**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:** R123,331,200.00

**Levelized Cost of Energy (R/kWh):** R0.932

**Notes:** PV limit: 1000 units

Wind limit: 100 units

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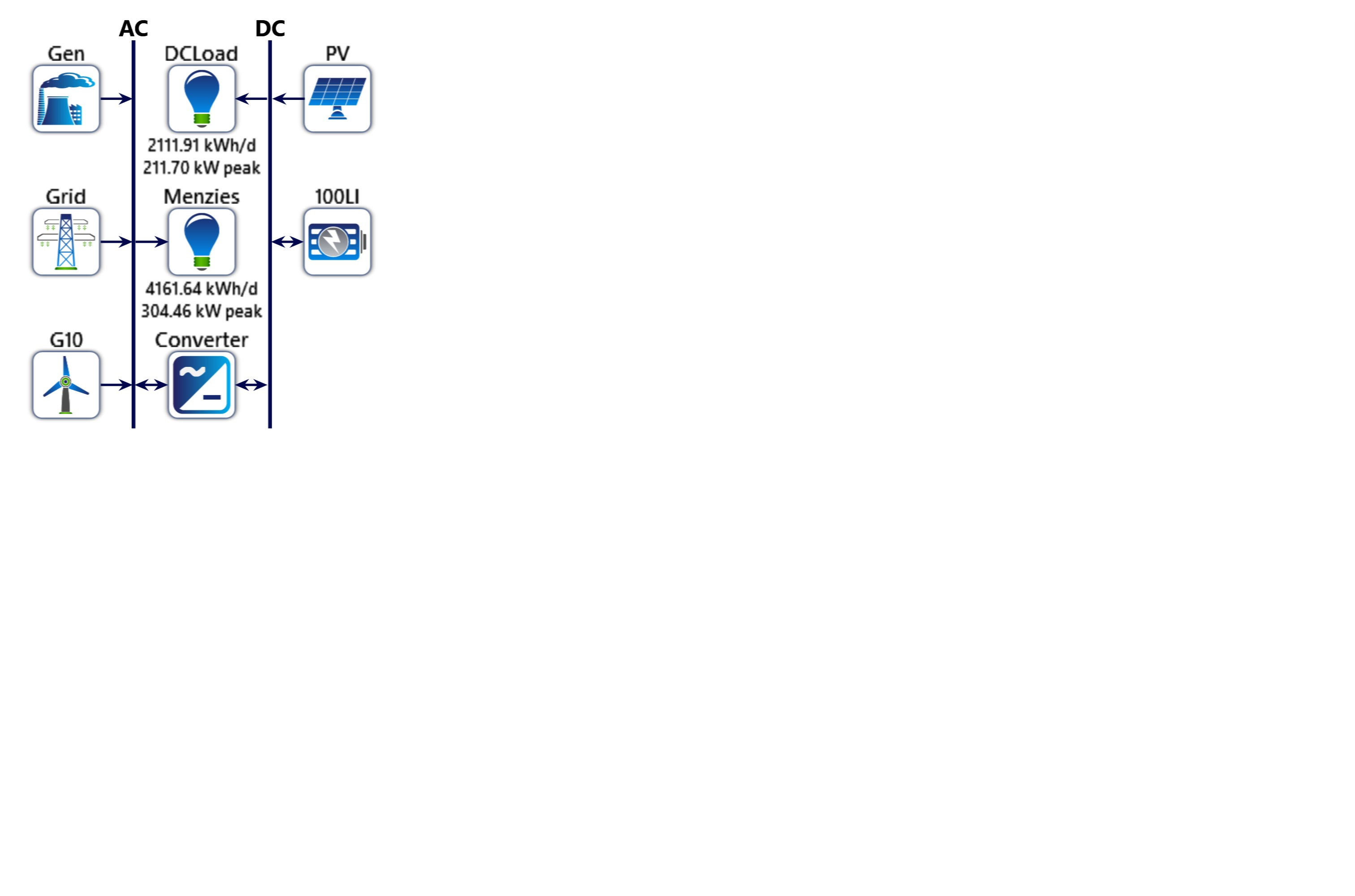
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# System Architecture

|  |  |  |  |
| --- | --- | --- | --- |
| Component | Name | Size | Unit |
| PV | Generic flat plate PV | 1,000 | kW |
| Storage | Generic 100kWh Li-Ion | 5 | strings |
| Wind turbine | Generic 10 kW | 100 | ea. |
| System converter | System Converter | 130 | 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 | R4.86M | R2.91M | R15.6M | -R15.6M | R0.00 | R7.71M |
| Generic 100kWh Li-Ion | R3.23M | R290,782 | R7.75M | -R4.63M | R0.00 | R6.65M |
| Generic flat plate PV | R4.40M | R581,564 | R0.00 | R0.00 | R0.00 | R4.98M |
| Grid | R0.00 | R97.3M | R0.00 | R0.00 | R0.00 | R97.3M |
| Other | R0.00 | R6.62M | R0.00 | R0.00 | R0.00 | R6.62M |
| System Converter | R38,851 | R0.00 | R93,108 | -R55,581 | R0.00 | R76,378 |
| System | R12.5M | R108M | R23.4M | -R20.3M | R0.00 | R123M |

**Annualized Costs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Name | Capital | Operating | Replacement | Salvage | Resource | Total |
| Generic 10 kW | R83,564 | R50,000 | R268,002 | -R268,986 | R0.00 | R132,581 |
| Generic 100kWh Li-Ion | R55,623 | R5,000 | R133,303 | -R79,575 | R0.00 | R114,351 |
| Generic flat plate PV | R75,589 | R10,000 | R0.00 | R0.00 | R0.00 | R85,589 |
| Grid | R0.00 | R1.67M | R0.00 | R0.00 | R0.00 | R1.67M |
| Other | R0.00 | R113,908 | R0.00 | R0.00 | R0.00 | R113,908 |
| System Converter | R668.04 | R0.00 | R1,601 | -R955.71 | R0.00 | R1,313 |
| System | R215,444 | R1.85M | R402,906 | -R349,516 | R0.00 | R2.12M |

# Cash Flow

# Electrical Summary

**Excess and Unmet**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Excess Electricity | 3,341,718 | kWh/yr |
| Unmet Electric Load | 13,314 | kWh/yr |
| Capacity Shortage | 22,782 | kWh/yr |

**Production Summary**

|  |  |  |
| --- | --- | --- |
| Component | Production (kWh/yr) | Percent |
| Generic flat plate PV | 1,748,505 | 31.0 |
| Generic 10 kW | 3,387,181 | 60.0 |
| Grid Purchases | 513,495 | 9.09 |
| Total | 5,649,182 | 100 |

**Consumption Summary**

|  |  |  |
| --- | --- | --- |
| Component | Consumption (kWh/yr) | Percent |
| AC Primary Load | 1,507,782 | 66.2 |
| DC Primary Load | 768,747 | 33.8 |
| Deferrable Load | 0 | 0 |
| Total | 2,276,528 | 100 |

# PV: Generic flat plate PV

**Generic flat plate PV Electrical Summary**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Minimum Output | 0 | kW |
| Maximum Output | 991 | kW |
| PV Penetration | 76.4 | % |
| Hours of Operation | 4,370 | hrs/yr |
| Levelized Cost | 0.0490 | R/kWh |

**Generic flat plate PV Statistics**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Rated Capacity | 1,000 | kW |
| Mean Output | 200 | kW |
| Mean Output | 4,790 | kWh/d |
| Capacity Factor | 20.0 | % |
| Total Production | 1,748,505 | 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 | 1,000 | kW |
| Wind Penetration | 148 | % |
| Hours of Operation | 7,817 | hrs/yr |
| Levelized Cost | 0.0391 | R/kWh |

**Generic 10 kW Statistics**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Total Rated Capacity | 1,000 | kW |
| Mean Output | 387 | kW |
| Capacity Factor | 38.7 | % |
| Total Production | 3,387,181 | kWh/yr |

**Generic 10 kW Output (kW)**

# Storage: Generic 100kWh Li-Ion

**Generic 100kWh Li-Ion Properties**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Batteries | 5.00 | qty. |
| String Size | 1.00 | batteries |
| Strings in Parallel | 5.00 | strings |
| Bus Voltage | 600 | V |

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

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Average Energy Cost | 1.09 | R/kWh |
| Energy In | 54,172 | kWh/yr |
| Energy Out | 48,755 | kWh/yr |
| Storage Depletion | 0 | kWh/yr |
| Losses | 5,417 | kWh/yr |
| Annual Throughput | 51,392 | kWh/yr |

**Generic 100kWh Li-Ion Statistics**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Autonomy | 1.53 | hr |
| Storage Wear Cost | 2.27 | R/kWh |
| Nominal Capacity | 500 | kWh |
| Usable Nominal Capacity | 400 | kWh |
| Lifetime Throughput | 770,886 | 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 | 1,479 | hrs/yr |
| Energy Out | 138,094 | kWh/yr |
| Energy In | 145,362 | kWh/yr |
| Losses | 7,268 | kWh/yr |

**System Converter Statistics**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Capacity | 130 | kW |
| Mean Output | 15.8 | kW |
| Minimum Output | 0 | kW |
| Maximum Output | 130 | kW |
| Capacity Factor | 12.2 | % |

**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 | 320 | R0.00 | R70,316 |
| February | 0 | 0 | 0 | 333 | R0.00 | R73,160 |
| March | 0 | 0 | 0 | 338 | R0.00 | R74,307 |
| April | 0 | 0 | 0 | 338 | R0.00 | R74,273 |
| May | 0 | 0 | 0 | 342 | R0.00 | R75,165 |
| June | 0 | 0 | 0 | 362 | R0.00 | R79,723 |
| July | 0 | 0 | 0 | 341 | R0.00 | R74,896 |
| August | 0 | 0 | 0 | 382 | R0.00 | R84,034 |
| September | 0 | 0 | 0 | 356 | R0.00 | R78,223 |
| October | 0 | 0 | 0 | 325 | R0.00 | R71,578 |
| November | 0 | 0 | 0 | 299 | R0.00 | R65,750 |
| December | 0 | 0 | 0 | 310 | R0.00 | R68,145 |
| Annual | 0 | 0 | 0 | 382 | R0.00 | R889,568 |

**Grid rate: OffPeak-Summer**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | Energy Purchased (kWh) | Energy Sold (kWh) | Net Energy Purchased (kWh) | Peak Demand (kW) | Energy Charge | Demand Charge |
| January | 17,201 | 0 | 17,201 | 0 | R20,819 | R0.00 |
| February | 19,698 | 0 | 19,698 | 0 | R23,841 | R0.00 |
| March | 28,162 | 0 | 28,162 | 0 | R34,084 | R0.00 |
| April | 33,313 | 0 | 33,313 | 0 | R40,319 | R0.00 |
| May | 40,695 | 0 | 40,695 | 0 | R49,254 | 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 | 30,848 | 0 | 30,848 | 0 | R37,335 | R0.00 |
| October | 24,568 | 0 | 24,568 | 0 | R29,734 | R0.00 |
| November | 19,974 | 0 | 19,974 | 0 | R24,175 | R0.00 |
| December | 23,139 | 0 | 23,139 | 0 | R28,005 | R0.00 |
| Annual | 237,598 | 0 | 237,598 | 0 | R287,565 | 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 | 6,758 | 0 | 6,758 | 0 | R11,232 | R0.00 |
| February | 7,716 | 0 | 7,716 | 0 | R12,824 | R0.00 |
| March | 10,518 | 0 | 10,518 | 0 | R17,480 | R0.00 |
| April | 12,024 | 0 | 12,024 | 0 | R19,984 | R0.00 |
| May | 14,262 | 0 | 14,262 | 0 | R23,704 | R0.00 |
| June | 7,852 | 0 | 7,852 | 0 | R13,051 | R0.00 |
| July | 7,139 | 0 | 7,139 | 0 | R11,865 | R0.00 |
| August | 8,908 | 0 | 8,908 | 0 | R14,805 | R0.00 |
| September | 9,160 | 0 | 9,160 | 0 | R15,224 | R0.00 |
| October | 9,272 | 0 | 9,272 | 0 | R15,410 | R0.00 |
| November | 6,052 | 0 | 6,052 | 0 | R10,059 | R0.00 |
| December | 6,090 | 0 | 6,090 | 0 | R10,122 | R0.00 |
| Annual | 105,752 | 0 | 105,752 | 0 | R175,759 | 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 | 3,543 | 0 | 3,543 | 0 | R7,870 | R0.00 |
| February | 3,991 | 0 | 3,991 | 0 | R8,864 | R0.00 |
| March | 5,935 | 0 | 5,935 | 0 | R13,181 | R0.00 |
| April | 5,831 | 0 | 5,831 | 0 | R12,951 | R0.00 |
| May | 8,882 | 0 | 8,882 | 0 | R19,726 | 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 | 5,430 | 0 | 5,430 | 0 | R12,061 | R0.00 |
| October | 4,784 | 0 | 4,784 | 0 | R10,625 | R0.00 |
| November | 1,123 | 0 | 1,123 | 0 | R2,494 | R0.00 |
| December | 3,228 | 0 | 3,228 | 0 | R7,170 | R0.00 |
| Annual | 42,748 | 0 | 42,748 | 0 | R94,942 | 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 | 32,906 | 0 | 32,906 | 0 | R43,824 | R0.00 |
| July | 38,919 | 0 | 38,919 | 0 | R51,832 | R0.00 |
| August | 32,071 | 0 | 32,071 | 0 | R42,713 | 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 | 103,896 | 0 | 103,896 | 0 | R138,369 | 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 | 4,930 | 0 | 4,930 | 0 | R10,318 | R0.00 |
| July | 3,418 | 0 | 3,418 | 0 | R7,154 | R0.00 |
| August | 5,361 | 0 | 5,361 | 0 | R11,220 | 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 | 13,709 | 0 | 13,709 | 0 | R28,692 | 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 | 4,154 | 0 | 4,154 | 0 | R24,619 | R0.00 |
| July | 2,190 | 0 | 2,190 | 0 | R12,981 | R0.00 |
| August | 3,449 | 0 | 3,449 | 0 | R20,444 | 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 | 9,793 | 0 | 9,793 | 0 | R58,043 | R0.00 |

**Grid rate: All**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | Energy Purchased (kWh) | Energy Sold (kWh) | Net Energy Purchased (kWh) | Peak Demand (kW) | Energy Charge | Demand Charge |
| January | 27,503 | 0 | 27,503 | 320 | R39,920 | R70,316 |
| February | 31,405 | 0 | 31,405 | 333 | R45,529 | R73,160 |
| March | 44,614 | 0 | 44,614 | 338 | R64,745 | R74,307 |
| April | 51,169 | 0 | 51,169 | 338 | R73,255 | R74,273 |
| May | 63,839 | 0 | 63,839 | 342 | R92,684 | R75,165 |
| June | 49,842 | 0 | 49,842 | 362 | R91,812 | R79,723 |
| July | 51,666 | 0 | 51,666 | 341 | R83,832 | R74,896 |
| August | 49,789 | 0 | 49,789 | 382 | R89,181 | R84,034 |
| September | 45,438 | 0 | 45,438 | 356 | R64,619 | R78,223 |
| October | 38,624 | 0 | 38,624 | 325 | R55,770 | R71,578 |
| November | 27,149 | 0 | 27,149 | 299 | R36,727 | R65,750 |
| December | 32,457 | 0 | 32,457 | 310 | R45,297 | R68,145 |
| Annual | 513,495 | 0 | 513,495 | 382 | R783,371 | R889,568 |

**Energy Purchased From Grid (kW)**

**Energy Sold To Grid (kW)**

# Compare Economics

IRR (%):**33.1**

Discounted payback (yr):**2.69**

Simple payback (yr):**3.01**

|  |  |  |
| --- | --- | --- |
|  | Base System | Proposed System |
| Net Present Cost | R349M | R123M |
| CAPEX | R68,550 | R12.5M |
| OPEX | R6.00M | R1.91M |
| LCOE (per kWh) | R2.86 | R0.932 |
| CO2 Emitted (kg/yr) | 1,347,349 | 324,529 |
| 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: