

Version 8

Standalone



Step-by-step tutorial

Summary

Chapter 1 : VC0_Controller without MPPT.....p.3

Chapter 2 : VC1_Controller with MPPT.....p.31

Chapter 3 : VC2_ $P_{NomPV} = 1.6 \text{ kW}$p.38

Chapter 4 : VC3_ $P_{NomPV} = 5.6 \text{ kW}$, storage 37 kWh.....p.54

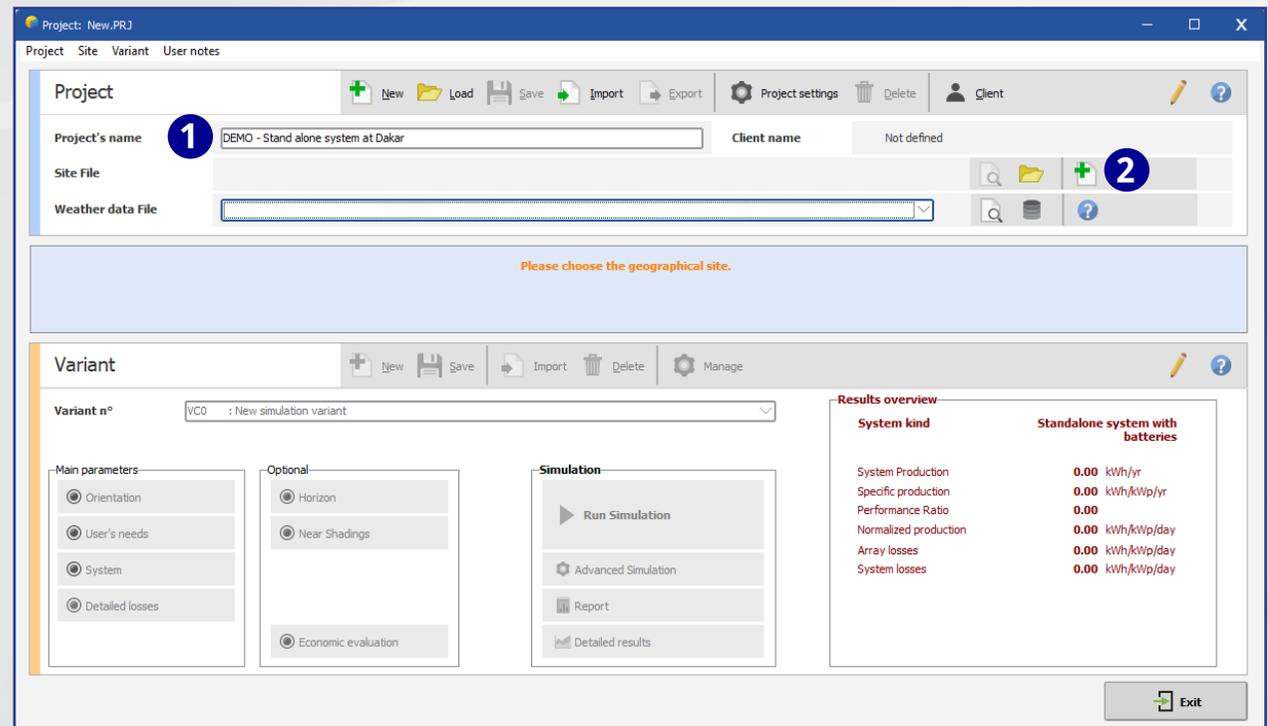
Chapter 5 : VC4_ $P_{nomPV} = 12 \text{ kW}$, Storage.....p.64

Chapter 1: VCO - Project Creation

1 Enter a project name

2 Select a site from the 2500 sites in the database by clicking on 

or create your new site by clicking on 



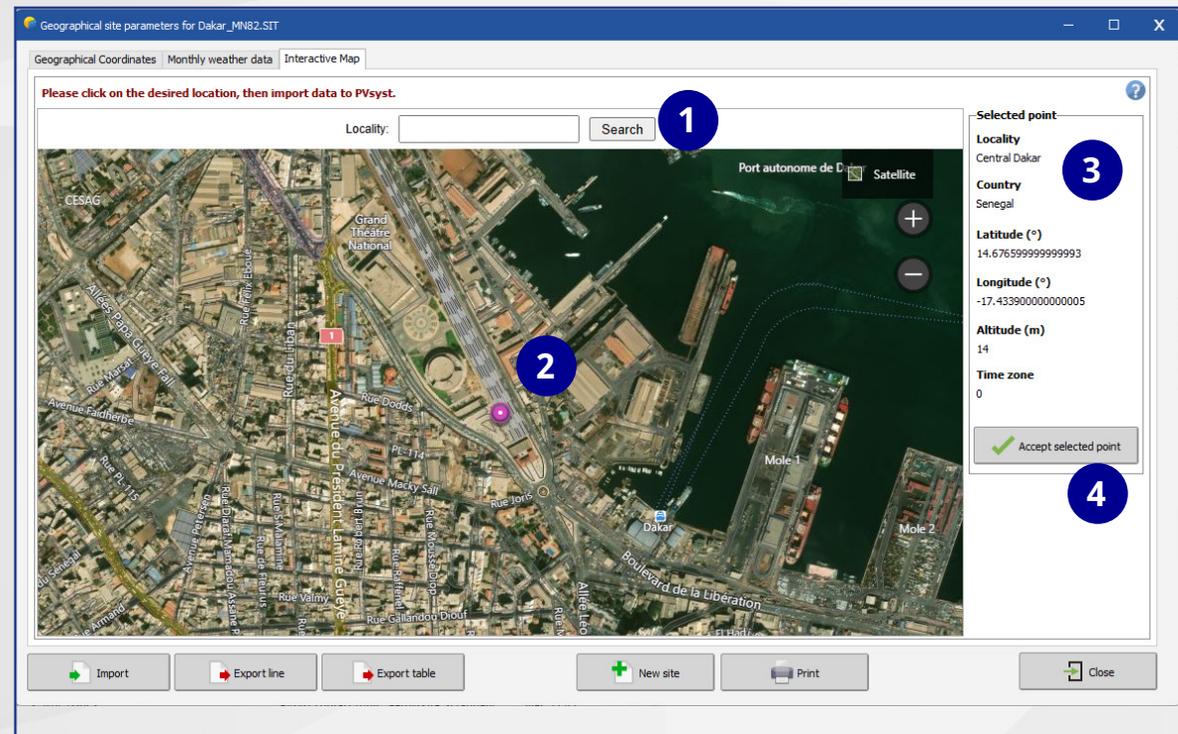
Chapter 1: VC0 - Project Creation_ Create a New Site

1 With the search bar

2 Or position the point on the interactive map

3 Verify the information of the selected point

4 Confirm by clicking «Accept selected point»



Chapter 1: VC0 - Project Creation_Weather Data Import

1

A selection of weather data sources is available. Meteonorm 8.2 is included with the PVsyst license.

2

Import weather data by clicking on «Import»

Chapter 1: VC0 - Project Creation_Imported Weather

1 Choose the irradiation units

2 Click «OK» to confirm

Geographical site parameters for Central Dakar_MN82.SIT

Geographical Coordinates Monthly weather data Interactive Map

Site **Central Dakar (Senegal)**

Data source Meteororm 8.2 (2010-2021), Sat=100%

	Global horizontal irradiation kWh/m²/mth	Horizontal diffuse irradiation kWh/m²/mth	Temperature °C	Wind Velocity m/s	Linke turbidity []	Relative humidity %
January	140.8	69.3	21.8	4.80	6.196	62.9
February	145.9	75.6	21.0	5.31	6.944	69.8
March	188.0	86.5	21.5	5.40	8.506	75.2
April	187.6	92.8	21.5	5.50	8.804	82.2
May	188.5	102.6	23.1	4.70	9.545	81.8
June	174.3	101.9	25.3	3.60	10.012	82.5
July	186.5	97.2	27.4	3.30	8.793	78.5
August	173.6	98.4	27.6	2.99	7.421	83.3
September	154.7	89.5	27.5	2.69	6.911	86.1
October	155.1	83.3	28.3	3.10	7.518	80.0
November	139.2	66.4	26.1	4.30	6.004	72.1
December	132.8	69.0	24.1	4.49	5.783	62.8
Year	1967.0	1032.5	24.6	4.2	7.703	76.4

Global horizontal irradiation year-to-year variability 4.2%

Required Data

- Global horizontal irradiation
- Average Ext. Temperature

Extra data

- Horizontal diffuse irradiation
- Wind velocity
- Linke turbidity
- Relative humidity

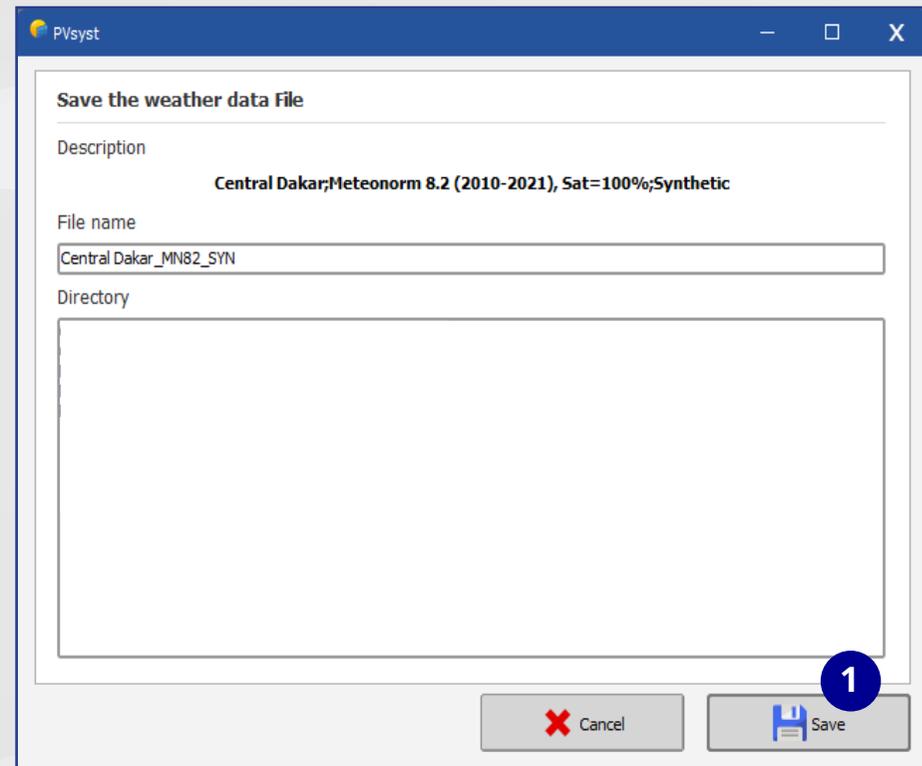
Irradiation units

- kWh/m²/day
- kWh/m²/mth
- MJ/m²/day
- MJ/m²/mth
- W/m²
- Clearness Index Kt

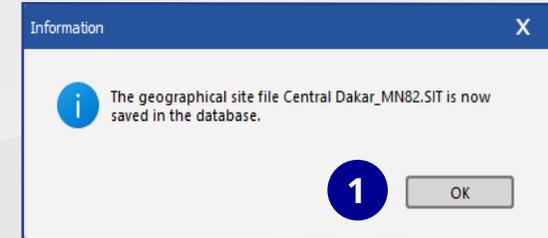
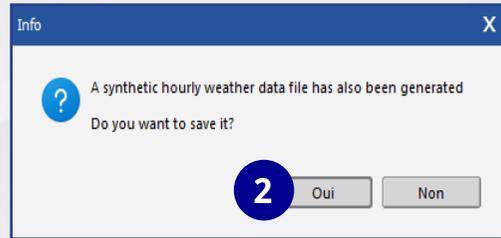
Buttons: Import, Export line, Export table, New site, Print, Cancel, OK

Chapter 1: VC0 - Project Creation_Weather Recording (1)

- 1 Click on «Save» to confirm the recording of the geographical site.



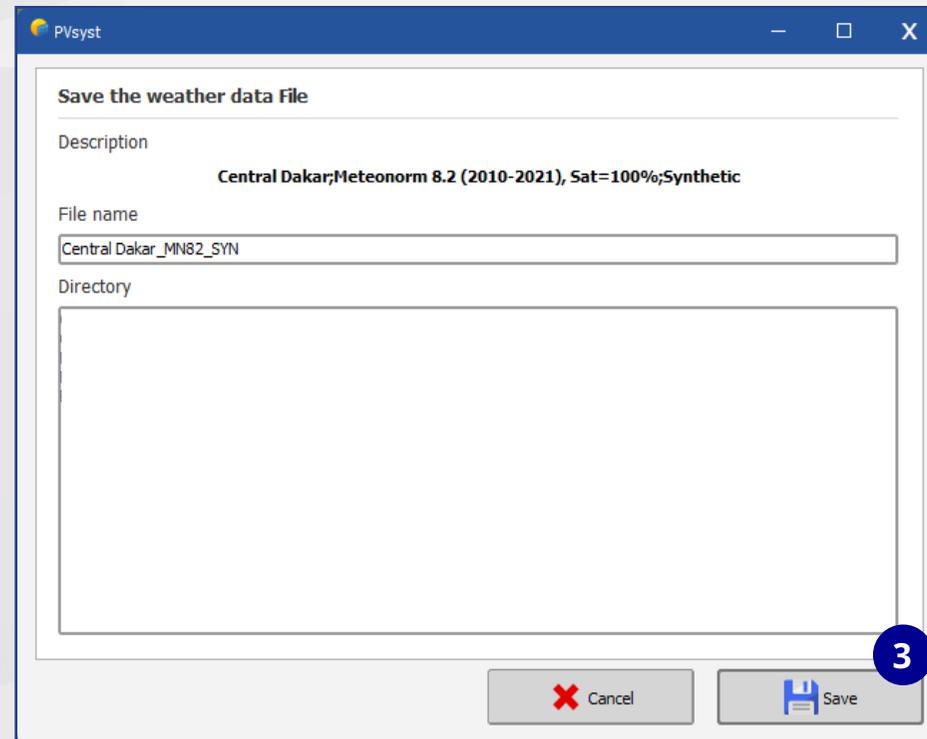
Chapter 1: VC0 - Project Creation_Weather Recording (2)



1 Click on «OK»

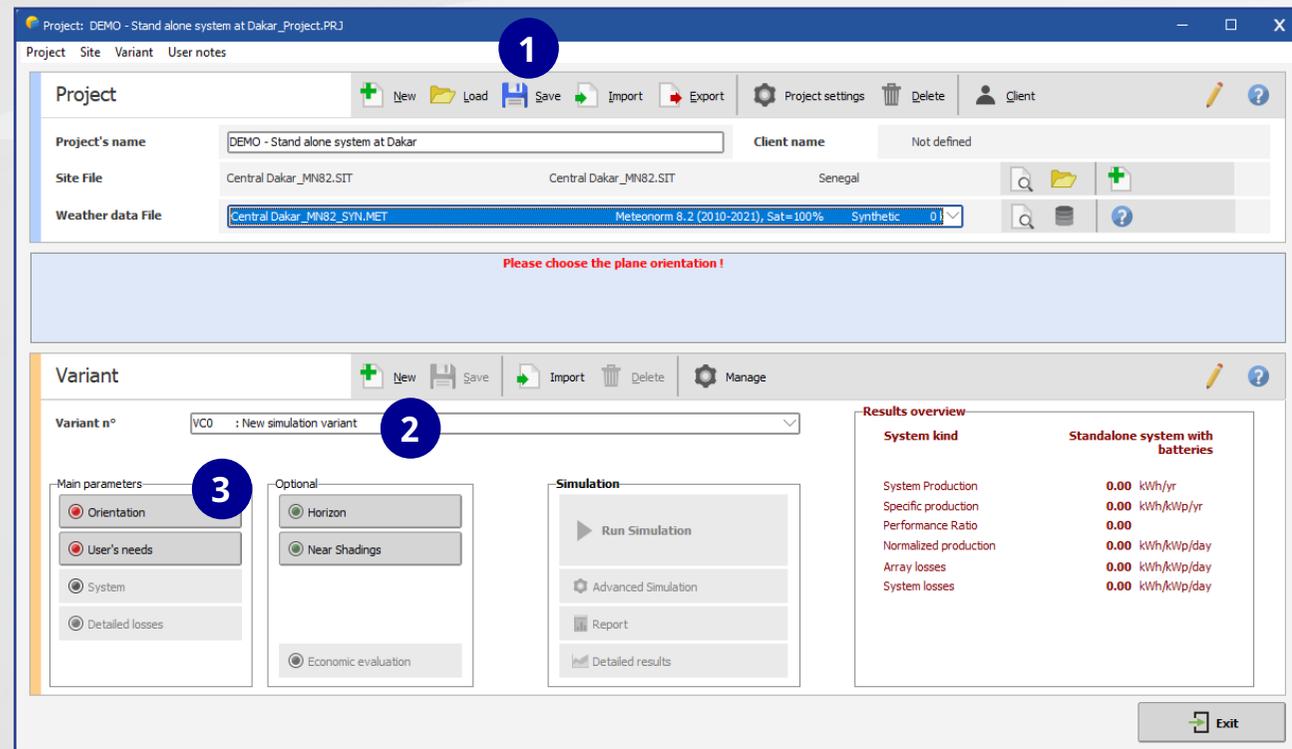
2 Click on «Yes» to create a synthetic hourly file for the simulation calculation

3 Save the synthetic weather file



Chapter 1: VC0 - Project Creation_Weather Recording

- 1 Save your project
- 2 Rename the variant to «Controller without MPPT»
- 3 Set the orientation



Chapter 1: VC0 - Orientation Definition_Controller without

- 1 Choice between multiple possible configurations: select «Fixed Tilted Plane»
- 2 Definition of field parameters: set the plane tilt to 15° and the azimuth to 0°

Orientations management

PVsystem uses orientations to calculate the transposition factor.
Each orientation must be linked to at least one sub-array in the System part.
When you define a 3D scene, the 3D areas of each orientation must match with the ones defined in the System!

