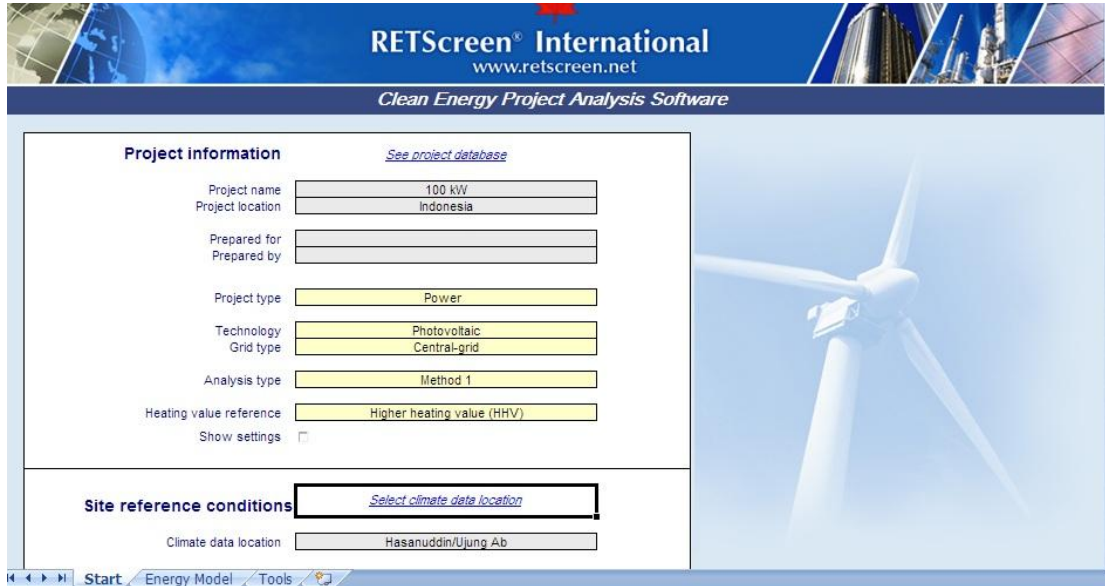


DAFTAR PUSTAKA

- [1] RETScreen International tools.
- [2] <http://id.wikipedia.org/wiki/Photovoltaic> (Pengertian photovoltaic).
- [3] <http://ejurnal.bppt.go.id> (Analisa dampak lingkungan).
- [4] <http://www.alpensteel.com/article/46-102-energi-matahari--surya--solar/2250--pemanfaatan-energi-surya-dimulai.html> (Pemanfaatan energi surya).
- [5] <http://konversi.wordpress.com/2008/05/18/sekilas-photovoltaic-cell/>(sekilas tentang photovoltaic dan pengertian photovoltaic).
- [6] <http://armand10dma.blogspot.com/2011/08/panel-surya.html>(gambar dan keterangan gambar photovoltaic).
- [7] <http://www.panelsurya.com/index.php/id/batere/11-batere> (baterai untuk sel surya).
- [8] <http://www.panelsurya.com/index.php/id/batere/charge-and-discharge-baterai-deep-cycle> (charging, discharging baterai dan jenis baterai kering).
- [9] <http://www.panelsurya.com/index.php/id/inverter> (inverter untuk photovoltaic).
- [10] <http://www.panelsurya.com/index.php/id/solar-controller/12-solar-charge-controller-solar-controller> (cara solar controller charge).
- [11] <http://www.panelsurya.com/index.php/id/batere/charge-and-discharge/controller-charging/12-solar-charge-controller-solar-controller.htm> (fase solar charge controller)
- [12] <http://www.on-grid.com/on-grid.htm> (pembagian grid dan off grid).
- [13] <http://www.Sekilas-Photovoltaic-Cell.com/Konversi-ITB.htm> (pembagian grid)

- [14] Ouaschning, 2005 (ambient temperatur udara)
- [15] <http://www.unud-332-1209885641.html> (Faktor pengoperasian sel surya)
- [16] <http://www.unud-257-836437215-florida-energy-centre2011.html> (Jenis connected grid dan stand alone PLTS)
- [17] <http://www.panelsurya.com/index.php/id./panel-surya-solar-cells-type.htm> (Pembagian PLTS).
- [18] <http://www.kabel-instalasi-panel-surya.html> (kabel instalasi)
- [19] Kusnandar Achmad. 2009. *Sel Surya*.

Lampiran 1 : Hasil simulasi RetScreen International untuk sistem Photovoltaik 100 kW pada Kota Makassar



Data intensitas cahaya matahari pada Kota Makassar dalam 1 tahun

Unit	Climate data location		Project location	
	°N	-5.1	-5.1	-5.1
Longitude	°E	119.6	119.6	119.6
Elevation	m	14	14	14
Heating design temperature	°C	21.1		
Cooling design temperature	°C	33.3		
Earth temperature amplitude	°C	3.3		

Month	Air temperature	Relative humidity	Daily solar radiation - horizontal	Atmospheric pressure	Wind speed	Earth temperature	Heating degree-days	Cooling degree-days
	°C	%	kWh/m²/d	kPa	m/s	°C	°C-d	°C-d
January	28.2	87.2%	4.57	100.2	2.1	28.4	0	502
February	28.3	87.2%	4.85	100.2	2.1	28.3	0	456
March	28.5	85.7%	5.75	100.2	2.0	28.6	0	512
April	28.8	84.1%	5.91	100.2	1.8	28.8	0	504
May	27.2	81.0%	5.97	100.3	1.7	28.4	0	533
June	26.9	78.6%	5.67	100.3	1.7	27.7	0	507
July	26.6	74.0%	5.95	100.4	1.9	27.1	0	515
August	27.0	66.8%	6.70	100.4	2.1	27.3	0	527
September	27.6	61.8%	7.22	100.4	2.4	26.1	0	534
October	27.7	72.1%	7.05	100.3	2.1	26.1	0	549
November	27.0	82.1%	6.09	100.2	2.0	26.4	0	510
December	26.3	86.3%	4.75	100.2	2.1	26.6	0	505
Annual	26.9	78.9%	5.88	100.3	2.0	26.3	0	6,154
Measured at	m				10.0	0.0		

Hasil simulasi Retscreen International menggunakan manufaktur "Helios tipe mono-Si-6T-245W"

Proposed case power system

Technology: Photovoltaic

Analysis type: Method 1

Photovoltaic Power capacity: 100.00 kW

Manufacturer: Helios

Model: mono-Si - 6T 245W

Capacity factor: 15.0%

Electricity exported to grid: 131.4 MWh

Electricity export rate: \$/MWh 420.00

Incremental initial cost: \$ 800,000

Emission Analysis

Country - region	Fuel type	GHG emission factor (excl. T&D) tCO2/MWh	T&D losses %	GHG emission factor tCO2/MWh
Canada	All types	0.196	5.0%	0.207

Electricity exported to grid: 131 MWh, T&D losses: 2.0%

GHG emission

Base case	tCO2	27.2
Proposed case	tCO2	0.5
Gross annual GHG emission reduction	tCO2	26.6
GHG credits transaction fee	%	

Proposed case power system

RETScreen Energy Model - Power project

Proposed case power system

Technology: Photovoltaic

Analysis type: Method 1

Photovoltaic Power capacity: 100.21 kW

Manufacturer: Helios

Model: mono-Si - 6T 245W

Capacity factor: 15.0%

Electricity exported to grid: 131.7 MWh

Electricity export rate: \$/MWh 420.00

Incremental initial costs: \$ 801,640

Show alternative units

Emission analysis

Emission Analysis

Country - region	Fuel type	GHG emission factor (excl. T&D) tCO2/MWh	T&D losses %	GHG emission factor tCO2/MWh
Canada	All types	0.196	5.0%	0.207

Electricity exported to grid: 132 MWh, T&D losses: 2.0%

GHG emission

Base case	tCO2	27.2
Proposed case	tCO2	0.5
Gross annual GHG emission reduction	tCO2	26.7
GHG credits transaction fee	%	
Net annual GHG emission reduction	tCO2	26.7

is equivalent to 4.9 Cars & light trucks not used

GHG reduction income

GHG reduction credit rate	\$/tCO2	
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Hasil simulasi Retscreen International menggunakan manufaktur “Schott tipe poly-Si-235W “

The screenshot displays the RETScreen Energy Model interface for a power project. The main window shows the 'Proposed case power system' configuration for a Photovoltaic system. Key parameters include a power capacity of 100.11 kW, a manufacturer of Schott, and a model of poly-Si - SCHOTT POLY 235W. The system is configured with 426 units, each with a capacity of 235 W, resulting in a total capacity of 100,110 W. The electricity exported to the grid is 131.5 MWh, and the electricity export rate is \$420.00 per MWh. The incremental initial cost is \$800,880.

An inset window titled 'RETScreen' provides a summary of the system configuration, including the System (Power), Technology (Photovoltaic), Type (poly-Si), Manufacturer (Schott), Model (poly-Si - SCHOTT POLY 235W), Capacity per unit (235 W), Number of units (426), and Capacity (100,110 W). It also lists the Efficiency (14.04%) and Frame area (1.67 m²).

The 'Emission Analysis' section provides a detailed breakdown of GHG emissions. The base case electricity system (Baseline) for Canada has a fuel type of All types, a GHG emission factor (excl. T&D) of 0.196 tCO2/MWh, T&D losses of 5.0%, and a GHG emission factor (incl. T&D) of 0.207 tCO2/MWh. The proposed case system has a GHG emission factor (excl. T&D) of 0.5 tCO2/MWh, T&D losses of 2.0%, and a GHG emission factor (incl. T&D) of 0.5 tCO2/MWh. The gross annual GHG emission reduction is 26.6 tCO2, which is equivalent to 4.9 cars & light trucks not used. The net annual GHG emission reduction is 26.6 tCO2, and the GHG reduction credit rate is \$/tCO2.

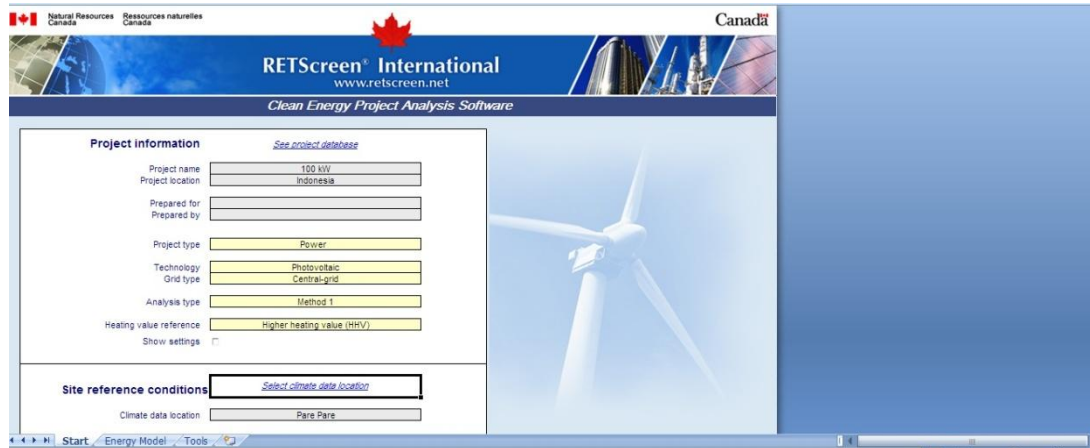
Proposed case power system

This section provides a detailed view of the 'Proposed case power system' configuration. The system is a Photovoltaic system with a power capacity of 100.11 kW. The manufacturer is Schott, and the model is poly-Si - SCHOTT POLY 235W. The system is configured with 426 units, each with a capacity of 235 W, resulting in a total capacity of 100,110 W. The electricity exported to the grid is 131.5 MWh, and the electricity export rate is \$420.00 per MWh. The incremental initial cost is \$800,880. The analysis type is Method 1.

Emission analysis

This section provides a detailed view of the 'Emission analysis'. The base case electricity system (Baseline) for Canada has a fuel type of All types, a GHG emission factor (excl. T&D) of 0.196 tCO2/MWh, T&D losses of 5.0%, and a GHG emission factor (incl. T&D) of 0.207 tCO2/MWh. The proposed case system has a GHG emission factor (excl. T&D) of 0.5 tCO2/MWh, T&D losses of 2.0%, and a GHG emission factor (incl. T&D) of 0.5 tCO2/MWh. The gross annual GHG emission reduction is 26.6 tCO2, which is equivalent to 4.9 cars & light trucks not used. The net annual GHG emission reduction is 26.6 tCO2, and the GHG reduction credit rate is \$/tCO2.

Lampiran 2 : Hasil simulasi RetScreen International untuk sistem Photovoltaik 100 kW pada Kota Pare-pare.

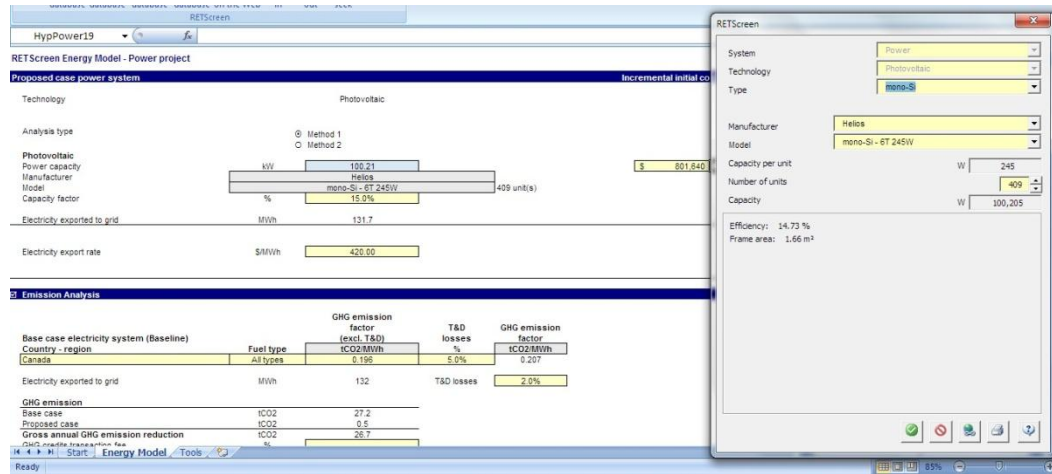


Data Intensitas cahaya matahari pada kota Pare-pare dalam 1 tahun

	Unit	Climate data		Project location	
		location		location	
Latitude	°N	-3.9		-3.9	
Longitude	°E	119.6		119.6	
Elevation	m	452		452	
Heating design temperature	°C	20.9			
Cooling design temperature	°C	28.9			
Earth temperature amplitude	°C	6.6			

Month	Air temperature	Relative humidity	Daily solar radiation - horizontal	Atmospheric pressure	Wind speed	Earth temperature	Heating degree-days	Cooling degree-days	
	°C	%	kWh/m ² /d	kPa	m/s	°C	°C-d	°C-d	
January	24.7	82.6%	5.03	97.4	2.5	26.1	0	455	
February	24.9	80.1%	5.22	97.4	2.5	26.4	0	416	
March	24.9	81.8%	5.28	97.4	1.8	26.5	0	463	
April	25.0	82.9%	5.47	97.4	1.6	26.4	0	449	
May	24.9	81.9%	5.29	97.4	2.5	26.0	0	460	
June	24.5	80.6%	5.14	97.5	2.9	25.5	0	434	
July	24.2	77.0%	5.22	97.5	3.2	25.3	0	441	
August	25.1	68.8%	5.83	97.5	3.4	26.5	0	468	
September	25.8	66.5%	6.11	97.5	3.0	27.4	0	475	
October	25.7	73.1%	5.97	97.4	2.1	27.4	0	486	
November	24.9	82.0%	5.39	97.4	1.7	26.5	0	446	
December	24.7	82.4%	4.86	97.4	2.1	26.2	0	455	
Annual									
Measured at	m	24.9	78.3%	5.40	97.4	2.4	26.3	0	5,446
						10.0	0.0		

Hasil simulasi Retcreen International menggunakan manufaktur “Helios mono-Si-6T-245W”.



Proposed case power system

Proposed case power system		Incremental initial costs	
Technology	Photovoltaic		
Analysis type	Method 1 (selected)		
Photovoltaic			
Power capacity	100.21 kW	\$ 801,840	See product database
Manufacturer	Helios		
Model	mono-Si - 6T 245W		
Capacity factor	15.0%		
Electricity exported to grid	131.7 MWh		
Electricity export rate	\$/MWh 420.00		

Emission analysis

Base case electricity system (Baseline)		GHG emission factor (excl. T&D) tCO2/MWh	T&D losses %	GHG emission factor tCO2/MWh
Country - region	Fuel type			
Canada	All types	0.196	5.0%	0.207
Electricity exported to grid	MWh	132	T&D losses	2.0%
GHG emission				
Base case	tCO2	27.2		
Proposed case	tCO2	0.5		
Gross annual GHG emission reduction	tCO2	26.7		
GHG credits transaction fee	%			
Net annual GHG emission reduction	tCO2	26.7	is equivalent to	4.9 Cars & light trucks not used
GHG reduction income				
GHG reduction credit rate	\$/tCO2			

Hasil simulasi Retscreen International menggunakan manufaktur “Schott tipe poly-Si-Schott-poly 235W”.

The screenshot shows the RETScreen Energy Model interface. The main window displays the 'Proposed case power system' and 'Emission Analysis' sections. A dialog box titled 'RETScreen' is open on the right, showing the following parameters:

- System: Power
- Technology: Photovoltaic
- Type: poly-Si
- Manufacturer: Schott
- Model: poly-Si - SCHOTT POLY 235W
- Capacity per unit: W 235
- Number of units: 426
- Capacity: W 100,110
- Efficiency: 14.04 %
- Frame area: 1.67 m²

The 'Proposed case power system' section shows the following data:

Technology	Photovoltaic	Incremental initial cost
Analysis type	Method 1	
Photovoltaic		
Power capacity	100.11 kW	\$ 800,880
Manufacturer	Schott	
Model	poly-Si - SCHOTT POLY 235W	426 unit(s)
Capacity factor	15.0%	
Electricity exported to grid	131.5 MWh	
Electricity export rate	420.00 \$/MWh	

The 'Emission Analysis' section shows the following data:

Base case electricity system (Baseline)	Fuel type	GHG emission factor (excl. T&D) tCO ₂ /MWh	T&D losses %	GHG emission factor tCO ₂ /MWh
Country - region	All types	0.196	5.0%	0.207
Electricity exported to grid	MWh	132	T&D losses	2.0%
GHG emission				
Base case	tCO ₂	27.2		
Proposed case	tCO ₂	0.5		
Gross annual GHG emission reduction	tCO ₂	26.6		
GHG credits transaction fee	%			
Net annual GHG emission reduction	tCO ₂	26.6	is equivalent to	4.9 Cars & light trucks not used
GHG reduction income	\$/tCO ₂			
GHG reduction credit rate				

Proposed case power system

RETScreen Energy Model - Power project Show alternative units

Proposed case power system **Incremental initial costs**

Technology: Photovoltaic

Analysis type: Method 1

Photovoltaic

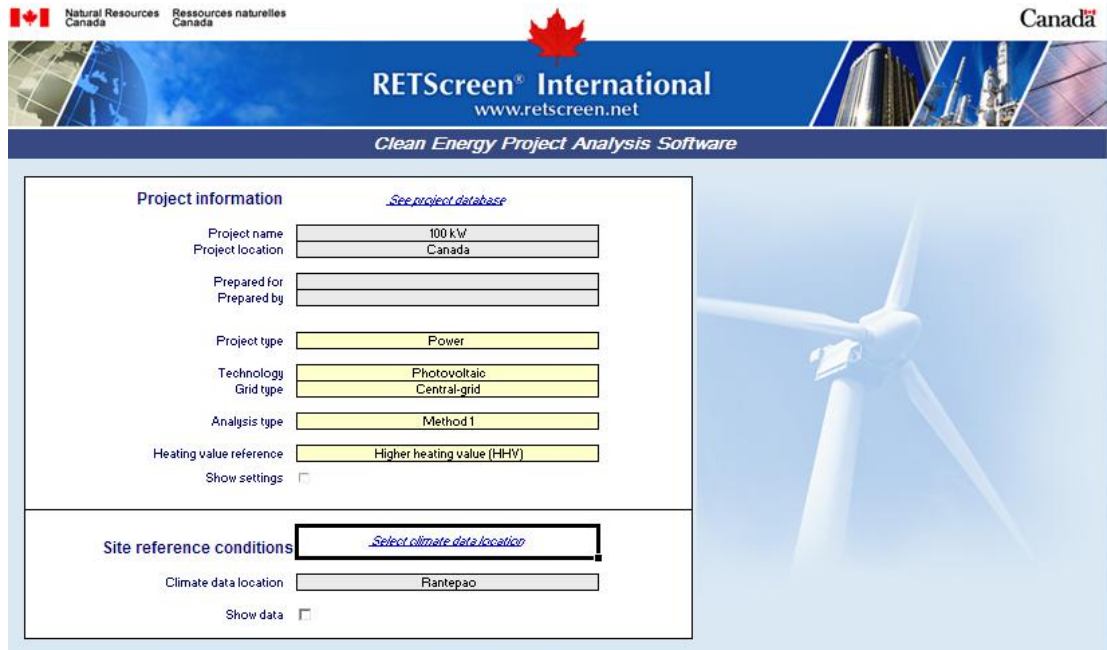
Parameter	Value	Cost
Power capacity	100.11 kW	\$ 800,880
Manufacturer	Schott	
Model	poly-Si - SCHOTT POLY 235W	426 unit(s)
Capacity factor	15.0%	
Electricity exported to grid	131.5 MWh	
Electricity export rate	420.00 \$/MWh	

Emission analysis

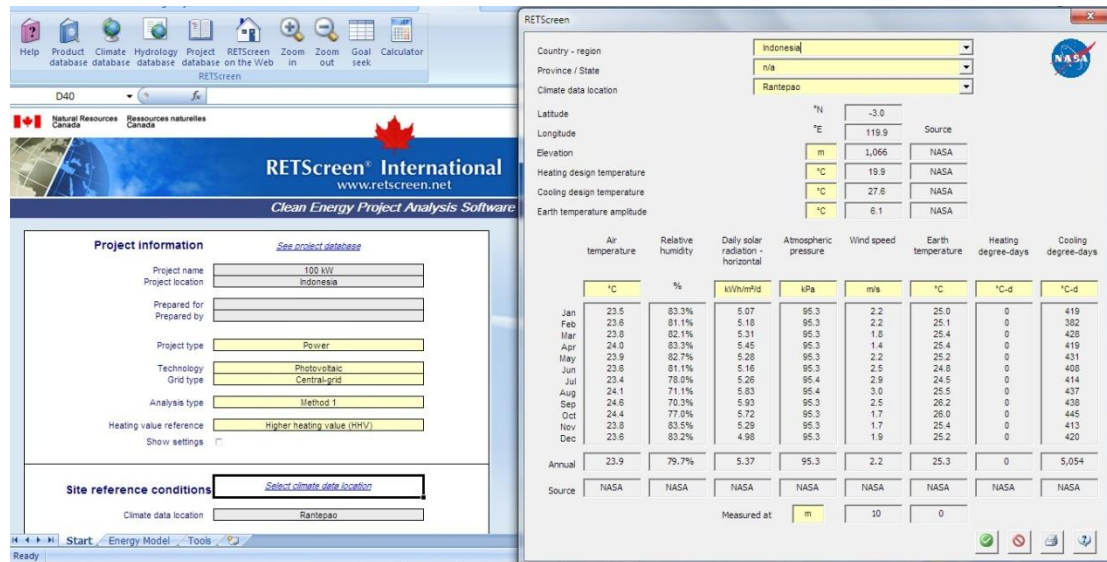
Emission Analysis

Base case electricity system (Baseline)	Fuel type	GHG emission factor (excl. T&D) tCO ₂ /MWh	T&D losses %	GHG emission factor tCO ₂ /MWh
Country - region	All types	0.196	5.0%	0.207
Electricity exported to grid	MWh	132	T&D losses	2.0%
GHG emission				
Base case	tCO ₂	27.2		
Proposed case	tCO ₂	0.5		
Gross annual GHG emission reduction	tCO ₂	26.6		
GHG credits transaction fee	%			
Net annual GHG emission reduction	tCO ₂	26.6	is equivalent to	4.9 Cars & light trucks not used
GHG reduction income	\$/tCO ₂			
GHG reduction credit rate				

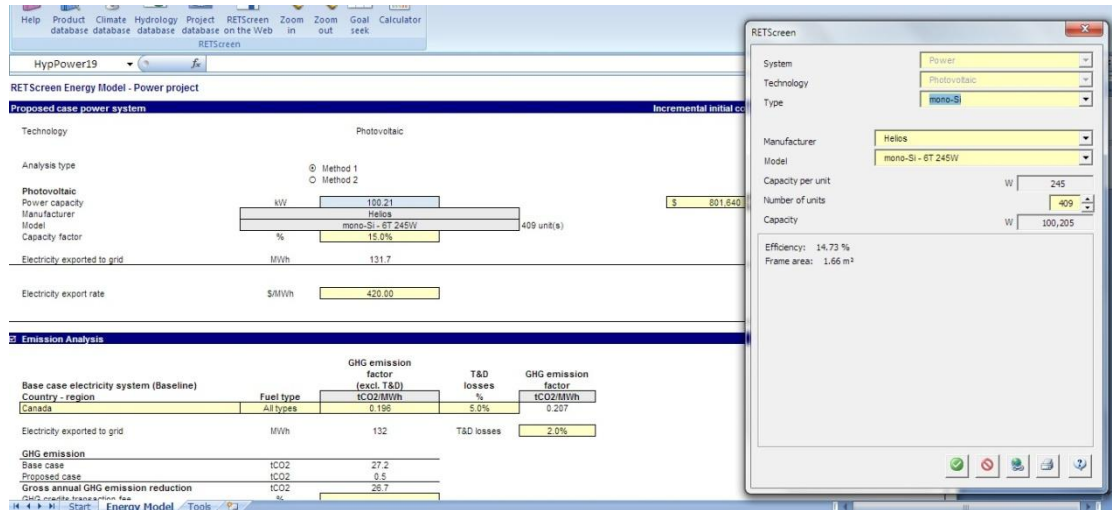
Lampiran 3 : Hasil simulasi Retscreen International untuk wilayah Toraja(Rantepao)



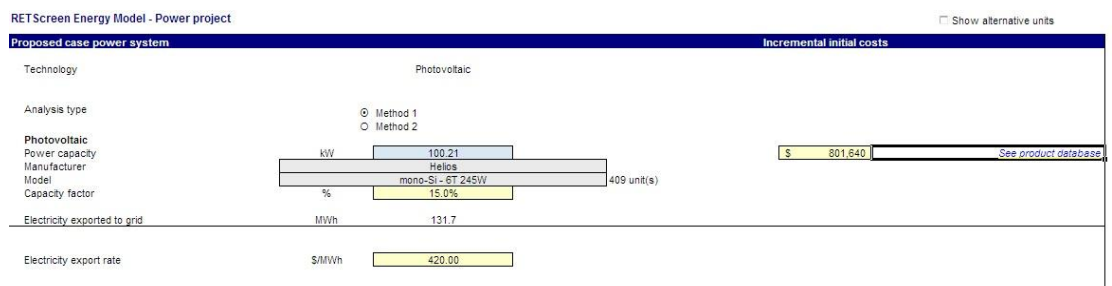
Data intensitas cahaya matahari pada kota Toraja (Rantepao) dalam 1 tahun



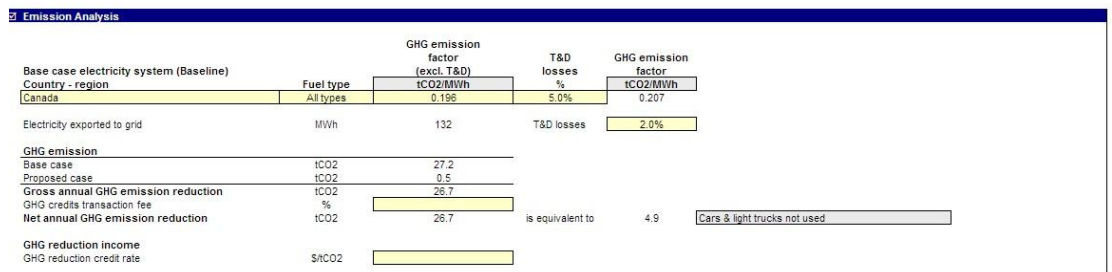
Hasil simulasi Retscreen International menggunakan manufaktur “Helios mono-Si-6T-245W”.



Proposed case power system



Emission analysis



Hasil simulasi Retscreen International menggunakan manufaktur “Schott tipe poly-Si-Schott-poly 235W”.

The screenshot shows the RETScreen Energy Model interface. The main window displays the 'Proposed case power system' for a Photovoltaic system. Key parameters include a power capacity of 100.11 kW, a manufacturer of Schott, and a model of poly-Si - SCHOTT POLY 235W. The system is configured for 426 units, resulting in a total capacity of 100,110 W. The electricity exported to the grid is 131.5 MWh, and the electricity export rate is \$420.00 per MWh. The incremental initial cost is \$800,880. A pop-up window on the right shows the system configuration details, including the manufacturer (Schott), model (poly-Si - SCHOTT POLY 235W), capacity per unit (235 W), and efficiency (14.04%).

Proposed Case System

RETScreen Energy Model - Power project

Proposed case power system Incremental initial costs

Technology: Photovoltaic

Analysis type: Method 1, Method 2

Photovoltaic parameters:

- Power capacity: 100.11 kW
- Manufacturer: Schott
- Model: poly-Si - SCHOTT POLY 235W
- Capacity factor: 15.0%
- Number of units: 426 unit(s)
- Total Capacity: 100,110 W

Electricity exported to grid: 131.5 MWh

Electricity export rate: \$/MWh 420.00

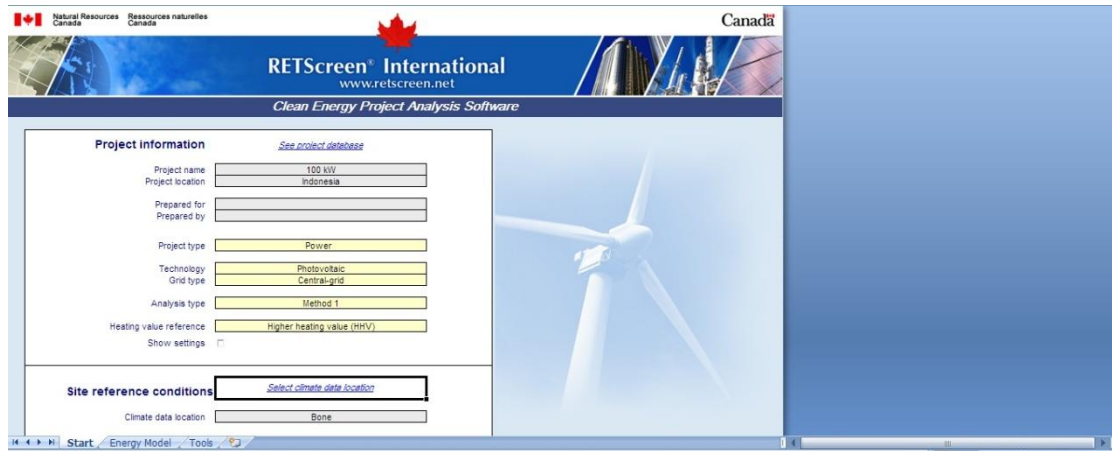
Incremental initial cost: \$ 800,880 [See product database](#)

Emission Analysis

Emission Analysis

Base case electricity system (Baseline)		GHG emission factor (excl. T&D)	T&D losses	GHG emission factor
Country - region	Fuel type	tCO2/MWh	%	tCO2/MWh
Canada	All types	0.196	5.0%	0.207
Electricity exported to grid		MWh	T&D losses	%
		132	2.0%	
GHG emission				
Base case	tCO2	27.2		
Proposed case	tCO2	0.5		
Gross annual GHG emission reduction		tCO2		
		26.6		
GHG credits transaction fee		%		
Net annual GHG emission reduction		tCO2	is equivalent to	4.9 Cars & light trucks not used
GHG reduction income				
GHG reduction credit rate		\$/tCO2		

Lampiran 4 : Hasil simulasi RetScreen International untuk wilayah Bone



Data intensitas cahaya tahunan pada wilayah Bone

The screenshot displays the RETScreen software interface with a detailed table of annual solar radiation data for Bone, Indonesia. The table includes monthly and annual data for air temperature, relative humidity, daily solar radiation, atmospheric pressure, wind speed, earth temperature, heating degree-days, and cooling degree-days.

	Air temperature °C	Relative humidity %	Daily solar radiation - horizontal kWh/m ² /d	Atmospheric pressure kPa	Wind speed m/s	Earth temperature °C	Heating degree-days °C-d	Cooling degree-days °C-d
Jan	25.5	82.7%	4.81	99.9	3.0	26.9	0	479
Feb	25.6	80.5%	4.85	99.9	3.0	27.1	0	437
Mar	25.6	81.9%	5.11	99.9	2.3	27.2	0	485
Apr	25.6	82.2%	4.91	99.9	2.2	27.0	0	469
May	25.4	81.4%	4.61	99.0	3.1	26.5	0	477
Jun	24.9	81.1%	4.38	99.0	3.4	25.9	0	447
Jul	24.5	78.0%	4.54	99.1	3.7	25.6	0	450
Aug	25.2	70.4%	5.36	99.1	3.8	26.7	0	472
Sep	26.2	66.4%	6.01	99.1	3.5	28.0	0	485
Oct	26.6	69.1%	5.90	99.0	2.6	26.7	0	516
Nov	26.0	77.9%	5.36	98.9	2.1	27.9	0	481
Dec	25.6	81.7%	4.77	98.9	2.5	27.1	0	482
Annual	25.6	77.8%	5.05	99.0	2.9	27.0	0	5,680
Source	NASA	NASA	NASA	NASA	NASA	NASA	NASA	NASA
Measured at				m	10	0		

Hasil simulasi Retscreen International menggunakan manufaktur “Helios mono-Si-6T-245W”.

Proposed case power system Incremental initial costs

Technology: Photovoltaic

Analysis type: Method 1 (selected)

Photovoltaic parameters:

- Power capacity: 100.21 kW
- Manufacturer: Helios
- Model: mono-Si - 6T 245W
- Capacity factor: 15.0%
- Number of units: 409 unit(s)

Electricity exported to grid: 131.7 MWh

Electricity export rate: \$/MWh 420.00

Total cost: \$ 801,640

Emission Analysis

Base case electricity system (Baseline)		GHG emission factor (excl. T&D)	T&D losses	GHG emission factor
Country - region	Fuel type	IC02/MWh	%	IC02/MWh
Canada	All types	0.196	5.0%	0.207

Electricity exported to grid: 132 MWh, T&D losses: 2.0%

GHG emission

Base case	IC02	27.2
Proposed case	IC02	0.5
Gross annual GHG emission reduction	IC02	26.7
GHG credits transaction fee	%	
Net annual GHG emission reduction	IC02	26.7

is equivalent to 4.9 Cars & light trucks not used

GHG reduction income: \$/IC02

GHG reduction credit rate: \$/IC02

Proposed power system

RETScreen Energy Model - Power project Show alternative units

Proposed case power system Incremental initial costs

Technology: Photovoltaic

Analysis type: Method 1 (selected)

Photovoltaic parameters:

- Power capacity: 100.21 kW
- Manufacturer: Helios
- Model: mono-Si - 6T 245W
- Capacity factor: 15.0%
- Number of units: 409 unit(s)

Electricity exported to grid: 131.7 MWh

Electricity export rate: \$/MWh 420.00

Total cost: \$ 801,640 [See product database](#)

Emission analysis

Emission Analysis

Base case electricity system (Baseline)		GHG emission factor (excl. T&D)	T&D losses	GHG emission factor
Country - region	Fuel type	IC02/MWh	%	IC02/MWh
Canada	All types	0.196	5.0%	0.207

Electricity exported to grid: 132 MWh, T&D losses: 2.0%

GHG emission

Base case	IC02	27.2
Proposed case	IC02	0.5
Gross annual GHG emission reduction	IC02	26.7
GHG credits transaction fee	%	
Net annual GHG emission reduction	IC02	26.7

is equivalent to 4.9 Cars & light trucks not used

GHG reduction income: \$/IC02

GHG reduction credit rate: \$/IC02

Hasil simulasi Retscreen International menggunakan manufaktur “Schott tipe poly-Si-Schott-poly 235W”.

The screenshot displays the RETScreen software interface. The main window shows the 'Proposed case power system' section with the following data:

Parameter	Value	Unit	Incremental initial cost
Technology	Photovoltaic		
Analysis type	Method 1		
Photovoltaic Power capacity	100.11	kW	\$ 800,880
Manufacturer	Schott		
Model	poly-Si - SCHOTT POLY 235W		
Capacity factor	15.0%	%	
Electricity exported to grid	131.5	MWh	
Electricity export rate	420.00	\$/MWh	

The 'Emission Analysis' section shows the following data:

Category	Fuel type	GHG emission factor (excl. T&D) tCO2/MWh	T&D losses %	GHG emission factor tCO2/MWh
Base case electricity system (Baseline)				
Country - region	All types	0.196	5.0%	0.207
Electricity exported to grid	MWh	132	T&D losses	2.0%
GHG emission				
Base case	tCO2	27.2		
Proposed case	tCO2	9.5		
Gross annual GHG emission reduction	tCO2	26.6		
GHG credits transaction fee	%			
Net annual GHG emission reduction	tCO2	26.6	is equivalent to	4.9

The right-hand pane shows system configuration details:

- System: Power
- Technology: Photovoltaic
- Type: poly-Si
- Manufacturer: Schott
- Model: poly-Si - SCHOTT POLY 235W
- Capacity per unit: 235 W
- Number of units: 426
- Capacity: 100,110 W
- Efficiency: 14.04 %
- Frame area: 1.67 m²

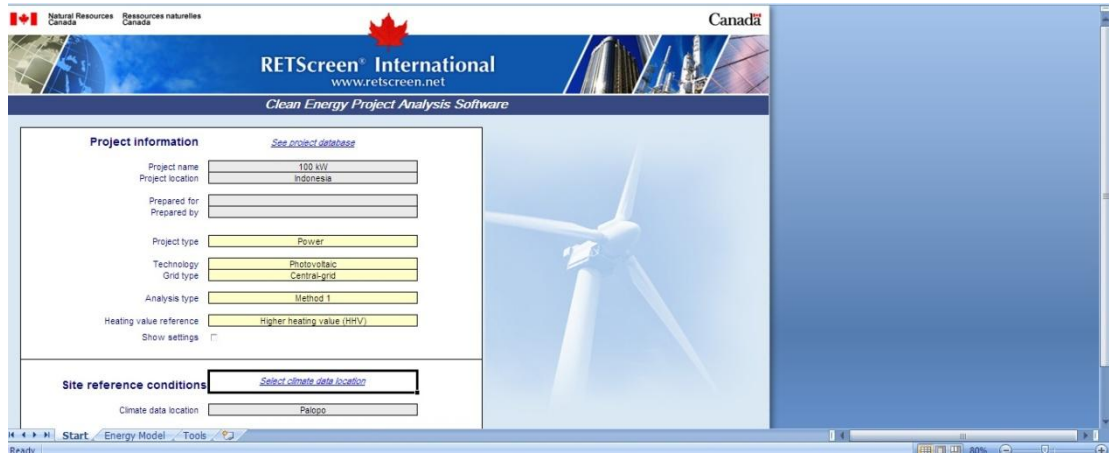
Proposed case power system

Proposed case power system		Incremental initial costs	
Technology	Photovoltaic		
Analysis type	Method 1		
Photovoltaic Power capacity	100.11	kW	\$ 800,880
Manufacturer	Schott		See product database
Model	poly-Si - SCHOTT POLY 235W		
Capacity factor	15.0%	%	
Electricity exported to grid	131.5	MWh	
Electricity export rate	420.00	\$/MWh	

Emission analysis

Emission Analysis		GHG emission factor (excl. T&D) tCO2/MWh		T&D losses %		GHG emission factor tCO2/MWh	
Base case electricity system (Baseline)							
Country - region	All types	0.196	5.0%	0.207			
Electricity exported to grid	MWh	132	T&D losses	2.0%			
GHG emission							
Base case	tCO2	27.2					
Proposed case	tCO2	9.5					
Gross annual GHG emission reduction	tCO2	26.6					
GHG credits transaction fee	%						
Net annual GHG emission reduction	tCO2	26.6	is equivalent to	4.9			Cars & light trucks not used
GHG reduction income	\$/tCO2						
GHG reduction credit rate	\$/tCO2						

Lampiran 5 : Hasil simulasi Retscreen International untuk sistem Photovoltaik 100 kW pada Kota Palopo.



Data intensitas cahaya di Kota Pare-pare dalam 1 tahun

The screenshot shows the RETScreen International software interface with the climate data for Palopo, Indonesia. The 'Country - region' is set to Indonesia, 'Province / State' to n/a, and 'Climate data location' to Palopo. The 'Climate data location' section shows the following parameters:

- Latitude: -3.1 °N
- Longitude: 120.2 °E
- Elevation: 188 m
- Heating design temperature: 19.3 °C
- Cooling design temperature: 29.1 °C
- Earth temperature amplitude: 8.1 °C

The 'Climate data location' table shows the following data for each month and annual totals:

	Air temperature °C	Relative humidity %	Daily solar radiation - horizontal kWh/m ² /d	Atmospheric pressure kPa	Wind speed m/s	Earth temperature °C	Heating degree-days °C-d	Cooling degree-days °C-d
Jan	24.2	83.5%	4.89	96.6	2.5	25.2	0	441
Feb	24.4	80.5%	4.99	96.6	2.6	25.6	0	404
Mar	24.4	82.5%	5.05	96.6	2.0	25.5	0	447
Apr	24.4	83.6%	4.88	96.6	1.8	25.3	0	431
May	24.1	83.1%	4.57	96.7	2.6	24.9	0	436
Jun	23.6	82.8%	4.34	96.7	2.8	24.2	0	407
Jul	23.2	79.7%	4.35	96.6	3.1	24.0	0	409
Aug	24.1	71.0%	4.95	96.8	3.2	25.3	0	436
Sep	25.2	65.9%	5.62	96.7	2.9	26.7	0	466
Oct	25.5	70.0%	5.66	96.7	2.1	27.0	0	480
Nov	24.6	80.7%	5.26	96.6	1.8	25.7	0	437
Dec	24.2	83.0%	4.67	96.6	2.2	25.2	0	441
Annual	24.3	78.9%	4.95	96.7	2.5	25.4	0	5,224
Source	NASA	NASA	NASA	NASA	NASA	NASA	NASA	NASA
				Measured at	m	10	0	

Hasil simulasi Retscreen International menggunakan manufaktur “Helios mono-Si-6T-245W”.

RETScreen Energy Model - Power project

Proposed case power system Incremental initial costs

Technology: Photovoltaic

Analysis type: Method 1

Photovoltaic:

- Power capacity: 100.21 kW
- Manufacturer: Helios
- Model: mono-Si - 6T 245W
- Capacity factor: 15.0%

 409 unit(s)

Electricity exported to grid: 131.7 MWh

Electricity export rate: \$/MWh 420.00

Incremental initial costs: \$ 801,640

5 Emission Analysis

Base case electricity system (Baseline)		Fuel type	GHG emission factor (excl. T&D) tCO2/MWh	T&D losses %	GHG emission factor tCO2/MWh
Country - region	Canada	All types	0.196	5.0%	0.207

Electricity exported to grid: 132 MWh, T&D losses: 2.0%

GHG emission

Base case	tCO2	27.2
Proposed case	tCO2	0.5
Gross annual GHG emission reduction	tCO2	26.7
GHG credits transaction fee	%	
Net annual GHG emission reduction	tCO2	26.7

is equivalent to 4.9 Cars & light trucks not used

Proposed case power system

RETScreen Energy Model - Power project Show alternative units

Proposed case power system Incremental initial costs

Technology: Photovoltaic

Analysis type: Method 1

Photovoltaic:

- Power capacity: 100.21 kW
- Manufacturer: Helios
- Model: mono-Si - 6T 245W
- Capacity factor: 15.0%

 409 unit(s)

Electricity exported to grid: 131.7 MWh

Electricity export rate: \$/MWh 420.00

Incremental initial costs: \$ 801,640 [See product database](#)

Emission analysis

5 Emission Analysis

Base case electricity system (Baseline)		Fuel type	GHG emission factor (excl. T&D) tCO2/MWh	T&D losses %	GHG emission factor tCO2/MWh
Country - region	Canada	All types	0.196	5.0%	0.207

Electricity exported to grid: 132 MWh, T&D losses: 2.0%

GHG emission

Base case	tCO2	27.2
Proposed case	tCO2	0.5
Gross annual GHG emission reduction	tCO2	26.7
GHG credits transaction fee	%	
Net annual GHG emission reduction	tCO2	26.7

is equivalent to 4.9 [Cars & light trucks not used](#)

GHG reduction income

GHG reduction credit rate	\$/tCO2	
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Hasil simulasi Retscreen International menggunakan manufaktur “Schott tipe poly-Si-Schott-poly 235W”.

The screenshot shows the RETScreen Energy Model interface. The main window displays the 'Proposed case power system' configuration for a photovoltaic system. The 'Manufacturer' is set to 'Schott' and the 'Model' is 'poly-Si - SCHOTT POLY 235W'. The system has a power capacity of 100.11 kW, a capacity factor of 15.0%, and an electricity export rate of \$420.00/MWh. The total incremental initial cost is \$800,880. A dialog box on the right shows the system details, including the manufacturer 'Schott', model 'poly-Si - SCHOTT POLY 235W', capacity per unit of 235 W, and an efficiency of 14.04%.

Proposed case power system

RETScreen Energy Model - Power project Show alternative units

Proposed case power system **Incremental initial costs**

Technology: Photovoltaic

Analysis type: Method 1 Method 2

Photovoltaic:

Power capacity	kW	100.11	\$ 800,880
Manufacturer		Schott	See product database
Model		poly-Si - SCHOTT POLY 235W	426 unit(s)
Capacity factor	%	15.0%	

Electricity exported to grid: MWh 131.5

Electricity export rate: \$/MWh 420.00

Emission analysis

Emission Analysis

Base case electricity system (Baseline)		GHG emission factor (excl. T&D)		T&D losses	GHG emission factor
Country - region	Fuel type	tCO2/MWh	%	%	tCO2/MWh
Canada	All types	0.196	5.0%		0.207

Electricity exported to grid: MWh 132 T&D losses 2.0%

GHG emission:

Base case	tCO2	27.2
Proposed case	tCO2	0.5
Gross annual GHG emission reduction	tCO2	26.6
GHG credits transaction fee	%	
Net annual GHG emission reduction	tCO2	26.6

is equivalent to 4.9 Cars & light trucks not used

GHG reduction income: \$/tCO2