

Site reference conditions

Climate data location

Australia - Queensland - Atherton



Facility location

Australia - QLD - Atherton

Legend

Facility location

Climate data location

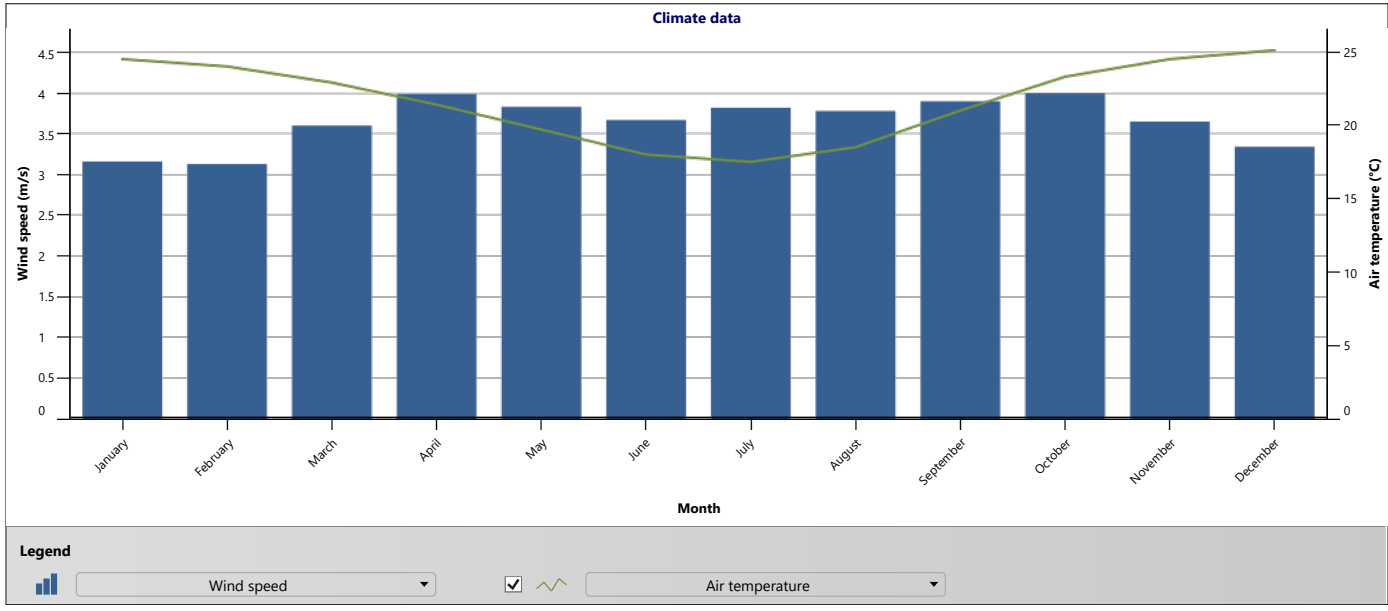
	Unit	Climate data location	Facility location	Source
Latitude		-17.3	-17.3	
Longitude		145.5	145.5	
Climate zone		2A - Hot - Humid		NASA
Elevation	m	556	767	NASA - Map
Heating design temperature	°C	15.7		NASA
Cooling design temperature	°C	28.6		NASA
Earth temperature amplitude	°C	9.1		NASA

Month	Air temperature °C	Relative humidity %	Precipitation mm	Daily solar radiation - horizontal kWh/m²/d	Atmospheric pressure kPa	Wind speed m/s	Earth temperature °C	Heating degree-days 18 °C °C-d	Cooling degree-days 10 °C °C-d
January	24.5	79.5%	292.33	6.12	94.6	3.2	25.3	0	450
February	24.0	85.3%	342.16	5.48	94.6	3.1	24.5	0	392
March	22.9	85.6%	262.88	5.38	94.8	3.6	23.3	0	400
April	21.4	84.7%	145.20	4.85	95.0	4.0	21.8	0	342
May	19.7	82.9%	82.46	4.41	95.1	3.8	20.1	0	301
June	18.0	79.4%	48.00	4.30	95.2	3.7	18.5	0	240
July	17.5	76.1%	40.92	4.59	95.3	3.8	18.0	16	233
August	18.5	70.7%	30.38	5.27	95.3	3.8	19.4	0	264
September	21.0	63.9%	25.20	6.31	95.2	3.9	22.2	0	330
October	23.3	62.0%	47.74	6.88	95.1	4.0	24.8	0	412
November	24.5	65.4%	104.40	6.84	94.8	3.7	26.0	0	435
December	25.1	70.8%	175.15	6.52	94.7	3.3	26.2	0	468
Annual	21.7	75.5%	1,596.82	5.58	95.0	3.7	22.5	16	4,266
Source	NASA	NASA	NASA	NASA	NASA	NASA	NASA	NASA	NASA

Measured at

m

 10 0



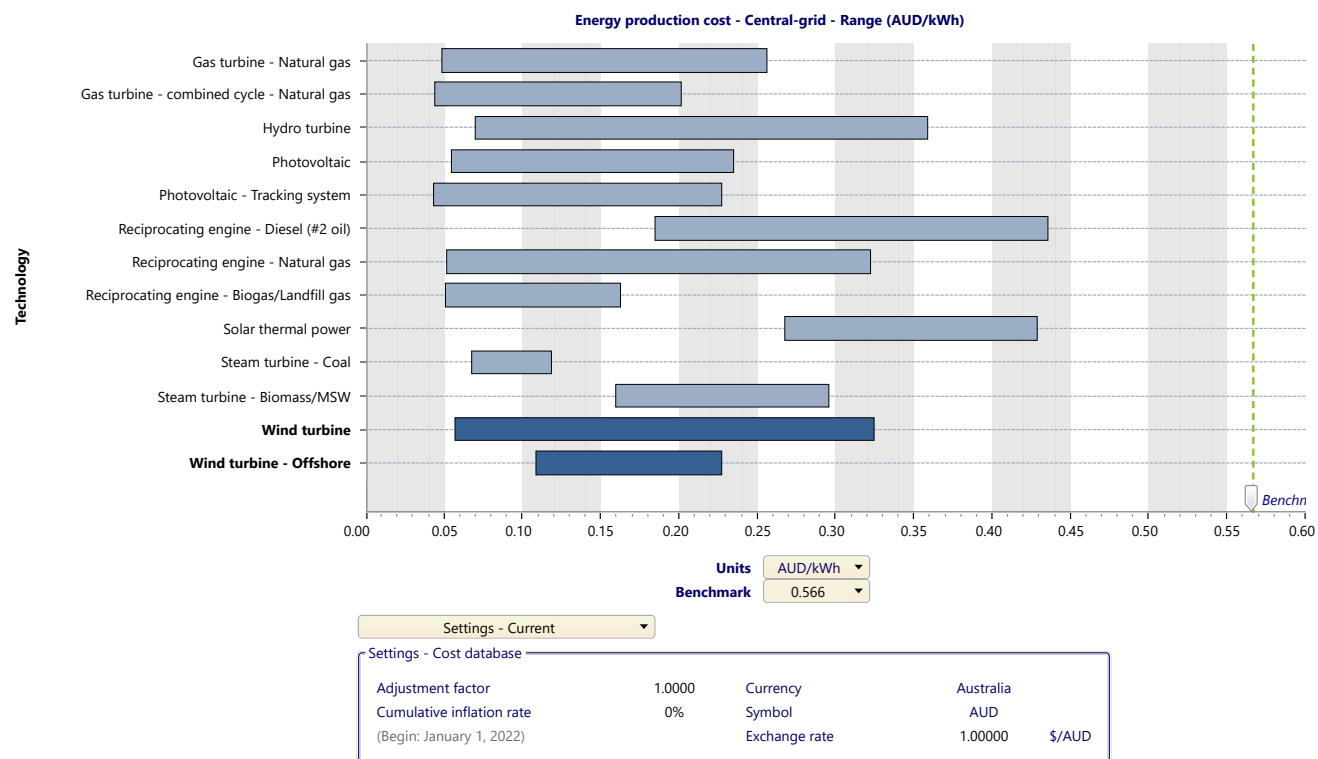
Facility information

Facility type	Power plant	
Type	Wind turbine	
Description	12 kW	
Prepared for	Prepared for	
Prepared by	Prepared by	
Facility name	Archetype	
Address	Address	
City/Municipality	Atherton	
Province/State	QLD	
Country	Australia	



Photo | Image - Kruger

Benchmark - Power plants



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

Power plant - 12 kW - Wind turbine

Fuels & schedules

Electricity and fuels

Technology

Power

12MW wind Farm

Summary

Include system?

Comparison

Wind

Description 12MW wind Farm

Note

Level

Level 1

Level 2

Level 3

Options

eLearning

RETScreen

Connect

Wind - Level 2

Resource assessment

Resource method	Wind speed	
Wind speed - annual	m/s	6.8
Measured at	m	50
Wind shear exponent		0.14
Air temperature - annual	°C	21.6863
Atmospheric pressure - annual	kPa	94.9697

Climate Data

Australia -

Queensland -

Atherton

3.7

10

21.7

95

Wind turbine

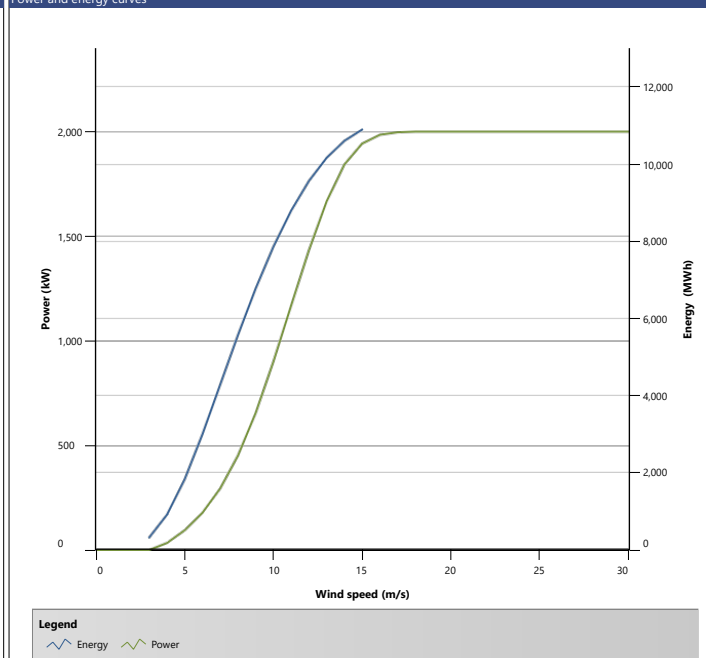
Power capacity per turbine	MW	2
Manufacturer		Vestas
Model		VESTAS V66-2.0 MW - 67m
Number of turbines		6
Power capacity	MW	12
Hub height	m	67
Rotor diameter per turbine	m	66
Swept area per turbine	m²	3,421.19
Energy curve data		Custom
Shape factor		1.85

7.1 m/s

Power and energy curves

Wind speed m/s	Power curve data kW	Energy curve data MWh
0	0	
1	0	
2	0	
3	0	324
4	33.4	914
5	94.3	1,834
6	178	3,001
7	294	4,284
8	451	5,569
9	655	6,777
10	901	7,862
11	1,169	8,795
12	1,433	9,564
13	1,667	10,164
14	1,843	10,604
15	1,943	10,896
16	1,985	
17	1,997	
18	2,000	
19	2,000	
20	2,000	
21	2,000	
22	2,000	
23	2,000	
24	2,000	
25	2,000	
26	2,000	
27	2,000	
28	2,000	
29	2,000	
30	2,000	

Power and energy curves



Losses

Array losses	%	0%
Airfoil losses	%	2%
Miscellaneous losses	%	6%
Availability	%	98%

Summary

Capacity factor	%	20.7%
Initial costs	AUD/kW	6,400
	AUD	76,800,000
O&M costs (savings)	AUD/kW-year	48
	AUD	576,000
Electricity export rate		Electricity export rate - annual
	AUD/kWh	0.10
Electricity exported to grid	MWh	21,801
Electricity export revenue	AUD	2,180,099

Other information

Other information		Per turbine
Unadjusted energy production	MWh	4,393
Pressure coefficient		0.938
Temperature coefficient		0.977
Gross energy production	MWh	4,025
Losses coefficient		0.9
Specific yield	kWh/m ²	1,062

Initial costs (credits)	Unit	Quantity	Unit cost	Amount
Initial cost				AUD 76,800,000
▼ Show data				
<div><div>-</div>User-defined</div>	cost ▼			AUD -
<div><div>+</div></div>				
Total initial costs			AUD	76,800,000

Annual costs (credits)	Unit	Quantity	Unit cost	Amount
O&M costs (savings)	project			AUD 576,000
▼ Show data				
<div><div>-</div>User-defined</div>	cost ▼			AUD -
<div><div>+</div></div>				
Total annual costs			AUD	576,000

Annual savings	Unit	Quantity	Unit cost	Amount
<div><div>-</div>User-defined</div>	cost ▼			AUD -
<div><div>+</div></div>				
Total annual savings			AUD	-

Emission analysis

Base case electricity system (Baseline)

Country - region

Australia

Fuel type

All types

GHG emission factor (excl. T&D)

tCO₂/MWh

0.709

T&D losses

%

7.0%

GHG emission factor

tCO₂/MWh

0.762

Electricity exported to grid

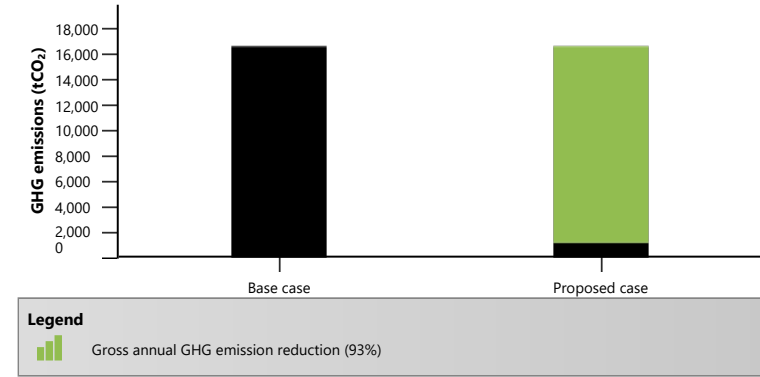
MWh

21,801

T&D losses

7.0%

GHG emissions				
Base case	tCO ₂	16,620		
Proposed case	tCO ₂	1,163		
Gross annual GHG emission reduction	tCO ₂	15,457	93%	



15,457 tCO₂ is equivalent to 2,831

Cars & light trucks not used

Carbon shadow price | GHG reduction revenue

Carbon shadow price

AUD/tCO₂

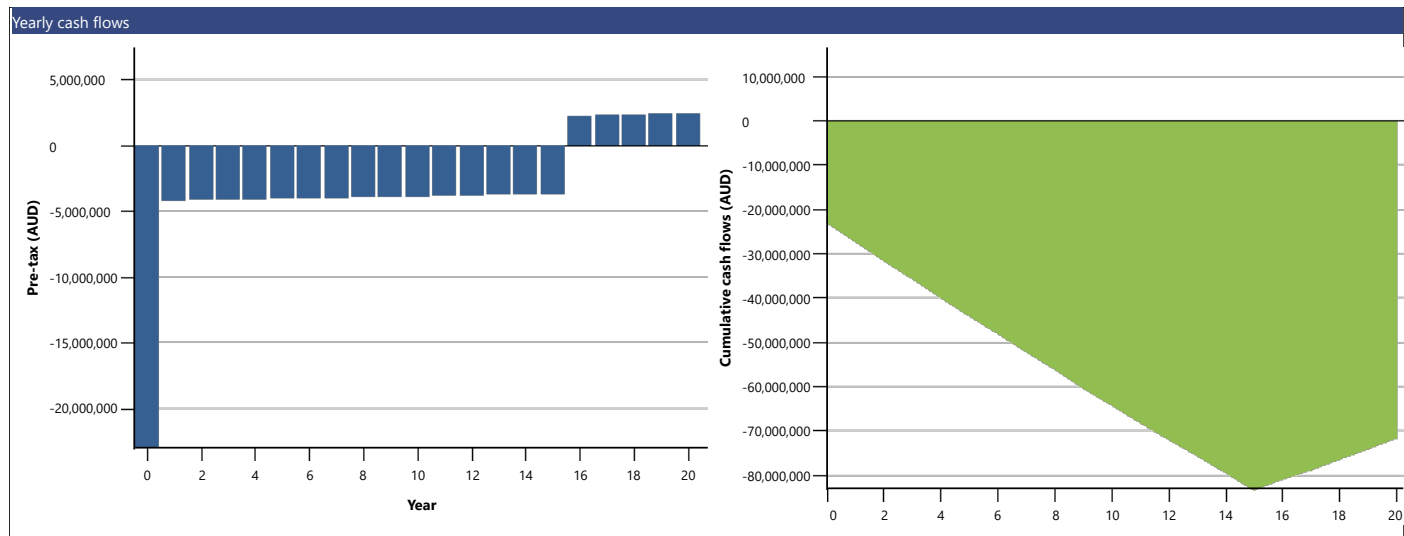
Carbon offsets

Remaining GHG emission reduction required

tCO₂

1,163

Financial parameters			Costs Savings Revenue			Yearly cash flows		
General			Initial costs			Year		
Fuel cost escalation rate		2%	Initial cost	100%	AUD	76,800,000	#	Pre-tax
Inflation rate	%	2%					AUD	Cumulative
Discount rate	%	9%					AUD	
Reinvestment rate	%	9%	Total initial costs			100%	AUD	76,800,000
Project life	yr	20	Yearly cash flows - Year 1					
Finance			Annual costs and debt payments					
Incentives and grants	AUD		O&M costs (savings)		AUD	576,000	0	-23,040,000
Debt ratio	%	70%	Debt payments - 15 yrs		AUD	5,902,559	1	-4,266,379
Debt	AUD	53,760,000	Total annual costs			AUD	6,478,559	2
Equity	AUD	23,040,000	Annual savings and revenue					
Debt interest rate	%	7%	Electricity export revenue		AUD	2,180,099	3	-4,233,655
Debt term	yr	15	GHG reduction savings		AUD	0	4	-4,200,277
Debt payments	AUD/yr	5,902,559	CE production revenue		AUD	0	5	-4,166,231
Income tax analysis			Total annual savings and revenue			AUD	2,180,099	6
			Net yearly cash flow - Year 1			AUD	-4,298,461	7
Annual savings and revenue			Financial viability					
Electricity export revenue			Pre-tax IRR - equity			%	Negative	8
Electricity exported to grid	kWh	21,800,985	Pre-tax MIRR - equity			%	-6.8%	9
Electricity export rate	AUD/kWh	0.10	Pre-tax IRR - assets			%	Negative	10
Electricity export revenue	AUD	2,180,099	Pre-tax MIRR - assets			%	-9.9%	11
Electricity export escalation rate	%	2%	Simple payback			yr	47.9	12
GHG reduction savings			Equity payback			yr	> project	13
Gross GHG reduction	tCO ₂ /yr	15,457	Net Present Value (NPV)			AUD	-53,442,041	14
Gross GHG reduction - 20 yrs	tCO ₂	309,138	Annual life cycle savings			AUD/yr	-5,854,387	15
GHG reduction savings	AUD	0	Benefit-Cost (B-C) ratio				-1.3	16
Other revenue (cost)			Debt service coverage				0.28	17
			GHG reduction cost			AUD/tCO ₂	423	18
Clean Energy (CE) production revenue			Energy production cost			AUD/kWh	0.386	19
								20



Sensitivity analysis

Perform analysis on

Net Present Value (NPV) ▼

Sensitivity range

25%

Threshold

0

AUD

- Remove analysis

Initial costs ▼

AUD

- +

Electricity export rate ▼		57,600,000	67,200,000	76,800,000	86,400,000	96,000,000
AUD/MWh		-25.0%	-12.5%	0.0%	12.5%	25.0%
75.00	-25.0%	-41,623,479	-50,450,816	-59,278,152	-68,105,488	-76,932,824
87.50	-12.5%	-38,705,424	-47,532,760	-56,360,097	-65,187,433	-74,014,769
100.00	0.0%	-35,787,369	-44,614,705	-53,442,041	-62,269,377	-71,096,714
112.50	12.5%	-32,869,314	-41,696,650	-50,523,986	-59,351,322	-68,178,658
125.00	25.0%	-29,951,258	-38,778,595	-47,605,931	-56,433,267	-65,260,603

- +

- Remove analysis

Initial costs ▼

AUD

- +

O&M ▼		57,600,000	67,200,000	76,800,000	86,400,000	96,000,000
AUD		-25.0%	-12.5%	0.0%	12.5%	25.0%
432,000	-25.0%	-34,245,420	-43,072,757	-51,900,093	-60,727,429	-69,554,765
504,000	-12.5%	-35,016,395	-43,843,731	-52,671,067	-61,498,403	-70,325,739
576,000	0.0%	-35,787,369	-44,614,705	-53,442,041	-62,269,377	-71,096,714
648,000	12.5%	-36,558,343	-45,385,679	-54,213,016	-63,040,352	-71,867,688
720,000	25.0%	-37,329,318	-46,156,654	-54,983,990	-63,811,326	-72,638,662

- +

- Remove analysis

Debt interest rate ▼

%

- +

Debt ratio ▼		5.25%	6.13%	7.00%	7.88%	8.75%
%		-25.0%	-12.5%	0.0%	12.5%	25.0%
53%	-25.0%	-51,146,607	-53,040,814	-54,987,369	-56,984,453	-59,030,189
61%	-12.5%	-49,733,816	-51,943,725	-54,214,705	-56,544,637	-58,931,328
70%	0.0%	-48,321,026	-50,846,635	-53,442,041	-56,104,820	-58,832,467
79%	12.5%	-46,908,235	-49,749,545	-52,669,377	-55,665,004	-58,733,607
88%	25.0%	-45,495,444	-48,652,456	-51,896,714	-55,225,187	-58,634,746

- +

- Remove analysis

Debt interest rate ▼

%

- +

Debt term ▼		5.25%	6.13%	7.00%	7.88%	8.75%
yr		-25.0%	-12.5%	0.0%	12.5%	25.0%
11	-25.0%	-50,487,426	-52,547,183	-54,651,582	-56,799,528	-58,989,900
13	-12.5%	-49,358,694	-51,661,909	-54,022,334	-56,438,296	-58,908,067
15	0.0%	-48,321,026	-50,846,635	-53,442,041	-56,104,820	-58,832,467
17	12.5%	-47,367,575	-50,096,658	-52,907,819	-55,797,701	-58,762,840
19	25.0%	-46,491,968	-49,407,513	-52,416,856	-55,515,520	-58,698,905

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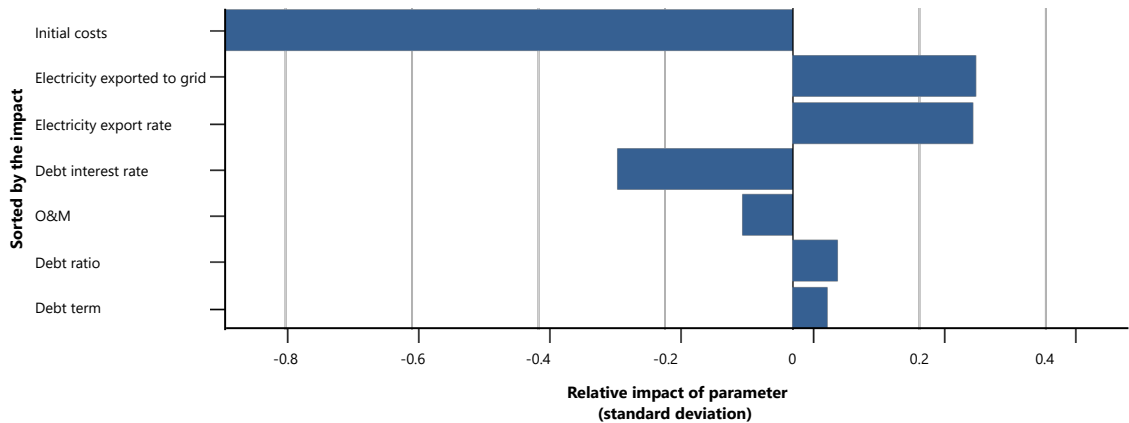
+ Add analysis

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	76,800,000	25%	57,600,000	96,000,000
O&M	AUD	576,000	25%	432,000	720,000
Electricity exported to grid	MWh	21,800.99	25%	16,350.74	27,251.23
Electricity export rate	AUD/MWh	100.00	25%	75.00	125.00
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	-53,546,510
Level of risk	%	10%
Minimum within level of confidence	AUD	-64,741,076
Maximum within level of confidence	AUD	-43,458,594

Distribution - Net Present Value (NPV)

