**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:** R144,182,900.00

**Levelized Cost of Energy (R/kWh):** R1.09

**Notes:** PV limit: 500units

Wind limit: 50 units

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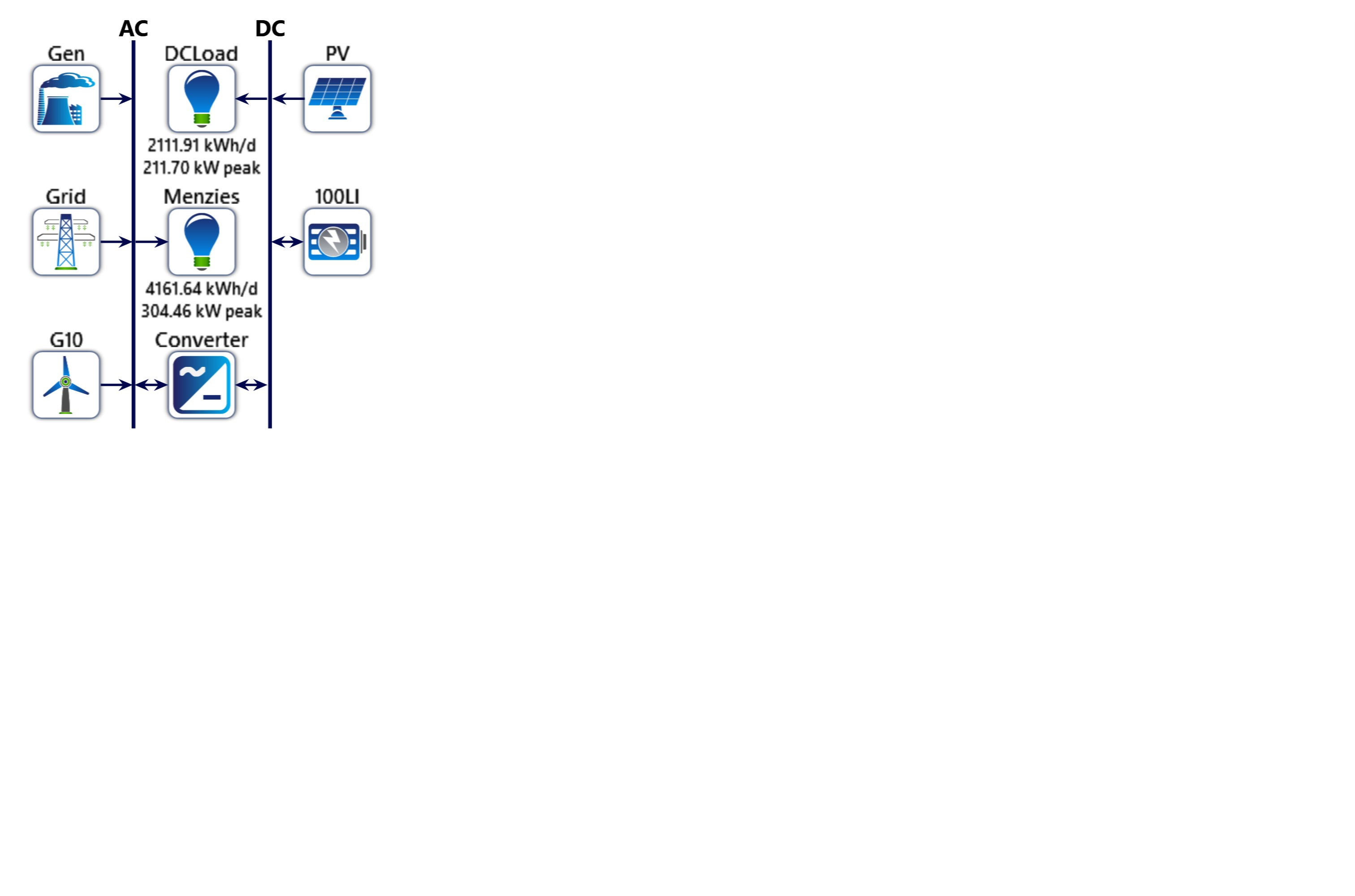
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# System Architecture

|  |  |  |  |
| --- | --- | --- | --- |
| Component | Name | Size | Unit |
| PV | Generic flat plate PV | 500 | kW |
| Storage | Generic 100kWh Li-Ion | 6 | strings |
| Wind turbine | Generic 10 kW | 50 | ea. |
| System converter | System Converter | 133 | 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 | R2.43M | R1.45M | R7.79M | -R7.82M | R0.00 | R3.86M |
| Generic 100kWh Li-Ion | R3.88M | R348,938 | R9.30M | -R5.55M | R0.00 | R7.98M |
| Generic flat plate PV | R2.20M | R290,782 | R0.00 | R0.00 | R0.00 | R2.49M |
| Grid | R0.00 | R121M | R0.00 | R0.00 | R0.00 | R121M |
| Other | R0.00 | R9.25M | R0.00 | R0.00 | R0.00 | R9.25M |
| System Converter | R39,988 | R0.00 | R95,832 | -R57,207 | R0.00 | R78,613 |
| System | R8.55M | R132M | R17.2M | -R13.4M | R0.00 | R144M |

**Annualized Costs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Name | Capital | Operating | Replacement | Salvage | Resource | Total |
| Generic 10 kW | R41,782 | R25,000 | R134,001 | -R134,493 | R0.00 | R66,290 |
| Generic 100kWh Li-Ion | R66,747 | R6,000 | R159,964 | -R95,490 | R0.00 | R137,221 |
| Generic flat plate PV | R37,795 | R5,000 | R0.00 | R0.00 | R0.00 | R42,795 |
| Grid | R0.00 | R2.07M | R0.00 | R0.00 | R0.00 | R2.07M |
| Other | R0.00 | R158,969 | R0.00 | R0.00 | R0.00 | R158,969 |
| System Converter | R687.59 | R0.00 | R1,648 | -R983.68 | R0.00 | R1,352 |
| System | R147,012 | R2.27M | R295,613 | -R230,967 | R0.00 | R2.48M |

# Cash Flow

# Electrical Summary

**Excess and Unmet**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Excess Electricity | 974,938 | kWh/yr |
| Unmet Electric Load | 16,794 | kWh/yr |
| Capacity Shortage | 31,794 | kWh/yr |

**Production Summary**

|  |  |  |
| --- | --- | --- |
| Component | Production (kWh/yr) | Percent |
| Generic flat plate PV | 874,253 | 26.6 |
| Generic 10 kW | 1,693,591 | 51.6 |
| Grid Purchases | 716,062 | 21.8 |
| Total | 3,283,905 | 100 |

**Consumption Summary**

|  |  |  |
| --- | --- | --- |
| Component | Consumption (kWh/yr) | Percent |
| AC Primary Load | 1,505,115 | 66.2 |
| DC Primary Load | 767,934 | 33.8 |
| Deferrable Load | 0 | 0 |
| Total | 2,273,049 | 100 |

# PV: Generic flat plate PV

**Generic flat plate PV Electrical Summary**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Minimum Output | 0 | kW |
| Maximum Output | 496 | kW |
| PV Penetration | 38.2 | % |
| Hours of Operation | 4,370 | hrs/yr |
| Levelized Cost | 0.0490 | R/kWh |

**Generic flat plate PV Statistics**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Rated Capacity | 500 | kW |
| Mean Output | 99.8 | kW |
| Mean Output | 2,395 | kWh/d |
| Capacity Factor | 20.0 | % |
| Total Production | 874,253 | 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 | 500 | kW |
| Wind Penetration | 74.0 | % |
| Hours of Operation | 7,817 | hrs/yr |
| Levelized Cost | 0.0391 | R/kWh |

**Generic 10 kW Statistics**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Total Rated Capacity | 500 | kW |
| Mean Output | 193 | kW |
| Capacity Factor | 38.7 | % |
| Total Production | 1,693,591 | kWh/yr |

**Generic 10 kW Output (kW)**

# Storage: Generic 100kWh Li-Ion

**Generic 100kWh Li-Ion Properties**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Batteries | 6.00 | qty. |
| String Size | 1.00 | batteries |
| Strings in Parallel | 6.00 | strings |
| Bus Voltage | 600 | V |

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

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Average Energy Cost | 1.16 | R/kWh |
| Energy In | 76,736 | kWh/yr |
| Energy Out | 69,063 | kWh/yr |
| Storage Depletion | 0 | kWh/yr |
| Losses | 7,674 | kWh/yr |
| Annual Throughput | 72,798 | kWh/yr |

**Generic 100kWh Li-Ion Statistics**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Autonomy | 1.84 | hr |
| Storage Wear Cost | 2.27 | R/kWh |
| Nominal Capacity | 600 | kWh |
| Usable Nominal Capacity | 480 | kWh |
| Lifetime Throughput | 1,091,974 | 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 | 1,645 | hrs/yr |
| Energy Out | 140,747 | kWh/yr |
| Energy In | 148,154 | kWh/yr |
| Losses | 7,408 | kWh/yr |

**System Converter Statistics**

|  |  |  |
| --- | --- | --- |
| Quantity | Value | Units |
| Capacity | 133 | kW |
| Mean Output | 16.1 | kW |
| Minimum Output | 0 | kW |
| Maximum Output | 133 | kW |
| Capacity Factor | 12.1 | % |

**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 | 338 | R0.00 | R74,340 |
| February | 0 | 0 | 0 | 372 | R0.00 | R81,732 |
| March | 0 | 0 | 0 | 393 | R0.00 | R86,486 |
| April | 0 | 0 | 0 | 356 | R0.00 | R78,325 |
| May | 0 | 0 | 0 | 363 | R0.00 | R79,760 |
| June | 0 | 0 | 0 | 377 | R0.00 | R83,003 |
| July | 0 | 0 | 0 | 369 | R0.00 | R81,214 |
| August | 0 | 0 | 0 | 420 | R0.00 | R92,369 |
| September | 0 | 0 | 0 | 388 | R0.00 | R85,285 |
| October | 0 | 0 | 0 | 330 | R0.00 | R72,681 |
| November | 0 | 0 | 0 | 314 | R0.00 | R69,094 |
| December | 0 | 0 | 0 | 314 | R0.00 | R69,022 |
| Annual | 0 | 0 | 0 | 420 | R0.00 | R953,311 |

**Grid rate: OffPeak-Summer**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | Energy Purchased (kWh) | Energy Sold (kWh) | Net Energy Purchased (kWh) | Peak Demand (kW) | Energy Charge | Demand Charge |
| January | 22,145 | 0 | 22,145 | 0 | R26,803 | R0.00 |
| February | 26,139 | 0 | 26,139 | 0 | R31,636 | R0.00 |
| March | 35,011 | 0 | 35,011 | 0 | R42,374 | R0.00 |
| April | 41,344 | 0 | 41,344 | 0 | R50,038 | R0.00 |
| May | 49,171 | 0 | 49,171 | 0 | R59,512 | 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 | 40,275 | 0 | 40,275 | 0 | R48,744 | R0.00 |
| October | 32,256 | 0 | 32,256 | 0 | R39,040 | R0.00 |
| November | 25,345 | 0 | 25,345 | 0 | R30,675 | R0.00 |
| December | 30,220 | 0 | 30,220 | 0 | R36,575 | R0.00 |
| Annual | 301,906 | 0 | 301,906 | 0 | R365,397 | 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 | 9,264 | 0 | 9,264 | 0 | R15,397 | R0.00 |
| February | 11,480 | 0 | 11,480 | 0 | R19,080 | R0.00 |
| March | 16,394 | 0 | 16,394 | 0 | R27,247 | R0.00 |
| April | 18,483 | 0 | 18,483 | 0 | R30,718 | R0.00 |
| May | 21,810 | 0 | 21,810 | 0 | R36,248 | R0.00 |
| June | 9,974 | 0 | 9,974 | 0 | R16,577 | R0.00 |
| July | 9,726 | 0 | 9,726 | 0 | R16,165 | R0.00 |
| August | 12,869 | 0 | 12,869 | 0 | R21,388 | R0.00 |
| September | 13,084 | 0 | 13,084 | 0 | R21,745 | R0.00 |
| October | 14,955 | 0 | 14,955 | 0 | R24,856 | R0.00 |
| November | 9,963 | 0 | 9,963 | 0 | R16,559 | R0.00 |
| December | 7,844 | 0 | 7,844 | 0 | R13,037 | R0.00 |
| Annual | 155,846 | 0 | 155,846 | 0 | R259,016 | 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 | 6,025 | 0 | 6,025 | 0 | R13,382 | R0.00 |
| February | 7,019 | 0 | 7,019 | 0 | R15,590 | R0.00 |
| March | 10,355 | 0 | 10,355 | 0 | R22,998 | R0.00 |
| April | 9,395 | 0 | 9,395 | 0 | R20,867 | R0.00 |
| May | 13,270 | 0 | 13,270 | 0 | R29,472 | 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 | 9,128 | 0 | 9,128 | 0 | R20,274 | R0.00 |
| October | 7,699 | 0 | 7,699 | 0 | R17,099 | R0.00 |
| November | 3,024 | 0 | 3,024 | 0 | R6,716 | R0.00 |
| December | 5,414 | 0 | 5,414 | 0 | R12,025 | R0.00 |
| Annual | 71,329 | 0 | 71,329 | 0 | R158,422 | 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 | 43,154 | 0 | 43,154 | 0 | R57,473 | R0.00 |
| July | 51,923 | 0 | 51,923 | 0 | R69,151 | R0.00 |
| August | 43,497 | 0 | 43,497 | 0 | R57,929 | 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 | 138,575 | 0 | 138,575 | 0 | R184,554 | 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 | 12,948 | 0 | 12,948 | 0 | R27,100 | R0.00 |
| July | 9,269 | 0 | 9,269 | 0 | R19,400 | R0.00 |
| August | 12,996 | 0 | 12,996 | 0 | R27,200 | 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 | 35,212 | 0 | 35,212 | 0 | R73,699 | 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 | 5,425 | 0 | 5,425 | 0 | R32,155 | R0.00 |
| July | 3,197 | 0 | 3,197 | 0 | R18,947 | R0.00 |
| August | 4,572 | 0 | 4,572 | 0 | R27,100 | 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 | 13,194 | 0 | 13,194 | 0 | R78,202 | R0.00 |

**Grid rate: All**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Month | Energy Purchased (kWh) | Energy Sold (kWh) | Net Energy Purchased (kWh) | Peak Demand (kW) | Energy Charge | Demand Charge |
| January | 37,435 | 0 | 37,435 | 338 | R55,582 | R74,340 |
| February | 44,638 | 0 | 44,638 | 372 | R66,306 | R81,732 |
| March | 61,760 | 0 | 61,760 | 393 | R92,619 | R86,486 |
| April | 69,222 | 0 | 69,222 | 356 | R101,623 | R78,325 |
| May | 84,251 | 0 | 84,251 | 363 | R125,232 | R79,760 |
| June | 71,501 | 0 | 71,501 | 377 | R133,305 | R83,003 |
| July | 74,115 | 0 | 74,115 | 369 | R123,662 | R81,214 |
| August | 73,934 | 0 | 73,934 | 420 | R133,618 | R92,369 |
| September | 62,487 | 0 | 62,487 | 388 | R90,764 | R85,285 |
| October | 54,911 | 0 | 54,911 | 330 | R80,995 | R72,681 |
| November | 38,331 | 0 | 38,331 | 314 | R53,949 | R69,094 |
| December | 43,478 | 0 | 43,478 | 314 | R61,637 | R69,022 |
| Annual | 716,062 | 0 | 716,062 | 420 | R1.12M | R953,311 |

**Energy Purchased From Grid (kW)**

**Energy Sold To Grid (kW)**

# Compare Economics

IRR (%):**43.8**

Discounted payback (yr):**2.08**

Simple payback (yr):**2.28**

|  |  |  |
| --- | --- | --- |
|  | Base System | Proposed System |
| Net Present Cost | R349M | R144M |
| CAPEX | R68,550 | R8.55M |
| OPEX | R6.00M | R2.33M |
| LCOE (per kWh) | R2.86 | R1.09 |
| CO2 Emitted (kg/yr) | 1,347,349 | 452,551 |
| 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: