

## Mr & Mrs Smith Solar PV Simulation

Customer No.: 001 Example  
Project Name: 001 Example  
Offer no.: 001 Example

### Customer Details

Company	N/A
Customer Number	001 Example
Contact person	Mr & Mrs Smith
Address	Somerset, UK
Phone	N/A
Fax	N/A
E-Mail	N/A

### Project Data

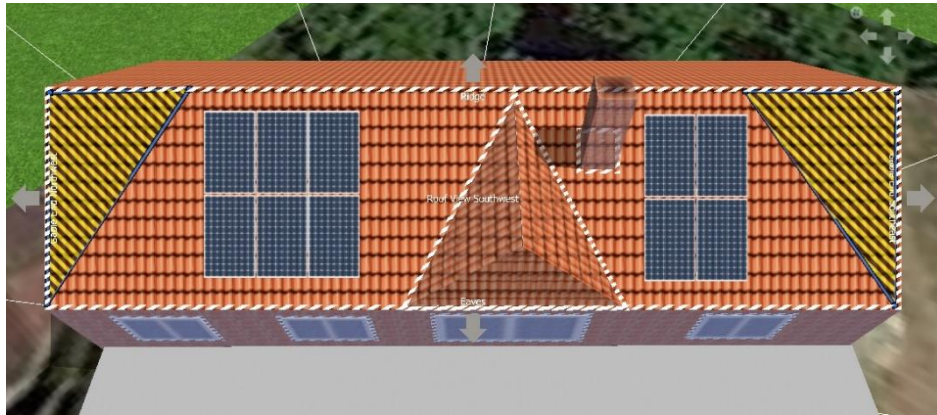
Project Name	001 Example
Offer no.	001 Example
Project Designer	Michael Middlemast
Address	Somerset, UK



### Project Description:

In roof mounting  
Solar Edge Inverter & Optimisers  
SunPower Solar Modules  
Tesla Powerwall Storage System

## Project Overview



## Simulation Details

Climate Data	YEOVILTON (NAVY), GBR (1991 - 2010)
Values source	Meteonorm 7.3
PV Generator Output	4 kWp
PV Generator Surface	17.7 m <sup>2</sup>
Number of PV Modules	10
Number of Inverters	1
No. of battery systems	1
No. of vehicles	1

## Production Forecast

<b>PV Generator Output</b>	<b>4.00 kWp</b>
Spec. Annual Yield	1,069.90 kWh/kWp
Performance Ratio (PR)	87.83 %
Yield Reduction due to Shading	2.9 %/Year
PV Generator Energy (AC grid)	4,291 kWh/Year
Direct Own Use	801 kWh/Year
Battery Charge	1,285 kWh/Year
Charge of the electric vehicle	864 kWh/Year
Grid Feed-in	1,340 kWh/Year
<b>Own Power Consumption</b>	<b>68.7 %</b>
<b>CO<sub>2</sub> Emissions avoided</b>	<b>961 kg / year</b>
<b>Level of Self-sufficiency</b>	<b>43.7 %</b>

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.

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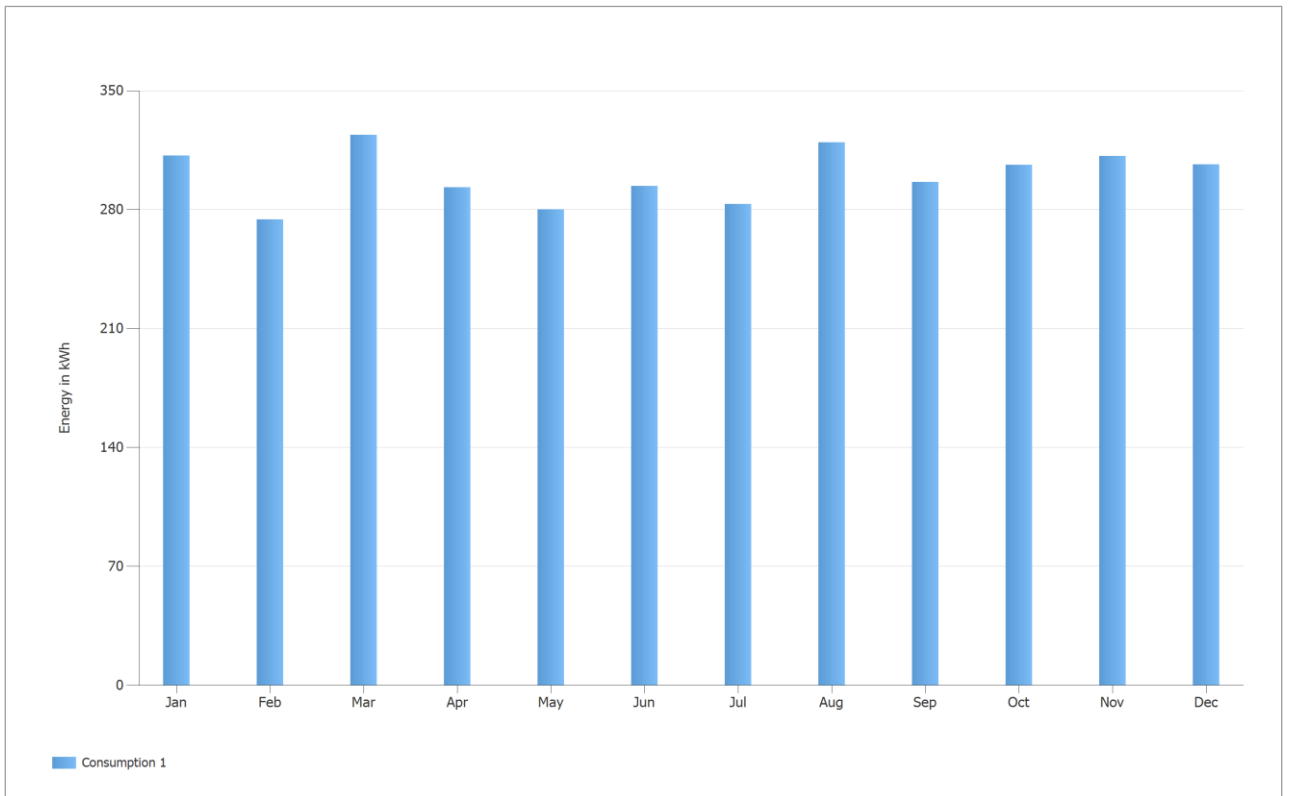


Figure: Consumption



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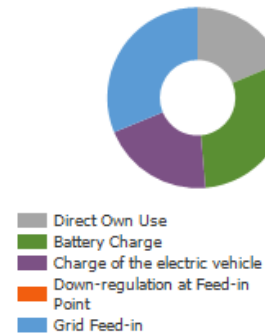


# Simulation Results

## PV System

PV Generator Output	4.00 kWp
Spec. Annual Yield	1,069.90 kWh/kWp
Performance Ratio (PR)	87.83 %
Yield Reduction due to Shading	2.9 %/Year
PV Generator Energy (AC grid)	4,291 kWh/Year
Direct Own Use	801 kWh/Year
Battery Charge	1,285 kWh/Year
Charge of the electric vehicle	864 kWh/Year
Down-regulation at Feed-in Point	0 kWh/Year
Grid Feed-in	1,340 kWh/Year
Own Power Consumption	68.7 %

PV Generator Energy (AC grid)

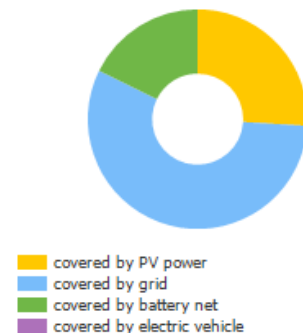


**CO<sub>2</sub> Emissions avoided** 961 kg / year

## Appliances

Appliances	3,600 kWh/Year
Standby Consumption (Inverter)	11 kWh/Year
Charge of the electric vehicle	2,802 kWh/Year
Total Consumption	6,413 kWh/Year
covered by PV power	1,665 kWh/Year
covered by grid	3,611 kWh/Year
covered by battery net	1,136 kWh/Year
covered by electric vehicle	0 kWh/Year
Solar Fraction	43.7 %

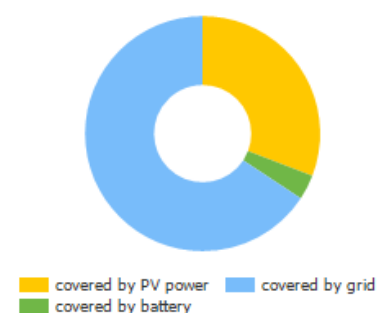
Total Consumption



## Electric vehicle

Charge at beginning	75 kWh
Charge of the electric vehicle (Total)	2,802 kWh/Year
covered by PV power	864 kWh/Year
covered by battery	96 kWh/Year
covered by grid	1,841 kWh/Year
Discharging the electric vehicle for consumption	0 kWh/Year
Losses due to charging/discharging	157 kWh/Year
Losses in Battery	146 kWh/Year
Consumption due to kilometres driven	2573 kWh/Year
Mileage per year	18250 km/Year
of which is solar	6256 km/Year

Charge of the electric vehicle (Total)



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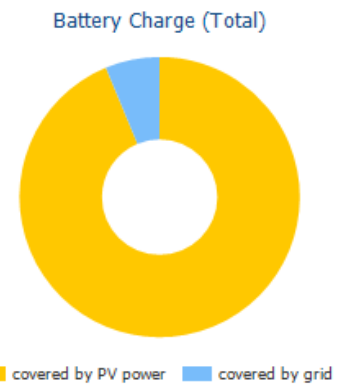
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### Battery System

Charge at beginning	6 kWh
Battery Charge (Total)	1,371 kWh/Year
covered by PV power	1,285 kWh/Year
covered by grid	86 kWh/Year
Battery Energy for the Covering of Consumption	1,222 kWh/Year
Charge of the electric vehicle	96 kWh/Year
Consumption	1,126 kWh/Year
Losses due to charging/discharging	143 kWh/Year
Losses in Battery	13 kWh/Year
Cycle Load	5.8 %
Service Life	17 Years



### Level of Self-sufficiency

<b>Total Consumption</b>	<b>6,413 kWh/Year</b>
<b>covered by grid</b>	<b>3,611 kWh/Year</b>
<b>Level of Self-sufficiency</b>	<b>43.7 %</b>

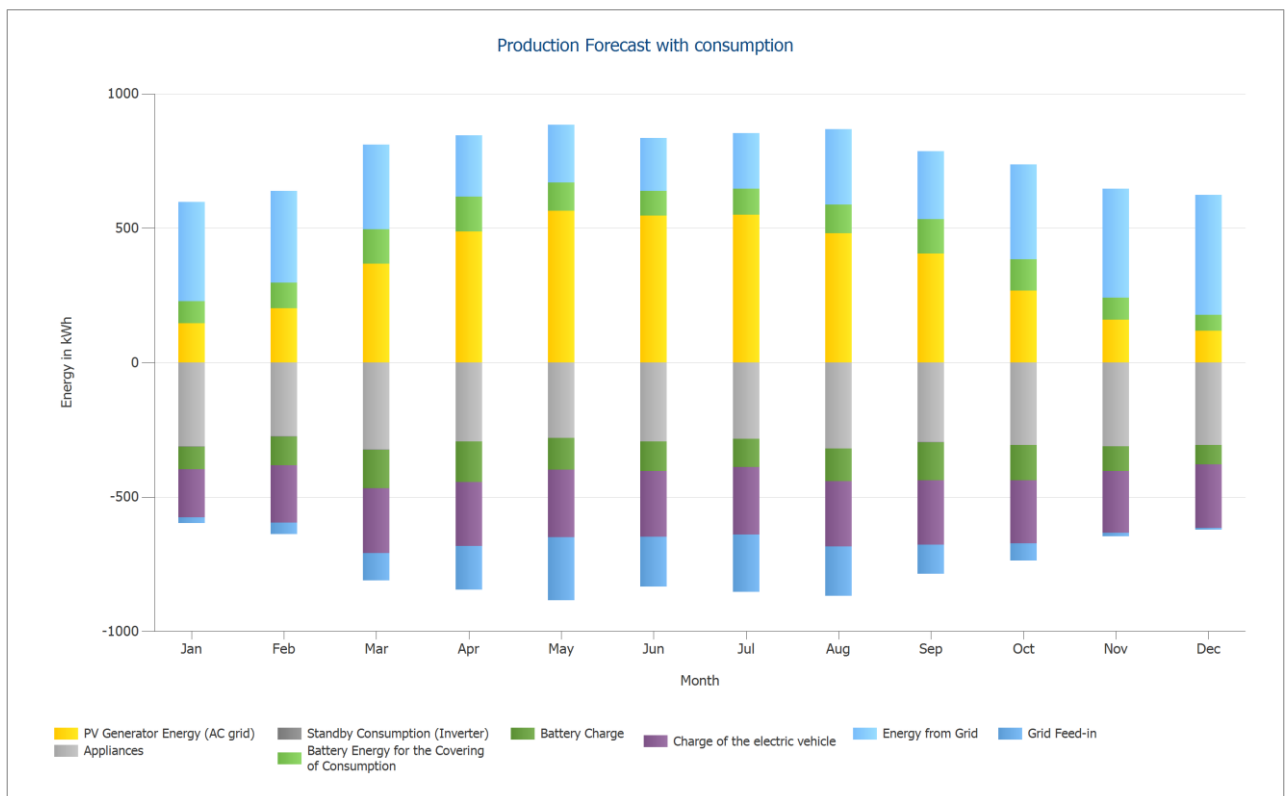


Figure: Production Forecast with consumption

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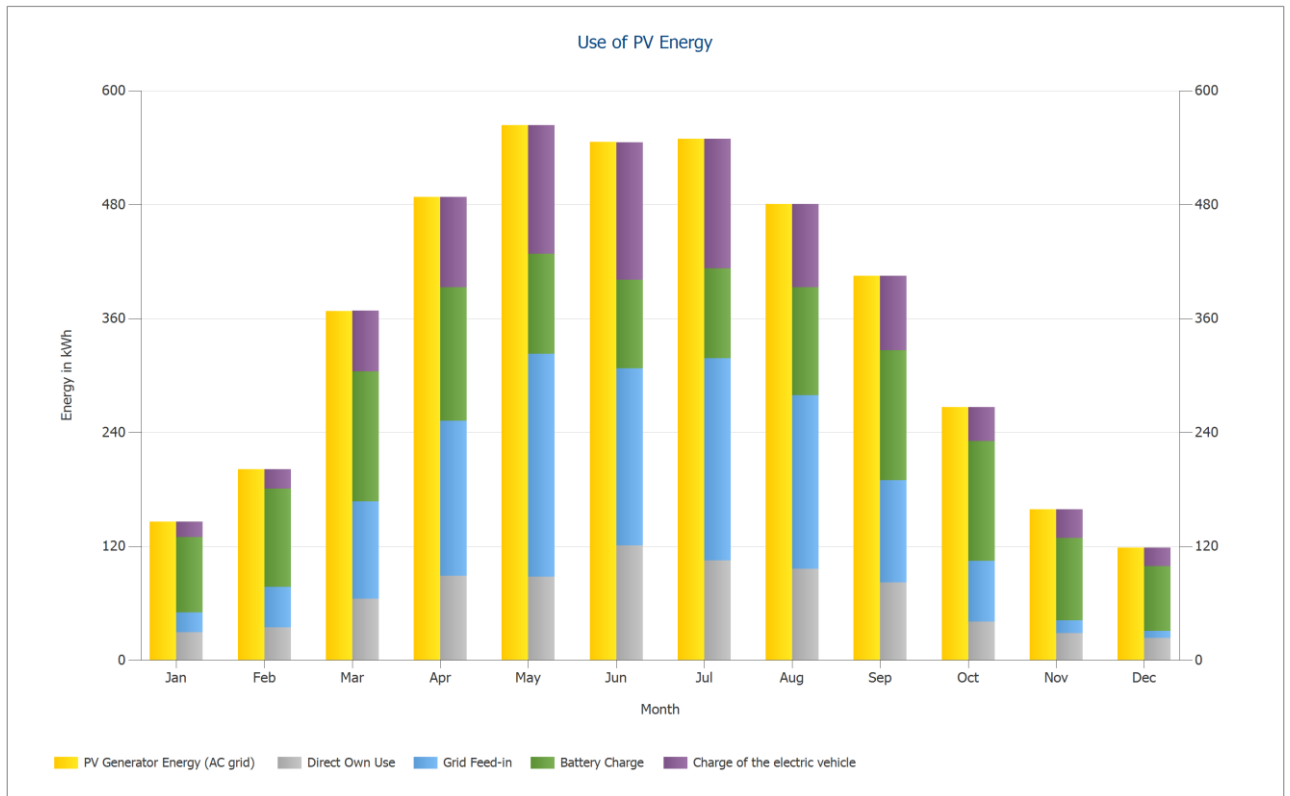


Figure: Use of PV Energy

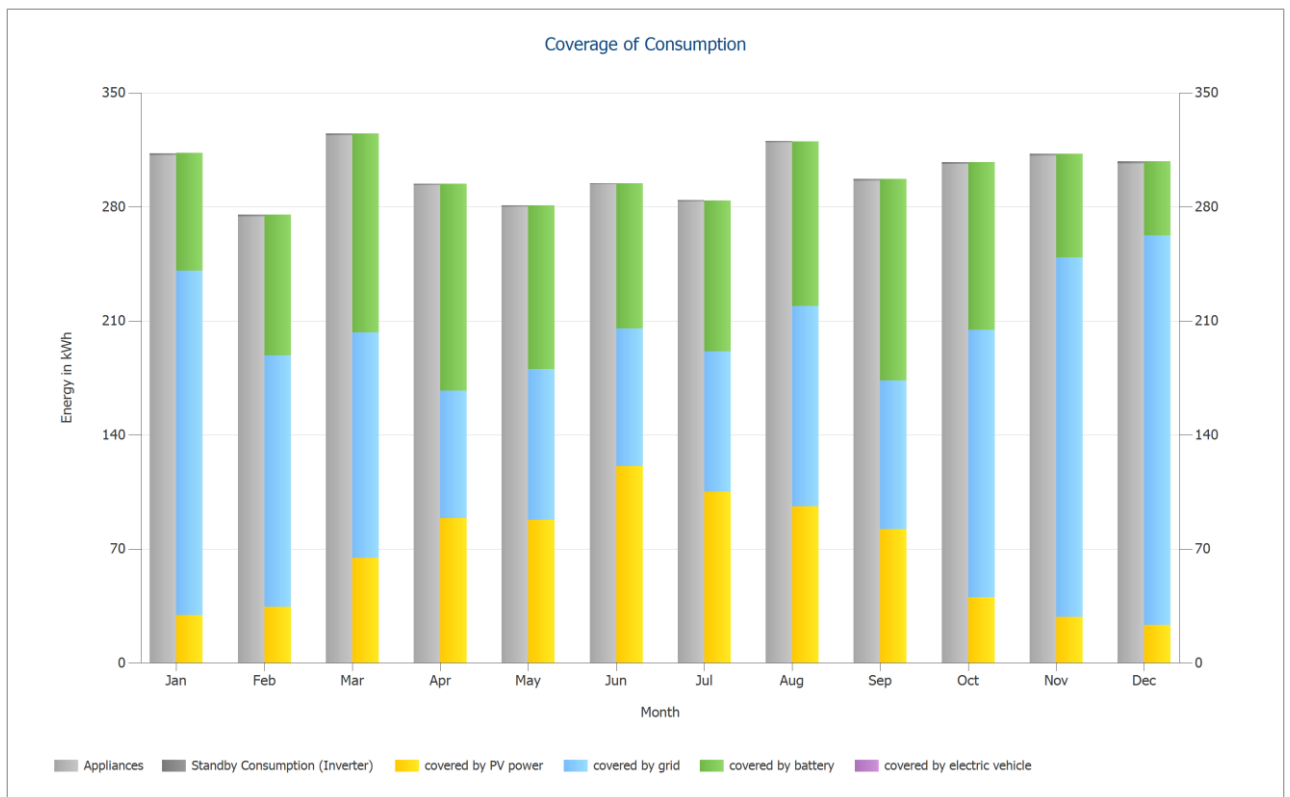


Figure: Coverage of Consumption

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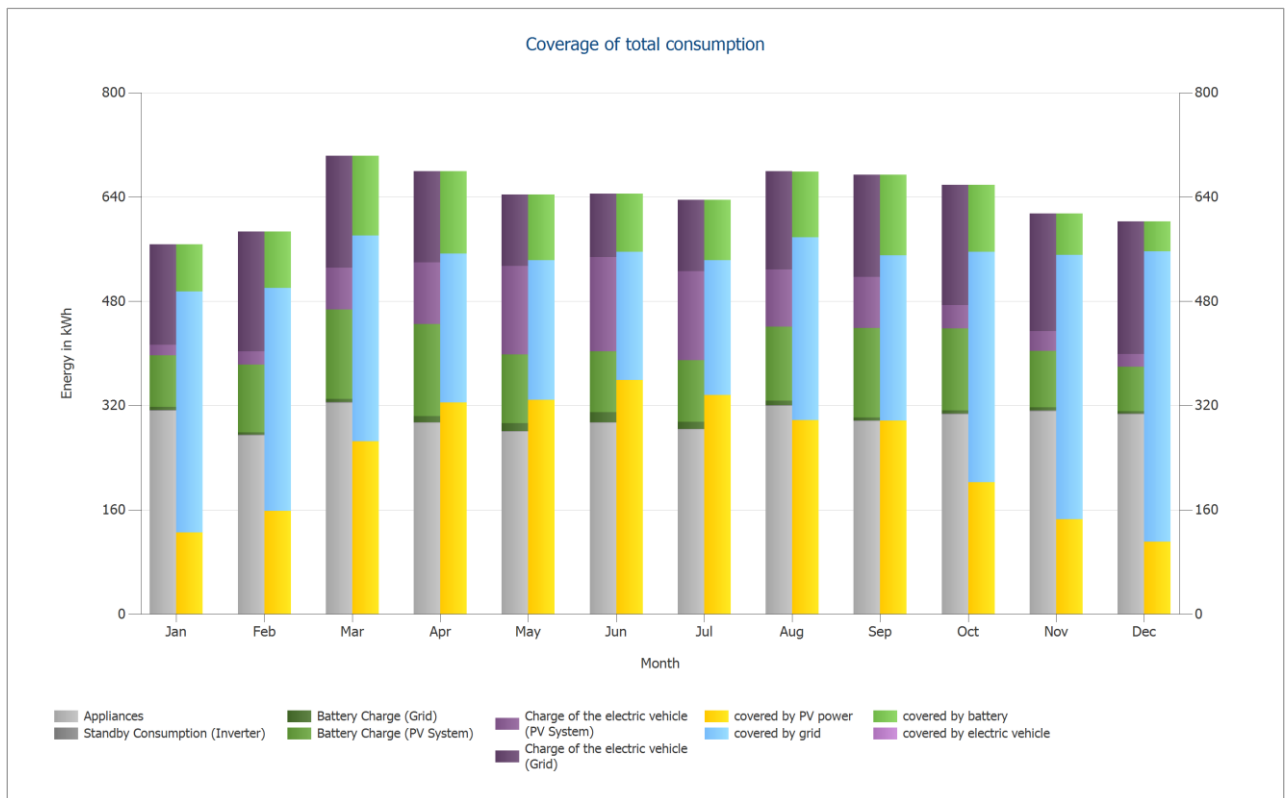


Figure: Coverage of total consumption

## PV System Energy Balance

<b>Global radiation - horizontal</b>	<b>1,117.20 kWh/m<sup>2</sup></b>	
Deviation from standard spectrum	-11.17 kWh/m <sup>2</sup>	-1.00 %
Ground Reflection (Albedo)	20.00 kWh/m <sup>2</sup>	1.81 %
Orientation and inclination of the module surface	95.83 kWh/m <sup>2</sup>	8.51 %
Module-independent shading	-3.96 kWh/m <sup>2</sup>	-0.32 %
Reflection on the Module Interface	0.00 kWh/m <sup>2</sup>	0.00 %
<b>Global Radiation at the Module</b>	<b>1,217.90 kWh/m<sup>2</sup></b>	
	1,217.90 kWh/m <sup>2</sup>	
	x 17.677 m <sup>2</sup>	
	= 21,529.34 kWh	
<b>Global PV Radiation</b>	<b>21,529.34 kWh</b>	
Soiling	0.00 kWh	0.00 %
STC Conversion (Rated Efficiency of Module 22.63 %)	-16,656.95 kWh	-77.37 %
<b>Rated PV Energy</b>	<b>4,872.39 kWh</b>	
Module-specific Partial Shading	-119.28 kWh	-2.45 %
Low-light performance	-70.45 kWh	-1.48 %
Deviation from the nominal module temperature	-100.76 kWh	-2.15 %
Diodes	-2.08 kWh	-0.05 %
Mismatch (Manufacturer Information)	0.00 kWh	0.00 %
Mismatch (Configuration/Shading)	0.00 kWh	0.00 %
Power optimizer (DC conversion/down-regulation)	-51.98 kWh	-1.13 %
<b>PV Energy (DC) without inverter down-regulation</b>	<b>4,527.84 kWh</b>	
Failing to reach the DC start output	0.00 kWh	0.00 %
Down-regulation on account of the MPP Voltage Range	-2.15 kWh	-0.05 %
Down-regulation on account of the max. DC Current	-1.51 kWh	-0.03 %
Down-regulation on account of the max. DC Power	0.00 kWh	0.00 %
Down-regulation on account of the max. AC Power/cos phi	-152.97 kWh	-3.38 %
MPP Matching	0.00 kWh	0.00 %
<b>PV energy (DC)</b>	<b>4,371.20 kWh</b>	
<b>Energy at the Inverter Input</b>	<b>4,371.20 kWh</b>	
Input voltage deviates from rated voltage	0.00 kWh	0.00 %
DC/AC Conversion	-58.86 kWh	-1.35 %
Standby Consumption (Inverter)	-11.16 kWh	-0.26 %
Total Cable Losses	-21.56 kWh	-0.50 %
<b>PV energy (AC) minus standby use</b>	<b>4,279.61 kWh</b>	
<b>PV Generator Energy (AC grid)</b>	<b>4,290.77 kWh</b>	



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# Data Sheets

## PV Module Data Sheet

PV Module: SPR-MAX3-400 (v1)

Manufacturer	SunPower
Available	Yes

### Electrical Data

Cell Type	Si monocrystalline
Half-cell module	No
Cell Count	104
Number of Bypass Diodes	3
Loss voltage per bypass diode	1 V
Integrated power optimizer	No
Only Transformer Inverters suitable	No

### I/V Characteristics at STC

MPP Voltage	65.8 V
MPP Current	6.08 A
Open Circuit Voltage	75.6 V
Short-Circuit Current	6.58 A
Increase open circuit voltage before stabilisation	0 %
Nominal output	400 W
Fill Factor	80.42 %
Efficiency	22.63 %

### I/V Part Load Characteristics

Values source	Manufacturer/user-created
Irradiance	200 W/m <sup>2</sup>
Voltage in MPP at Part Load	62.9 V
Current in MPP at Part Load	1.23 A
Open Circuit Voltage (Part Load)	71.3 V
Short Circuit Current at Part Load	1.32 A

### Additional Parameters

Temperature Coefficient of Voc	-176.8 mV/K
Temperature Coefficient of Isc	2.9 mA/K
Temperature Coefficient of Pmpp	-0.29 %/K
Incident Angle Modifier (IAM)	100 %
Maximum System Voltage	1000 V

### Mechanical Data

Width	1046 mm
Height	1690 mm
Depth	40 mm
Frame Width	7 mm
Weight	19 kg

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# Power Optimizer Data Sheet

Power Optimizer: P405 WorldWide (v2)

Manufacturer	SolarEdge
Available	Yes
<b>Electrical Data</b>	
module-integrated	No
Optimizer mode	Full
DC nominal output	405 W
Max. Input Voltage	125 V
Max. output voltage	85 V
Max. Input Current	11 A
Max. output current	15 A
Min. MPP Voltage	12.5 V
Max. MPP Voltage	105 V
Reduction of the open circuit voltage	0 %
Maximum string mismatch	0 %

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# Inverter Data Sheet

Inverter: SE3000H-EU-APAC/AUS (v1)

Manufacturer	SolarEdge
Available	Yes
<b>Electrical data - DC</b>	
DC nominal output	4.65 kW
Max. DC Power	4.65 kW
Nom. DC Voltage	380 V
Max. Input Voltage	480 V
Max. Input Current	9 A
Number of DC Inlets	1
<b>Electrical data - AC</b>	
AC Power Rating	3 kW
Max. AC Power	3 kVA
Number of Phases	1
With Transformer	No
<b>Electrical data - other</b>	
Change in Efficiency when Input Voltage deviates from Rated Voltage	0 %/100V
Min. Feed-in Power	0 W
Standby Consumption	2.5 W
Night Consumption	2.5 W
<b>MPP Tracker</b>	
Output Range < 20% of Power Rating	100 %
Output Range > 20% of Power Rating	100 %
Count of MPP Trackers	1
<b>MPP Tracker 1</b>	
Max. Input Current	9 A
Max. Input Power	4.65 kW
Min. MPP Voltage	380 V
Max. MPP Voltage	380 V

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# Battery System Data Sheet

## Battery System: Tesla Powerwall + SolarEdge StorEdge SE3500 (6,4 kWh) (v1)

Manufacturer	Tesla Motors
Available	Yes
<b>Battery Inverter</b>	
Nominal output	3.3 kW
Maximum Charging Power	3.3 kW
Maximum Discharge Power	3.3 kW
Type of Coupling	AC coupling
<b>Battery</b>	
Manufacturer Battery	Tesla Motors
Model	Powerwall (v1)
Quantity	1 (1x1)
DC Battery System Voltage	48.0 V
Usable Battery Energy	6.4 kWh
Capacity at t=10h	133.33 Ah

# Battery Data Sheet

## Battery: Powerwall (v1)

Manufacturer	Tesla Motors
Available	Yes
<b>Electrical Data</b>	
Battery Type	Lithium iron phosphate
Cell voltage	3.2 V
No. of Cells in Series	15
Nom. Voltage	48 V
Number of Battery Strings	2
Internal Resistance	1.2 mΩ
Self-Discharge	3 %/Month
Service Life in Charge-discharge Cycles (DoD = 40 %)	11480
<b>Mechanical Data</b>	
Length	180 mm
Width	860 mm
Height	1300 mm
Weight	100 kg

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# Electrical Vehicle Data Sheet

Electric vehicle: Model 3 Maximum Range (AC charging) (AC Typ 2) (v1)

Manufacturer	Tesla
Available	Yes
<b>Vehicle</b>	
Range in accordance with WLTP	560 km
Consumption	14.1 kWh / 100km
Battery Capacity	75 kWh
Discharge Power	11 kW
Engine power	340 kW
Number of seats	5
<b>Charging station</b>	
Charging technology	AC Typ 2
Charging Power	11 kW
Discharge for covering consumption	No

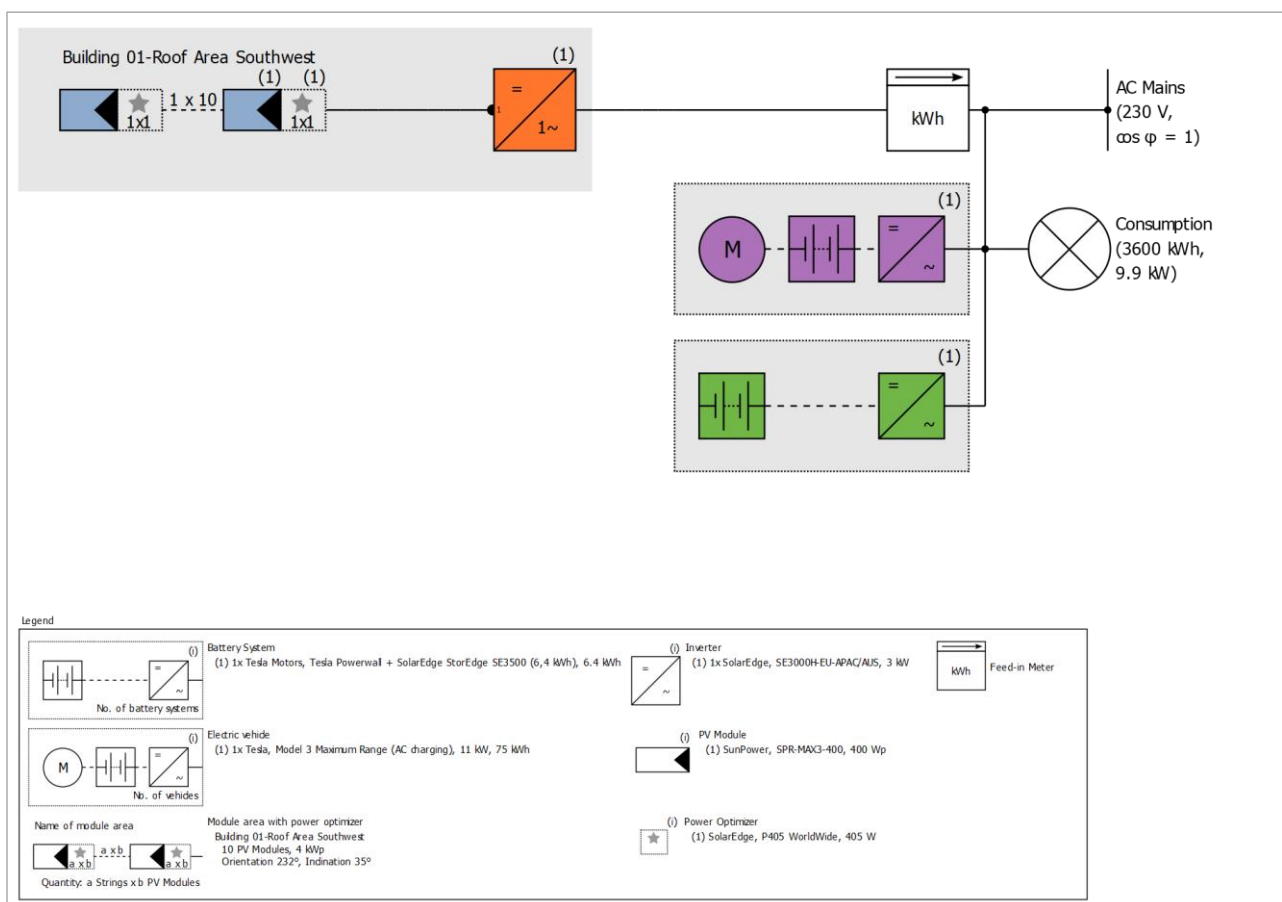


Figure: Circuit Diagram

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## Dimensioning Plan

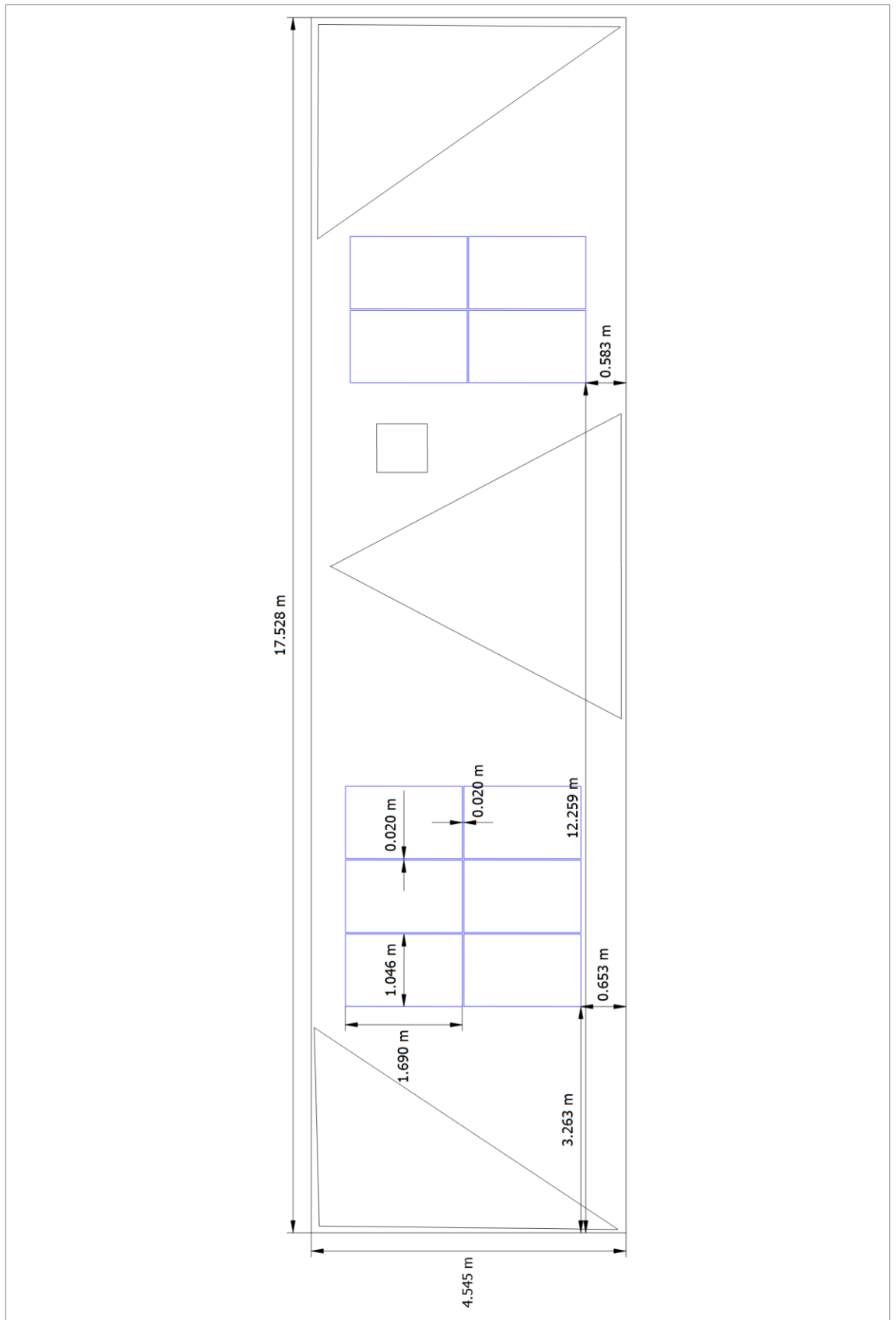


Figure: Building 01-Roof Area Southwest

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## String Plan

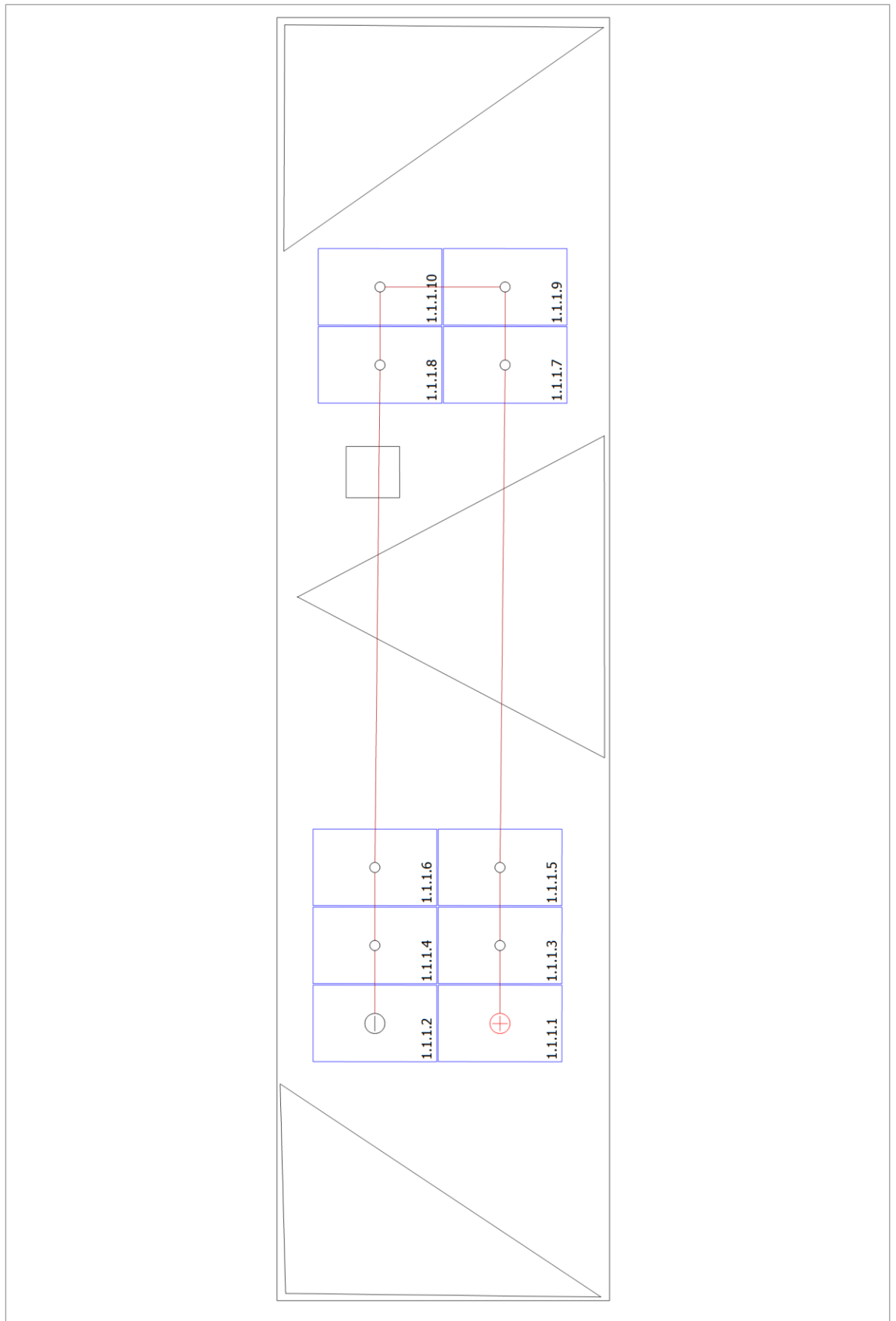


Figure: Building 01-Roof Area Southwest

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## Parts list

### Parts list

#	Type	Item number	Manufacturer	Name	Quantity	Unit
1	PV Module		SunPower	SPR-MAX3-400	10	Piece
2	Inverter		SolarEdge	SE3000H-EU- APAC/AUS	1	Piece
3	Power Optimizer		SolarEdge	P405 WorldWide	10	Piece
4	Battery System		Tesla Motors	Tesla Powerwall + SolarEdge StorEdge SE3500 (6,4 kWh)	1	Piece
5	Electric vehicle		Tesla	Model 3 Maximum Range (AC charging)	1	Piece
7	Components			Circuit Breaker B 25A	1	Piece
8	Components			Circuit Breaker	1	Piece
9	Components			Dynamic feed-in control	1	Piece
10	Components			Network and system protection (simplified)	1	Piece