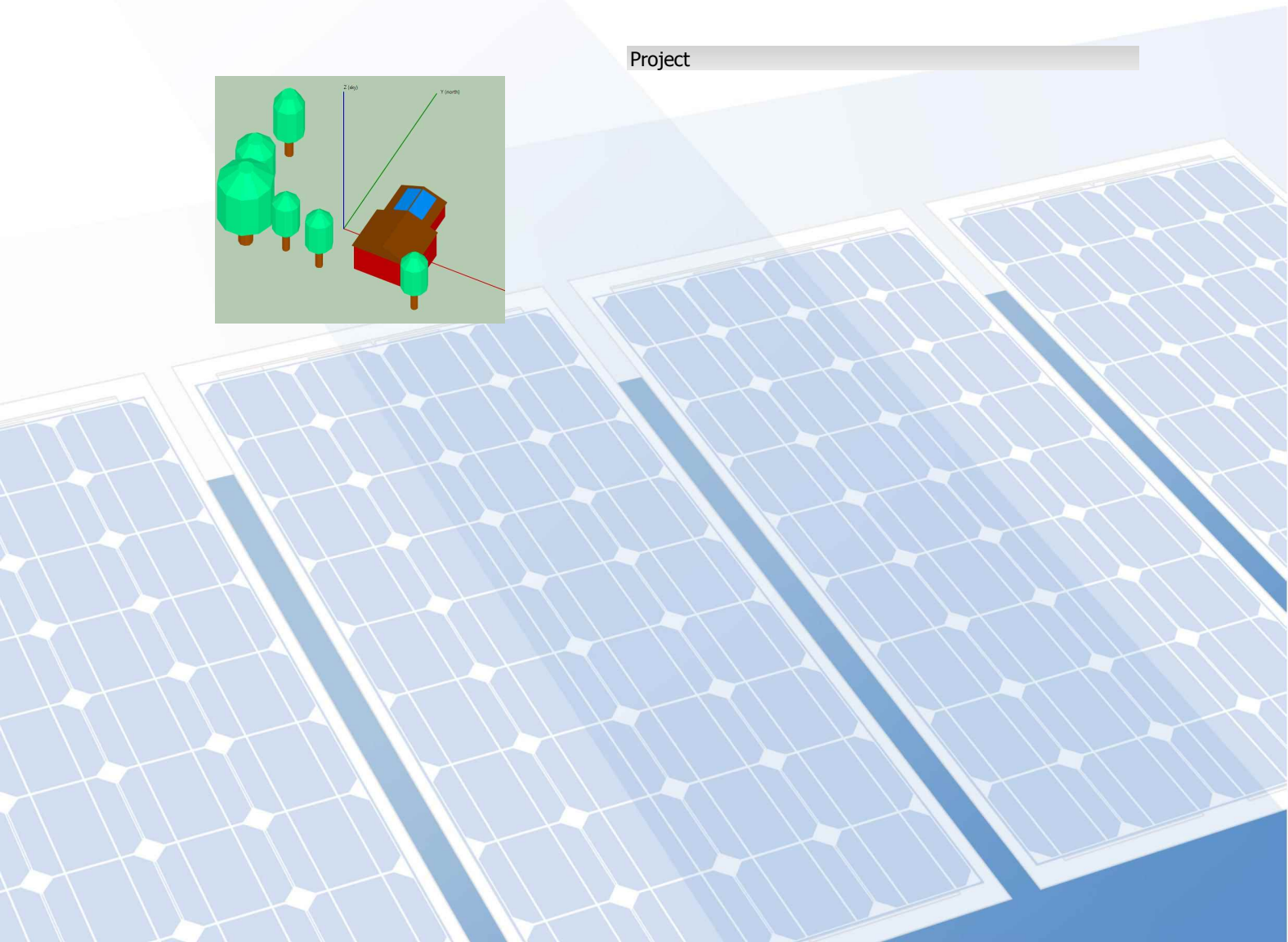
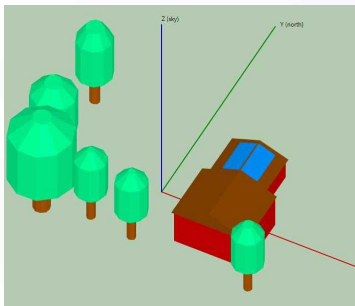


Company

Please enter in Options > User data.

Client

Project

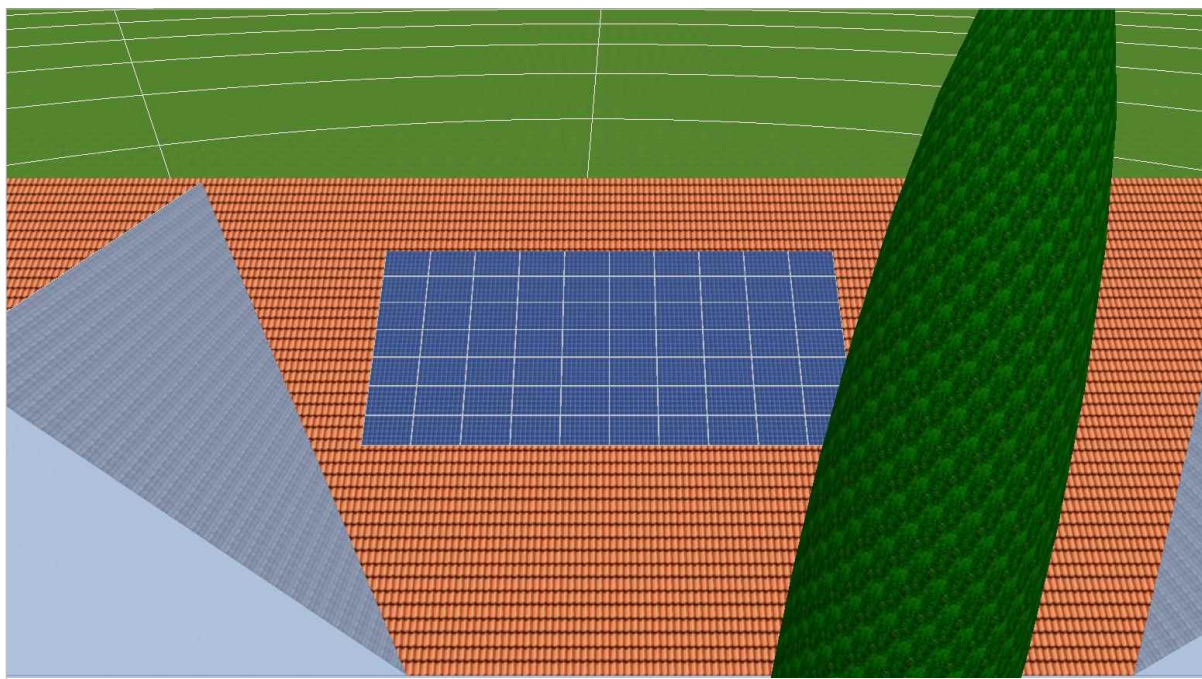


Date of Offer: 8/8/2016

9815 Babbitt

Project Designer:

Company: Please enter in Options > User data.



### 3D, Grid Connected PV System

Climate Data

LOS ANGELES INTL ARPT (1991 - 2005)

PV Generator Output

14 kWp

PV Generator Surface

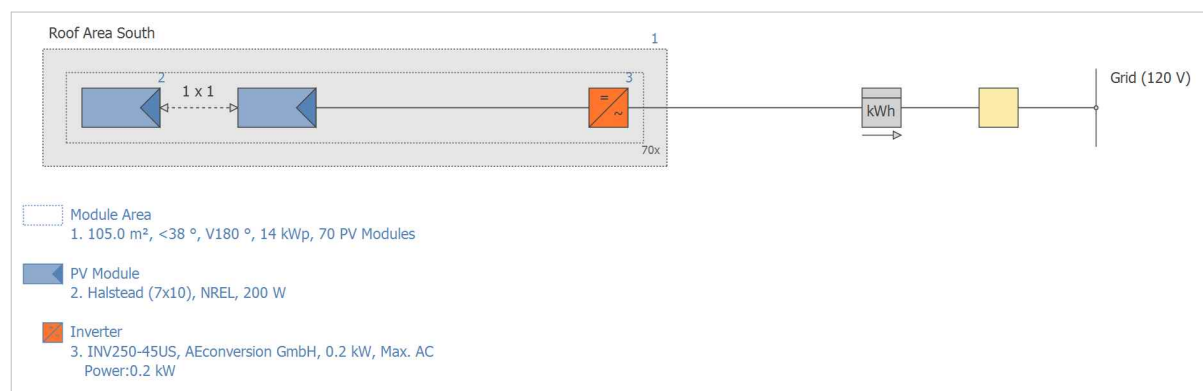
105.0 m<sup>2</sup>

Number of PV Modules

70

Number of Inverters

70



### The yield

PV Generator Energy (AC grid)

19,806 kWh

Spec. Annual Yield

1,414.75 kWh/kWp

Performance Ratio (PR)

73.4 %

Calculation of Shading Losses

10.8 %/year

CO<sub>2</sub> Emissions avoided

11,879 kg / year

Date of Offer: 8/8/2016

**9815 Babbitt**

Project Designer:

Company: Please enter in Options > User data.

---

#### Your Gain

Total investment costs	21,000.00	\$
Return on Assets	4.44	%
Amortization Period	14.5	Years
Electricity Production Costs	0.06	\$/kWh

---

The results have been calculated with a mathematical model calculation from Valentin Software GmbH (PV\*SOL algorithms). The actual yields from the solar power system may differ as a result of weather variations, the efficiency of the modules and inverter, and other factors.

Date of Offer: 8/8/2016

9815 Babbitt

Project Designer:  
Company: Please enter in Options > User data.

## Set-up of the system

Climate Data

LOS ANGELES INTL ARPT

Type of System

3D, Grid Connected PV System

### PV Generator Module Area

Name

Roof Area South

PV Modules\*

70 x Halstead (7x10)

Manufacturer

NREL

Inclination

38 °

Orientation

South 180 °

Installation Type

Roof parallel

PV Generator Surface

105.0 m<sup>2</sup>

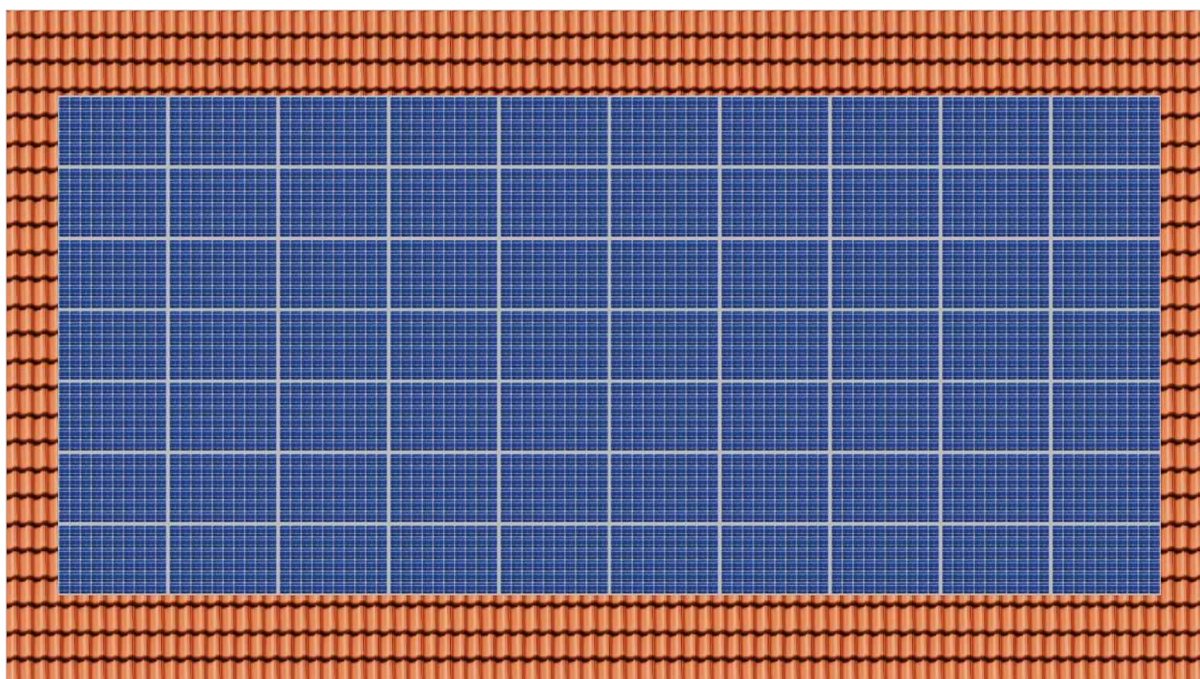


Figure: 3D Design for Roof Area South

## Losses

### Inverter

#### Module Area

#### Roof Area South

Inverter 1\*

70 x INV250-45US

Manufacturer

AEconversion GmbH

Configuration

MPP 1: 1 x 1

### AC Mains

Number of Phases

3

Mains Voltage (1-phase)

120 V

Displacement Power Factor (cos phi)

+/- 1

Date of Offer: 8/8/2016

**9815 Babbitt**

Project Designer:

Company: Please enter in Options > User data.

---

Cable

Max. Total Loss

0 %

\* The guarantee provisions of the respective manufacturer apply

---



**Simulation Results****PV System**

PV Generator Output	14 kWp
Spec. Annual Yield	1,414.75 kWh/kWp
Performance Ratio (PR)	73.4 %
Yield Reduction due to Shading	10.8 %/year

Grid Feed-in	19,806 kWh/year
Grid Feed-in in the first year (incl. module degradation)	19,806 kWh/year
Stand-by Consumption	9 kWh/year
CO <sub>2</sub> Emissions avoided	11,879 kg / year

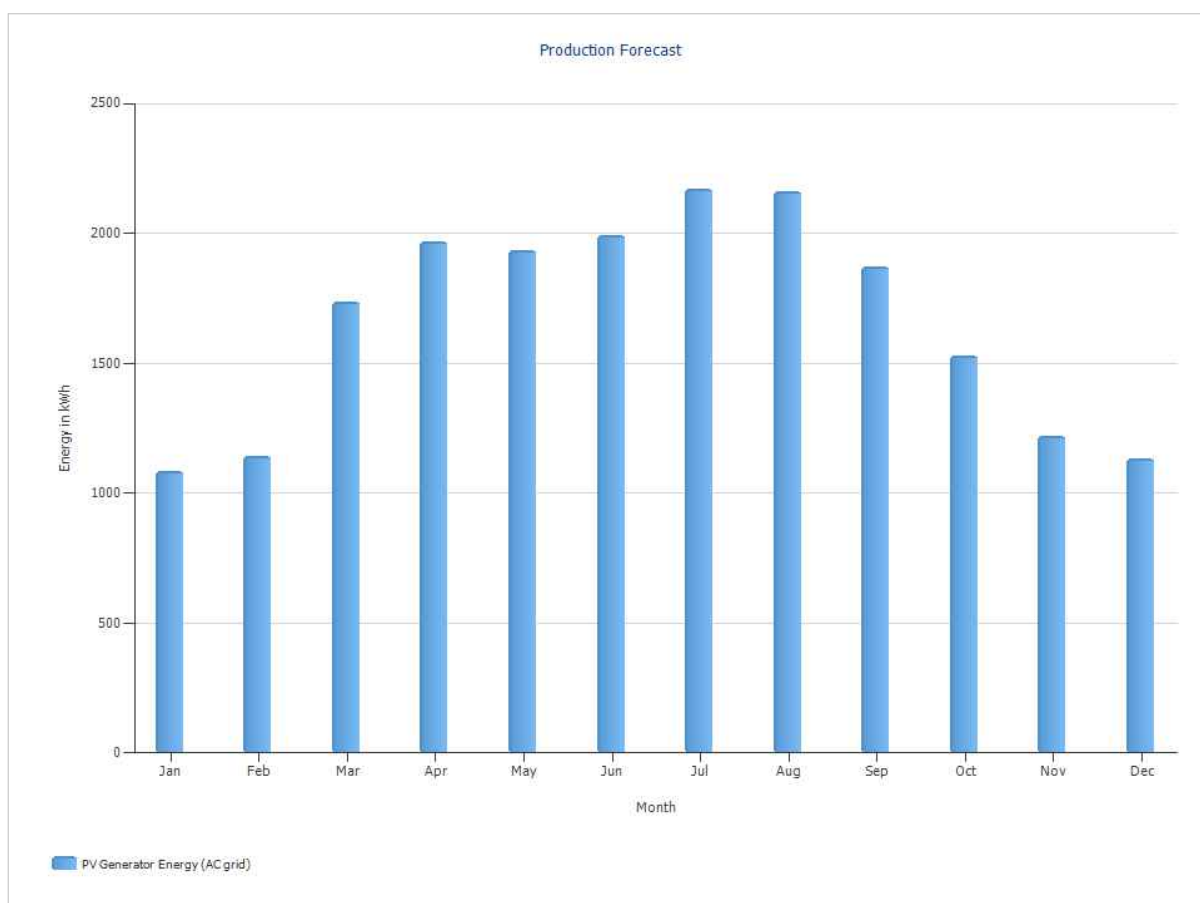


Figure: Production Forecast

**PV System Energy Balance**

<b>Global radiation - horizontal</b>	<b>1,824.6 kWh/m<sup>2</sup></b>	
Deviation from standard spectrum	-18.25 kWh/m <sup>2</sup>	-1.00 %
Orientation and inclination of the module surface	149.31 kWh/m <sup>2</sup>	8.27 %
Shading of diffuse radiation by horizon	-28.64 kWh/m <sup>2</sup>	-1.46 %
Reflection on the Module Interface	-72.44 kWh/m <sup>2</sup>	-3.76 %
<b>Global Radiation at the Module</b>	<b>1,854.5 kWh/m<sup>2</sup></b>	

$$\begin{aligned}
 &1,854.5 \text{ kWh/m}^2 \\
 &\times 105.04 \text{ m}^2 \\
 &= 194,804.4 \text{ kWh}
 \end{aligned}$$

<b>Global PV Radiation</b>	<b>194,804.4 kWh</b>	
Soiling	0.00 kWh	0.00 %
STC Conversion (Rated Efficiency of Module 13.33 %)	-168,828.44 kWh	-86.67 %
<b>Rated PV Energy</b>	<b>25,975.9 kWh</b>	
Module-specific Partial Shading	-986.39 kWh	-3.80 %
Low-light performance	-1,513.60 kWh	-6.06 %
Deviation from the nominal module temperature	-1,313.33 kWh	-5.59 %
Diodes	-58.54 kWh	-0.26 %
Mismatch (Manufacturer Information)	0.00 kWh	0.00 %
Mismatch (Configuration/Shading)	0.00 kWh	0.00 %
<b>PV Energy (DC) without inverter regulation</b>	<b>22,104.1 kWh</b>	
Regulation on account of the MPP Voltage Range	-271.63 kWh	-1.23 %
Regulation on account of the max. DC Current	0.00 kWh	0.00 %
Regulation on account of the max. DC Power	0.00 kWh	0.00 %
Regulation on account of the max. AC Power/cos phi	0.00 kWh	0.00 %
MPP Matching	-79.22 kWh	-0.36 %
<b>PV energy (DC)</b>	<b>21,753.2 kWh</b>	

<b>Energy at the Inverter Input</b>	<b>21,753.2 kWh</b>	
Input voltage deviates from rated voltage	-3.66 kWh	-0.02 %
DC/AC Conversion	-1,943.09 kWh	-8.93 %
Stand-by Consumption	-8.84 kWh	-0.04 %
Total Cable Losses	0.00 kWh	0.00 %
<b>PV energy (AC) minus standby use</b>	<b>19,797.6 kWh</b>	
<b>Grid Feed-in</b>	<b>19,806.5 kWh</b>	

**Financial Analysis****System Data**

Grid Feed-in in the first year (incl. module degradation)	19,806 kWh/year
PV Generator Output	14 kWp
Start of Operation of the System	1/1/2015
Assessment Period	20 Years

**Economic Parameters**

Return on Assets	4.44 %
Accrued Cash Flow (Cash Balance)	9,623.73 \$
Amortization Period	14.5 Years
Electricity Production Costs	0.06 \$/kWh

**Payment Overview**

Specific Investment Costs	1,500.00 \$/kWp
Investment Costs	21,000.00 \$
One-off Payments	0.00 \$
Incoming Subsidies	0.00 \$
Annual Costs	0.00 \$/year
Other Revenue or Savings	0.00 \$/year

**Remuneration and Savings**

Total Payment from Utility in First Year	0.00 \$
California feed-in tariff program - 20 year term - All	
Validity	8/5/2016 - 8/4/2036
Specific feed-in / export Remuneration	0.0895 \$/kWh
Feed-in / Export Tariff	1,772.68 \$/year



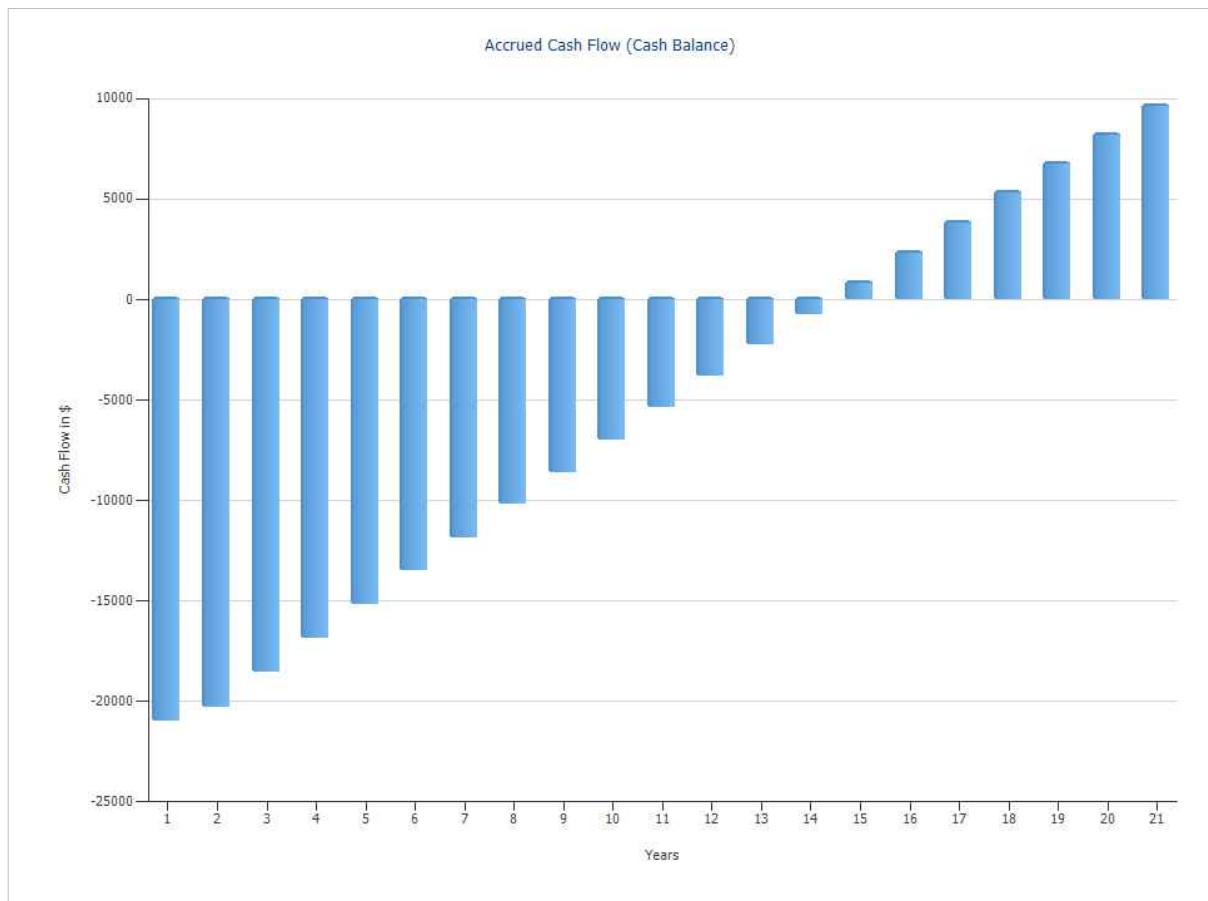


Figure: Accrued Cash Flow (Cash Balance)

**Cashflow Table**

	<b>year 1</b>	<b>year 2</b>	<b>year 3</b>	<b>year 4</b>	<b>year 5</b>
Investments	(\$21,000.00)	\$0.00	\$0.00	\$0.00	\$0.00
Feed-in / Export Tariff	\$0.00	\$689.22	\$1,720.55	\$1,703.51	\$1,686.64
<b>Annual Cash Flow</b>	<b>(\$21,000.00)</b>	<b>\$689.22</b>	<b>\$1,720.55</b>	<b>\$1,703.51</b>	<b>\$1,686.64</b>
Accrued Cash Flow (Cash Balance)	(\$21,000.00)	(\$20,310.78)	(\$18,590.23)	(\$16,886.72)	(\$15,200.08)

	<b>year 6</b>	<b>year 7</b>	<b>year 8</b>	<b>year 9</b>	<b>year 10</b>
Investments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Feed-in / Export Tariff	\$1,669.94	\$1,653.41	\$1,637.04	\$1,620.83	\$1,604.78
<b>Annual Cash Flow</b>	<b>\$1,669.94</b>	<b>\$1,653.41</b>	<b>\$1,637.04</b>	<b>\$1,620.83</b>	<b>\$1,604.78</b>
Accrued Cash Flow (Cash Balance)	(\$13,530.13)	(\$11,876.72)	(\$10,239.68)	(\$8,618.85)	(\$7,014.07)

	<b>year 11</b>	<b>year 12</b>	<b>year 13</b>	<b>year 14</b>	<b>year 15</b>
Investments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Feed-in / Export Tariff	\$1,588.89	\$1,573.16	\$1,557.59	\$1,542.17	\$1,526.90
<b>Annual Cash Flow</b>	<b>\$1,588.89</b>	<b>\$1,573.16</b>	<b>\$1,557.59</b>	<b>\$1,542.17</b>	<b>\$1,526.90</b>
Accrued Cash Flow (Cash Balance)	(\$5,425.17)	(\$3,852.01)	(\$2,294.42)	(\$752.26)	\$774.64

	<b>year 16</b>	<b>year 17</b>	<b>year 18</b>	<b>year 19</b>	<b>year 20</b>
Investments	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
Feed-in / Export Tariff	\$1,511.78	\$1,496.81	\$1,481.99	\$1,467.32	\$1,452.79
<b>Annual Cash Flow</b>	<b>\$1,511.78</b>	<b>\$1,496.81</b>	<b>\$1,481.99</b>	<b>\$1,467.32</b>	<b>\$1,452.79</b>
Accrued Cash Flow (Cash Balance)	\$2,286.42	\$3,783.23	\$5,265.22	\$6,732.54	\$8,185.33

	<b>year 21</b>
Investments	\$0.00
Feed-in / Export Tariff	\$1,438.41
<b>Annual Cash Flow</b>	<b>\$1,438.41</b>
Accrued Cash Flow (Cash Balance)	\$9,623.73

Degradation and inflation rates are applied on a monthly basis over the entire observation period.  
This is done in the first year.

**PV Module: Halstead (7x10)**

Manufacturer	NREL
Available	Yes

**Electrical Data**

Cell Type	Si polycrystalline
Only Transformer Inverters suitable	No
Number of Cells	60
Number of Bypass Diodes	3

**Mechanical Data**

Width	984 mm
Height	1525 mm
Depth	38 mm
Frame Width	0 mm
Weight	22 kg
Framed	No

**I/V Characteristics at STC**

MPP Voltage	28.3 V
MPP Current	7.07 A
Power Rating	200 W
Open Circuit Voltage	36.1 V
Short-Circuit Current	7.7 A
Increase open circuit voltage before stabilisation	0 %

**I/V Part Load Characteristics (calculated)**

Values source	Standard (Two-diode Model)
Series resistance Rs	7.51e-03 $\Omega$
Parallel Resistance Rp	1.802 $\Omega$
Saturation Current Parameters Cs1	195.8 A/K <sup>3</sup>
Saturation Current Parameters Cs2	-1.459e-13 A/K <sup>(2,5)</sup>
Photocurrent Parameters C1	6.957e-03 m <sup>2</sup> /V
Photocurrent Parameters C2	2.6e-06 m <sup>2</sup> /V
Photocurrent	7.732 A

**Further**

Voltage Coefficient	-123 mV/K
Electricity Coefficient	2.6 mA/K
Output Coefficient	-0.4 %/K
Incident Angle Modifier	95 %
Maximum System Voltage	1000 V
Spec. Heat Capacity	920 J/(kg*K)
Absorption Coefficient	70 %
Emissions Coefficient	85 %

Date of Offer: 8/8/2016

Project Designer:  
Company: Please enter in Options > User data.

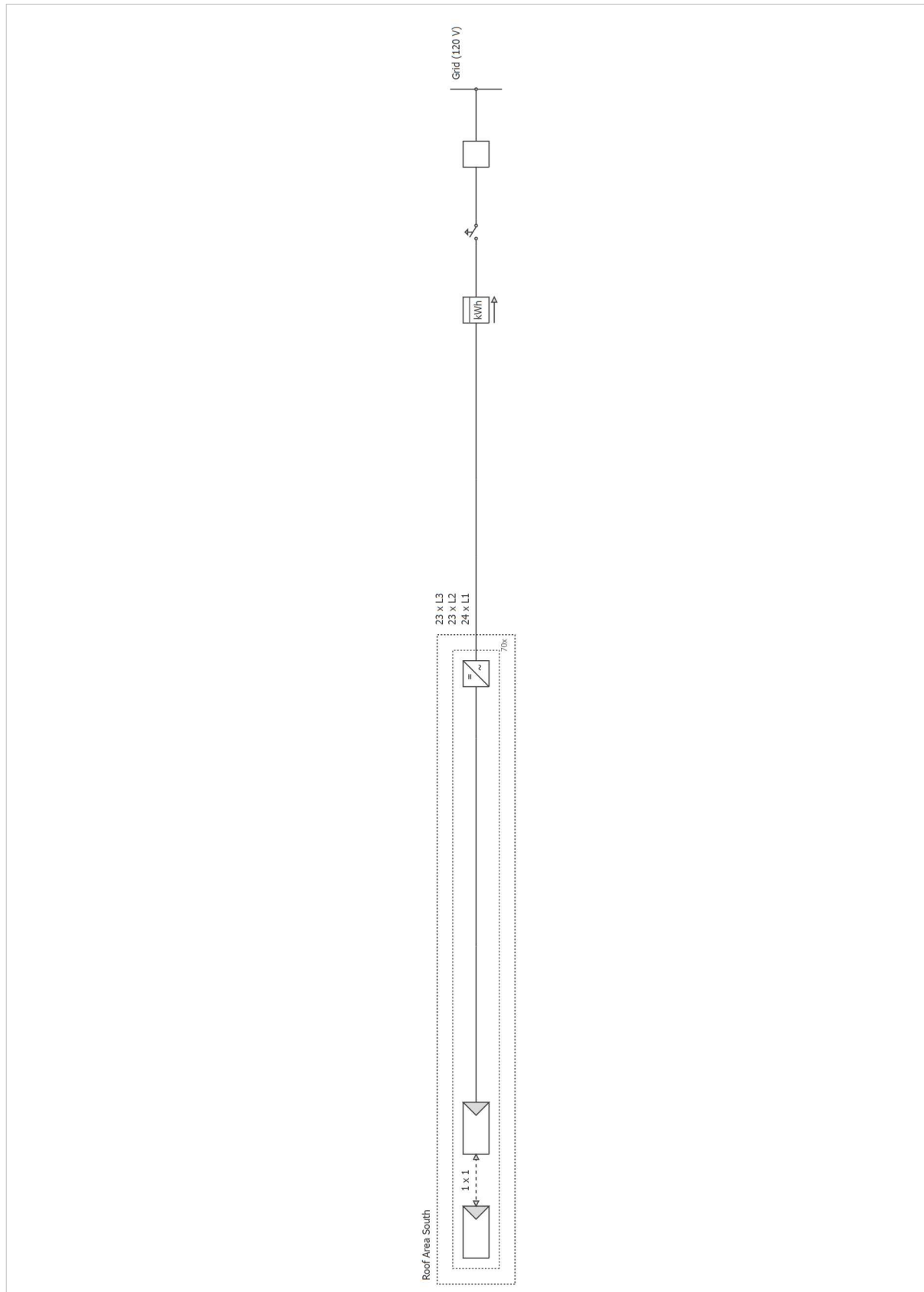
9815 Babbitt

#### Inverter: INV250-45US

Manufacturer	AEconversion GmbH
Available	Yes
<b>Electrical Data</b>	
DC Power Rating	0.25 kW
AC Power Rating	0.24 kW
Max. DC Power	0.26 kW
Max. AC Power	0.24 kW
Stand-by Consumption	0.03 W
Night Consumption	0.03 W
Feed-in from	3 W
Max. Input Current	11 A
Max. Input Voltage	60 V
Nom. DC Voltage	30 V
Number of Feed-in Phases	1
Number of DC Inlets	1
With Transformer	Yes
Change in Efficiency when Input Voltage deviates from Rated Voltage	0.5 %/100V

#### MPP Tracker

Output Range < 20% of Power Rating	99.98 %
Output Range > 20% of Power Rating	99.6 %
No. of MPP Trackers	1
Max. Input Current per MPP Tracker	11 A
Max. Input Power per MPP Tracker	0.25 kW
Min. MPP Voltage	20 V
Max. MPP Voltage	45 V



Roof Area South

