Stand alone pv system design using Pvsyst

ห้องปฏิบัติการวิจัยเทคโนโลยีพลังงานแสงอาทิตย์,

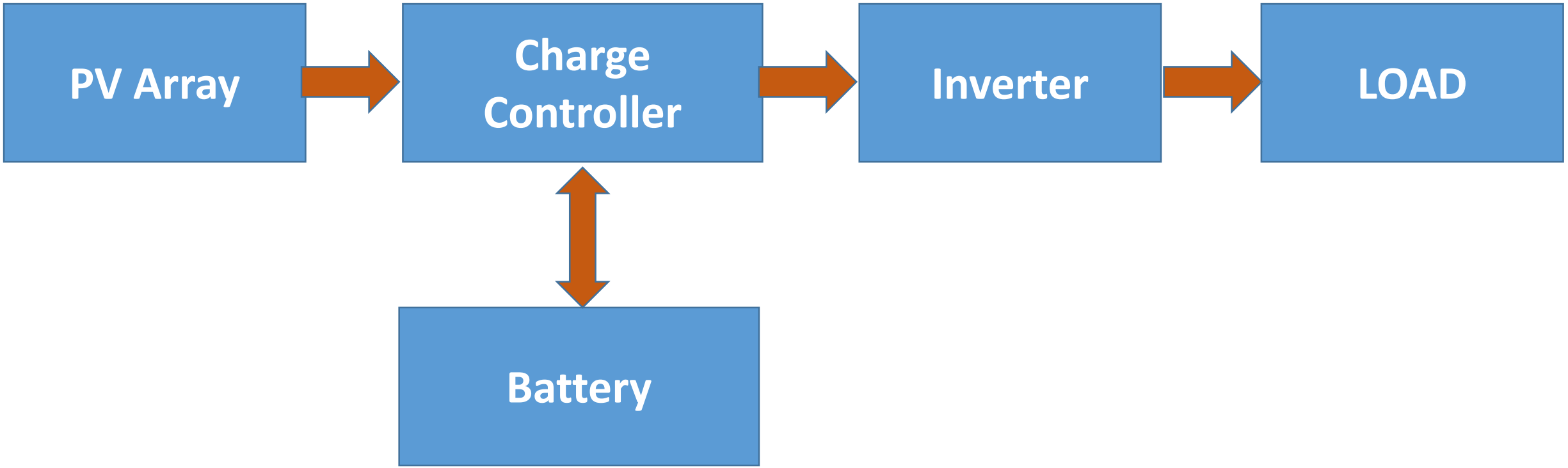
Solar Energy Technology Laboratory (STL)

ศูนย์เทคโนโลยีอิเล็กทรอนิกส์และคอมพิวเตอร์แห่งชาติ

(National Electronics and Computer Technology Center (NECTEC)

Pvsyst : Design Steps

PV Stand-alone systems



Pvsyst : Design Steps

Preliminary design

Project design
- Define system

Project specification
- Site coordinates
- Meteorological
- Project setting

Parameter
- Load

Simulation
- Simulation

Results
- Report

Project Design

Project design
- Define system

Project specification
- Site coordinates
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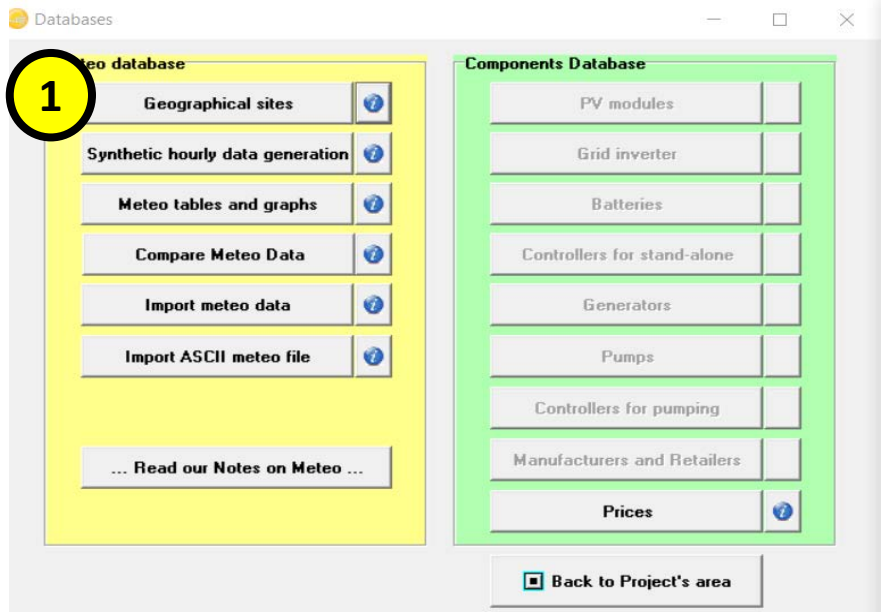
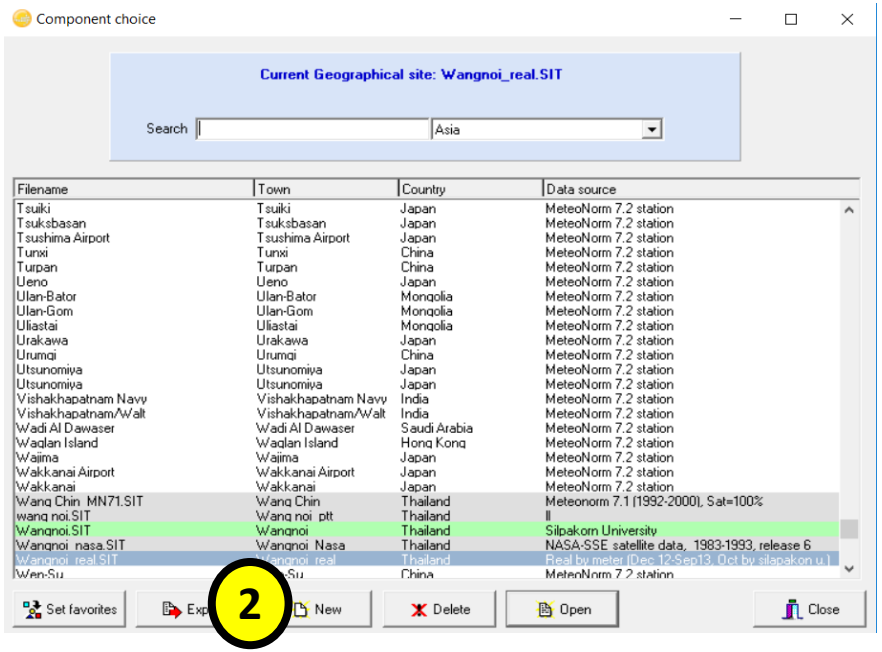
Parameter
- Load
- Battery
- PV Module
- Loss

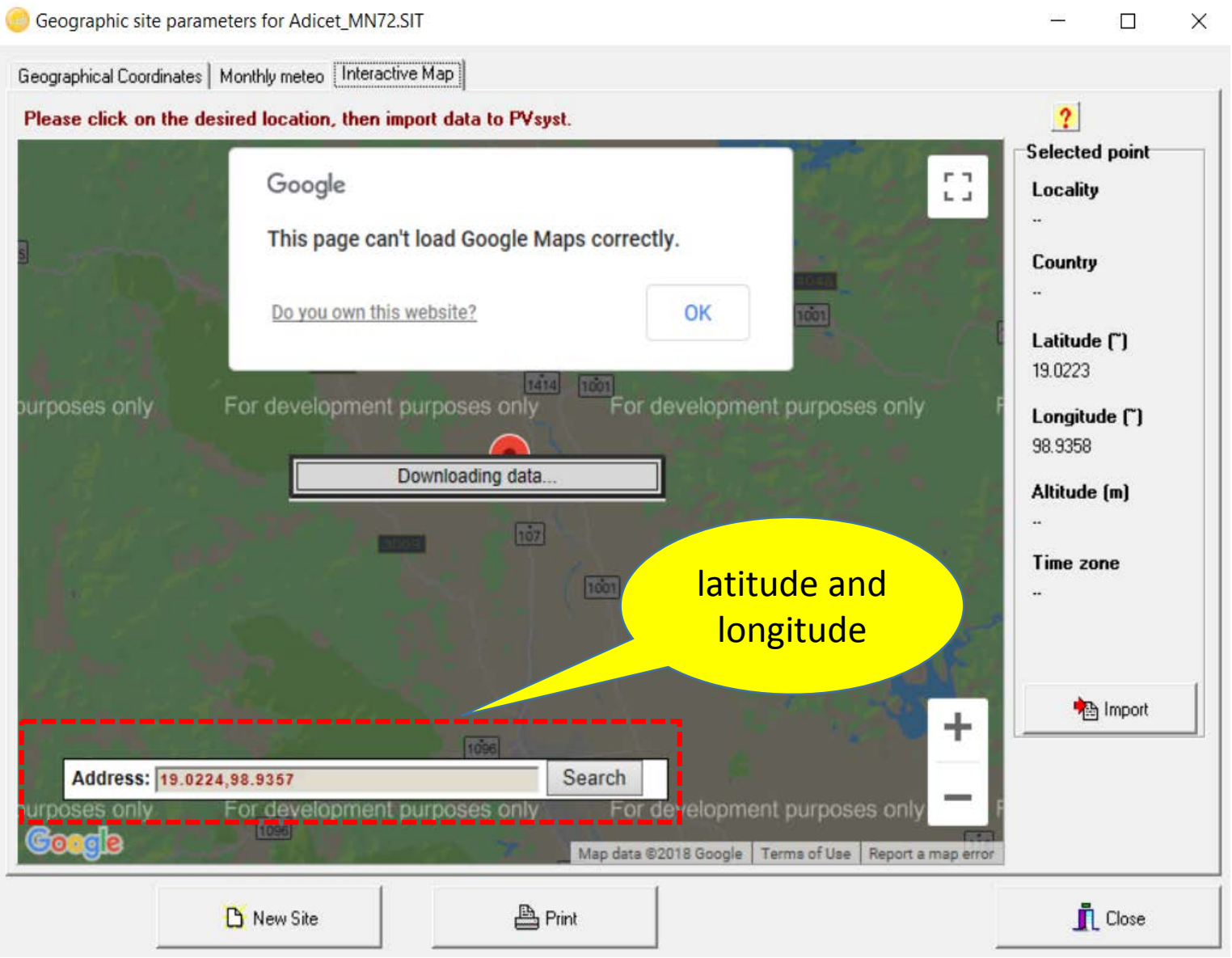
Simulation
- Simulation setting

Results
- Report

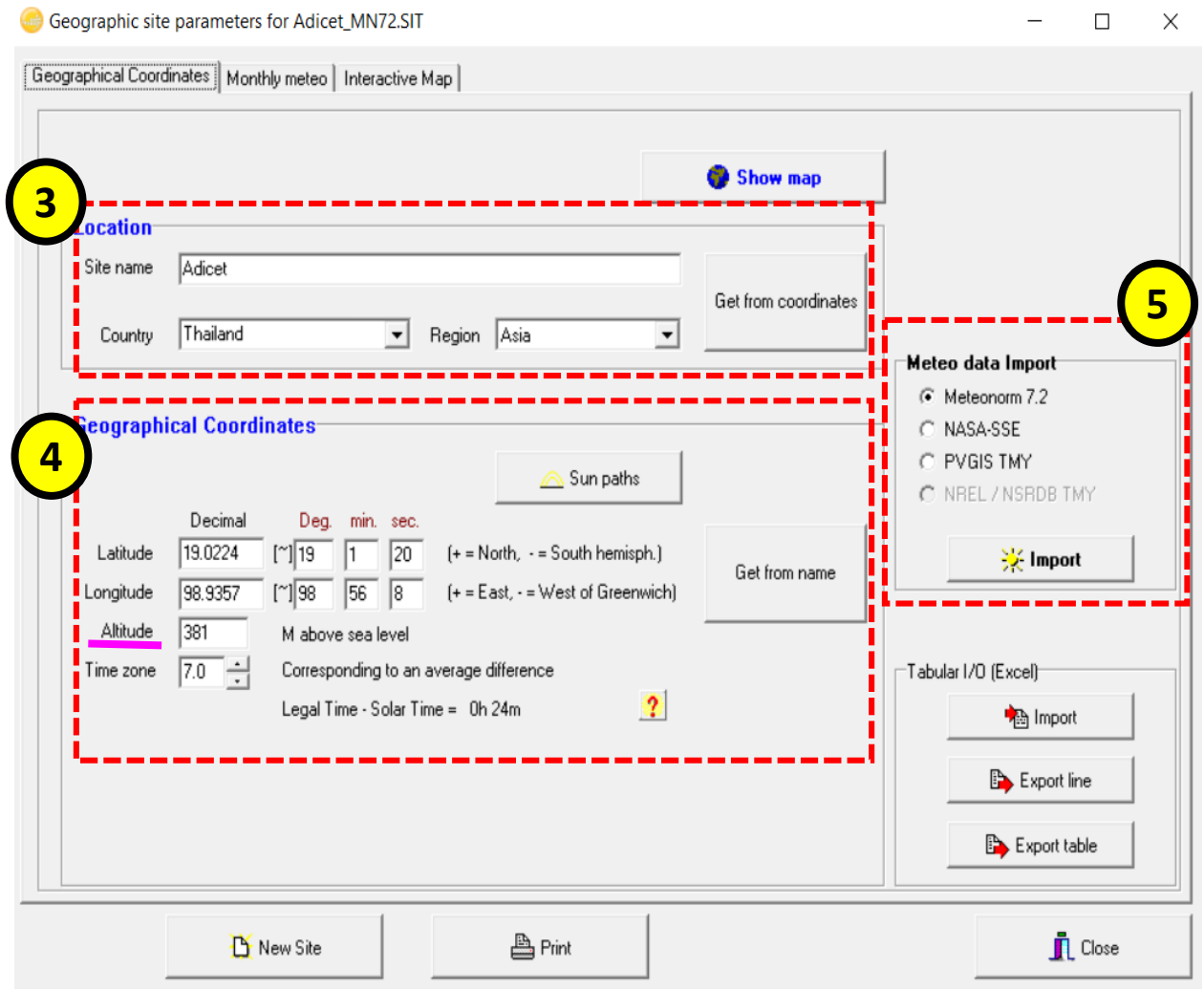
Pvsyst : Data bases

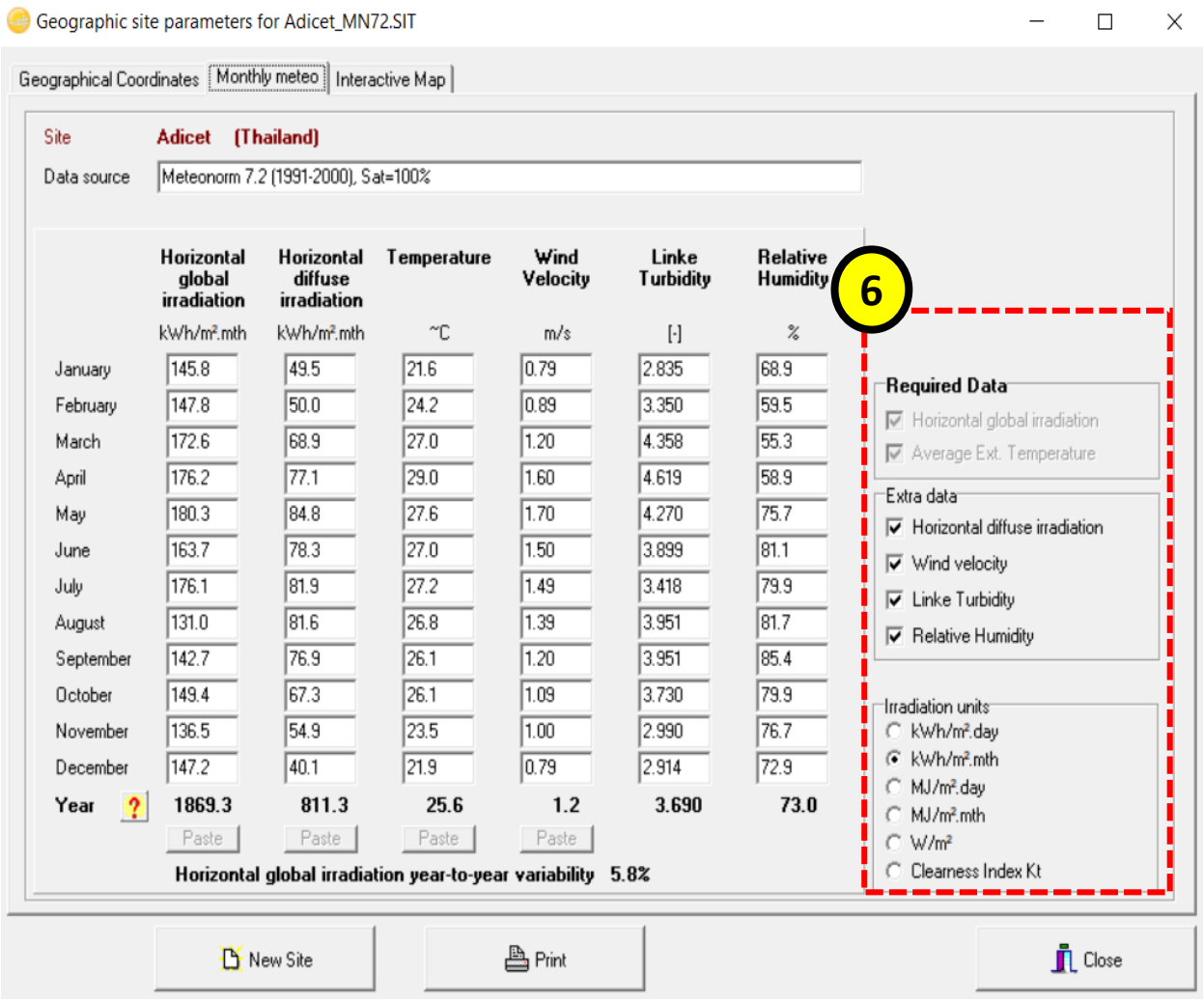






Pvsyst : Databases



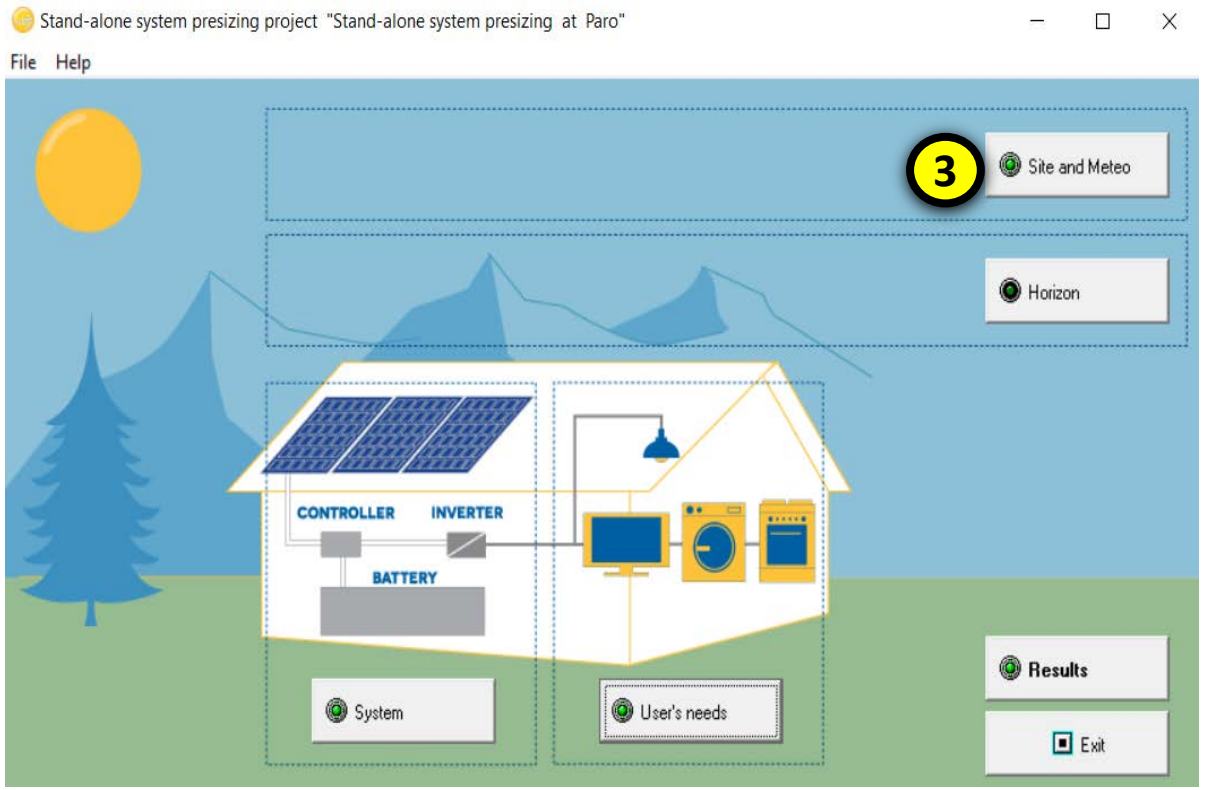


Pvsyst : Preliminary Design

Estimate Loads

Electric equipment	Power (W)	Number	Time (hr)	Energy (kWh)
LED	8	6	6	0.288
FAN	55	2	10	1.10
TV 21”	110	1	4	0.44
Computer	100	1	4	0.40
Fridge	70	1	24	1.68
			Total Energy	**3.908**

Pvsyst : Preliminary Design



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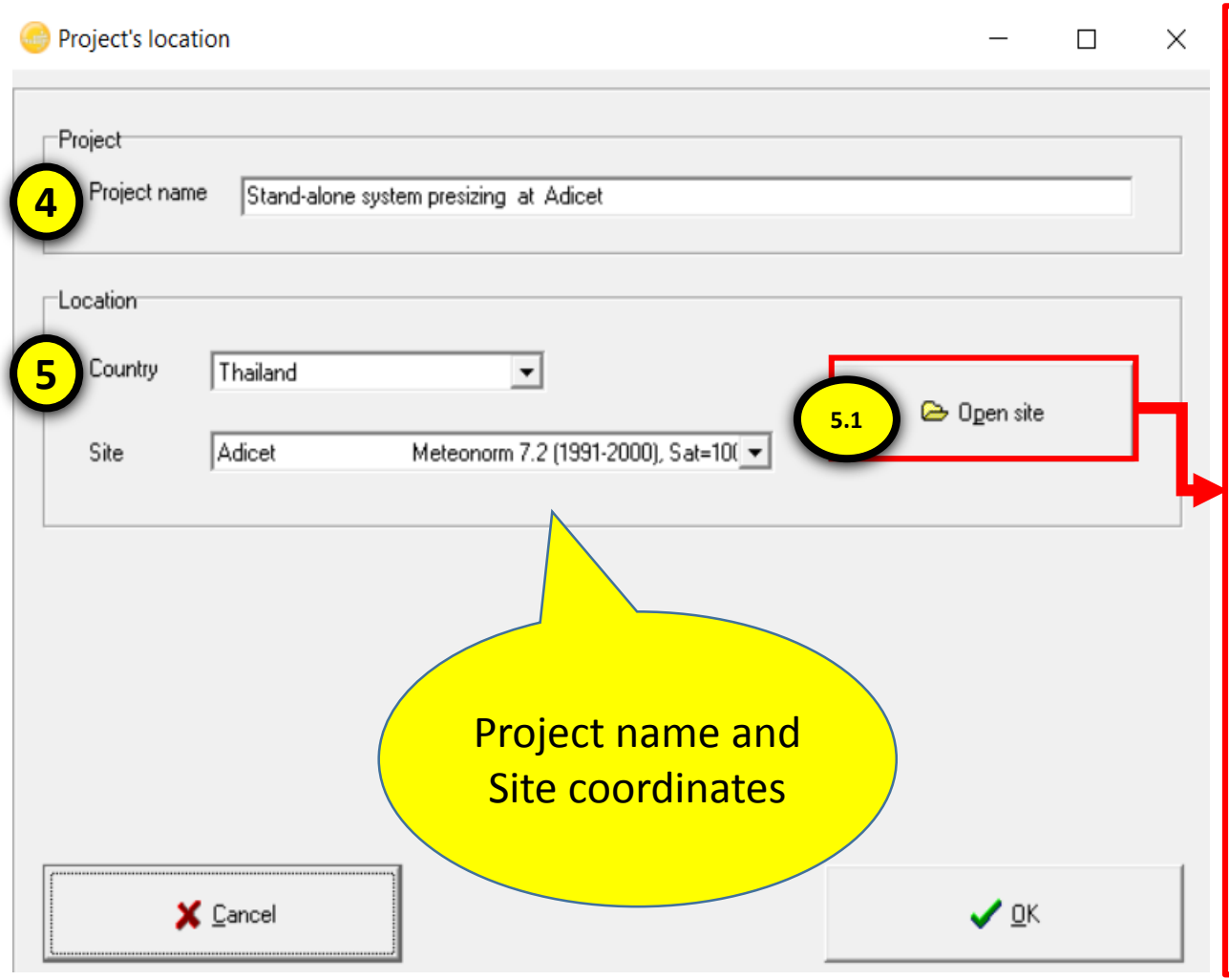
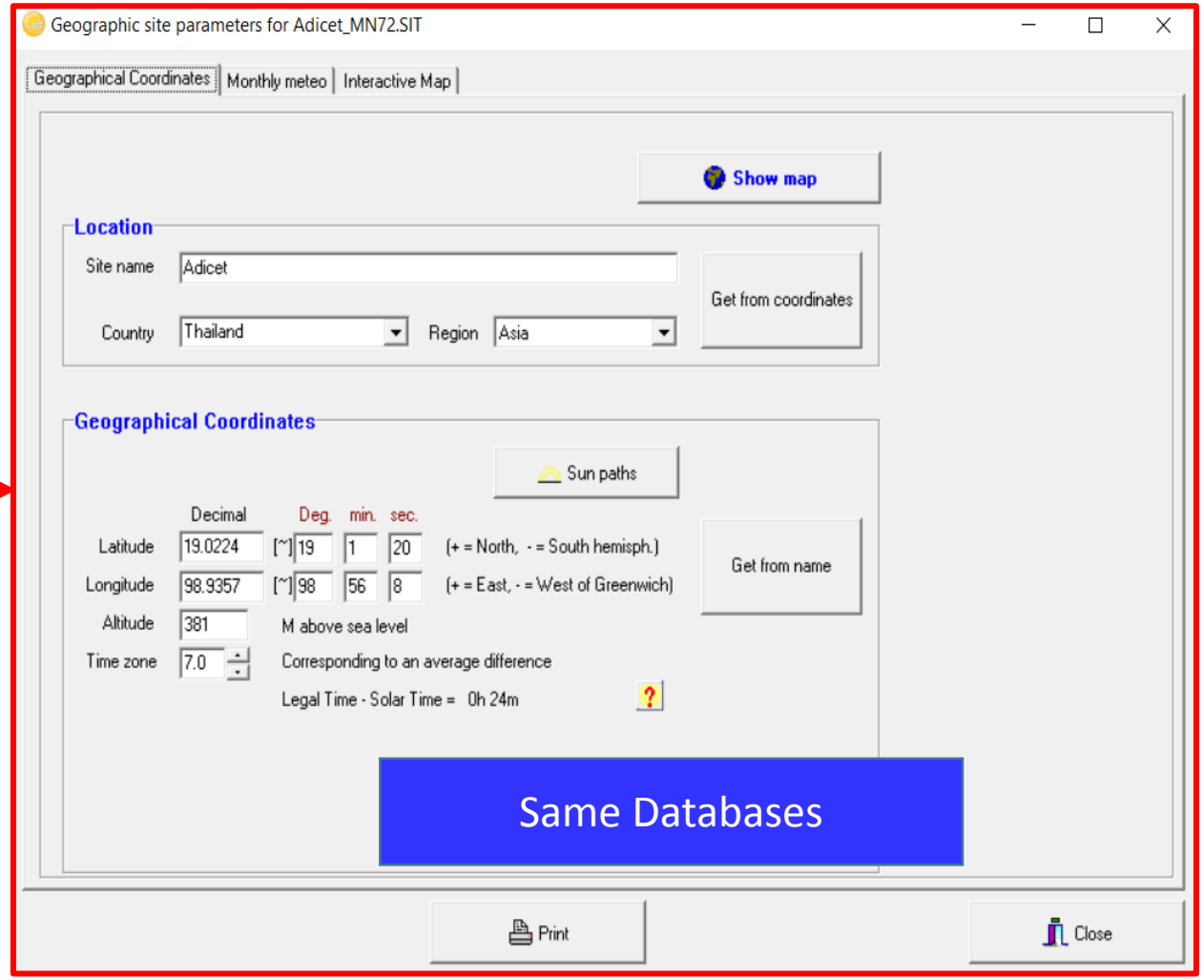
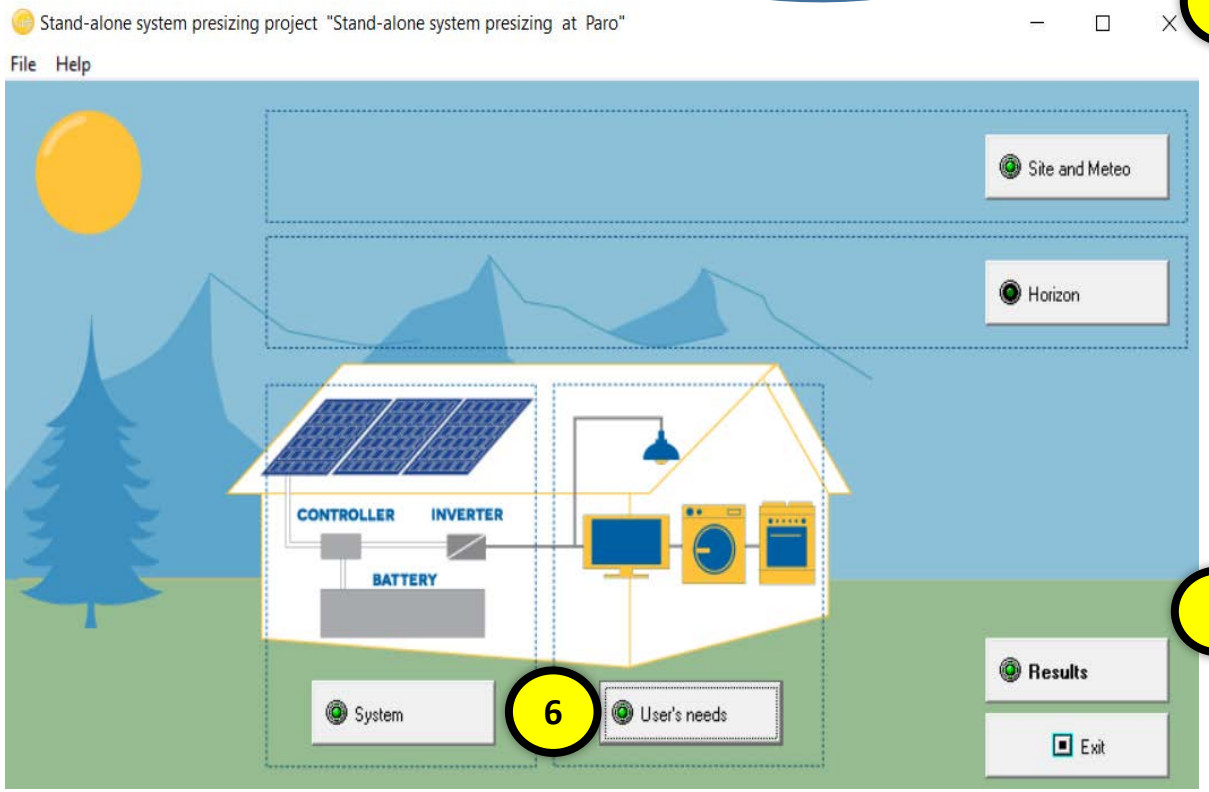
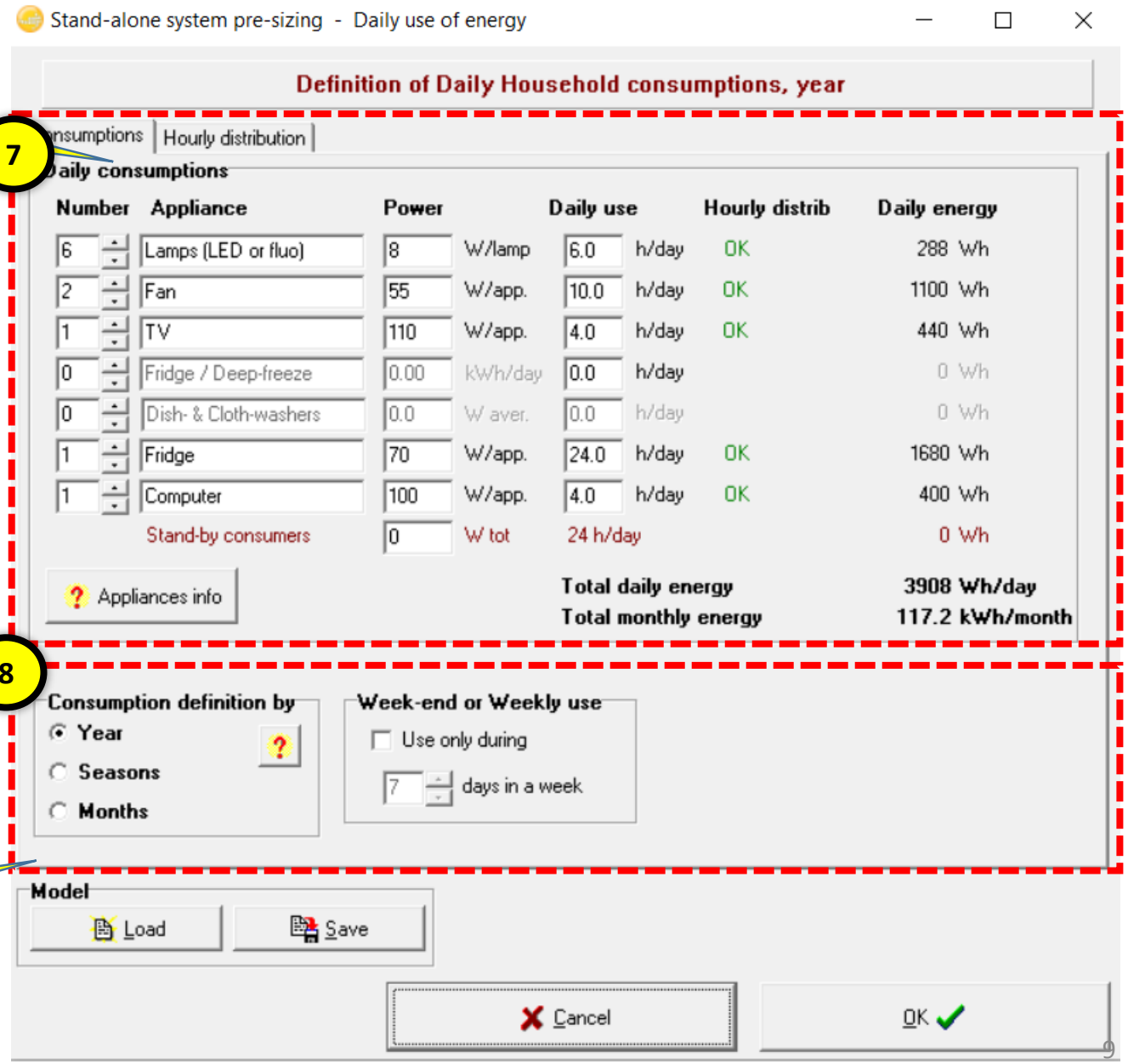




Pvsyst : Preliminary design

Electric equipment





Using time

Pvsyst : Preliminary design

Stand-alone system pre-sizing - Daily use of energy

Definition of Daily Household consumptions, year

Consumptions | Hourly distribution

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Daily consumptions

Number	Appliance	Power		Daily use		Hourly distrib	Daily energy
6	Lamps (LED or fluo)	8	W/lamp	6.0	h/day	OK	288 Wh
2	Fan	55	W/app.	10.0	h/day	OK	1100 Wh
1	TV	110	W/app.	4.0	h/day	OK	440 Wh
0	Fridge / Deep-freeze	0.00	kWh/day	0.0	h/day		0 Wh
0	Dish- & Cloth-washers	0.0	W aver.	0.0	h/day		0 Wh
1	Fridge	70	W/app.	24.0	h/day	OK	1680 Wh
1	Computer	100	W/app.	4.0	h/day	OK	400 Wh
	Stand-by consumers	0	W tot	24 h/day			0 Wh

Appliances info

Total daily energy 3908 Wh/day

Total monthly energy 117.2 kWh/month

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Consumption definition by

- Year
- Seasons
- Months

Week-end or Weekly use

Use only during 7 days in a week

Model

Load | Save

10.1

Cancel | OK

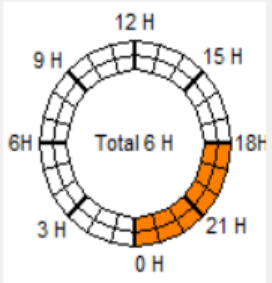
Daily use of Energy, Variant "New simulation variant"

Definition of Daily Household consumptions, year

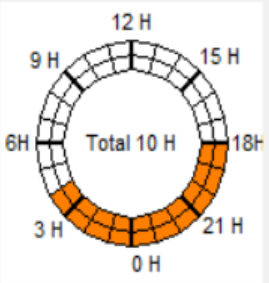
Con | Hourly distribution

9

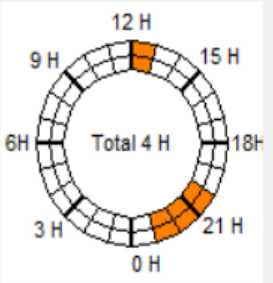
Lamps (LED or fluo)



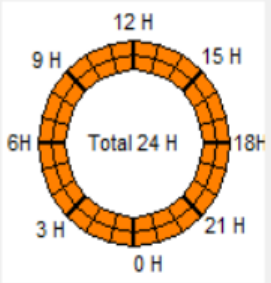
Fan



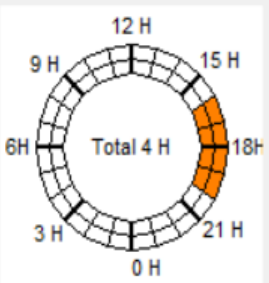
TV



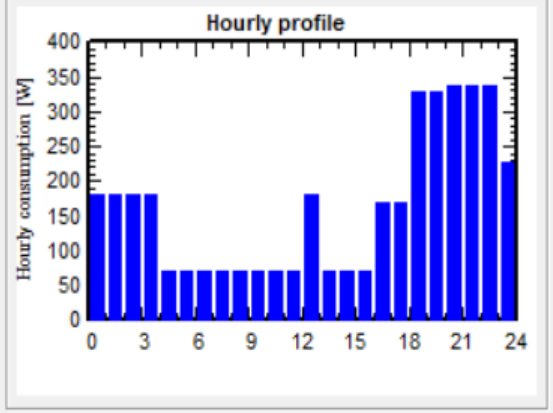
Fridge



Computer



Daily global consumption



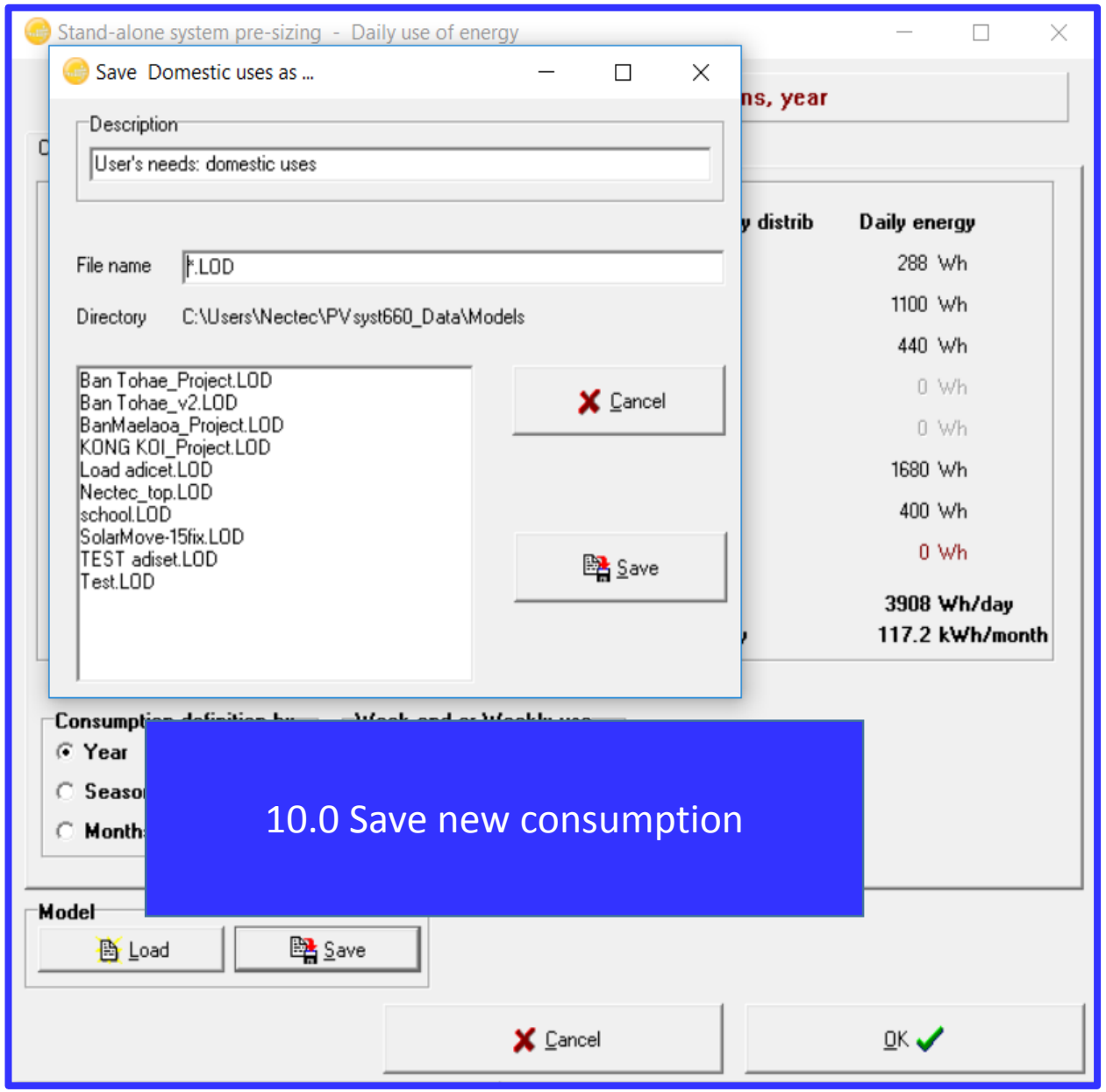
Model

Load | Save

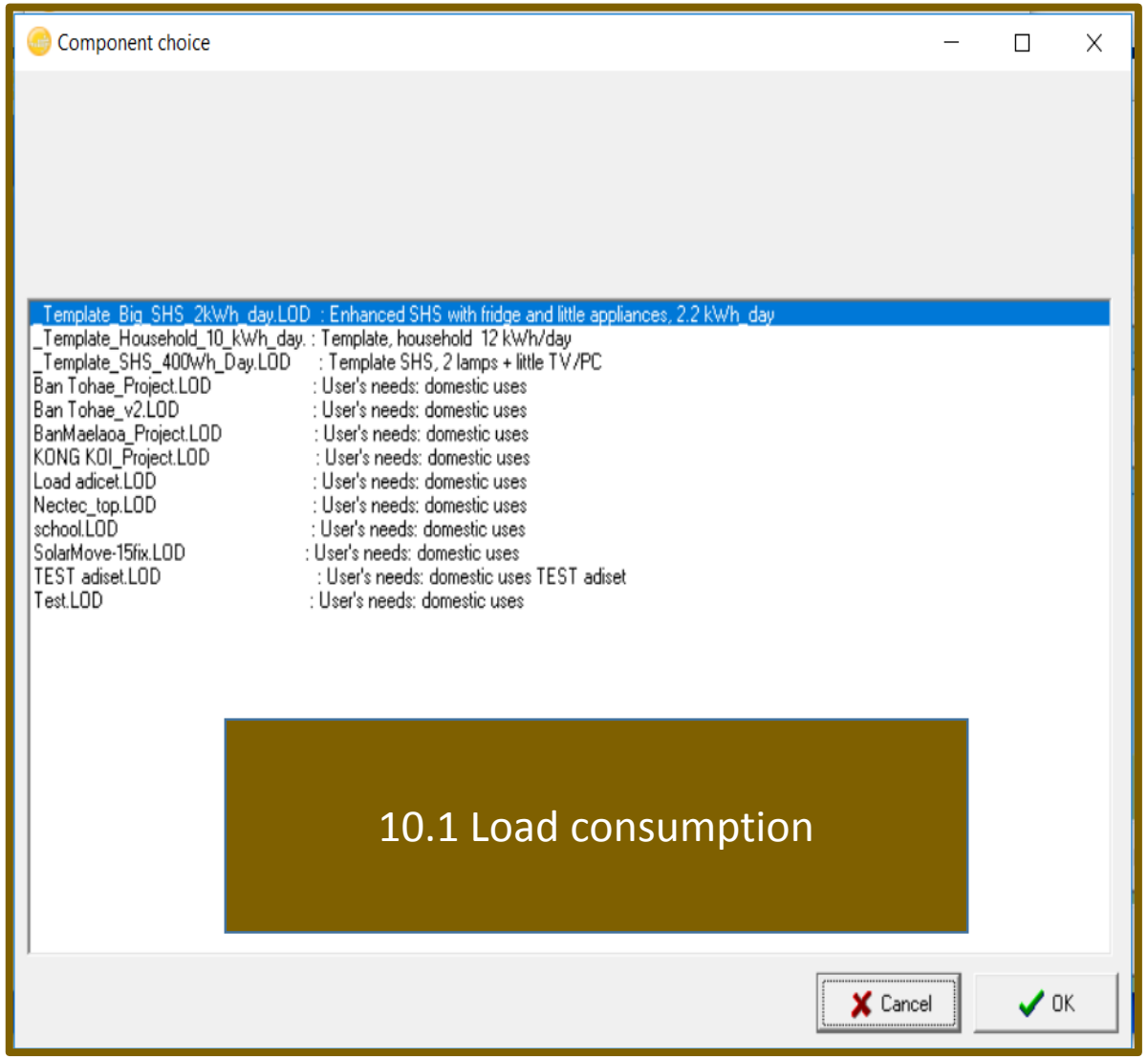
10.0

Other profile | Cancel | OK

Pvsyst : Preliminary design

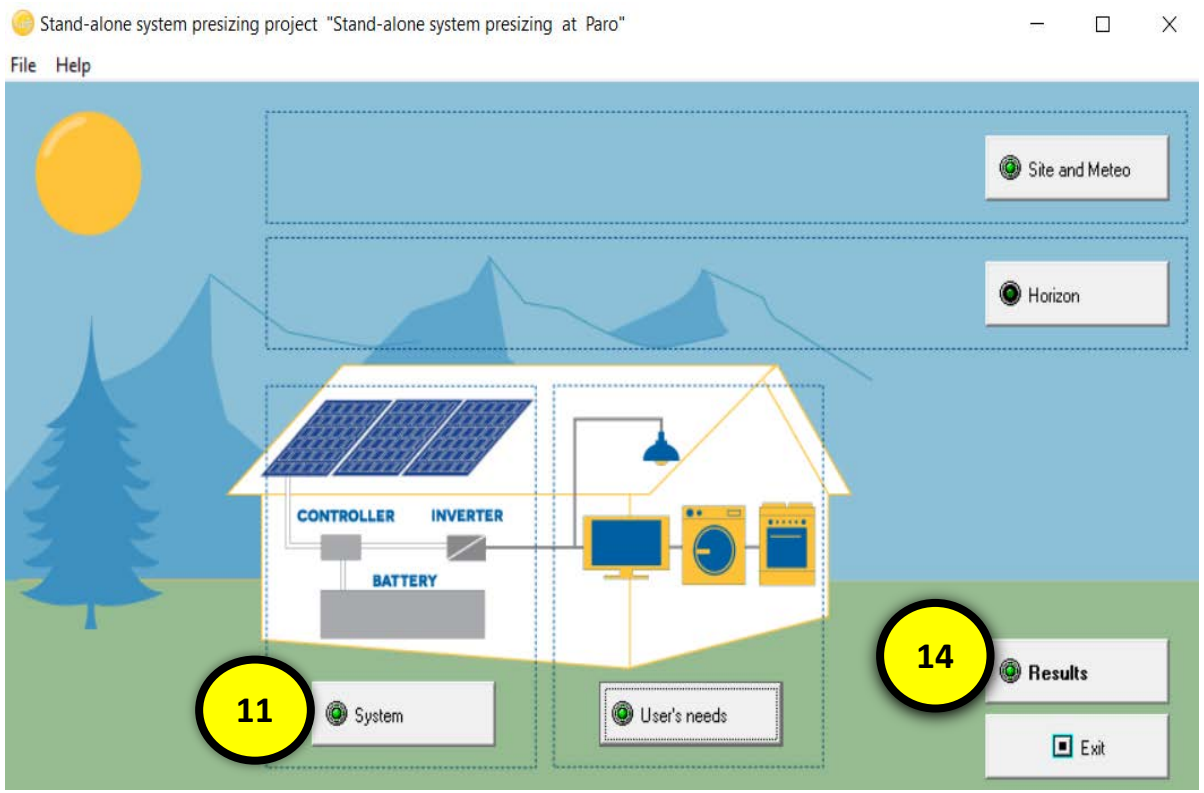


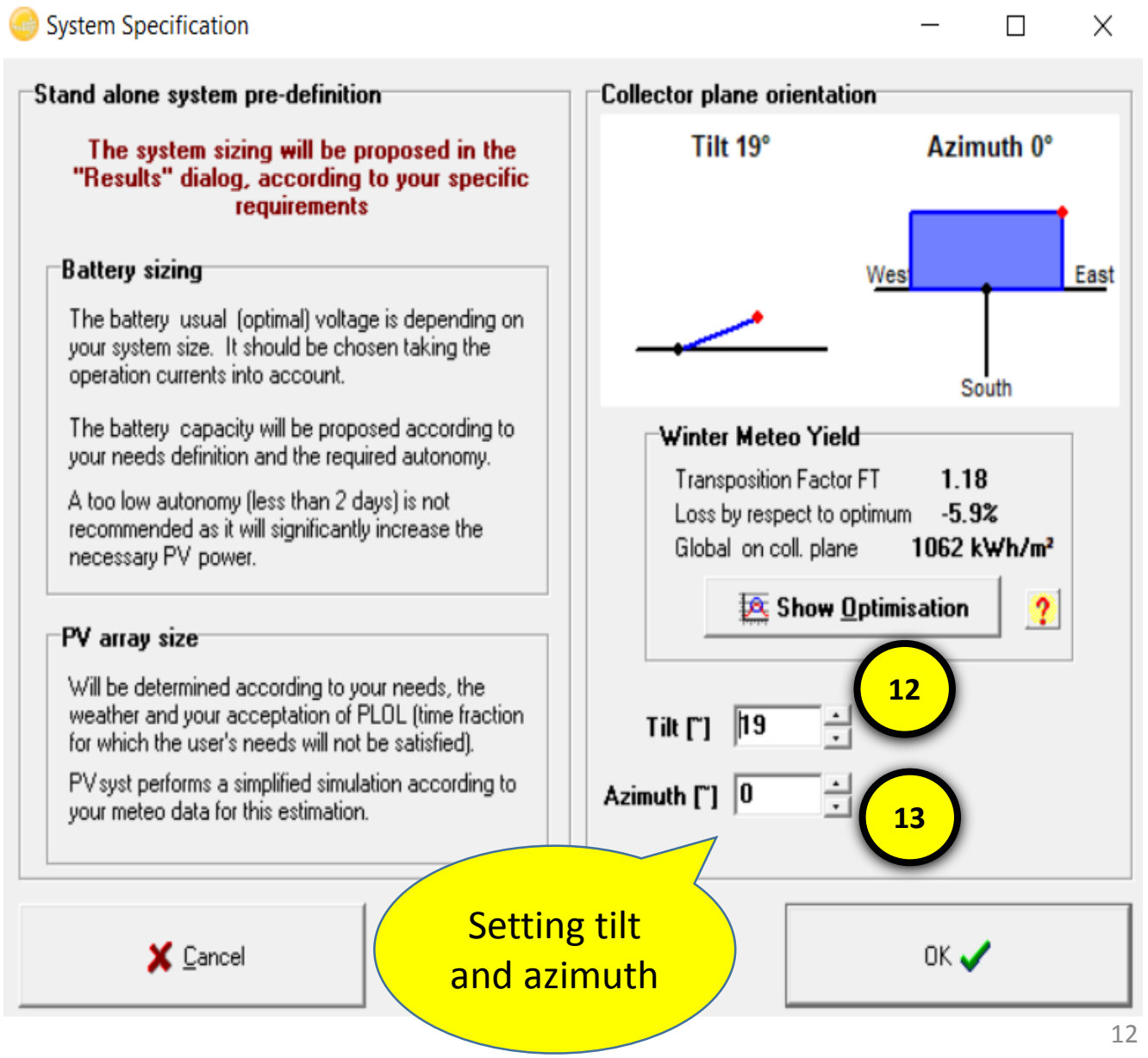
10.0 Save new consumption



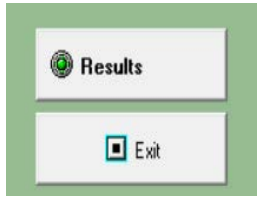
10.1 Load consumption

Pvsyst : Preliminary design

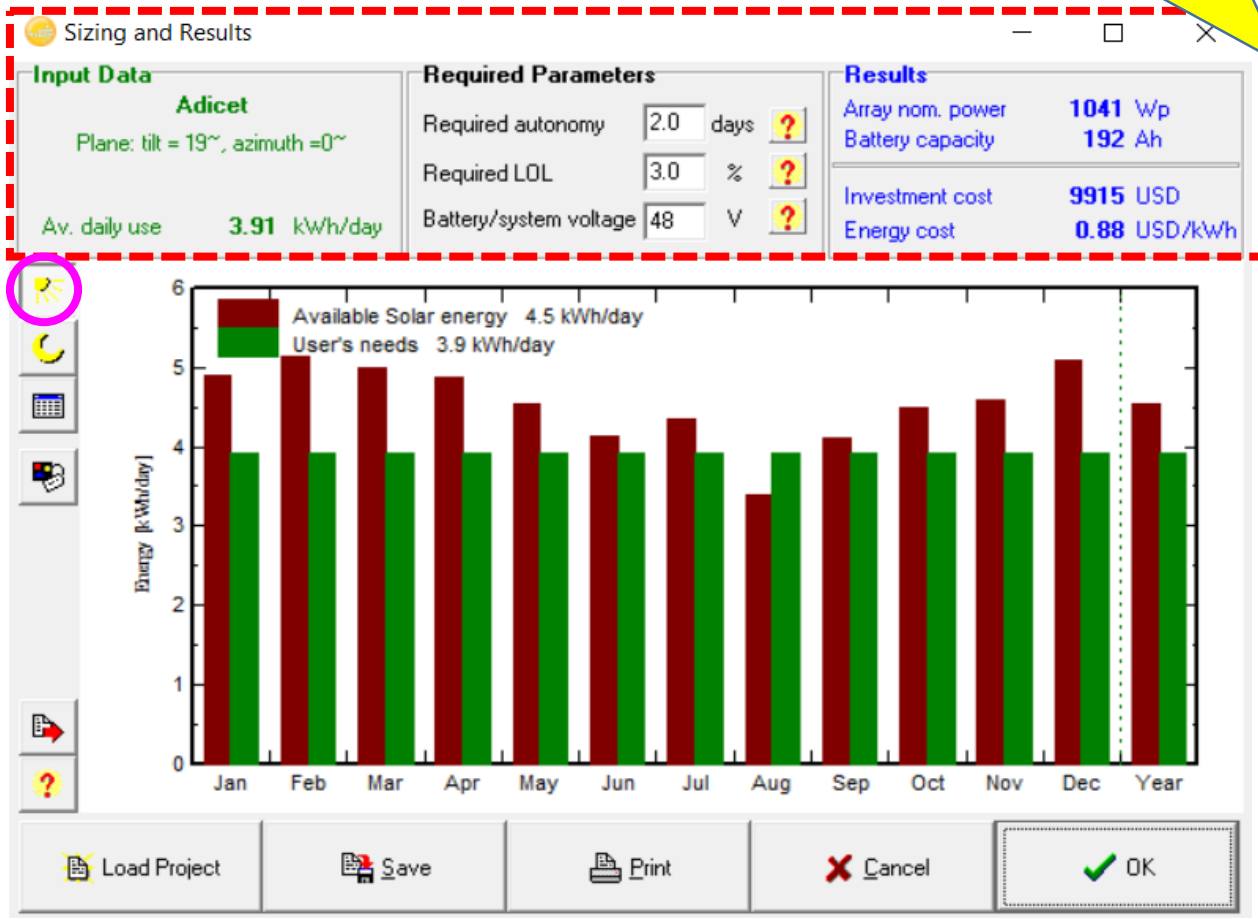




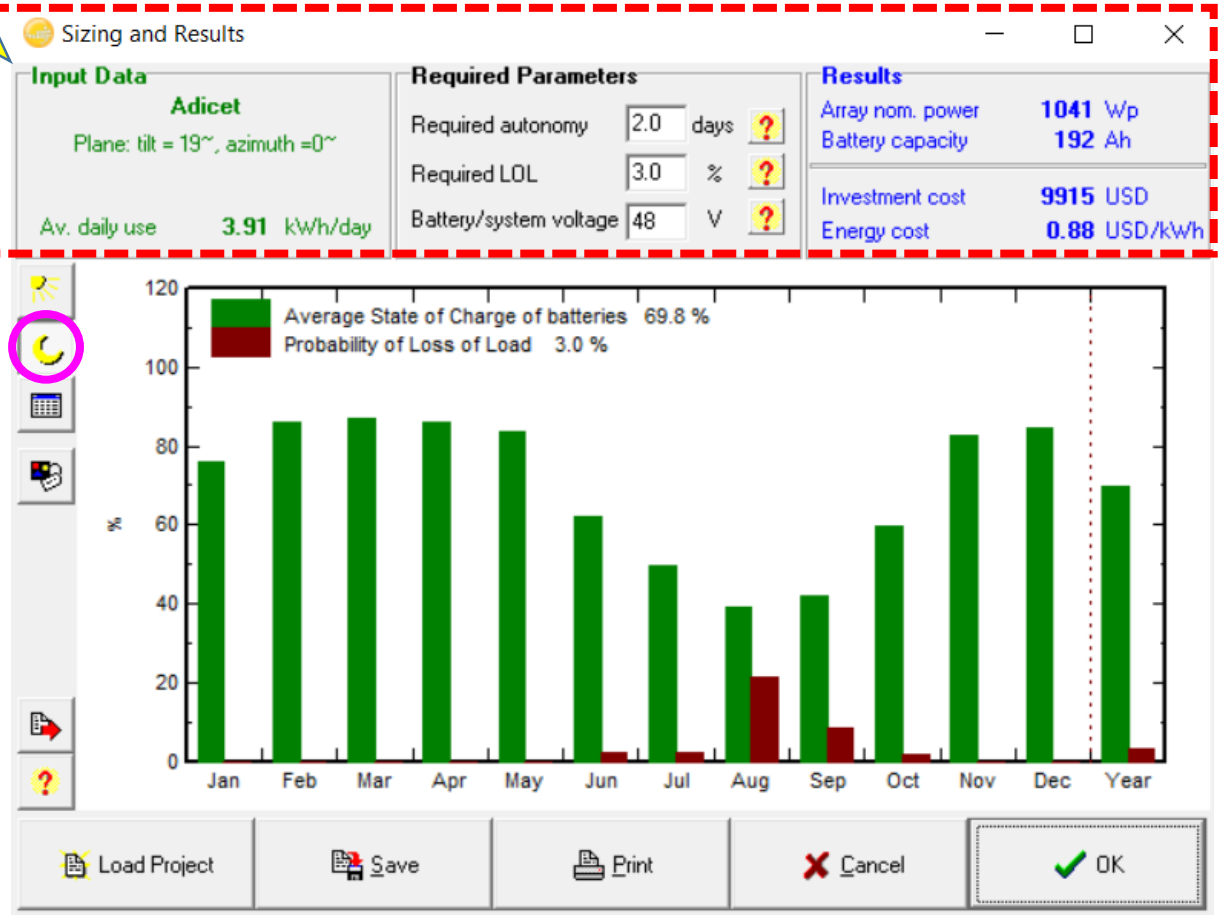
Pvsyst : Perliminary design



Result parameter at site and power output

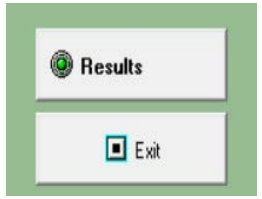


Day time



Night time

Pvsyst : Perliminary design



Sizing and Results

Input Data

Adicet

Plane: tilt = 19~, azimuth =0~

Av. daily use 3.91 kWh/day

Required Parameters

Required autonomy 2.0 days

Required LOL 3.0 %

Battery/system voltage 48 V

Results

Array nom. power 1041 Wp

Battery capacity 192 Ah

Investment cost 9915 USD

Energy cost 0.88 USD/kWh

	Incid. kWh/m².day	PV avail. kWh	Demand kWh	Excess kWh	Missing kWh	SOC %	Pr. LOL %	Fuel liter
Jan.	5.9	151.6	121.1	14.3	0.0	76	0.0	0.0
Feb.	6.2	143.9	109.4	20.9	0.0	86	0.0	0.0
Mar.	6.0	155.1	121.1	19.4	0.0	87	0.0	0.0
Apr.	5.8	146.1	117.2	15.2	0.0	86	0.0	0.0
May	5.5	140.9	121.1	6.0	0.0	84	0.0	0.0
June	5.0	124.3	117.2	5.1	2.3	62	2.1	1.5
July	5.2	135.0	121.1	0.0	2.4	50	2.1	1.6
Aug.	4.1	105.4	121.1	0.0	22.0	39	21.5	14.6
Sep.	4.9	123.0	117.2	0.0	9.8	42	8.5	6.5
Oct.	5.4	139.4	121.1	1.3	2.3	60	1.8	1.5
Nov.	5.5	137.4	117.2	5.7	0.0	83	0.0	0.0
Dec.	6.1	157.9	121.1	20.6	0.0	85	0.0	0.0
Year	5.5	1660.0	1426.4	108.6	38.8	70	3.0	25.8

Load Project | Save | Print | Cancel | OK

Result monthly

Sizing and Results

Input Data

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Plane: tilt = 19~, azimuth =0~

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Results

Array nom. power 1041 Wp

Battery capacity 192 Ah

Investment cost 9915 USD

Energy cost 0.88 USD/kWh

Economic gross evaluation

Module cost	1274	USD
Battery cost	1688	USD
Regulator cost	818	USD
Transport/Fitting	6135	USD
Total investment	**9915**	**USD**
Annuities	796	USD/yr
Maintenance costs	422	USD/yr
Total Yearly cost	**1218**	**USD/yr**
Energy cost	**0.88**	**USD/kWh**

These values should only be considered as an order of magnitude. More precise evaluations will be available with detailed simulation.

Currency

USD - United States Do

Rates

Loan

Duration 20 years

Rate 5.0 %

Ann. factor : 0.080

Edit costs

Load Project | Save | Print | Cancel | OK

Result economic

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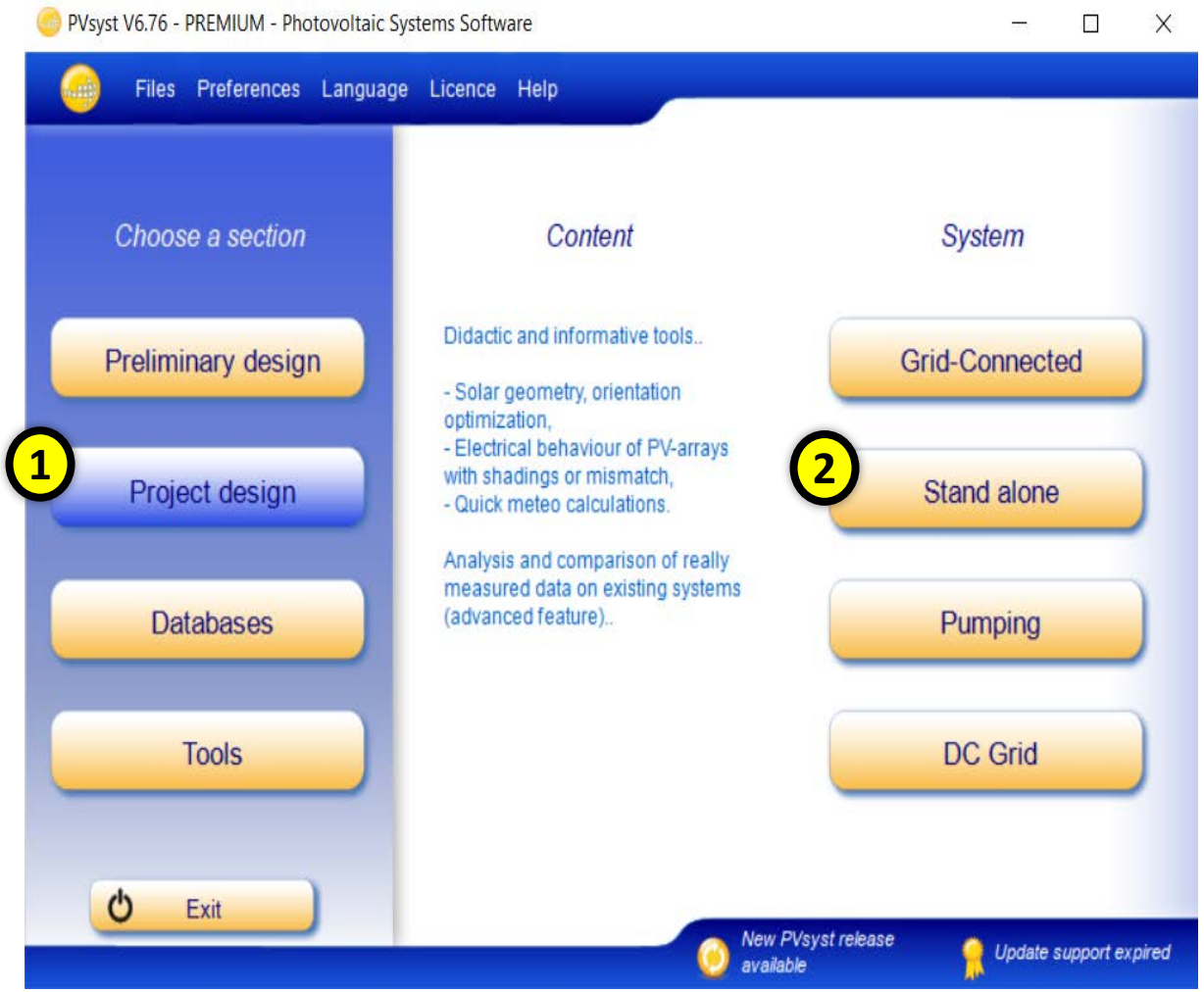

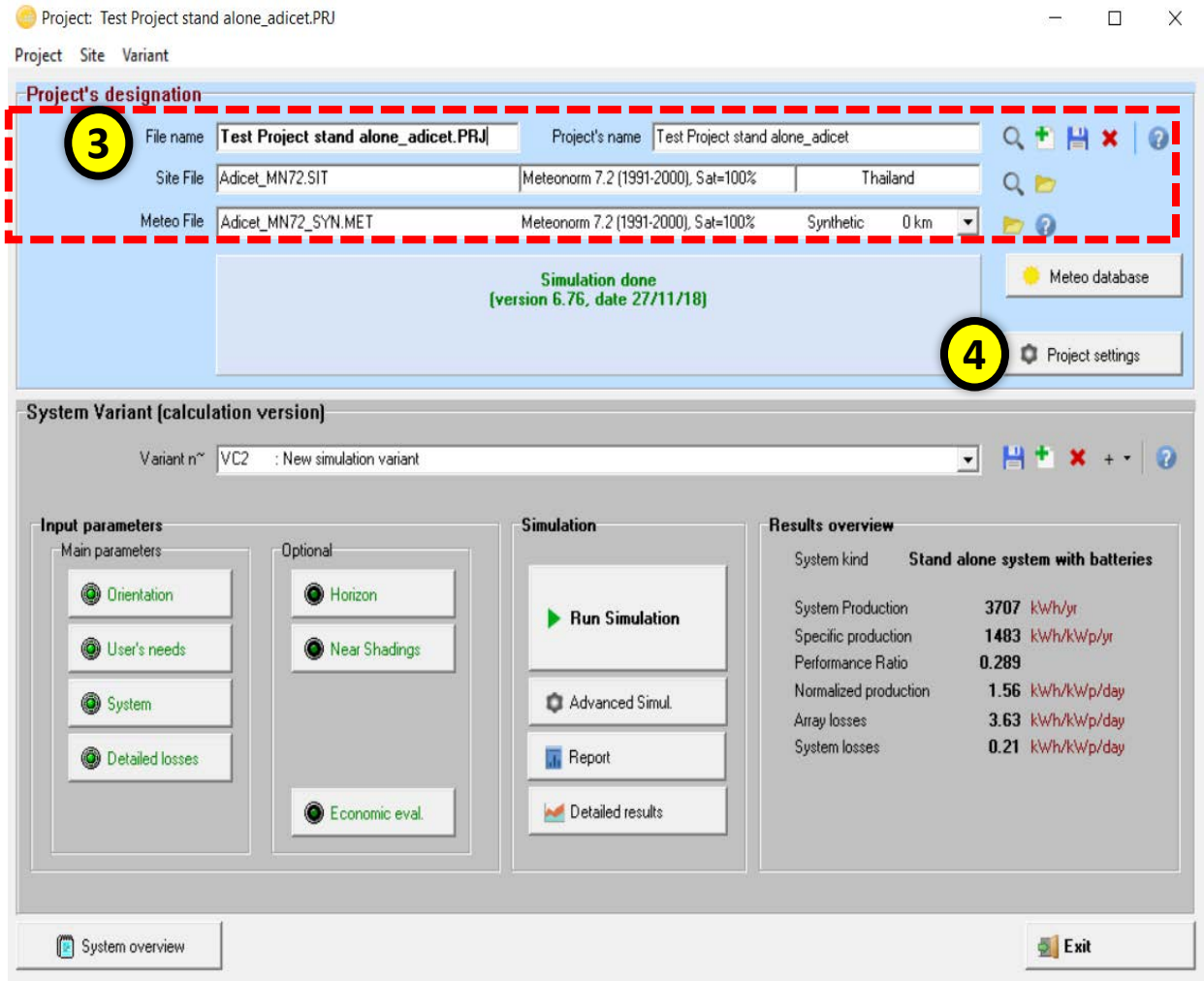

Pvsyst : Project Design

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Albedo | Design conditions | Other limitations | Preferences

Albedo values

Monthly values

Jan.	0.20	July	0.20
Feb.	0.20	Aug.	0.20
Mar.	0.20	Sep.	0.20
Apr.	0.20	Oct.	0.20
May	0.20	Nov.	0.20
June	0.20	Dec.	0.20

Set a common value

Common value 0.20

(Default: albedo = 0.2)

Set

Usual values for albedo

Urban situation	0.14 - 0.22
Grass	0.15 - 0.25
Fresh Grass	0.26
Fresh snow	0.82
Wet snow	0.55 - 0.75
Dry asphalt	0.09 - 0.15
Wet asphalt	0.18
Concrete	0.25 - 0.35
Red tiles	0.33
Aluminium	0.85
New galvanised steel	0.35
Very dirty galavanised stee	0.08

Cancel | OK

6

Design conditions | Other limitations | Preferences

Site-dependent Design parameters

Reference temperatures for array design by respect to the inverter input voltages

			Default
Lower temperature for Absolute Voltage limit	-10	~C	☑
Winter operating temperature for VmppMax design	20	~C	☑
Usual operating temperature under 1000 W/m	50	~C	☑
Summer operating temperature for VmppMin design	60	~C	☑

Other design Parameters

Array Max. voltage

- IEC (usually 1000 V)
- UL (usually 600 V)

muVoc value

- From one-diode model
- From specification

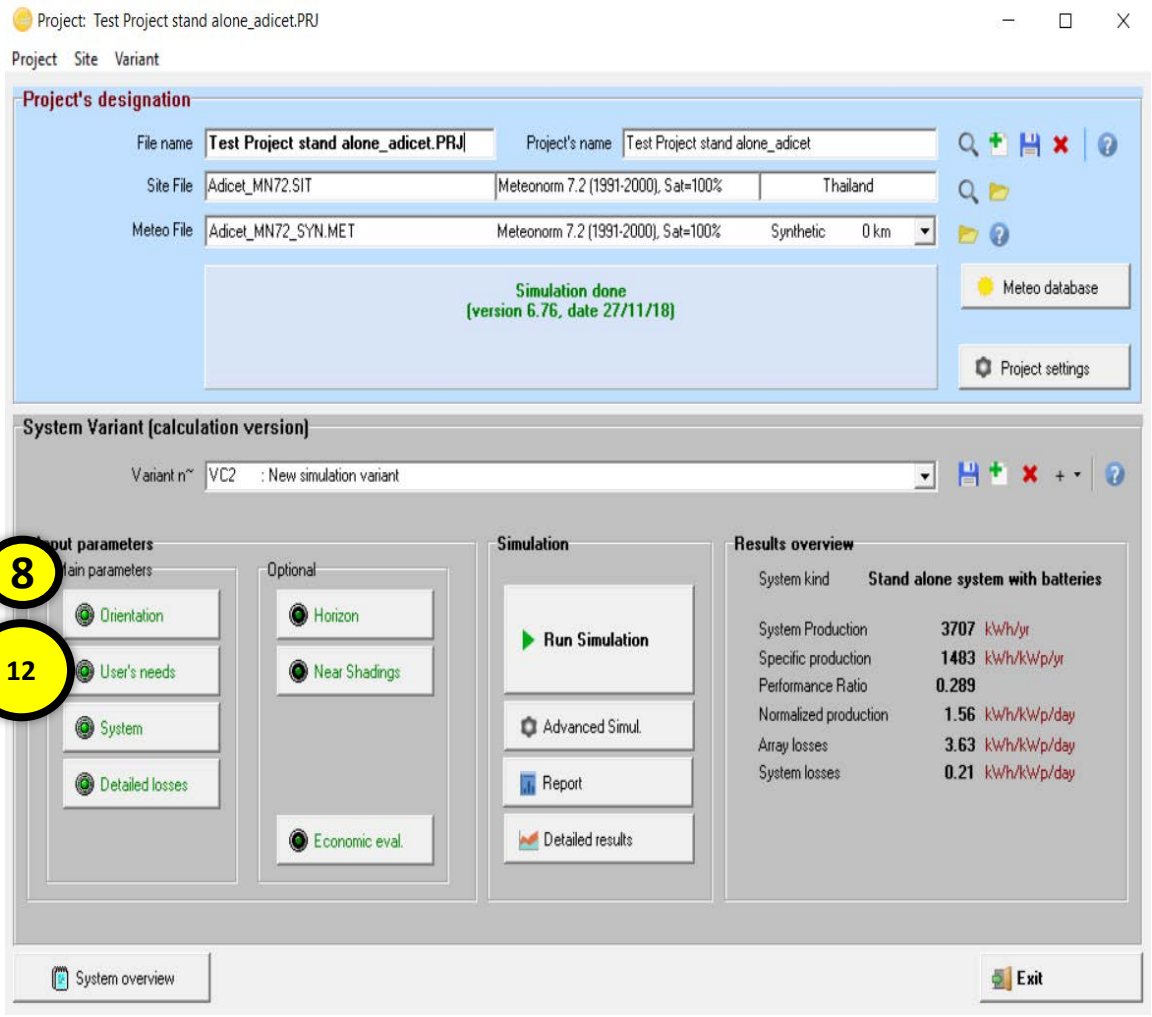
Limit overload loss for design 3.0 % ☑

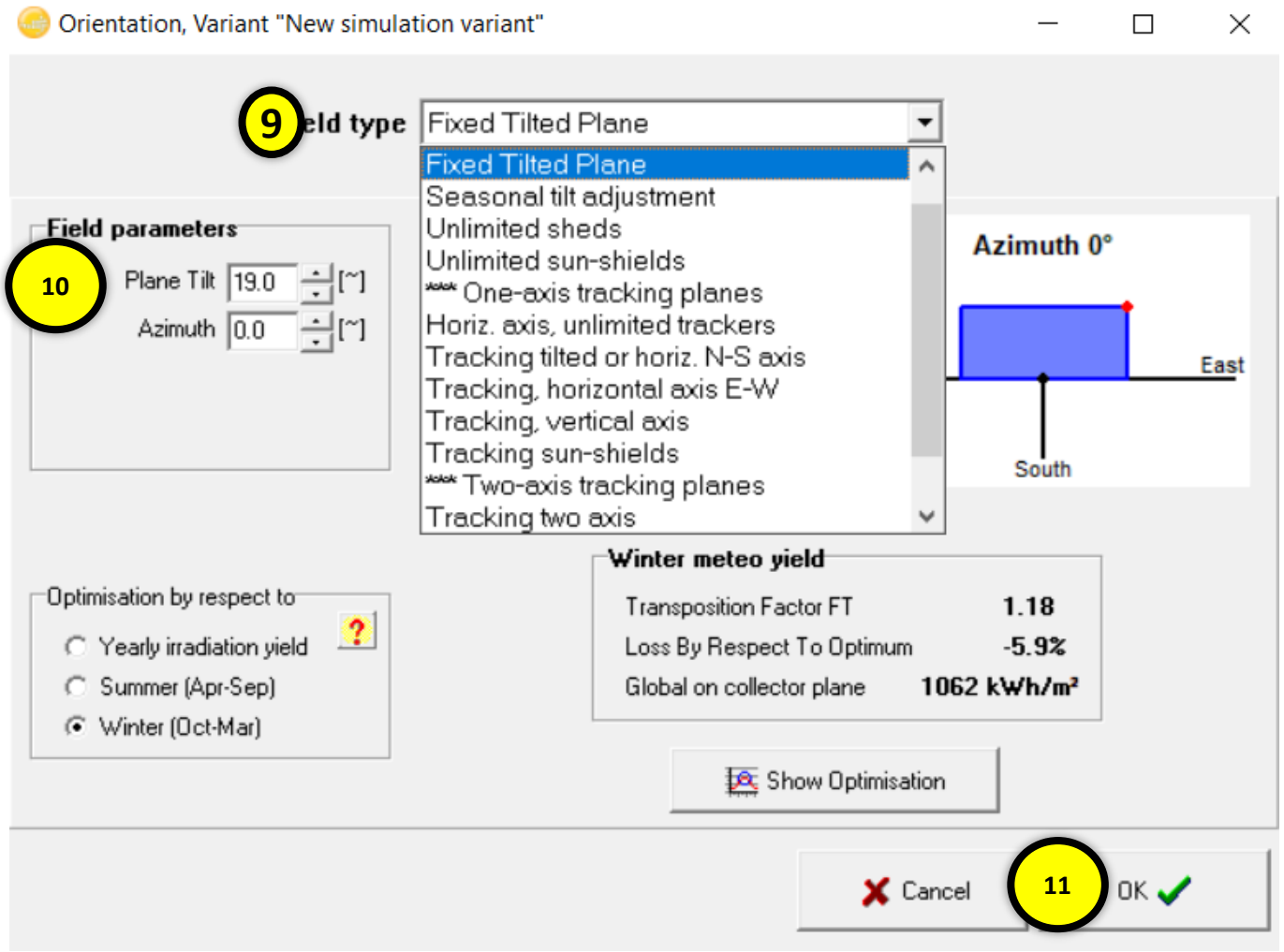
Transposition Model for this project

- Hay model (robust)
- Perez-Ineichen model (sophisticated)

Cancel | 7 OK

Pvsyst : Project Design





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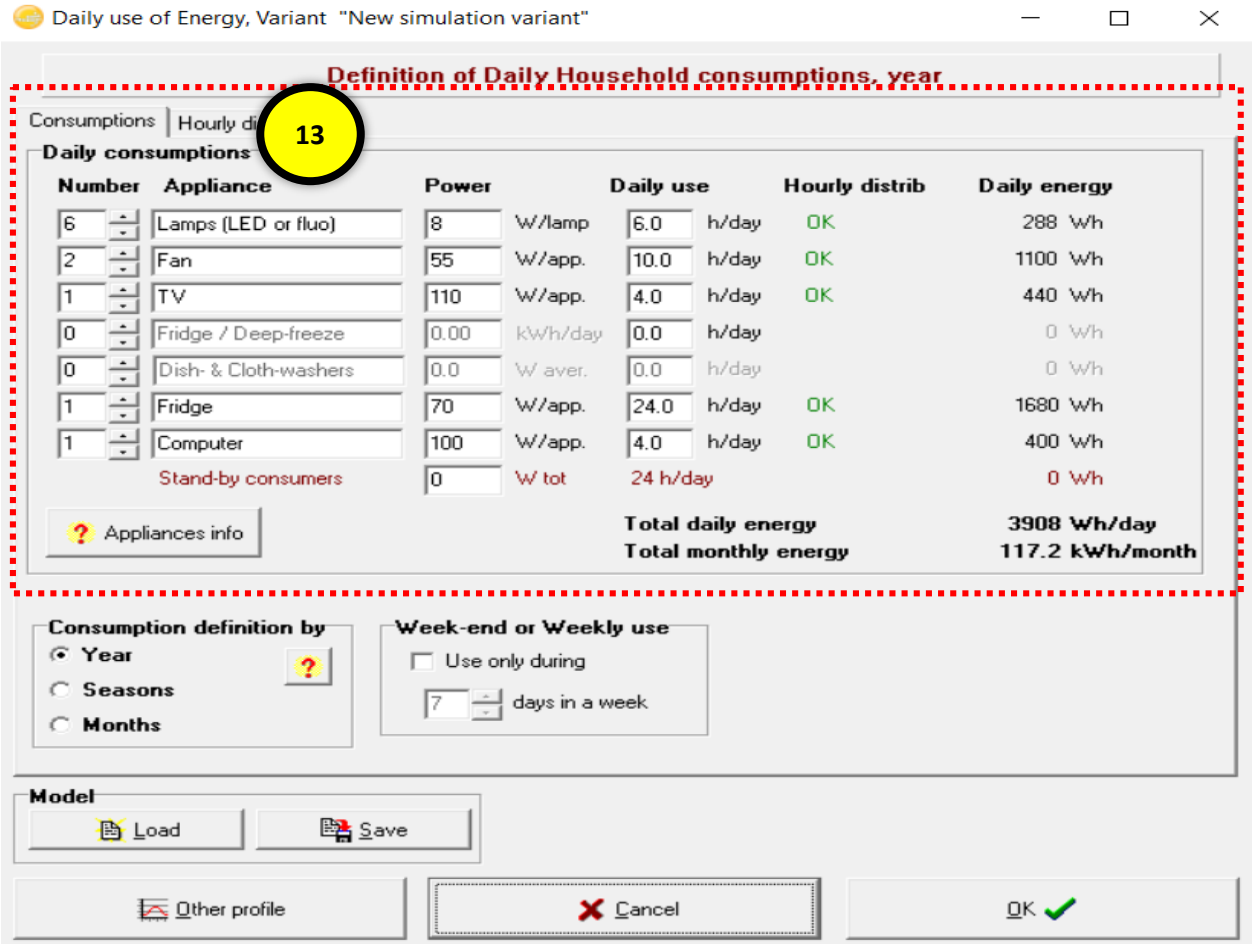

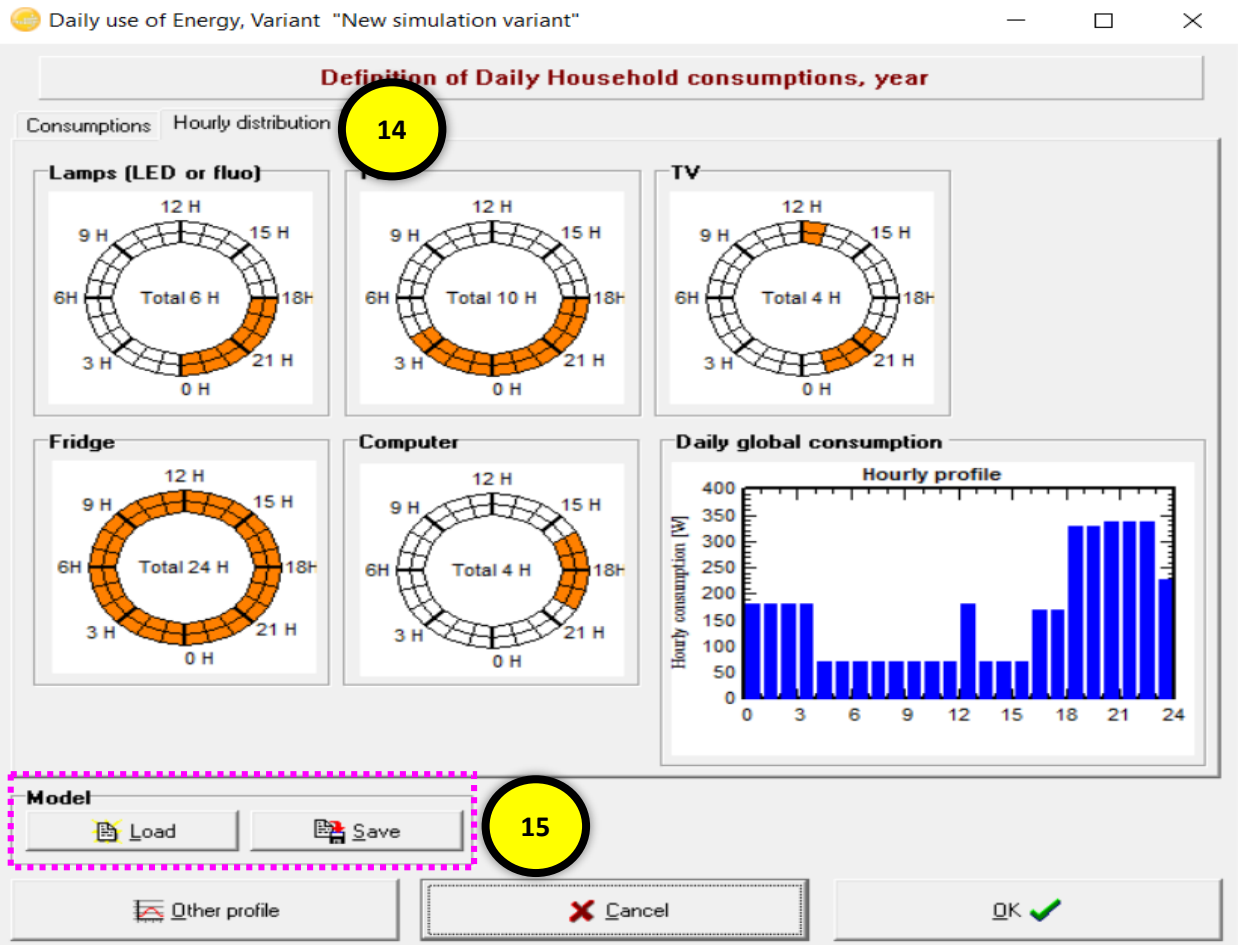

Setting Load

- Number of devices, their individual power, the duration of their use.
- Operating hours in the day.

Pvsyst : Project Design

Project: Test Project stand alone_adicet.PRJ

Project Site Variant

Project's designation

File name: Test Project stand alone_adicet.PRJ | Project's name: Test Project stand alone_adicet

Site File: Adicet_MN72.SIT | Meteonorm 7.2 (1991-2000), Sat=100% | Thailand

Meteo File: Adicet_MN72_SYN.MET | Meteonorm 7.2 (1991-2000), Sat=100% | Synthetic | 0 km

Simulation done
(version 6.76, date 27/11/18)

Meteo database

Project settings

System Variant (calculation version)

Variant n° VC2 : New simulation variant

Input parameters

Main parameters: Orientation, User's needs, System, Detailed losses

Optional: Horizon, Near Shadings, Economic eval.

Simulation

Run Simulation

Advanced Simul.

Report

Detailed results

Results overview

System kind	Stand alone system with batteries	
System Production	3707	kWh/yr
Specific production	1483	kWh/kWp/yr
Performance Ratio	0.289	
Normalized production	1.56	kWh/kWp/day
Array losses	3.63	kWh/kWp/day
System losses	0.21	kWh/kWp/day

System overview

Exit

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Specified User's needs | Pre-sizing suggestions | System summary

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Av. daily needs : 3.9 kWh/day

Enter accepted LOL 3.0 %

Enter requested autonomy 2.0 day(s)

Detailed pre-sizing

Battery (user) voltage 48 V

Suggested capacity 191 Ah

Suggested PV power 1125 Wp (nom.)

Storage | PV Array | Back-up | Schema

Procedure

The Pre-sizing suggestions are based on the Monthly meteo and the user's needs definition

1. - Pre-sizing — Define the desired Pre-sizing conditions (LOL, Autonomy, Battery voltage)
2. - Storage — Define the battery pack (default checkboxes will approach the pre-sizing)
3. - PV Array design — Design the PV array (PV module) and the control mode. You are advised to begin with a universal controller.
4. - Back-up — Define an eventual Genset

Specify the Battery set

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Sort Batteries by: voltage | capacity | manufacturer

Panasonic | 48.1 V | 54 Ah | Li LCO | DCB102Z | Since 2017 | Open

Lithium-ion

The selected battery is a module

1 modules in serie

4 modules in parallel

Number of modules 4

Number of elements 936

Battery pack voltage	48	V
Global capacity	216	Ah
Stored energy (80% DOD)	9.4	kWh
Total weight	80	kg
Nb. cycles at 50% DOD	1475	
Total stored energy during the battery life	7767	kWh

Operating battery temperature

Temper. mode: Fixed (tempered local)

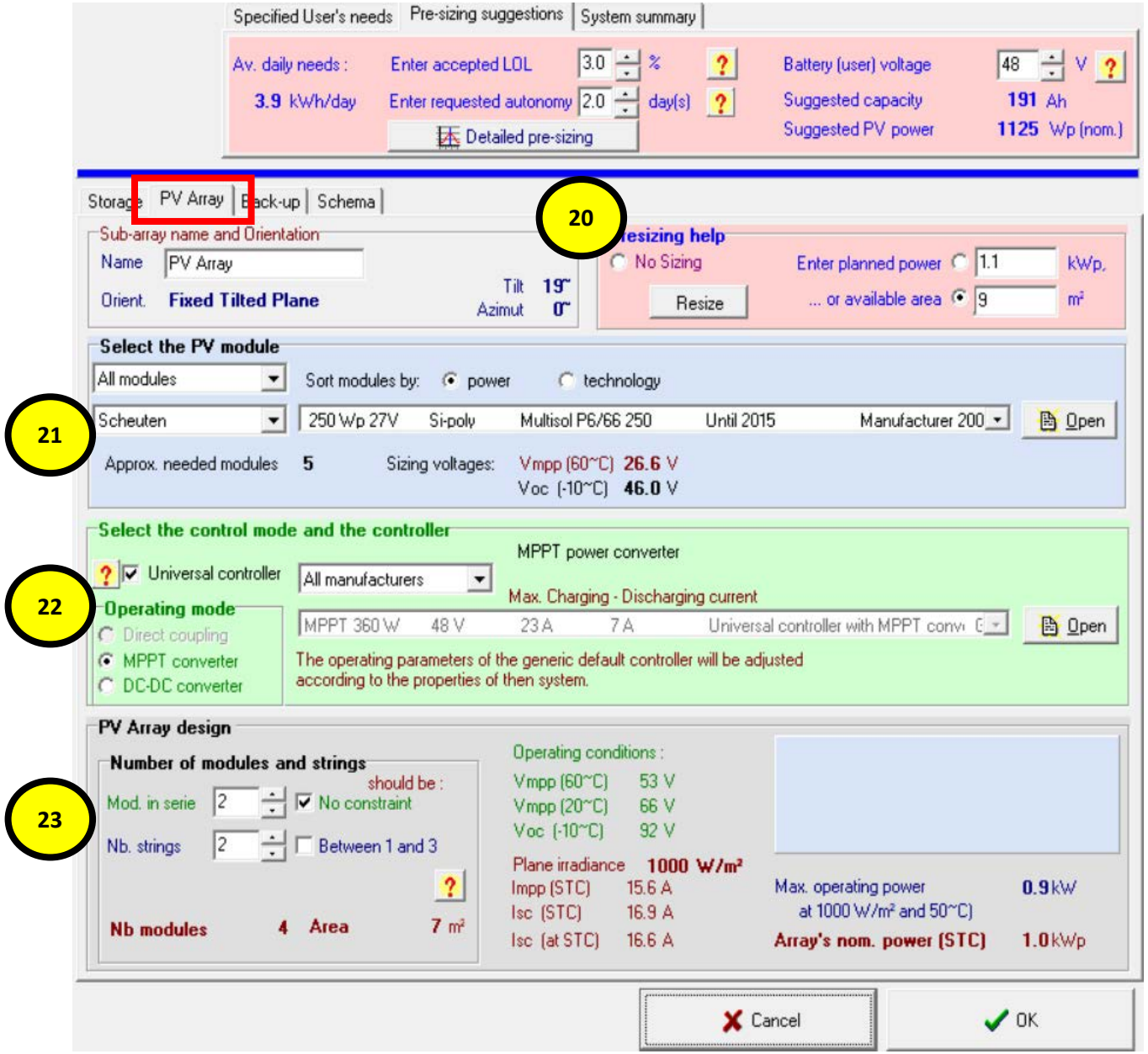
Fixed temperature 30 °C

19

The battery temperature is important for the ageing of the battery. An increase of 10 °C divides the "static" battery life by a factor of 2.

Cancel | OK

Pvsyst : Project Design



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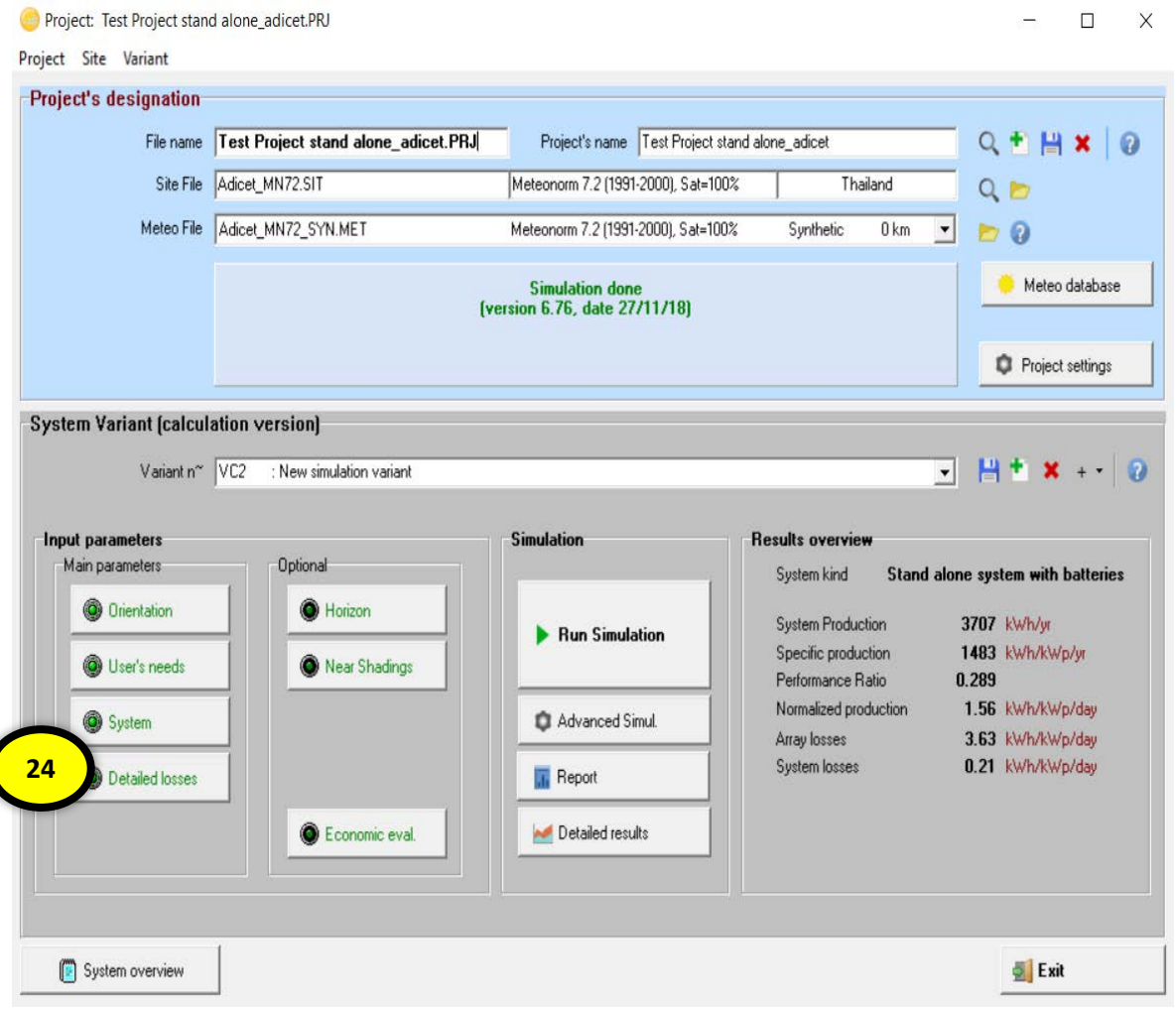

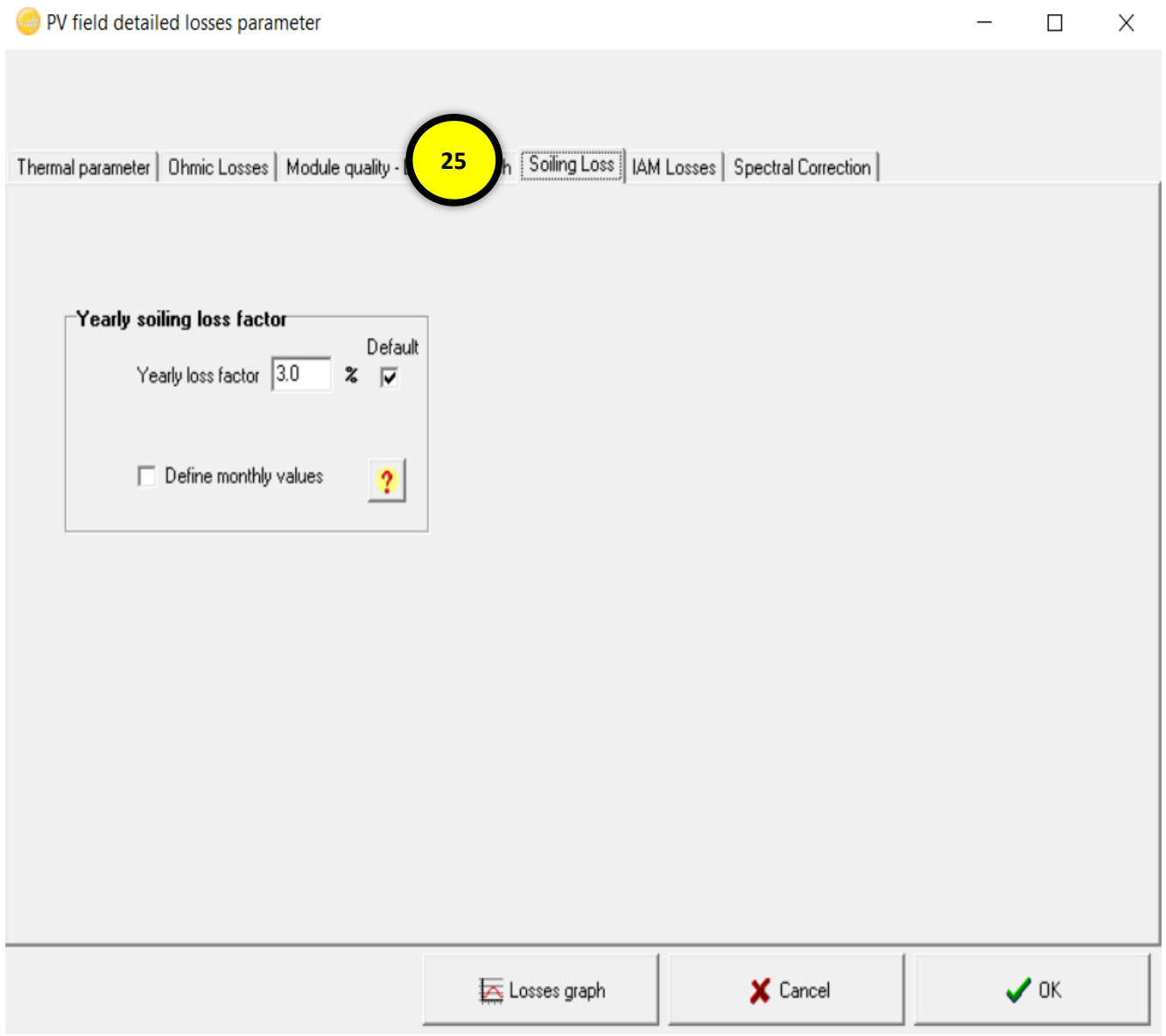

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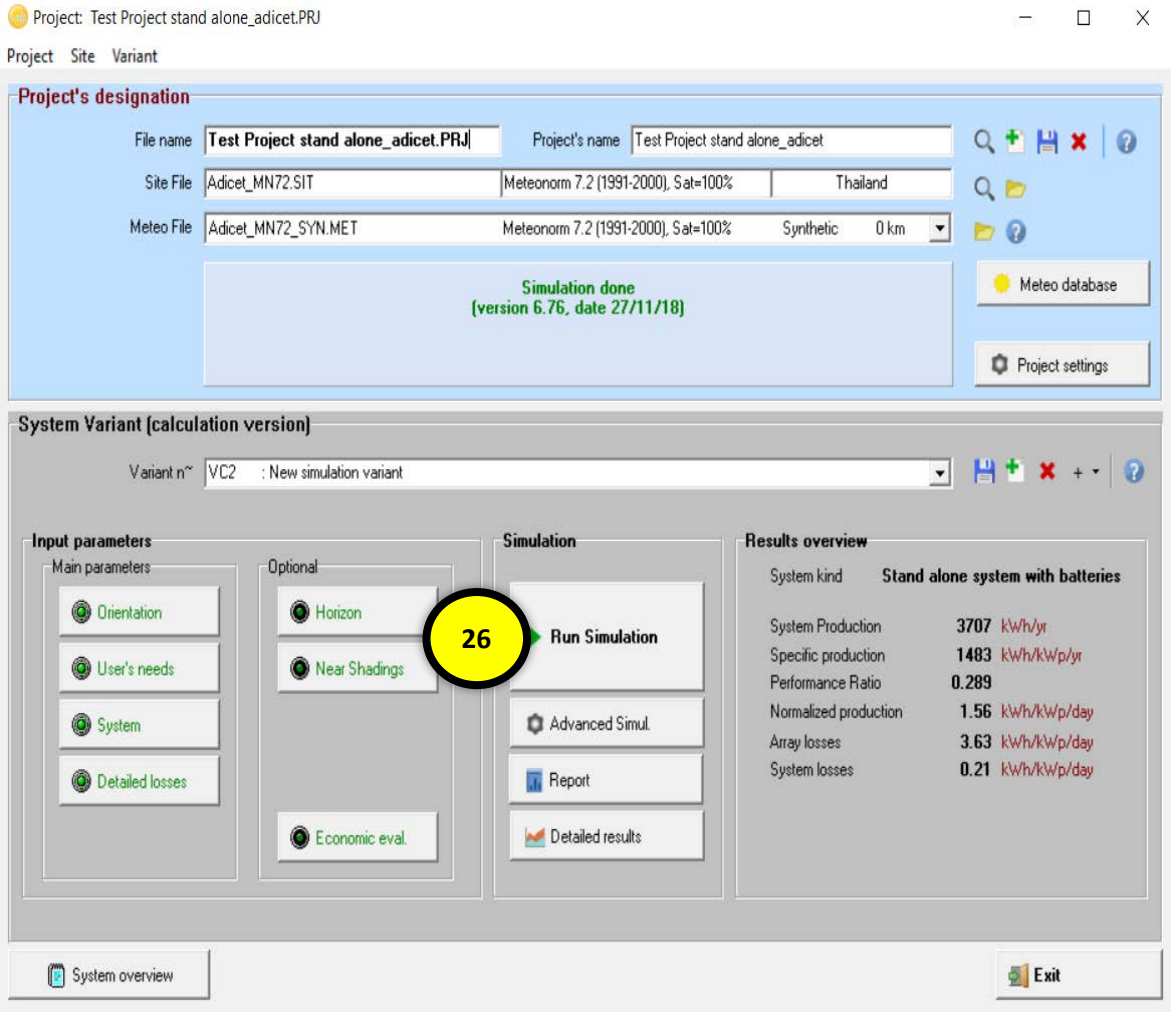
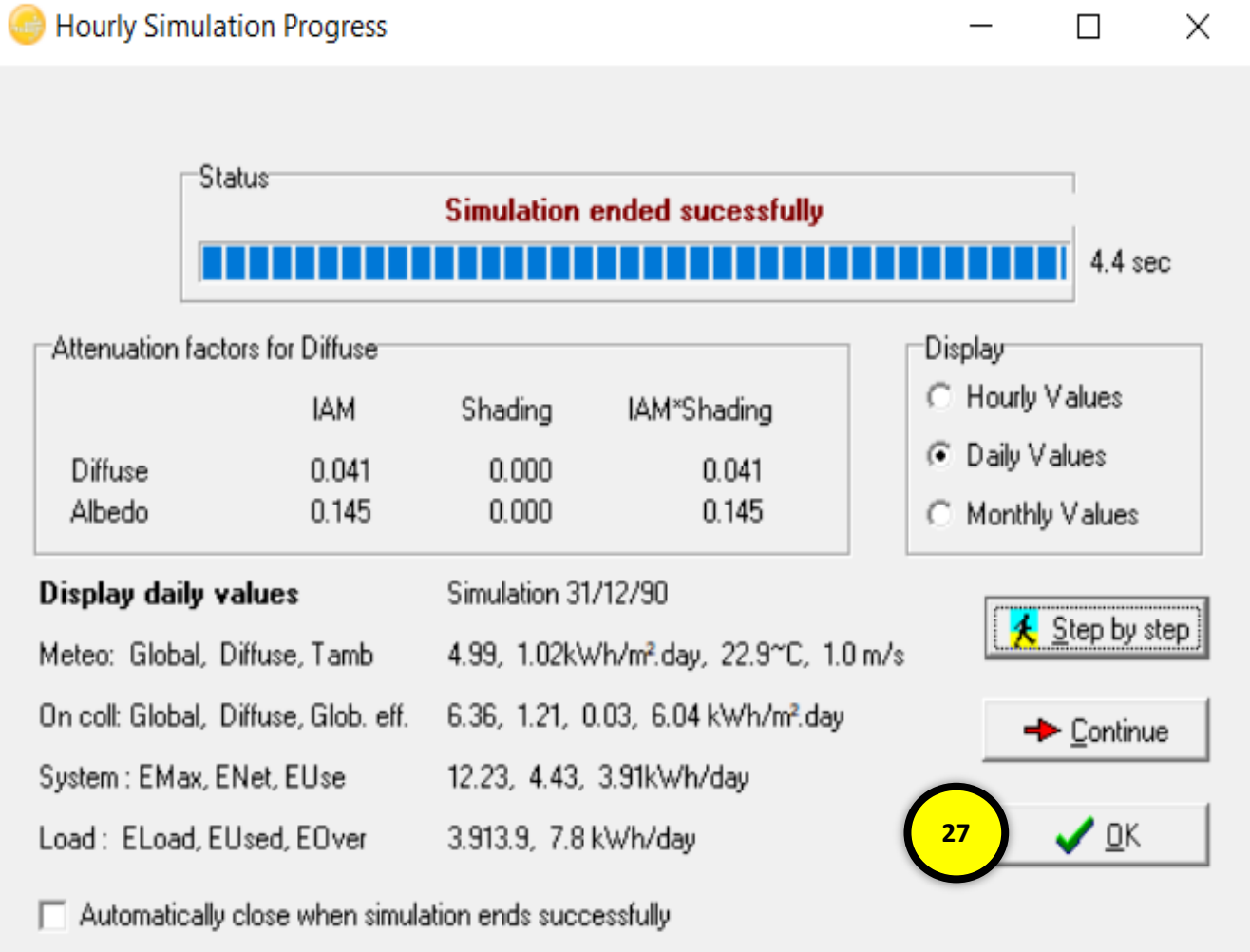
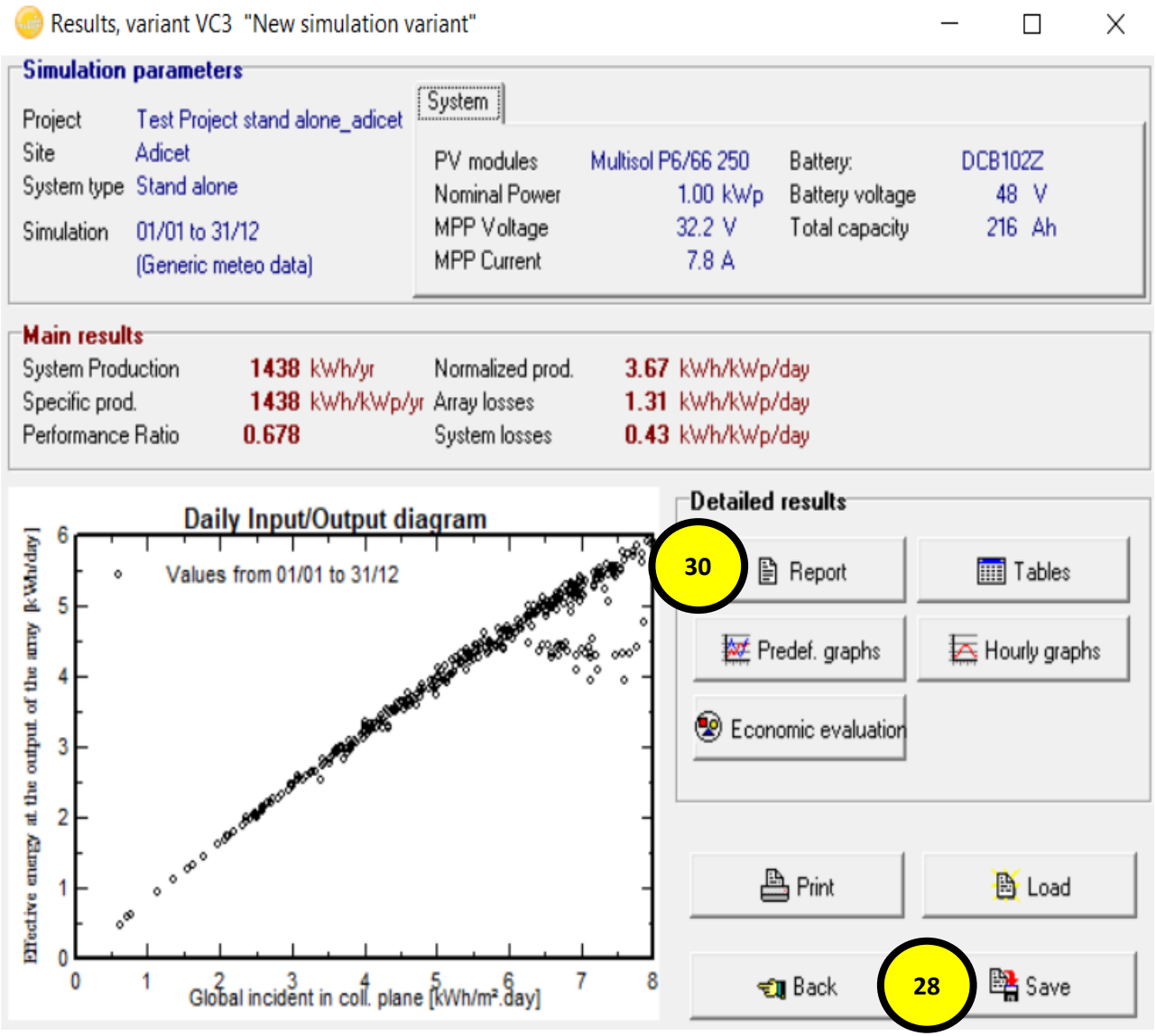
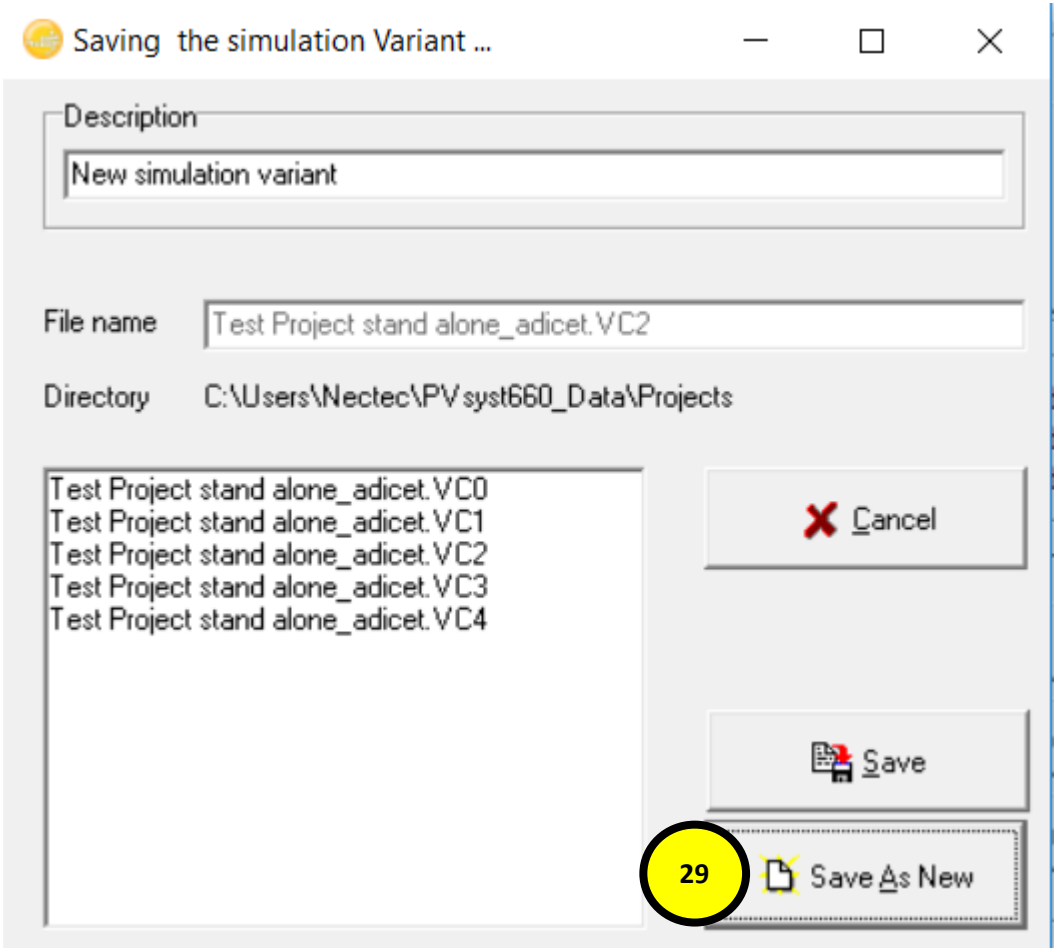




Pvsyst : Project Design





Pvsyst : Project Design

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Stand alone system: Simulation parameters

Project : **Test Project stand alone_adicet**

Geographical Site	**Adicet**		Country	**Thailand**
Situation	Latitude	19.02° N	Longitude	98.94° E
Time defined as	Legal Time	Time zone UT+7	Altitude	381 m
	Albedo	0.20		
Meteo data:	**Adicet**	Meteonorm 7.2 (1991-2000), Sat=100% - Synthetic		

Simulation variant : **New simulation variant**

Simulation date 27/11/18 11h27

Simulation parameters	System type	**Stand alone system with batteries**		
Collector Plane Orientation	Tilt	19°	Azimuth	0°
Models used	Transposition	Perez	Diffuse	Perez, Meteonorm
User's needs :	Daily household consumers	Constant over the year		
	average	3.9 kWh/Day		

PV Array Characteristics

PV module	Si-poly	Model	**Multisol P6/66 250**	
Original PVsyst database		Manufacturer	Scheuten	
Number of PV modules		In series	2 modules	In parallel 2 strings
Total number of PV modules		Nb. modules	4	Unit Nom. Power 250 Wp
Array global power		Nominal (STC)	**1000 Wp**	At operating cond. 880 Wp (50°C)
Array operating characteristics (50°C)		U mpp	56 V	I mpp 16 A
Total area		Module area	**7.3 m²**	

System Parameter	System type	**Stand alone system**		
Battery	Model	**DCB102Z**		
	Manufacturer	Panasonic		
Battery Pack Characteristics	Nb. of units	4 in parallel		
	Voltage	48 V	Nominal Capacity	216 Ah
	Discharging min. SOC	10.0 %	Stored energy	9.4 kWh
	Temperature	Fixed (30°C)		
Controller	Model	Universal controller with MPPT converter		
	Technology	MPPT converter	Temp coeff.	-5.0 mV/°C/elem.
Converter	Maxi and EURO efficiencies	97.0 / 95.0 %		
Battery Management control	Threshold commands as	SOC calculation		
	Charging	SOC = 0.96 / 0.80		
	Discharging	SOC = 0.10 / 0.35		

PV Array loss factors

Array Soiling Losses			Loss Fraction	3.0 %
Thermal Loss factor	Uc (const)	20.0 W/m²K	Uv (wind)	0.0 W/m²K / m/s
Wiring Ohmic Loss	Global array res.	62 mOhm	Loss Fraction	1.5 % at STC
Serie Diode Loss	Voltage Drop	0.7 V	Loss Fraction	1.1 % at STC
Module Quality Loss			Loss Fraction	0.5 %
Module Mismatch Losses			Loss Fraction	1.0 % at MPP
Strings Mismatch loss			Loss Fraction	0.10 %
Incidence effect, ASHRAE parametrization	IAM =	1 - bo (1/cos i - 1)	bo Param.	0.05

Detail System

- Location
- PV
- Battery
- Loss factor

Detail Load

- Electric equipment
- Time use

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Stand alone system: Detailed User's needs

Project : **Test Project stand alone_adicet**

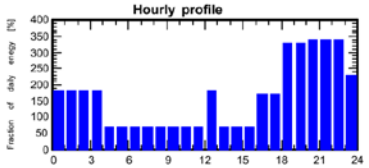
Simulation variant : **New simulation variant**

Main system parameters	System type	**Stand alone system with batteries**		
PV Field Orientation	tilt	19°	azimuth	0°
PV modules	Model	Multisol P6/66 250	Pnom	250 Wp
PV Array	Nb. of modules	4	Pnom total	**1000 Wp**
Battery	Model	DCB102Z	Technology	Lithium-ion, LCO
Battery Pack	Nb. of units	4	Voltage / Capacity	**48 V / 216 Ah**
User's needs	Daily household consumers	Constant over the year	Global	1426 kWh/year

Daily household consumers, Constant over the year, average = 3.9 kWh/day

Annual values

	Number	Power	Use	Energy
Lamps (LED or fluo)	6	8 W/lamp	6 h/day	288 Wh/day
Fan	2	55 W/app	10 h/day	1100 Wh/day
TV	1	110 W/app	4 h/day	440 Wh/day
Fridge	1	70 W tot	24 h/day	1680 Wh/day
Computer	1	100 W tot	4 h/day	400 Wh/day
Total daily energy				3908 Wh/day



Pvsyst : Project Design

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Stand alone system: Main results

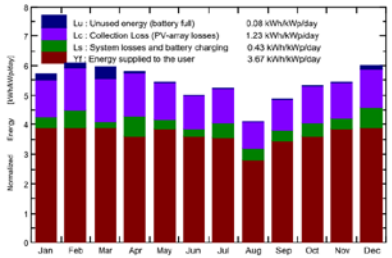
Project : **Test Project stand alone_adicet**

Simulation variant : **New simulation variant**

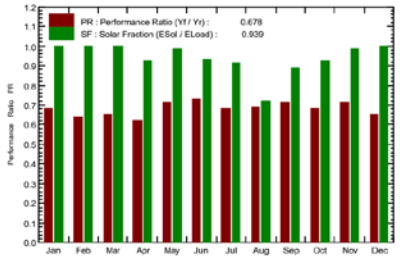
Main system parameters	System type	**Stand alone system with batteries**		
PV Field Orientation	tilt	19°	azimuth	0°
PV modules	Model	Multisol P6/66 250	Pnom	250 Wp
PV Array	Nb. of modules	4	Pnom total	**1000 Wp**
Battery	Model	DCB102Z	Technology	Lithium-ion, LCO
Battery Pack	Nb. of units	4	Voltage / Capacity	**48 V / 216 Ah**
User's needs	Daily household consumers	Constant over the year	Global	1426 kWh/year

Main simulation results				
System Production	**Available Energy**	**1438 kWh/year**	Specific prod.	1438 kWh/kWp/year
	Used Energy	1339 kWh/year	Excess (unused)	30 kWh/year
	Performance Ratio PR	67.83 %	Solar Fraction SF	93.86 %
Loss of Load	Time Fraction	7.5 %	Missing Energy	88 kWh/year
Battery ageing (State of Wear)	Cycles SOW	88.0%	Static SOW	71.7%
	Battery lifetime	3.5 years		

Normalized productions (per installed kWp): Nominal power 1000 Wp



Performance Ratio PR and Solar Fraction SF



New simulation variant

Balances and main results

	GlobHor kWh/m²	GlobEff kWh/m²	E_Avail kWh	EUnused kWh	E_Miss kWh	E_User kWh	E_Load kWh	SolFrac
January	145.8	168.2	130.9	6.23	0.00	121.1	121.1	1.000
February	147.8	161.1	123.1	4.73	0.00	109.4	109.4	1.000
March	172.6	174.4	132.3	12.87	0.00	121.1	121.1	1.000
April	176.2	163.6	123.3	1.23	8.57	108.7	117.2	0.927
May	180.3	157.4	121.8	0.02	1.48	119.7	121.1	0.988
June	163.7	139.9	109.4	0.00	8.26	109.0	117.2	0.930
July	176.1	151.7	118.5	0.00	10.78	110.4	121.1	0.911
August	131.0	118.6	93.9	0.02	34.21	86.9	121.1	0.718
September	142.7	137.1	107.6	0.01	13.42	103.8	117.2	0.886
October	149.4	154.6	119.3	0.02	9.36	111.8	121.1	0.923
November	136.5	153.1	119.9	0.03	1.54	115.7	117.2	0.987
December	147.2	176.2	138.0	4.48	0.00	121.1	121.1	1.000
Year	1869.3	1855.8	1438.0	29.64	87.62	1338.8	1426.4	0.939

Legends:
- GlobHor — Horizontal global irradiation
- GlobEff — Effective Global, corr. for IAM and shadings
- E_Avail — Available Solar Energy
- EUnused — Unused energy (battery full)
- E_Miss — Missing energy
- E_User — Energy supplied to the user
- E_Load — Energy need of the user (Load)
- SolFrac — Solar fraction (EUsed / ELoad)

Result System

- System Production (Power output PR etc.)
- Loss of load
- Battery

Result Loss

- environment loss
- System loss

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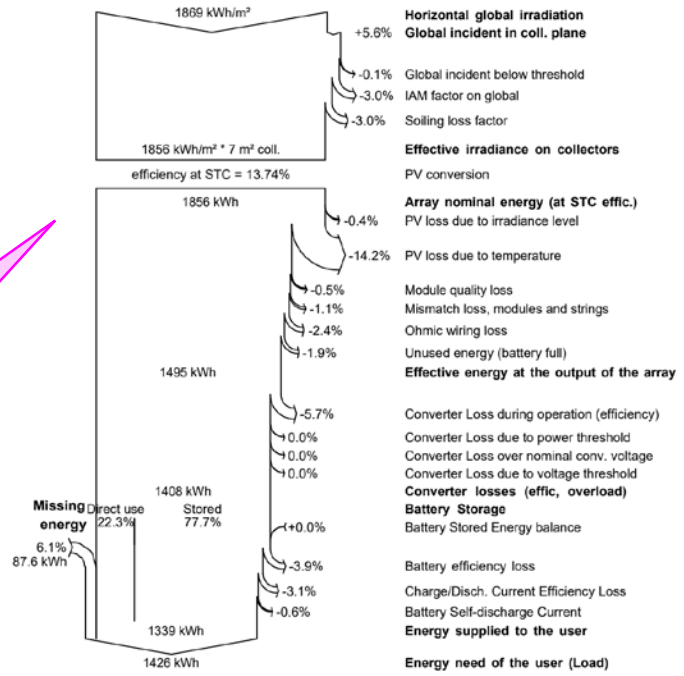
Stand alone system: Loss diagram

Project : **Test Project stand alone_adicet**

Simulation variant : **New simulation variant**

Main system parameters	System type	**Stand alone system with batteries**		
PV Field Orientation	tilt	19°	azimuth	0°
PV modules	Model	Multisol P6/66 250	Pnom	250 Wp
PV Array	Nb. of modules	4	Pnom total	**1000 Wp**
Battery	Model	DCB102Z	Technology	Lithium-ion, LCO
Battery Pack	Nb. of units	4	Voltage / Capacity	**48 V / 216 Ah**
User's needs	Daily household consumers	Constant over the year	Global	1426 kWh/year

Loss diagram over the whole year



Thank You.

Question

Load

Electric equipment	Power (W)	Number	Time (hr)	Energy (kWh)
LED	8	6	6	0.288
FAN	55	2	10	1.10
TV 21”	110	1	4	0.44
Computer	100	1	4	0.40
Fridge	70	1	24	1.68
			Total Energy	**3.908**

Location

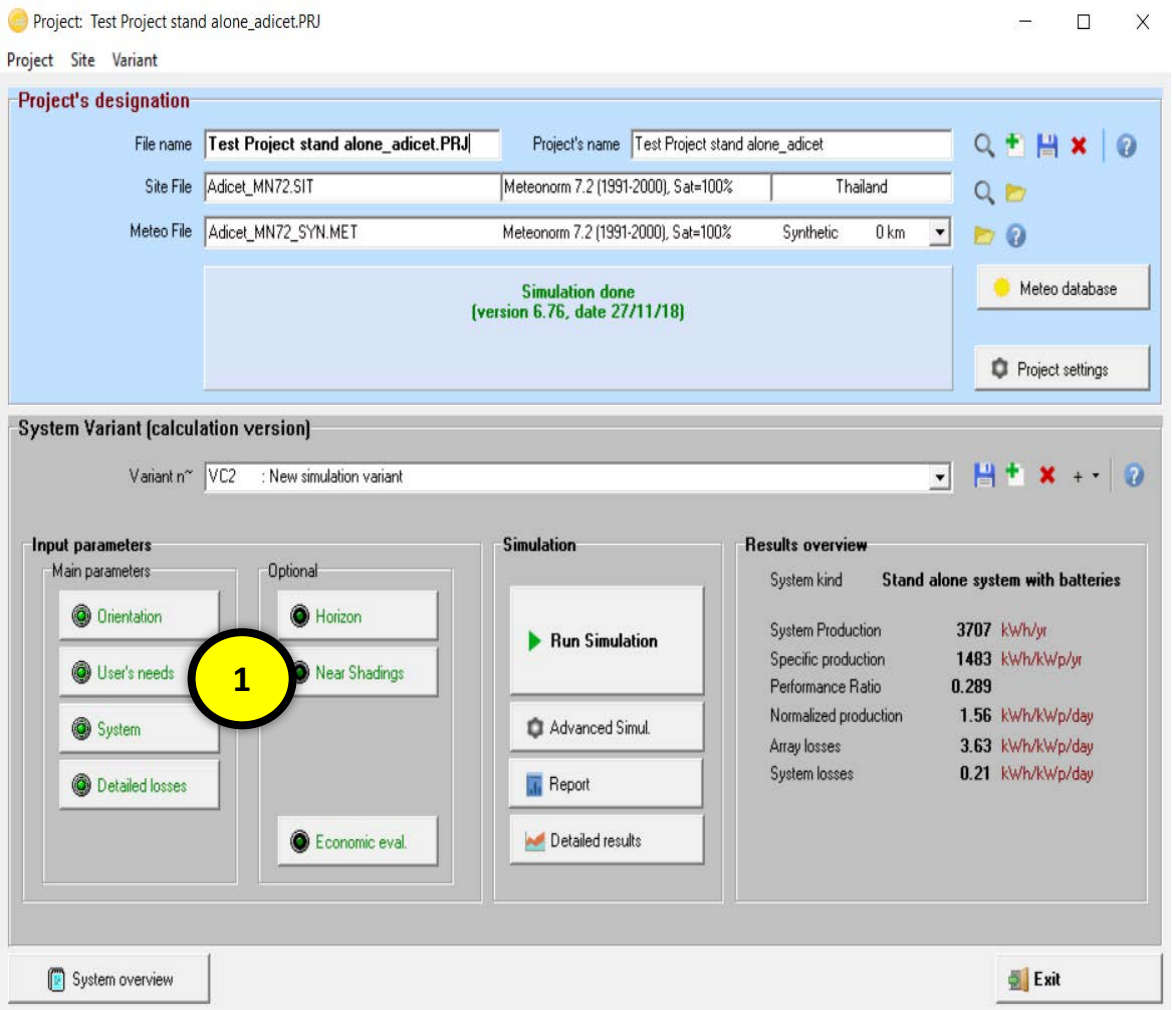
- Tshongdu, Paro, Bhutan
- 27.421679, 89.416208

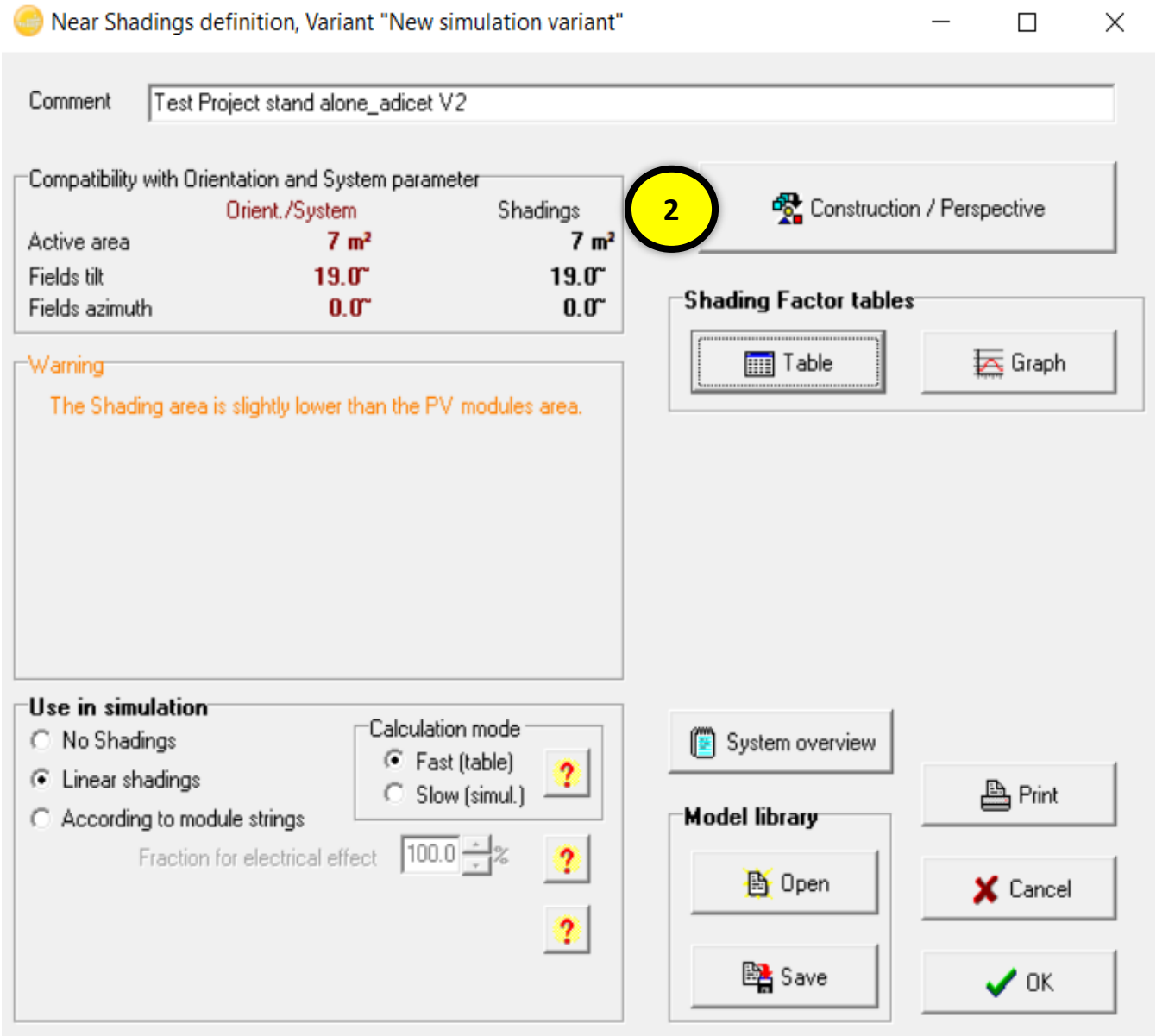
Design stand alone PV system

Afternoon Section

Pvsyst : Project Design

3D Shading





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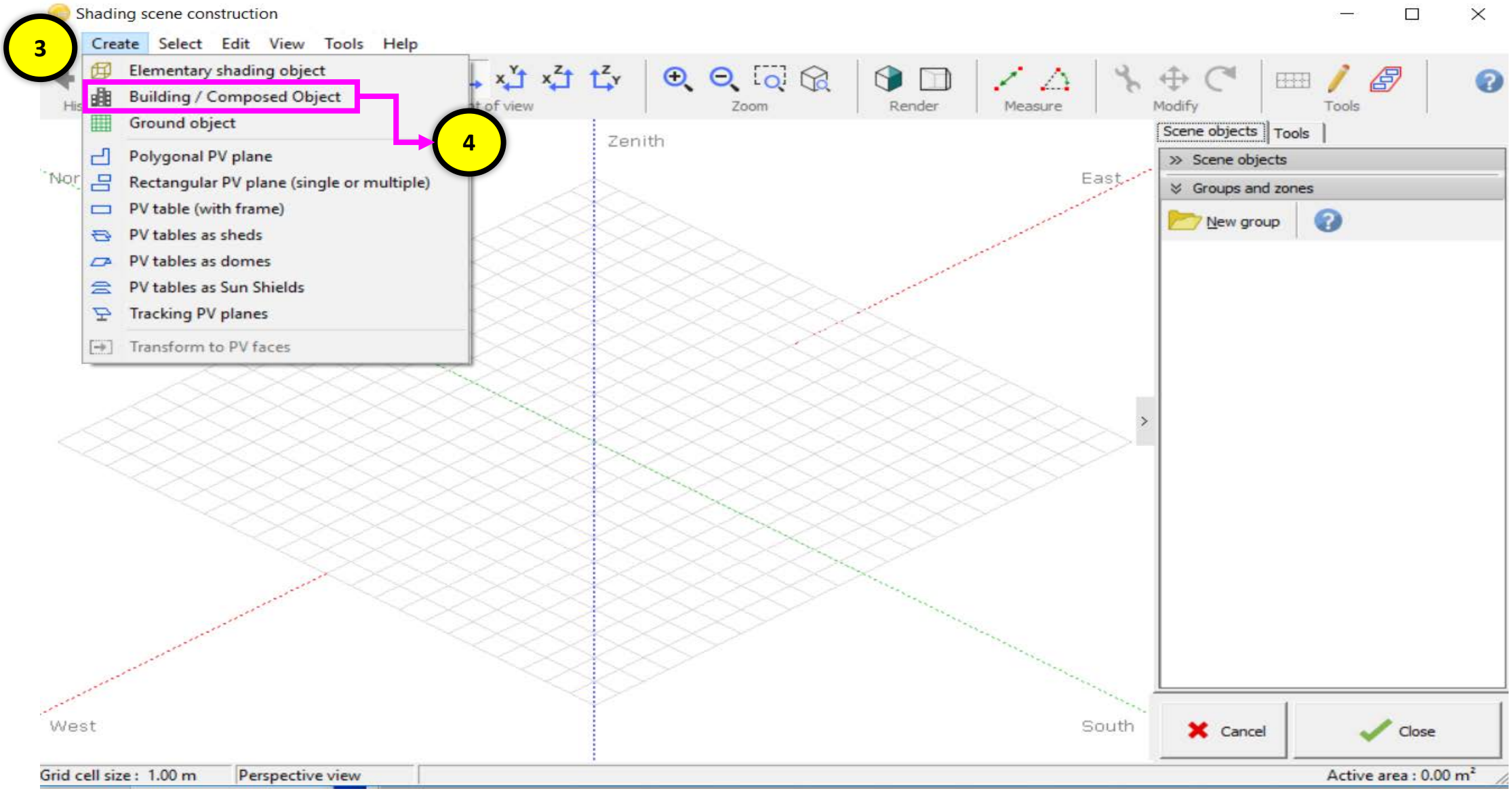

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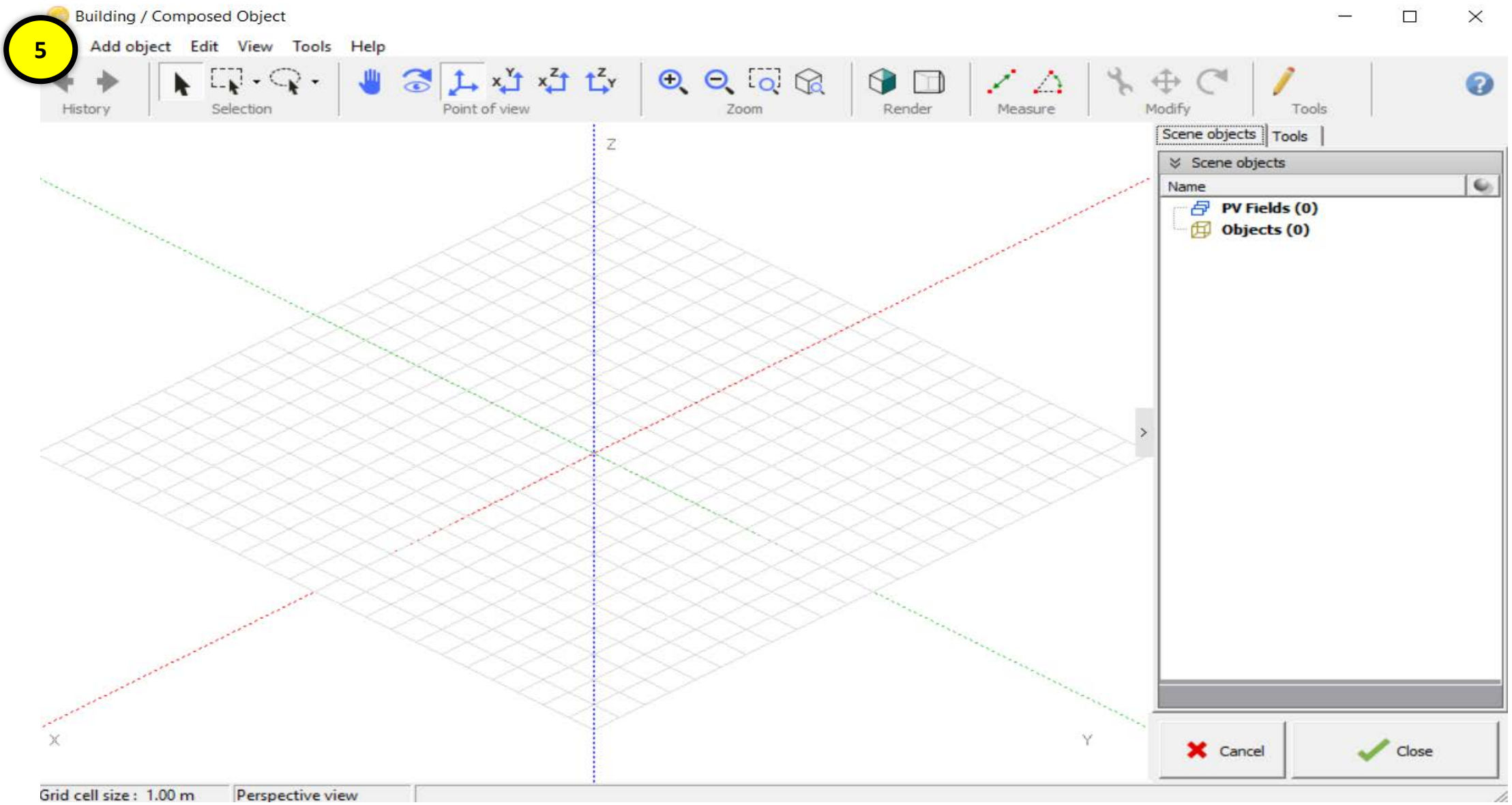

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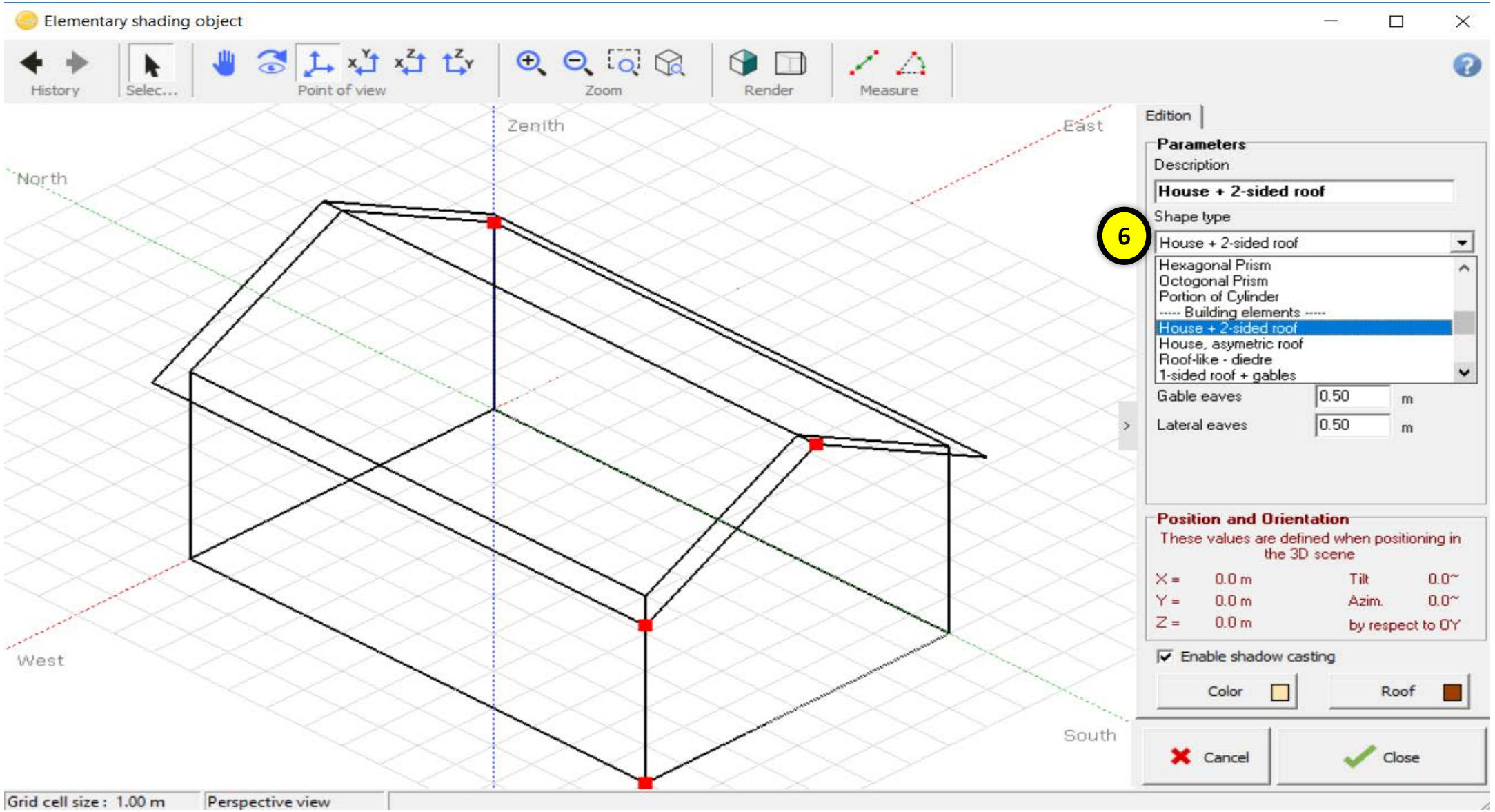

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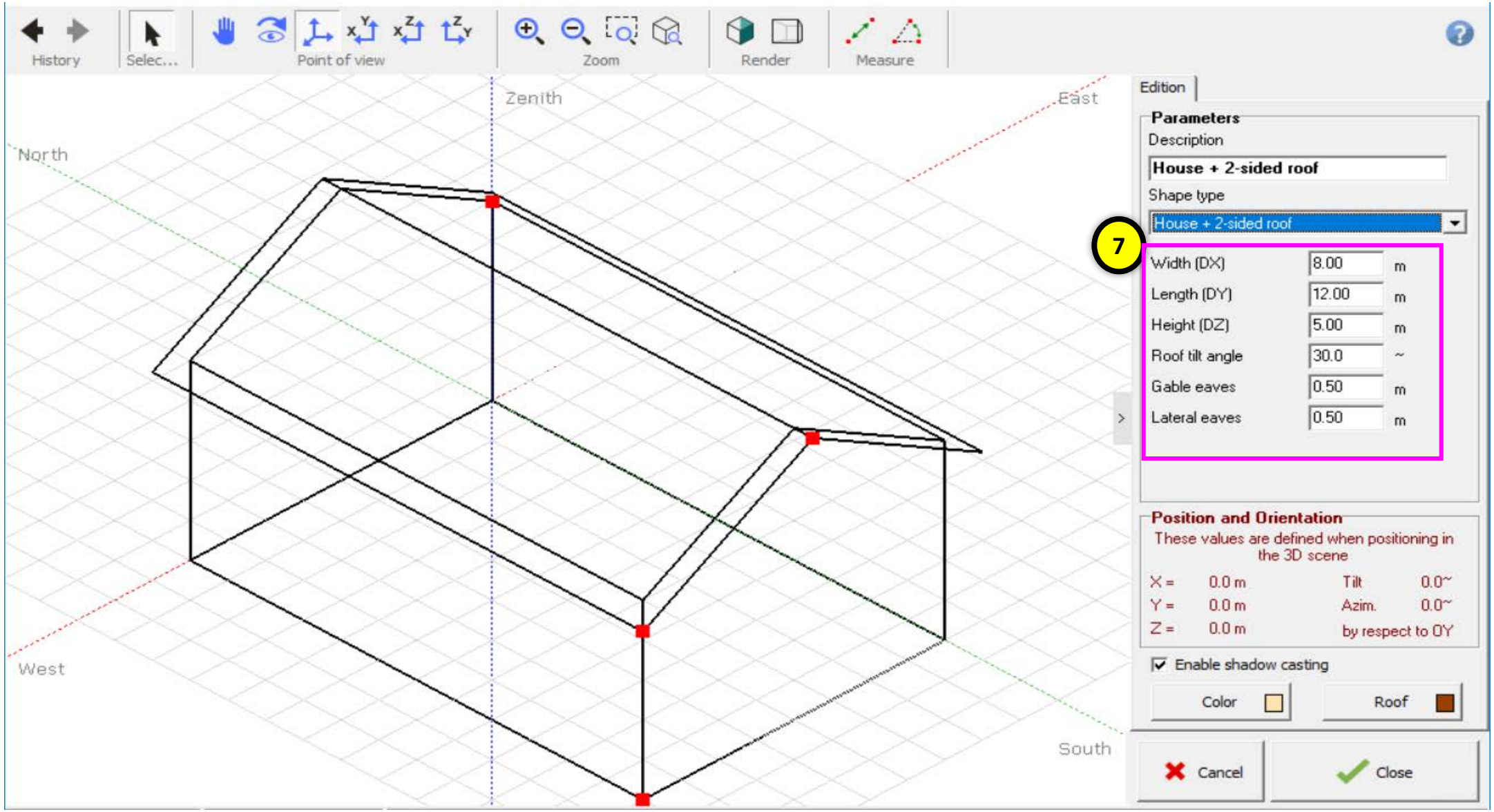

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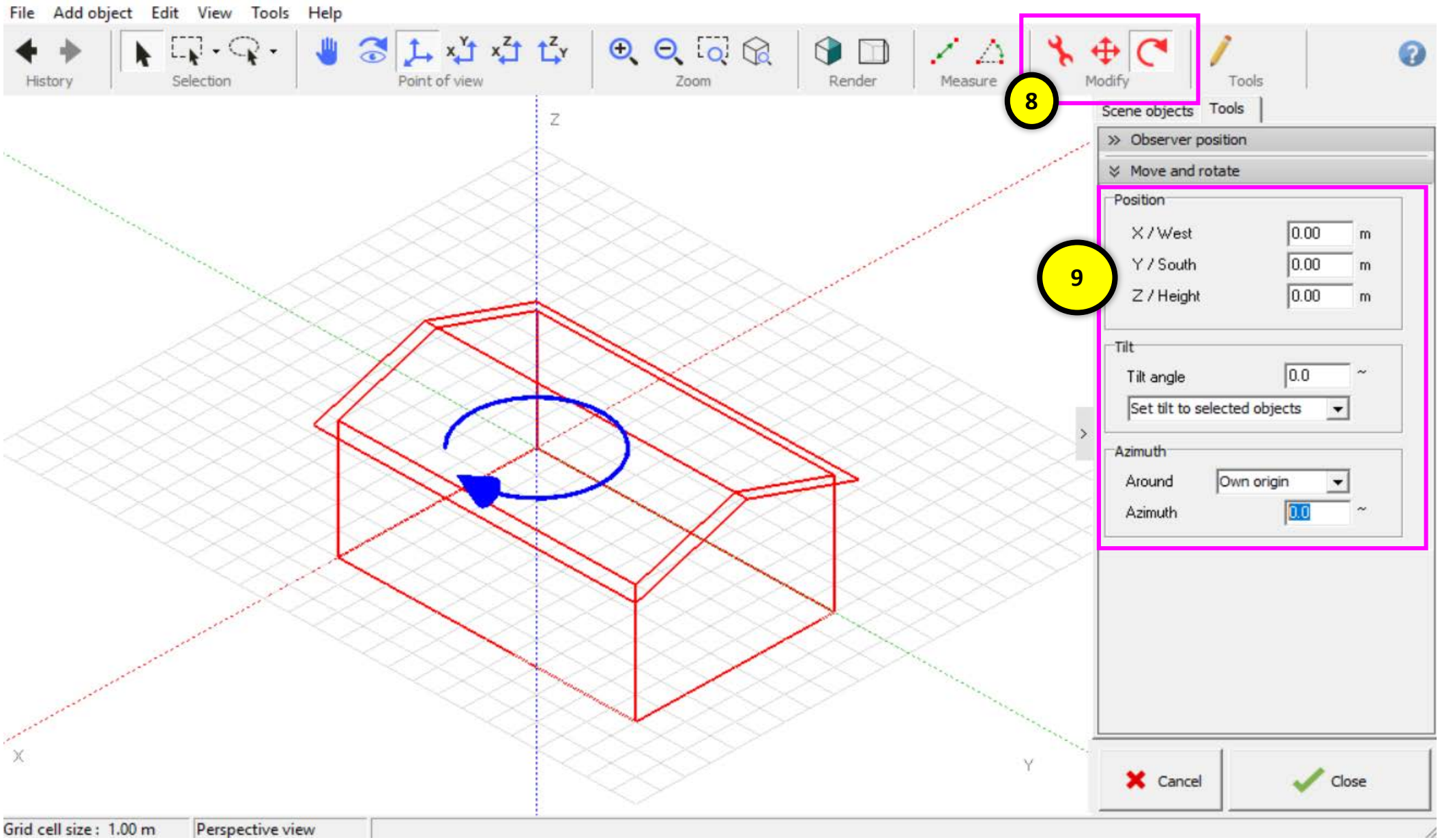

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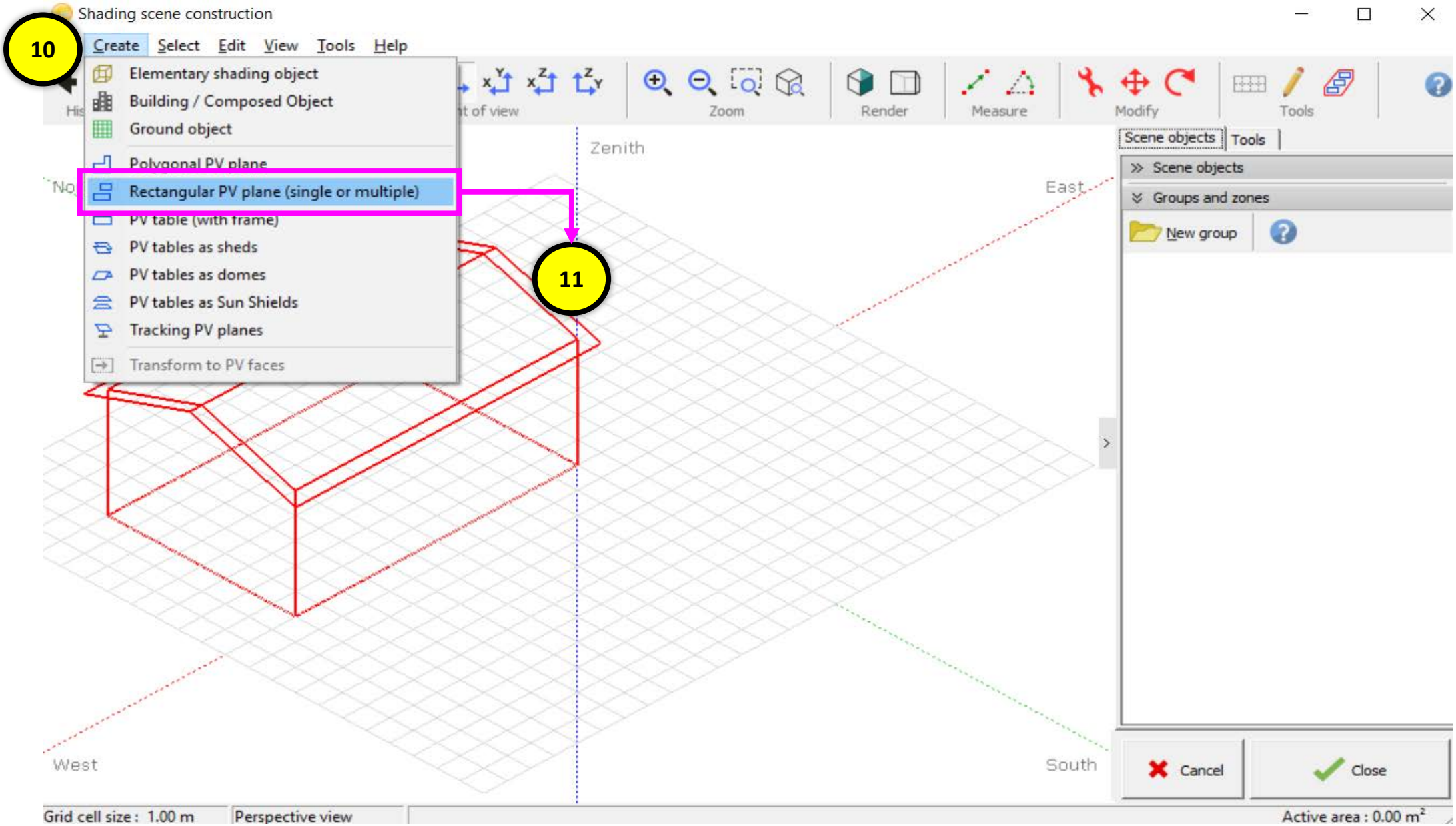

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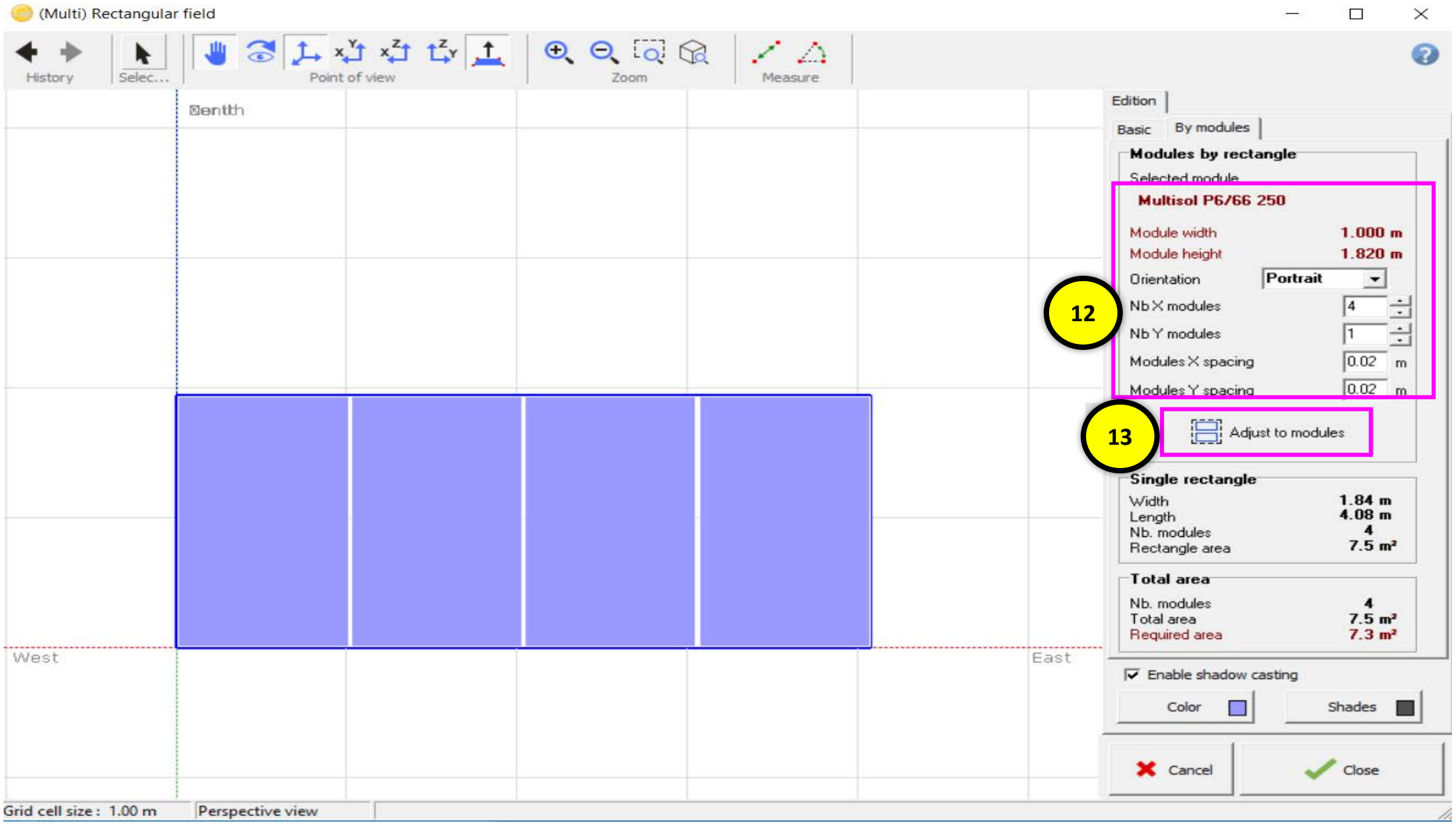

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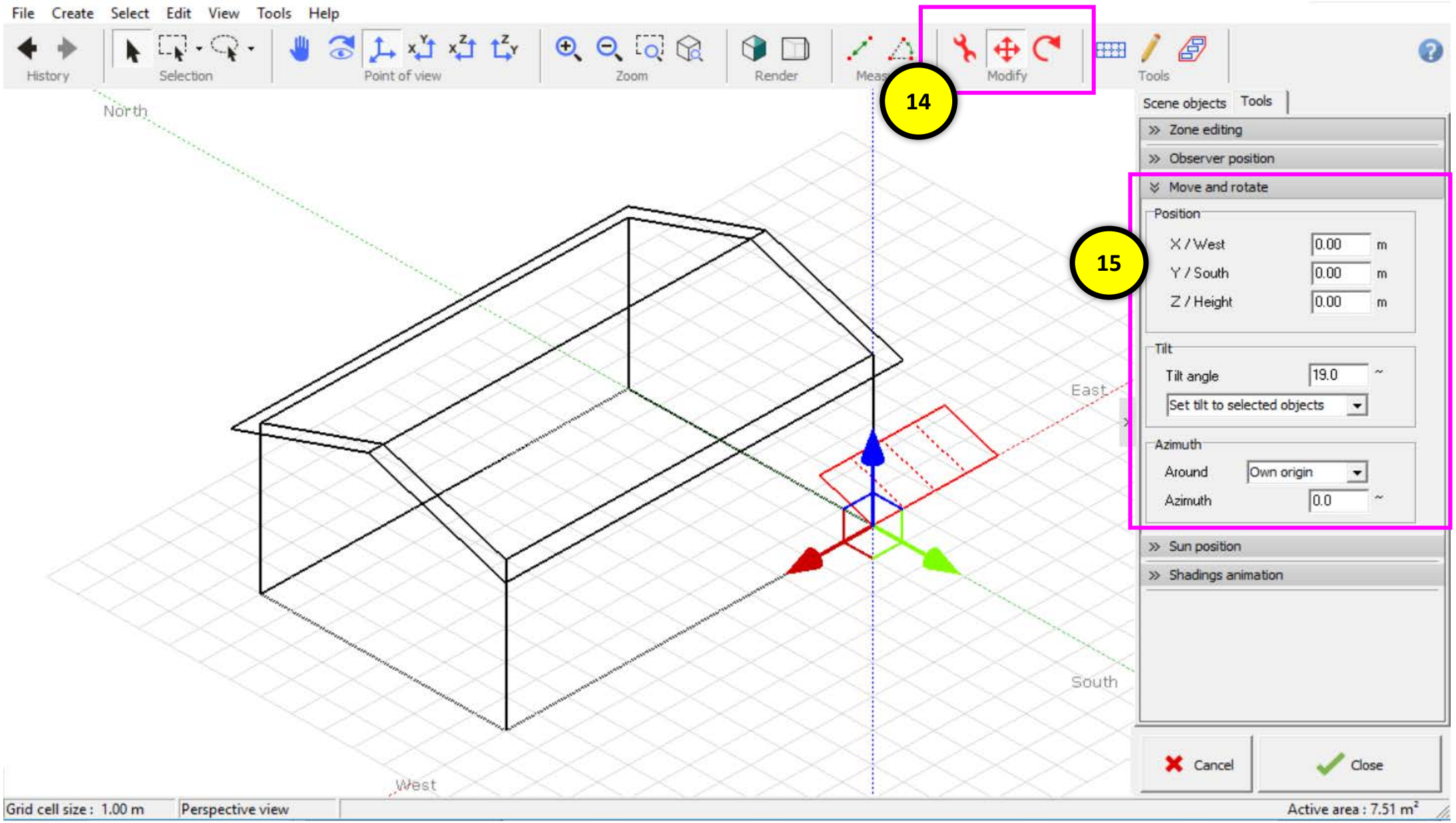
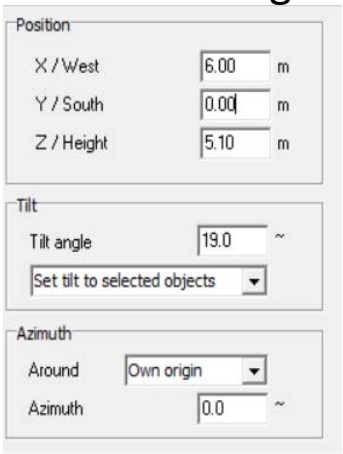


After setting



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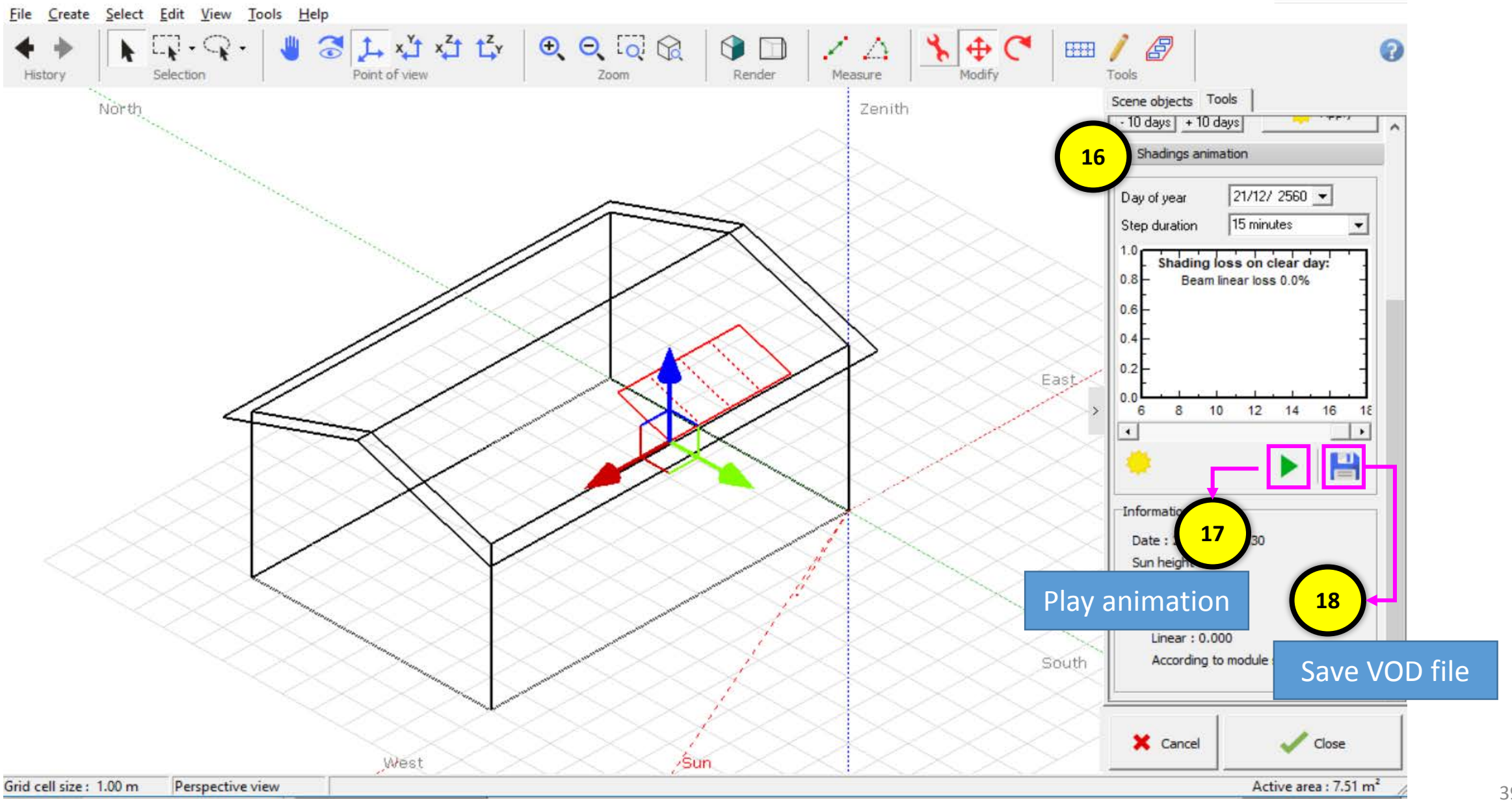

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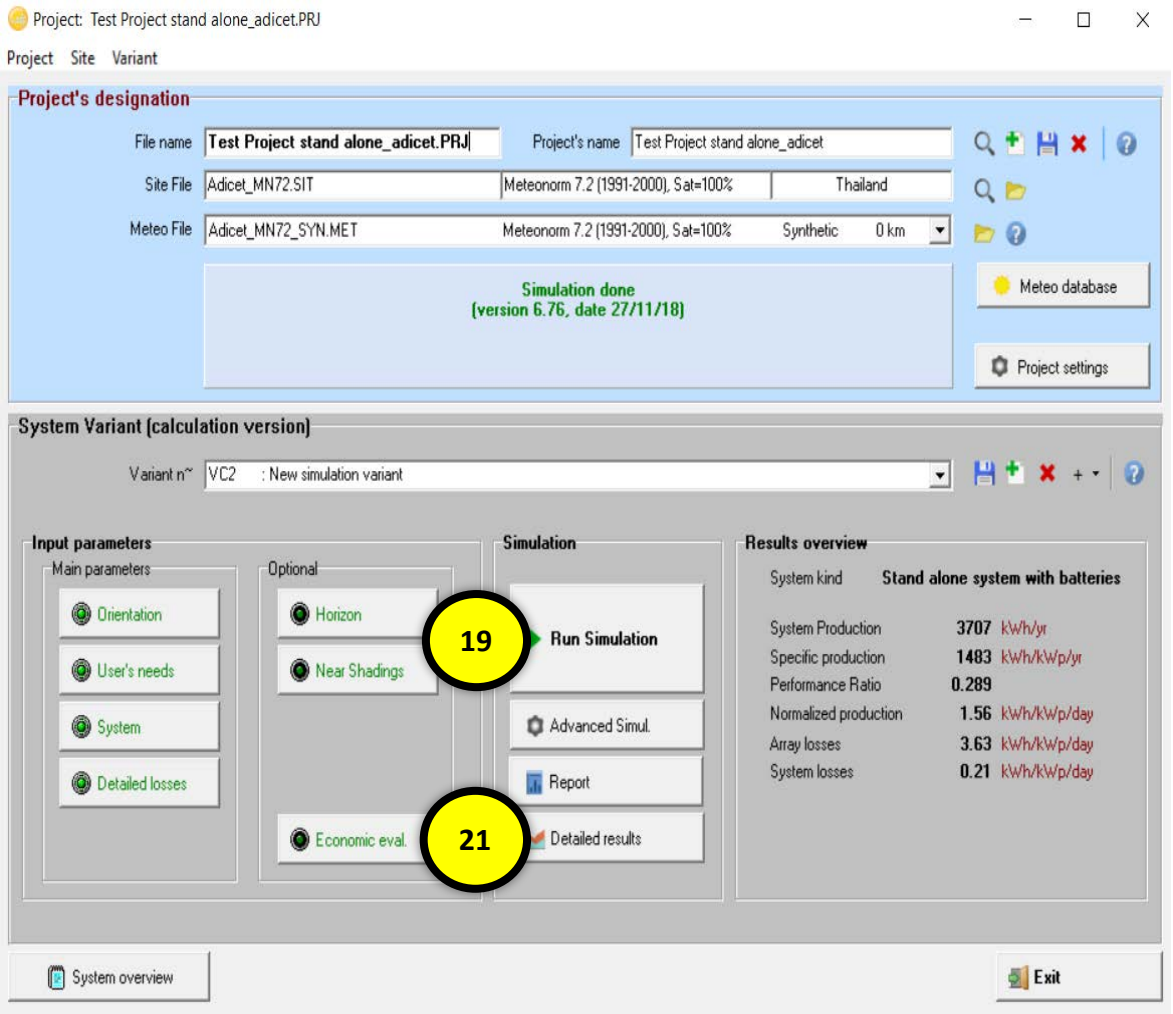

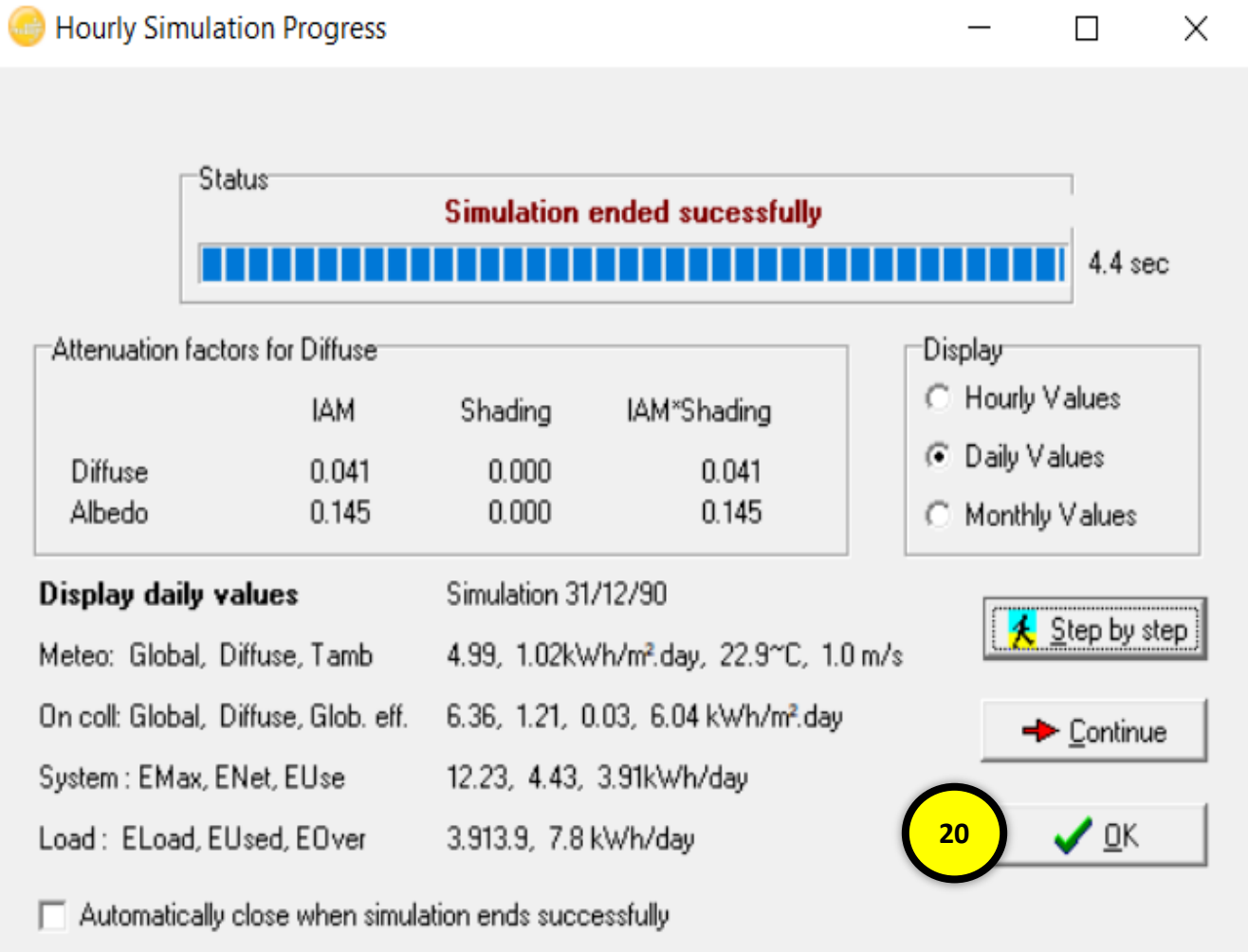

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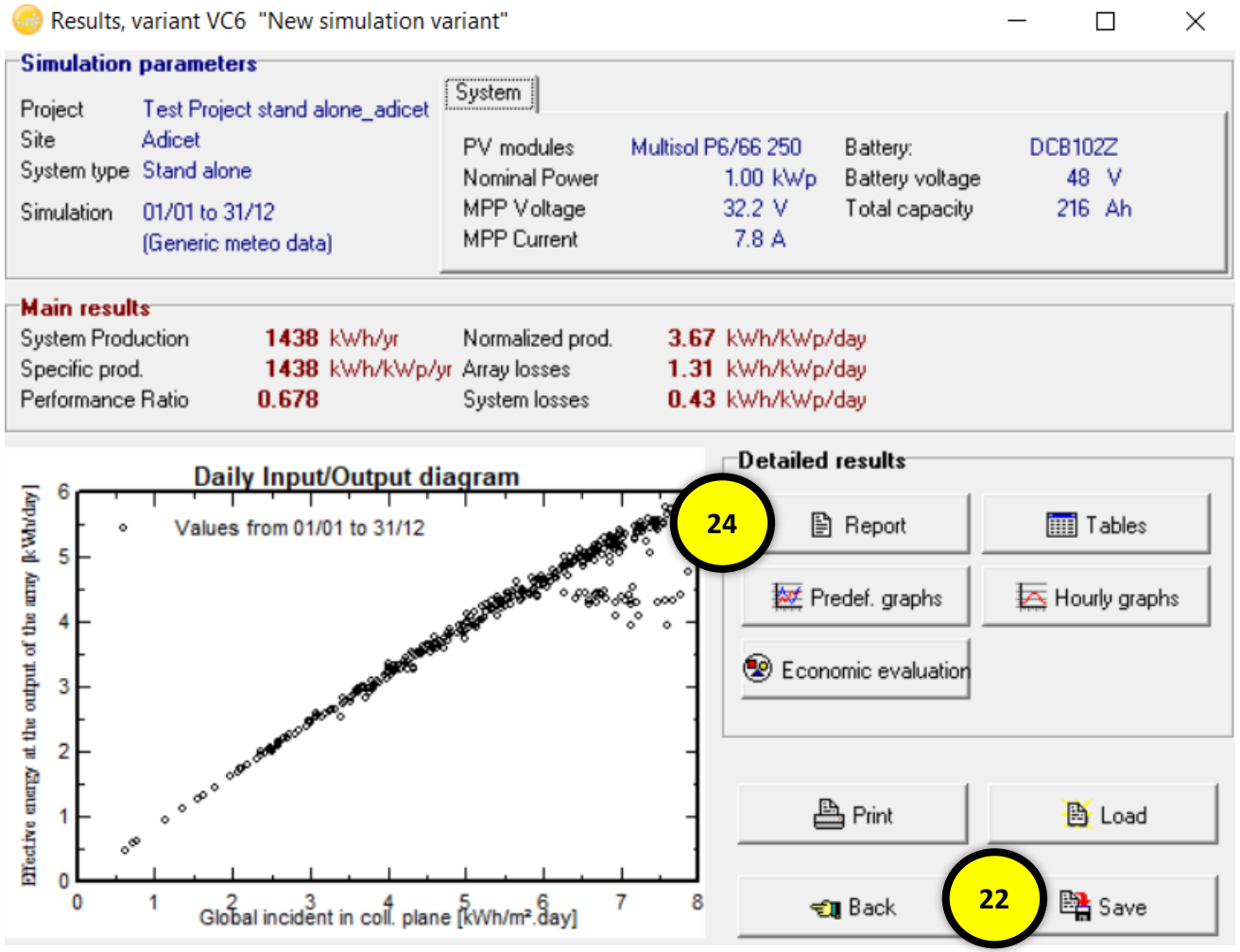

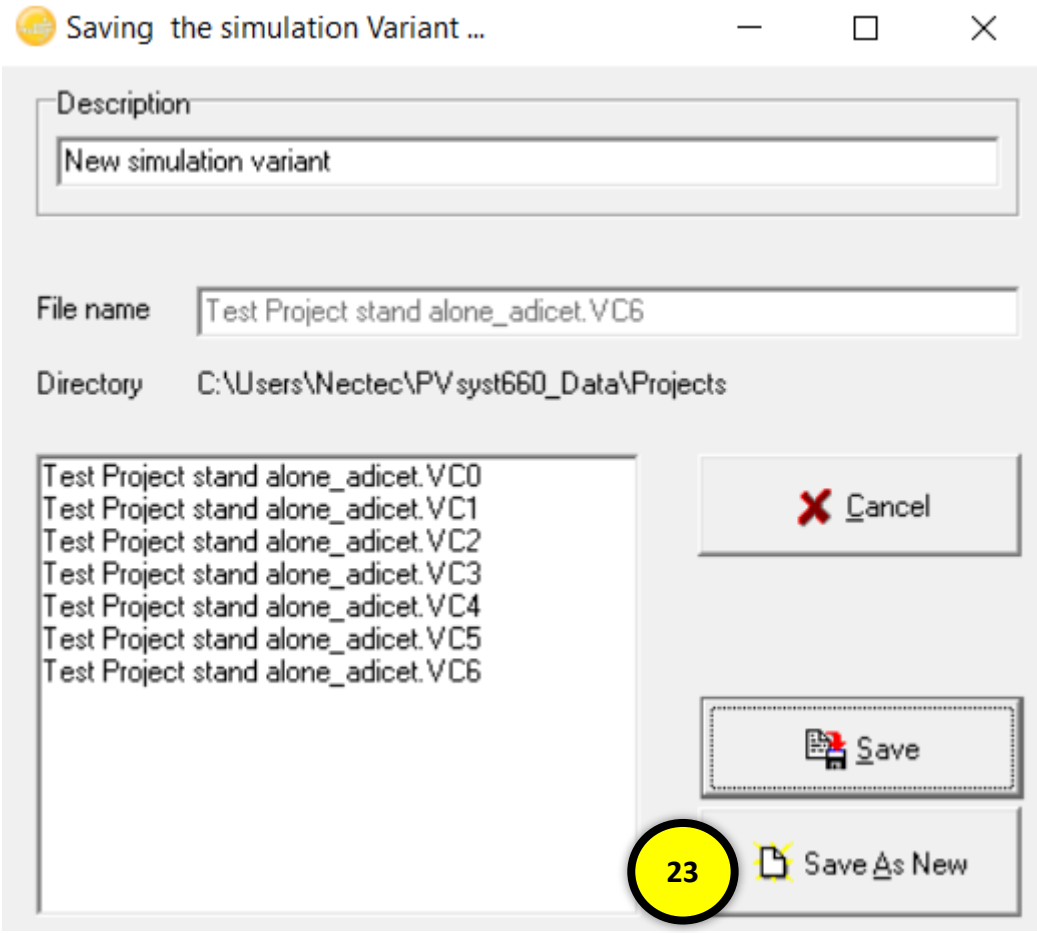

Pvsyst : Project Design

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Stand alone system: Simulation parameters

Project : **Test Project stand alone_adicet**

Geographical Site	**Adicet**		Country	**Thailand**
Situation	Latitude	19.02° N	Longitude	98.94° E
Time defined as	Legal Time	Time zone UT+7	Altitude	381 m
	Albedo	0.20		
Meteo data:	**Adicet**	Meteonorm 7.2 (1991-2000), Sat=100% - Synthetic		

Simulation variant : **New simulation variant**

Simulation date 27/11/18 18h17

Simulation parameters	System type	**Stand alone system with batteries**		
Collector Plane Orientation	Tilt	19°	Azimuth	0°
Models used	Transposition	Perez	Diffuse	Perez, Meteonorm
Near Shadings	According to strings		Electrical effect	100 %
User's needs :	Daily household consumers	Constant over the year		
	average	3.9 kWh/Day		

PV Array Characteristics

PV module	Si-poly	Model	**Multisol P6/66 250**	
Original PVsyst database		Manufacturer	Scheuten	
Number of PV modules		In series	2 modules	In parallel 2 strings
Total number of PV modules		Nb. modules	4	Unit Nom. Power 250 Wp
Array global power		Nominal (STC)	**1000 Wp**	At operating cond. 880 Wp (50°C)
Array operating characteristics (50°C)		U mpp	56 V	I mpp 16 A
Total area		Module area	**7.3 m²**	

System Parameter	System type	**Stand alone system**		
Battery	Model	**DCB102Z**		
	Manufacturer	Panasonic		
Battery Pack Characteristics	Nb. of units	4 in parallel		
	Voltage	48 V	Nominal Capacity	216 Ah
	Discharging min. SOC	10.0 %	Stored energy	9.4 kWh
	Temperature	Fixed (30°C)		
Controller	Model	Universal controller with MPPT converter		
	Technology	MPPT converter	Temp coeff.	-5.0 mV/°C/elem.
Converter	Maxi and EURO efficiencies	97.0 / 95.0 %		
Battery Management control	Threshold commands as	SOC calculation		
	Charging	SOC = 0.96 / 0.80		
	Discharging	SOC = 0.10 / 0.35		

PV Array loss factors

Array Soiling Losses			Loss Fraction	3.0 %
Thermal Loss factor	Uc (const)	20.0 W/m²K	Uv (wind)	0.0 W/m²K / m/s
Wiring Ohmic Loss	Global array res.	62 mOhm	Loss Fraction	1.5 % at STC
Serie Diode Loss	Voltage Drop	0.7 V	Loss Fraction	1.1 % at STC
Module Quality Loss			Loss Fraction	0.5 %
Module Mismatch Losses			Loss Fraction	1.0 % at MPP
Strings Mismatch loss			Loss Fraction	0.10 %
Incidence effect, ASHRAE parametrization	IAM =	1 - bo (1/cos i - 1)	bo Param.	0.05

Detail System

- Location
- PV
- Battery
- Loss factor

Shading

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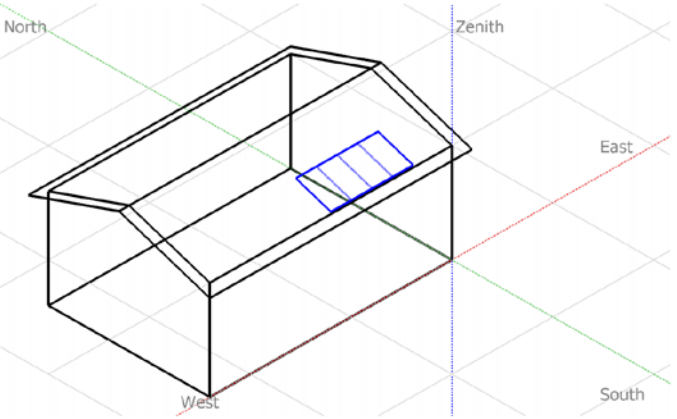
Stand alone system: Near shading definition

Project : **Test Project stand alone_adicet**

Simulation variant : **New simulation variant**

Main system parameters	System type	**Stand alone system with batteries**		
Near Shadings	According to strings		Electrical effect	100 %
PV Field Orientation	tilt	19°	azimuth	0°
PV modules	Model	Multisol P6/66 250	Pnom	250 Wp
PV Array	Nb. of modules	4	Pnom total	**1000 Wp**
Battery	Model	DCB102Z	Technology	Lithium-ion, LCO
Battery Pack	Nb. of units	4	Voltage / Capacity	**48 V / 216 Ah**
User's needs	Daily household consumers	Constant over the year	Global	1426 kWh/year

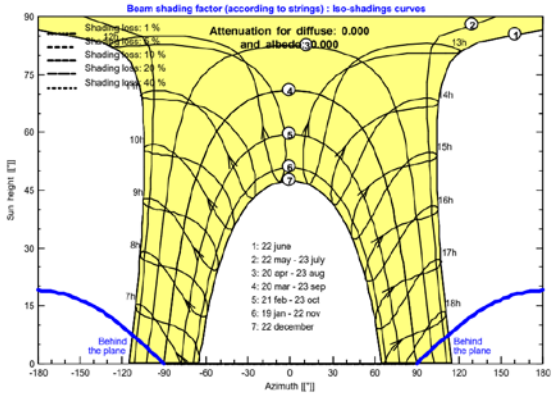
Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

Test Project stand alone_adicet

Beam shading factor (according to strings) : Iso-shadings curves



Pvsyst : Project Design

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Stand alone system: Detailed User's needs

Project : **Test Project stand alone_adicet**

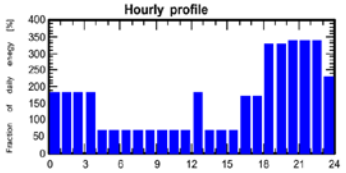
Simulation variant : **New simulation variant**

Main system parameters	System type	**Stand alone system with batteries**		
Near Shadings	According to strings		Electrical effect	100 %
PV Field Orientation	tilt	19°	azimuth	0°
PV modules	Model	Multisol P6/66 250	Pnom	250 Wp
PV Array	Nb. of modules	4	Pnom total	**1000 Wp**
Battery	Model	DCB102Z	Technology	Lithium-ion, LCO
Battery Pack	Nb. of units	4	Voltage / Capacity	**48 V / 216 Ah**
User's needs	Daily household consumers	Constant over the year	Global	1426 kWh/year

Daily household consumers, Constant over the year, average = 3.9 kWh/day

Annual values

	Number	Power	Use	Energy
Lamps (LED or fluo)	6	8 W/lamp	6 h/day	288 Wh/day
Fan	2	55 W/app	10 h/day	1100 Wh/day
TV	1	110 W/app	4 h/day	440 Wh/day
Fridge	1	70 W tot	24 h/day	1680 Wh/day
Computer	1	100 W tot	4 h/day	400 Wh/day
Total daily energy				3908 Wh/day



Detail Load

- Electric equipment
- Time use

Result System

- System Production (Power output PR etc.)
- Loss of load
- Battery

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Stand alone system: Main results

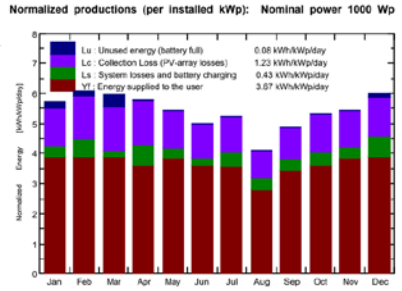
Project : **Test Project stand alone_adicet**

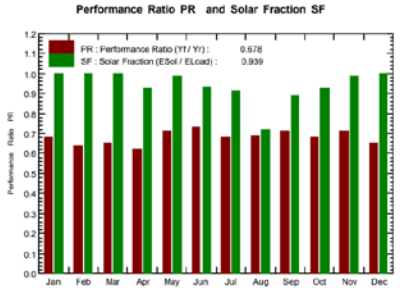
Simulation variant : **New simulation variant**

Main system parameters	System type	**Stand alone system with batteries**		
Near Shadings	According to strings		Electrical effect	100 %
PV Field Orientation	tilt	19°	azimuth	0°
PV modules	Model	Multisol P6/66 250	Pnom	250 Wp
PV Array	Nb. of modules	4	Pnom total	**1000 Wp**
Battery	Model	DCB102Z	Technology	Lithium-ion, LCO
Battery Pack	Nb. of units	4	Voltage / Capacity	**48 V / 216 Ah**
User's needs	Daily household consumers	Constant over the year	Global	1426 kWh/year

Main simulation results

System Production	**Available Energy**	**1438 kWh/year**	Specific prod.	1438 kWh/kWp/year
	Used Energy	1339 kWh/year	Excess (unused)	30 kWh/year
	Performance Ratio PR	67.83 %	Solar Fraction SF	93.86 %
Loss of Load	Time Fraction	7.5 %	Missing Energy	88 kWh/year
Battery ageing (State of Wear)	Cycles SOW	88.0%	Static SOW	71.7%
	Battery lifetime	3.5 years		





New simulation variant
Balances and main results

	GlobHor kWh/m²	GlobEff kWh/m²	E_Avail kWh	EUnused kWh	E_Miss kWh	E_User kWh	E_Load kWh	SolFrac
January	145.8	168.2	130.9	6.25	0.00	121.1	121.1	1.000
February	147.8	161.1	123.1	4.73	0.00	109.4	109.4	1.000
March	172.6	174.4	132.3	12.87	0.00	121.1	121.1	1.000
April	175.2	163.6	123.3	1.23	8.57	108.7	117.2	0.927
May	180.3	157.4	121.8	0.02	1.49	119.7	121.1	0.988
June	163.7	139.9	109.4	0.00	8.26	109.0	117.2	0.930
July	178.1	151.7	118.5	0.00	10.78	110.4	121.1	0.911
August	131.0	118.6	93.9	0.02	34.22	86.9	121.1	0.718
September	142.7	137.1	107.6	0.01	13.42	103.8	117.2	0.886
October	149.4	154.6	119.3	0.02	9.36	111.8	121.1	0.923
November	136.5	153.1	119.9	0.03	1.54	115.7	117.2	0.987
December	147.2	176.2	138.0	4.48	0.00	121.1	121.1	1.000
Year	1869.3	1855.8	1438.0	29.66	87.63	1338.8	1426.4	0.939

Legends:

GlobHor	Horizontal global irradiation	E_Miss	Missing energy
GlobEff	Effective Global, corr. for IAM and shadings	E_User	Energy supplied to the user
E_Avail	Available Solar Energy	E_Load	Energy need of the user (Load)
EUnused	Unused energy (battery full)	SolFrac	Solar fraction (EUsed / ELoad)

Pvsyst : Project Design

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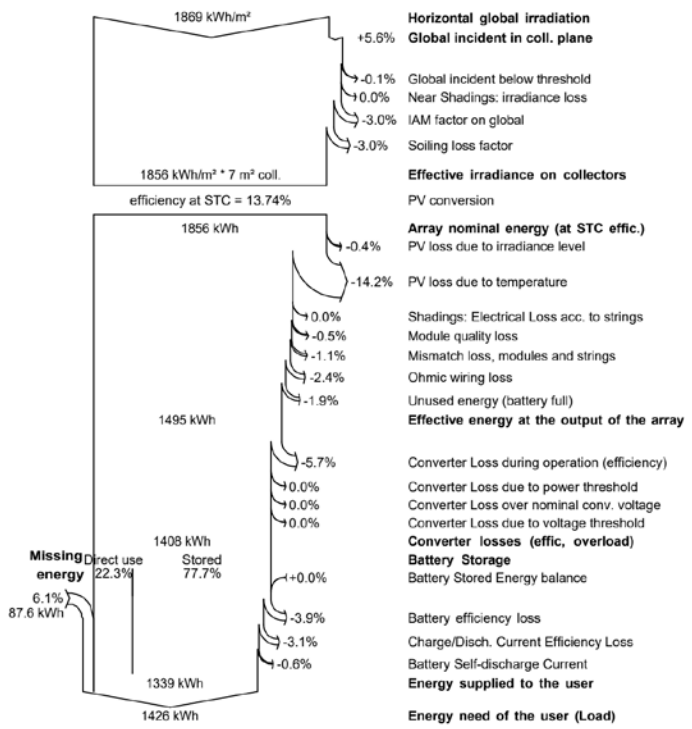
Stand alone system: Loss diagram

Project : **Test Project stand alone_adicet**

Simulation variant : **New simulation variant**

Main system parameters	System type	**Stand alone system with batteries**		
Near Shadings	According to strings		Electrical effect	100 %
PV Field Orientation	tilt	19°	azimuth	0°
PV modules	Model	Multisol P6/66 250	Pnom	250 Wp
PV Array	Nb. of modules	4	Pnom total	**1000 Wp**
Battery	Model	DCB102Z	Technology	Lithium-ion, LCO
Battery Pack	Nb. of units	4	Voltage / Capacity	**48 V / 216 Ah**
User's needs	Daily household consumers	Constant over the year	Global	1426 kWh/year

Loss diagram over the whole year



Result Loss

- environment loss
- System loss

Kadrin Chhe.