**System Simulation Report**



**File:** MeziesGrid2.homer

**Author:**

**Location:** Level 6, Menzies building, Library Rd, Rondebosch, Cape Town, 7701, South Africa (33°57.5'S, 18°27.6'E)

**Total Net Present Cost:** R116,423,500.00

**Levelized Cost of Energy (R/kWh):** R0.879

**Notes:** no limit

**Table of Contents**

System Architecture 3

Cost Summary 4

Cash Flow 5

Electrical Summary 6

PV: Generic flat plate PV 7

Wind Turbine: Generic 10 kW 8

Storage: Generic 100kWh Li-Ion 9

Converter: System Converter 10

Grid: Grid 11

Compare Economics 14

Time series charts: 16

Time series charts: 17

Time series charts: 18

Time series charts: 19

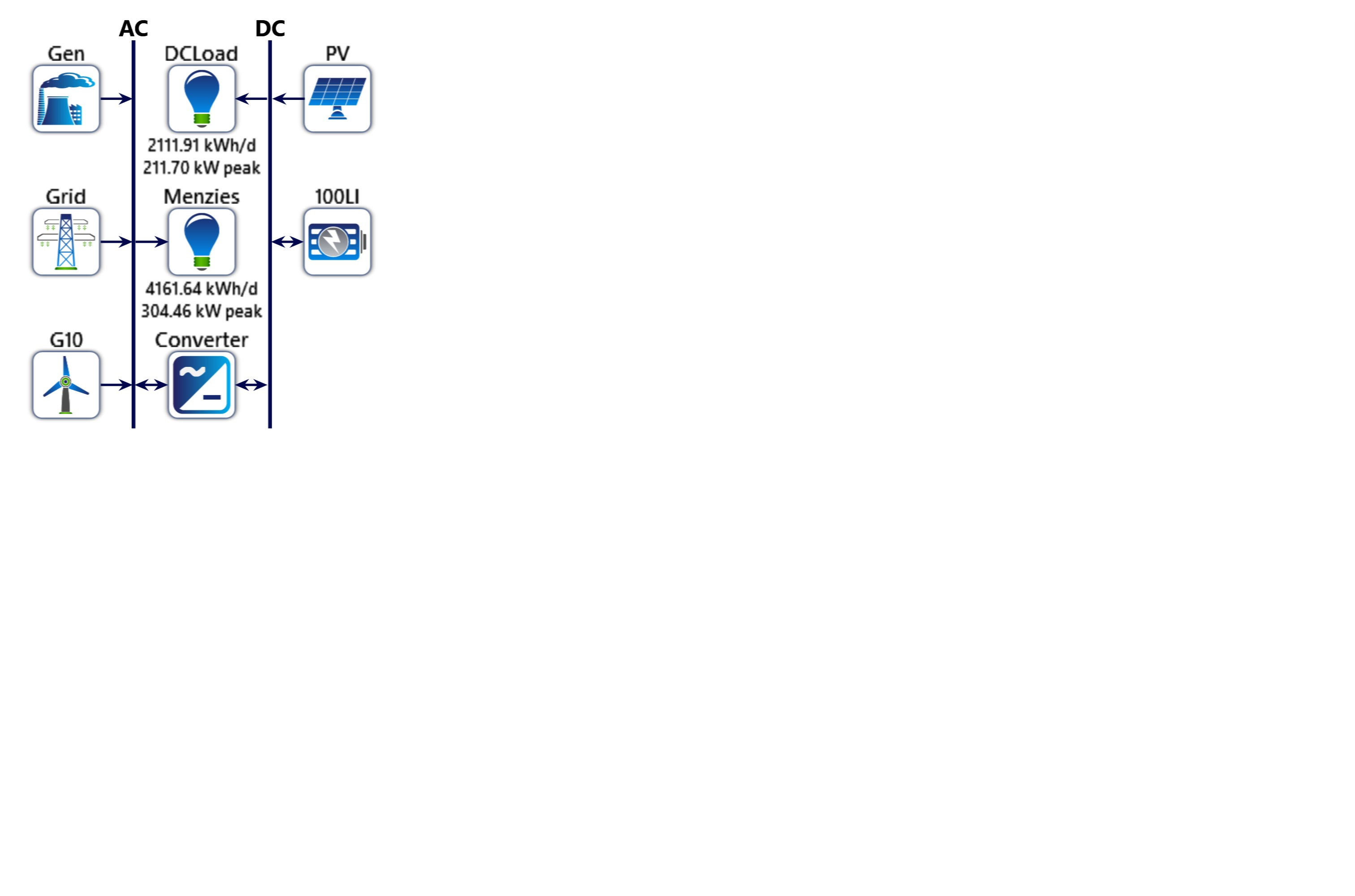
Time series charts: 20

Time series charts: 21

# System Architecture

|  |  |  |  |
| --- | --- | --- | --- |
| Component | Name | Size | Unit |
| PV | Generic flat plate PV | 1,334 | kW |
| Storage | Generic 100kWh Li-Ion | 4 | strings |
| Wind turbine | Generic 10 kW | 223 | ea. |
| System converter | System Converter | 126 | kW |
| Grid | Grid | 999,999 | kW |
| Dispatch strategy | HOMER Cycle Charging |  |  |

**Schematic**



# Cost Summary

**Net Present Costs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Name | Capital | Operating | Replacement | Salvage | Resource | Total |
| Generic 10 kW | R10.8M | R6.48M | R34.8M | -R34.9M | R0.00 | R17.2M |
| Generic 100kWh Li-Ion | R2.59M | R232,626 | R6.20M | -R3.70M | R0.00 | R5.32M |
| Generic flat plate PV | R5.87M | R776,076 | R0.00 | R0.00 | R0.00 | R6.64M |
| Grid | R0.00 | R81.6M | R0.00 | R0.00 | R0.00 | R81.6M |
| Other | R0.00 | R5.61M | R0.00 | R0.00 | R0.00 | R5.61M |
| System Converter | R37,681 | R0.00 | R90,304 | -R53,907 | R0.00 | R74,078 |
| System | R19.3M | R94.7M | R41.0M | -R38.6M | R0.00 | R116M |

**Annualized Costs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Name | Capital | Operating | Replacement | Salvage | Resource | Total |
| Generic 10 kW | R186,348 | R111,500 | R597,645 | -R599,838 | R0.00 | R295,656 |
| Generic 100kWh Li-Ion | R44,498 | R4,000 | R106,642 | -R63,660 | R0.00 | R91,480 |
| Generic flat plate PV | R100,871 | R13,345 | R0.00 | R0.00 | R0.00 | R114,216 |
| Grid | R0.00 | R1.40M | R0.00 | R0.00 | R0.00 | R1.40M |
| Other | R0.00 | R96,396 | R0.00 | R0.00 | R0.00 | R96,396 |
| System Converter | R647.92 | R0.00 | R1,553 | -R926.93 | R0.00 | R1,274 |
| System | R332,366 | R1.63M | R705,840 | -R664,425 | R0.00 | R2.00M |

# Cash Flow

# Electrical Summary

**Excess and Unmet**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Excess Electricity | 7,962,252 | kWh/yr |
| Unmet Electric Load | 11,875 | kWh/yr |
| Capacity Shortage | 19,279 | kWh/yr |

**Production Summary**

|  |  |  |
| --- | --- | --- |
| Component | Production (kWh/yr) | Percent |
| Generic flat plate PV | 2,333,318 | 22.7 |
| Generic 10 kW | 7,553,414 | 73.6 |
| Grid Purchases | 379,914 | 3.70 |
| Total | 10,266,647 | 100 |

**Consumption Summary**

|  |  |  |
| --- | --- | --- |
| Component | Consumption (kWh/yr) | Percent |
| AC Primary Load | 1,509,194 | 66.3 |
| DC Primary Load | 768,773 | 33.7 |
| Deferrable Load | 0 | 0 |
| Total | 2,277,967 | 100 |

# PV: Generic flat plate PV

**Generic flat plate PV Electrical Summary**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Minimum Output | 0 | kW |
| Maximum Output | 1,323 | kW |
| PV Penetration | 102 | % |
| Hours of Operation | 4,370 | hrs/yr |
| Levelized Cost | 0.0490 | R/kWh |

**Generic flat plate PV Statistics**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Rated Capacity | 1,334 | kW |
| Mean Output | 266 | kW |
| Mean Output | 6,393 | kWh/d |
| Capacity Factor | 20.0 | % |
| Total Production | 2,333,318 | kWh/yr |

**Generic flat plate PV Output (kW)**

# Wind Turbine: Generic 10 kW

**Generic 10 kW Electrical Summary**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Minimum Output | 0 | kW |
| Maximum Output | 2,230 | kW |
| Wind Penetration | 330 | % |
| Hours of Operation | 7,817 | hrs/yr |
| Levelized Cost | 0.0391 | R/kWh |

**Generic 10 kW Statistics**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Total Rated Capacity | 2,230 | kW |
| Mean Output | 862 | kW |
| Capacity Factor | 38.7 | % |
| Total Production | 7,553,414 | kWh/yr |

**Generic 10 kW Output (kW)**

# Storage: Generic 100kWh Li-Ion

**Generic 100kWh Li-Ion Properties**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Batteries | 4.00 | qty. |
| String Size | 1.00 | batteries |
| Strings in Parallel | 4.00 | strings |
| Bus Voltage | 600 | V |

**Generic 100kWh Li-Ion Result Data**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Average Energy Cost | 0.871 | R/kWh |
| Energy In | 37,045 | kWh/yr |
| Energy Out | 33,340 | kWh/yr |
| Storage Depletion | 0 | kWh/yr |
| Losses | 3,704 | kWh/yr |
| Annual Throughput | 35,144 | kWh/yr |

**Generic 100kWh Li-Ion Statistics**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Autonomy | 1.22 | hr |
| Storage Wear Cost | 2.27 | R/kWh |
| Nominal Capacity | 400 | kWh |
| Usable Nominal Capacity | 320 | kWh |
| Lifetime Throughput | 527,154 | kWh |
| Expected Life | 15.0 | yr |

**Generic 100kWh Li-Ion State of Charge (%)**

# Converter: System Converter

**System Converter Electrical Summary**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Hours of Operation | 1,104 | hrs/yr |
| Energy Out | 101,816 | kWh/yr |
| Energy In | 107,175 | kWh/yr |
| Losses | 5,359 | kWh/yr |

**System Converter Statistics**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Capacity | 126 | kW |
| Mean Output | 11.6 | kW |
| Minimum Output | 0 | kW |
| Maximum Output | 126 | kW |
| Capacity Factor | 9.25 | % |

**System Converter Inverter Output (kW)**

**System Converter Rectifier Output (kW)**

# Grid: Grid

**Grid rate: Demand 1**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | Energy Purchased (kWh) | Energy Sold (kWh) | Net Energy Purchased (kWh) | Peak Demand (kW) | Energy Charge | Demand Charge |
| January | 0 | 0 | 0 | 269 | R0.00 | R59,169 |
| February | 0 | 0 | 0 | 307 | R0.00 | R67,425 |
| March | 0 | 0 | 0 | 334 | R0.00 | R73,517 |
| April | 0 | 0 | 0 | 331 | R0.00 | R72,755 |
| May | 0 | 0 | 0 | 342 | R0.00 | R75,165 |
| June | 0 | 0 | 0 | 314 | R0.00 | R68,971 |
| July | 0 | 0 | 0 | 318 | R0.00 | R69,957 |
| August | 0 | 0 | 0 | 357 | R0.00 | R78,531 |
| September | 0 | 0 | 0 | 336 | R0.00 | R73,830 |
| October | 0 | 0 | 0 | 313 | R0.00 | R68,863 |
| November | 0 | 0 | 0 | 267 | R0.00 | R58,781 |
| December | 0 | 0 | 0 | 296 | R0.00 | R65,162 |
| Annual | 0 | 0 | 0 | 357 | R0.00 | R832,126 |

**Grid rate: OffPeak-Summer**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | Energy Purchased (kWh) | Energy Sold (kWh) | Net Energy Purchased (kWh) | Peak Demand (kW) | Energy Charge | Demand Charge |
| January | 12,921 | 0 | 12,921 | 0 | R15,638 | R0.00 |
| February | 14,556 | 0 | 14,556 | 0 | R17,617 | R0.00 |
| March | 21,596 | 0 | 21,596 | 0 | R26,138 | R0.00 |
| April | 25,619 | 0 | 25,619 | 0 | R31,007 | R0.00 |
| May | 33,016 | 0 | 33,016 | 0 | R39,960 | R0.00 |
| June | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| July | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| August | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| September | 22,874 | 0 | 22,874 | 0 | R27,684 | R0.00 |
| October | 18,701 | 0 | 18,701 | 0 | R22,634 | R0.00 |
| November | 15,555 | 0 | 15,555 | 0 | R18,827 | R0.00 |
| December | 16,714 | 0 | 16,714 | 0 | R20,229 | R0.00 |
| Annual | 181,553 | 0 | 181,553 | 0 | R219,733 | R0.00 |

**Grid rate: Standard-Summer**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | Energy Purchased (kWh) | Energy Sold (kWh) | Net Energy Purchased (kWh) | Peak Demand (kW) | Energy Charge | Demand Charge |
| January | 5,037 | 0 | 5,037 | 0 | R8,371 | R0.00 |
| February | 5,921 | 0 | 5,921 | 0 | R9,841 | R0.00 |
| March | 7,191 | 0 | 7,191 | 0 | R11,952 | R0.00 |
| April | 8,524 | 0 | 8,524 | 0 | R14,168 | R0.00 |
| May | 9,814 | 0 | 9,814 | 0 | R16,310 | R0.00 |
| June | 5,675 | 0 | 5,675 | 0 | R9,431 | R0.00 |
| July | 4,973 | 0 | 4,973 | 0 | R8,265 | R0.00 |
| August | 6,277 | 0 | 6,277 | 0 | R10,432 | R0.00 |
| September | 6,590 | 0 | 6,590 | 0 | R10,953 | R0.00 |
| October | 6,150 | 0 | 6,150 | 0 | R10,222 | R0.00 |
| November | 3,986 | 0 | 3,986 | 0 | R6,625 | R0.00 |
| December | 4,687 | 0 | 4,687 | 0 | R7,790 | R0.00 |
| Annual | 74,825 | 0 | 74,825 | 0 | R124,359 | R0.00 |

**Grid rate: Peak-Summer**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | Energy Purchased (kWh) | Energy Sold (kWh) | Net Energy Purchased (kWh) | Peak Demand (kW) | Energy Charge | Demand Charge |
| January | 2,398 | 0 | 2,398 | 0 | R5,326 | R0.00 |
| February | 2,900 | 0 | 2,900 | 0 | R6,441 | R0.00 |
| March | 3,796 | 0 | 3,796 | 0 | R8,431 | R0.00 |
| April | 4,485 | 0 | 4,485 | 0 | R9,961 | R0.00 |
| May | 6,101 | 0 | 6,101 | 0 | R13,550 | R0.00 |
| June | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| July | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| August | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| September | 3,956 | 0 | 3,956 | 0 | R8,787 | R0.00 |
| October | 3,254 | 0 | 3,254 | 0 | R7,227 | R0.00 |
| November | 481 | 0 | 481 | 0 | R1,069 | R0.00 |
| December | 1,829 | 0 | 1,829 | 0 | R4,061 | R0.00 |
| Annual | 29,200 | 0 | 29,200 | 0 | R64,853 | R0.00 |

**Grid rate: OffPeak-Winter**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | Energy Purchased (kWh) | Energy Sold (kWh) | Net Energy Purchased (kWh) | Peak Demand (kW) | Energy Charge | Demand Charge |
| January | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| February | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| March | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| April | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| May | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| June | 26,349 | 0 | 26,349 | 0 | R35,092 | R0.00 |
| July | 30,470 | 0 | 30,470 | 0 | R40,580 | R0.00 |
| August | 23,694 | 0 | 23,694 | 0 | R31,556 | R0.00 |
| September | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| October | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| November | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| December | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| Annual | 80,513 | 0 | 80,513 | 0 | R107,227 | R0.00 |

**Grid rate: Standard-Winter**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | Energy Purchased (kWh) | Energy Sold (kWh) | Net Energy Purchased (kWh) | Peak Demand (kW) | Energy Charge | Demand Charge |
| January | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| February | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| March | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| April | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| May | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| June | 2,084 | 0 | 2,084 | 0 | R4,362 | R0.00 |
| July | 1,508 | 0 | 1,508 | 0 | R3,157 | R0.00 |
| August | 3,541 | 0 | 3,541 | 0 | R7,412 | R0.00 |
| September | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| October | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| November | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| December | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| Annual | 7,134 | 0 | 7,134 | 0 | R14,931 | R0.00 |

**Grid rate: Peak-Winter**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | Energy Purchased (kWh) | Energy Sold (kWh) | Net Energy Purchased (kWh) | Peak Demand (kW) | Energy Charge | Demand Charge |
| January | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| February | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| March | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| April | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| May | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| June | 2,282 | 0 | 2,282 | 0 | R13,527 | R0.00 |
| July | 1,537 | 0 | 1,537 | 0 | R9,111 | R0.00 |
| August | 2,870 | 0 | 2,870 | 0 | R17,014 | R0.00 |
| September | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| October | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| November | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| December | 0 | 0 | 0 | 0 | R0.00 | R0.00 |
| Annual | 6,690 | 0 | 6,690 | 0 | R39,652 | R0.00 |

**Grid rate: All**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | Energy Purchased (kWh) | Energy Sold (kWh) | Net Energy Purchased (kWh) | Peak Demand (kW) | Energy Charge | Demand Charge |
| January | 20,356 | 0 | 20,356 | 269 | R29,336 | R59,169 |
| February | 23,377 | 0 | 23,377 | 307 | R33,899 | R67,425 |
| March | 32,583 | 0 | 32,583 | 334 | R46,520 | R73,517 |
| April | 38,629 | 0 | 38,629 | 331 | R55,136 | R72,755 |
| May | 48,931 | 0 | 48,931 | 342 | R69,820 | R75,165 |
| June | 36,390 | 0 | 36,390 | 314 | R62,413 | R68,971 |
| July | 38,488 | 0 | 38,488 | 318 | R61,113 | R69,957 |
| August | 36,383 | 0 | 36,383 | 357 | R66,414 | R78,531 |
| September | 33,420 | 0 | 33,420 | 336 | R47,424 | R73,830 |
| October | 28,105 | 0 | 28,105 | 313 | R40,083 | R68,863 |
| November | 20,023 | 0 | 20,023 | 267 | R26,520 | R58,781 |
| December | 23,229 | 0 | 23,229 | 296 | R32,080 | R65,162 |
| Annual | 379,914 | 0 | 379,914 | 357 | R570,756 | R832,126 |

**Energy Purchased From Grid (kW)**

**Energy Sold To Grid (kW)**

# Compare Economics

IRR (%):**22.2**

Discounted payback (yr):**3.82**

Simple payback (yr):**4.41**

|  |  |  |
| --- | --- | --- |
|  | Base System | Proposed System |
| Net Present Cost | R349M | R116M |
| CAPEX | R68,550 | R19.3M |
| OPEX | R6.00M | R1.67M |
| LCOE (per kWh) | R2.86 | R0.879 |
| CO2 Emitted (kg/yr) | 1,347,349 | 240,106 |
| Fuel Consumption (L/yr) | 0 | 0 |

**Proposed Annual Nominal Cash Flows**

**Base System Annual Nominal Cash Flows**

**Cumulative Discounted Cash Flows**

# Time series charts:

# Time series charts:

# Time series charts:

# Time series charts:

# Time series charts:

# Time series charts: