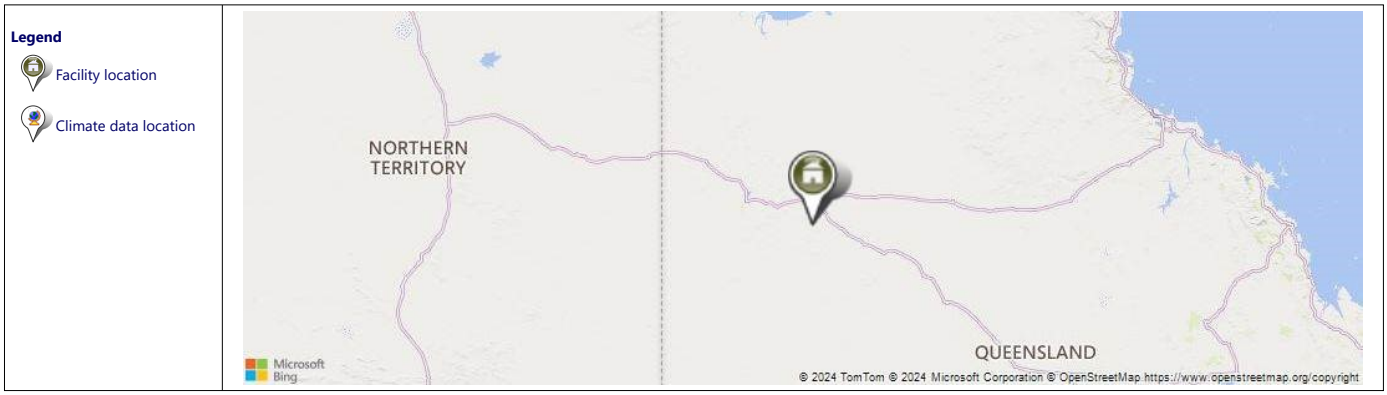
Site reference conditions

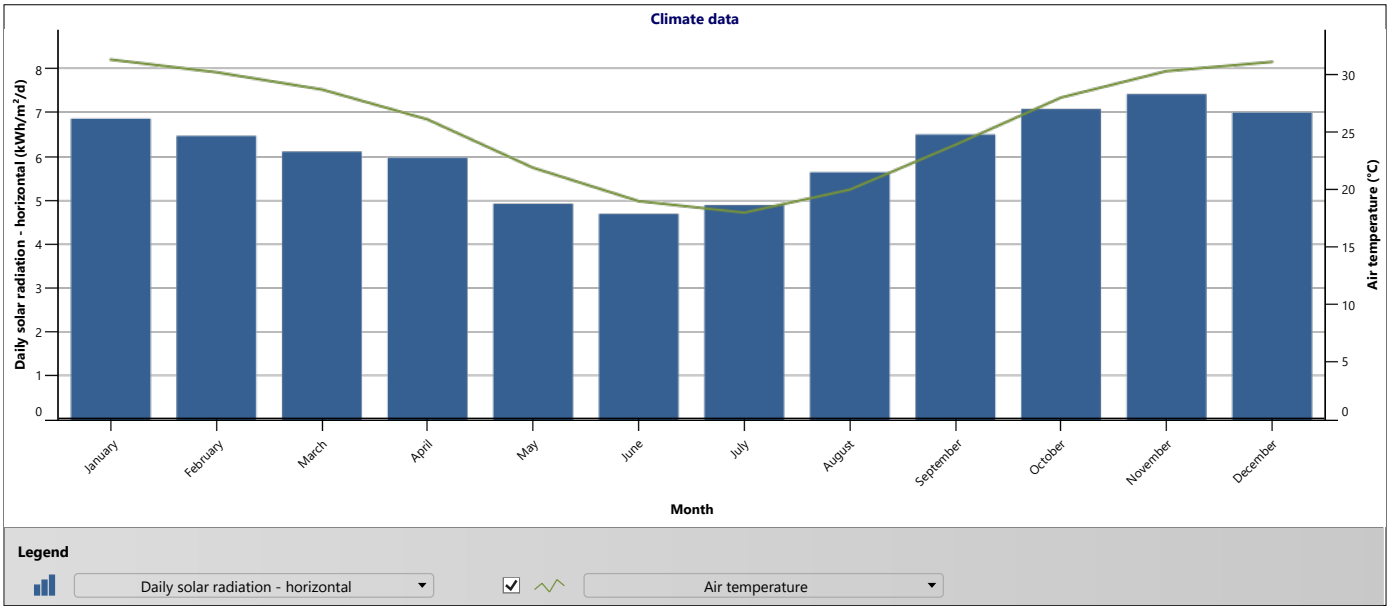
Climate data location: Australia - Queensland - Cloncurry A

Facility location: Australia



	Unit	Climate data location	Facility location	Source
Latitude		-20.7	-20.7	
Longitude		140.5	140.5	
Climate zone		1B - Very hot - Dry		Ground+NASA
Elevation	m	190	188	Ground – Map
Heating design temperature	°C	9.2		Ground
Cooling design temperature	°C	39.7		Ground
Earth temperature amplitude	°C	19.6		NASA

Month	Air temperature	Relative humidity	Precipitation	Daily solar radiation - horizontal	Atmospheric pressure	Wind speed	Earth temperature	Heating degree-days 18 °C	Cooling degree-days 10 °C
	°C	%	mm	kWh/m²/d	kPa	m/s	°C	°C-d	°C-d
January	31.3	48.5%	128.65	6.86	98.4	4.1	32.3	0	660
February	30.2	54.0%	106.96	6.47	98.5	4.1	31.0	0	566
March	28.7	47.5%	63.55	6.11	98.7	4.6	29.1	0	580
April	26.1	41.5%	16.50	5.97	99.1	4.1	26.9	0	483
May	21.9	42.0%	12.71	4.92	99.3	4.6	22.6	0	369
June	19.0	43.5%	10.50	4.69	99.5	3.6	18.9	0	270
July	18.0	39.5%	6.51	4.89	99.5	3.6	18.3	0	248
August	20.0	33.0%	2.79	5.64	99.5	3.6	21.1	0	310
September	23.9	28.0%	4.50	6.50	99.3	4.1	26.3	0	417
October	28.0	28.5%	20.46	7.08	99.0	4.1	30.7	0	558
November	30.3	29.5%	43.50	7.42	98.8	4.1	32.9	0	609
December	31.1	37.0%	82.77	7.00	98.5	4.1	33.6	0	654
Annual	**25.7**	**39.3%**	**499.40**	**6.13**	**99.0**	**4.1**	**26.9**	**0**	**5,724**
Source	Ground	Ground	NASA	Ground	Ground	Ground	NASA	Ground	Ground
Measured at					m	10	0		



Facility information

Facility type	Power | Storage | Off-grid
Type	Photovoltaic
Description	24 kWh/day - Genset → PV+Battery
Prepared for	*Prepared for*
Prepared by	*Prepared by*
Facility name	Archetype
Address	*Address*
City/Municipality	*City*
Province/State	*Province/State*
Country	Australia

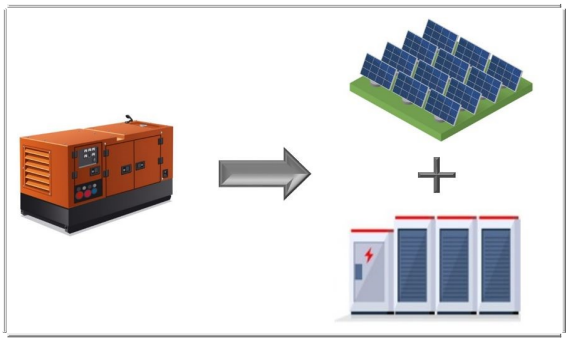
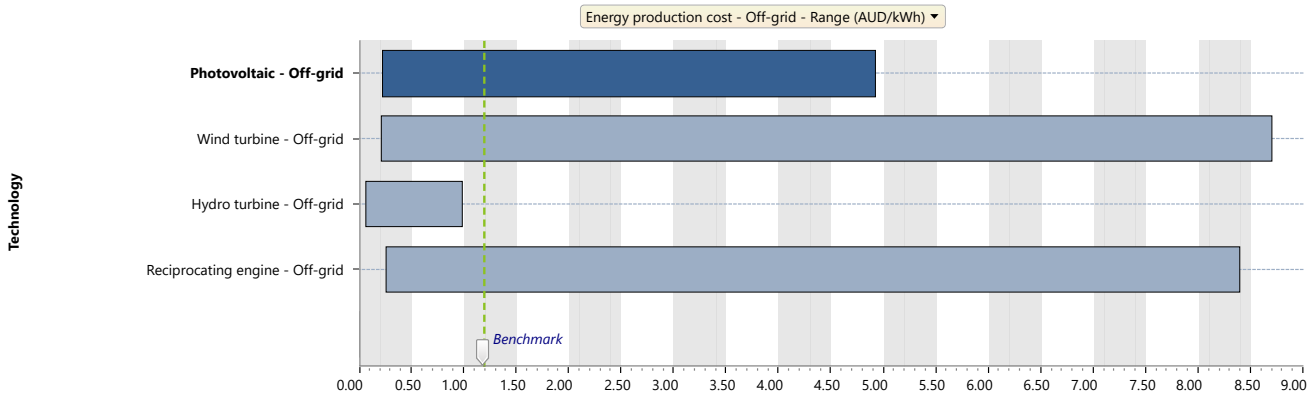


Photo | Image - Shutterstock.com

Benchmark - Power | Storage | Off-grid



Units AUD/kWh

Benchmark 1.19

Settings - Current

Settings - Cost database

Adjustment factor	1.0000	Currency	Australia	
Cumulative inflation rate	0%	Symbol	AUD	
(Begin: January 1, 2022)		Exchange rate	1.00000	$/AUD

Note: Typical cost values in Canadian $ as of January 1, 2022.
Purchasing power parity (Exchange rate) approximately 1.25 CAD = 1 USD.

Power project

- **Fuels**
  - Electricity and fuels
- **Base case**
  - Power system & load characteristics
- **Proposed case**
  - Inverter | Battery
  - Base load - Photovoltaic
- **Summary**
  - System summary

Method: Method 1 | Method 2

Power system & load characteristics

Base case power system

Technology		Reciprocating engine
Fuel type		Diesel (#2 oil) - L
Fuel rate	AUD/L	1.20
Capacity	kW	5
Heat rate	kJ/kWh	28,450
Annual O&M costs	AUD	3,000
Electricity rate - base case	AUD/kWh	1.22
Total electricity cost	AUD	11,134

Load characteristics

	Unit	Base case	Proposed case
Electricity - daily - DC	kWh	5	5
Electricity - daily - AC	kWh	20	20
Intermittent resource-load correlation			Zero

Percent of month used

	Unit	Base case	Proposed case	Energy saved	Incremental initial costs
Electricity - annual - DC	kWh	1,825	1,825	0%	
Electricity - annual - AC	kWh	7,300	7,300	0%	
Peak load - annual	kW		5		

Note - Power | Storage | Off-grid

Times New Ror 16

Archetype

Base case: Genset
Diesel-fired reciprocating engine generator (or multiple, staged generators for larger loads) supplying AC power on a continuous basis.
- The heat rate is strongly affected by the operating level: at loading levels below 75%, the heat rate can be much higher than the heat rate at full load. If the capacity of the generator or the daily load is adjusted, the heat rate may also need to be adjusted. The average operating level can be determined by:

$$\text{Average operating level (\%)} = \text{Daily load (kWh)} / (\text{Capacity of the generator (kW)} \times 24\ \text{h}) \times 100\%.$$

- The Annual O&M costs for the Base case power system includes a range of preventative maintenance and repairs that must be done on daily, weekly, monthly, biannual, and annual schedules. It does not include major overhauls, the cost of which appears on the Cost worksheet (Level 2 & 3). It does not include cost of land rental, managerial staff, insurance, etc.

Proposed case: PV + Battery
Photovoltaic array combined with an industrial AGM or gel battery, a charge controller with maximum power point tracking, and a pure sine-wave inverter.
- For supply of AC loads year-round.
- The Capacity of the inverter is equal to the annual Peak load. This value is used for the inverter Initial costs calculation.
- The system is designed to meet over 95% of the annual load (high latitude areas excepted).
- For latitudes greater than 55°, consider a PV + Battery + Genset system; during winter months, meeting the majority of the load with a PV + Battery system may be impossible or require an excessively large array. Thus, months with a tilted Daily solar radiation below 1 kWh/m²/day are ignored in the determination of the proposed array power capacity for PV + Battery systems.
- The Power capacity of the photovoltaic array is calculated as:

$$\text{Power capacity} = 1.6 \times \text{Daily AC electricity load (kWh/day)} / \text{Minimum (PSH/day)} / \text{Inverter efficiency}$$

where, PSH/day is the monthly value for the daily peak sun hours which is equivalent to the tilted Daily solar radiation monthly value. For latitude over 55°, the average of the two lowest values that are over 1 kWh/m²/day is used as the Minimum (PSH/day) in the above equation.
- For photovoltaic array with a Power capacity of 10 kW or larger, the cost of inverter is already included in the Initial costs of the Base load power system.
- For DC loads, delete the inverter, move load from Electricity – daily – AC to Electricity – daily – DC, and delete inverter costs from Cost worksheet.

Note:
Initial and O&M costs can be 2 to 3 times higher than indicated for very remote communities/industrial sites. Costs can also be higher than indicated where markets for the given technology are poorly developed (e.g., the technology is rarely employed).

Initial costs (credits)	Unit	Quantity	Unit cost		Amount	Relative costs
Feasibility study						
Feasibility study	cost			AUD	-	
Subtotal:				**AUD**	**-**	
Development						
Development	cost			AUD	-	
Subtotal:				**AUD**	**-**	
Engineering						
Engineering	cost			AUD	-	
Subtotal:				**AUD**	**-**	
Power system						
Base load - Photovoltaic	kW	7.59	AUD 3,035.0265	AUD	23,036	
Inverter	kW	5	AUD 400	AUD	2,000	
Battery	kWh	23	AUD 320.2092	AUD	7,378	
Energy efficiency measures - DC	project			AUD	-	
Energy efficiency measures - AC	project			AUD	-	
Road construction	km			AUD	-	
Transmission line	km			AUD	-	
Substation	project			AUD	-	
Purchase and installation of generator & balance	credit	1	AUD 10,000	AUD	(10,000)	
Subtotal:				**AUD**	**22,413**	100.0%
Balance of system & miscellaneous						
Spare parts	%			AUD	-	
Transportation	project			AUD	-	
Training & commissioning	p-d			AUD	-	
Electrical infrastructure	project			AUD	-	
User-defined	cost			AUD	-	
Contingencies	%		AUD 22,413	AUD	-	
Interest during construction			AUD 22,413	AUD	-	
Subtotal:				**AUD**	**-**	
Total initial costs				**AUD**	**22,413**	100.0%

Annual costs (credits)	Unit	Quantity	Unit cost		Amount
O&M					
Show data				AUD	287
Parts & labour	project			AUD	-
User-defined	cost			AUD	-
Contingencies	%		AUD 287	AUD	-
Subtotal:				**AUD**	**287**

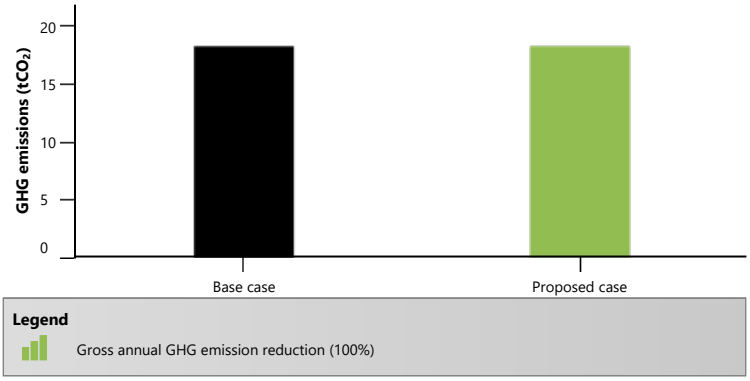
Annual savings	Unit	Quantity	Unit cost		Amount
Fuel cost - base case					
Diesel (#2 oil)	L	6,778	AUD 1.64	AUD	11,134
Subtotal:				**AUD**	**11,134**
User-defined	cost			AUD	-
Subtotal:				**AUD**	**-**

Periodic costs (credits)	Unit	Year	Unit cost		Amount
Generator replacement	credit	2	AUD 10,000	AUD	(10,000)
Proposed case battery replacement	cost	6	AUD 28,019.5841	AUD	28,020
Proposed case inverter replacement	cost	13	AUD 2,000	AUD	2,000
End of project life	cost			AUD	-

Emission analysis

GHG emissions

Base case	tCO_2	18.2	
Proposed case	tCO_2	0	
Gross annual GHG emission reduction	tCO_2	18.2	100%



18.2 tCO_2 is equivalent to 3.3

Cars & light trucks not used

Carbon shadow price | GHG reduction revenue

Carbon shadow price | AUD/tCO_2 |

Carbon offsets

Remaining GHG emission reduction required	tCO_2	0	0	

Financial parameters

General

Fuel cost escalation rate		2%
Inflation rate	%	2%
Discount rate	%	9%
Reinvestment rate	%	9%
Project life	yr	20

Finance

Incentives and grants	AUD	
Debt ratio	%	70%
Debt	AUD	15,689
Equity	AUD	6,724
Debt interest rate	%	7%
Debt term	yr	15
Debt payments	AUD/yr	1,723

Income tax analysis ☐

Annual savings and revenue

GHG reduction savings

Gross GHG reduction	tCO_2/yr	18
Gross GHG reduction - 20 yrs	tCO_2	365
GHG reduction savings	AUD	0

Other revenue (cost) ☐

Costs | Savings | Revenue

Initial costs

Power system	100%	AUD	22,413
Total initial costs	**100%**	AUD	**22,413**

Yearly cash flows - Year 1

Annual costs and debt payments

O&M	AUD	287
Debt payments - 15 yrs	AUD	1,723
Total annual costs	**AUD**	**2,010**

Annual savings and revenue

Fuel cost - base case	AUD	11,134
GHG reduction savings	AUD	0
Total annual savings and revenue	**AUD**	**11,134**
Net yearly cash flow - Year 1	**AUD**	**9,124**

Periodic costs (credits)

Generator replacement - 2 yrs	AUD	-10,000
Proposed case battery replacement - 6 yrs	AUD	28,020
Proposed case inverter replacement - 13 yrs	AUD	2,000

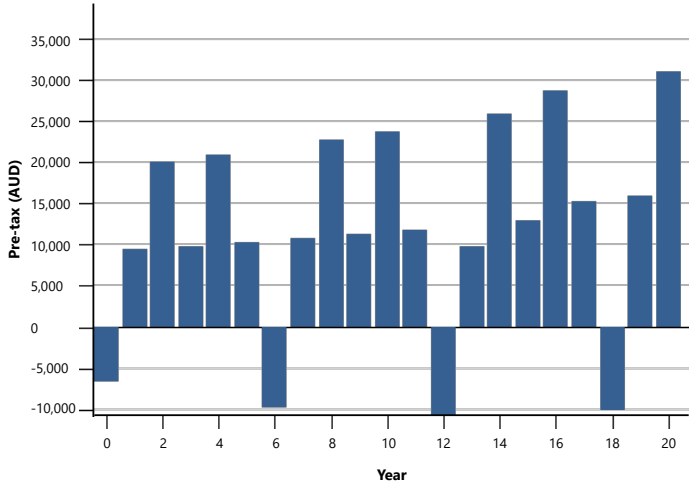
Financial viability

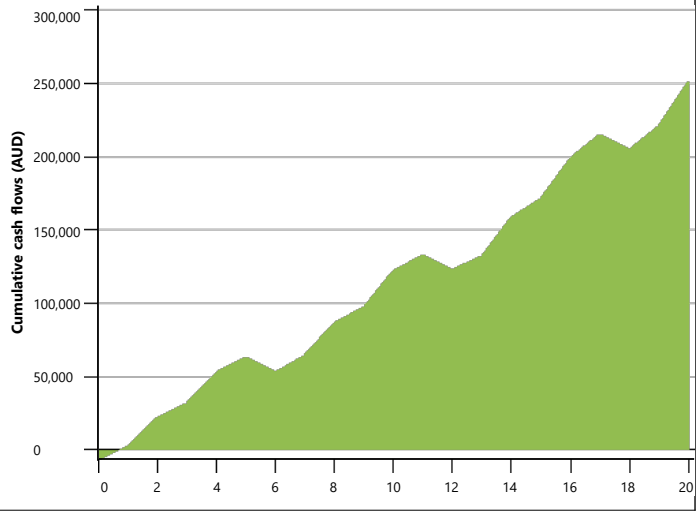
Pre-tax IRR - equity	%	180%
Pre-tax MIRR - equity	%	19.9%
Pre-tax IRR - assets	%	56.2%
Pre-tax MIRR - assets	%	16.3%
Simple payback	yr	2.1
Equity payback	yr	0.72
Net Present Value (NPV)	AUD	106,522
Annual life cycle savings	AUD/yr	11,669
Benefit-Cost (B-C) ratio		16.8
Debt service coverage		6.4
GHG reduction cost	AUD/tCO_2	-629
Energy production cost	AUD/kWh	0.959

Yearly cash flows

Year #	Pre-tax AUD	Cumulative AUD
0	-6,724	-6,724
1	9,341	2,617
2	19,966	22,583
3	9,788	32,371
4	20,842	53,213
5	10,253	63,466
6	-9,801	53,665
7	10,737	64,402
8	22,702	87,104
9	11,240	98,344
10	23,689	122,033
11	11,764	133,797
12	-10,820	122,977
13	9,721	132,699
14	25,784	158,483
15	12,875	171,358
16	28,618	199,976
17	15,188	215,163
18	-10,245	204,919
19	15,801	220,720
20	30,977	251,697

Yearly cash flows





Sensitivity analysis

Perform analysis on	Net Present Value (NPV)	
Sensitivity range	25%	
Threshold	0	AUD

- Remove analysis

Fuel cost - base case		Initial costs: 16,810	19,612	22,413	25,215	28,017 AUD
AUD		-25.0%	-12.5%	0.0%	12.5%	25.0%
8,350	-25.0%	81,869	79,293	76,716	74,140	71,564
9,742	-12.5%	96,771	94,195	91,619	89,043	86,467
11,134	0.0%	111,674	109,098	**106,522**	103,946	101,369
12,526	12.5%	126,577	124,001	121,424	118,848	116,272
13,917	25.0%	141,479	138,903	136,327	133,751	131,175

- Remove analysis

O&M		Initial costs: 16,810	19,612	22,413	25,215	28,017 AUD
AUD		-25.0%	-12.5%	0.0%	12.5%	25.0%
216	-25.0%	112,443	109,867	107,291	104,715	102,139
251	-12.5%	112,059	109,483	106,906	104,330	101,754
287	0.0%	111,674	109,098	**106,522**	103,946	101,369
323	12.5%	111,289	108,713	106,137	103,561	100,985
359	25.0%	110,905	108,329	105,752	103,176	100,600

- Remove analysis

Debt ratio		Debt interest rate: 5.25%	6.13%	7.00%	7.88%	8.75% %
%		-25.0%	-12.5%	0.0%	12.5%	25.0%
53%	-25.0%	107,192	106,639	106,071	105,488	104,891
61%	-12.5%	107,604	106,959	106,296	105,616	104,920
70%	0.0%	108,016	107,279	**106,522**	105,745	104,949
79%	12.5%	108,429	107,599	106,747	105,873	104,977
88%	25.0%	108,841	107,920	106,973	106,001	105,006

- Remove analysis

Debt term		Debt interest rate: 5.25%	6.13%	7.00%	7.88%	8.75% %
yr		-25.0%	-12.5%	0.0%	12.5%	25.0%
11	-25.0%	107,384	106,783	106,169	105,542	104,903
13	-12.5%	107,713	107,041	106,352	105,647	104,926
15	0.0%	108,016	107,279	**106,522**	105,745	104,949
17	12.5%	108,294	107,498	106,678	105,834	104,969
19	25.0%	108,550	107,699	106,821	105,917	104,988

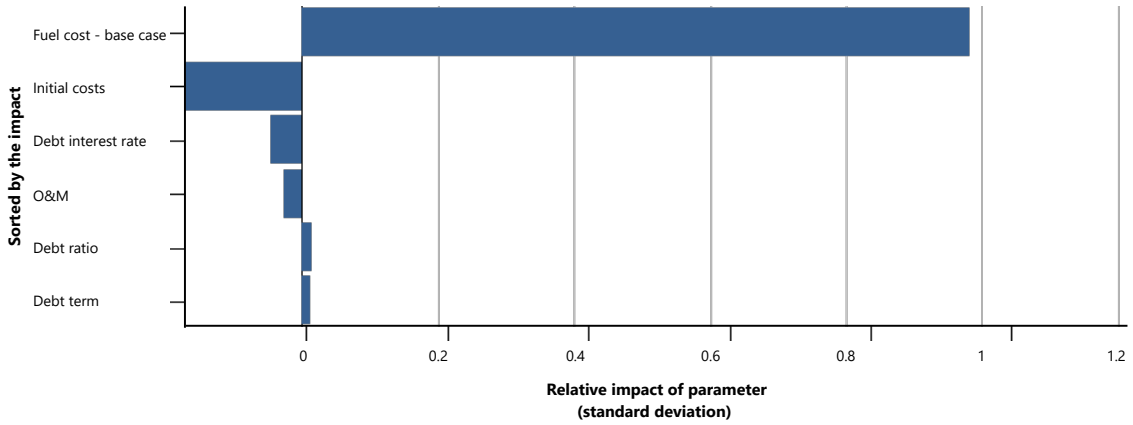
+ Add analysis

Risk analysis

Perform analysis on	Net Present Value (NPV)
Number of combinations	500
Random seed	No

Parameter	Unit	Value	Range (+/-)	Minimum	Maximum
Initial costs	AUD	22,413	25%	16,810	28,017
O&M	AUD	287	25%	216	359
Fuel cost - base case	AUD	11,134	25%	8,350	13,917
Debt ratio	%	70.0%	25%	52.5%	87.5%
Debt interest rate	%	7.00%	25%	5.25%	8.75%
Debt term	yr	15	25%	11	19

Impact - Net Present Value (NPV)



Median	AUD	107,156
Level of risk	%	10%
Minimum within level of confidence	AUD	91,163
Maximum within level of confidence	AUD	122,795

Distribution - Net Present Value (NPV)