Orientation #1 - Fixed, Tilt 15.0°, Azim. 0.0° Status: OK

Field type: **Fixed Tilted Plane** (1) Name: Fixed, Tilt 15.0°, Azim. 0.0°

Module area:
System: 4 m² 2 modules
3D scene: 0 m² 0 modules

Field parameters (2):
Plane tilt: 15.0
Azimuth: 0.0
Base tilt angle: 0.0

Quick optimization (acc. to clear-sky model)

Optimization with respect to:
 Annual yield
 Summer (Apr-Sep)
 Winter (Oct-Mar)

Winter incident irradiation

Transposition Factor FT: 1.11
Loss with respect to optimum: -4.2%
Global on collector plane: 997 kWh/m²

Graphs:
Left: Winter incident irradiation vs Plane tilt (0 to 90°). FTTranspos.= 1.11, Loss/opt.= -4.2%
Right: Winter incident irradiation vs Plane orientation (-90 to 90°)

3D scene diagram: Tilt 15.0°
2D scene diagram: Azimuth 0° (West, East, South)

Buttons: Cancel OK

Chapter 1: VCO - User's needs Controller without MPPT

1

The red message means: that it is necessary to define the user requirements in order to proceed with the simulation.

2

Define the «User's needs»

The screenshot shows the PVsyst software interface for a project named "DEMO - Stand alone system at Dakar_Project.PRJ". The "Project" tab is active, displaying fields for "Project's name", "Client name", "Site File", and "Weather data File". A red error message is displayed: "User's needs not defined. With a Stand-alone system you have to define valid (non-zero) user's needs." A blue circle with the number "1" is placed over this message. Below the error message, the "Variant" tab is active, showing a dropdown menu for "Variant n°" set to "VCO : Controller with MPPT". In the "Main parameters" section, the "User's needs" option is selected and highlighted with a blue circle containing the number "2". Other options include "Orientation", "System", and "Detailed losses". The "Optional" section includes "Horizon", "Near Shadings", and "Economic evaluation". The "Simulation" section contains buttons for "Run Simulation", "Advanced Simulation", "Report", and "Detailed results". On the right, a "Results overview" table shows values for "System kind", "System Production", "Specific production", "Performance Ratio", "Normalized production", "Array losses", and "System losses", all of which are currently 0.00. An "Exit" button is located at the bottom right of the interface.

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

Chapter 1: VC0 - Consumption Definition - Controller without

1

Definition of consumption by «Seasons» and «Summer»

2

Define the daily consumption for summer: «Number», «Appliance», «Power»

- 6 Lamps (LED or Fluo) ->18W/lamp->4h/day
- 1 TV/PC/Mobile->75W/appliance->3h/day
- 1 Domestic appliance->200W/appliance->1h/day
- 1 Fridge/Deep-freezer->1kWh/day ->24h/day

3

Click on « Hourly Distribution »

Daily use of energy, variant "SHS SolarHome System, 2.2 kWh/day, 570 Wp, controller without MPPT"

Definition of daily household consumptions for Summer (Jun-Aug).

Consumption | Hourly distribution

Daily consumptions

Number	Appliance	Power	Daily use	Hourly distrib.	Daily energy
6	Lamps (LED or fluo)	18 W/lamp	4.0 h/day	OK	432 Wh
1	TV / PC / Mobile	75 W/app	3.0 h/day	OK	225 Wh
1	Domestic appliances	200 W/app	1.0 h/day	OK	200 Wh
1	Fridge / Deep-freezer	1.00 kWh/day	24.0 h/day	OK	1001 Wh
0	Dish- and Cloth-washer	0.0 W aver.	0.0 h/day		0 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
Stand-by consumers			6 W tot	24 h/day	144 Wh
Total daily energy					2002 Wh/day
Monthly energy					60.1 kWh/mth

Appliances info

Consumption definition by

Years

Seasons

Months

Show values of

Summer

Autumn

Winter

Spring

Copy values

Week-end or Weekly use

Use only during

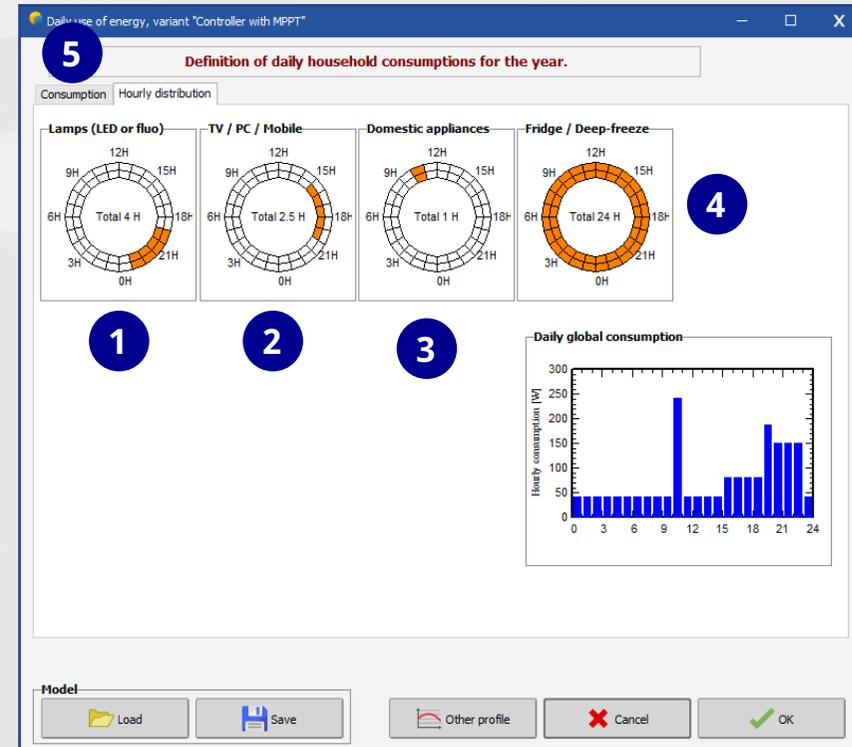
7 days in a week

Model

Load Save Other profile Cancel OK

Chapter 1: VC0 - Definition of Hourly Distribution Controller without MPPT

- 1 Define «4h->Lamps (LED or Fluo)»
- 2 Define «3h->TV/PC/Mobile»
- 3 Define «1h->Domestic appliances»
- 4 Define «24h->Fridge/Deep-freezer»
- 5 Click on «Consumption»



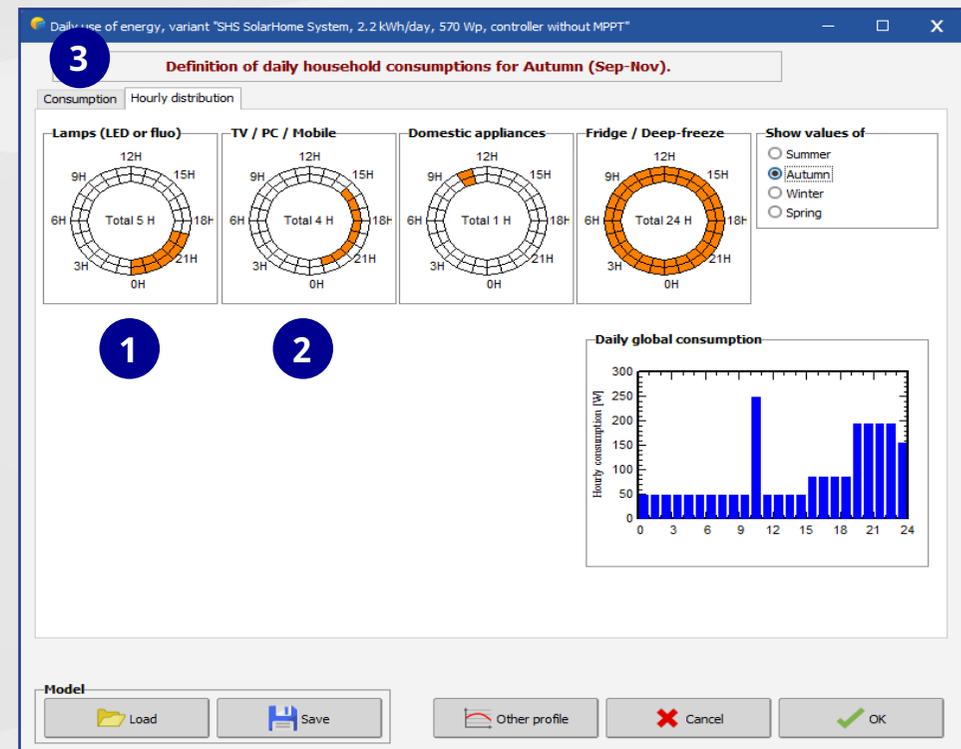
Chapter 1: VC0 - Consumption Definition - Controller without

- 1 Definition of consumption by «Seasons» and «Autumn»
- 2 Define the daily consumption for autumn: «Number», «Appliance», «Power»
 - 6 Lamps (LED or Fluo)->18W/lamp->5h/day
 - 1 TV/PC/Mobile->75W/appliance->4h/day
- 3 Click on «Hourly Distribution»

Number	Appliance	Power	Daily use	Hourly distrib.	Daily energy
6	Lamps (LED or fluo)	18 W/lamp	5.0 h/day	OK	540 Wh
1	TV / PC / Mobile	75 W/app	4.0 h/day	OK	300 Wh
1	Domestic appliances	200 W/app	1.0 h/day	OK	200 Wh
1	Fridge / Deep-freeze	1.00 kWh/day	24.0	OK	1001 Wh
0	Dish- and Cloth-washer	0.0 W aver.	0.0 h/day		0 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
Stand-by consumers		6 W tot	24 h/day		144 Wh
Total daily energy					2185 Wh/day
Monthly energy					65.5 kWh/mth

Chapter 1: VC0 - Definition of Hourly Distribution Controller wi-

- 1 Define «5h->Lamps (LED or Fluo)»
- 2 Define «4h->TV/PC/Mobile»
- 3 Click on «Consumption»



Chapter 1: VC0 - Consumption Definition Controller without

1

Definition of consumption by «Seasons» and «Winter»

2

Define the daily consumption for winter: «Number», «Appliance», «Power»

- 6 Lamps (LED or Fluo)->18W/lamp->6h/day
- 1 TV/PC/Mobile->75W/appliance ->6h/day

3

Click on «Hourly Distribution»

Daily use of energy, variant "SHS SolarHome System, 2.2 kWh/day, 570 Wp, controller without MPPT"

3 Definition of daily household consumptions for Winter (Dec-Feb).

Consumption Hourly distribution

Number	Appliance	Power	Daily use	Hourly distrib.	Daily energy
6	Lamps (LED or fluo)	18 W/lamp	6.0 h/day	OK	648 Wh
1	TV / PC / Mobile	75 W/app	6.0 h/day	OK	450 Wh
1	Domestic appliances	200 W/app	1.0 h/day	OK	200 Wh
1	Fridge / Deep-freeze	1.00 kWh/day	24.0 h/day	OK	1001 Wh
0	Dish- and Cloth-washer	0.0 W aver.	0.0 h/day		0 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
Stand-by consumers		6 W tot	24 h/day		144 Wh

Appliances info

Total daily energy: 2443 Wh/day
Monthly energy: 73.3 kWh/mth

Consumption definition by:
 Years
 Seasons
 Months

Show values of:
 Summer
 Autumn
 Winter
 Spring

Copy values

Week-end or Weekly use:
 Use only during
7 days in a week

Daily global consumption

Model:
Load Save Other profile Cancel OK

Chapter 1: VC0 - Definition of Hourly Distribution Controller wi-

1

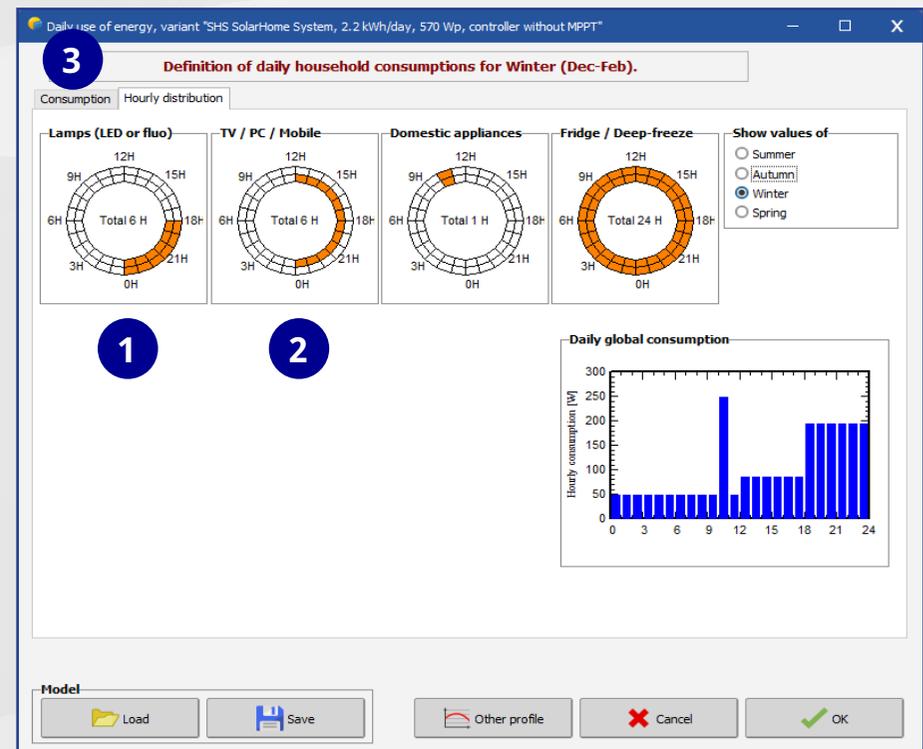
Define «6h->Lamps (LED or Fluo)»

2

Define «6h->TV/PC/Mobile»

3

Click on «Consumption»



Chapter 1: VC0 - Consumption Definition - Controller without

1 Definition of consumption by «Seasons» and «Spring»

2 Define the daily consumption for spring: «Number», «Appliance», «Power»

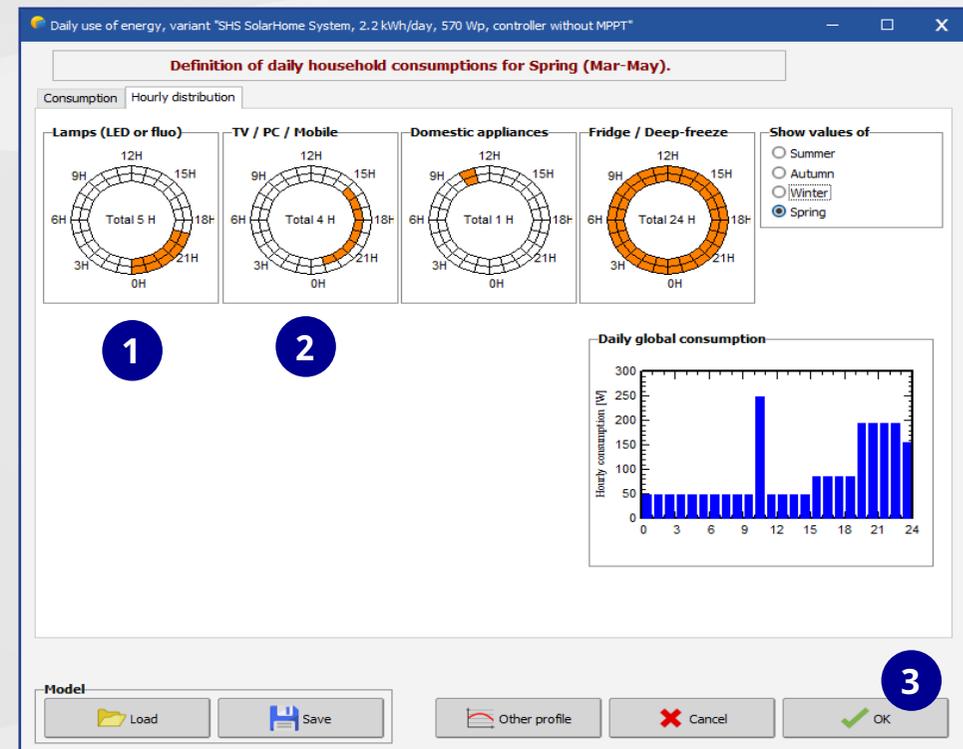
- 6 Lamps (LED or Fluo)->18W/lamp->5h/day
- 1 TV/PC/Mobile->75W/appliance->4h/day

3 Click on «Hourly Distribution»

Number	Appliance	Power	Daily use	Hourly distrib.	Daily energy
6	Lamps (LED or fluo)	18 W/lamp	5.0 h/day	OK	540 Wh
1	TV / PC / Mobile	75 W/app	4.0 h/day	OK	300 Wh
1	Domestic appliances	200 W/app	1.0 h/day	OK	200 Wh
1	Fridge / Deep-freeze	1.00 kWh/day	24.0	OK	1001 Wh
0	Dish- and Cloth-washer	0.0 W aver.	0.0 h/day		0 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
Stand-by consumers			6 W tot	24 h/day	144 Wh
Total daily energy					2185 Wh/day
Monthly energy					65.5 kWh/mth

Chapter 1: VC0 - Definition of Hourly Distribution Controller wi-

- 1 Define «5h->Lamps (LED or Fluo)»
- 2 Define «4h->TV/PC/Mobile»
- 3 Click on «OK» to confirm



Chapter 1: VC0 - System Definition _Controller without MPPT

1 The red message : **Please define the system.**

2 Define the «System»

Project: DEMO - Stand alone system at Dakar_Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO - Stand alone system at Dakar Client name: Not defined

Site File: Central Dakar_MN82.SIT Central Dakar_MN82.SIT Senegal

Weather data File: Central Dakar_MN82_SYN.MET Meteoronorm 8.2 (2010-2021), Sat=100% Synthetic 0

Please define the system !

Variant

Variant n°: VC0 : Controller with MPPT

Main parameters

- Orientation
- User's needs
- System**
- Detailed losses

Optional

- Horizon
- Near Shadings
- Economic evaluation

Simulation

- Run Simulation
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

Exit

Chapter 1: VC0 - System Definition Controller without MPPT

1 Select a generic 12V 160Ah Sealed Lead-Acid battery

2 Number of batteries in series (2) and in parallel (2)

3 Once the parameters are defined to determine the nominal power of the PV system, a red message indicates that it is necessary to «select the PV module»

4 Click on «Subarrays Design»

The screenshot displays the 'Stand-alone system definition' window in PVsyst. The interface is divided into several sections:

- List of subarrays:** A table showing the configuration of subarrays. The 'PV Array' is listed with 1 module and 1 string.
- Global system summary:** A table providing an overview of the system's current state:

Number of modules	0
Module area	0 m ²
Nominal PV Power	0.0 kWp
Maximum PV Power	0.0 kWdc
Number of controllers	1
Number of batteries	4 (2 in series x 2 in parallel)
Battery pack voltage	24 V
- Specify the Battery set:** A section for configuring battery parameters. It includes a dropdown for 'Sort batteries by' (set to 'voltage'), a dropdown for 'Generic' (set to 'Lead-acid'), and input fields for 'batteries in series' (2) and 'batteries in parallel' (2). A summary table on the right shows:

Battery pack voltage	24 V
Global capacity	200 Ah
Stored energy (80% DOD)	3.8 kWh
Total weight	190 kg
Nb. cycles at 80% DOD	1200
Total stored energy during the battery life	5082 kWh
- Operating battery temperature:** A section for setting the battery temperature mode to 'Fixed (air-conditioned)' and the fixed temperature to 20 °C. A warning message states: 'The battery temperature is important for the aging of the battery. An increase of 10 °C divides the "static" battery life by a factor of two.'
- Procedure:** A section providing guidance on the pre-sizing process, including steps for defining pre-sizing conditions, battery pack, PV array, and back-up.
- Warning:** A red message at the bottom right says 'Please choose the PV module!'.

Chapter 1: VC0 - PV System Definition - Controller without MPPT

- 1 Select the generic 285 Wc module
300 Wc générique
- 2 Select the universal regulator mode
«Direct Coupling»
300 Wc générique
- 3 Select 1 module in series and 2 strings
- 4 Click «OK»

Stand-alone system definition, Variant: "Controller with MPPT", Variant: "Controller with MPPT"

List of subarrays

Name	#Mod #Con.	#String
PV Array		
Generic_Poly_285W.PAN	1	2
Universal_Controller_LA_Direct.RLT	1	

Global system summary

Number of modules	2
Module area	4 m ²
Nominal PV Power	0.6 kWp
Maximum PV Power	0.5 kWdc
Number of controllers	1
Number of batteries	4 (2 in series x 2 in parallel)
Battery pack voltage	24 V

Sub-array name and Orientation

Name: PV Array
Orient.: Fixed, Tilt 15.0°, Azim. 0.0°

Select the PV module

Available Now | Sort modules: Power | Technology: Power Technology

Generic | 285 Wp 30V Si-poly Poly 285 Wp 72 cells | Since 2011 | Open

Sizing voltages: V_{mpp} (60°C) 31.2 V
V_{oc} (-10°C) 49.9 V

Select the control mode and the controller

Direct coupling of PV array to battery

Universal controller | Generic

Operating mode

Direct coupling | Series 24 V 26 A 10 A | Universal direct controller | Open

MPPT converter
 DC-DC converter

The operating parameters of the universal controller will automatically be adjusted according to the properties of the system.

Design the array

Number of modules and strings

Mod. in series: 1 | should be: 1 mod. nominal
Nb. strings: 2 | between 2 and 2

Operating conditions:

V _{mpp} (60°C)	31 V
V _{mpp} (20°C)	37 V
V _{oc} (-10°C)	50 V
Plane irradiance	1000 W/m ²
I _{mp} (60°C)	15.8 A
I _{sc} (60°C)	17.0 A
I _{sc} (at STC)	16.9 A

Nb. modules 2 **Area** 4 m²

Max. operating power (at max. irradiance and 50°C) **0.52 kW**
Array nom. Power (STC) **0.57 kWp**

Cancel OK

Chapter 1: VC0 - Definition of Detailed Losses Controller wit-

1

Click on «Detailed Losses»

The screenshot displays the PVsyst software interface for a project named "DEMO - Stand alone system at Dakar". The interface is divided into several sections:

- Project Settings:** Includes fields for Project's name, Client name, Site File, and Weather data File.
- Ready for simulation:** A blue banner indicating the project is ready for simulation.
- Variant Settings:** Shows the selected variant "VC0 : SHS SolarHome System, 2.2 kWh/day, 570 Wp, controller without MPPT".
- Main parameters:** Includes "Orientation", "User's needs", "System", and "Detailed losses" (highlighted with a blue circle and the number 1).
- Optional:** Includes "Horizon", "Near Shadings", and "Economic evaluation".
- Simulation:** Includes "Run Simulation", "Advanced Simulation", "Report", and "Detailed results".
- Results overview:** A table showing simulation results for a "Standalone system with batteries".

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

Chapter 1: VC0 - Definition of Detailed Losses Controller without MPPT

1

In «Thermal Parameters», check the box «Bare sensors with air circulation all around»

2

Click on «Ohmic Losses» to continue

PV field detailed losses parameter

1 2

Thermal parameter Ohmic Losses Module quality - LID - Mismatch Soiling Loss IAM Losses Spectral correction

You can define either the Field thermal Loss factor or the standard NOCT coefficient: the program gives the equivalence!

Field Thermal Loss Factor ?

Thermal Loss factor $U = U_c + U_v * \text{Wind vel}$

Constant loss factor U_c 29.0 W/m²K

Wind loss factor U_v 0.0 W/m²K m/s

Default value acc. to mounting

"Free" mounted modules with air circulation

Domes

Semi-integrated with air duct behind

Integration with fully insulated back

NOCT equivalent factor ?

NOCT (Nominal Operating Cell temperature) is often specified by manufacturers for the module itself. This is an alternative information to the U-value definition which doesn't make sense when applied to the operating array.

Don't use the NOCT approach. This is quite confusing when applied to an array!

See the NOCT anyway

Losses graph Cancel OK

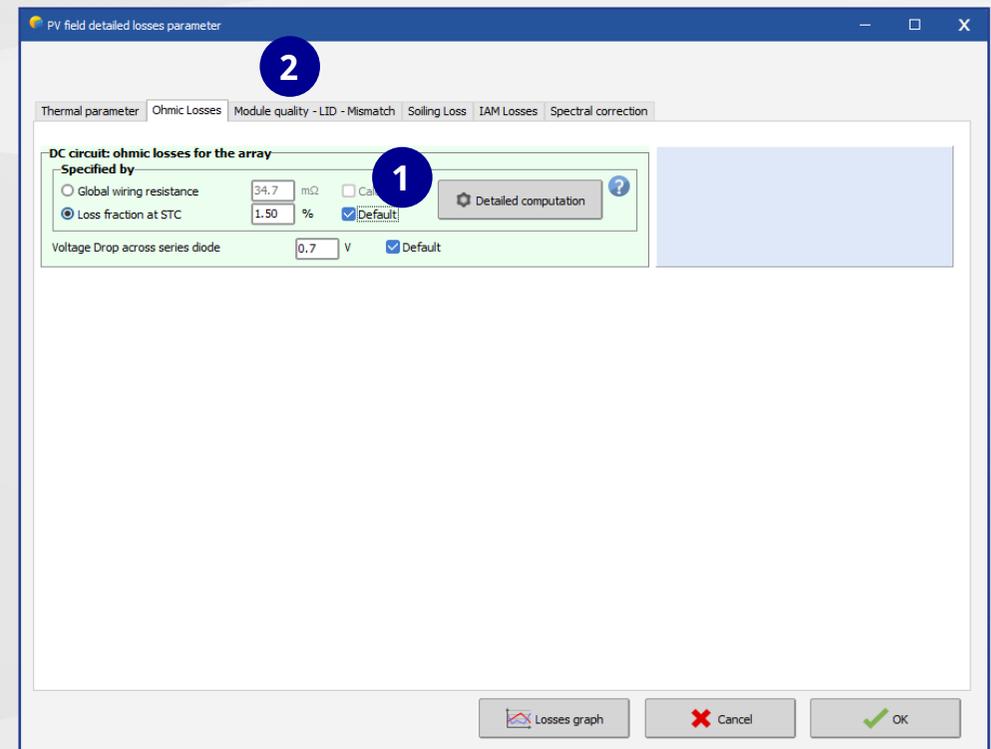
Chapter 1: VC0 - Definition of Detailed Losses Controller without MPPT

1

Leave the default value at 1.50%

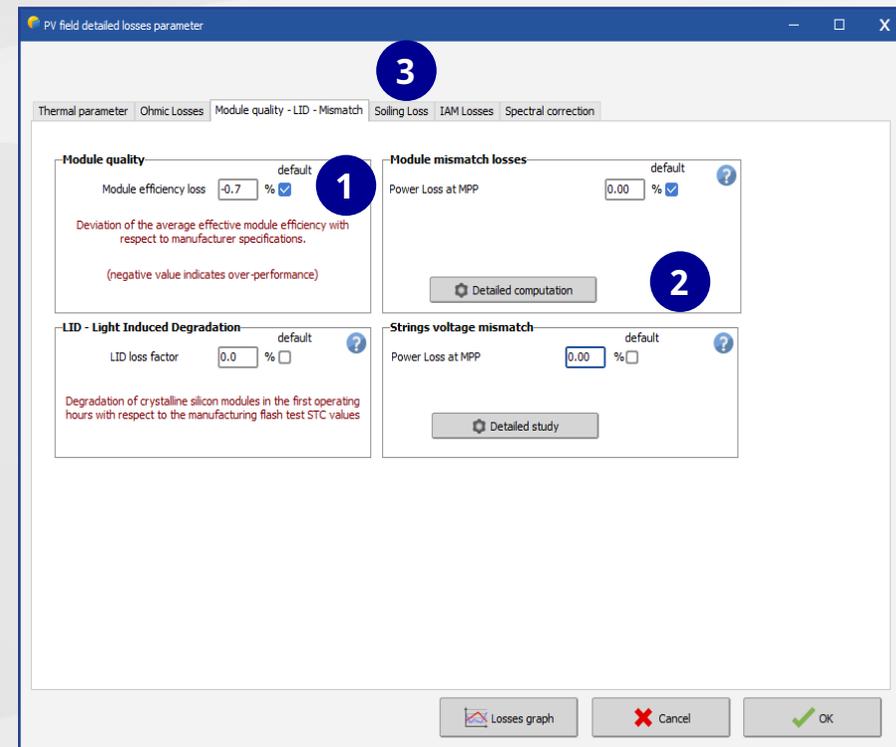
2

Click on «Module Quality – LID – Mismatch» to continue



Chapter 1: VC0 - Definition of Detailed Losses Controller without MPPT

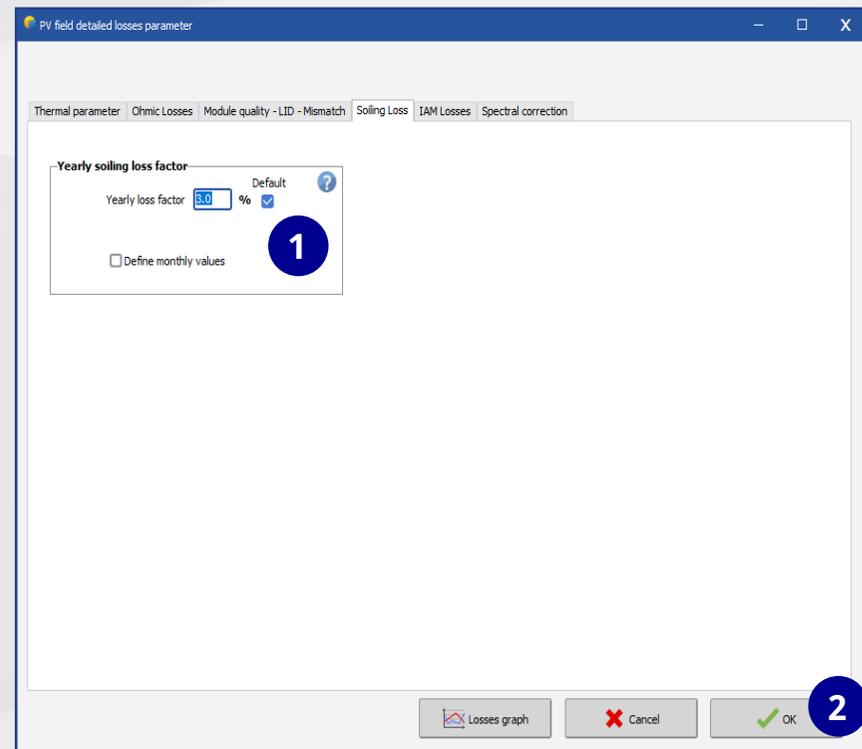
- 1 «Module Efficiency Loss» (-0.7V)
- 2 Leave the default value at 0% for «Power loss at MPP»
- 3 Click on «Soiling Losses» to continue



Chapter 1: VC0 - Definition of Detailed Losses Controller without MPPT

1 Click the default checkbox for «Annual Loss Factor»

2 Click «OK» to save



Detailed losses are the same
in all variants

Chapter 1: VC0 - Run the Simulation _Controller without MPPT

1

Click on «Run the Simulation»

The screenshot shows the PVsyst software interface for a project named "DEMO - Stand alone system at Dakar". The project settings are as follows:

- Project's name: DEMO - Stand alone system at Dakar
- Client name: Not defined
- Site File: Dakar_MN82.SIT
- Weather data File: Dakar_MN82_SYN.MET

The interface is ready for simulation. The variant selected is "VC0 : SHS SolarHome System, 2.2 kWh/day, 570 Wp, controller without MPPT".

The simulation options are:

- Main parameters: Orientation, User's needs, System, Detailed losses
- Optional: Horizon, Near Shadings, Economic evaluation
- Simulation: Run Simulation (highlighted with a blue circle and the number 1), Advanced Simulation, Report, Detailed results

The Results overview table shows the following data:

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

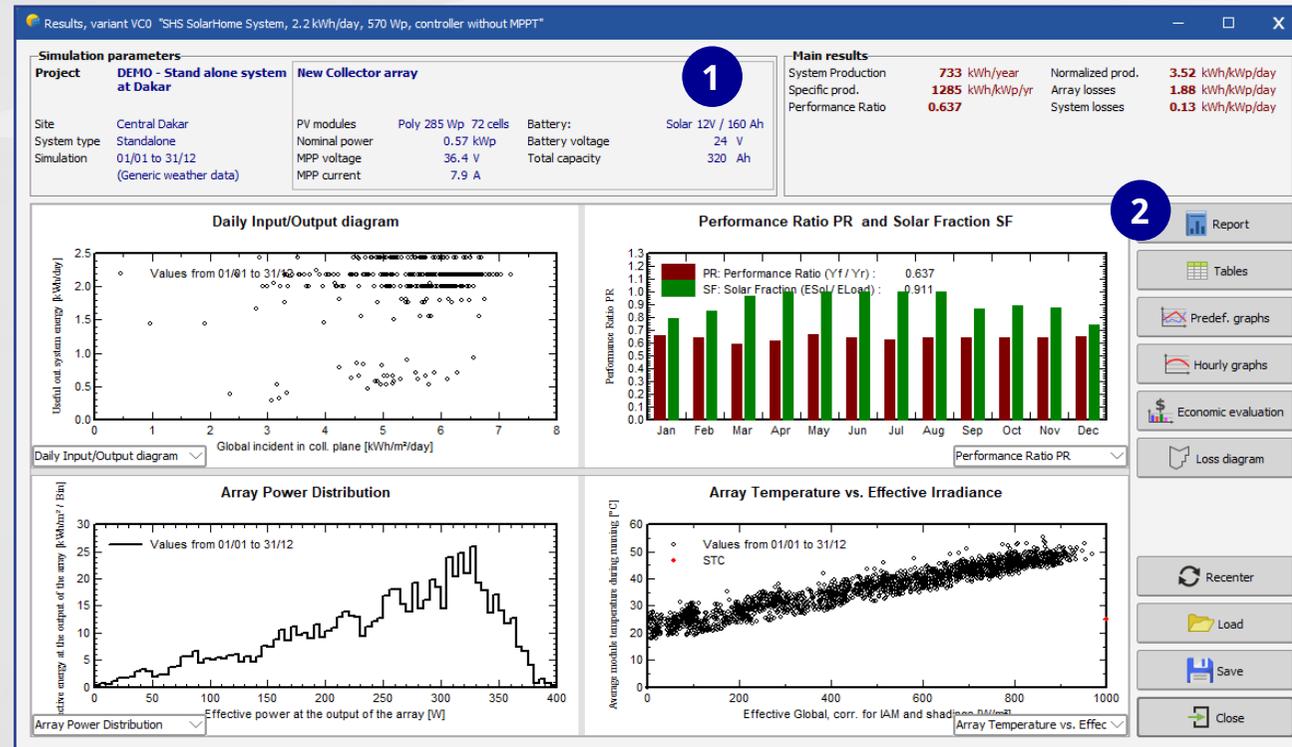
Chapter 1: VC0 - Simulation Results Controller without MPPT

1

Main Simulation Results

2

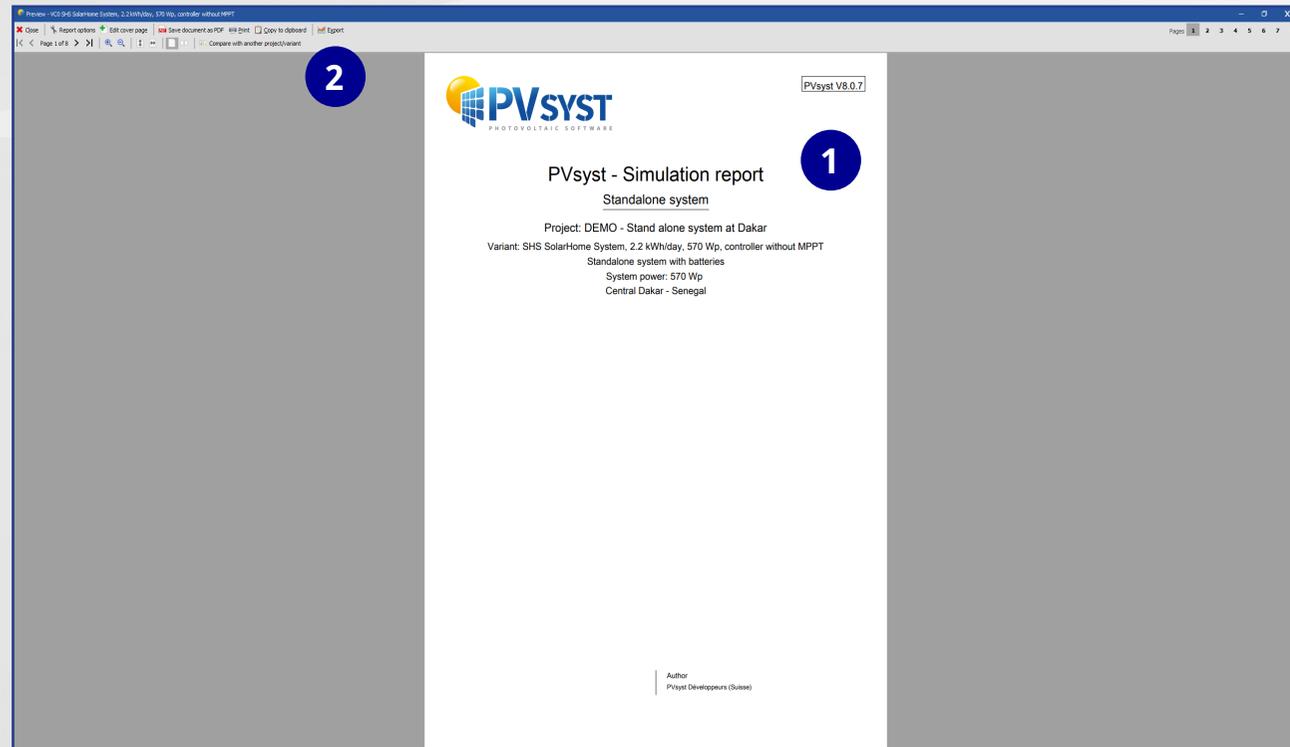
Click on «Report» to generate and view the simulation results report



Chapter 1: VC0 - Simulation Results Report

1 Save the PDF or print it

2 View the different pages of the report



Chapter 2: VC1 - Project Creation - Controller with MPPT

1

Click on «Save - Create a new variant»

The screenshot displays the PVsyst software interface for a project named "DEMO - Stand alone system at Dakar". The interface is divided into several sections:

- Project Section:** Contains fields for "Project's name" (DEMO - Stand alone system at Dakar), "Client name" (Not defined), "Site File" (Dakar_MN82.SIT), and "Weather data File" (Dakar_MN82_SYN.MET). A toolbar includes icons for New, Load, Save, Import, Export, Project settings, Delete, and Client.
- Simulation Status:** A blue banner indicates "Simulation done (version 8.0.0, date 28/10/24)".
- Variant Section:** Shows "Variant n°" as "VC1 : SHS SolarHome System, 2.2 kWh/day, 570 Wp, controller with MPPT". It includes sub-sections for "Main parameters" (Orientation, User's needs, System, Detailed losses), "Optional" (Horizon, Near Shadings, Economic evaluation), and "Simulation" (Run Simulation, Advanced Simulation, Report, Detailed results).
- Results overview:** A table comparing "System kind" and "Standalone system with batteries".

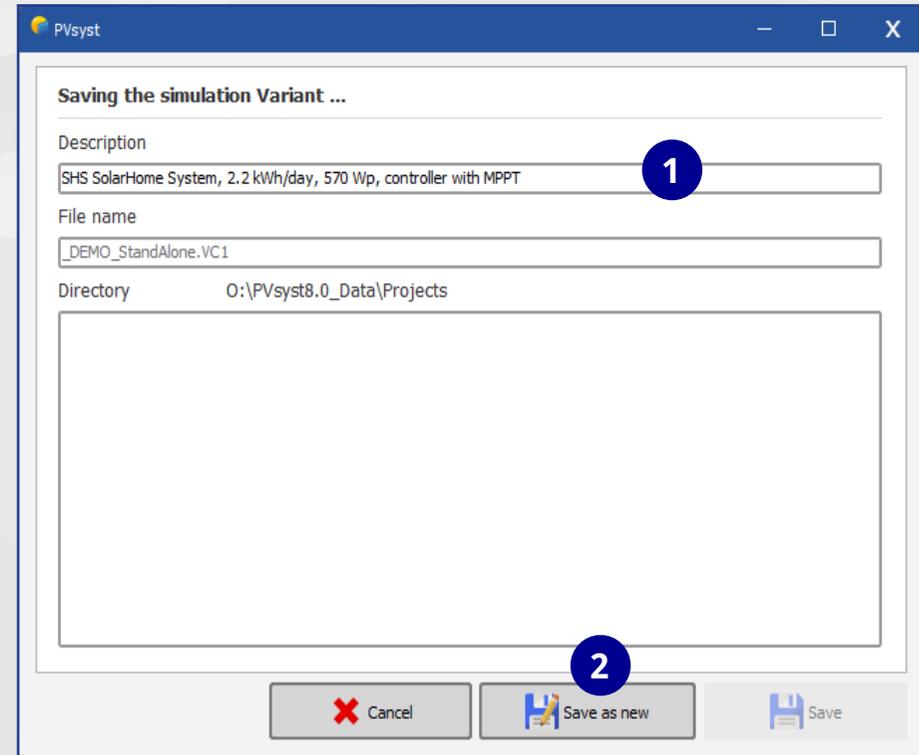
System kind	Standalone system with batteries
System Production	800 kWh/yr
Specific production	1403 kWh/kWp/yr
Performance Ratio	0.695
Normalized production	3.84 kWh/kWp/day
Array losses	1.36 kWh/kWp/day
System losses	0.32 kWh/kWp/day

A blue circle with the number "1" is overlaid on the "Save" icon in the Variant section's toolbar, corresponding to the instruction "Click on «Save - Create a new variant»".

Chapter 2: VC1 - SHS SolarHome System_controller with MPPT

1 Give a new name to the new variant:
«SHS SolarHome System_Controller
with MPPT»

2 Click on «Save as new» to create the
new variant while keeping the previous
parameters.



Chapter 2: VC1 - Controller with MPPT - User Requirements

1

In the VC1 variant, we will avoid repeating the steps already carried out in the VC0 variant, as the user's needs remain the same.

2

Click on «System»

The screenshot displays the PVsyst software interface for a project named "DEMO - Stand alone system at Dakar". The "Project" section includes fields for "Project's name", "Client name", "Site File", and "Weather data File". A message indicates "Simulation done (version 8.0.0, date 28/10/24)". The "Variant" section shows "Variant n°" set to "VC1 : SHS SolarHome System, 2.2 kWh/day, 570 Wp, controller with MPPT". Under "Main parameters", the "System" option is selected. Under "Optional", the "Economic evaluation" option is selected. The "Simulation" section contains buttons for "Run Simulation", "Advanced Simulation", "Report", and "Detailed results". The "Results overview" table on the right provides the following data:

System kind	Standalone system with batteries
System Production	800 kWh/yr
Specific production	1403 kWh/kWp/yr
Performance Ratio	0.695
Normalized production	3.84 kWh/kWp/day
Array losses	1.36 kWh/kWp/day
System losses	0.32 kWh/kWp/day

Chapter 2: VC1 - Controller with MPPT_User Requirements

1 Select Universal Controller «MPPT Converter»

2 Click «OK» to save

The screenshot displays the PVsyst software interface for configuring a subarray. The window title is "Stand-alone system definition, Variant: 'SHS SolarHome System, 2.2 kWh/day, 570 Wp, controller with MPPT', Variant: 'SHS SolarHome System, 2.2 kWh/day, 570 Wp, controller with MPPT'".

List of subarrays:

Name	#Mod #Con.	#String
New Collector array		
Generic_Poly_285W.PAN	1	2
Universal_Controller_LA_MPPT.RLT	1	

Global system summary:

Number of modules	2
Module area	4 m ²
Nominal PV Power	0.6 kWp
Maximum PV Power	0.5 kWdc
Number of controllers	1
Number of batteries	4 (2 in series x 2 in parallel)
Battery pack voltage	24 V

Configuration Parameters:

- Av. daily needs: 2.20 kWh/day
- Enter accepted PLOL: 5.0 %
- Requested autonomy: 4.0 day(s)
- Battery voltage: 24 V
- Suggested capacity: 479 Ah
- Suggested PV power: 564 Wp

Select the PV module:

- Available Now: [Dropdown]
- Sort modules: Power Technology
- Module: _Generic (285 Wp 30V Si-poly Poly 285 Wp 72 cells Since 2011)
- Sizing voltages: V_{mpp} (60°C) 31.2 V, V_{oc} (-10°C) 49.9 V

Select the control mode and the controller:

- Universal controller: _Generic
- MPPT power converter
- Operating mode: MPPT converter (1)
- Max. Charging - Discharging current: [Dropdown]

Design the array:

- Number of modules and strings: should be: [Dropdown]
- Mod. in series: 1 (checked: No constraint)
- Nb. strings: 2 (checked: between 2 and 3)
- Nb. modules: 2, Area: 4 m²
- Operating conditions: V_{mpp} (60°C) 31 V, V_{mpp} (20°C) 37 V, V_{oc} (-10°C) 50 V
- Plane irradiance: 1000 W/m²
- Imp (60°C) 15.8 A, I_{sc} (60°C) 17.0 A, I_{sc} (at STC) 16.9 A
- Max. operating power (at max. irradiance and 50°C): 0.52 kW
- Array nom. Power (STC): 0.57 kWp

Buttons: Cancel, OK (2)

Chapter 2: VC1 - Controller with MPPT_Run the Simulation

1

Click on «Run Simulation»

The screenshot displays the PVsyst software interface for a project named "DEMO - Stand alone system at Dakar". The interface is divided into several sections:

- Project Section:** Contains fields for Project's name, Client name, Site File, and Weather data File. The Project's name is "DEMO - Stand alone system at Dakar", Client name is "Not defined", Site File is "Dakar_MN82.SIT", and Weather data File is "Dakar_MN82_SYN.MET".
- Ready for simulation:** A blue banner indicating the system is ready for simulation.
- Variant Section:** Contains a dropdown menu for Variant n° (VC1 : SHS SolarHome System, 2.2 kWh/day, 570 Wp, controller with MPPT) and a "Simulation" panel with a "Run Simulation" button highlighted with a blue circle and the number 1.
- Results overview:** A table showing simulation results for a "Standalone system with batteries".

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

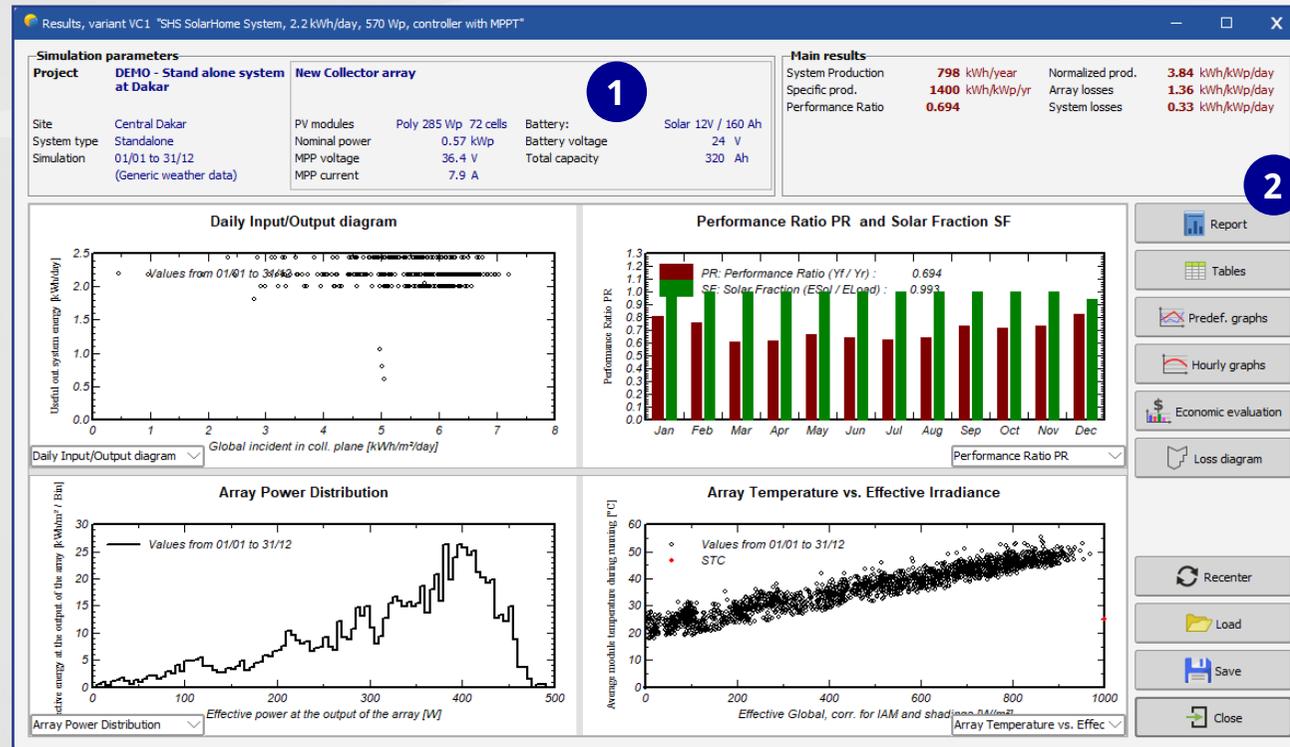
Chapter 2: VC1 - Controller with MPPT_Run the Simulation

1

Main Simulation Results

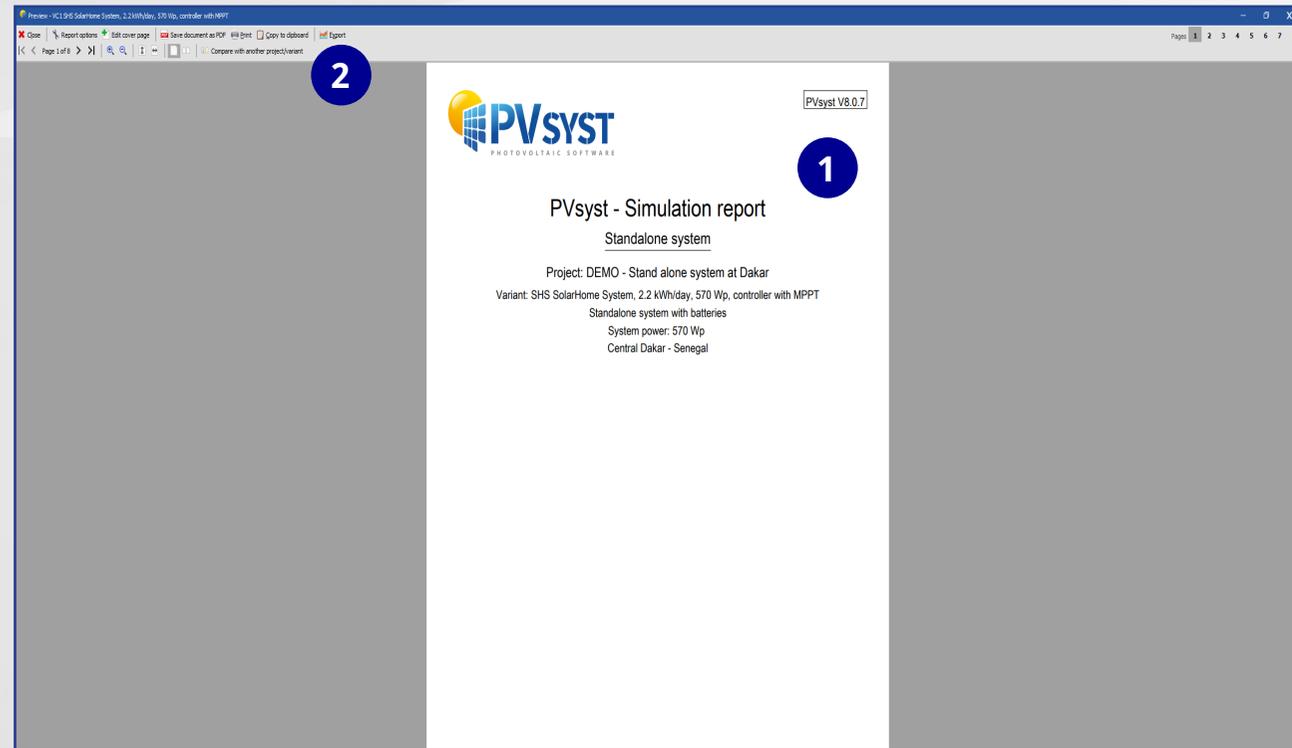
2

Click on «Report» to generate and view the simulation results report



Chapter 2: VC1 - Controller with MPPT_Simulation Report

- 1 Save the PDF or print it
- 2 Compare the VC1 variant with VC0



Chapter 3: VC2 - Create a New Variant_PNomPV = 1.6 kW

1

Create a new variant – Click on Save

The screenshot shows the PVsyst software interface. The 'Project' section at the top contains the following information:

- Project's name: DEMO - Stand alone system at Dakar
- Client name: Not defined
- Site File: Dakar_MN82.SIT, Meteoronorm 8.2 (2010-2021), Sat=100%, Senegal
- Weather data File: Dakar_MN82_SYN.MET, Meteoronorm 8.2 (2010-2021), Sat=100%, Synthetic, 0 k

A notification bar indicates: **Simulation done (version 8.0.0, date 28/10/24)**

The 'Variant' section below shows:

- Variant n°: VC1 : SHS SolarHome System, 2.2 kWh/day, 570 Wp, controller with MPPT
- Buttons for: Orientation, User's needs, System, Detailed losses (Main parameters); Horizon, Near Shadings, Economic evaluation (Optional); Run Simulation, Advanced Simulation, Report, Detailed results (Simulation).
- Results overview table:

System kind	Standalone system with batteries
System Production	800 kWh/yr
Specific production	1403 kWh/kWp/yr
Performance Ratio	0.695
Normalized production	3.84 kWh/kWp/day
Array losses	1.36 kWh/kWp/day
System losses	0.32 kWh/kWp/day

A blue circle with the number '1' highlights the 'Save' button in the Variant section.

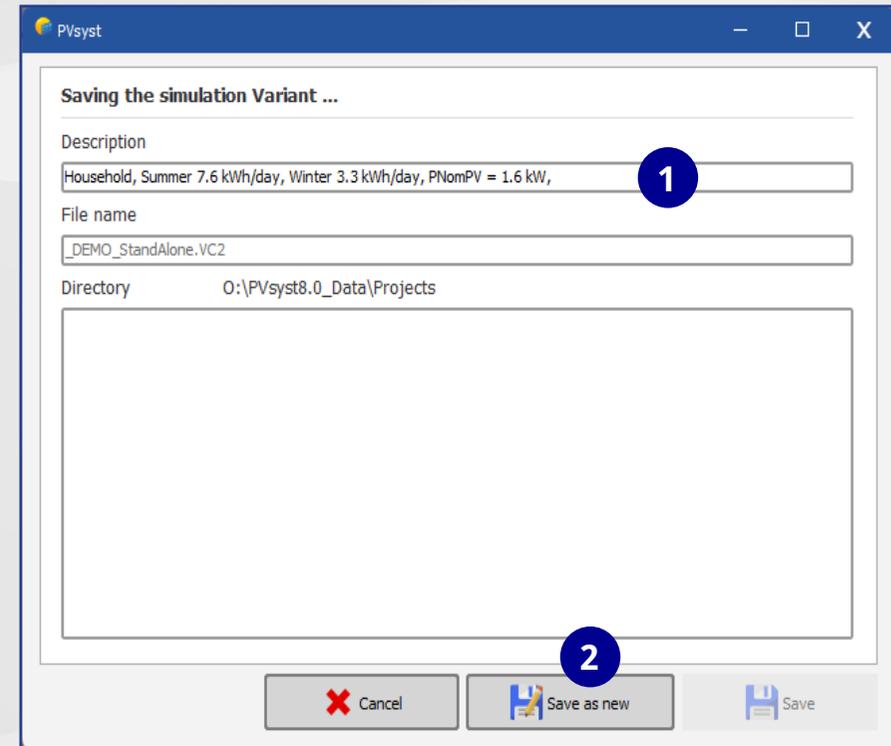
Chapter 3: VC2 - Create a New Variant_PNomPV = 1.6 kW

1

Give a new name to the new variant:
«PNomPV = 1.6 kW»

2

Click «Save as new» to create the new
variant while keeping the previous
settings



Chapter 3: VC2 - Define User Requirements_PNomPV = 1.6 kW

1

Click to edit «User's Needs»

The screenshot displays the PVsyst software interface for a project named "DEMO - Stand alone system at Dakar". The "Project" section includes fields for Project's name, Site File (Dakar_MN82.SIT), Weather data File (Dakar_MN82_SYN.MET), Client name (Not defined), and location (Senegal). A status message indicates "Simulation done (version 8.0.0, date 28/10/24)".

The "Variant" section shows "Variant n°" set to "VC2 : Household, Summer 7.6 kWh/day, Winter 3.3 kWh/day, PNomPV = 1.6 kW". Under "Main parameters", the "User's needs" option is selected and highlighted with a blue circle containing the number "1". Other options include Orientation, System, Detailed losses, Horizon, Near Shadings, and Economic evaluation. The "Simulation" section contains buttons for "Run Simulation", "Advanced Simulation", "Report", and "Detailed results".

The "Results overview" table on the right provides the following data:

System kind	Standalone system with batteries
System Production	2064 kWh/yr
Specific production	1290 kWh/kWp/yr
Performance Ratio	0.640
Normalized production	3.53 kWh/kWp/day
Array losses	1.67 kWh/kWp/day
System losses	0.32 kWh/kWp/day

Chapter 3: VC2 - Define Consumption_PNomPV = 1.6 kW

1 Definition of consumption by «Seasons» and «Summer»

- 2 Define Summer Daily Consumption:
«Number», «Appliance», «Power»
- 6 - Lamp (LED or Fluo)->10 W/lamp ->4h/day
 - 1 - TV/PC/Mobile->120 W/app->3h/day
 - 2 - Domestic appliances->200 W/app->2h/day
 - 1 - Fridge/Deep-freeze->2 kWh/day->24h
 - 1 - Dish-and Cloth-washer->1000 W (aver)-> 1h/day
 - 1 - Air conditioner->500 W/app->6h/day

3 Click on «Hourly Distribution»

Daily use of energy, variant "Household, Summer 7.6 kWh/day, Winter 3.3 kWh/day, PNomPV = 1.6 kW,"

Definition of daily household consumptions for Summer (Jun-Aug).

Consumption: Hourly distribution

Daily consumptions

Number	Appliance	Power	Daily use	Hourly distrib.	Daily energy
6	Lamps (LED or fluo)	10 W/lamp	4.0 h/day	OK	240 Wh
1	TV / PC / Mobile	120 W/app	3.0 h/day	OK	360 Wh
2	Domestic appliances	200 W/app	2.0 h/day	OK	800 Wh
1	Fridge / Deep-freeze	2.00 kWh/day	24.0	OK	1999 Wh
1	Dish- and Cloth-washer	1000.0 W aver.	1.0 h/day	OK	1000 Wh
1	Air conditioner	500 W/app	6.0 h/day	OK	3000 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
Stand-by consumers		10 W tot	24 h/day		240 Wh

Total daily energy 7639 Wh/day
Monthly energy 229.2 kWh/mth

Appliances info

Consumption definition by

Years

Seasons

Months

Show values of

Summer

Autumn

Winter

Spring

Week-end or Weekly use

Use only during

7 days in a week

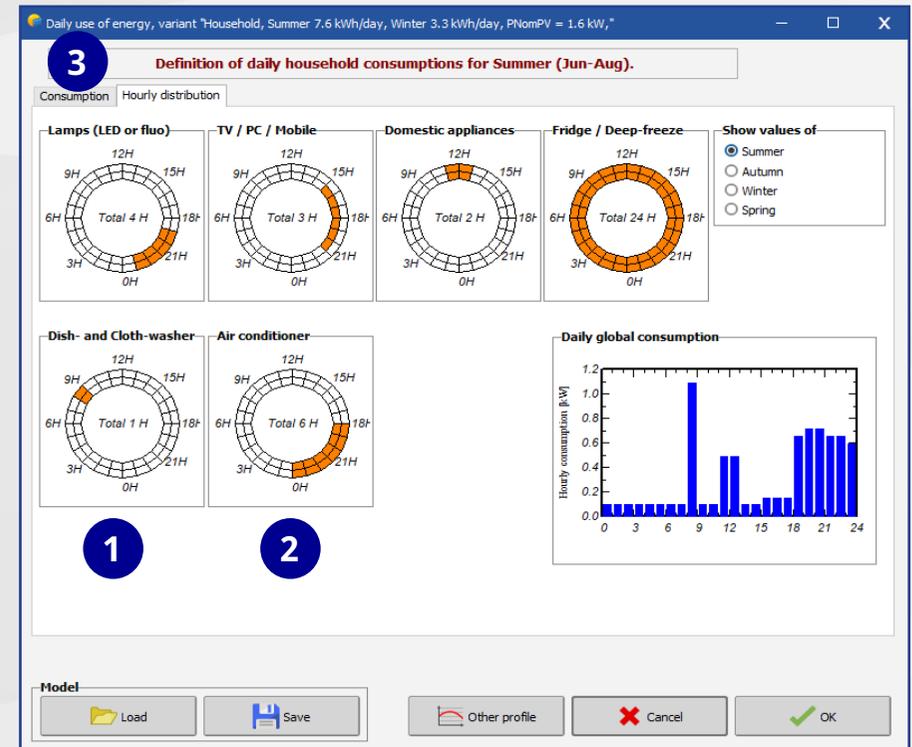
Daily global consumption

Model

Load Save Other profile Cancel OK

Chapter 3: VC2 - Hourly Distribution_PNomPV = 1.6 kW

- 1 Define: 1h = Dish-and Cloth-Washer
- 2 Define: 6h = Air conditioner
- 3 Click on «Consumption»



Chapter 3: VC2 - Define Consumption_PNomPV = 1.6 kW

1 Definition of consumption by «Seasons» and «Autumn»

2 Define Autumn Daily Consumption: «Number», «Appliance», «Power»

- 1 - Air conditioner->500 W/appl-> 3h/day

3 Click on «Hourly Distribution»

Number	Appliance	Power	Daily use	Hourly distrib.	Daily energy
6	Lamps (LED or fluo)	10 W/lamp	4.0 h/day	OK	240 Wh
1	TV / PC / Mobile	120 W/app	3.0 h/day	OK	360 Wh
2	Domestic appliances	200 W/app	2.0 h/day	OK	800 Wh
1	Fridge / Deep-freeze	2.00 kWh/day	24.0	OK	1999 Wh
1	Dish- and Cloth-washer	1000.0 W aver.	1.0 h/day	OK	1000 Wh
1	Air conditioner	500 W/app	3.0 h/day	OK	1500 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
Stand-by consumers		10 W tot	24 h/day		240 Wh
Total daily energy					6139 Wh/day
Monthly energy					184.2 kWh/mth

Consumption definition by:
 Years
 Seasons
 Months

Show values of:
 Summer
 Autumn
 Winter
 Spring

Copy values

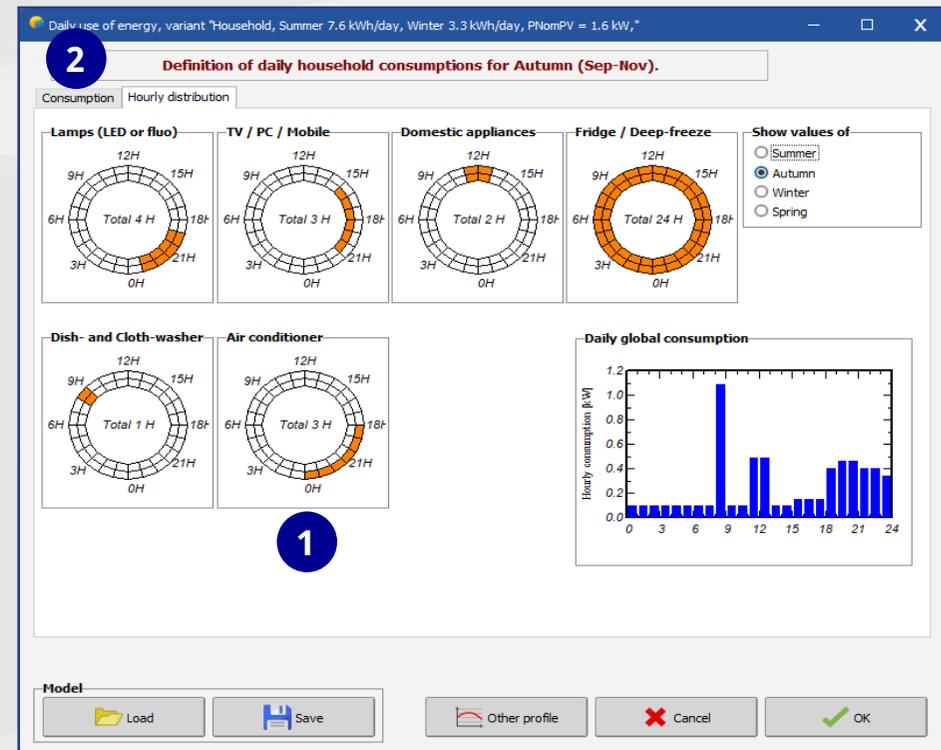
Week-end or Weekly use:
 Use only during
7 days in a week

Model:
Load Save Other profile Cancel OK

Chapter 3: VC2 - Hourly Distribution_PNomPV = 1.6 kW

1 Define: 6h = Air conditioner

2 Click on «Consumption»



Chapter 3: VC2 - Define Consumption_PNomPV = 1.6 kW

1

Definition of consumption by «Seasons» and «Winter»

2

Define Winter Daily Consumption: «Number», «Appliance», «Power»

- 6 - Lamps (LED or Fluo)->18W/lamp->5h/day
- 1 - TV/PC/Mobile->75W/app->3h/day
- 1 - Domestic appliances->200W/app->2h/day
- 1 - Fridge/Deep-freeze->1kWh/day->24h/day
- 1 - Dish-and Cloth-washer->1000W->1h/day

Delete Winter Daily Consumption (Air Conditioner)

3

Click on «Hourly Distribution»

Number	Appliance	Power	Daily use	Hourly distrib.	Daily energy
6	Lamps (LED or fluo)	18 W/lamp	5.0 h/day	OK	540 Wh
1	TV / PC / Mobile	75 W/app	3.0 h/day	OK	225 Wh
1	Domestic appliances	200 W/app	2.0 h/day	OK	400 Wh
1	Fridge / Deep-freeze	1.00 kWh/day	24.0 h/day	OK	1001 Wh
1	Dish- and Cloth-washer	1000.0 W aver.	1.0 h/day	OK	1000 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
Stand-by consumers		6 W tot	24 h/day		144 Wh
Total daily energy					3310 Wh/day
Monthly energy					99.3 kWh/mth

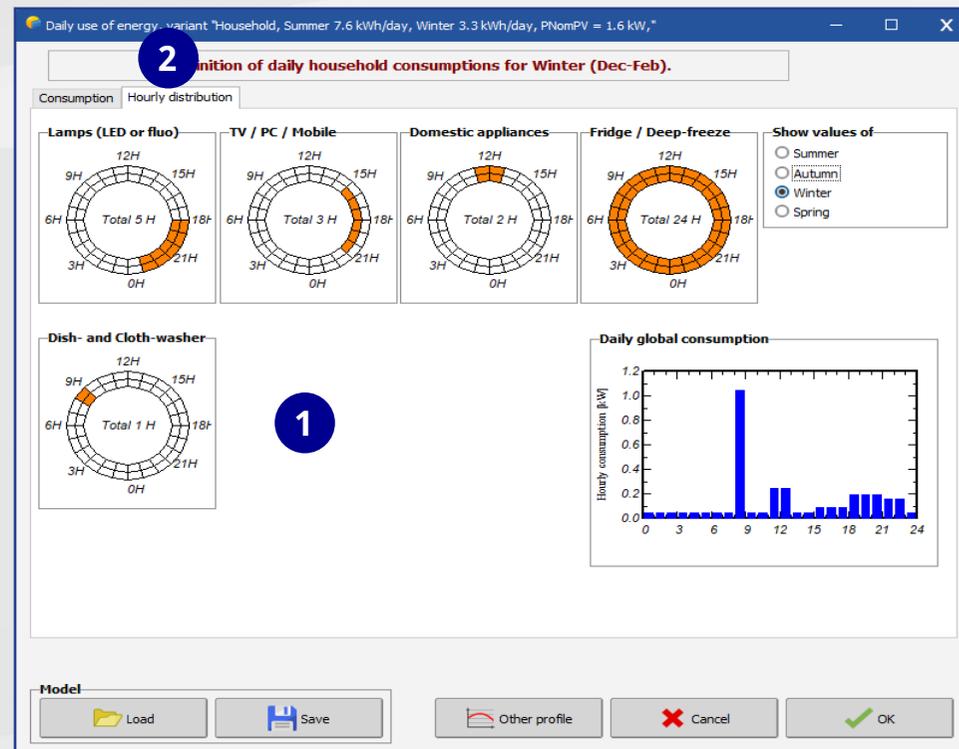
Chapter 3: VC2 - Hourly Distribution_PNomPV = 1.6 kW

1

The «Air Conditioner» is automatically removed as soon as it is deleted from the consumption

2

Click on «Consumption»



Chapter 3: VC2 - Define Consumption_PNomPV = 1.6 kW

1 Définition de la consommation par «Saisons» et «Printemps»

2 Definition of consumption by «Seasons» and «Spring»

«Number», «Appliance», «Power»

- 6 - Lamp (LED or Fluo)->10 W/lamp ->4h/day
- 1 - TV/PC/Mobile->120 W/app->3h/day
- 2 - Domestic appliances->200 W/app->2h/day
- 1 - Fridge/Deep-freeze->2 kWh/day->24h
- 1 - Dish-and Cloth-washer->1000 W (aver) ->1h/day
- 1 - Air conditioner->500 W/appliance->3h/day

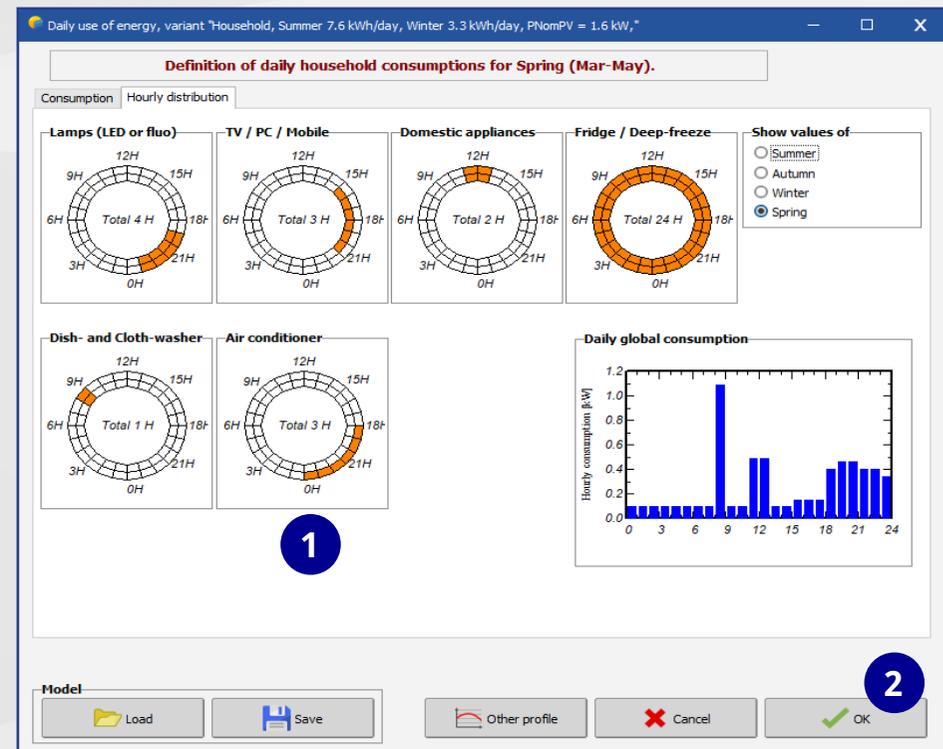
3 Click on «Hourly Distribution»

Number	Appliance	Power	Daily use	Hourly distrib.	Daily energy
6	Lamps (LED or fluo)	10 W/lamp	4.0 h/day	OK	240 Wh
1	TV / PC / Mobile	120 W/app	3.0 h/day	OK	360 Wh
2	Domestic appliances	200 W/app	2.0 h/day	OK	800 Wh
1	Fridge / Deep-freeze	2.00 kWh/day	24.0 h/day	OK	1999 Wh
1	Dish- and Cloth-washer	1000.0 W aver.	1.0 h/day	OK	1000 Wh
1	Air conditioner	500 W/app	3.0 h/day	OK	1500 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
Stand-by consumers		10 W tot	24 h/day		240 Wh
Total daily energy					6139 Wh/day
Monthly energy					184.2 kWh/mth

Chapter 3: VC2 - Hourly Distribution_PNomPV = 1.6 kW

1 Define: 3h = Air conditioner

2 Click on «OK» to confirm this window and the next one



Chapter 3: VC2 - System_PNomPV = 1.6 kW

1 Define the «System»

Project: DEMO - Stand alone system at Dakar_Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO - Stand alone system at Dakar Client name: Not defined

Site File: Central Dakar_MN82.SIT Central Dakar_MN82.SIT Senegal

Weather data File: Central Dakar_MN82_SYN.MET Meteororm 8.2 (2010-2021), Sat=100% Synthetic 0 k

Please define the system !

Variant

Variant n°: VC2 : Household, Summer 7.6 kWh/day, Winter 3.3 kWh/day, PNomPV = 1.6 kW,

Main parameters:

- Orientation
- User's needs
- System
- Detailed losses

Optional:

- Horizon
- Near Shadings
- Economic evaluation

Simulation:

- Run Simulation
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

Exit

Chapter 3: VC2 - Storage Definition_PNomPV = 1.6 kW

- 1 Select a generic 12V 160Ah Sealed Pb battery
- 2 The number of batteries in series (2) and in parallel (5)
- 3 Click on «Sub-array Design» to define the PV system

The screenshot displays the 'Sub-array Design' window in PVsyst. The window title is 'Stand-alone system definition, Variant: "Household, Summer 7.6 kWh/day, Winter 3.3 kWh/day, PNomPV = 1.6 kW," Variant: "Household, Summer 7.6 kWh/day, Winter 3.3 kWh/day, PNomPV = 1.6 kW,"'. The interface is divided into several sections:

- List of subarrays:** A table showing the configuration of subarrays. It includes columns for Name, #Mod, #Con., and #String. The subarray 'New Collector array' contains 'Generic_Mono_400W.PAN' (4 modules, 1 controller) and 'Universal_Controller_LA_MPPT.RLT' (1 module, 1 controller).
- Global system summary:** A table providing an overview of the system parameters:

Number of modules	4
Module area	9 m ²
Nominal PV Power	1.6 kWp
Maximum PV Power	0.0 kWdc
Number of controllers	1
Number of batteries	10 (2 in series x 5 in parallel)
Battery pack voltage	24 V
- Procedure:** A list of steps for the design process:
 1. Pre-sizing: Define the desired Pre-sizing conditions (PLOL, 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:** This section allows for selecting and configuring the battery type. It includes a search bar with 'Generic' selected, a dropdown for 'Lead-acid', and a table of battery specifications:

Sort batteries by	<input checked="" type="radio"/> voltage	<input type="radio"/> capacity	<input type="radio"/> manufacturer
Generic	12 V	160 Ah	Pb Sealed Gel
Lead-acid	2	batteries in series	10
	5	batteries in parallel	60
	100.0	Initial State of Wear (nb. of cycles)	1300
	100.0	Initial State of Wear (static)	21332 kWh
- Operating battery temperature:** A section for setting the temperature mode to 'Fixed (air-conditioned)' and the fixed temperature to 25 °C. A note states: 'The battery temperature is important for the aging of the battery. An increase of 10 °C divides the "static" battery life by a factor of two.'

At the bottom right, there are 'Cancel' and 'OK' buttons.

Chapter 3: VC2 - PV System Definition_PNomPV = 1.6 kW

- 1 Select the generic 400 Wc module
- 2 Select the regulation mode «MPPT Converter»
- 3 Select 4 modules in series and 1 string
- 4 Click on «OK»

Stand-alone system definition, Variant "Household, Summer 7.6 kWh/day, Winter 3.3 kWh/day, PNomPV = 1.6 kW," Variant "Household, Summer 7.6 kWh/day, Winter 3.3 kWh/day, PNomPV = 1.6 kW,"

List of subarrays

Name	#Mod #Con.	#String
- New Collector array		
Generic_Mono_400W.PAN	4	1
Universal_Controller_LA_MPPT.RLT	1	

Global system summary

Number of modules	4
Module area	9 m ²
Nominal PV Power	1.6 kWp
Maximum PV Power	0.0 kWdc
Number of controllers	1
Number of batteries	10 (2 in series x 5 in parallel)
Battery pack voltage	24 V

Av. daily needs: 5.81 kWh/day
Enter accepted PLOL: 4.0 %
Requested autonomy: 5.1 day(s)
Detailed pre-sizing

Battery voltage: 48 V
Suggested capacity: 961 Ah
Suggested PV power: 1.69 kWp

Sub-array name and Orientation
Name: New Collector array
Orient.: Fixed, Tilt 15.0°, Azim. 0.0°
Pre-sizing Help: No sizing, Planned power: 0.5 kWp, or available area: 0 m²

Select the PV module
Available Now: [v]
Sort modules: Power, Technology
Generic: 400 Wp 32V Si-mono Mono 400 Wp 72 cells Since 2020
Sizing voltages: Vmpp (60°C): 33.0 V, Voc (-10°C): 52.0 V

Select the control mode and the controller
Universal controller: Generic, MPPT power converter
Operating mode: MPPT 1000 W 24 V 73 A 46 A Universal controller with MPPT conve
Direct coupling, MPPT converter, DC-DC converter

Design the array
Number of modules and strings: should be: 4, No constraint, between 1 and 1
Mod. in series: 4, Nb. strings: 1
Nb. modules: 4, Area: 9 m²
Operating conditions: Vmpp (60°C): 132 V, Vmpp (20°C): 156 V, Voc (-10°C): 208 V
Plane irradiance: 1000 W/m²
Imp (60°C): 10.5 A, Isc (60°C): 11.3 A, Isc (at STC): 11.3 A
Max. operating power (at max. irradiance and 50°C): 1.45 kW
Array nom. Power (STC): 1.60 kWp

Cancel OK

Chapter 3: VC2 - Run the Simulation

1

Click on «Run the Simulation»

The screenshot shows the PVsyst SA - Standalone software interface. The window title is "Project: _DEMO_StandAlone.PRJ". The interface is divided into several sections:

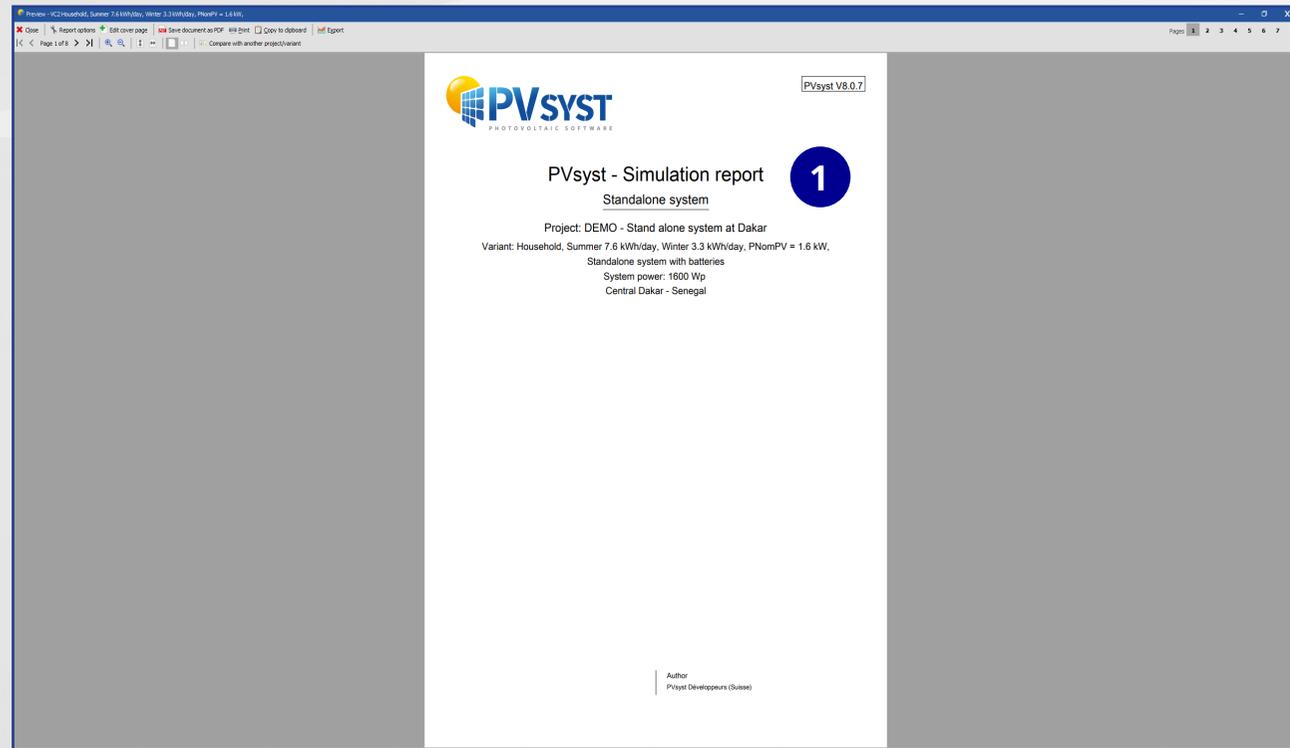
- Project:** Contains fields for Project's name (DEMO - Stand alone system at Dakar), Client name (Not defined), Site File (Dakar_MN82.SIT), and Weather data File (Dakar_MN82_SYN.MET). A green bar below this section indicates "Ready for simulation".
- Variant:** Contains a dropdown for Variant n° (VC2 : Household, Summer 7.6 kWh/day, Winter 3.3 kWh/day, PNomPV = 1.6 kW). Below this are three columns of options:
 - Main parameters:** Orientation, User's needs, System, Detailed losses.
 - Optional:** Horizon, Near Shadings, Economic evaluation.
 - Simulation:** Run Simulation (highlighted with a blue circle and the number 1), Advanced Simulation, Report, Detailed results.
- Results overview:** A table showing simulation results for a "Standalone system with batteries".

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

An "Exit" button is located at the bottom right of the interface.

Chapter 3: VC2 - Simulation Report

1 Simulation Report



Chapter 4: VC3 - New Variant_PNomPV = 5.6 kW, Storage 37 kWh

1

Click on «New» and create a new simulation variant: «Communication station, constant 1 kW, secure, PNomPV = 5.6 kW, storage 37 kWh»

2

Define the same orientation as in the previous variants

Project: DEMO - Stand alone system at Dakar_Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO - Stand alone system at Dakar Client name: Not defined

Site File: Central Dakar_MN82.SIT Central Dakar_MN82.SIT Senegal

Weather data File: Central Dakar_MN82_SYN.MET Meteornorm 8.2 (2010-2021), Sat=100% Synthetic

Please choose the plane orientation !

Variant

Variant n°: VC3 : New simulation variant

Main parameters:

- Orientation
- User's needs
- System
- Detailed losses

Optional:

- Horizon
- Near Shadings
- Economic evaluation

Simulation:

- Run Simulation
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

Exit

Chapter 4: VC3 - User Requirements_PNomPV = 5.6 kW, Storage 37 kWh

1

Define «User Requirements»

The screenshot displays the PVsyst software interface for a project named "DEMO - Stand alone system at Dakar_Project.PRJ". The interface is divided into several sections:

- Project Section:** Contains fields for "Project's name" (DEMO - Stand alone system at Dakar), "Client name" (Not defined), "Site File" (Central Dakar_MN82.SIT), and "Weather data File" (Central Dakar_MN82_SYN.MET).
- Warning Message:** A red text box states: "User's needs not defined. With a Stand-alone system you have to define valid (non-zero) user's needs."
- Variant Section:** Shows "Variant n°" as "VC3 : Communication station, constant 1 kW, secure, PNomPV = 5.6 kW, storage 37 kWh". It includes sub-sections for "Main parameters" (with "User's needs" selected and marked with a blue circle and '1'), "Optional" (Horizon, Near Shadings, Economic evaluation), and "Simulation" (Run Simulation, Advanced Simulation, Report, Detailed results).
- Results overview Section:** A table showing system performance metrics for a "Standalone system with batteries".

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

Chapter 4: VC3 - Load Profile_PNomPV = 5.6 kW, Storage 37 kWh

1

Click on «Other Profile» to define a new type of load profile

Daily use of energy, variant "Communication station, constant 1 kW, secure, PNomPV = 5.6 kW, storage 37 kWh"

Definition of daily household consumptions for the year.

Consumption Hourly distribution

Number	Appliance	Power	Daily use	Hourly distrib.	Daily energy
0	Lamps (LED or fluo)	0 W/lamp	0.0 h/day		0 Wh
0	TV / PC / Mobile	0 W/app	0.0 h/day		0 Wh
0	Domestic appliances	0 W/app	0.0 h/day		0 Wh
0	Fridge / Deep-freeze	0.00 kWh/day	24.0 h/day		0 Wh
0	Dish- and Cloth-washer	0.0 W aver.	2.0 h/day		0 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
0	Other uses	0 W/app	0.0 h/day		0 Wh
Stand-by consumers		1 W tot	24 h/day		0 Wh

Appliances info

Total daily energy: 0 Wh/day
Monthly energy: 0.0 kWh/mth

Consumption definition by:
 Years
 Seasons
 Months

Week-end or Weekly use:
 Use only during
 7 days in a week

Daily global consumption

Model

1 No appliance defined.

Load Save Other profile Cancel OK

Chapter 4: VC3 - Load Profile_PNomPV = 5.6 kW, Storage 37 kWh

1 Type of load profile: «Fixed constant consumption»

2 Define «Fixed Consumption = 1 kW»

3 Click on «OK» to confirm

User's needs definitionVariant: "Communication station, constant 1 kW, secure, PNomPV = 5.6 kW, storage 37 kWh", Variant "C..."

Comment: New User's needs

General features

Kind of load profile

- Unlimited load (grid)
- Fixed constant consumption **1**
- Monthly values
- Daily profiles
- Probability profiles
- Household consumers
- Load values from a CSV hourly/daily file

Fixed constant consumption **2**

Fixed consumption: 1.00

- kW
- kWh/yr
- MWh/yr

Info system: Defined PV array

Nominal PV Power	0.00	Wp
Estimated system yield	0.00	kWh/yr
PnomPV / PLoad average	0.00	Pnom ratio
PnomPV / PLoad max	0.00	Pnom ratio

Model

Load Save

Print Cancel OK **3**

Chapter 4: VC3 - System_PNomPV = 5.6 kW, Storage 37 kWh

1

Define «System»

Project: DEMO - Stand alone system at Dakar_Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO - Stand alone system at Dakar Client name: Not defined

Site File: Central Dakar_MN82.SIT Central Dakar_MN82.SIT Senegal

Weather data File: Central Dakar_MN82_SYN.MET Meteororm 8.2 (2010-2021), Sat=100% Synthetic 0 k

Please define the system !

Variant

Variant n°: VC3 : Communication station, constant 1 kW, secure, PNomPV = 5.6 kW, storage 37 kWh

Main parameters:

- Orientation *
- User's needs
- System 1
- Detailed losses

Optional:

- Horizon
- Near Shadings
- Economic evaluation

Simulation:

- Run Simulation
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

Exit

Chapter 4: VC3 - System_PNomPV = 5.6 kW, Storage 37 kWh

- 1 Select a generic 12V 160Ah Sealed Pb battery
- 2 Select 4 batteries in series and 6 in parallel
- 3 Define «Battery Temperature (25°C)»
- 4 Click on «Sub-array Design» to define the PV system

The screenshot displays the 'Sub-array Design' window in PVsyst. The window title is 'Stand-alone system definition, Variant "Communication station, constant 1 kW, secure, PNomPV = 5.6 kW, storage 37 kWh", Variant "Communication station, constant 1 kW, secure, PNomPV = 5.6 kW, stora...'. The window is divided into several sections:

- List of subarrays:** A table with columns 'Name', '#Mod #Con.', and '#String'. It shows a 'PV Array' with 1 module and 1 string.
- Global system summary:** A table with the following data:

Number of modules	0
Module area	0 m ²
Nominal PV Power	0.0 kWp
Maximum PV Power	0.0 kWdc
Number of controllers	1
Number of batteries	24 (4 in series x 6 in parallel)
Battery pack voltage	48 V
- Specify the Battery set:** This section is the primary focus. It includes a 'Sort batteries by' dropdown set to 'voltage'. Below it, a search bar shows 'Generic' and '12 V 160 Ah Pb Sealed Gel Solar 12V / 160 Ah Since 2000'. A table shows the following specifications:

Number of batteries in series	4	Number of batteries	24
Number of batteries in parallel	6	Number of elements	144
Initial State of Wear (nb. of cycles)	100.0%		
Initial State of Wear (static)	100.0%		
- Operating battery temperature:** This section shows a dropdown menu set to 'Fixed (air-conditioned)' with a temperature of 25°C. A red warning box at the bottom right says 'Please choose the PV module!'.

Chapter 4: VC3 - System_PNomPV = 5.6 kW, Storage 37 kWh

1 Select the generic 400 Wc module

2 Select the regulation mode «MPPT Converter»

3 Select 7 modules in series and 2 strings

4 Click on «OK» to confirm

Stand-alone system definition, Variant "Communication station, constant 1 kW, secure, PNomPV = 5.6 kW, storage 37 kWh", Variant "Communication station, constant 1 kW, secure, PNomPV = 5.6 kW, stora...

List of subarrays

Name	#Mod #Con.	#String
New Collector array		
Generic_Mono_400W.PAN	7	2
Universal_Controller_LA_MPPT.RLT	1	

Global system summary

Number of modules	14
Module area	31 m ²
Nominal PV Power	5.6 kWp
Maximum PV Power	5.4 kWdc
Number of controllers	1
Number of batteries	24 (4 in series x 6 in parallel)
Battery pack voltage	48 V

Av. daily needs: 24.0 kWh/day, Enter accepted PLOL: 5.0 %, Requested autonomy: 3.0 day(s)

Battery voltage: 48 V, Suggested capacity: 1765 Ah, Suggested PV power: 5.92 kWp

Storage: Sub-array design, Back-Up, Simplified sketch

Sub-array name and Orientation: Name: New Collector array, Orient.: Fixed, Tilt 15.0°, Azim. 0.0°

Select the PV module: Available Now, Sort modules: Power, Technology, _Generic, 400 Wp 32V Si-mono Mono 400 Wp 72 cells, Since 2021, Sizing voltages: Vmpp (60°C) 33.0 V, Voc (-10°C) 52.0 V

Select the control mode and the controller: Universal controller: _Generic, MPPT power converter, Operating mode: MPPT converter

Design the array: Number of modules and strings: Mod. in series: 7, Nb. strings: 2, Operating conditions: Vmpp (60°C) 231 V, Vmpp (20°C) 273 V, Voc (-10°C) 364 V, Plane irradiance 1000 W/m², Impp (60°C) 21.0 A, Isc (60°C) 22.7 A, Isc (at STC) 22.5 A, Max. operating power (at max. irradiance and 50°C) 5.1 kW, Array nom. Power (STC) 5.6 kWp

Cancel OK

Chapter 4: VC3 - Loss_PNomPV = 5.6 kW, Storage 37 kWh

1

Define the same «Detailed Losses» as in «VC0»

The screenshot displays the PVsyst software interface for a project named "DEMO - Stand alone system at Dakar". The interface is divided into several sections:

- Project Section:** Contains fields for Project's name, Client name, Site File, and Weather data File. The project is ready for simulation.
- Variant Section:** Shows the selected variant "VC3 : Communication station, constant 1 kW, secure, PNomPV = 5.6 kW, storage 37 kWh". It includes a "Main parameters" list with "Detailed losses" selected and highlighted with a blue circle containing the number 1. Other parameters include Orientation, User's needs, System, Horizon, Near Shadings, and Economic evaluation.
- Simulation Section:** Features a "Run Simulation" button and options for Advanced Simulation, Report, and Detailed results.
- Results overview Section:** Displays a table of system performance metrics for a "Standalone system with batteries".

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

Chapter 4: VC3 - Run the Simulation_PNomPV = 5.6 kW, Storage

1

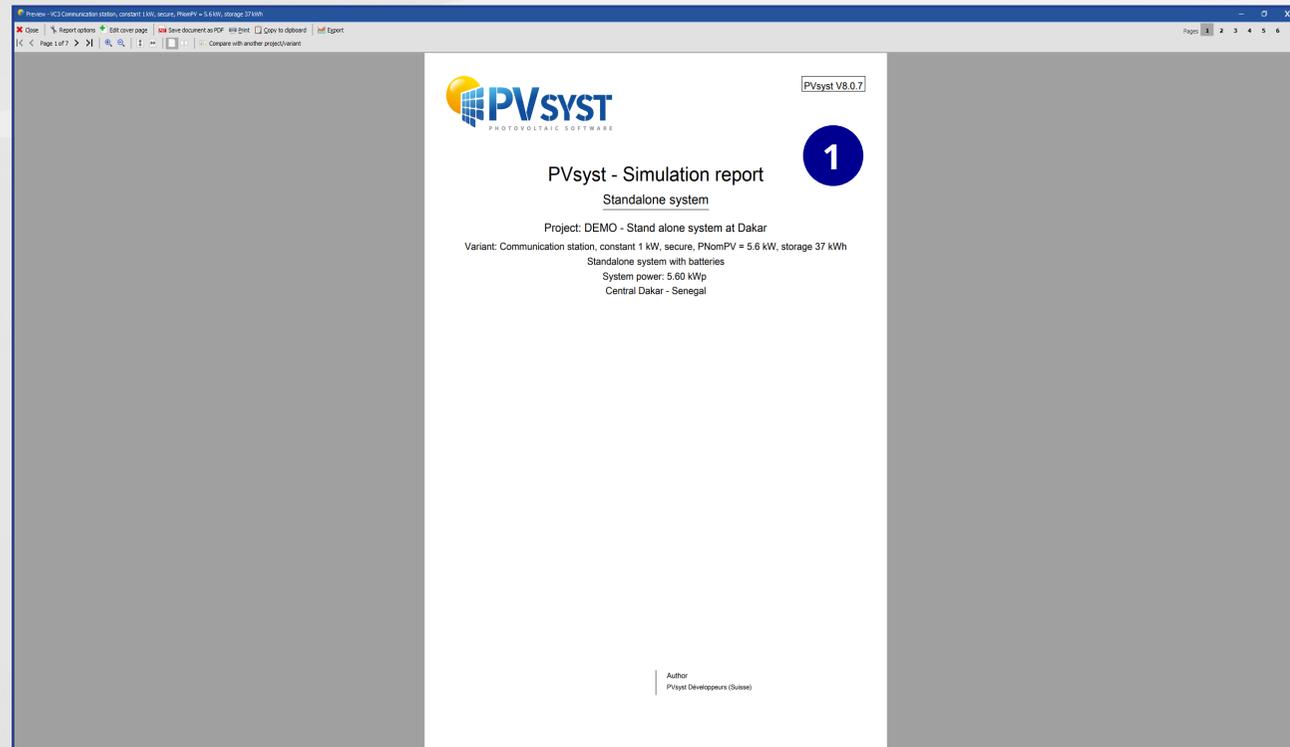
Run the Simulation

The screenshot shows the PVsyst software interface for a project named "DEMO - Stand alone system at Dakar". The "Project" section includes fields for "Project's name", "Client name", "Site File", and "Weather data File". The "Variant" section shows "Variant n°" as "VC3 : Communication station, constant 1 kW, secure, PNomPV = 5.6 kW, storage 37 kWh". Under "Main parameters", "Orientation" is selected with an asterisk. Under "Optional", "Horizon" and "Near Shadings" are selected. The "Simulation" section features a prominent "Run Simulation" button with a blue circle containing the number "1". Other options include "Advanced Simulation", "Report", and "Detailed results". A "Results overview" table is visible on the right.

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

Chapter 4: VC3 - Report_PNomPV = 5.6 kW, Storage

1 Simulation Report



Chapter 5: VC4 - New Variant_PnomPV = 12 kW, Storage

1

Create a new simulation variant «Rural little industry, 5 kW 10H/day, 1 kW during night, PnomPV = 12 kW, Storage»

Project: DEMO - Stand alone system at Dakar_Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO - Stand alone system at Dakar Client name: Not defined

Site File: Central Dakar_MN82.SIT Central Dakar_MN82.SIT Senegal

Weather data File: Central Dakar_MN82_SYN.MET Meteororm 8.2 (2010-2021), Sat=100% Synthetic 0 k

Please choose the plane orientation !

Variant

Variant n°: VC4 : New simulation variant

Main parameters

- Orientation
- User's needs
- System
- Detailed losses

Optional

- Horizon
- Near Shadings
- Economic evaluation

Simulation

- Run Simulation
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

Exit

Chapter 5: VC4 - User Requirements_PnomPV = 12 kW, Storage

1 Define the same orientation as in the previous variants

2 Define «User Requirements»

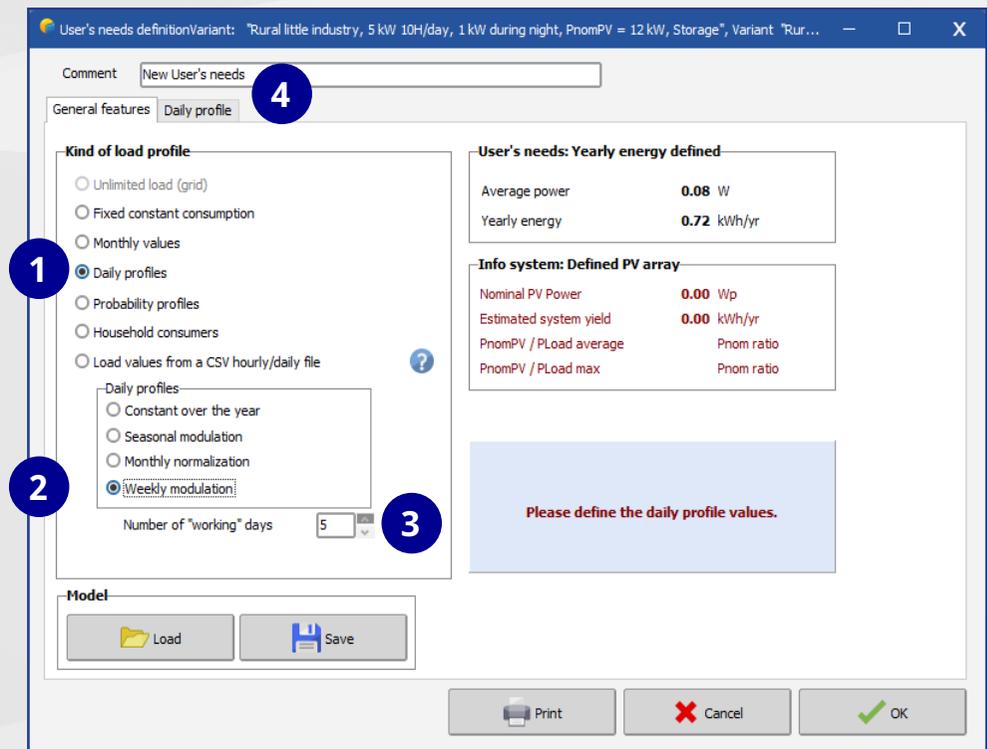
The screenshot displays the PVsyst software interface for a project titled "Project: DEMO - Stand alone system at Dakar_Project.PRJ". The interface is divided into several sections:

- Project Section:** Contains fields for "Project's name" (DEMO - Stand alone system at Dakar), "Client name" (Not defined), "Site File" (Central Dakar_MN82.SIT), and "Weather data File" (Central Dakar_MN82_SYN.MET).
- Warning:** A red message states: "User's needs not defined. With a Stand-alone system you have to define valid (non-zero) user's needs."
- Variant Section:** Shows "Variant n°" as "VC4 : Rural little industry, 5 kW 10H/day, 1 kW during night, PnomPV = 12 kW, Storage".
- Main parameters:** Includes "Orientation" (selected), "User's needs" (selected), "System", and "Detailed losses".
- Optional:** Includes "Horizon", "Near Shadings", and "Economic evaluation".
- Simulation:** Includes "Run Simulation", "Advanced Simulation", "Report", and "Detailed results".
- Results overview:** A table showing system performance metrics for a "Standalone system with batteries".

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

Chapter 5: VC4 - User Requirements_PnomPV = 12 kW, Storage

- 1 Type of Load Profile:
 - Daily Profiles
 - Weekly Modulation
 - Number of Working Days: «5»
- 2 Define the values of the daily profile «Weekly Modulation»
- 3 Number of working days: «5»
- 4 Click on «Daily Profile»



Chapter 5: VC4 - User Requirements_PnomPV = 12 kW, Storage

1 Define «Hourly Values»

2 Click on «OK» to confirm

The screenshot shows the 'User's needs definition' window with the following components:

- Comment:** Nouveau Besoins de l'utilisateur
- General features:** Daily profile, Graph
- Graph:** 'User's needs: daily profile, weekly modulation'. The y-axis is 'Hourly Power [kW]' (0 to 7) and the x-axis is 'Hour' (0 to 24). The profile shows 1 kW from 0-7h, 5 kW from 8-17h, and 1 kW from 18-23h.
- Hourly values table:**

Hour	Power (kW)	Hour	Power (kW)
0 h	1.00	12 h	5.00
1 h	1.00	13 h	5.00
2 h	1.00	14 h	5.00
3 h	1.00	15 h	5.00
4 h	1.00	16 h	5.00
5 h	1.00	17 h	5.00
6 h	1.00	18 h	1.00
7 h	1.00	19 h	1.00
8 h	5.00	20 h	1.00
9 h	5.00	21 h	1.00
10 h	5.00	22 h	1.00
11 h	5.00	23 h	1.00
- Summary:** Average: 2.67 kW, Day sum: 0.064 MWh/day, Month sum: 1.92 MWh/mth
- Operator (acting on all values):** Identical (selected), Value: 0.00 kW, Work out button.
- Shows values of:** Working Days, Copy values button.
- Buttons:** Print, Cancel, OK.

Chapter 5: VC4 - System_PnomPV = 12 kW, Storage

1 Define the «System»

Project: DEMO - Stand alone system at Dakar_Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO - Stand alone system at Dakar Client name: Not defined

Site File: Central Dakar_MN82.SIT Central Dakar_MN82.SIT Senegal

Weather data File: Central Dakar_MN82_SYN.MET Meteorom 8.2 (2010-2021), Sat=100% Synthetic 0 k

Please define the system !

Variant

Variant n°: VC4 : Rural little industry, 5 kW 10H/day, 1 kW during night, PnomPV = 12 kW, Storage

Main parameters

- Orientation *
- User's needs
- System 1
- Detailed losses

Optional

- Horizon
- Near Shadings
- Economic evaluation

Simulation

- Run Simulation
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

Exit

Chapter 5: VC4 - System_1 kW during night, PnomPV = 12 kW, Storage

- 1 Select a generic 12V 160Ah Sealed Pb battery
- 2 Select «4» batteries in series and «6» in parallel
- 3 Battery operating temperature: (25°C)
- 4 Define «Sub-array Design»

The screenshot shows the PVsyst software interface for a stand-alone system definition. The window title is "Stand-alone system definition, Variant: 'Rural little industry, 5 kW 10H/day, 1 kW during night, PnomPV = 12 kW, Storage', Variant: 'Rural little industry, 5 kW 10H/day, 1 kW during night, PnomPV = 12 kW, S...".

Step 1: The "Specify the Battery set" section shows "Sort batteries by" set to "voltage". The selected battery is "Generic" with a voltage of 12 V, capacity of 160 Ah, and technology "Pb Sealed Gel".

Step 2: The "batteries in series" checkbox is checked and set to 4, and the "batteries in parallel" checkbox is checked and set to 6. The resulting "Number of batteries" is 24 and "Number of elements" is 144.

Step 3: The "Operating battery temperature" section shows "Temperature mode" set to "Fixed (air-conditioned)" and "Fixed temperature" set to 25 °C.

Step 4: The "Sub-array design" tab is selected in the top navigation bar.

Global system summary:

Number of modules	1
Module area	0 m ²
Nominal PV Power	-10.0 kWp
Maximum PV Power	0.0 kWdc
Number of controllers	1
Number of batteries	24 (4 in series x 6 in parallel)
Battery pack voltage	48 V

Procedure:

1. Pre-sizing: Define the desired Pre-sizing conditions (PLOL, 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 summary:

Battery pack voltage	48 V
Global capacity (C10)	960 Ah
Stored energy (80% DOD)	36.9 kWh
Total weight	1781 kg
Nb. cycles at 80% DOD	1300
Total stored energy during the battery life	51 MWh

Operating battery temperature:

Temperature mode: Fixed (air-conditioned)

Fixed temperature: 25 °C

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

Additional parameters:

- Av. daily needs: 0.00 kWh/day
- Enter accepted PLOL: 5.0 %
- Requested autonomy: 4.0 day(s)
- Battery voltage: 12 V
- Suggested capacity: 1 Ah
- Suggested PV power: 0.68 Wp

Global system summary (bottom left):

Name	#Mod #Con.	#String
PV Array	1	1
	1	

Chapter 5: VC4 - System_1 kW During Night, PnomPV = 12 kW, Storage

- 1 Select the generic 400 Wc module
- 2 Select the regulation mode «MPPT Converter»
- 3 Select 10 modules in series and 3 strings
- 4 Click «OK» to save

List of subarrays

Name	#Mod #Con.	#String
New Collector array		
Generic_Mono_400W.PAN	10	3
Universal_Controller_LA_MPPT.RLT	1	

Global system summary

Number of modules	30
Module area	67 m ²
Nominal PV Power	12.0 kWp
Maximum PV Power	0.0 kWdc
Number of controllers	1
Number of batteries	24 (4 in series x 6 in parallel)
Battery pack voltage	48 V

Sub-array design

Av. daily needs: 52.6 kWh/day
Requested autonomy: 3.0 day(s)
Battery voltage: 48 V
Suggested capacity: 3866 Ah
Suggested PV power: 13.0 kWp

Sub-array name and Orientation: Name: New Collector array, Orient.: Fixed, Tilt 15.0°, Azim. 0.0°

Select the PV module

Available Now | Sort modules: Power | Mono 400 Wp 32V Si-mono Mono 400 Wp 72 cells Since 2020

1. Select PV module: _Generic

Sizing voltages: Vmpp (60°C) 33.0 V, Voc (-10°C) 52.0 V

Select the control mode and the controller

MPPT power converter | Universal controller: _Generic

2. Select control mode: MPPT converter

MPPT 1000 W 48 V 275 A 104 A Universal controller with MPPT conve

Design the array

3. Design array: Number of modules and strings

Mod. in series: 10 (No constraint) | Nb. strings: 3 (between 2 and 3)

Nb. modules: 30 | Area: 67 m²

Operating conditions: Vmpp (60°C) 330 V, Vmpp (20°C) 390 V, Voc (-10°C) 520 V

Plane irradiance: 1000 W/m²
Imp (60°C) 31.6 A, Isc (60°C) 34.0 A
Isc (at STC) 33.8 A

Max. operating power (at max. irradiance and 50°C): 10.9 kW
Array nom. Power (STC): 12.0 kWp

4. Click OK to save

Chapter 5: VC4 - Report_1 kW During Night, PnomPV = 12 kW, Storage

1 Run the Simulation

Project: _DEMO_StandAlone.PRJ

Project Site Variant User notes

Project

Project's name: DEMO - Stand alone system at Dakar Client name: Not defined

Site File: Dakar_MN82.SIT Meteoronorm 8.2 (2010-2021), Sat=100% Senegal

Weather data File: Dakar_MN82_SYN.MET Meteoronorm 8.2 (2010-2021), Sat=100% Synthetic 0 k

Ready for simulation

Variant

Variant n°: VC4 : Rural little industry, 5 kW 10H/day, 1 kW during night, PnomPV = 12 kW, Storage

Main parameters:

- Orientation
- User's needs
- System
- Detailed losses

Optional:

- Horizon
- Near Shadings
- Economic evaluation

Simulation:

- Run Simulation 1
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Standalone system with batteries
System Production	0.00 kWh/yr
Specific production	0.00 kWh/kWp/yr
Performance Ratio	0.00
Normalized production	0.00 kWh/kWp/day
Array losses	0.00 kWh/kWp/day
System losses	0.00 kWh/kWp/day

Exit

Chapter 5: VC4 - Report_1 kW During Night, PnomPV = 12 kW, Storage

1 Simulation Report

