec	635	66	569	7	46	0
Annual	4,166	531	3,635	7	296	0

Rate: Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	0	0	0	0	0	0
Feb	0	0	0	0	0	0
Mar	0	0	0	0	0	0
Apr	0	0	0	0	0	0

Renewable Energy System Performance Analysis Report

May	540	83	457	6	41	0
Jun	569	75	495	7	45	0
Jul	571	76	494	6	45	0
Aug	666	71	595	6	54	0
Sep	585	81	504	6	46	0
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	0	0	0	0	0	0
Annual	2,931	386	2,545	7	230	0

Rate: All

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	632	81	551	7	45	0
Feb	515	74	441	5	36	0
Mar	623	86	537	6	44	0
Apr	569	84	485	7	39	0
May	540	83	457	6	41	0
Jun	569	75	495	7	45	0
Jul	571	76	494	6	45	0
Aug	666	71	595	6	54	0

Sep	585	81	504	6	46	0
Oct	607	71	536	6	44	0
Nov	586	69	517	6	42	0
Dec	635	66	569	7	46	0
Annual	7,098	917	6,181	7	526	0

2.2.10 Emissions Avoidance

Pollutant	Emissions (kg/yr)
Carbon dioxide	3,906
Carbon monoxide	0
Unburned hydrocarbons	0
Particulate matter	0
Sulfur dioxide	16.9
Nitrogen oxides	8.28

2.3 Financial Analysis

Solar PV 2.16 KW Analysis

Prepared for: **KCPL**
Date: **4/20/2008**

Cash Purchase

Assumptions (Inputs)

Total Installed Cost (\$):	\$26,900
Allocation to Business (%):	0
Annual Energy Output (kWh):	2,944
Electricity Cost (\$/kWh):	\$0.0850
Electricity Inflation Rate (%):	8
Loan Downpayment (%):	100
Down Payment (\$):	\$26,900
Amount of Loan (\$):	\$0
Interest Rate (%):	0
Loan Term (Years):	10
Month Installed:	0
Net Federal Tax Rate (%):	28
Net State Tax Rate (%):	8
O & M Cost (\$/kWh):	\$0.000
O & M Inflation Rate (%):	0
State Rebate (%):	0
State Tax Credit (%):	0

Annual Cash Flow Model

	Net Energy	O&M Costs	Net Deprec.	Net Loan Payments	Annual Cash Flow	Total Cash Flow
Year						
0					(\$24,748)	(\$24,748)
1	\$250	\$0	\$0	\$0	\$250	(\$24,498)
2	\$270	\$0	\$0	\$0	\$270	(\$24,228)
3	\$292	\$0	\$0	\$0	\$292	(\$23,936)
4	\$315	\$0	\$0	\$0	\$315	(\$23,620)
5	\$340	\$0	\$0	\$0	\$340	(\$23,280)
6	\$368	\$0	\$0	\$0	\$368	(\$22,912)
7	\$397	\$0	\$0	\$0	\$397	(\$22,515)
8	\$429	\$0	\$0	\$0	\$429	(\$22,086)
9	\$463	\$0	\$0	\$0	\$463	(\$21,623)
10	\$500	\$0	\$0	\$0	\$500	(\$21,123)
11	\$540	\$0	\$0	\$0	\$540	(\$20,583)
12	\$583	\$0	\$0	\$0	\$583	(\$19,999)

Federal Tax Credit (%):	8	13	\$630	\$0	\$0	\$0	\$630	(\$19,369)
		14	\$681	\$0	\$0	\$0	\$681	(\$18,688)
Results		15	\$735	\$0	\$0	\$0	\$735	(\$17,953)
		16	\$794	\$0	\$0	\$0	\$794	(\$17,160)
Loan Payments		17	\$857	\$0	\$0	\$0	\$857	(\$16,302)
Monthly Payment (\$):	\$0	18	\$926	\$0	\$0	\$0	\$926	(\$15,376)
Value of Interest Deduction (\$):	\$0	19	\$1,000	\$0	\$0	\$0	\$1,000	(\$14,376)
Net Monthly Payment (\$):	\$0	20	\$1,080	\$0	\$0	\$0	\$1,080	(\$13,297)
		21	\$1,166	\$0	\$0	\$0	\$1,166	(\$12,130)
Ave. Monthly Savings on Bill		22	\$1,260	\$0	\$0	\$0	\$1,260	(\$10,871)
Year 1 (\$):	\$21	23	\$1,360	\$0	\$0	\$0	\$1,360	(\$9,510)
Year 10 (\$):	\$45	24	\$1,469	\$0	\$0	\$0	\$1,469	(\$8,041)
Year 20 (\$):	\$97	25	\$1,587	\$0	\$0	\$0	\$1,587	(\$6,454)
Year 30 (\$):	\$210	26	\$1,714	\$0	\$0	\$0	\$1,714	(\$4,740)
		27	\$1,851	\$0	\$0	\$0	\$1,851	(\$2,889)
Internal Rate of Return		28	\$1,999	\$0	\$0	\$0	\$1,999	(\$890)
Years 1 - 30:	0.7%	29	\$2,159	\$0	\$0	\$0	\$2,159	\$1,268
		30	\$2,332	\$0	\$0	\$0	\$2,332	\$3,600

Conservative assumption of no scrap value after 30 years.

Cash flow analysis is pre-tax.

3 Solar PV System Analysis 3.024 KW – Northeast Kansas City

The following assumptions were used in preparing this system performance with **HOMER**:

- **3.024 KW Grid-tied** system using 14 Sharp 216 Watt Solar PV Panels and SMA SB 4000 inverter;
- System install price **\$32,900.00** includes all cost and tax;
- Primary Load **25 KWH/Day** and a daily **7.3 KW** Peak;
- The financial analysis assumes cash purchase;
- Energy escalation rate of **8%**;
- The federal Solar PV Tax Credit of **\$2,000** is treated as an incentive.

3.1 Summary of Results

The following summarizes the results of this analysis. All the detail is provided in the system production report section below.

- Annual power production from system **4,122 KWH**
- First year value of the power produced by the system for consumer **\$352.24**
- **IRR 1.3% Payback 26 years**

PV (kW)	Converter (kW)	Grid (kW)	Initial capital	Operating cost (\$/yr)	Total NPC	COE (\$/kWh)	Renewable fraction
		1000	\$0	777	\$9,936	0.085	0
3.084	4	1000	\$32,900	418	\$38,244	0.328	0.4

3.2 System Production Report

3.2.1 Sensitivity case

Primary Load 1 Scaled Average: 25 kWh/d

3.2.2 System architecture

PV Array: 3.02 kW

Grid: 1,000 kW

Inverter: 4 kW

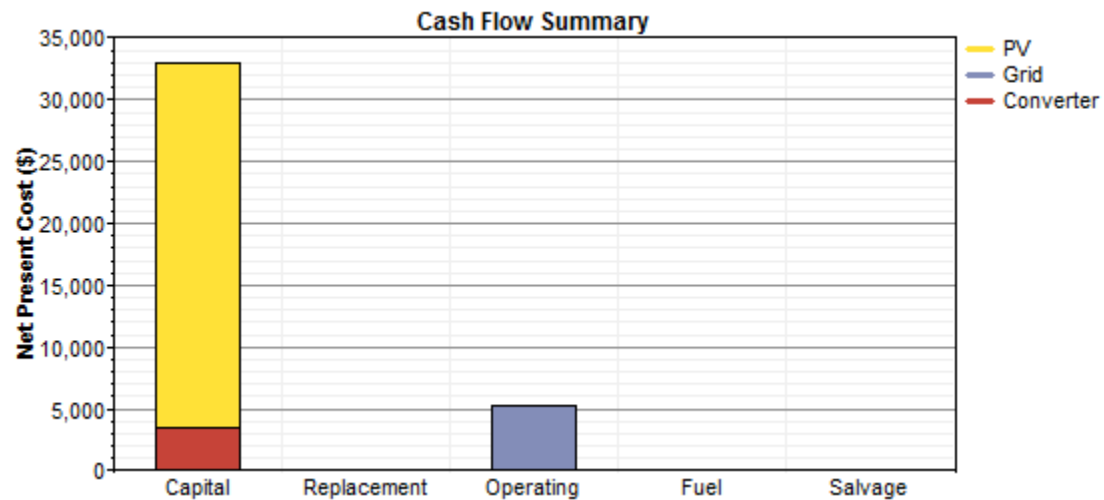
Rectifier: 4 kW

3.2.3 Cost summary

Total net present cost: 38,333 \$

Levelized cost of energy: 0.329 \$/kWh

Operating cost: 425 \$

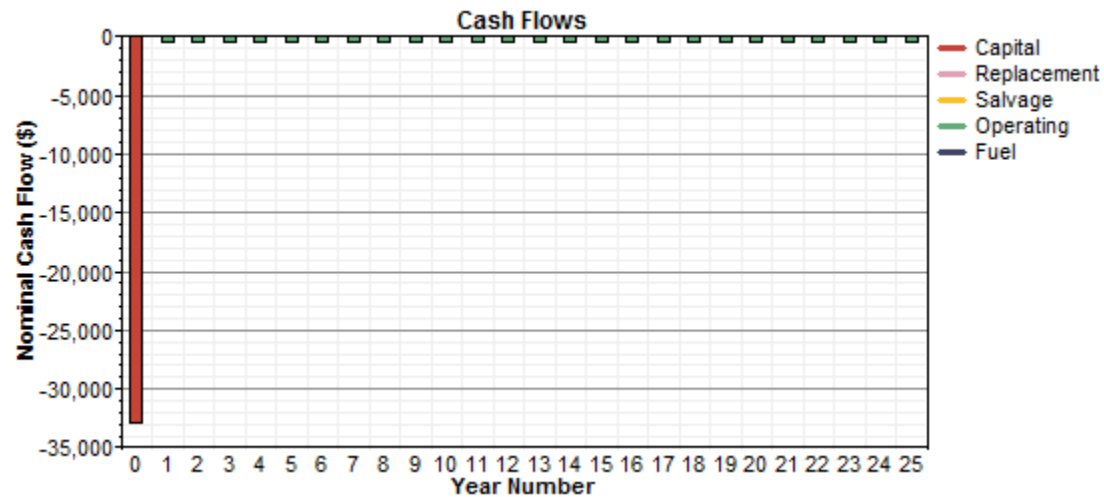


3.2.4 Net Present Costs

Component	Capital (\$)	Replacement (\$)	O&M (\$)	Fuel (\$)	Salvage (\$)	Total (\$)
PV	29,400	0	0	0	0	29,400
Grid	0	0	5,433	0	0	5,433
Converter	3,500	0	0	0	0	3,500
System	32,900	0	5,433	0	0	38,333

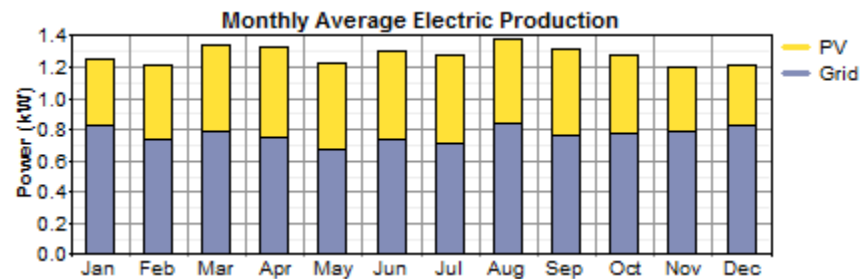
3.2.5 Annualized Costs

Component	Capital (\$/yr)	Replacement (\$/yr)	O&M (\$/yr)	Fuel (\$/yr)	Salvage (\$/yr)	Total (\$/yr)
PV	2,300	0	0	0	0	2,300
Grid	0	0	425	0	0	425
Converter	274	0	0	0	0	274
System	2,574	0	425	0	0	2,999



3.2.6 Annual electric energy production

Component	Production	Fraction
	(kWh/yr)	
PV array	4,385	39%
Grid purchases	6,750	61%
Total	11,135	100%



Month	PV KW	Grid KW
Jan	0.42996	0.82249
Feb	0.48153	0.73303
Mar	0.55129	0.79452
April	0.57982	0.74556
May	0.55111	0.67596
June	0.56389	0.73700
July	0.56524	0.71638
August	0.54488	0.84000
September	0.55381	0.76617

October	0.50207	0.77500
November	0.41200	0.78501
December	0.38995	0.82520

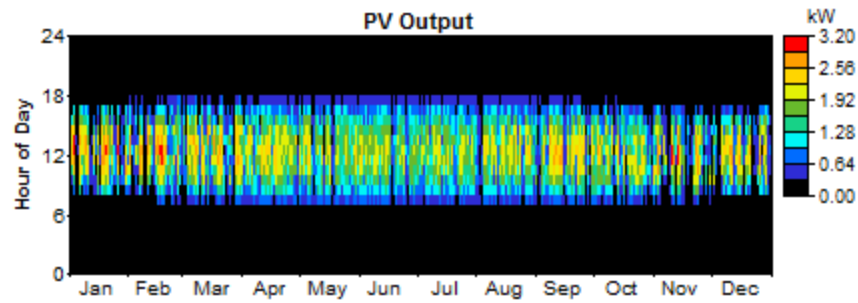
3.2.7 Annual electric energy consumption

Load	Consumption	Fraction
	(kWh/yr)	
AC primary load	9,125	84%
Grid sales	1,747	16%
Total	10,872	100%

Variable	Value	Units
Renewable fraction:	0.394	
Excess electricity:	0	kWh/yr
Unmet load:	0	kWh/yr
Capacity shortage:	0	kWh/yr

3.2.8 PV

Variable	Value	Units
Average output:	12.0	kWh/d
Minimum output:	0.00	kW
Maximum output:	3.00	kW
Solar penetration:	48.1	%
Capacity factor:	16.6	%
Hours of operation:	4,387	hr/yr



Monthly Solar PV Production

Month	Energy Produced	Energy Savings
	(kWh)	\$
Jan	295	\$23.98
Feb	298	\$24.23
Mar	378	\$30.73
Apr	385	\$31.30
May	378	\$34.17
Jun	374	\$33.81
Jul	388	\$35.08
Aug	374	\$33.81
Sep	368	\$33.27
Oct	344	\$27.97
Nov	273	\$22.19
Dec	267	\$21.71
Annual	4,122	\$352.24

3.2.9 Monthly Grid and Solar PV Power Sold Net Metering

Rate: Non Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	613	146	467	7	38	0
Feb	494	138	356	5	29	0
Mar	593	164	429	6	35	0
Apr	539	164	375	7	30	0
May	0	0	0	0	0	0
Jun	0	0	0	0	0	0
Jul	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sep	0	0	0	0	0	0
Oct	578	140	438	6	36	0
Nov	566	128	438	6	36	0
Dec	615	123	492	7	40	0
Annual	3,997	1,002	2,995	7	243	0

Rate: Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	0	0	0	0	0	0
Feb	0	0	0	0	0	0
Mar	0	0	0	0	0	0
Apr	0	0	0	0	0	0

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May	505	156	349	6	32	0
Jun	533	145	388	7	35	0
Jul	535	151	384	6	35	0
Aug	627	139	489	6	44	0
Sep	553	154	399	6	36	0
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	0	0	0	0	0	0
Annual	2,753	745	2,008	7	182	0

Rate: All

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	613	146	467	7	38	0
Feb	494	138	356	5	29	0
Mar	593	164	429	6	35	0
Apr	539	164	375	7	30	0
May	505	156	349	6	32	0
Jun	533	145	388	7	35	0
Jul	535	151	384	6	35	0
Aug	627	139	489	6	44	0
Sep	553	154	399	6	36	0
Oct	578	140	438	6	36	0
Nov	566	128	438	6	36	0
Dec	615	123	492	7	40	0
Annual	6,750	1,747	5,003	7	425	0

3.2.10 Emissions

Pollutant	Emissions (kg/yr)
Carbon dioxide	3,162
Carbon monoxide	0
Unburned hydrocarbons	0
Particulate matter	0
Sulfur dioxide	13.7
Nitrogen oxides	6.7

3.3 Financial Analysis

Solar PV 3.02 KW Analysis

Prepared for: **KCPL**
Date: **4/20/2008**

Cash Purchase

Assumptions (Inputs)

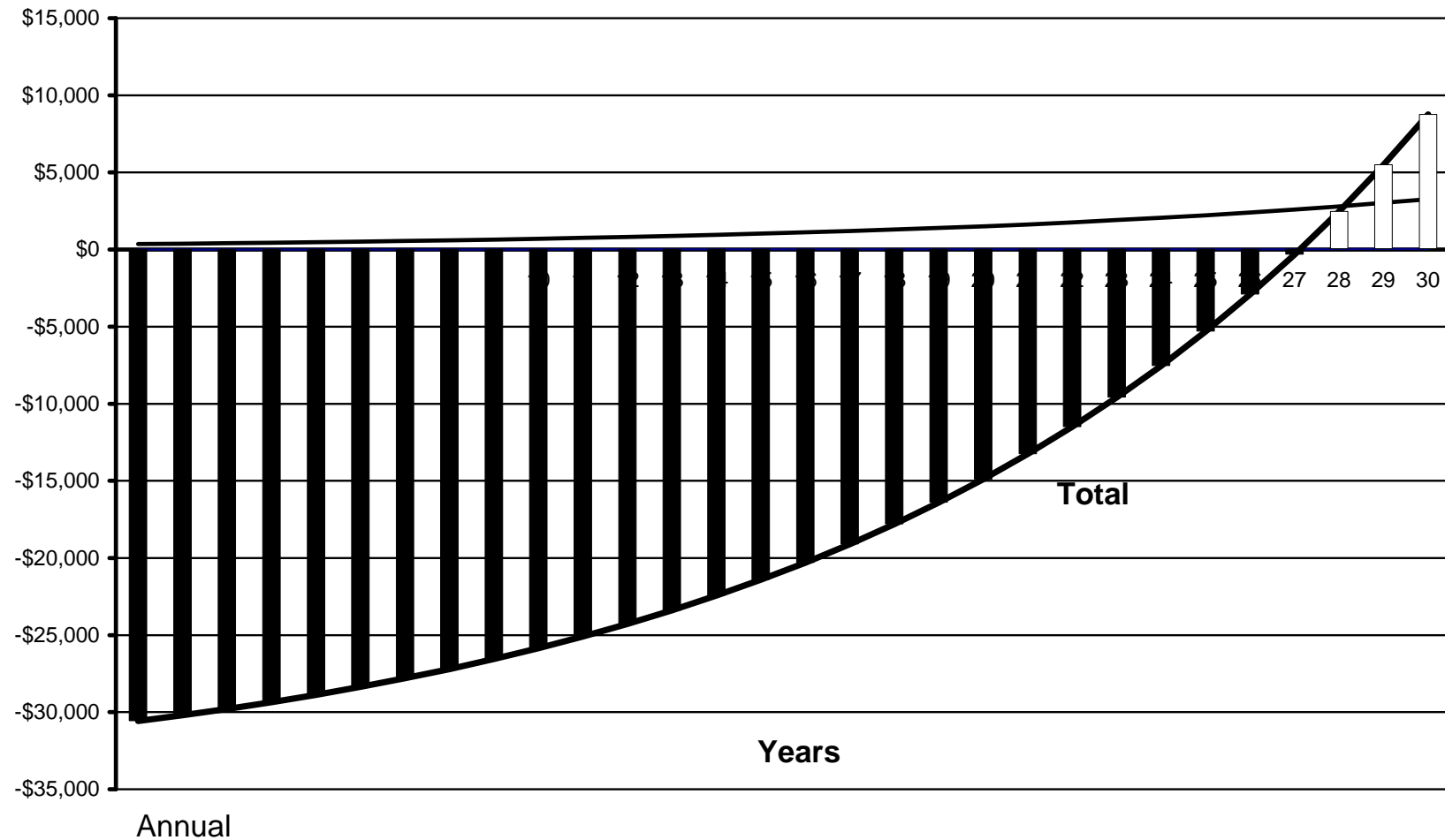
Total Installed Cost (\$):	\$32,900
Allocation to Business (%):	0
Annual Energy Output (kWh):	4,122
Electricity Cost (\$/kWh):	\$0.0850
Electricity Inflation Rate (%):	8
Loan Downpayment (%):	100
Down Payment (\$):	\$32,900
Amount of Loan (\$):	\$0
Interest Rate (%):	0

Annual Cash Flow Model

	Net	O&M	Net	Net Loan	Annual	Total
Year	Energy	Costs	Deprec.	Payments	Cash Flow	Cash Flow
0					(\$30,926)	(\$30,926)
1	\$350	\$0	\$0	\$0	\$350	(\$30,576)
2	\$378	\$0	\$0	\$0	\$378	(\$30,197)
3	\$409	\$0	\$0	\$0	\$409	(\$29,789)
4	\$441	\$0	\$0	\$0	\$441	(\$29,347)

Loan Term (Years):	10	5	\$477	\$0	\$0	\$0	\$477	(\$28,871)
Month Installed:	0	6	\$515	\$0	\$0	\$0	\$515	(\$28,356)
Net Federal Tax Rate (%):	28	7	\$556	\$0	\$0	\$0	\$556	(\$27,800)
Net State Tax Rate (%):	8	8	\$600	\$0	\$0	\$0	\$600	(\$27,199)
O & M Cost (\$/kWh):	\$0.000	9	\$649	\$0	\$0	\$0	\$649	(\$26,551)
O & M Inflation Rate (%):	0	10	\$700	\$0	\$0	\$0	\$700	(\$25,850)
State Rebate (%):	0	11	\$756	\$0	\$0	\$0	\$756	(\$25,094)
State Tax Credit (%):	0	12	\$817	\$0	\$0	\$0	\$817	(\$24,277)
Federal Tax Credit (%):	6	13	\$882	\$0	\$0	\$0	\$882	(\$23,395)
		14	\$953	\$0	\$0	\$0	\$953	(\$22,442)
Results		15	\$1,029	\$0	\$0	\$0	\$1,029	(\$21,413)
		16	\$1,111	\$0	\$0	\$0	\$1,111	(\$20,301)
Loan Payments		17	\$1,200	\$0	\$0	\$0	\$1,200	(\$19,101)
Monthly Payment (\$):	\$0	18	\$1,296	\$0	\$0	\$0	\$1,296	(\$17,805)
Value of Interest Deduction (\$):	\$0	19	\$1,400	\$0	\$0	\$0	\$1,400	(\$16,404)
Net Monthly Payment (\$):	\$0	20	\$1,512	\$0	\$0	\$0	\$1,512	(\$14,892)
		21	\$1,633	\$0	\$0	\$0	\$1,633	(\$13,259)
Ave. Monthly Savings on Bill		22	\$1,764	\$0	\$0	\$0	\$1,764	(\$11,496)
Year 1 (\$):	\$29	23	\$1,905	\$0	\$0	\$0	\$1,905	(\$9,591)
Year 10 (\$):	\$63	24	\$2,057	\$0	\$0	\$0	\$2,057	(\$7,534)
Year 20 (\$):	\$136	25	\$2,222	\$0	\$0	\$0	\$2,222	(\$5,312)
Year 30 (\$):	\$294	26	\$2,400	\$0	\$0	\$0	\$2,400	(\$2,912)
		27	\$2,591	\$0	\$0	\$0	\$2,591	(\$321)
Internal Rate of Return		28	\$2,799	\$0	\$0	\$0	\$2,799	\$2,478
Years 1 - 30:	1.2%	29	\$3,023	\$0	\$0	\$0	\$3,023	\$5,501
		30	\$3,264	\$0	\$0	\$0	\$3,264	\$8,765

Cash Purchase Annual and Total Cash Flow



4 Solar PV System Analysis 2.16 KW – Southwest Overland Park, KS

The following assumptions were used in preparing this system performance with **HOMER**:

- **2.16 KW Grid-tied** system using 10 Sharp 216 Watt Solar PV Panels and SMA SB 3000 inverter;
- System install price **\$26,900.00** includes all cost and tax;
- Primary Load **25 KWH/Day** and a daily **7.3 KW** Peak;
- The financial analysis assumes cash purchase;
- Energy escalation rate of **8%**;
- The federal Solar PV Tax Credit of **\$2,000** is treated as an incentive.

4.1 Summary of Results

The following summarizes the results of this analysis. All the detail is provided in the system production report section below.

- Annual power production from system **2,968 KWH**
- First year value of the power produced by the system for consumer **\$259.00**
- Traditional Payback Analysis **IRR 0.7 % Simple Payback 28 years**

PV (kW)	Converter (kW)	Grid (kW)	Initial capital	Operating cost (\$/yr)	Total NPC	COE (\$/kWh)	Renewable fraction
		1000	\$0	796	\$10,177	0.087	0
2.16	3	1000	\$26,900	537	\$33,766	0.289	0.31

4.2 System Production Report

4.2.1 Sensitivity case

Primary Load 1 Scaled Average: 25 kWh/d

4.2.2 System architecture

PV Array: 2.16 kW

Grid: 1,000 kW

Inverter: 3 kW

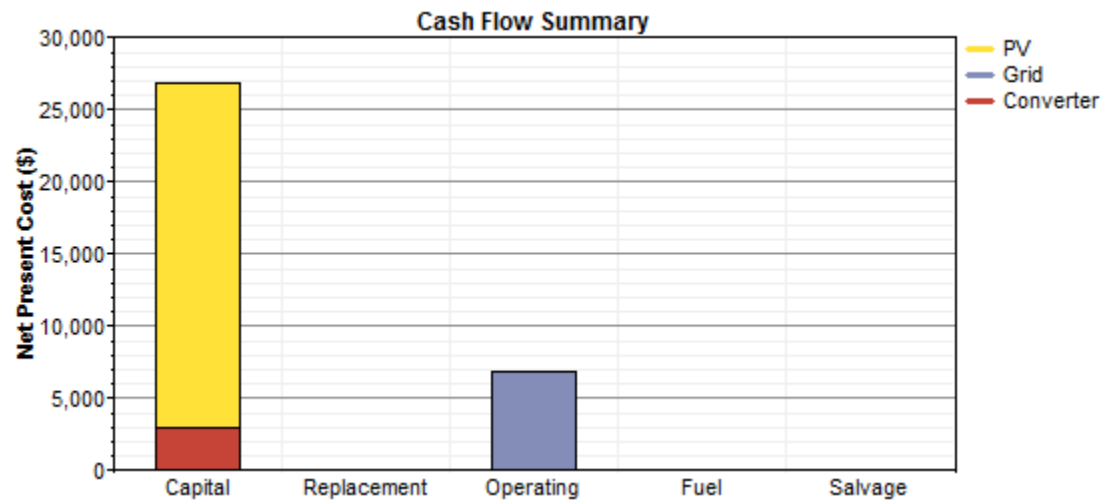
Rectifier: 3 kW

4.2.3 Cost summary

Total net present cost: 33,766 \$

Levelized cost of energy: 0.289 \$/kWh

Operating cost: 537 \$

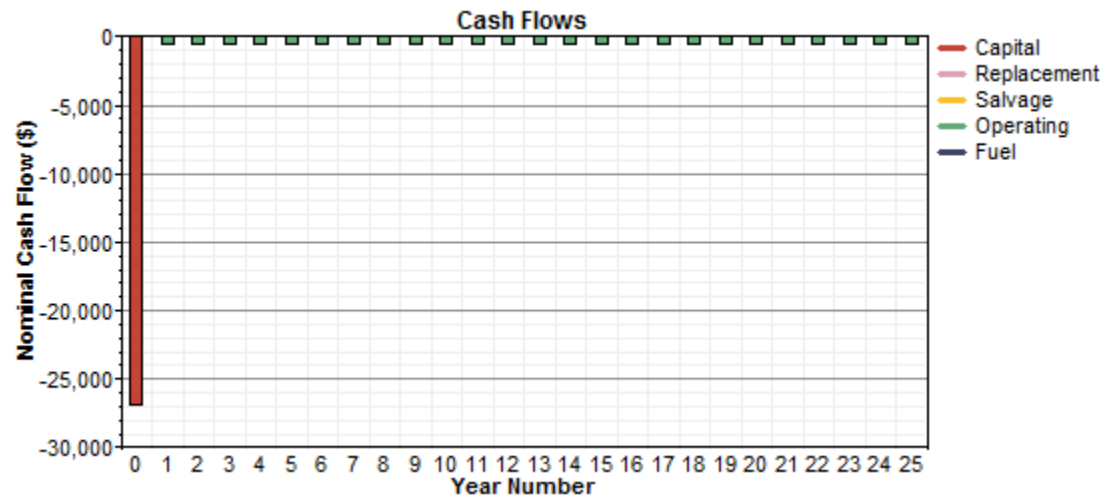


4.2.4 Net Present Costs

Component	Capital (\$)	Replacement (\$)	O&M (\$)	Fuel (\$)	Salvage (\$)	Total (\$)
PV	23,900	0	0	0	0	23,900
Grid	0	0	6,866	0	0	6,866
Converter	3,000	0	0	0	0	3,000
System	26,900	0	6,866	0	0	33,766

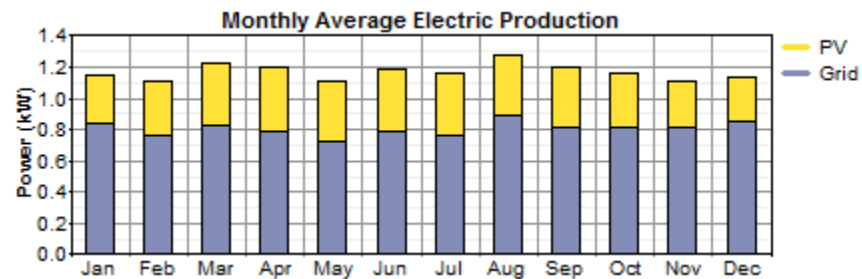
4.2.5 Annualized Costs

Component	Capital (\$/yr)	Replacement (\$/yr)	O&M (\$/yr)	Fuel (\$/yr)	Salvage (\$/yr)	Total (\$/yr)
PV	1,870	0	0	0	0	1,870
Grid	0	0	537	0	0	537
Converter	235	0	0	0	0	235
System	2,104	0	537	0	0	2,641



4.2.6 Annual electric energy production

Component	Production	Fraction
	(kWh/yr)	
PV array	3,157	31%
Grid purchases	7,086	69%
Total	10,243	100%



Month	PV KW	Grid KW
Jan	0.30927	0.84600
Feb	0.34035	0.76538
Mar	0.39203	0.83440
April	0.41040	0.78830
May	0.38671	0.72581
June	0.39365	0.79112
July	0.39162	0.76923
August	0.38084	0.89596
September	0.38863	0.81230

October	0.35213	0.81580
November	0.29646	0.80937
December	0.28275	0.84790

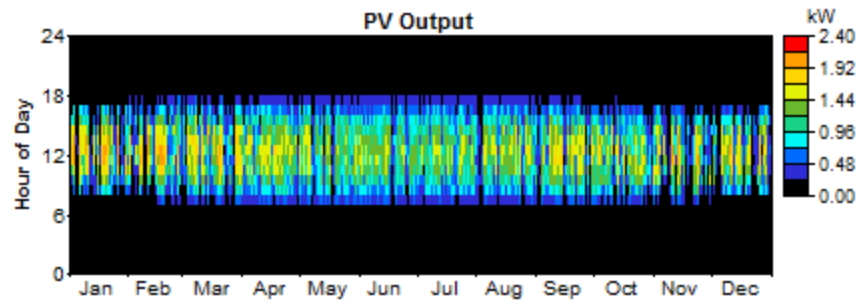
4.2.7 Annual electric energy consumption

Load	Consumption	Fraction
	(kWh/yr)	
AC primary load	9,125	91%
Grid sales	929	9%
Total	10,054	100%

Variable	Value	Units
Renewable fraction:	0.308	
Excess electricity:	0	kWh/yr
Unmet load:	0	kWh/yr
Capacity shortage:	0	kWh/yr

4.2.8 PV

Variable	Value	Units
Average output:	8.65	kWh/d
Minimum output:	0.00	kW
Maximum output:	2.15	kW
Solar penetration:	34.6	%
Capacity factor:	16.7	%
Hours of operation:	4,387	hr/yr



Monthly Solar PV Production

Month	Energy Produced	Energy Savings
	(kWh)	\$
Jan	216	\$18.71
Feb	215	\$18.62
Mar	274	\$23.73
Apr	278	\$24.08
May	270	\$23.79
Jun	266	\$23.44
Jul	274	\$24.14
Aug	266	\$23.44
Sep	263	\$23.17
Oct	246	\$21.31
Nov	201	\$17.41
Dec	198	\$17.15
Annual	2,968	\$258.98

4.2.9 Monthly Grid and Solar PV Power Sold Net Metering

Rate: Non Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	629	84	546	7	47	0
Feb	514	75	439	5	38	0
Mar	621	88	533	6	46	0
Apr	568	86	482	7	42	0
May	0	0	0	0	0	0
Jun	0	0	0	0	0	0
Jul	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sep	0	0	0	0	0	0
Oct	607	71	536	6	46	0
Nov	583	72	511	6	44	0
Dec	631	69	562	7	49	0
Annual	4,153	545	3,608	7	312	0

Rate: Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	0	0	0	0	0	0
Feb	0	0	0	0	0	0
Mar	0	0	0	0	0	0
Apr	0	0	0	0	0	0

Renewable Energy System Performance Analysis Report

May	540	84	456	6	40	0
Jun	570	74	495	7	44	0
Jul	572	75	497	6	44	0
Aug	667	71	596	6	53	0
Sep	585	81	504	6	44	0
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	0	0	0	0	0	0
Annual	2,933	384	2,549	7	225	0

Rate: All

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	629	84	546	7	47	0
Feb	514	75	439	5	38	0
Mar	621	88	533	6	46	0
Apr	568	86	482	7	42	0
May	540	84	456	6	40	0
Jun	570	74	495	7	44	0
Jul	572	75	497	6	44	0
Aug	667	71	596	6	53	0
Sep	585	81	504	6	44	0
Oct	607	71	536	6	46	0
Nov	583	72	511	6	44	0
Dec	631	69	562	7	49	0
Annual	7,086	929	6,157	7	537	0

4.2.10 Emissions

Pollutant	Emissions (kg/yr)
Carbon dioxide	3,891
Carbon monoxide	0
Unburned hydrocarbons	0
Particulate matter	0
Sulfur dioxide	16.9
Nitrogen oxides	8.25

4.3 Financial Analysis

Solar PV 2.16 KW Analysis Southwest

Prepared for: **KCPL**
Date: **4/20/2008**

Cash Purchase

Assumptions (Inputs)

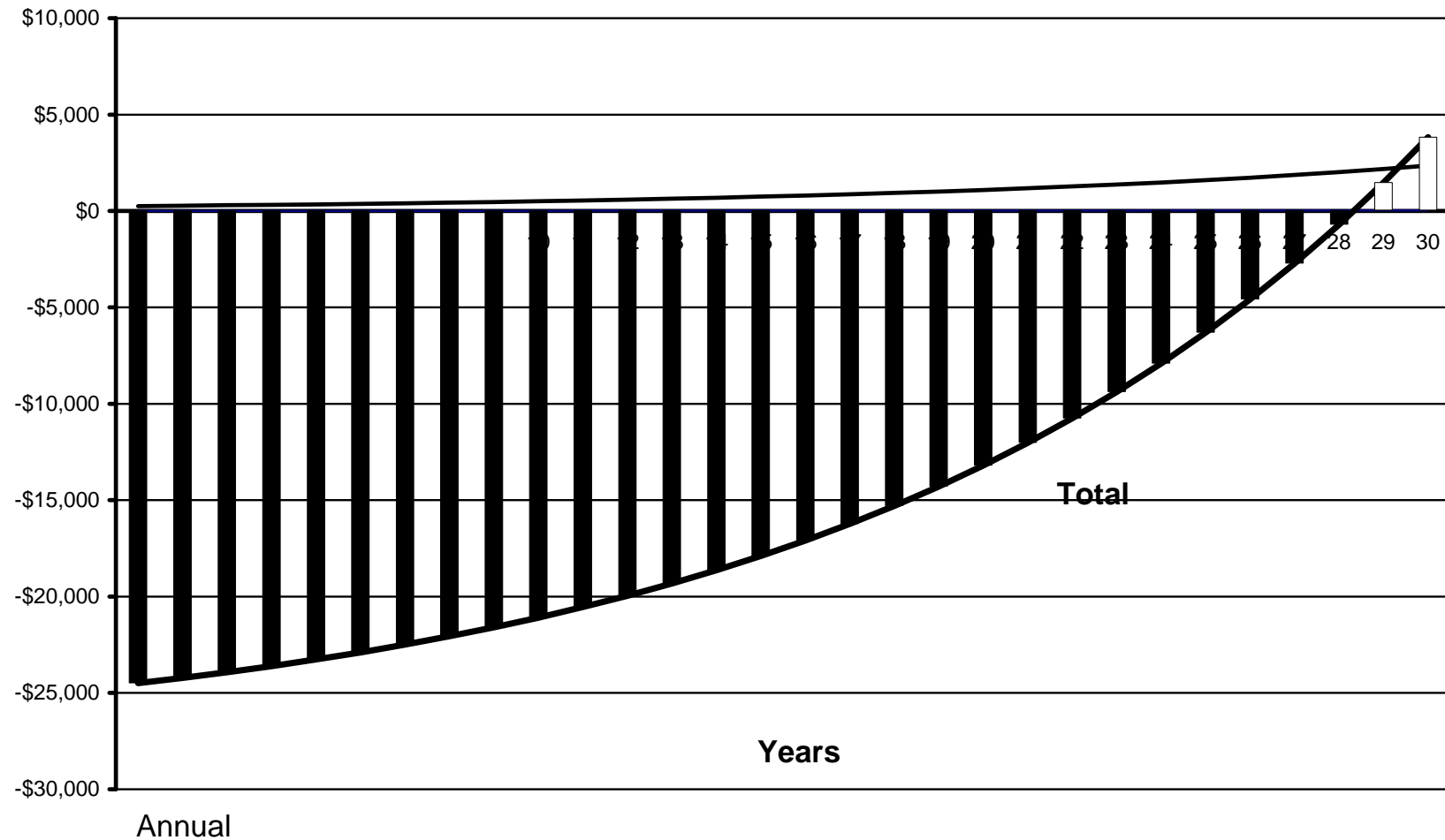
Total Installed Cost (\$):	\$26,900
Allocation to Business (%):	0
Annual Energy Output (kWh):	2,968
Electricity Cost (\$/kWh):	\$0.0850
Electricity Inflation Rate (%):	8
Loan Downpayment (%):	100
Down Payment (\$):	\$26,900
Amount of Loan (\$):	\$0
Interest Rate (%):	0

Annual Cash Flow Model

	Net Energy	O&M Costs	Net Deprec.	Net Loan Payments	Annual Cash Flow	Total Cash Flow
Year						
0					(\$24,748)	(\$24,748)
1	\$252	\$0	\$0	\$0	\$252	(\$24,496)
2	\$272	\$0	\$0	\$0	\$272	(\$24,223)
3	\$294	\$0	\$0	\$0	\$294	(\$23,929)
4	\$318	\$0	\$0	\$0	\$318	(\$23,611)

Loan Term (Years):	10	5	\$343	\$0	\$0	\$0	\$343	(\$23,268)
Month Installed:	0	6	\$371	\$0	\$0	\$0	\$371	(\$22,897)
Net Federal Tax Rate (%):	28	7	\$400	\$0	\$0	\$0	\$400	(\$22,497)
Net State Tax Rate (%):	8	8	\$432	\$0	\$0	\$0	\$432	(\$22,065)
O & M Cost (\$/kWh):	\$0.000	9	\$467	\$0	\$0	\$0	\$467	(\$21,598)
O & M Inflation Rate (%):	0	10	\$504	\$0	\$0	\$0	\$504	(\$21,093)
State Rebate (%):	0	11	\$545	\$0	\$0	\$0	\$545	(\$20,549)
State Tax Credit (%):	0	12	\$588	\$0	\$0	\$0	\$588	(\$19,960)
Federal Tax Credit (%):	8	13	\$635	\$0	\$0	\$0	\$635	(\$19,325)
		14	\$686	\$0	\$0	\$0	\$686	(\$18,639)
Results		15	\$741	\$0	\$0	\$0	\$741	(\$17,898)
		16	\$800	\$0	\$0	\$0	\$800	(\$17,098)
Loan Payments		17	\$864	\$0	\$0	\$0	\$864	(\$16,233)
Monthly Payment (\$):	\$0	18	\$933	\$0	\$0	\$0	\$933	(\$15,300)
Value of Interest Deduction (\$):	\$0	19	\$1,008	\$0	\$0	\$0	\$1,008	(\$14,292)
Net Monthly Payment (\$):	\$0	20	\$1,089	\$0	\$0	\$0	\$1,089	(\$13,203)
		21	\$1,176	\$0	\$0	\$0	\$1,176	(\$12,027)
Ave. Monthly Savings on Bill		22	\$1,270	\$0	\$0	\$0	\$1,270	(\$10,757)
Year 1 (\$):	\$21	23	\$1,372	\$0	\$0	\$0	\$1,372	(\$9,386)
Year 10 (\$):	\$45	24	\$1,481	\$0	\$0	\$0	\$1,481	(\$7,905)
Year 20 (\$):	\$98	25	\$1,600	\$0	\$0	\$0	\$1,600	(\$6,305)
Year 30 (\$):	\$212	26	\$1,728	\$0	\$0	\$0	\$1,728	(\$4,577)
		27	\$1,866	\$0	\$0	\$0	\$1,866	(\$2,711)
Internal Rate of Return		28	\$2,015	\$0	\$0	\$0	\$2,015	(\$696)
Years 1 - 30:	0.7%	29	\$2,176	\$0	\$0	\$0	\$2,176	\$1,481
		30	\$2,351	\$0	\$0	\$0	\$2,351	\$3,831

Cash Purchase Annual and Total Cash Flow



5 Solar PV System Analysis 3.024 KW – Southwest Overland Park

The following assumptions were used in preparing this system performance with **HOMER**:

- **3.024 KW Grid-tied** system using 14 Sharp 216 Watt Solar PV Panels and SMA SB 4000 inverter;
- System install price **\$32,900.00** includes all cost and tax;
- Primary Load **25 KWH/Day** and a daily **7.3 KW** Peak;
- The financial analysis assumes cash purchase;
- Energy escalation rate of **8%**;
- The federal Solar PV Tax Credit of **\$2,000** is treated as an incentive.

5.1 Summary of Results

The following summarizes the results of this analysis. All the detail is provided in the system production report section below.

- Annual power production from system **4,155 KWH**
- First year value of the power produced by the system for consumer **\$362.77**
- **IRR 1.4% Payback 27 years**

PV (kW)	Converter (kW)	Grid (kW)	Initial capital	Operating cost (\$/yr)	Total NPC	COE (\$/kWh)	Renewable fraction
		1000	\$ 0	796	\$ 10,177	0.087	0.00
3.024	4	1000	\$ 32,900	433	\$ 38,441	0.330	0.40

5.2 System Production Report

5.2.1 Sensitivity case

Primary Load 1 Scaled Average: 25 kWh/d

5.2.2 System architecture

PV Array: 3.02 kW

Grid: 1,000 kW

Inverter: 4 kW

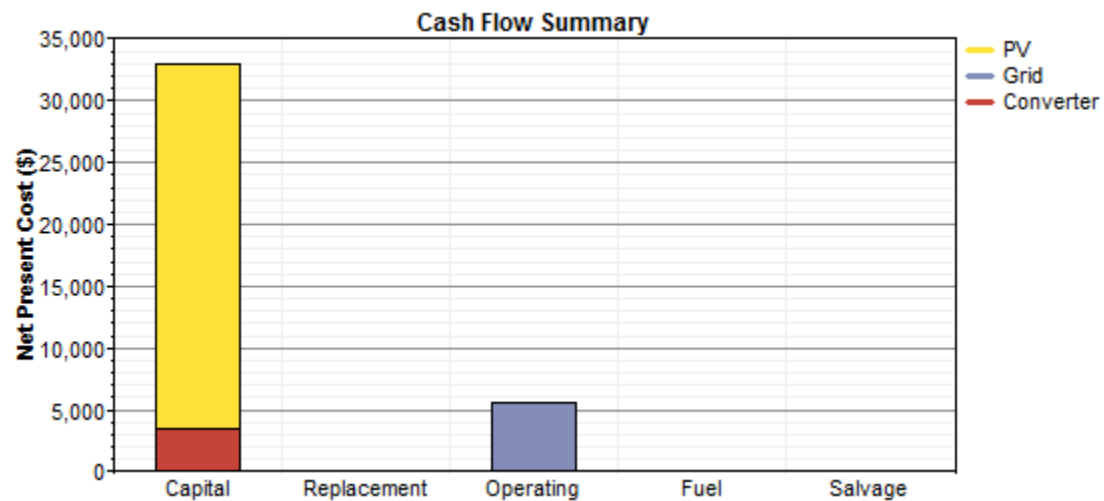
Rectifier: 4 kW

5.2.3 Cost summary

Total net present cost: 38,441 \$

Levelized cost of energy: 0.330 \$/kWh

Operating cost: 433 \$

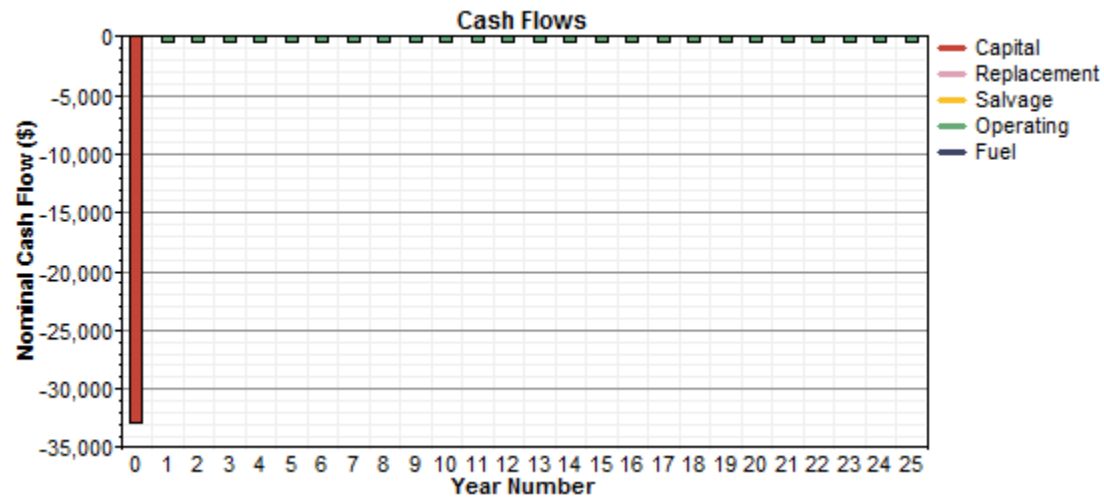


5.2.4 Net Present Costs

Component	Capital (\$)	Replacement (\$)	O&M (\$)	Fuel (\$)	Salvage (\$)	Total (\$)
PV	29,400	0	0	0	0	29,400
Grid	0	0	5,541	0	0	5,541
Converter	3,500	0	0	0	0	3,500
System	32,900	0	5,541	0	0	38,441

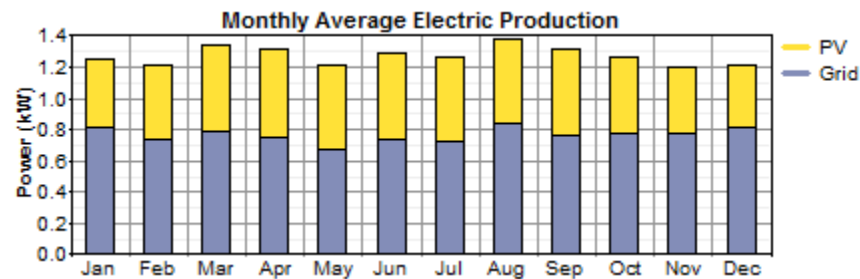
5.2.5 Annualized Costs

Component	Capital (\$/yr)	Replacement (\$/yr)	O&M (\$/yr)	Fuel (\$/yr)	Salvage (\$/yr)	Total (\$/yr)
PV	2,300	0	0	0	0	2,300
Grid	0	0	433	0	0	433
Converter	274	0	0	0	0	274
System	2,574	0	433	0	0	3,007



5.2.6 Annual electric energy production

Component	Production	Fraction
	(kWh/yr)	
PV array	4,420	40%
Grid purchases	6,738	60%
Total	11,159	100%



Month	PV KW	Grid KW
Jan	0.43298	0.81962
Feb	0.47649	0.73327
Mar	0.54885	0.79409
April	0.57456	0.74621
May	0.54140	0.67841
June	0.55111	0.74059
July	0.54827	0.72106
August	0.53317	0.84364
September	0.54408	0.76817

October	0.49298	0.77661
November	0.41504	0.78246
December	0.39585	0.82146

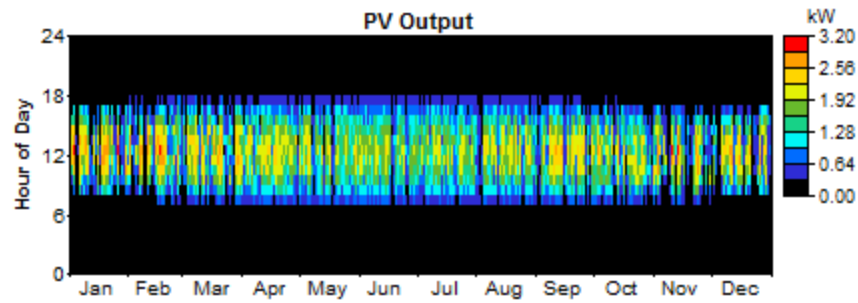
5.2.7 Annual electric energy consumption

Load	Consumption	Fraction
	(kWh/yr)	
AC primary load	9,125	84%
Grid sales	1,768	16%
Total	10,893	100%

Variable	Value	Units
Renewable fraction:	0.396	
Excess electricity:	0	kWh/yr
Unmet load:	0	kWh/yr
Capacity shortage:	0	kWh/yr

5.2.8 PV

Variable	Value	Units
Average output:	12.1	kWh/d
Minimum output:	0.00	kW
Maximum output:	3.01	kW
Solar penetration:	48.4	%
Capacity factor:	16.7	%
Hours of operation:	4,387	hr/yr



Monthly Solar PV Production

Month	Energy Produced	Energy Savings
	(kWh)	\$
Jan	303	\$26.24
Feb	301	\$26.07
Mar	384	\$33.26
Apr	389	\$33.69
May	379	\$33.39
Jun	373	\$32.87
Jul	383	\$33.75
Aug	373	\$32.87
Sep	368	\$32.42
Oct	345	\$29.88
Nov	281	\$24.34
Dec	277	\$23.99
Annual	4,155	\$362.77

5.2.9 Monthly Grid and Solar PV Power Sold Net Metering

Rate: Non Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	610	151	459	7	40	0
Feb	493	140	353	5	31	0
Mar	591	168	423	6	37	0
Apr	537	167	371	7	32	0
May	0	0	0	0	0	0
Jun	0	0	0	0	0	0
Jul	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sep	0	0	0	0	0	0
Oct	578	140	437	6	38	0
Nov	563	132	431	6	37	0
Dec	611	128	483	7	42	0
Annual	3,983	1,026	2,957	7	256	0

Rate: Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	0	0	0	0	0	0
Feb	0	0	0	0	0	0
Mar	0	0	0	0	0	0
Apr	0	0	0	0	0	0
May	505	157	348	6	31	0
Jun	533	144	389	7	34	0

Jul	536	149	388	6	34	0
Aug	628	138	489	6	43	0
Sep	553	155	398	6	35	0
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	0	0	0	0	0	0
Annual	2,755	742	2,013	7	177	0

Rate: All

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	610	151	459	7	40	0
Feb	493	140	353	5	31	0
Mar	591	168	423	6	37	0
Apr	537	167	371	7	32	0
May	505	157	348	6	31	0
Jun	533	144	389	7	34	0
Jul	536	149	388	6	34	0
Aug	628	138	489	6	43	0
Sep	553	155	398	6	35	0
Oct	578	140	437	6	38	0
Nov	563	132	431	6	37	0
Dec	611	128	483	7	42	0
Annual	6,738	1,768	4,970	7	433	0

5.3 Emissions

Pollutant	Emissions (kg/yr)
Carbon dioxide	3,141

Carbon monoxide	0
Unburned hydrocarbons	0
Particulate matter	0
Sulfur dioxide	13.6
Nitrogen oxides	6.66

5.4 Financial Analysis

Solar PV 3.02 KW Southwest Analysis

Prepared for: **KCPL**
Date: **4/20/2008**

Cash Purchase

Assumptions (Inputs)		Annual Cash Flow Model					
Total Installed Cost (\$):	\$32,900						
Allocation to Business (%):	0						
Annual Energy Output (kWh):	4,155	Year	Net Energy	O&M Costs	Net Deprec.	Net Loan Payments	Annual Cash Flow
Electricity Cost (\$/kWh):	\$0.0870	0					(\$30,926)
Electricity Inflation Rate (%):	8						
Loan Downpayment (%):	100	1	\$361	\$0	\$0	\$0	(\$30,565)
Down Payment (\$):	\$32,900	2	\$390	\$0	\$0	\$0	(\$30,174)
Amount of Loan (\$):	\$0	3	\$422	\$0	\$0	\$0	(\$29,752)
Interest Rate (%):	0	4	\$455	\$0	\$0	\$0	(\$29,297)
Loan Term (Years):	10	5	\$492	\$0	\$0	\$0	(\$28,805)

Month Installed:	0	6	\$531	\$0	\$0	\$0	\$531	(\$28,274)
Net Federal Tax Rate (%):	28	7	\$574	\$0	\$0	\$0	\$574	(\$27,701)
Net State Tax Rate (%):	8	8	\$620	\$0	\$0	\$0	\$620	(\$27,081)
O & M Cost (\$/kWh):	\$0.000	9	\$669	\$0	\$0	\$0	\$669	(\$26,412)
O & M Inflation Rate (%):	0	10	\$723	\$0	\$0	\$0	\$723	(\$25,689)
State Rebate (%):	0	11	\$780	\$0	\$0	\$0	\$780	(\$24,909)
State Tax Credit (%):	0	12	\$843	\$0	\$0	\$0	\$843	(\$24,066)
Federal Tax Credit (%):	6	13	\$910	\$0	\$0	\$0	\$910	(\$23,156)
		14	\$983	\$0	\$0	\$0	\$983	(\$22,173)

Results

Loan Payments

Monthly Payment (\$):	\$0	18	\$1,338	\$0	\$0	\$0	\$1,338	(\$17,388)
Value of Interest Deduction (\$):	\$0	19	\$1,445	\$0	\$0	\$0	\$1,445	(\$15,944)
Net Monthly Payment (\$):	\$0	20	\$1,560	\$0	\$0	\$0	\$1,560	(\$14,384)

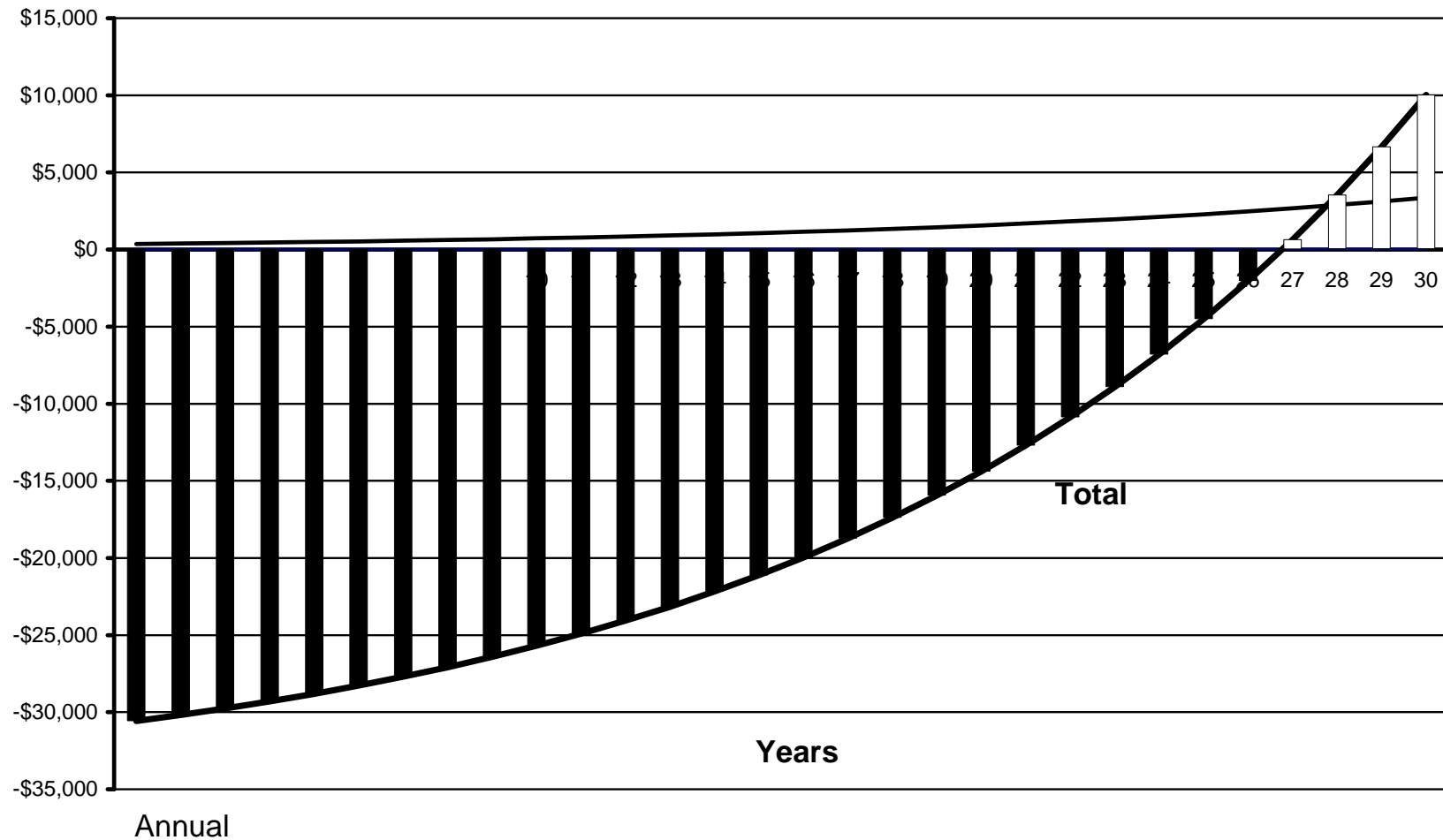
Ave. Monthly Savings on Bill

Year 1 (\$):	\$30	23	\$1,965	\$0	\$0	\$0	\$1,965	(\$8,914)
Year 10 (\$):	\$65	24	\$2,122	\$0	\$0	\$0	\$2,122	(\$6,792)
Year 20 (\$):	\$140	25	\$2,292	\$0	\$0	\$0	\$2,292	(\$4,499)
Year 30 (\$):	\$303	26	\$2,476	\$0	\$0	\$0	\$2,476	(\$2,024)
		27	\$2,674	\$0	\$0	\$0	\$2,674	\$650

Internal Rate of Return

Years 1 - 30:	1.4%	28	\$2,888	\$0	\$0	\$0	\$2,888	\$3,538
		29	\$3,119	\$0	\$0	\$0	\$3,119	\$6,656
		30	\$3,368	\$0	\$0	\$0	\$3,368	\$10,024

Cash Purchase Annual and Total Cash Flow



6 Wind Turbine Analysis 1.8 KW System North

The following assumptions were used in preparing this system performance with **HOMER**:

- **1.8 KW Grid-tied** Skystream 3.7 wind turbine system from Southwest Windpower;
- Wind turbine system is installed on a 45 foot tower;
- Average annual wind speed 4.6 m/s or 10.3 MPH;
- Capacity factor 17.4%;
- System install price **\$22,900.00** includes all cost and tax;
- Primary Load **25 KWH/Day** and a daily **7.3 KW** Peak;
- The financial analysis assumes cash purchase;
- Energy escalation rate of **8%**;

6.1 Summary of Results

The following summarizes the results of this analysis. All the detail is provided in the system production report section below.

- Annual power production from system **2,766 KWH**
- First year value of the power produced by the system for consumer **\$233.81**
- **IRR 0.8 % Simple Payback 28 years**

Wind (kW)	Converter (kW)	Grid (kW)	Initial capital	Operating cost (\$/yr)	Total NPC	COE (\$/kWh)	Renewable fraction
		1000000	\$ 0	777	\$ 9,936	0.085	
1.8	1.8	1000000	\$ 22,900	543	\$ 29,847	0.256	.29

6.2 System Production Report

6.2.1 Sensitivity case

Primary Load 1 Scaled Average: 25 kWh/d

6.2.2 System architecture

Wind turbine: 1 SW Skystream 3.7

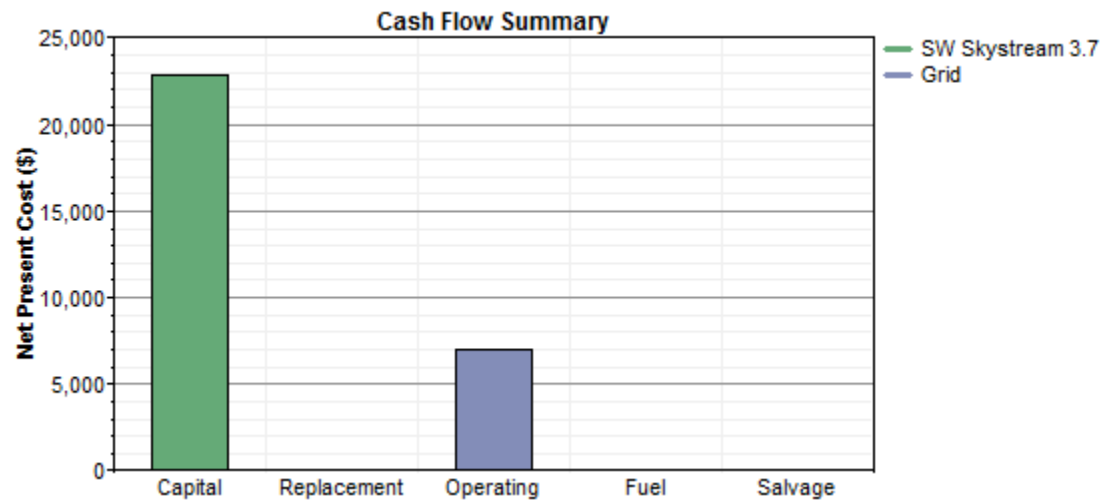
Grid: 1,000,000 kW

6.2.3 Cost summary

Total net present cost: 29,847 \$

Levelized cost of energy: 0.256 \$/kWh

Operating cost: 543 \$

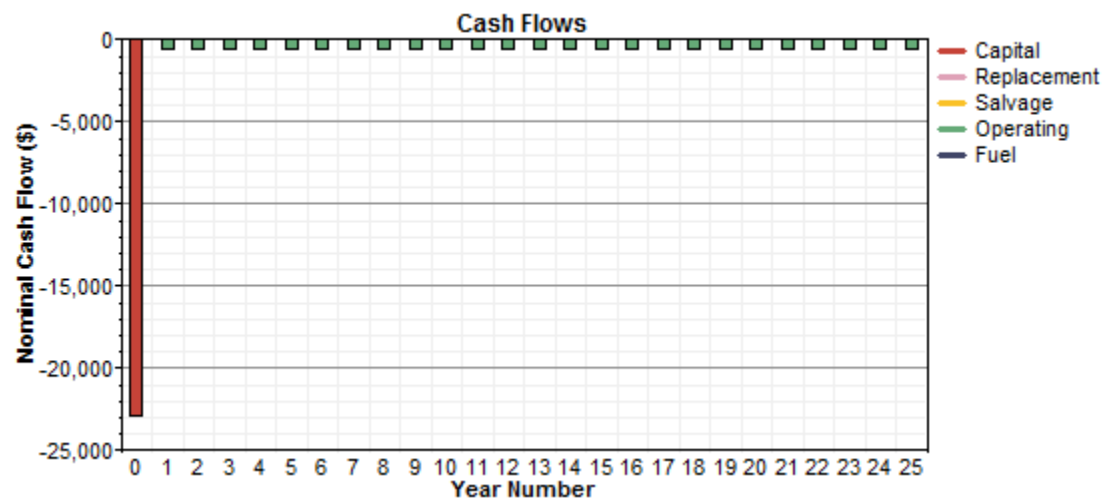


6.2.4 Net Present Costs

Component	Capital	Replacement	O&M	Fuel	Salvage	Total
	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)
SW Skystream 3.7	22,900	0	0	0	0	22,900
Grid	0	0	6,947	0	0	6,947
System	22,900	0	6,947	0	0	29,847

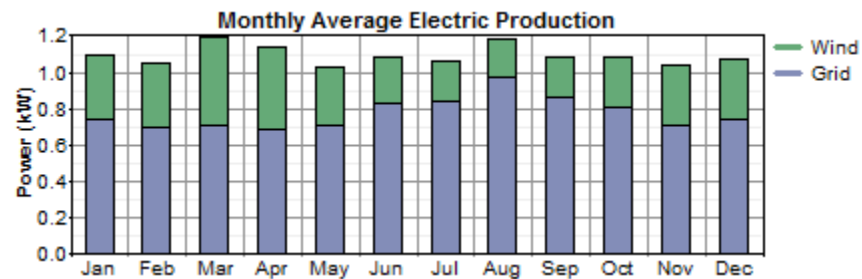
6.2.5 Annualized Costs

Component	Capital	Replacement	O&M	Fuel	Salvage	Total
	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)
SW Skystream 3.7	1,791	0	0	0	0	1,791
Grid	0	0	543	0	0	543
System	1,791	0	543	0	0	2,335



6.2.6 Annual electric energy production

Component	Production	Fraction
	(kWh/yr)	
Wind turbine	2,776	29%
Grid purchases	6,812	71%
Total	9,588	100%



Month	Wind KW	Grid KW
Jan	0.35393	0.9294
Feb	0.35271	0.8748
Mar	0.48615	0.9077
April	0.45970	0.8771
May	0.31204	0.8981
June	0.25629	1.0360
July	0.22096	1.0416
August	0.20432	1.2028
September	0.22106	1.0737

October	0.27412	1.0150
November	0.33311	0.8984
December	0.33211	0.9348

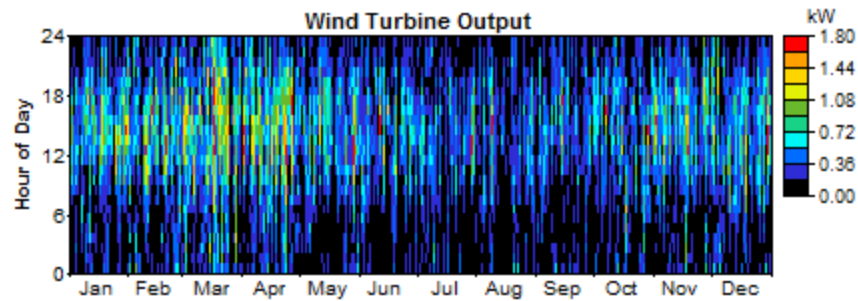
6.2.7 Annual electric energy consumption

Load	Consumption	Fraction
	(kWh/yr)	
AC primary load	9,125	95%
Grid sales	463	5%
Total	9,588	100%

Variable	Value	Units
Renewable fraction:	0.290	
Excess electricity:	0	kWh/yr
Unmet load:	0	kWh/yr
Capacity shortage:	0	kWh/yr

6.2.8 AC Wind Turbine: SW Skystream 3.7

Variable	Value	Units
Total capacity:	1.82	kW
Average output:	0.317	kW
Minimum output:	0.00	kW
Maximum output:	1.77	kW
Wind penetration:	30.4	%
Capacity factor:	17.4	%
Hours of operation:	7,480	hr/yr



Month	Energy Sold	Net Purchases
	(kWh)	(kWh)
Jan	263	\$21.38
Feb	237	\$19.27
Mar	362	\$29.43
Apr	331	\$26.91
May	232	\$20.97
Jun	185	\$16.72
Jul	164	\$14.83
Aug	152	\$13.74
Sep	159	\$14.37
Oct	204	\$16.59
Nov	240	\$19.51
Dec	247	\$20.08
Annual	2,776	\$233.81

6.2.9 Monthly Grid and Wind Power Sold Net Metering

Rate: Non Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	550	51	499	6	41	0
Feb	466	50	417	5	34	0
Mar	529	84	445	6	36	0
Apr	493	65	429	6	35	0
May	0	0	0	0	0	0
Jun	0	0	0	0	0	0
Jul	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sep	0	0	0	0	0	0
Oct	604	26	578	6	47	0
Nov	513	41	472	5	38	0
Dec	552	39	513	6	42	0
Annual	3,708	355	3,352	6	273	0

Rate: Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	0	0	0	0	0	0
Feb	0	0	0	0	0	0
Mar	0	0	0	0	0	0
Apr	0	0	0	0	0	0
May	531	36	495	5	45	0
Jun	599	22	577	7	52	0

Jul	626	19	607	6	55	0
Aug	725	15	710	6	64	0
Sep	624	16	608	6	55	0
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	0	0	0	0	0	0
Annual	3,105	108	2,997	7	271	0

Rate: All

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	550	51	499	6	41	0
Feb	466	50	417	5	34	0
Mar	529	84	445	6	36	0
Apr	493	65	429	6	35	0
May	531	36	495	5	45	0
Jun	599	22	577	7	52	0
Jul	626	19	607	6	55	0
Aug	725	15	710	6	64	0
Sep	624	16	608	6	55	0
Oct	604	26	578	6	47	0
Nov	513	41	472	5	38	0
Dec	552	39	513	6	42	0
Annual	6,812	463	6,349	7	543	0

6.3 Emissions

Pollutant	Emissions (kg/yr)
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Carbon dioxide	4,012
Carbon monoxide	0
Unburned hydrocarbons	0
Particulate matter	0
Sulfur dioxide	17.4
Nitrogen oxides	8.51

6.4 Financial Analysis

Skystream 3.7 1.8 KW North Analysis

Prepared for: **KCPL**
Date: **4/20/2008**

Cash Purchase

Assumptions (Inputs)

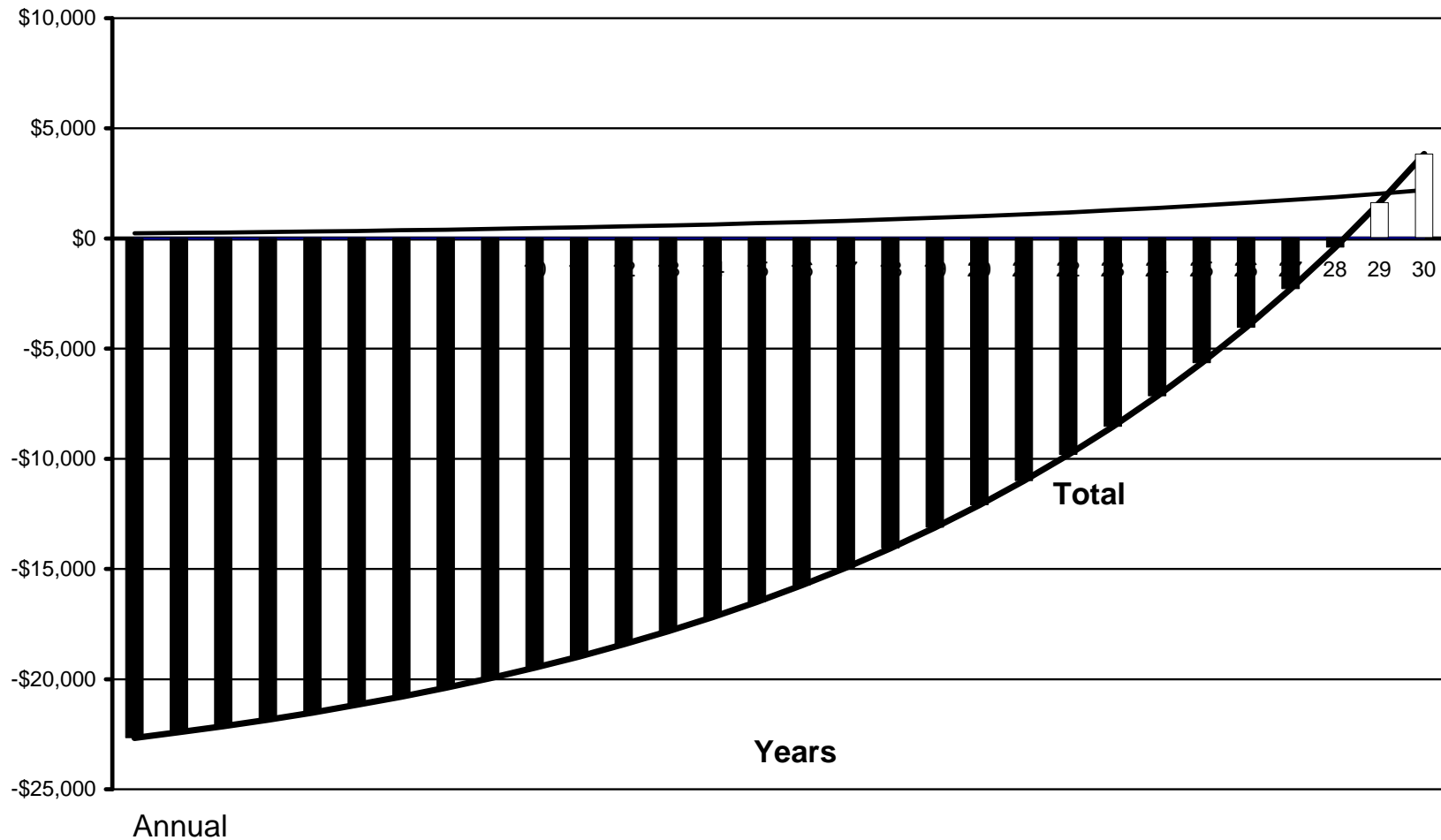
Total Installed Cost (\$):	\$22,900
Allocation to Business (%):	0
Annual Energy Output (kWh):	2,776
Electricity Cost (\$/kWh):	\$0.0850
Electricity Inflation Rate (%):	8
Loan Downpayment (%):	100
Down Payment (\$):	\$22,900
Amount of Loan (\$):	\$0
Interest Rate (%):	0
Loan Term (Years):	10

Annual Cash Flow Model

	Net	O&M	Net	Net Loan	Annual	Total
Year	Energy	Costs	Deprec.	Payments	Cash Flow	Cash Flow
0					(\$22,900)	(\$22,900)
1	\$236	\$0	\$0	\$0	\$236	(\$22,664)
2	\$255	\$0	\$0	\$0	\$255	(\$22,409)
3	\$275	\$0	\$0	\$0	\$275	(\$22,134)
4	\$297	\$0	\$0	\$0	\$297	(\$21,837)
5	\$321	\$0	\$0	\$0	\$321	(\$21,516)

Month Installed:	0	6	\$347	\$0	\$0	\$0	\$347	(\$21,169)
Net Federal Tax Rate (%):	28	7	\$374	\$0	\$0	\$0	\$374	(\$20,795)
Net State Tax Rate (%):	8	8	\$404	\$0	\$0	\$0	\$404	(\$20,390)
O & M Cost (\$/kWh):	\$0.000	9	\$437	\$0	\$0	\$0	\$437	(\$19,953)
O & M Inflation Rate (%):	0	10	\$472	\$0	\$0	\$0	\$472	(\$19,482)
State Rebate (%):	0	11	\$509	\$0	\$0	\$0	\$509	(\$18,972)
State Tax Credit (%):	0	12	\$550	\$0	\$0	\$0	\$550	(\$18,422)
Federal Tax Credit (%):	0	13	\$594	\$0	\$0	\$0	\$594	(\$17,828)
		14	\$642	\$0	\$0	\$0	\$642	(\$17,186)
Results		15	\$693	\$0	\$0	\$0	\$693	(\$16,493)
		16	\$749	\$0	\$0	\$0	\$749	(\$15,745)
Loan Payments		17	\$808	\$0	\$0	\$0	\$808	(\$14,936)
Monthly Payment (\$):	\$0	18	\$873	\$0	\$0	\$0	\$873	(\$14,063)
Value of Interest Deduction (\$):	\$0	19	\$943	\$0	\$0	\$0	\$943	(\$13,120)
Net Monthly Payment (\$):	\$0	20	\$1,018	\$0	\$0	\$0	\$1,018	(\$12,102)
		21	\$1,100	\$0	\$0	\$0	\$1,100	(\$11,002)
Ave. Monthly Savings on Bill		22	\$1,188	\$0	\$0	\$0	\$1,188	(\$9,814)
Year 1 (\$):	\$20	23	\$1,283	\$0	\$0	\$0	\$1,283	(\$8,532)
Year 10 (\$):	\$42	24	\$1,385	\$0	\$0	\$0	\$1,385	(\$7,146)
Year 20 (\$):	\$92	25	\$1,496	\$0	\$0	\$0	\$1,496	(\$5,650)
Year 30 (\$):	\$198	26	\$1,616	\$0	\$0	\$0	\$1,616	(\$4,034)
		27	\$1,745	\$0	\$0	\$0	\$1,745	(\$2,289)
Internal Rate of Return		28	\$1,885	\$0	\$0	\$0	\$1,885	(\$404)
Years 1 - 30:	0.8%	29	\$2,036	\$0	\$0	\$0	\$2,036	\$1,632
		30	\$2,199	\$0	\$0	\$0	\$2,199	\$3,830

Cash Purchase Annual and Total Cash Flow



7 Wind Turbine Analysis 10 KW System North

The following assumptions were used in preparing this system performance with **HOMER**:

- **10 KW Grid-tied** Excel - S wind turbine system from Bergey Windpower;
- Wind turbine system is installed on a 100 foot tower;
- Average annual wind speed 4.6 m/s or 10.3 MPH;
- Capacity factor **8.05 %**;
- System install price **\$63,000.00** includes all cost and tax;
- Primary Load **25 KWH/Day** and a daily **7.3 KW** Peak;
- The financial analysis assumes cash purchase;
- Energy escalation rate of **8%**;

7.1 Summary of Results

The following summarizes the results of this analysis. All the detail is provided in the system production report section below.

- Annual power production from system **8,449 KWH**
- First year value of the power produced by the system for consumer **\$711.04**
- **IRR 1.3 % Simple Payback 27 years**

Wind (kW)	Converter (kW)	Grid (kW)	Initial capital	Operating cost (\$/yr)	Total NPC	COE (\$/kWh)	Renewable fraction
		1000000	\$ 0	777	\$ 9,936	0.085	0.00
10	10	1000000	\$ 63,000	110	\$ 64,412	0.552	0.65

7.2 System Production Report

7.2.1 Sensitivity case

Primary Load 1 Scaled Average: 25 kWh/d

7.2.2 System architecture

Wind turbine: 1 BWC Excel-S

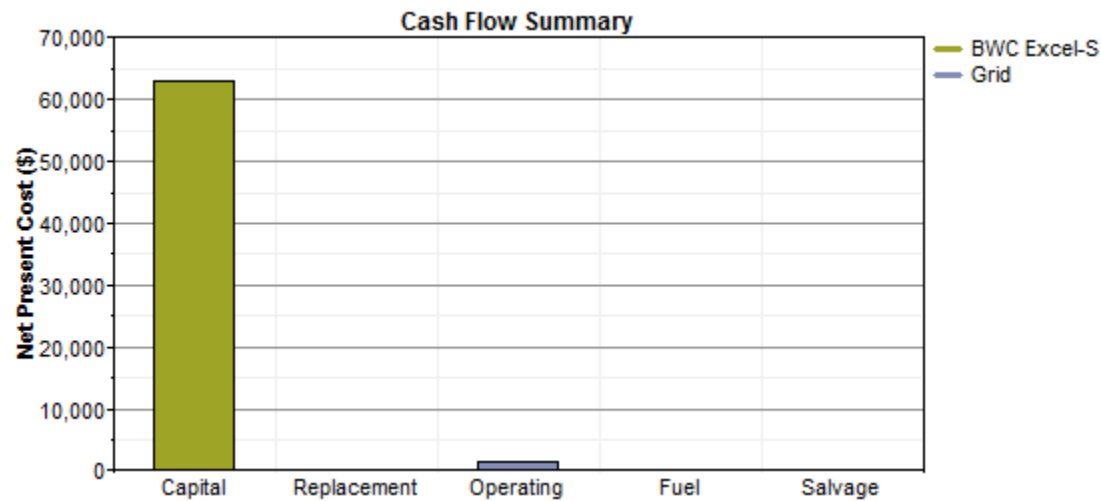
Grid: 1,000,000 kW

7.2.3 Cost summary

Total net present cost: 64,412 \$

Levelized cost of energy: 0.552 \$/kWh

Operating cost: 110 \$

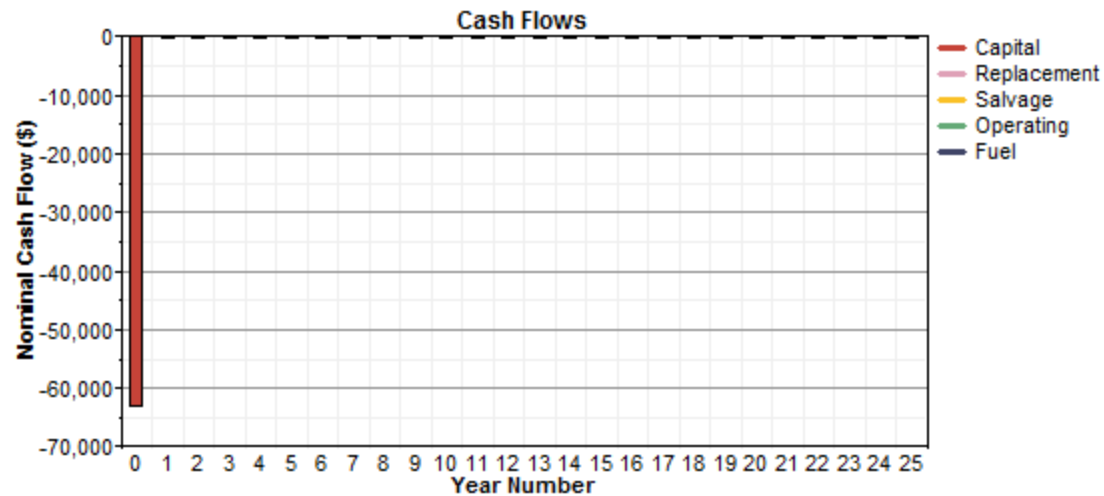


7.2.3.1 Net Present Costs

Component	Capital	Replacement	O&M	Fuel	Salvage	Total
	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)
BWC Excel-S	63,000	0	0	0	0	63,000
Grid	0	0	1,412	0	0	1,412
System	63,000	0	1,412	0	0	64,412

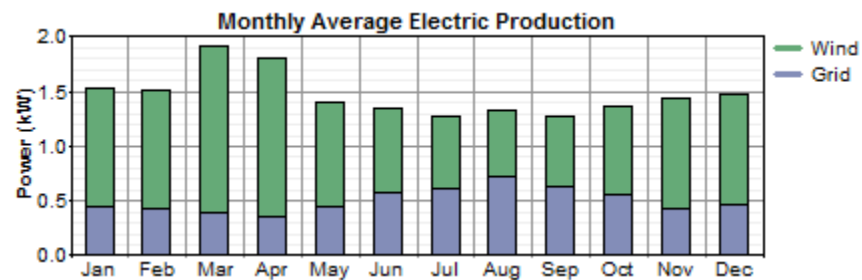
7.2.4 Annualized Costs

Component	Capital	Replacement	O&M	Fuel	Salvage	Total
	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)
BWC Excel-S	4,928	0	0	0	0	4,928
Grid	0	0	110	0	0	110
System	4,928	0	110	0	0	5,039



7.2.5 Annual electric energy production

Component	Production	Fraction
	(kWh/yr)	
Wind turbine	8,461	65%
Grid purchases	4,469	35%
Total	12,930	100%



Month	PV KW	Grid KW
Jan	1.0741	0.45234
Feb	1.0797	0.43872
Mar	1.5280	0.39235
April	1.4544	0.35871
May	0.9476	0.45015
June	0.7644	0.58399
July	0.6537	0.62035
August	0.6034	0.73155
September	0.6548	0.62930

October	0.8207	0.55465
November	1.0128	0.43538
December	1.0091	0.46583

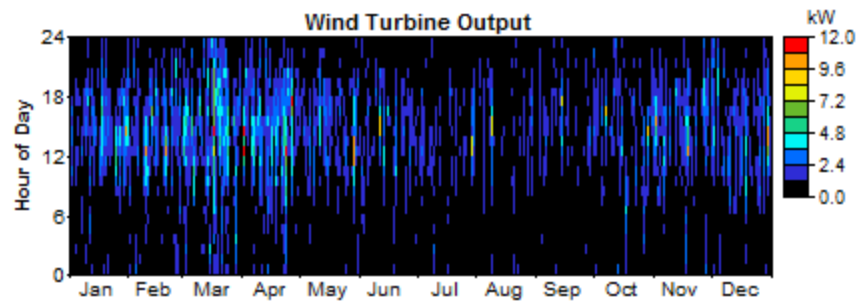
7.2.6 Annual electric energy consumption

Load	Consumption	Fraction
	(kWh/yr)	
AC primary load	9,125	71%
Grid sales	3,802	29%
Total	12,927	100%

Variable	Value	Units
Renewable fraction:	0.654	
Excess electricity:	3	kWh/yr
Unmet load:	0	kWh/yr
Capacity shortage:	0	kWh/yr

7.2.7 AC Wind Turbine: BWC Excel-S

Variable	Value	Units
Total capacity:	12.0	kW
Average output:	0.966	kW
Minimum output:	0.00	kW
Maximum output:	11.6	kW
Wind penetration:	92.7	%
Capacity factor:	8.05	%
Hours of operation:	8,520	hr/yr



Month	Energy Produced	Energy Savings
	(kWh)	(kWh)
Jan	798	\$64.88
Feb	724	\$58.86
Mar	1,135	\$92.28
Apr	1,041	\$84.63
May	705	\$63.73
Jun	550	\$49.72
Jul	486	\$43.93
Aug	449	\$40.59
Sep	471	\$42.58
Oct	611	\$49.67
Nov	728	\$59.19
Dec	750	\$60.98
Annual	8,449	\$711.04

7.2.8 Monthly Grid and Wind Power Sold Net Metering

Rate: Non Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	337	374	-37	6	-1	0
Feb	295	366	-72	5	-1	0
Mar	292	621	-329	6	-7	0
Apr	258	544	-286	5	-6	0
May	0	0	0	0	0	0
Jun	0	0	0	0	0	0
Jul	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sep	0	0	0	0	0	0
Oct	413	241	172	5	14	0
Nov	313	331	-17	5	0	0
Dec	347	338	9	5	1	0
Annual	2,254	2,815	-561	6	0	0

Rate: Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	0	0	0	0	0	0
Feb	0	0	0	0	0	0
Mar	0	0	0	0	0	0
Apr	0	0	0	0	0	0
May	335	313	22	5	2	0
Jun	420	209	211	7	19	0

Jul	462	177	285	6	26	0
Aug	544	131	413	6	37	0
Sep	453	158	295	5	27	0
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	0	0	0	0	0	0
Annual	2,214	987	1,227	7	111	0

Rate: All

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	337	374	-37	6	-1	0
Feb	295	366	-72	5	-1	0
Mar	292	621	-329	6	-7	0
Apr	258	544	-286	5	-6	0
May	335	313	22	5	2	0
Jun	420	209	211	7	19	0
Jul	462	177	285	6	26	0
Aug	544	131	413	6	37	0
Sep	453	158	295	5	27	0
Oct	413	241	172	5	14	0
Nov	313	331	-17	5	0	0
Dec	347	338	9	5	1	0
Annual	4,469	3,802	666	7	110	0

7.2.9 Emissions

Pollutant	Emissions (kg/yr)
Carbon dioxide	421

Carbon monoxide	0
Unburned hydrocarbons	0
Particulate matter	0
Sulfur dioxide	1.83
Nitrogen oxides	0.893

7.3 Financial Analysis

Bergey 10 KW North Analysis

Prepared for: **KCPL**
Date: **4/20/2008**

Cash Purchase

Assumptions (Inputs)

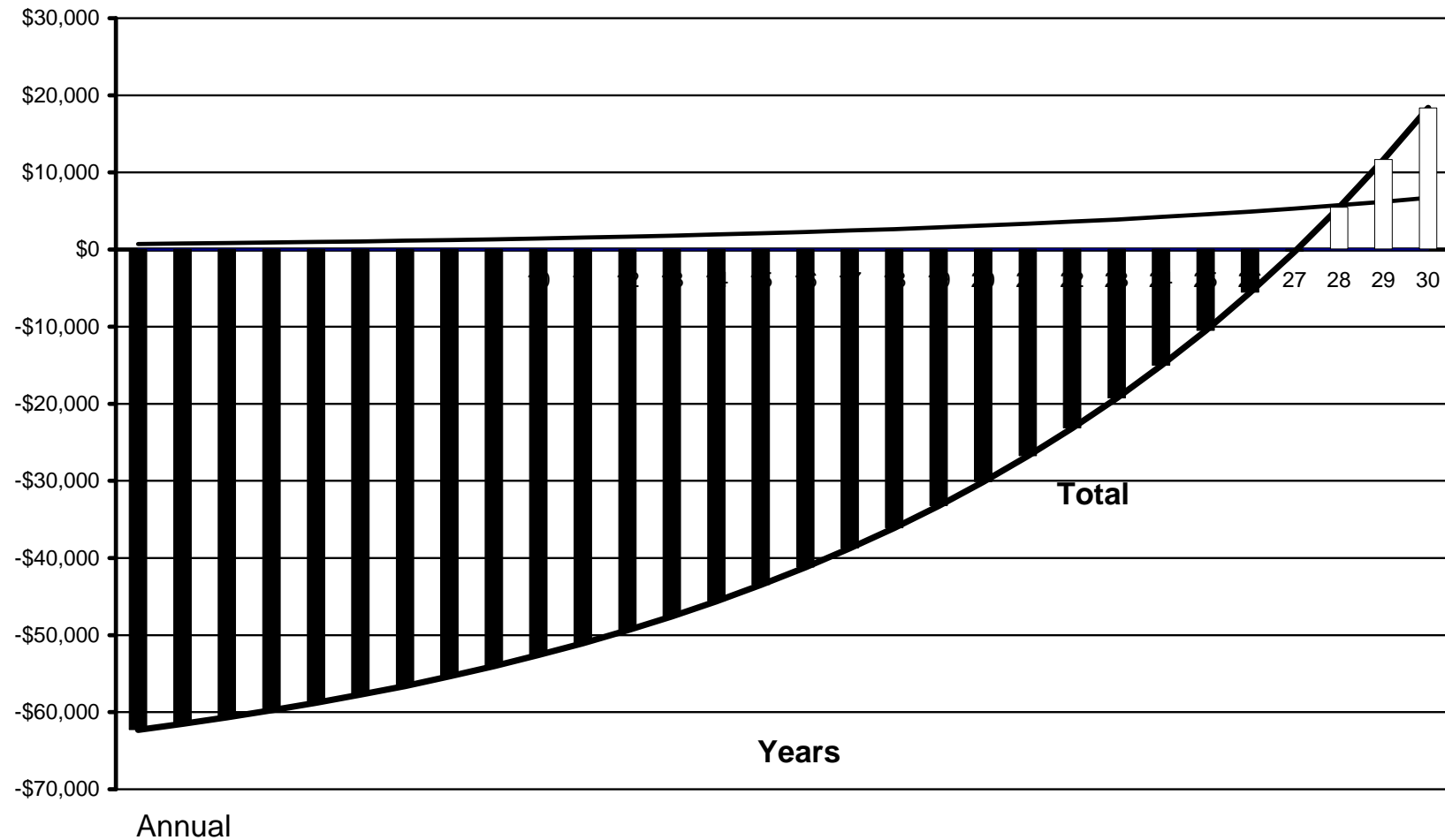
Total Installed Cost (\$):	\$63,000
Allocation to Business (%):	0
Annual Energy Output (kWh):	8,449
Electricity Cost (\$/kWh):	\$0.0850
Electricity Inflation Rate (%):	8
Loan Downpayment (%):	100
Down Payment (\$):	\$63,000
Amount of Loan (\$):	\$0
Interest Rate (%):	0
Loan Term (Years):	10
Month Installed:	0
Net Federal Tax Rate (%):	28

Annual Cash Flow Model

	Net Energy	O&M Costs	Net Deprec.	Net Loan Payments	Annual Cash Flow	Total Cash Flow
Year						
0					(\$63,000)	(\$63,000)
1	\$718	\$0	\$0	\$0	\$718	(\$62,282)
2	\$776	\$0	\$0	\$0	\$776	(\$61,506)
3	\$838	\$0	\$0	\$0	\$838	(\$60,669)
4	\$905	\$0	\$0	\$0	\$905	(\$59,764)
5	\$977	\$0	\$0	\$0	\$977	(\$58,787)
6	\$1,055	\$0	\$0	\$0	\$1,055	(\$57,732)
7	\$1,140	\$0	\$0	\$0	\$1,140	(\$56,592)

Net State Tax Rate (%):	8	8	\$1,231	\$0	\$0	\$0	\$1,231	(\$55,361)
O & M Cost (\$/kWh):	\$0.000	9	\$1,329	\$0	\$0	\$0	\$1,329	(\$54,032)
O & M Inflation Rate (%):	0	10	\$1,436	\$0	\$0	\$0	\$1,436	(\$52,596)
State Rebate (%):	0	11	\$1,550	\$0	\$0	\$0	\$1,550	(\$51,046)
State Tax Credit (%):	0	12	\$1,675	\$0	\$0	\$0	\$1,675	(\$49,371)
Federal Tax Credit (%):	0	13	\$1,808	\$0	\$0	\$0	\$1,808	(\$47,563)
		14	\$1,953	\$0	\$0	\$0	\$1,953	(\$45,610)
Results		15	\$2,109	\$0	\$0	\$0	\$2,109	(\$43,500)
		16	\$2,278	\$0	\$0	\$0	\$2,278	(\$41,222)
Loan Payments		17	\$2,460	\$0	\$0	\$0	\$2,460	(\$38,762)
Monthly Payment (\$):	\$0	18	\$2,657	\$0	\$0	\$0	\$2,657	(\$36,105)
Value of Interest Deduction (\$):	\$0	19	\$2,870	\$0	\$0	\$0	\$2,870	(\$33,235)
Net Monthly Payment (\$):	\$0	20	\$3,099	\$0	\$0	\$0	\$3,099	(\$30,135)
		21	\$3,347	\$0	\$0	\$0	\$3,347	(\$26,788)
Ave. Monthly Savings on Bill		22	\$3,615	\$0	\$0	\$0	\$3,615	(\$23,173)
Year 1 (\$):	\$60	23	\$3,904	\$0	\$0	\$0	\$3,904	(\$19,269)
Year 10 (\$):	\$129	24	\$4,217	\$0	\$0	\$0	\$4,217	(\$15,052)
Year 20 (\$):	\$279	25	\$4,554	\$0	\$0	\$0	\$4,554	(\$10,498)
Year 30 (\$):	\$602	26	\$4,918	\$0	\$0	\$0	\$4,918	(\$5,580)
		27	\$5,312	\$0	\$0	\$0	\$5,312	(\$268)
Internal Rate of Return		28	\$5,737	\$0	\$0	\$0	\$5,737	\$5,469
Years 1 - 30:	1.3%	29	\$6,196	\$0	\$0	\$0	\$6,196	\$11,665
		30	\$6,691	\$0	\$0	\$0	\$6,691	\$18,356

Cash Purchase Annual and Total Cash Flow



8 Wind Turbine Analysis 1.8 KW System Southwest

The following assumptions were used in preparing this system performance with **HOMER**:

- **1.8 KW Grid-tied** Skystream 3.7 wind turbine system from Southwest Windpower;
- Wind turbine system is installed on a 45 foot tower;
- Average annual wind speed 4.4 m/s or 9.8 MPH;
- Capacity factor 15.3%;
- System install price **\$22,900.00** includes all cost and tax;
- Primary Load **25 KWH/Day** and a daily **7.3 KW** Peak;
- The financial analysis assumes cash purchase;
- Energy escalation rate of **8%**;

8.1 Summary of Results

The following summarizes the results of this analysis. All the detail is provided in the system production report section below.

- Annual power production from system **2,437 KWH**
- First year value of the power produced by the system for consumer **\$211.08**
- **IRR 0.2 % Simple Payback 29 years**

Wind (kW)	Converter (kW)	Grid (kW)	Initial capital	Operating cost (\$/yr)	Total NPC	COE (\$/kWh)	Renewable fraction
		1000000	\$ 0	796	\$ 10,177	0.087	0.00
1.8	1.8	1000000	\$ 22,900	584	\$ 30,365	0.260	0.26

8.2 System Production Report

8.2.1 Sensitivity case

Primary Load 1 Scaled Average: 25 kWh/d

8.2.2 System architecture

Wind turbine: 1 SW Skystream 3.7

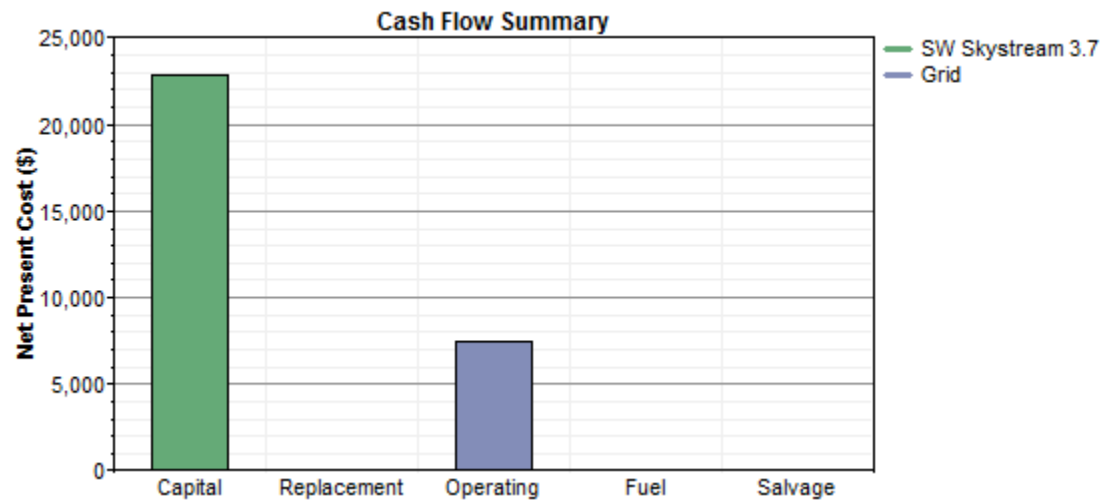
Grid: 1,000,000 kW

8.2.3 Cost summary

Total net present cost: 30,365 \$

Levelized cost of energy: 0.260 \$/kWh

Operating cost: 584 \$

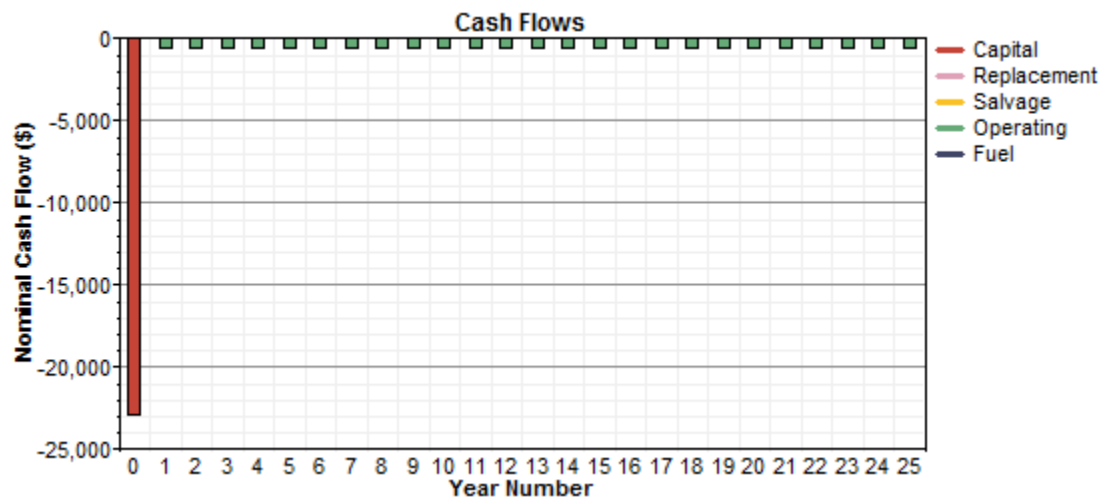


8.2.3.1 Net Present Costs

Component	Capital	Replacement	O&M	Fuel	Salvage	Total
	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)
SW Skystream 3.7	22,900	0	0	0	0	22,900
Grid	0	0	7,465	0	0	7,465
System	22,900	0	7,465	0	0	30,365

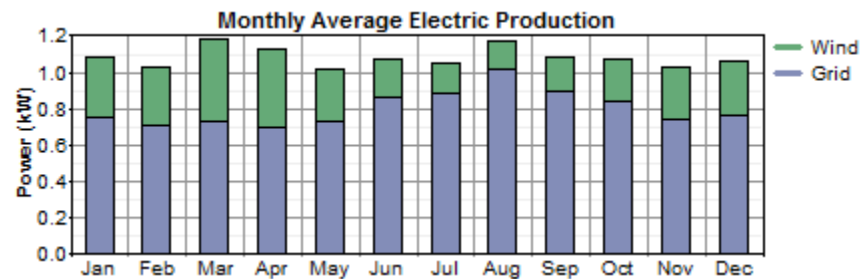
8.2.3.2 Annualized Costs

Component	Capital	Replacement	O&M	Fuel	Salvage	Total
	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)
SW Skystream 3.7	1,791	0	0	0	0	1,791
Grid	0	0	584	0	0	584
System	1,791	0	584	0	0	2,375



8.2.4 Annual electric energy production

Component	Production	Fraction
	(kWh/yr)	
Wind turbine	2,437	26%
Grid purchases	7,048	74%
Total	9,485	100%



Month	Wind KW	Grid KW
Jan	0.32414	0.7562
Feb	0.32292	0.7112
Mar	0.45170	0.7289
April	0.42643	0.7044
May	0.28420	0.7319
June	0.21420	0.8639
July	0.16647	0.8831
August	0.15153	1.0192
September	0.18194	0.8970

October	0.23040	0.8448
November	0.28518	0.7441
December	0.30321	0.7607

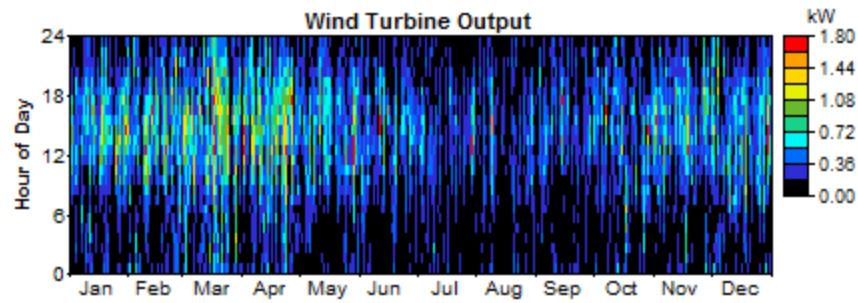
8.2.5 Annual electric energy consumption

Load	Consumption	Fraction
	(kWh/yr)	
AC primary load	9,125	96%
Grid sales	360	4%
Total	9,485	100%

Variable	Value	Units
Renewable fraction:	0.257	
Excess electricity:	0	kWh/yr
Unmet load:	0	kWh/yr
Capacity shortage:	0	kWh/yr

8.2.6 AC Wind Turbine: SW Skystream 3.7

Variable	Value	Units
Total capacity:	1.82	kW
Average output:	0.278	kW
Minimum output:	0.00	kW
Maximum output:	1.77	kW
Wind penetration:	26.7	%
Capacity factor:	15.3	%
Hours of operation:	7,298	hr/yr



Month	Energy Sold	Net Purchases
	(kWh)	(kWh)
Jan	241	\$20.87
Feb	217	\$18.79
Mar	336	\$29.10
Apr	307	\$26.59
May	211	\$18.59
Jun	154	\$13.57
Jul	124	\$10.93
Aug	113	\$9.96
Sep	131	\$11.54
Oct	171	\$14.81
Nov	205	\$17.76
Dec	226	\$19.57
Annual	2,437	\$212.08

8.2.7 Monthly Grid and Wind Power Sold Net Metering

Rate: Non Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	563	42	521	6	45	0
Feb	478	41	437	5	38	0
Mar	542	71	471	6	41	0
Apr	507	55	453	6	39	0
May	0	0	0	0	0	0
Jun	0	0	0	0	0	0
Jul	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sep	0	0	0	0	0	0
Oct	629	18	611	6	53	0
Nov	536	29	507	5	44	0
Dec	566	32	534	6	46	0
Annual	3,820	288	3,532	6	306	0

Rate: Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	0	0	0	0	0	0
Feb	0	0	0	0	0	0
Mar	0	0	0	0	0	0
Apr	0	0	0	0	0	0
May	545	29	515	5	45	0
Jun	622	14	608	7	54	0

Jul	657	10	647	6	57	0
Aug	758	9	750	6	66	0
Sep	646	10	636	6	56	0
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	0	0	0	0	0	0
Annual	3,228	72	3,156	7	278	0

Rate: All

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	563	42	521	6	45	0
Feb	478	41	437	5	38	0
Mar	542	71	471	6	41	0
Apr	507	55	453	6	39	0
May	545	29	515	5	45	0
Jun	622	14	608	7	54	0
Jul	657	10	647	6	57	0
Aug	758	9	750	6	66	0
Sep	646	10	636	6	56	0
Oct	629	18	611	6	53	0
Nov	536	29	507	5	44	0
Dec	566	32	534	6	46	0
Annual	7,048	360	6,688	7	584	0

8.2.8 Emissions

Pollutant	Emissions (kg/yr)
Carbon dioxide	4,227

Carbon monoxide	0
Unburned hydrocarbons	0
Particulate matter	0
Sulfur dioxide	18.3
Nitrogen oxides	8.96

8.3 Financial Analysis

Skystream 3.7 1.8 KW South Analysis

Prepared for: **KCPL**
Date: **4/20/2008**

Cash Purchase

Assumptions (Inputs)		Annual Cash Flow Model					
Total Installed Cost (\$):	\$22,900						
Allocation to Business (%):	0						
Annual Energy Output (kWh):	2,437	Year	Net Energy	O&M Costs	Net Deprec.	Net Loan Payments	Annual Cash Flow
Electricity Cost (\$/kWh):	\$0.0870	0					(\$22,900)
Electricity Inflation Rate (%):	8						
Loan Downpayment (%):	100	1	\$212	\$0	\$0	\$0	\$212 (\$22,688)
Down Payment (\$):	\$22,900	2	\$229	\$0	\$0	\$0	\$229 (\$22,459)
Amount of Loan (\$):	\$0	3	\$247	\$0	\$0	\$0	\$247 (\$22,212)
Interest Rate (%):	0	4	\$267	\$0	\$0	\$0	\$267 (\$21,945)
Loan Term (Years):	10	5	\$288	\$0	\$0	\$0	\$288 (\$21,656)

Month Installed:	0	6	\$312	\$0	\$0	\$0	\$312	(\$21,345)
Net Federal Tax Rate (%):	28	7	\$336	\$0	\$0	\$0	\$336	(\$21,008)
Net State Tax Rate (%):	8	8	\$363	\$0	\$0	\$0	\$363	(\$20,645)
O & M Cost (\$/kWh):	\$0.000	9	\$392	\$0	\$0	\$0	\$392	(\$20,252)
O & M Inflation Rate (%):	0	10	\$424	\$0	\$0	\$0	\$424	(\$19,829)
State Rebate (%):	0	11	\$458	\$0	\$0	\$0	\$458	(\$19,371)
State Tax Credit (%):	0	12	\$494	\$0	\$0	\$0	\$494	(\$18,876)
Federal Tax Credit (%):	0	13	\$534	\$0	\$0	\$0	\$534	(\$18,343)
		14	\$577	\$0	\$0	\$0	\$577	(\$17,766)
Results		15	\$623	\$0	\$0	\$0	\$623	(\$17,143)
		16	\$673	\$0	\$0	\$0	\$673	(\$16,471)
Loan Payments		17	\$726	\$0	\$0	\$0	\$726	(\$15,744)
Monthly Payment (\$):	\$0	18	\$784	\$0	\$0	\$0	\$784	(\$14,960)
Value of Interest Deduction (\$):	\$0	19	\$847	\$0	\$0	\$0	\$847	(\$14,113)
Net Monthly Payment (\$):	\$0	20	\$915	\$0	\$0	\$0	\$915	(\$13,198)
		21	\$988	\$0	\$0	\$0	\$988	(\$12,209)
Ave. Monthly Savings on Bill		22	\$1,067	\$0	\$0	\$0	\$1,067	(\$11,142)
Year 1 (\$):	\$18	23	\$1,153	\$0	\$0	\$0	\$1,153	(\$9,989)
Year 10 (\$):	\$38	24	\$1,245	\$0	\$0	\$0	\$1,245	(\$8,745)
Year 20 (\$):	\$82	25	\$1,344	\$0	\$0	\$0	\$1,344	(\$7,400)
Year 30 (\$):	\$178	26	\$1,452	\$0	\$0	\$0	\$1,452	(\$5,948)
		27	\$1,568	\$0	\$0	\$0	\$1,568	(\$4,380)
Internal Rate of Return		28	\$1,694	\$0	\$0	\$0	\$1,694	(\$2,686)
Years 1 - 30:	0.2%	29	\$1,829	\$0	\$0	\$0	\$1,829	(\$857)
		30	\$1,975	\$0	\$0	\$0	\$1,975	\$1,118

9 Wind Turbine Analysis 10 KW System North

The following assumptions were used in preparing this system performance with **HOMER**:

- **10 KW Grid-tied** Excel - S wind turbine system from Bergey Windpower;
- Wind turbine system is installed on a 100 foot tower;
- Average annual wind speed 4.4 m/s or 9.8 MPH;
- Capacity factor **6.52 %**;
- System install price **\$63,000.00** includes all cost and tax;
- Primary Load **25 KWH/Day** and a daily **7.3 KW** Peak;
- The financial analysis assumes cash purchase;
- Energy escalation rate of **8%**;

9.1 Summary of Results

The following summarizes the results of this analysis. All the detail is provided in the system production report section below.

- Annual power production from system **6,852 KWH**
- First year value of the power produced by the system for consumer **\$599.57**
- **IRR .3 % Simple Payback 29 years**

Wind (kW)	Converter (kW)	Grid (kW)	Initial capital	Operating cost (\$/yr)	Total NPC	COE (\$/kWh)	Renewable fraction
		1000000	\$ 0	777	\$ 9,936	0.085	0.00
10	10	1000000	\$ 63,000	110	\$ 64,412	0.552	0.65

9.2 System Production Report

Primary Load 1 Scaled Average: 25 kWh/d

9.2.1 System architecture

Wind turbine: 1 BWC Excel-S

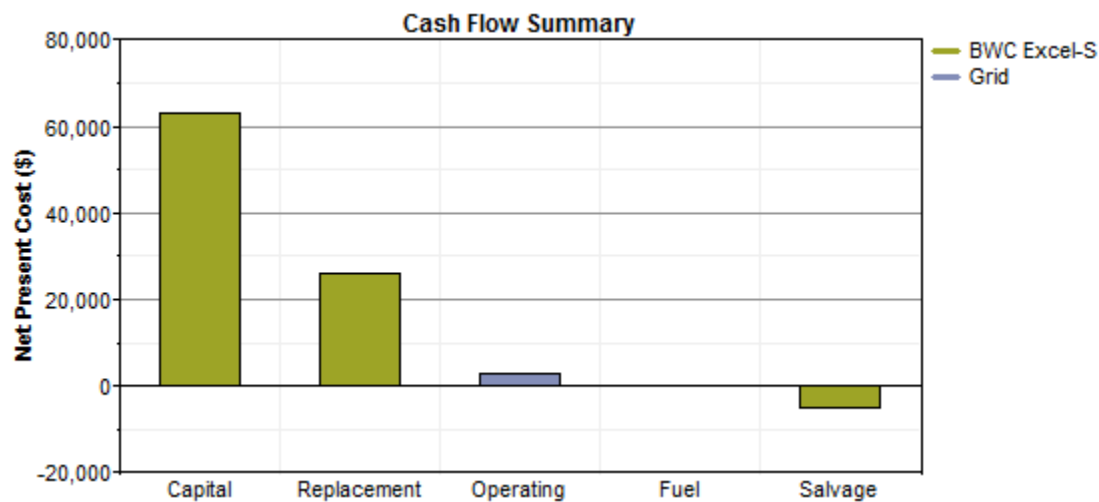
Grid: 1,000,000 kW

9.2.2 Cost summary

Total net present cost: 87,203 \$

Levelized cost of energy: 0.748 \$/kWh

Operating cost: 1,893 \$



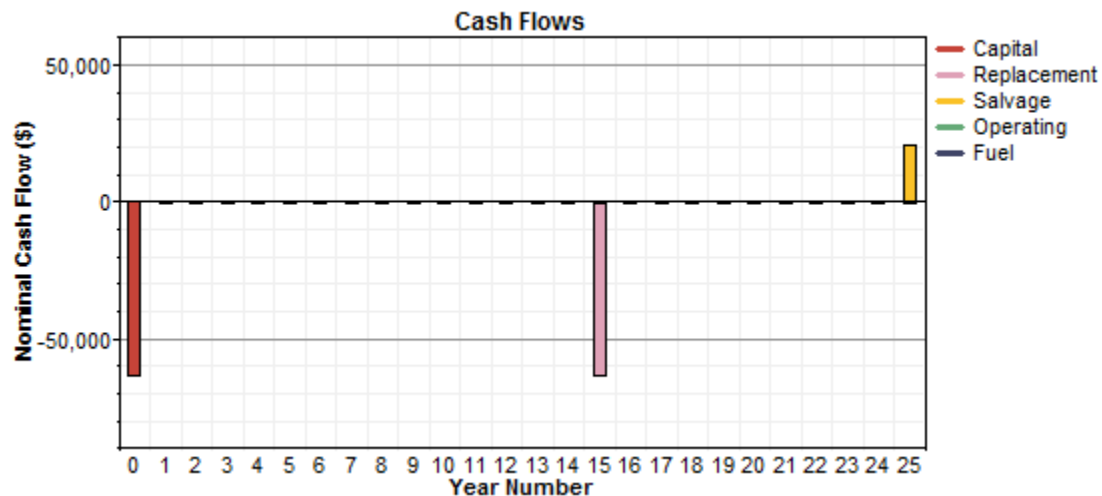
9.2.3 Net Present Costs

Component	Capital	Replacement	O&M	Fuel	Salvage	Total
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	(\$)	(\$)	(\$)	(\$)	(\$)	(\$)
BWC Excel-S	63,000	26,288	0	0	-4,893	84,395
Grid	0	0	2,808	0	0	2,808
System	63,000	26,288	2,808	0	-4,893	87,203

9.2.4 Annualized Costs

Component	Capital	Replacement	O&M	Fuel	Salvage	Total
	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)	(\$/yr)
BWC Excel-S	4,928	2,056	0	0	-383	6,602
Grid	0	0	220	0	0	220
System	4,928	2,056	220	0	-383	6,822

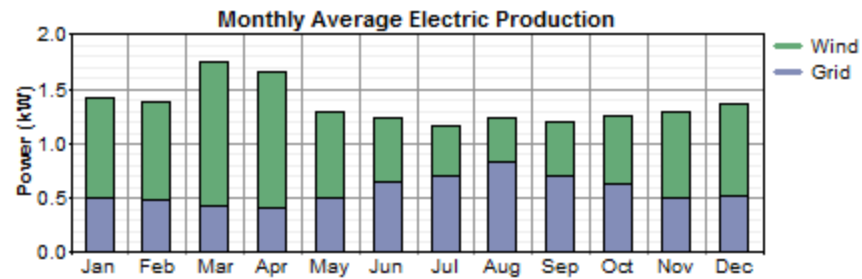


9.2.5 Annual electric energy production

Component	Production	Fraction
	(kWh/yr)	

Renewable Energy System Performance Analysis Report

Wind turbine	6,858	58%
Grid purchases	5,020	42%
Total	11,879	100%



Month	Wind KW	Grid KW
Jan	0.9074	0.50581
Feb	0.9121	0.48186
Mar	1.3118	0.43662
April	1.2498	0.40761
May	0.7952	0.49693
June	0.5869	0.65525
July	0.4546	0.70840
August	0.4145	0.83239
September	0.4970	0.70021
October	0.6331	0.62426
November	0.7946	0.50431

December	0.8501	0.51401
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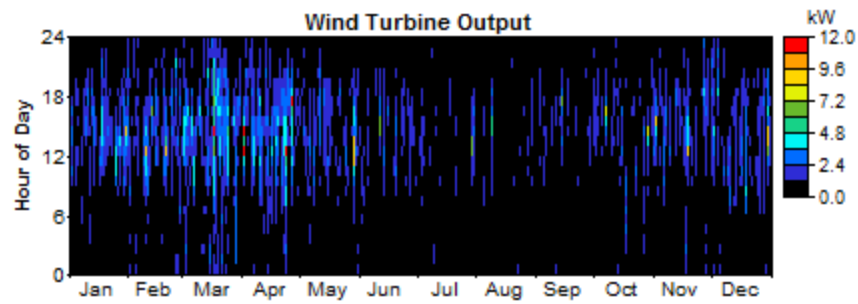
9.2.6 Annual electric energy consumption

Load	Consumption	Fraction
	(kWh/yr)	
AC primary load	9,125	77%
Grid sales	2,752	23%
Total	11,877	100%

Variable	Value	Units
Renewable fraction:	0.577	
Excess electricity:	1	kWh/yr
Unmet load:	0	kWh/yr
Capacity shortage:	0	kWh/yr

9.2.7 AC Wind Turbine: BWC Excel-S

Variable	Value	Units
Total capacity:	12.0	kW
Average output:	0.783	kW
Minimum output:	0.00	kW
Maximum output:	11.3	kW
Wind penetration:	75.2	%
Capacity factor:	6.52	%
Hours of operation:	8,470	hr/yr



Month	Energy Produced	Energy Savings
	(kWh)	(kWh)
Jan	675	\$58.46
Feb	613	\$53.09
Mar	975	\$84.44
Apr	895	\$77.52
May	592	\$52.16
Jun	423	\$37.27
Jul	338	\$29.78
Aug	308	\$27.14
Sep	358	\$31.54
Oct	471	\$40.79
Nov	572	\$49.54
Dec	633	\$54.82
Annual	6,852	\$596.57

9.2.8 Monthly Grid and Wind Power Sold Net Metering

Rate: Non Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	376	290	87	6	8	0
Feb	324	283	41	5	4	0
Mar	325	493	-168	6	-3	0
Apr	293	433	-140	5	-3	0
May	0	0	0	0	0	0
Jun	0	0	0	0	0	0
Jul	0	0	0	0	0	0
Aug	0	0	0	0	0	0
Sep	0	0	0	0	0	0
Oct	464	153	311	5	27	0
Nov	363	223	140	5	12	0
Dec	382	255	127	5	11	0
Annual	2,528	2,131	398	6	55	0

Rate: Summer Rate

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	0	0	0	0	0	0
Feb	0	0	0	0	0	0
Mar	0	0	0	0	0	0
Apr	0	0	0	0	0	0
May	370	235	135	5	12	0
Jun	472	133	339	7	30	0

Jul	527	94	433	6	38	0
Aug	619	65	554	6	49	0
Sep	504	95	409	6	36	0
Oct	0	0	0	0	0	0
Nov	0	0	0	0	0	0
Dec	0	0	0	0	0	0
Annual	2,492	622	1,870	7	165	0

Rate: All

Month	Energy Purchased	Energy Sold	Net Purchases	Peak Demand	Energy Charge	Demand Charge
	(kWh)	(kWh)	(kWh)	(kW)	(\$)	(\$)
Jan	376	290	87	6	8	0
Feb	324	283	41	5	4	0
Mar	325	493	-168	6	-3	0
Apr	293	433	-140	5	-3	0
May	370	235	135	5	12	0
Jun	472	133	339	7	30	0
Jul	527	94	433	6	38	0
Aug	619	65	554	6	49	0
Sep	504	95	409	6	36	0
Oct	464	153	311	5	27	0
Nov	363	223	140	5	12	0
Dec	382	255	127	5	11	0
Annual	5,020	2,752	2,268	7	220	0

9.2.9 Emissions

Pollutant	Emissions (kg/yr)
Carbon dioxide	1,433

Carbon monoxide	0
Unburned hydrocarbons	0
Particulate matter	0
Sulfur dioxide	6.21
Nitrogen oxides	3.04

9.3 Financial Analysis

Bergey 10 KW South Analysis

Prepared for: **KCPL**
Date: **4/20/2008**

Cash Purchase

Assumptions (Inputs)

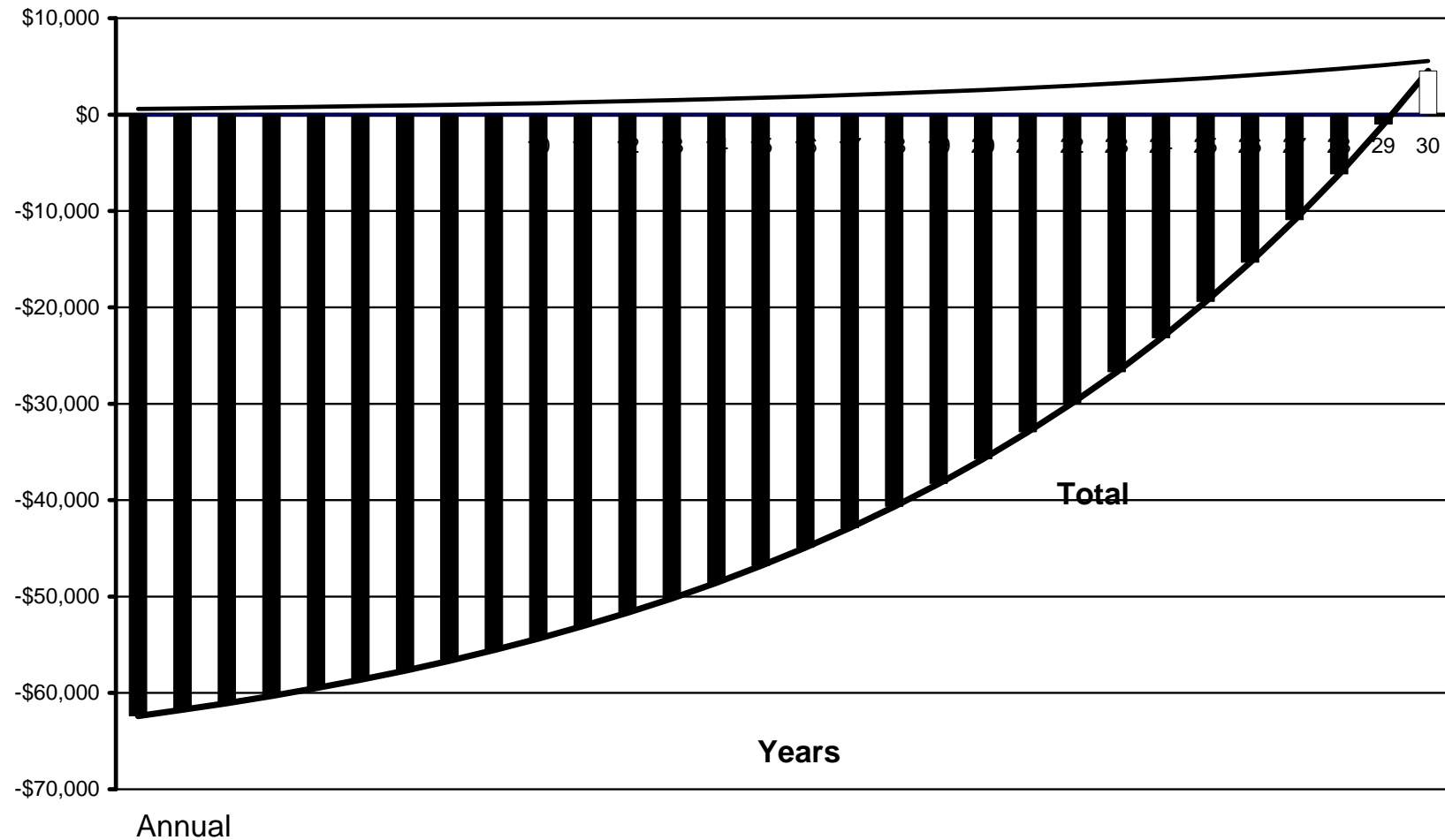
Total Installed Cost (\$):	\$63,000
Allocation to Business (%):	0
Annual Energy Output (kWh):	6,852
Electricity Cost (\$/kWh):	\$0.0870
Electricity Inflation Rate (%):	8
Loan Downpayment (%):	100
Down Payment (\$):	\$63,000
Amount of Loan (\$):	\$0
Interest Rate (%):	0
Loan Term (Years):	10

Annual Cash Flow Model

	Net Energy	O&M Costs	Net Deprec.	Net Loan Payments	Annual Cash Flow	Total Cash Flow
Year						
0					(\$63,000)	(\$63,000)
1	\$596	\$0	\$0	\$0	\$596	(\$62,404)
2	\$644	\$0	\$0	\$0	\$644	(\$61,760)
3	\$695	\$0	\$0	\$0	\$695	(\$61,065)
4	\$751	\$0	\$0	\$0	\$751	(\$60,314)
5	\$811	\$0	\$0	\$0	\$811	(\$59,503)

Month Installed:	0	6	\$876	\$0	\$0	\$0	\$876	(\$58,627)
Net Federal Tax Rate (%):	28	7	\$946	\$0	\$0	\$0	\$946	(\$57,681)
Net State Tax Rate (%):	8	8	\$1,022	\$0	\$0	\$0	\$1,022	(\$56,659)
O & M Cost (\$/kWh):	\$0.000	9	\$1,103	\$0	\$0	\$0	\$1,103	(\$55,556)
O & M Inflation Rate (%):	0	10	\$1,192	\$0	\$0	\$0	\$1,192	(\$54,364)
State Rebate (%):	0	11	\$1,287	\$0	\$0	\$0	\$1,287	(\$53,077)
State Tax Credit (%):	0	12	\$1,390	\$0	\$0	\$0	\$1,390	(\$51,687)
Federal Tax Credit (%):	0	13	\$1,501	\$0	\$0	\$0	\$1,501	(\$50,186)
		14	\$1,621	\$0	\$0	\$0	\$1,621	(\$48,565)
Results		15	\$1,751	\$0	\$0	\$0	\$1,751	(\$46,814)
		16	\$1,891	\$0	\$0	\$0	\$1,891	(\$44,923)
Loan Payments		17	\$2,042	\$0	\$0	\$0	\$2,042	(\$42,881)
Monthly Payment (\$):	\$0	18	\$2,206	\$0	\$0	\$0	\$2,206	(\$40,675)
Value of Interest Deduction (\$):	\$0	19	\$2,382	\$0	\$0	\$0	\$2,382	(\$38,293)
Net Monthly Payment (\$):	\$0	20	\$2,573	\$0	\$0	\$0	\$2,573	(\$35,720)
		21	\$2,779	\$0	\$0	\$0	\$2,779	(\$32,942)
Ave. Monthly Savings on Bill		22	\$3,001	\$0	\$0	\$0	\$3,001	(\$29,941)
Year 1 (\$):	\$50	23	\$3,241	\$0	\$0	\$0	\$3,241	(\$26,700)
Year 10 (\$):	\$107	24	\$3,500	\$0	\$0	\$0	\$3,500	(\$23,200)
Year 20 (\$):	\$232	25	\$3,780	\$0	\$0	\$0	\$3,780	(\$19,420)
Year 30 (\$):	\$500	26	\$4,083	\$0	\$0	\$0	\$4,083	(\$15,337)
		27	\$4,409	\$0	\$0	\$0	\$4,409	(\$10,928)
Internal Rate of Return		28	\$4,762	\$0	\$0	\$0	\$4,762	(\$6,166)
Years 1 - 30:	0.3%	29	\$5,143	\$0	\$0	\$0	\$5,143	(\$1,023)
		30	\$5,554	\$0	\$0	\$0	\$5,554	\$4,531

Cash Purchase Annual and Total Cash Flow



10 Solar Hot Water System Analysis Kansas City Northeast

The following assumptions were used in preparing this system performance with RETScreen:

- System comprised of 2 Heliodyne Gobi 410s Solar Hot Water Collectors, 80 Gallon Hot Water Tank;
- System install price **\$9,500.00** includes all cost and tax;
- The financial analysis assumes cash purchase;
- Energy escalation rate of **8%**;
- The federal Solar PV Tax Credit of **\$2,000** is treated as an incentive.


10.1 Summary of Results

The following summarizes the results of this analysis. All the detail is provided in the system production report section below.

- Annual power production from system **4,393 KWH**
- First year value of the power produced by the system for consumer **\$373.00**
- **IRR and ROI 8% and 11.8 Years to positive cash flow**

RETScreen® Energy Model - Solar Water Heating Project

[Training & Support](#)

Site Conditions		Estimate	Notes/Range
Project name		Residential North East	See Online Manual
Project location		Kansas City, MO	
Nearest location for weather data		Kansas City, MO	 Complete SR&HL sheet
Annual solar radiation (tilted surface)	MWh/m²	1.75	
Annual average temperature	°C	12.6	-20.0 to 30.0
Annual average wind speed	m/s	4.6	

Desired load temperature	°C	60
Hot water use	L/d	302
Number of months analysed	month	12.00
Energy demand for months analysed	MWh	6.10

System Characteristics		Estimate	Notes/Range
Application type		Service hot water (with storage)	
Base Case Water Heating System			
Heating fuel type	-	Electricity	50% to 190%
Water heating system seasonal efficiency	%	190%	
Solar Collector			
Collector type	-	Glazed	See Technical Note 1 See Product Database
Solar water heating collector manufacturer		Heliodyne	
Solar water heating collector model		Heliodyne Gobi 410	
Gross area of one collector	m²	3.74	1.00 to 5.00
Aperture area of one collector	m²	3.56	1.00 to 5.00
Fr (tau alpha) coefficient	-	0.74	0.50 to 0.90
Fr UL coefficient	(W/m²)/°C	4.57	1.50 to 8.00
Temperature coefficient for Fr UL	(W/(m·°C)²)	0.00	0.000 to 0.010
Suggested number of collectors		2	
Number of collectors		2	
Total gross collector area	m²	7.5	
Storage			
Ratio of storage capacity to coll. area	L/m²	45.9	37.5 to 100.0
Storage capacity	L	327	
Balance of System			
Heat exchanger/antifreeze protection	yes/no	No	
Suggested pipe diameter	mm	10	8 to 25 or PVC 35 to 50
Pipe diameter	mm	38	8 to 25 or PVC 35 to 50
Pumping power per collector area	W/m²	22	3 to 22, or 0
Piping and solar tank losses	%	1%	1% to 10%
Losses due to snow and/or dirt	%	3%	2% to 10%

Horz. dist. from mech. room to collector	m	5	5 to 20
# of floors from mech. room to collector	-	2	0 to 20

Annual Energy Production (12.00 months analysed)		Estimate	Notes/Range
SWH system capacity	kW _{th}	5	
	MW _{th}	0.005	
Pumping energy (electricity)	MWh	0.27	
Specific yield	kWh/m ²	587	
System efficiency	%	34%	
Solar fraction	%	72%	
Renewable energy delivered	MWh	4.39	
	kWh	4,393	

[Complete Cost Analysis sheet](#)

RETScreen® Financial Summary - Solar Water Heating Project

Annual Energy Balance					
Project name	Residential North East	Electricity required	MWh	-	
Project location	Kansas City, MO				
Renewable energy delivered	MWh	4.39	Net GHG reduction	t _{CO2} /yr	1.14
Heating fuel displaced	-	Electricity	Net GHG emission reduction - 20 yrs	t _{CO2}	22.71
Financial Parameters					
Avoided cost of heating energy	\$/kWh	0.162	Debt ratio	%	0.0%
GHG emission reduction credit	\$/t _{CO2}	-	Income tax analysis?	yes/no	No
Retail price of electricity	\$/kWh	-			
Energy cost escalation rate	%	8.0%			
Inflation	%	3.0%			
Discount rate	%	6.0%			
Project life	yr	20			
Project Costs and Savings					
Initial Costs			Annual Costs and Debt		
Feasibility study	0.0%	\$ -	O&M	\$ -	
Development	0.0%	\$ -	Electricity	\$ -	
Engineering	0.0%	\$ -			
Energy equipment	41.2%	\$ 3,912	Annual Costs and Debt - Total	\$ -	
Balance of system	47.2%	\$ 4,484			
Miscellaneous	11.6%	\$ 1,104	Annual Savings or Income		
Initial Costs - Total	100.0%	\$ 9,500	Heating energy savings/income	\$ 373	
Incentives/Grants		\$ 2,000			
			Annual Savings - Total	\$ 373	
Periodic Costs (Credits)					
Valves and fittings		\$ -			
Pool heat pump compressor		\$ -			
		\$ -			
End of project life -		\$ -			
Financial Feasibility					
Pre-tax IRR and ROI	%	8.0%	Calculate GHG reduction cost?	yes/no	No
After-tax IRR and ROI	%	8.0%			
Simple Payback	yr	20.1	Project equity	\$	9,500
Year-to-positive cash flow	yr	11.8			
Net Present Value - NPV	\$	1,640			
Annual Life Cycle Savings	\$	143			
Benefit-Cost (B-C) ratio	-	1.17			
Yearly Cash Flows					
Year	Pre-tax	After-tax	Cumulative		
#	\$	\$	\$		
0	(7,500)	(7,500)	(7,500)		
1	403	403	(7,096)		
2	435	435	(6,661)		
3	470	470	(6,190)		
4	508	508	(5,683)		
5	549	549	(5,134)		
6	592	592	(4,541)		
7	640	640	(3,902)		
8	691	691	(3,210)		
9	746	746	(2,464)		
10	806	806	(1,658)		
11	871	871	(787)		
12	940	940	153		
13	1,015	1,015	1,168		
14	1,097	1,097	2,265		
15	1,184	1,184	3,449		
16	1,279	1,279	4,728		
17	1,381	1,381	6,110		
18	1,492	1,492	7,602		
19	1,611	1,611	9,213		
20	1,740	1,740	10,953		

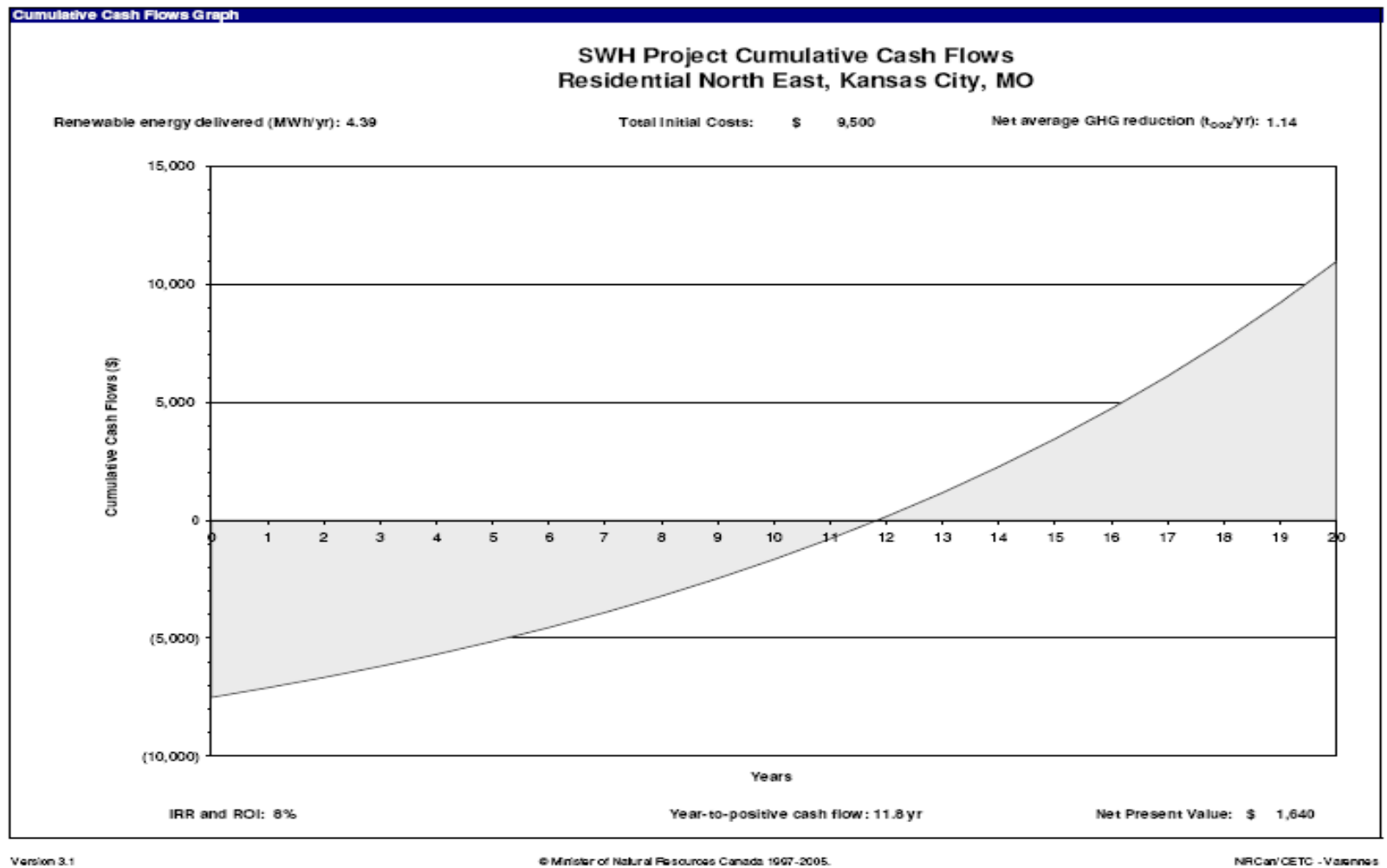
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RETScreen® Financial Summary - Solar Water Heating Project



11 Solar Hot Water System Analysis Kansas City Southwest

The following assumptions were used in preparing this system performance with RETScreen:

- System comprised of 2 Heliodyne Gobi 410s Solar Hot Water Collectors, 80 Gallon Hot Water Tank;
- System install price **\$9,500.00** includes all cost and tax;
- The financial analysis assumes cash purchase;
- Energy escalation rate of **8%**;
- The federal Solar PV Tax Credit of **\$2,000** is treated as an incentive.


11.1 Summary of Results

The following summarizes the results of this analysis. All the detail is provided in the system production report section below.

- Annual power production from system **4,393 KWH**
- First year value of the power produced by the system for consumer **\$375.00**
- **IRR and ROI 8% and 11.8 Years to positive cash flow**

RETScreen® Energy Model - Solar Water Heating Project

[Training & Support](#)

Site Conditions		Estimate	Notes/Range
Project name		Residential Southwest	See Online Manual
Project location		Overland Park, KS	
Nearest location for weather data		Kansas City, MO	 Complete SR&HL sheet
Annual solar radiation (tilted surface)	MWh/m²	1.75	
Annual average temperature	°C	12.6	-20.0 to 30.0

Annual average wind speed	m/s	4.6
Desired load temperature	°C	60
Hot water use	L/d	302
Number of months analysed	month	12.00
Energy demand for months analysed	MWh	6.10

System Characteristics		Estimate	Notes/Range
Application type		Service hot water (with storage)	
Base Case Water Heating System			
Heating fuel type	-	Electricity	
Water heating system seasonal efficiency	%	190%	50% to 190%
Solar Collector			
Collector type	-	Glazed	See Technical Note 1
Solar water heating collector manufacturer		Heliodyne	See Product Database
Solar water heating collector model		Heliodyne Gobi 410	
Gross area of one collector	m²	3.74	1.00 to 5.00
Aperture area of one collector	m²	3.56	1.00 to 5.00
Fr (tau alpha) coefficient	-	0.74	0.50 to 0.90
Fr UL coefficient	(W/m²)/°C	4.57	1.50 to 8.00
Temperature coefficient for Fr UL	(W/(m·°C)²)	0.00	0.000 to 0.010
Suggested number of collectors		2	
Number of collectors		2	
Total gross collector area	m²	7.5	
Storage			
Ratio of storage capacity to coll. area	L/m²	45.9	37.5 to 100.0
Storage capacity	L	327	
Balance of System			
Heat exchanger/antifreeze protection	yes/no	Yes	
Heat exchanger effectiveness	%	100%	50% to 85%
Suggested pipe diameter	mm	10	8 to 25 or PVC 35 to 50
Pipe diameter	mm	38	8 to 25 or PVC 35 to 50
Pumping power per collector area	W/m²	0	3 to 22, or 0

Piping and solar tank losses	%	1%	1% to 10%
Losses due to snow and/or dirt	%	3%	2% to 10%
Horz. dist. from mech. room to collector	m	5	5 to 20
# of floors from mech. room to collector	-	2	0 to 20

Annual Energy Production (12.00 months analysed)		Estimate	Notes/Range
SWH system capacity	kW _{th}	5	
	W _{th}	4,984	
Pumping energy (electricity)	MWh	0.00	
Specific yield	kWh/m ²	587	
System efficiency	%	34%	
Solar fraction	%	72%	
Renewable energy delivered	MWh	4.39	
	kWh	4,393	

[Complete Cost Analysis sheet](#)

Renewable Energy System Performance Analysis Report

RETScreen® Financial Summary - Solar Water Heating Project

Annual Energy Balance					
Project name	Residential Southwest	Electricity required	MWh	-	
Project location	Overland Park, KS				
Renewable energy delivered	MWh	4.39	Net GHG reduction	t _{CO2} /yr	1.14
Heating fuel displaced	-	Electricity	Net GHG emission reduction - 20 yrs	t _{CO2}	22.71
Financial Parameters					
Avoided cost of heating energy	\$/kWh	0.162	Debt ratio	%	0.0%
GHG emission reduction credit	\$/t _{CO2}	-	Income tax analysis?	yes/no	No
Retail price of electricity	\$/kWh	-			
Energy cost escalation rate	%	8.0%			
Inflation	%	3.0%			
Discount rate	%	6.0%			
Project life	yr	20			
Project Costs and Savings					
Initial Costs			Annual Costs and Debt		
Feasibility study	0.0%	\$ -	O&M	\$ -	
Development	0.0%	\$ -	Electricity	\$ -	
Engineering	0.0%	\$ -			
Energy equipment	41.2%	\$ 3,912	Annual Costs and Debt - Total	\$ -	
Balance of system	47.2%	\$ 4,484			
Miscellaneous	11.6%	\$ 1,104	Annual Savings or Income		
Initial Costs - Total	100.0%	\$ 9,500	Heating energy savings/income	\$ 375	
Incentives/Grants	\$	2,000			
			Annual Savings - Total	\$ 375	
Periodic Costs (Credits)					
Valves and fittings	\$	-			
Pool heat pump compressor	\$	-			
	\$	-			
End of project life -	\$	-			
Financial Feasibility					
Pre-tax IRR and ROI	%	8.0%	Calculate GHG reduction cost?	yes/no	No
After-tax IRR and ROI	%	8.0%			
Simple Payback	yr	20.0	Project equity	\$	9,500
Year-to-positive cash flow	yr	11.8			
Net Present Value - NPV	\$	1,668			
Annual Life Cycle Savings	\$	145			
Benefit-Cost (B-C) ratio	-	1.18			
Yearly Cash Flows					
Year	Pre-tax	After-tax	Cumulative		
#	\$	\$	\$		
0	(7,500)	(7,500)	(7,500)		
1	404	404	(7,095)		
2	437	437	(6,658)		
3	472	472	(6,186)		
4	510	510	(5,677)		
5	550	550	(5,127)		
6	594	594	(4,532)		
7	642	642	(3,890)		
8	693	693	(3,197)		
9	749	749	(2,448)		
10	809	809	(1,640)		
11	873	873	(767)		
12	943	943	176		
13	1,019	1,019	1,195		
14	1,100	1,100	2,295		
15	1,188	1,188	3,483		
16	1,283	1,283	4,766		
17	1,386	1,386	6,152		
18	1,497	1,497	7,649		
19	1,616	1,616	9,265		
20	1,746	1,746	11,011		

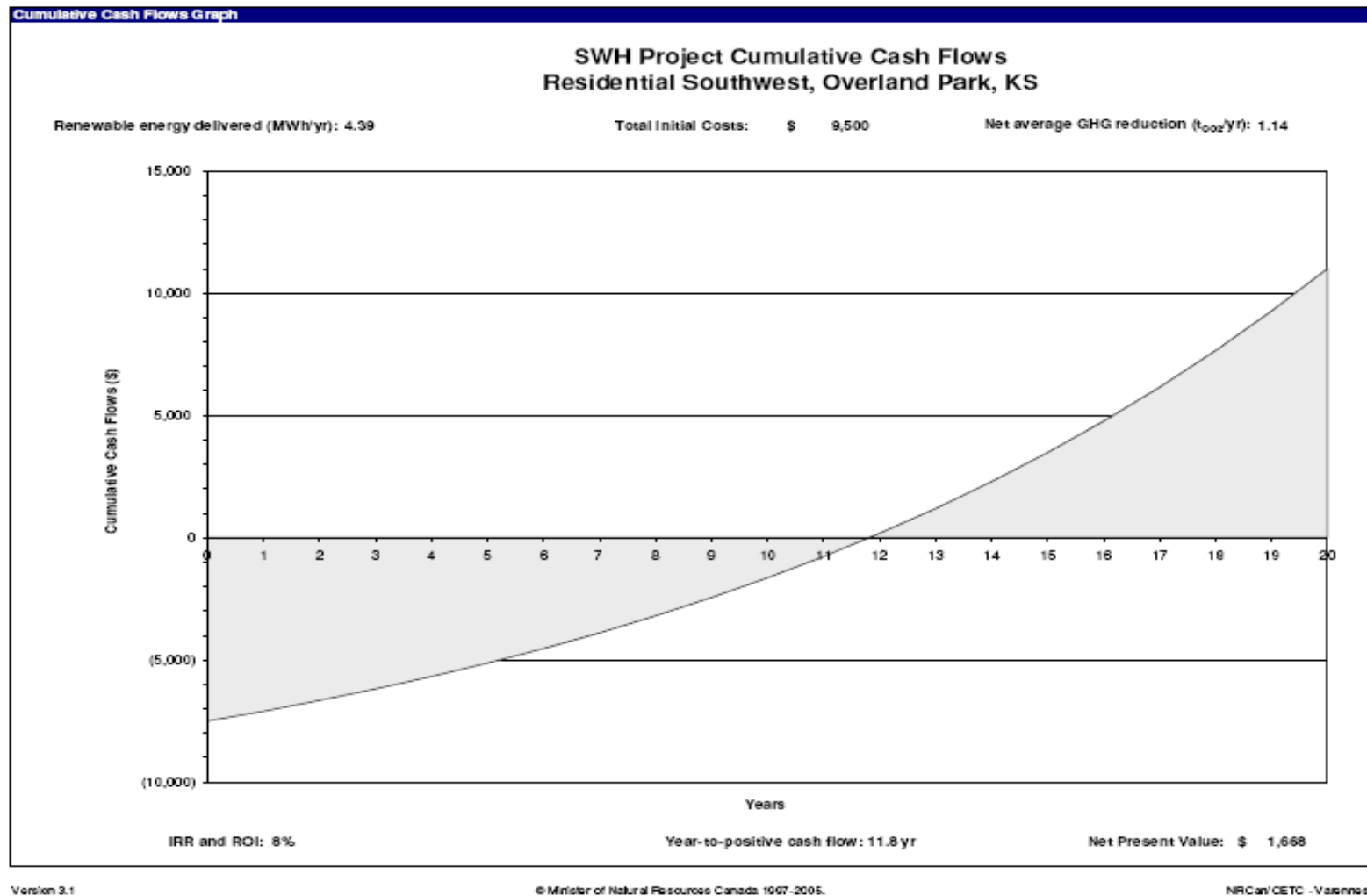
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RETScreen® Financial Summary - Solar Water Heating Project



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12 Solar Air Heating System Analysis Kansas City Northeast

The following assumptions were used in preparing this system performance with RETScreen:

- System comprised of one SolarSheat;
- System install price **\$2,300.00** includes all cost and tax;
- The financial analysis assumes cash purchase;
- Energy escalation rate of **8%**;

12.1 Summary of Results


The following summarizes the results of this analysis. All the detail is provided in the system production report section below.

- Annual power production from system **2,807 KWH**
- First year value of the power produced by the system for consumer **\$237.00**
- **IRR and ROI 18.5% and 7 Years to positive cash flow**

RETScreen® Energy Model - Solar Air Heating Project

[Training & Support](#)

Units: Imperial

Site Conditions		Estimate	Notes/Range
Project name		Residential Northeast	See Online Manual
Project location		Kansas City, MO	
Nearest location for weather data		Kansas City, MO	 Complete SR sheet
Annual solar radiation (tilted surface)	kWh/ft²	143.22	

Annual average temperature	°F	12.6
Annual average wind speed	mph	4.6

System Characteristics		Estimate	Notes/Range
Heating application type	-	Ventilation air	
Base Case Heating System			
Heating fuel type	-	Electricity	
Heating system seasonal efficiency	%	100%	0% to 350%
Building			
Building type	-	Residential	
Indoor temperature	°F	70.0	68.0 to 77.0
Maximum delivered air temperature	°F	105.0	
R-value of building wall	ft² - °F/(Btu/h)	19.0	0.6 to 56.8
Airflow Requirements			
Design airflow rate	cfm	6,200	29 to 588,578
Operating days per week (weekday)	d/w	5.0	0.0 to 5.0
Operating hours per day (weekday)	h/d	5.0	5.0 to 24.0
Operating days per week (weekend)	d/w	2.0	0.0 to 2.0
Operating hours per day (weekend)	h/d	5.0	5.0 to 24.0
Solar Collector			
Design objective	-	High temperature rise	
Collector colour	-	Black	See Product Database
Solar absorptivity	-	0.94	0.20 to 0.99
Suggested solar collector area	ft²	3,150	
Solar collector area	ft²	80	
Percent shading during season of use	%	0%	0% to 50%
SAH fan flow rate	cfm/ft²	78	
Average air temperature rise	°F	1.5	
Incremental fan power	W/ft²	0.0	0.0 to 0.7

Annual Energy Production (6.0 months analysed)		Estimate	Notes/Range
Incremental fan energy	MWh	0.0	
Specific yield	kWh/ft ²	35	
Collector efficiency	%	95%	
Solar availability while operating	%	25%	
Renewable energy collected	million Btu	9.2	
Building heat loss recaptured	million Btu	0.4	
Renewable energy delivered	MWh	2.8	
	kWh	2,807	

[Complete Cost Analysis sheet](#)

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RETScreen® Financial Summary - Solar Air Heating Project

Annual Energy Balance					
Project name	Residential Northeast	Electricity required	MWh	-	
Project location	Kansas City, MO				
Renewable energy delivered	MWh	2.8	Net GHG reduction	t _{CO2} /yr	3.00
Heating fuel displaced	-	Electricity	Net GHG emission reduction - 30 yrs	t _{CO2}	90

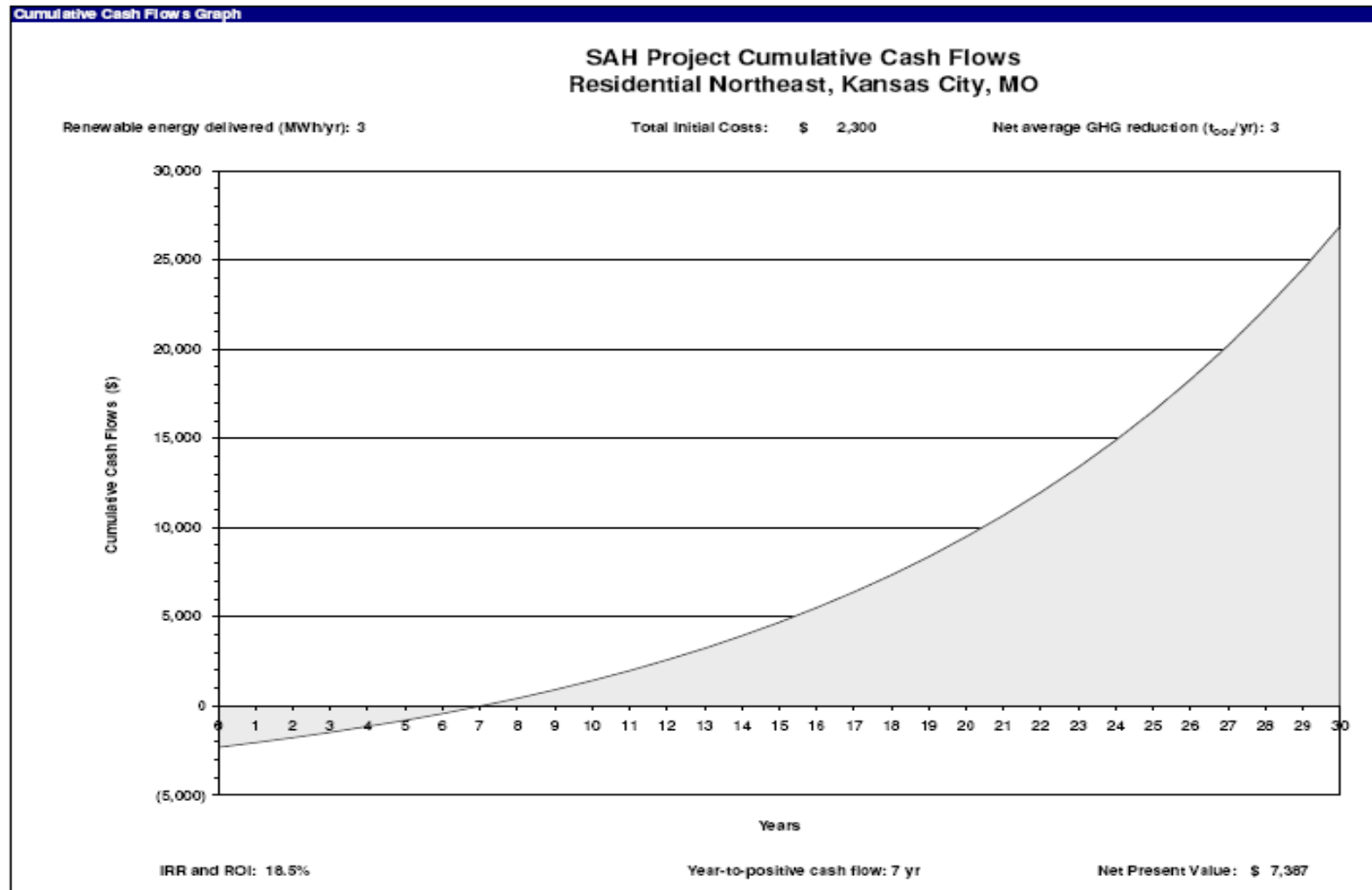
Financial Parameters					
Avoided cost of heating energy	\$/kWh	0.085	Debt ratio	%	0.0%
GHG emission reduction credit	\$/t _{CO2}	-	Income tax analysis?	yes/no	No
Retail price of electricity	\$/kWh	-			
Energy cost escalation rate	%	8.0%			
Inflation	%	3.0%			
Discount rate	%	6.0%			
Project life	yr	30			

Project Costs and Savings					
Initial Costs			Annual Costs and Debt		
Feasibility study	0.0%	\$ -	O&M	\$	-
Development	0.0%	\$ -	Fuel/Electricity	\$	-
Engineering	0.0%	\$ -			
Energy equipment	95.7%	\$ 2,200	Annual Costs - Total	\$	-
Balance of equipment	4.3%	\$ 100			
Miscellaneous	0.0%	\$ -	Annual Savings or Income		
Initial Costs - Total	100.0%	\$ 2,300	Heating energy savings/income	\$	239
Incentives/Grants		\$ -			
			Annual Savings - Total	\$	239
Periodic Costs (Credits)		\$ -			
		\$ -			
		\$ -			
End of project life -		\$ -			

Financial Feasibility					
Pre-tax IRR and ROI	%	18.5%	Calculate GHG reduction cost?	yes/no	No
After-tax IRR and ROI	%	18.5%			
Simple Payback	yr	9.6	Project equity	\$	2,300
Year-to-positive cash flow	yr	7.0			
Net Present Value - NPV	\$	7,387			
Annual Life Cycle Savings	\$	537			
Benefit-Cost (B-C) ratio	-	4.21			

Yearly Cash Flows			
Year	Pre-tax	After-tax	Cumulative
#	\$	\$	\$
0	(2,300)	(2,300)	(2,300)
1	258	258	(2,042)
2	278	278	(1,764)
3	301	301	(1,464)
4	325	325	(1,139)
5	351	351	(789)
6	379	379	(410)
7	409	409	(1)
8	442	442	440
9	477	477	917
10	515	515	1,432
11	556	556	1,989
12	601	601	2,589
13	649	649	3,238
14	701	701	3,939
15	757	757	4,695
16	817	817	5,513
17	883	883	6,395
18	953	953	7,349
19	1,030	1,030	8,378
20	1,112	1,112	9,490
21	1,201	1,201	10,691
22	1,297	1,297	11,988
23	1,401	1,401	13,389
24	1,513	1,513	14,901
25	1,634	1,634	16,535
26	1,764	1,764	18,299
27	1,906	1,906	20,205
28	2,058	2,058	22,263
29	2,223	2,223	24,486
30	2,401	2,401	26,886

RETScreen® Financial Summary - Solar Air Heating Project



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13 Solar Air Heating System Analysis Kansas City Southwest

The following assumptions were used in preparing this system performance with RETScreen:

- System comprised of one SolarSheat;
- System install price **\$2,300.00** includes all cost and tax;
- The financial analysis assumes cash purchase;
- Energy escalation rate of **8%**;

13.1 Summary of Results


The following summarizes the results of this analysis. All the detail is provided in the system production report section below.

- Annual power production from system **2,807 KWH**
- First year value of the power produced by the system for consumer **\$237.00**
- **IRR and ROI 18.5% and 7 Years to positive cash flow**

RETScreen® Energy Model - Solar Air Heating Project

[Training & Support](#)

Units: Imperial

Site Conditions		Estimate	Notes/Range
Project name		Residential Southwest	See Online Manual
Project location		Overland Park, KS	
Nearest location for weather data		Kansas City, MO	 Complete SR sheet
Annual solar radiation (tilted surface)	kWh/ft²	143.22	

Annual average temperature	°F	12.6	
Annual average wind speed	mph	4.6	

System Characteristics		Estimate	Notes/Range
Heating application type	-	Ventilation air	
Base Case Heating System			
Heating fuel type	-	Electricity	
Heating system seasonal efficiency	%	100%	0% to 350%
Building			
Building type	-	Residential	
Indoor temperature	°F	70.0	68.0 to 77.0
Maximum delivered air temperature	°F	105.0	
	ft² -		
R-value of building wall	°F/(Btu/h)	19.0	0.6 to 56.8
Airflow Requirements			
Design airflow rate	cfm	6,200	29 to 588,578
Operating days per week (weekday)	d/w	5.0	0.0 to 5.0
Operating hours per day (weekday)	h/d	5.0	5.0 to 24.0
Operating days per week (weekend)	d/w	2.0	0.0 to 2.0
Operating hours per day (weekend)	h/d	5.0	5.0 to 24.0
Solar Collector			
Design objective	-	High temperature rise	
Collector colour	-	Black	See Product Database
Solar absorptivity	-	0.94	0.20 to 0.99
Suggested solar collector area	ft²	3,150	
Solar collector area	ft²	80	
Percent shading during season of use	%	0%	0% to 50%
SAH fan flow rate	cfm/ft²	78	
Average air temperature rise	°F	1.5	
Incremental fan power	W/ft²	0.0	0.0 to 0.7

Annual Energy Production (6.0 months analysed)		Estimate	Notes/Range
--	--	----------	-------------

Incremental fan energy	MWh	0.0
Specific yield	kWh/ft²	35
Collector efficiency	%	95%
Solar availability while operating	%	25%
Renewable energy collected	million Btu	9.2
Building heat loss recaptured	million Btu	0.4
Renewable energy delivered	MWh	2.8
	kWh	2,807

[Complete Cost Analysis sheet](#)

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Renewable Energy System Performance Analysis Report

RETScreen® Financial Summary - Solar Air Heating Project

Annual Energy Balance					
Project name	Residential Southwest	Electricity required	MWh	-	
Project location	Overland Park, KS				
Renewable energy delivered	MWh	2.8	Net GHG reduction	t _{CO2} /yr	3.00
Heating fuel displaced	-	Electricity	Net GHG emission reduction - 30 yrs	t _{CO2}	90
Financial Parameters					
Avoided cost of heating energy	\$/kWh	0.086	Debt ratio	%	0.0%
GHG emission reduction credit	\$/t _{CO2}	-	Income tax analysis?	yes/no	No
Retail price of electricity	\$/kWh	-			
Energy cost escalation rate	%	8.0%			
Inflation	%	3.0%			
Discount rate	%	6.0%			
Project life	yr	30			
Project Costs and Savings					
Initial Costs			Annual Costs and Debt		
Feasibility study	0.0%	\$ -	O&M	\$	-
Development	0.0%	\$ -	Fuel/Electricity	\$	-
Engineering	0.0%	\$ -			
Energy equipment	95.7%	\$ 2,200	Annual Costs - Total	\$	-
Balance of equipment	4.3%	\$ 100			
Miscellaneous	0.0%	\$ -	Annual Savings or Income		
Initial Costs - Total	100.0%	\$ 2,300	Heating energy savings/income	\$	241
Incentives/Grants	\$	-			
			Annual Savings - Total	\$	241
Periodic Costs (Credits)	\$	-			
	\$	-			
	\$	-			
End of project life -	\$	-			
Financial Feasibility					
Pre-tax IRR and ROI	%	18.7%	Calculate GHG reduction cost?	yes/no	No
After-tax IRR and ROI	%	18.7%			
Simple Payback	yr	9.5	Project equity	\$	2,300
Year-to-positive cash flow	yr	6.9			
Net Present Value - NPV	\$	7,501			
Annual Life Cycle Savings	\$	545			
Benefit-Cost (B-C) ratio	-	4.26			

Yearly Cash Flows			
Year	Pre-tax	After-tax	Cumulative
#	\$	\$	\$
0	(2,300)	(2,300)	(2,300)
1	261	261	(2,039)
2	282	282	(1,758)
3	304	304	(1,454)
4	328	328	(1,125)
5	355	355	(771)
6	383	383	(388)
7	414	414	-26
8	447	447	473
9	482	482	955
10	521	521	1,476
11	563	563	2,039
12	608	608	2,647
13	656	656	3,303
14	709	709	4,012
15	766	766	4,778
16	827	827	5,605
17	893	893	6,498
18	964	964	7,462
19	1,042	1,042	8,504
20	1,125	1,125	9,629
21	1,215	1,215	10,844
22	1,312	1,312	12,156
23	1,417	1,417	13,573
24	1,531	1,531	15,104
25	1,653	1,653	16,757
26	1,785	1,785	18,542
27	1,928	1,928	20,470
28	2,082	2,082	22,552
29	2,249	2,249	24,801
30	2,429	2,429	27,230

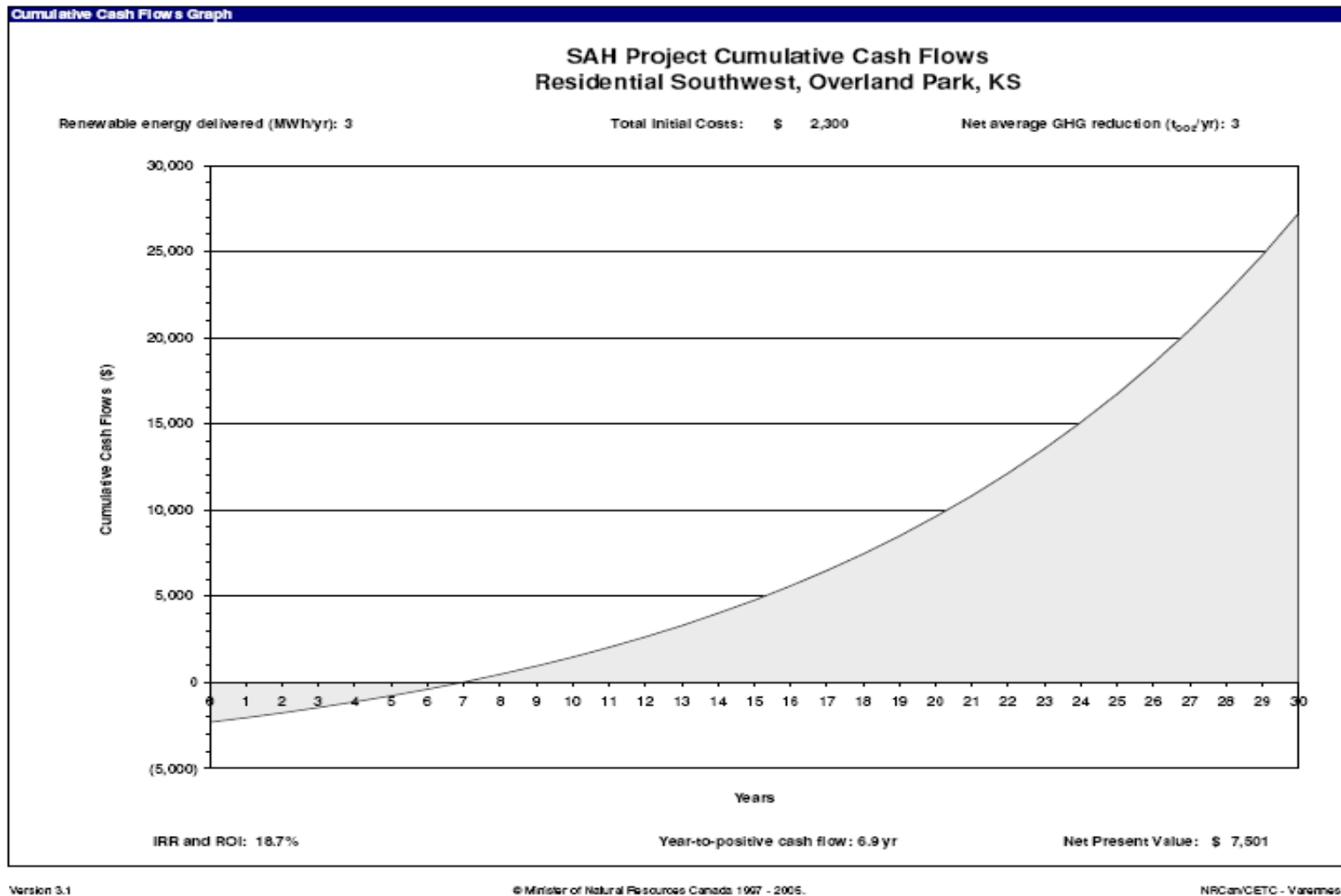
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RETScreen® Financial Summary - Solar Air Heating Project



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14 Appendix A Product Information

This section contains the product information used in the preparation of this analysis report.