

Version 8

Pumping



Step by Step Tutorial

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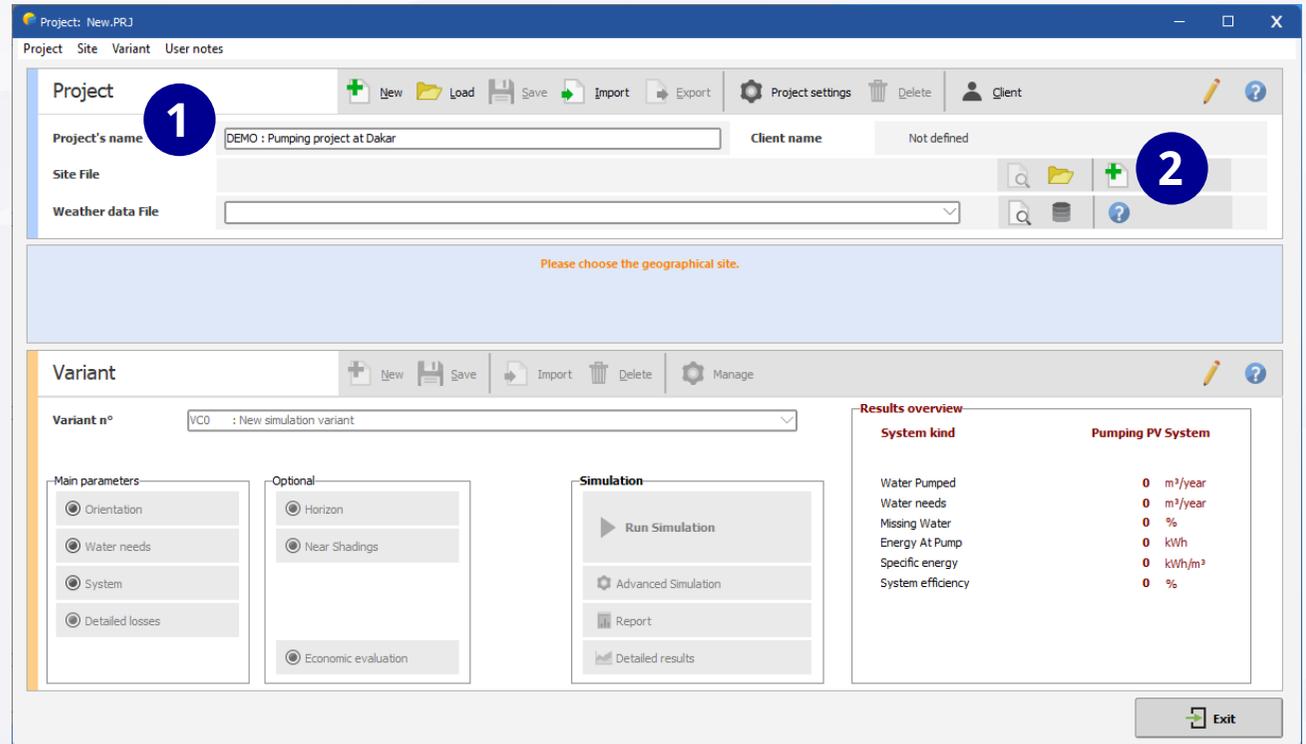
Chapter 1 : VC0 - Project Creation

1 Give a project name

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

or create your new site by clicking on 

Click on create a new site



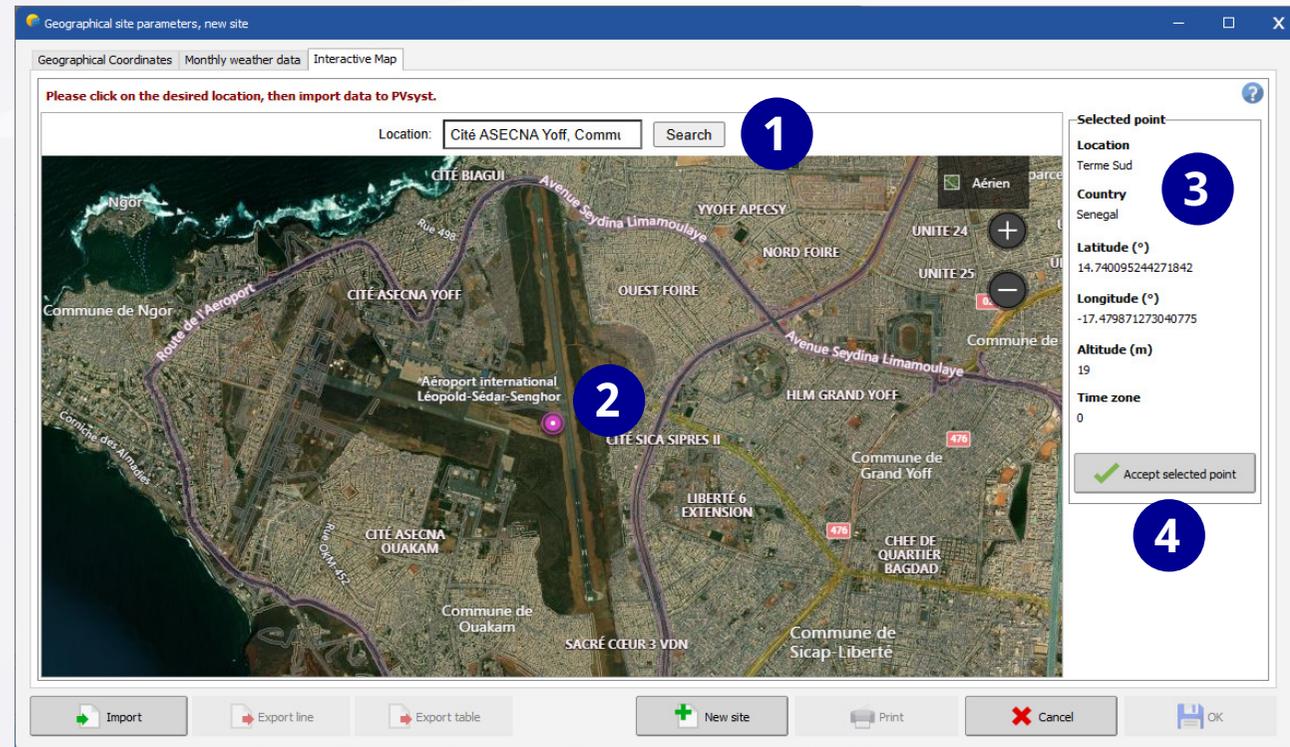
Chapter 1 : VC0 - Project Creation_Create a new site

1 With the search bar

2 Or place the point on the map

3 Check the point information

4 Validate by clicking «Validate selected point»



Chapter 1 : VC0 - Imported Meteorological Data

1 Select the irradiation units

2 Click «OK» to validate

Geographical site parameters for Terme Sud_MN82.SIT

Geographical Coordinates Monthly weather data Interactive Map

Site Terme Sud (Senegal)

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

	Global horizontal irradiation kWh/m ² /mth	Horizontal diffuse irradiation kWh/m ² /mth	Temperature °C	Wind Velocity m/s	Linke turbidity [-]	Relative humidity %
January	140.8	69.1	21.8	4.80	6.190	63.2
February	146.3	74.9	21.0	5.31	6.938	69.7
March	187.4	88.1	21.5	5.40	8.502	75.2
April	187.7	92.0	21.4	5.50	8.800	82.6
May	188.7	101.4	23.1	4.70	9.540	81.9
June	174.1	102.3	25.3	3.60	10.007	82.5
July	185.7	99.9	27.4	3.30	8.789	78.5
August	173.8	97.8	27.6	2.99	7.414	83.3
September	154.7	86.1	27.5	2.70	6.905	86.0
October	154.6	84.4	28.3	3.10	7.512	80.0
November	139.5	70.0	26.1	4.30	5.999	72.0
December	132.2	71.9	24.1	4.50	5.779	62.4
Year	1965.4	1037.8	24.6	4.2	7.698	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

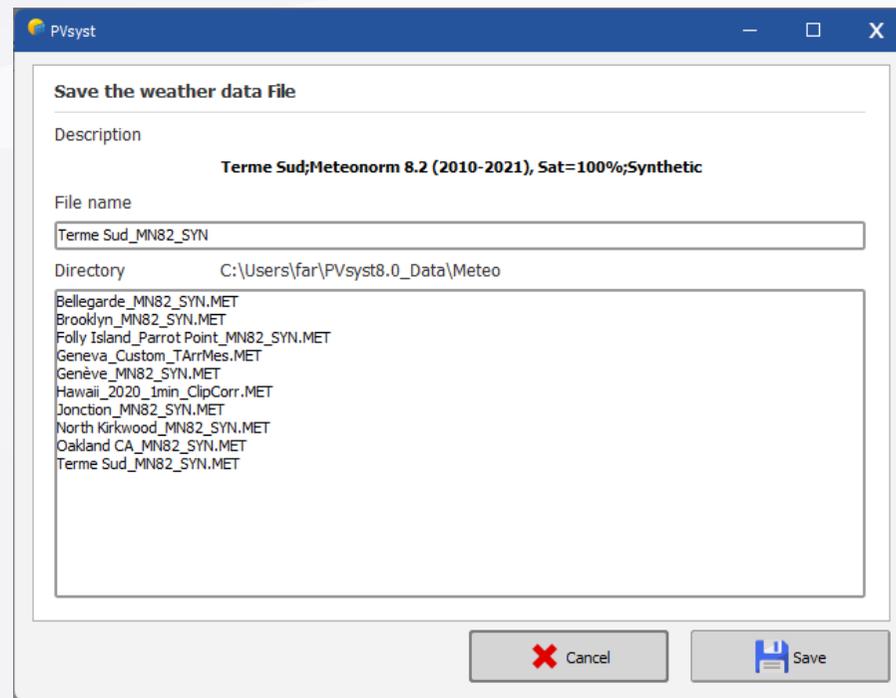
Buttons: Import, Export line, Export table, New site, Print, Cancel, OK

2

Chapter 1 : VC0 - Project Creation_Weather Data Saving (1)

1

Click «Save» to confirm the recording

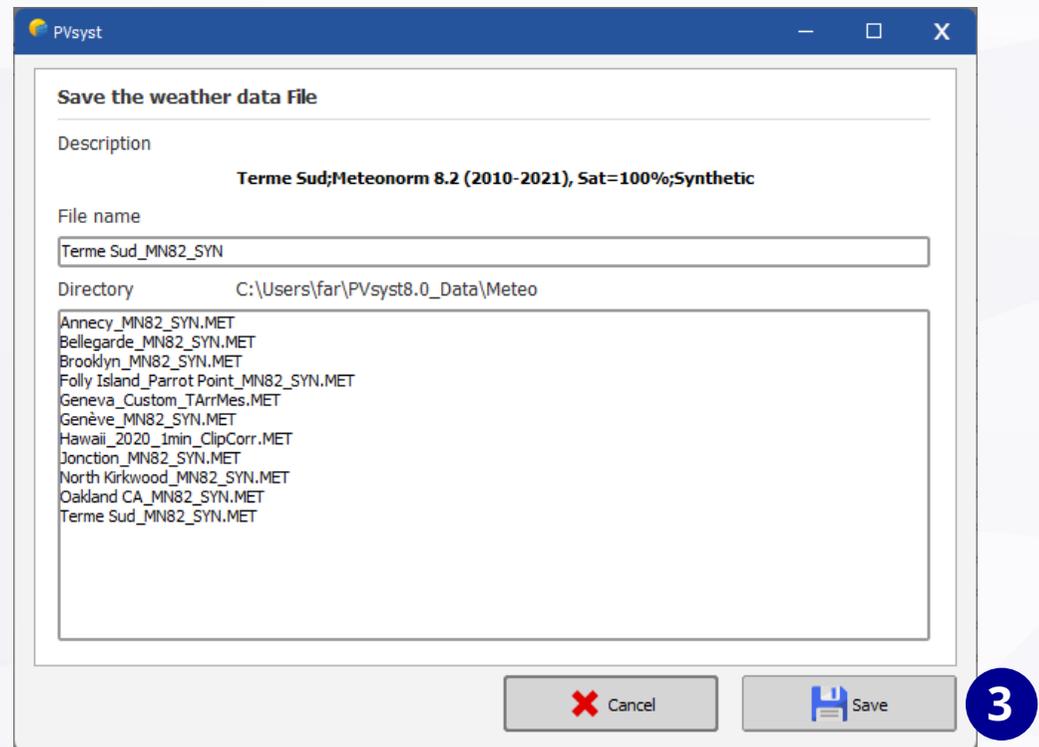
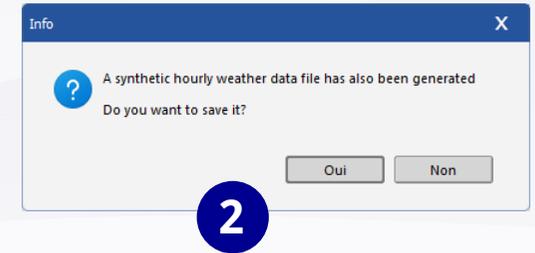
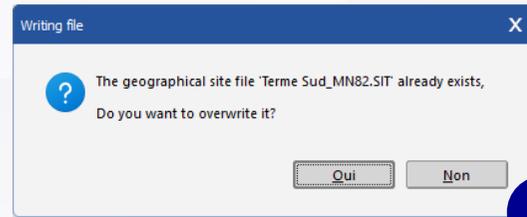


Chapter 1 : VC0 - Project Creation_Weather Data Saving (2)

1 Click «OK»

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

3 Save the synthetic weather file

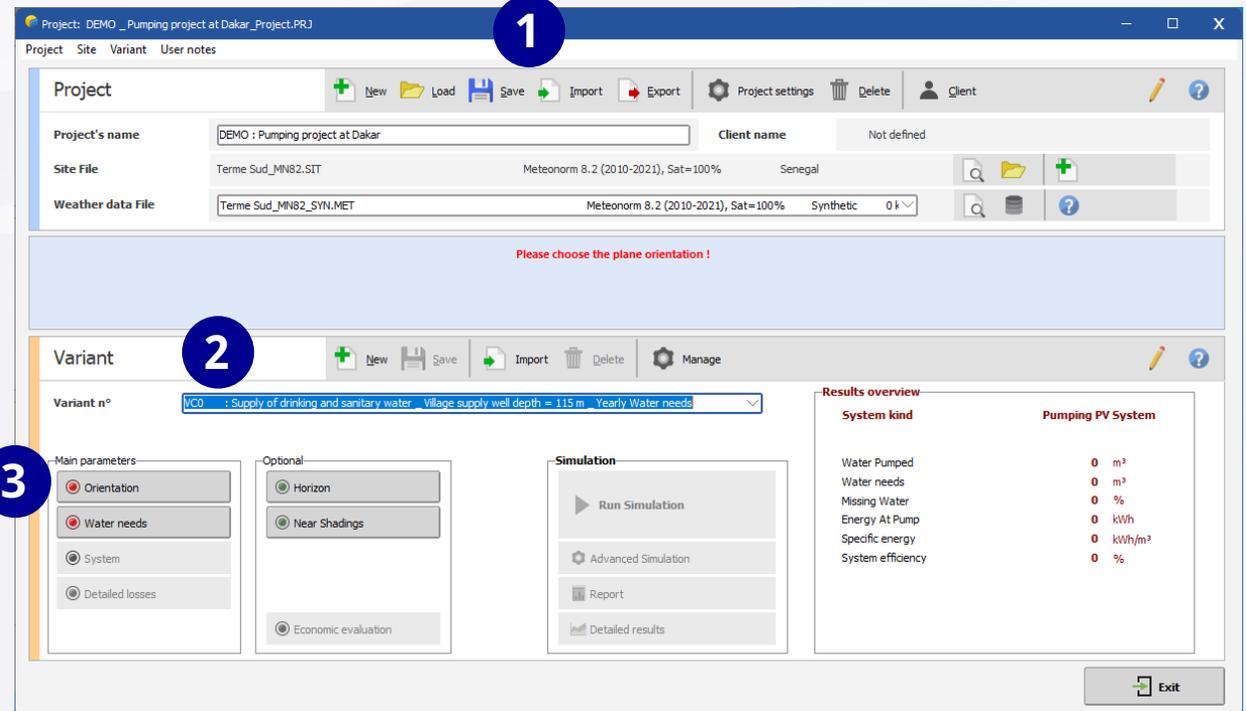


Chapter 1 : VC0 - Project Creation_Weather Data Saving

1 Save your project

2 Change the variant name to «Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Yearly Water needs»

3 Set the orientation



Chapter 1 : VC0 - Orientation Definition

- 1 Choice between several possible configurations: select «Fixed tilted plane»
- 2 Set the field parameters: define the plane tilt at 36° and the azimuth at 0°
- 3 Click «OK»

The screenshot shows the 'Orientations management' window with the following details:

- Title Bar:** Orientations management
- Information:** PVsyst 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!
- Buttons:** Add orientation, ?
- Orientation #1 - Fixed, Tilt 36.0°, Azim. 0.0°** (Status: OK)
- Field type:** Fixed Tilted Plane (selected)
- Name:** Fixed, Tilt 36.0°, Azim. 0.0°
- Module area:** System: 0 m², 0 modules; 3D scene: 0 m², 0 modules
- Field parameters:** Plane tilt: 36.0°, Azimuth: 0.0°, Base tilt angle: 0.0°
- Visuals:** A diagram shows a plane tilted at 36.0° and an azimuth diagram showing 0° (facing South).
- Quick optimization (acc. to clear-sky model):** Optimization with respect to: Annual yield, Summer (Apr-Sep), Winter (Oct-Mar) (selected).
- Winter incident irradiation:** Transposition Factor FT: 1.16, Loss with respect to optimum: 0.0%, Global on collector plane: 1042 kWh/m².
- Graphs:** Two graphs showing Winter incident irradiation vs. Plane tilt and Plane orientation. A tooltip indicates FT_{transpos.} = 1.16 and Loss/opt. = 0.0%.
- Footer:** Please define the orientation(s) and click "OK"
- Buttons:** Cancel, OK

Chapter 1 : VC0 - Water Needs

1

The red message means: that it is necessary to define the water needs in order to proceed with the simulation

2

Define the «Water Needs»

The screenshot shows the PVsyst software interface for a project named "DEMO : Pumping project at Dakar". The interface is divided into several sections:

- Project Section:** Contains fields for Project's name, Site File, and Weather data File. A red error message is displayed: "Error in User needs. Hydraulic circuit definitions: Please define the nominal static level." A blue circle with the number "1" is placed over this message.
- Variant Section:** Shows the variant name "VC0 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Yearly Water needs". A blue circle with the number "2" is placed over the variant name.
- Main parameters:** Includes radio buttons for Orientation, Water needs, System, and Detailed losses. The "Water needs" option is selected.
- Optional:** Includes radio buttons for Horizon, Near Shadings, and Economic evaluation.
- Simulation:** Contains buttons for Run Simulation, Advanced Simulation, Report, and Detailed results.
- Results overview:** A table showing simulation results for a "Pumping PV System".

System kind	Pumping PV System
Water Pumped	0 m ³
Water needs	0 m ³
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

Chapter 1 : VC0 - Water Needs (1)

1

Define the borehole characteristics:

Static level : -100.0 m
 Drawdown : -0.80 m
 Minimum dynamic level : -110.0 m
 Pump level : -115.0 m
 Borehole diameter : 20 cm

2

Define the hydraulic circuit:

Pipe selection : PE50 (2")
 Pipe length : 280 m
 Number of bends : 7
 Other head losses : 0.00

3

Define the tank:

Volume : 50.0 m³
 Diameter : 3.50 m
 Height (full) : 5.20 m
 Injection altitude : 8.00 m

4

Click on «Definition of water needs and pressure»

Chapter 1 : VC0 - Water Needs (2)

1

Define the water needs:

Annual needs: 40.0 m³/day

2

Click «OK»

Water Needs and Hydraulic Head / Pressure, Variant: "Supply of drinking and sanitary water _ Village supply well depth = 115 m ..."

Comment: New User's needs

Pumping Hydraulic Circuit | Water needs and Head definitions

Water needs

- Yearly Average
- Seasonal values
- Monthly values

Whole Year needs: 40.0 m³/day

Well static depth variations

- Yearly constant
- Seasonal values
- Monthly values

Whole Year: 100.0 meterW

Additional heads

Feeding altitude	8 m	
Dynamic heads	5.0 meterW	
(at flowrate = 8.0 m ³ /h)	Drawdown	6.4 meterW

Hydraulic units

Flowrate: m³/h

Pressure: meterW

Yearly summary

Water needs average	40.0 m ³ /day
Yearly water needs	14600 m ³
Yearly Head average	108 meterW
Hydraulic Energy	4297 kWh
PV needs (very roughly)	14511 kWh

Model File

Load Save Cancel OK

2

Chapter 1 : VC0 - System

1 Define the system, click on «System»

The screenshot shows the PVsyst software interface. The 'Project' section is at the top, with fields for 'Project's name' (DEMO : Pumping project at Dakar), 'Client name' (Not defined), 'Site File' (Terme Sud_MN82.SIT), and 'Weather data File' (Terme Sud_MN82_SYN.MET). A red message 'Please define the system!' is displayed in the center. The 'Variant' section is below, with a dropdown menu for 'Variant n°' (VC0 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Yearly Water needs). The 'Main parameters' section has radio buttons for 'Orientation', 'Water needs', 'System' (selected), and 'Detailed losses'. The 'Optional' section has radio buttons for 'Horizon', 'Near Shadings', and 'Economic evaluation'. The 'Simulation' section has buttons for 'Run Simulation', 'Advanced Simulation', 'Report', and 'Detailed results'. The 'Results overview' section shows a 'Pumping PV System' with the following metrics: Water Pumped (0 m³), Water needs (0 m³), Missing Water (0 %), Energy At Pump (0 kWh), Specific energy (0 kWh/m³), and System efficiency (0 %). An 'Exit' button is at the bottom right.

1

Chapter 1 : VC0 - Pump Definition

- 1 Choice between several possible manufacturers: select «_Generic»
- 2 Select the model: «6.3kW 60-160 m / Well 6 kW Head 60-160»
- 3 Click on «Sub-array design»

The screenshot shows the 'Pumping system definition' software interface. The title bar reads 'Pumping system definition, Variant: "Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Yearly Water needs"'. The interface is divided into several sections:

- Pre-sizing suggestions:** A table showing system parameters and suggestions.

Average daily needs :		Requested autonomy	4.0 Days	Suggested tank volume	160 m ³
Head min.	108.0 meterW	Accepted missing	5.0 %	Suggested Pump power	6.4 kW
Head max.	117.6 meterW			Suggested PV power	8.1 kWp (nom.)
Volume	40.0 m ³ /day				
Hydraulic power	2459 W (very approximative)				
- Pump definition / Sub-array design:** A tabbed interface where 'Sub-array design' is selected. It contains:
 - Select a pump model:** A dropdown menu showing '_Generic' selected. Below it, a list of models is shown, with '6.3 kW 60-160 m Well, AC, Centrifugal Multistage Well 6 kW Head 60-160 - FR 1 Since 2021' highlighted. An 'Open' button is next to it.
 - Pumps configuration:** '1' pump selected, 'Pumps in parallel' checked.
 - Pump characteristics:** A table for the selected pump model.

	Centrifugal Multistage		
	AC motor, triphased		
Maximal power	6300 W	Voltage	700 V
		Max. current	9.0 A
Head Min / Nom / Max	60	100	160 meterW
Corresp. Flowrate	12.8	10.2	6.2 m ³ /h
Corresp. Power	6300	6300	6300 W
Efficiency	33.2	44.2	42.8 %
- Units for this project:** A section with dropdown menus for Flowrate (m³/h), Head (meterW), Power (kW), and Energy (kWh).
- Hydro Energy calculation tool:** A section with input fields for Flowrate (8.8 m³/h), Head (121.0 meterW), and Power (2.902 kW).
- Control strategy:** A message box stating 'The control strategy is not defined.'
- Buttons:** 'Cancel' and 'OK' buttons at the bottom right.

Chapter 1 : VC0 - Sub-array Design

- 1 Choice between several possible manufacturers: select «_Generic»
- 2 Select the model : «250 Wp 26V / Mono 250Wp 60 cells»
- 3 Set the desired Pnom : 10.2 kWp
- 4 Click «OK»

Pre-sizing suggestions

Average daily needs :	Requested autonomy	4.0 Days	Suggested tank volume	160 m ³
Head min. 108.0 meterW	Accepted missing	5.0 %	Suggested Pump power	6.3 kW
Head max. 117.4 meterW			Suggested PV power	7.9 kWp (nom.)
Volume 40.0 m ³ /day				
Hydraulic power 2457 W (very approximative)				

Pump definition | Sub-array design

System information

Chosen pump	Well 6 kW Head 60-160 - FR 10 m ³ /h
Technology	Centrifugal Multistage Head 60.0 - 160.0 meterW
Max. power	6300 W Flowrate 12.79 - 6.19 m ³ /h

Pre-sizing Help

No sizing Planned power 10.2 kWp or available area 0 m²

Select the PV module

Available Now

250 Wp 26V Si-mono Mono 250 Wp 60 cells Since 2015

Approx. needed modules 41 Sizing voltages : V_{mpp} (60°C) 26.2 V Voc (-10°C) 41.7 V

Select the control mode and the controller

Universal controller control mode MPPT-AC inverter

1000 W MPPT-AC inverter Universal MPPT - AC Inverter Generic device Adaptabl

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

PV Array design

Number of modules and strings

Mod. in series 20 only possibility 20 between 1 and 3

nb. modules 40 Area 65 m²

Operating conditions

V _{mpp} (60°C)	524 V
V _{mpp} (20°C)	626 V
V _{oc} (-10°C)	833 V
Plane irradiance	1000 kWh/m ²
I _{mpp}	16.4 A
I _{sc}	17.3 A
I _{sc} (at STC)	17.3 A
Max. operating power (at 1000 W/m ² and 50°C)	9.0 kW
Array nom. Power (STC)	10.0 kWp

Chapter 1 : VC0 - Run the Simulation

1

Click on : «Run simulation»

The screenshot shows the PVsyst software interface for a project named "DEMO : Pumping project at Dakar_Project-PRJ". The interface is divided into several sections:

- Project Section:** Contains fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Terme Sud_MN82.SIT), and "Weather data File" (Terme Sud_MN82_SYN.MET). A "Ready for simulation" status bar is visible below this section.
- Variant Section:** Shows "Variant n°" as "VC0 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Yearly Water needs". It includes sub-sections for "Main parameters" (Orientation, Water needs, System, Detailed losses), "Optional" (Horizon, Near Shadings, Economic evaluation), and "Simulation" (Run Simulation, Advanced Simulation, Report, Detailed results).
- Results overview Section:** Displays a table of simulation results for a "Pumping PV System".

System kind	Pumping PV System
Water Pumped	0 m ³
Water needs	0 m ³
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

The "Run Simulation" button in the Simulation section is highlighted with a blue circle and the number 1, indicating the step to be performed.

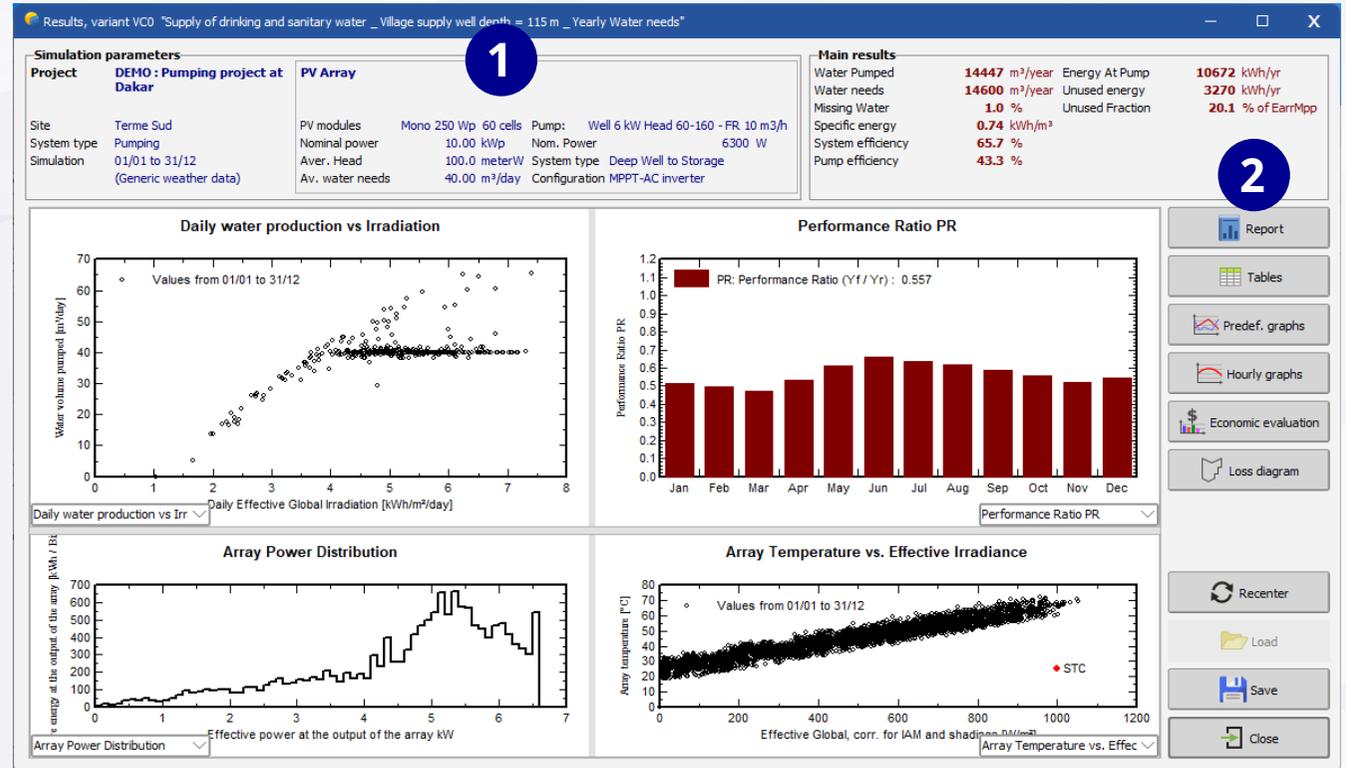
Chapter 1 : VC0 - Simulation Results

1

Main simulation results

2

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



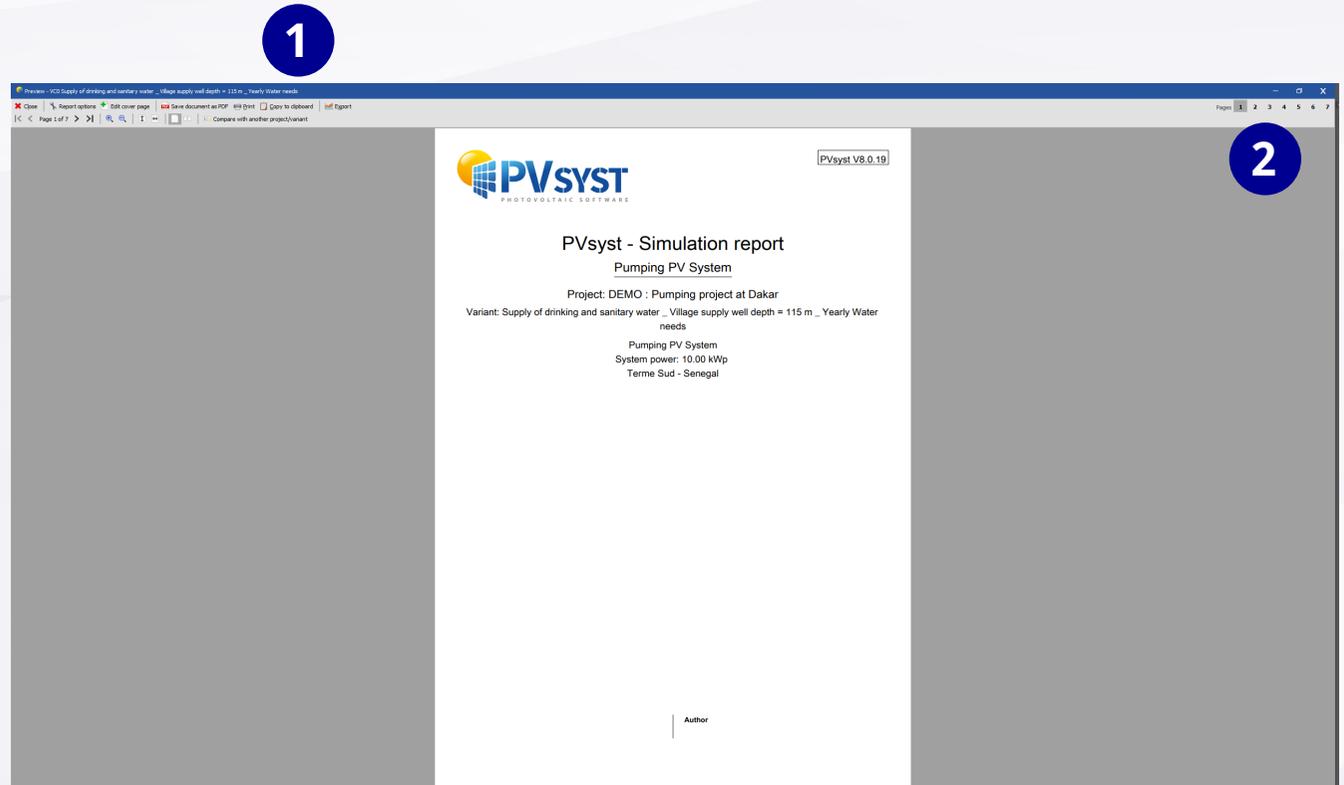
Chapter 1 : VC0 - Simulation Result_Report

1

Save the PDF or print it

2

View the different pages of the report



Chapter 2 : VC1 - Project Creation

1

Click on «Save» to create a new variant.

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

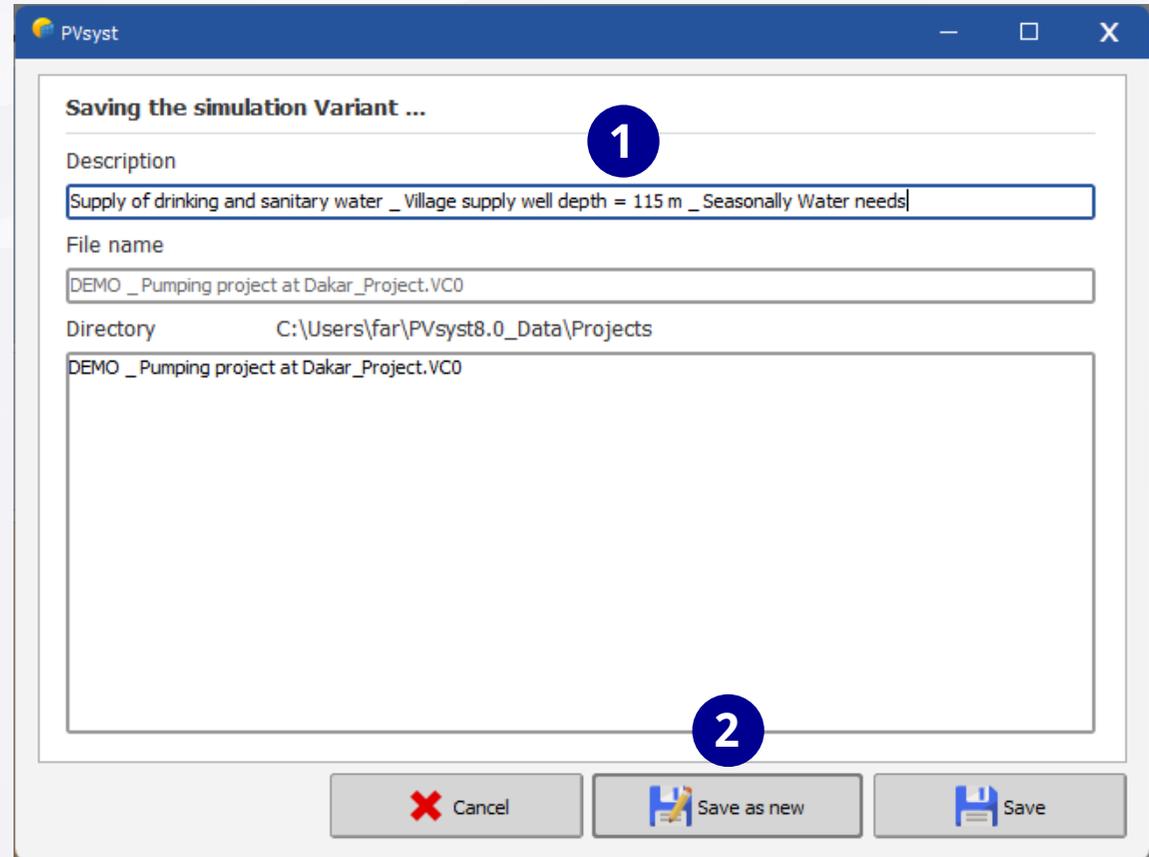
- Project Section:** Contains fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Terme Sud_MN82.SIT), and "Weather data File" (Terme Sud_MN82_SYN.MET). A "Simulation done" notification (version 8.0.19, date 14/01/26) is visible in the center.
- Variant Section:** Shows "Variant n°" as "VCO : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Yearly Water needs". It includes "Main parameters" (Orientation, Water needs, System, Detailed losses) and "Optional" (Horizon, Near Shadings, Economic evaluation) settings.
- Simulation Section:** Features a "Run Simulation" button, along with "Advanced Simulation", "Report", and "Detailed results" options.
- Results overview Section:** Displays key performance indicators for the "Pumping PV System":

System kind	Pumping PV System
Water Pumped	14447 m ³ /year
Water needs	14600 m ³ /year
Missing Water	1.0 %
Energy At Pump	10672 kWh
Specific energy	0.74 kWh/m ³
System efficiency	65.7 %

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

Chapter 2 : VC1 - Project Creation

- 1 Give a new name to the new variant:
«Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Seasonally Water needs»
- 2 Click «Save as new» to create the new variant using the previous parameters



Chapter 2 : VC1 - Orientation Definition (1)

1 Set the orientation

Project: DEMO _ Pumping project at Dakar_Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO : Pumping project at Dakar Client name: Not defined

Site File: Terme Sud_MN82.SIT Meteorom 8.2 (2010-2021), Sat=100% Senegal

Weather data File: Terme Sud_MN82_SYN.MET Meteorom 8.2 (2010-2021), Sat=100% Synthetic 0

Simulation done (version 8.0.19, date 14/01/26)

Variant

Variant n°: VC1 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Seasonally Water needs

Main parameters

- Orientation
- Water needs
- System
- Detailed losses

Optional

- Horizon
- Near Shadings
- Economic evaluation

Simulation

- Run Simulation**
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Pumping PV System
Water Pumped	14447 m ³ /year
Water needs	14600 m ³ /year
Missing Water	1.0 %
Energy At Pump	10672 kWh
Specific energy	0.74 kWh/m ³
System efficiency	65.7 %

Exit

Chapter 2 : VC1 - Orientation Definition (2)

- 1 Choice between several possible configurations: select «Fixed tilted plane»
- 2 Set the field parameters: define the plane tilt at 35.6° and the azimuth at 0°
- 3 Click «OK»

The screenshot shows the 'Orientations management' window with the following details:

- Title Bar:** Orientations management
- Info:** PVsyst 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!
- Buttons:** Add orientation, ?
- Orientation #1 - Fixed, Tilt 35.6°, Azim. 0.0°** (Status: OK)
- Field type:** Fixed Tilted Plane
- Name:** Fixed, Tilt 35.6°, Azim. 0.0°
- Module area:** System: 65 m², 40 modules; 3D scene: 0 m², 0 modules
- Field parameters:** Plane tilt: 35.6°, Azimuth: 0.0°, Base tilt angle: 0.0°
- Diagrams:** A 3D diagram shows a plane tilted at 35.6°. A 2D diagram shows the azimuth at 0° relative to a West-East axis.
- Quick optimization (acc. to clear-sky model):** Optimization with respect to: Annual yield, Summer (Apr-Sep), Winter (Oct-Mar) (selected).
- Winter incident irradiation:** Transposition Factor FT: 1.16, Loss with respect to optimum: 0.0%, Global on collector plane: 1042 kWh/m².
- Graphs:** Two graphs showing transposition factor vs. plane tilt and plane orientation. A tooltip indicates FT_{transpos.} = 1.16 and Loss/opt. = 0.0%.
- Buttons:** Cancel, OK

Chapter 2: VC1 - Water Needs

1

Define the «Water Needs»

The screenshot displays the PVsyst software interface for a project titled "DEMO : Pumping project at Dakar". The interface is divided into several sections:

- Project Section:** Includes fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Terme Sud_MN82.SIT), "Weather data File" (Terme Sud_MN82_SYN.MET), and "Client" (Not defined).
- Variant Section:** Shows "Variant n°" as "VC1 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Seasonally Water needs".
- Main parameters:** Includes "Orientation" (selected), "Water needs" (selected), "System", and "Detailed losses".
- Optional:** Includes "Horizon", "Near Shadings", and "Economic evaluation".
- Simulation:** Includes buttons for "Run Simulation", "Advanced Simulation", "Report", and "Detailed results".
- Results overview:** A table showing simulation results for a "Pumping PV System".

System kind	Pumping PV System
Water Pumped	0 m ³ /year
Water needs	0 m ³ /year
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

A blue circle with the number "1" is overlaid on the "Water needs" option in the Main parameters section.

Chapter 2 : VC1 - Define the Water Needs

1 Choice between several possible configurations:
select «Seasonal values»

2 Set the water parameters:

Summer : 40.0
Autumn : 35.0
Winter : 28.0
Spring : 30.0

3 Click «OK»

Water Needs and Hydraulic Head / Pressure, Variant: "Supply of drinking and sanitary water _ Village supply well depth = 115 m ...

Comment: New User's needs

Pumping Hydraulic Circuit: Water needs and Head definitions

Water needs

- Yearly Average
- Seasonal values
- Monthly values

Water (m³/day)

Summer	40.0
Autumn	35.0
Winter	28.0
Spring	30.0

Well static depth variations

- Yearly constant
- Seasonal values
- Monthly values

Whole Year: 100.0 meterW

Additional heads

Feeding altitude	8 m
Pipes	5.0 meterW
Drawdown	6.4 meterW

Hydraulic units

Flowrate: m³/h

Pressure: meterW

Yearly summary

Water needs average	33.3 m³/day
Yearly water needs	12145 m³
Yearly Head average	108 meterW
Hydraulic Energy	3574 kWh
PV needs (very roughly)	12071 kWh

Model File

Load Save Cancel OK

3

Chapter 2 : VC1 - System

1 Define the «System»

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

- Project Section:** Contains fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Terme Sud_MN82.SIT), "Weather data File" (Terme Sud_MN82_SYN.MET), and "Client" (Not defined).
- Variant Section:** Shows "Variant n°" as "VC1 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Seasonally Water needs".
- Main parameters:** Includes "Orientation" (selected), "Water needs", "System", and "Detailed losses".
- Optional:** Includes "Horizon", "Near Shadings", and "Economic evaluation".
- Simulation:** Features buttons for "Run Simulation", "Advanced Simulation", "Report", and "Detailed results".
- Results overview:** A table showing simulation results for a "Pumping PV System".

System kind	Pumping PV System
Water Pumped	0 m ³ /year
Water needs	0 m ³ /year
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

Chapter 2 : VC1 - Sub-array Design

1 Click on the «Sub-array design» window

2 Set the sizing aid parameters:
 Desired Pnom : 9.5 kWp
 Available area : 0 m²

3 Click «No pre-dim.»
 Select «No pre-dim.»

Pre-sizing suggestions

Average daily needs :	Requested autonomy	4.0 Days	Suggested tank volume	160 m ³
Head min. 108.0 meterW	Accepted missing	5.0 %	Suggested Pump power	5.9 kW
Head max. 116.6 meterW			Suggested PV power	7.4 kWp (nom.)
Volume 33.3 m ³ /day				
Hydraulic power 2037 W (very approximative)				

Pump definition | **Sub-array design** **1**

System information

Chosen pump	Well 6 kW Head 60-160 - FR 10 m ³ /h
Technology	Centrifugal Multistage
Max. power	6300 W
Head	60.0 - 160.0 meterW
Flowrate	12.79 - 6.19 m ³ /h

Pre-sizing Help **2**

No sizing Planned power 9.5 kWp
 or available area 0 m²

Select the PV module

Available Now

_Generic 250 Wp 26V Si-mono Mono 250 Wp 60 cells Since 2015

Approx. needed modules 38 Sizing voltages : Vmpp (60°C) 26.2 V
 Voc (-10°C) 41.7 V

Select the control mode and the controller

Universal controller control mode MPPT-AC inverter

All manufacturers 1000 W MPPT-AC inverter Universal MPPT - AC Inverter Generic device Adaptabl

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

PV Array design

Number of modules and strings

Mod. in series 20 should be: only possibility 20
 2 between 1 and 3

Operating conditions

Vmpp (60°C)	524 V
Vmpp (20°C)	626 V
Voc (-10°C)	833 V
Plane irradiance	1000 kWh/m ²
Impp	16.4 A
Isc	17.3 A
Isc (at STC)	17.3 A
Max. operating power (at 1000 W/m ² and 50°C)	9.0 kW
Array nom. Power (STC)	10.0 kWp

nb. modules 40 Area 65 m²

3 OK

Chapter 2 : VC1 - Run the Simulation

1

Click on: «Run simulation»

The screenshot shows the PVsyst software interface for a project named "DEMO : Pumping project at Dakar". The interface is divided into several sections:

- Project Section:** Contains fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Terme Sud_MN82.SIT), and "Weather data File" (Terme Sud_MN82_SYN.MET). A green bar below this section indicates "Ready for simulation".
- Variant Section:** Shows "Variant n°" as "VC1 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Seasonally Water needs". It includes "Main parameters" (Orientation, Water needs, System, Detailed losses) and "Optional" parameters (Horizon, Near Shadings, Economic evaluation).
- Simulation Section:** Features a "Run Simulation" button, which is highlighted with a blue circle and the number 1. Other options include "Advanced Simulation", "Report", and "Detailed results".
- Results overview Section:** Displays a table of results for a "Pumping PV System":

System kind	Pumping PV System
Water Pumped	0 m ³ /year
Water needs	0 m ³ /year
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

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

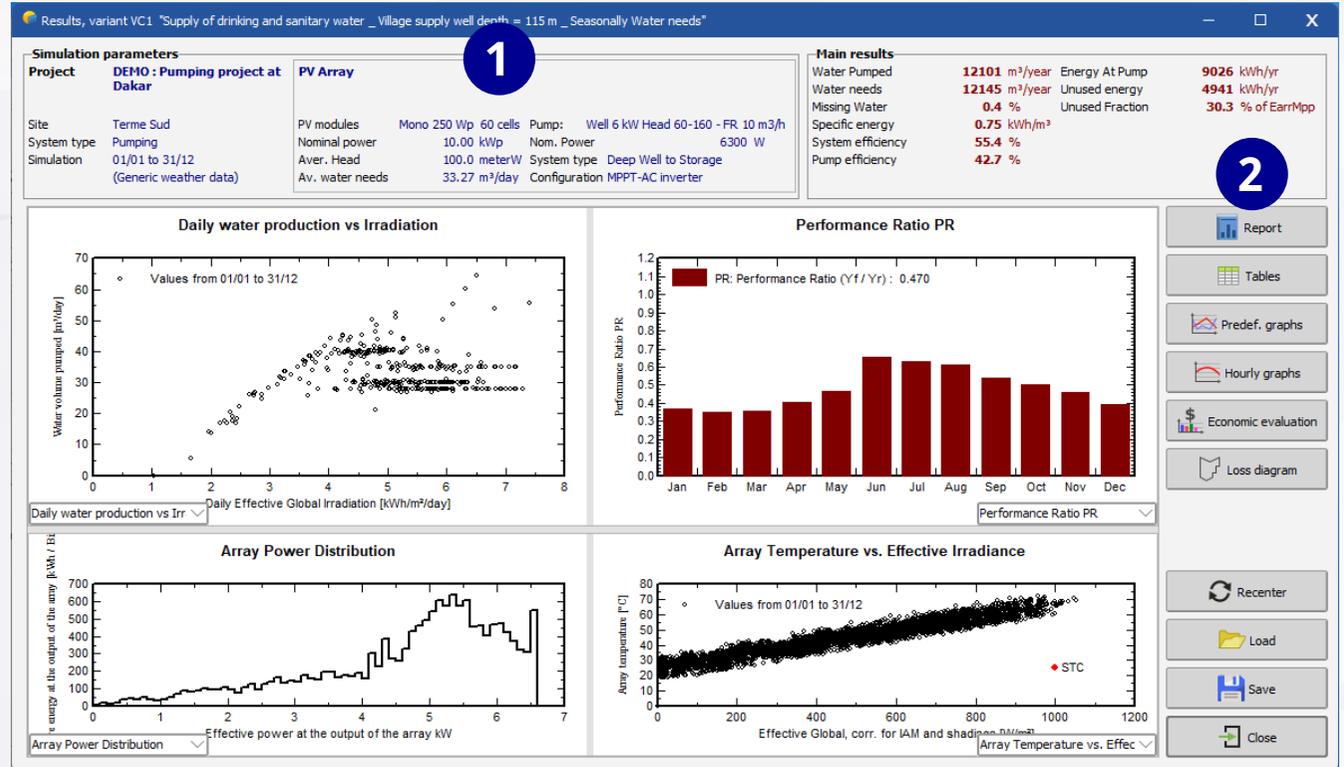
Chapter 2 : VC1 - Simulation Results

1

Main simulation results

2

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



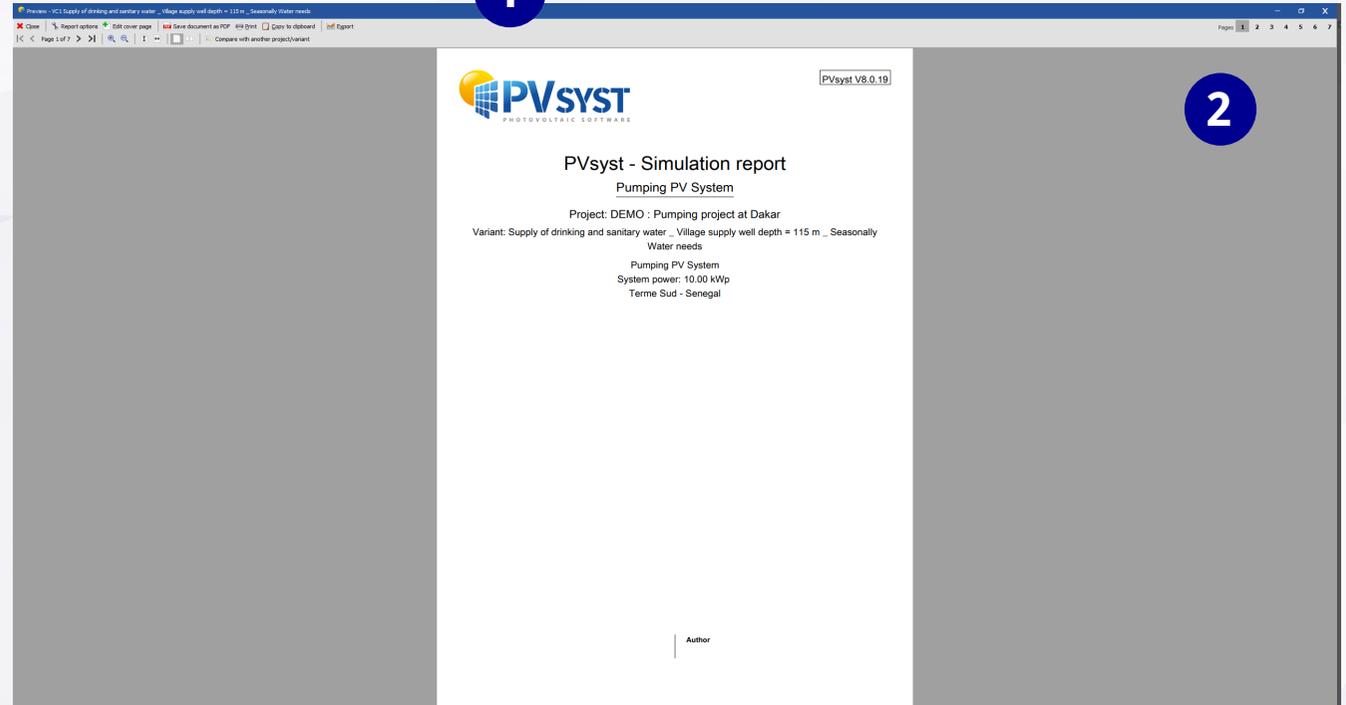
Chapter 2 : VC1 - Simulation Result_Report

1

Save the PDF or print it

2

View the different pages of the report



Chapter 3 : VC2 - Project Creation

1

Click on «Save» to create a new variant.

The screenshot displays the PVsyst software interface for a project titled "DEMO : Pumping project at Dakar". The interface is divided into several sections:

- Project Section:** Contains fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Terme Sud_MN82.SIT), and "Weather data File" (Terme Sud_MN82_SYN.MET). It also shows meteorological data: "Meteonorm 8.2 (2010-2021), Sat=100%" and "Senegal".
- Simulation Status:** A blue banner indicates "Simulation done (version 8.0.19, date 14/01/26)".
- Variant Section:** Shows "Variant n°" as "VC1 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Seasonally Water needs". It includes sub-sections for "Main parameters" (Orientation, Water needs, System, Detailed losses), "Optional" (Horizon, Near Shadings, Economic evaluation), and "Simulation" (Run Simulation, Advanced Simulation, Report, Detailed results).
- Results overview:** A table summarizing the system performance for a "Pumping PV System".

System kind	Pumping PV System
Water Pumped	12101 m ³ /year
Water needs	12145 m ³ /year
Missing Water	0.4 %
Energy At Pump	9026 kWh
Specific energy	0.75 kWh/m ³
System efficiency	55.4 %

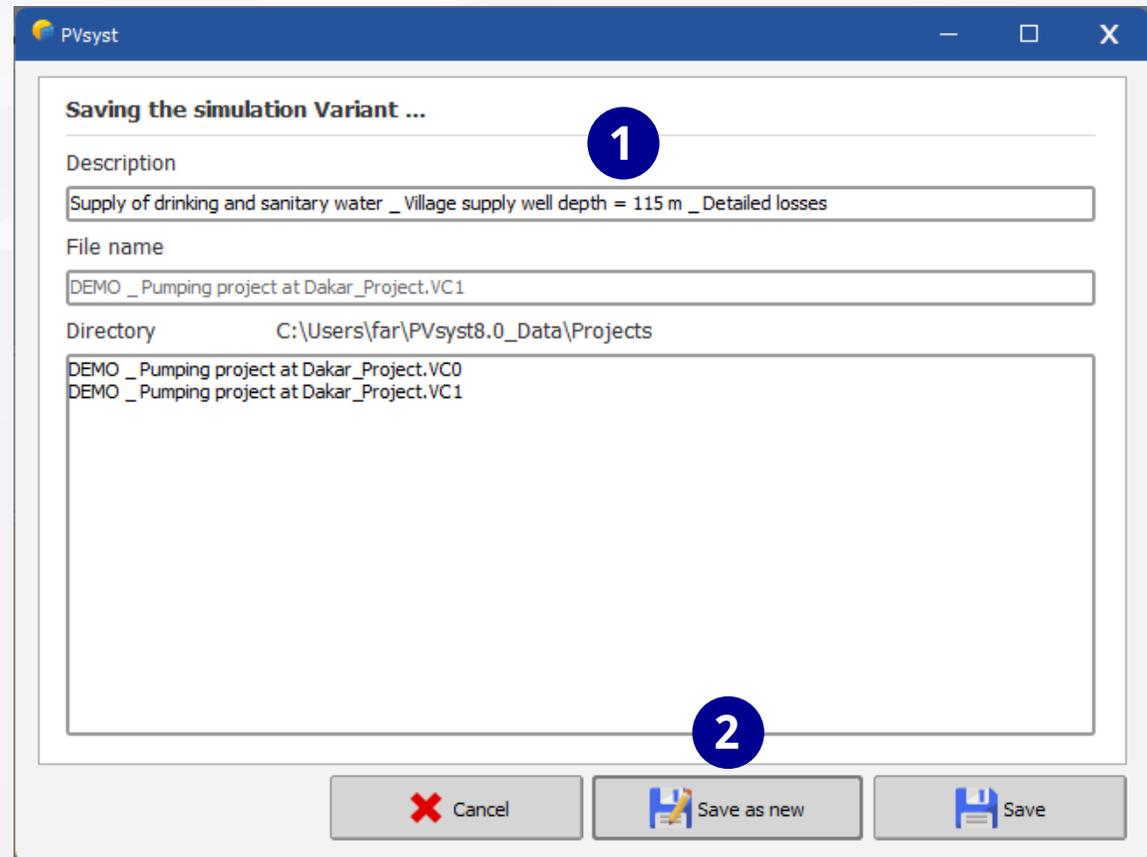
Chapter 3 : VC2 - Project Creation

1

Give a new name to the new variant:
«Supply of drinking and sanitary water _
Village supply well depth = 115 m _ Detailed
losses»

2

Click «Save as new» to create the new variant
using the previous parameters



Chapter 3 : VC2 - Orientation Definition (1)

1 Set the orientation

The screenshot shows the PVsyst software interface. The 'Project' section is at the top, with fields for 'Project's name' (DEMO : Pumping project at Dakar), 'Site File' (Terme Sud_MN82.SIT), and 'Weather data File' (Terme Sud_MN82_SYN.MET). Below this, a blue banner indicates 'Simulation done (version 8.0.19, date 14/01/26)'. The 'Variant' section is below, with a dropdown for 'Variant n°' set to 'VC2 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Detailed losses'. The 'Main parameters' section has 'Orientation' selected. The 'Optional' section has 'Horizon' and 'Near Shadings' selected. The 'Simulation' section has 'Run Simulation' selected. The 'Results overview' table shows the following data:

System kind	Pumping PV System
Water Pumped	12101 m ³ /year
Water needs	12145 m ³ /year
Missing Water	0.4 %
Energy At Pump	9026 kWh
Specific energy	0.75 kWh/m ³
System efficiency	55.4 %

Chapter 3 : VC2 - Orientation Definition (2)

- 1 Choice between several possible configurations: select «Fixed tilted plane»
- 2 Set the field parameters: define the plane tilt at 36.1° and the azimuth at 0°
- 3 Click «OK»

The screenshot shows the 'Orientations management' window with the following details:

- Title Bar:** Orientations management
- Info:** PVsyst 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!
- Buttons:** Add orientation, ?
- Orientation #1 - Fixed, Tilt 36.1°, Azim. 0.0°** (Status: OK)
- Field type:** Fixed Tilted Plane
- Name:** Fixed, Tilt 36.1°, Azim. 0.0°
- Module area:** System: 65 m², 40 modules; 3D scene: 0 m², 0 modules
- Field parameters:** Plane tilt: 36.1°, Azimuth: 0.0°, Base tilt angle: 0.0°
- Diagrams:** A 3D diagram shows a plane tilted at 36.1°. A 2D diagram shows the azimuth at 0° relative to a West-East axis.
- Quick optimization (acc. to clear-sky model):** Optimization with respect to: Annual yield, Summer (Apr-Sep), Winter (Oct-Mar) (selected).
- Winter incident irradiation:** Transposition Factor FT: 1.16, Loss with respect to optimum: 0.0%, Global on collector plane: 1042 kWh/m².
- Graphs:** Two graphs showing transposition factor vs. plane tilt and plane orientation. A tooltip indicates FT_{transpos.} = 1.16 and Loss/opt. = 0.0%.
- Buttons:** Cancel, OK

Chapter 3 : VC2 - Water Needs

1 Define the «Water Needs»

Project: DEMO _ Pumping project at Dakar _ Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO : Pumping project at Dakar Client name: Not defined

Site File: Terme Sud_MN82.SIT Meteoronorm 8.2 (2010-2021), Sat=100% Senegal

Weather data File: Terme Sud_MN82_SYN.MET Meteoronorm 8.2 (2010-2021), Sat=100% Synthetic 0

Ready for simulation

Variant

Variant n°: VC2 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Detailed losses

Main parameters:

- Orientation *
- Water needs
- System
- Detailed losses

Optional:

- Horizon
- Near Shadings
- Economic evaluation

Simulation:

- Run Simulation**
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Pumping PV System
Water Pumped	0 m ³ /year
Water needs	0 m ³ /year
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

Exit

1

Chapter 3 : VC2 - Define the Water Needs

1 Choice between several possible configurations:
select «Yearly average»

2 Define the annual needs:
40.0 m³/day

3 Click «OK»

Water Needs and Hydraulic Head / Pressure, Variant: "Supply of drinking and sanitary water _ Village supply well depth = 115 m ...

Comment: New User's needs

Pumping Hydraulic Circuit: Water needs and Head definitions

Water needs

- Yearly Average
- Seasonal values
- Monthly values

Whole Year needs: 40.0 m³/day

Well static depth variations

- Yearly constant
- Seasonal values
- Monthly values

Whole Year: 100.0 meterW

Additional heads

Feeding altitude	8 m	
Dynamic heads	5.0 meterW	
(at flowrate = 8.0 m ³ /h)	Drawdown	6.4 meterW

Hydraulic units

Flowrate: m³/h

Pressure: meterW

Yearly summary

Water needs average	40.0 m ³ /day
Yearly water needs	14600 m ³
Yearly Head average	108 meterW
Hydraulic Energy	4297 kWh
PV needs (very roughly)	14511 kWh

Model File

Load Save Cancel OK

Chapter 3 : VC2 - Detailed Losses

1

Define the «Detailed Losses»

Projet : DEMO _ Pumping project at Dakar_Project.PRJ

Projet Site Variante Mémo utilisateur

Projet

Nom du projet: DEMO : Pumping project at Dakar DEMO

Nom du client: Non défini

Fichier site: Terme Sud_MN82.SIT

Fichier Météo: Dakar_MN82_SYN.MET

Prêt pour la simulation

Variante

N° de Variante: VC2 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Detailed losses

Paramètres principaux

- Orientation *
- Besoins d'eau
- Système
- Pertes détaillées

Optionnel

- Horizon
- Ombrages proches
- Evaluation économique

Simulation

- Lancer la simulation
- Simulation avancée
- Rapport
- Résultats détaillés

Résultats principaux

Type de système	Système de pompage PV
Eau pompée	0 m³/an
Besoins d'eau	0 m³/an
Eau manquante	0 %
Energie à la pompe	0 kWh
Energie spécifique	0 kWh/m³
Efficacité système	0 %

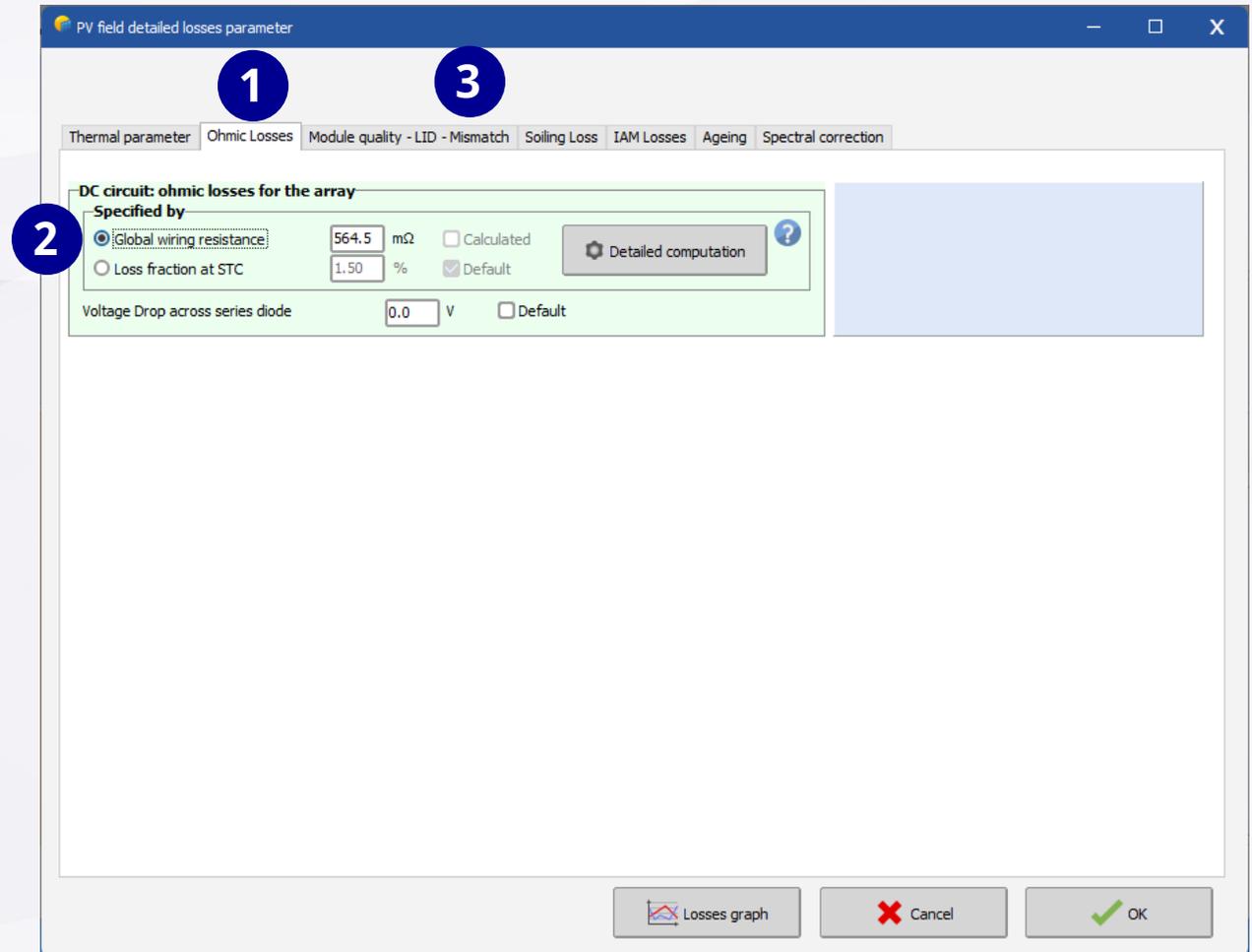
Sortir

Chapter 3 : VC2 - Detailed Losses (1)

1 Open the «Ohmic Losses» window

2 Select: «Global wiring resistance»
Then leave the value as it is.

3 Click on:
«Module quality - LID - Mismatch»

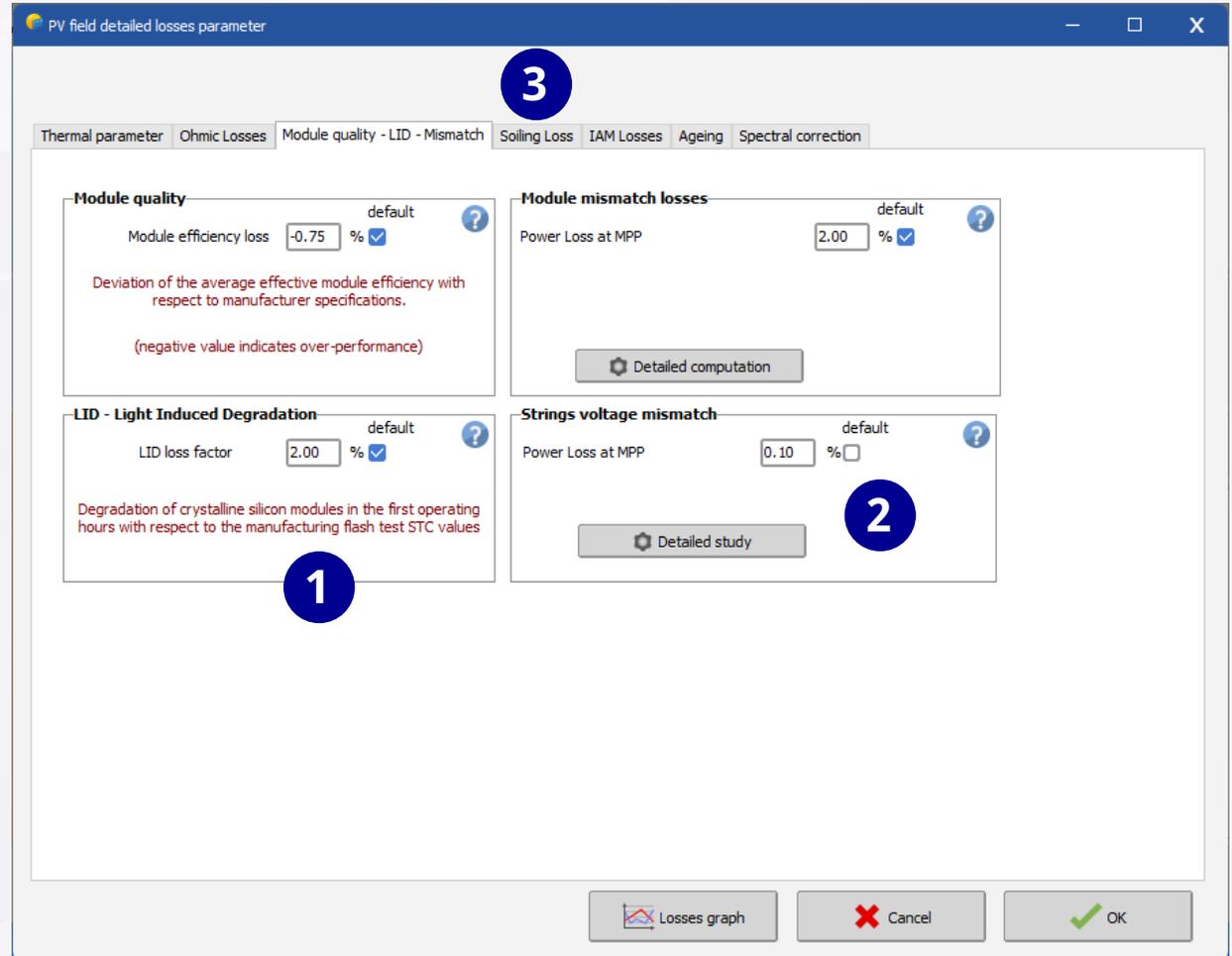


Chapter 3 : VC2 - Detailed Losses (2)

1 Set «LID loss factor»:
2.0%

2 Set «Power loss at MPP»:
0.10%

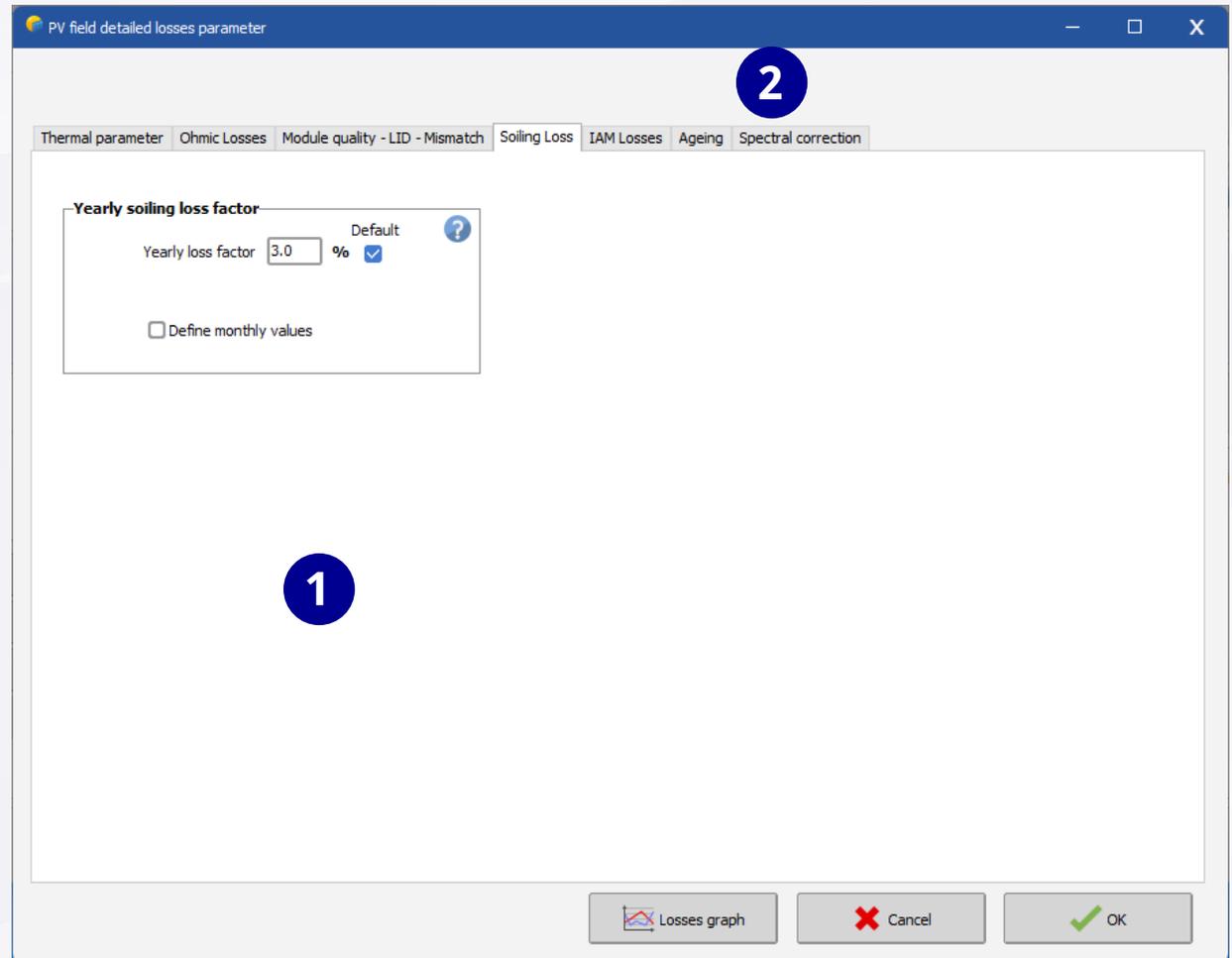
3 Click on:
«Soiling loss»



Chapter 3 : VC2 - Detailed Losses (3)

1 Set «Annual loss factor»:
3.0%

2 Click on:
«Aging»



Chapter 3 : VC2 - Detailed Losses (4)

1 Set «Parameters in the simulation»:

Simulation for year no : 10
 Individual PV modules : 3.90%
 (Global degradation factor)
 Mismatch degradation factor : 1.32%

2 Set «PV module aging parameters»:

Average degradation factor : 0.40%
 Imp/Vmp contribution : 50 - 50

3 Check the box: «Keep calculated mismatch values»

4 Set «Module warranty»:

Year 0 - Warranty: 98.0% Pnom
 Year 10 - Warranty: 91.0% Linear interpolation
 Year 20 - Warranty: 84.0%
 Year 25 - Warranty: 80.0% Pnom

5 Click on: «Spectral correction»

Chapter 3 : VC2 - Detailed Losses (5)

1 Check the box:
«Use spectral correction in the simulation»

2 Click «OK»

PV field detailed losses parameter

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

Use spectral correction in simulation

FirstSolar model

According to PV module technology

C0: 0.8591400 Coefficient Set Monocrystalline Si Default

C1: -0.0208800

C2: -0.0058853

C3: 0.1202900

C4: 0.0268140

C5: -0.0017810

Weather data input Relative humidity is available in the weather data variables. It will be used to estimate the precipitable water column

PV modules PV module model: Mono 250 Wp 60 cells

NB: This model has been proposed by First Solar. It is mainly applicable for the CdTe technology.

PVsyst doesn't accept any liability about its results for other technologies.
We consider that the spectral dependency of crystalline and CIS technologies is extremely low, and doesn't necessitate a correction.

Losses graph Cancel OK

2

Chapter 3 : VC2 - Run the Simulation

1

Click on: «Run simulation»

The screenshot shows the PVsyst software interface for a project named "DEMO : Pumping project at Dakar_Project-PRJ". The interface is divided into several sections:

- Project Section:** Contains fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Terme Sud_MN82.SIT), and "Weather data File" (Terme Sud_MN82_SYN.MET). A "Ready for simulation" status bar is visible below this section.
- Variant Section:** Contains a "Variant n°" dropdown menu set to "VC2 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Detailed losses".
- Main parameters:** Includes "Orientation", "Water needs", "System" (marked with an asterisk), and "Detailed losses".
- Optional:** Includes "Horizon", "Near Shadings", and "Economic evaluation".
- Simulation Section:** Contains a "Run Simulation" button, which is highlighted with a blue circle and the number 1. Other options include "Advanced Simulation", "Report", and "Detailed results".
- Results overview:** A table showing simulation results for a "Pumping PV System".

System kind	Pumping PV System
Water Pumped	0 m ³
Water needs	0 m ³
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

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

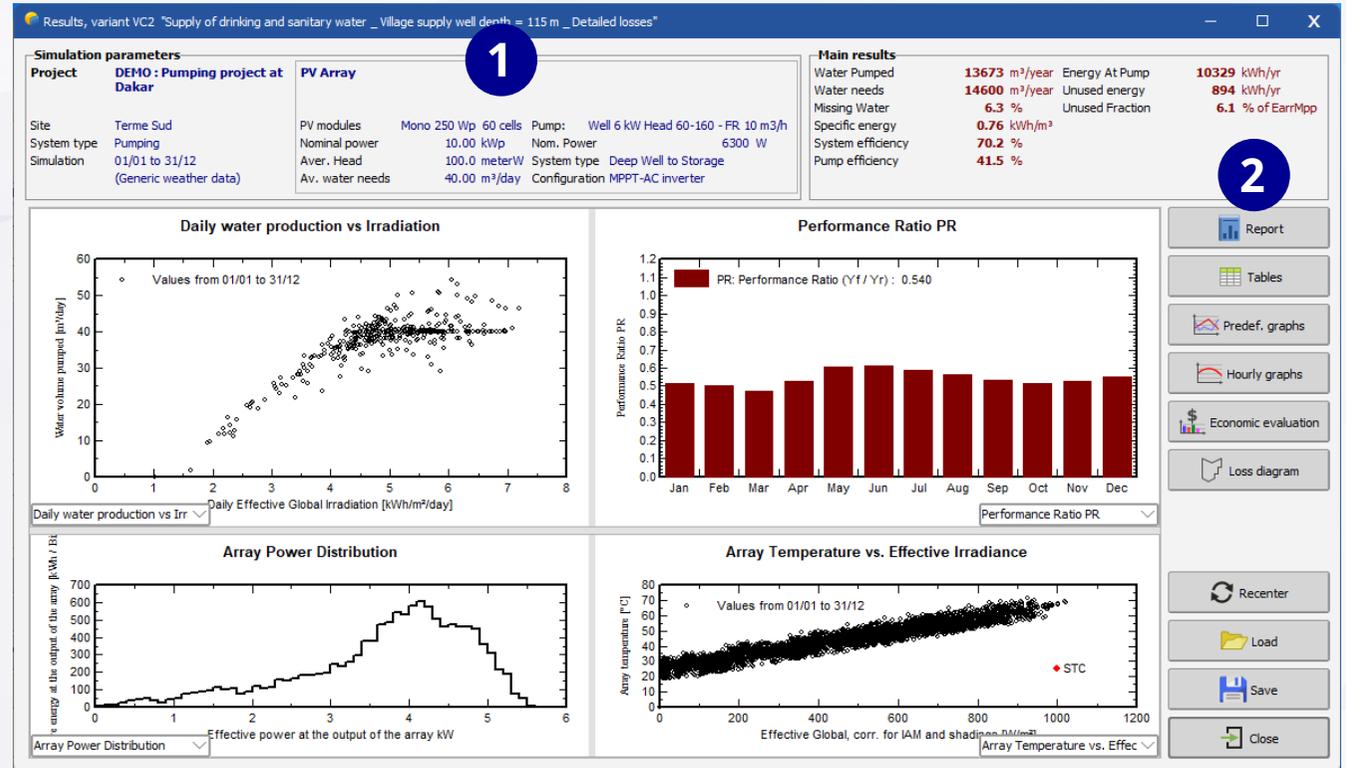
Chapter 3 : VC2 - Simulation Results

1

Main simulation results

2

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



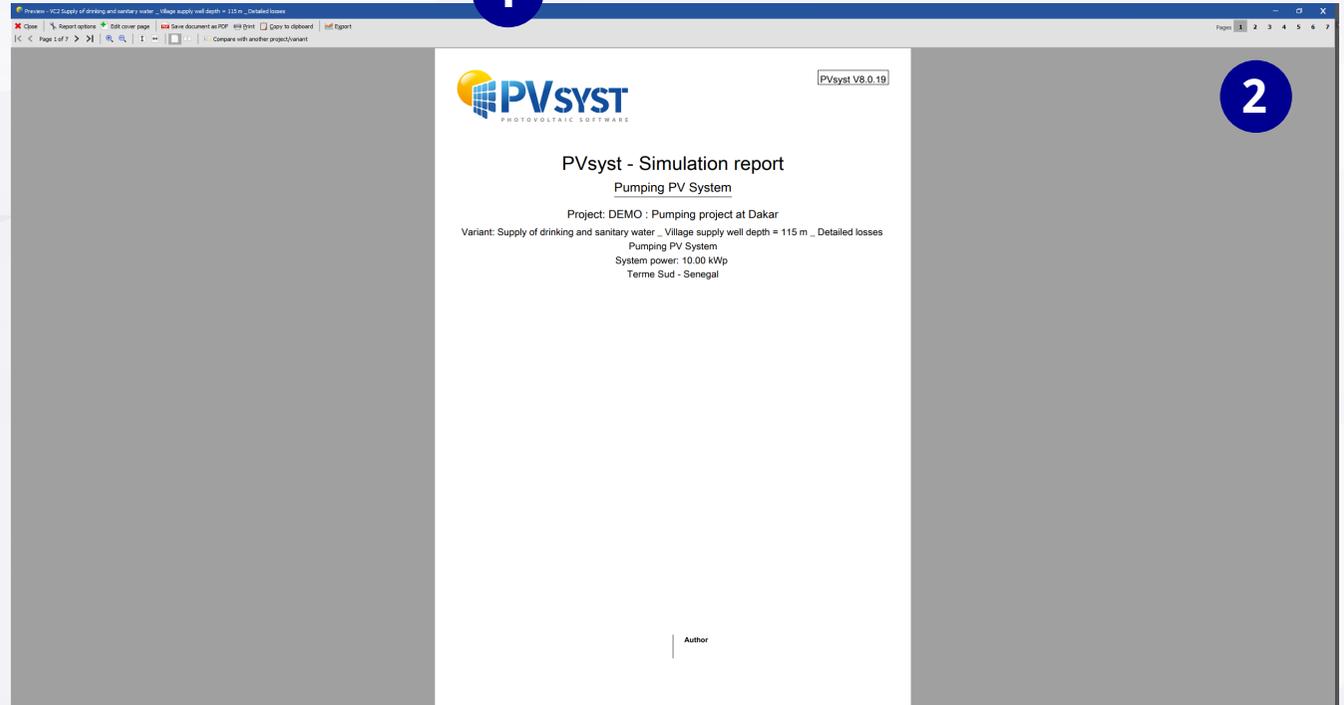
Chapter 3 : VC2 - Simulation Result_Report

1

Save the PDF or print it

2

View the different pages of the report



Chapter 4 : VC3 - Project Creation

1

Click on «Save» to create a new variant.

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

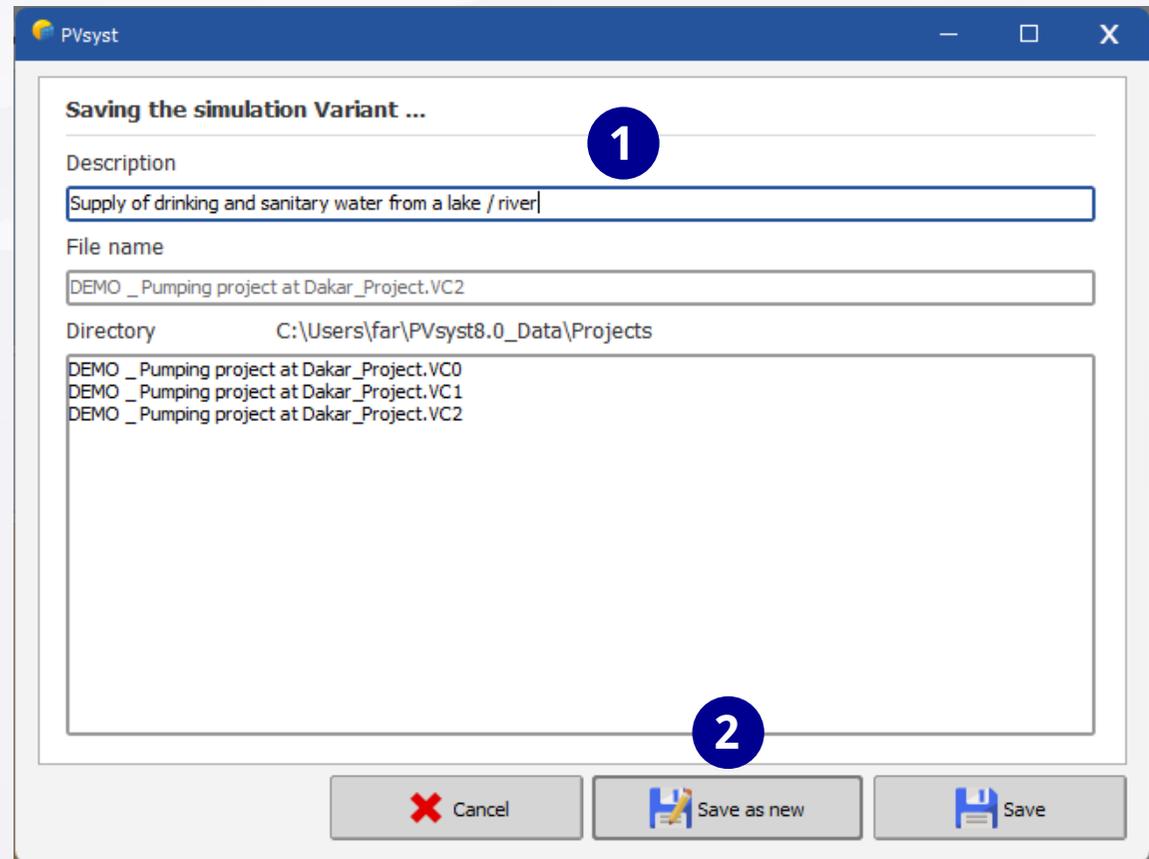
- Project Section:** Contains fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Terme Sud_MN82.SIT), and "Weather data File" (Terme Sud_MN82_SYN.MET). A toolbar includes options like New, Load, Save, Import, Export, Project settings, Delete, and Client.
- Simulation Status:** A blue banner indicates "Simulation done (version 8.0.19, date 15/01/26)".
- Variant Section:** Shows "Variant n°" as "VC2 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Detailed losses". It includes sub-sections for "Main parameters" (Orientation, Water needs, System, Detailed losses), "Optional" (Horizon, Near Shadings, Economic evaluation), and "Simulation" (Run Simulation, Advanced Simulation, Report, Detailed results).
- Results overview:** A table summarizing key performance indicators for the "Pumping PV System".

System kind	Pumping PV System
Water Pumped	13673 m ³ /year
Water needs	14600 m ³ /year
Missing Water	6.3 %
Energy At Pump	10329 kWh
Specific energy	0.76 kWh/m ³
System efficiency	70.2 %

Chapter 4 : VC3 - Project Creation

1 Give a new name to the new variant:
«Supply of drinking and sanitary water from
a lake / river»

2 Click «Save as new» to create the new variant
using the previous parameters



Chapter 4 : VC3 - Water Needs

1 Define the water needs

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

- Project Section:** Contains fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Terme Sud_MNB2.SIT), and "Weather data File" (Terme Sud_MNB2_SYN.MET). It also shows weather data details: "Meteonorm 8.2 (2010-2021), Sat=100% Senegal".
- Simulation Status:** A blue banner indicates "Simulation done (version 8.0.19, date 15/01/26)".
- Variant Section:** Shows "Variant n°" as "VC3 : Supply of drinking and sanitary water from a lake / river". It includes a "Main parameters" panel with radio buttons for "Orientation", "Water needs", "System", and "Detailed losses". An "Optional" panel includes "Horizon", "Near Shadings", and "Economic evaluation". A "Simulation" panel contains buttons for "Run Simulation", "Advanced Simulation", "Report", and "Detailed results".
- Results overview:** A table showing simulation results for a "Pumping PV System":

System kind	Pumping PV System
Water Pumped	13673 m ³ /year
Water needs	14600 m ³ /year
Missing Water	6.3 %
Energy At Pump	10329 kWh
Specific energy	0.76 kWh/m ³
System efficiency	70.2 %
- Exit Button:** A button labeled "Exit" is located at the bottom right of the interface.

Chapter 4 : VC3 - Water Needs

- 1 Select the system type: «Lake or river to tank»
- 2 Define the lake or river characteristics:
Water level : -4.0 m
Pump level : -23.0 m
- 3 Define the tank characteristics:
Volume : 8.0 m³
- 4 Define the hydraulic circuit:
Pipe length : 80 m
Number of bends : 5
- 5 Click on:
«Definition of water needs and pressure»

Water Needs and Hydraulic Head / Pressure, Variant: "Supply of drinking and sanitary water from a lake / river"

Comment: New User's needs

Pumping Hydraulic Circuit: Water needs and Head definitions

Pumping System Type: Lake or River to Storage

Lake or River characteristics

- Water level: -4.0 m (with respect to ground level)
- Pump level: -23.0 m (cannot be higher than 4-5 meters above the lake level)

Storage tank

- Volume: 8.0 m³
- Diameter: 1.40 m
- Water full height: 5.20 m
- Feeding altitude: 8.00 m
- Bottom alimentation

Hydraulic circuit

- Pipe choice: PE50 (2")
- Customized pipe
- Piping length: 80 m
- Number of elbows: 5
- Other friction losses: 0.00

The pipes diameter is strongly undersized (38.6% loss with respect to static head)

head [m] vs flowrate [m³/h] graph showing Total with friction loss (green line) and Altitude diff. Injection - static (blue line).

Model File: Load, Save, Cancel, OK

Chapter 4 : VC3 - Water Needs

1

Select the water needs:

Check «Annual average»
Set 8.0 m³/day

2

Define the lake or river level variations:

Check «Constant over the year»
Set 4.0 mWC

3

Click «OK»

Water Needs and Hydraulic Head / Pressure, Variant: "Supply of drinking and sanitary water from a lake / river"

Comment: New User's needs

Pumping Hydraulic Circuit | Water needs and Head definitions

Water needs

Yearly Average
 Seasonal values
 Monthly values

Whole Year needs: 8.0 m³/day

Hydraulic units

Flowrate: m³/h
Pressure: meterW

Yearly summary

Water needs average	8.00 m ³ /day
Yearly water needs	2920 m ³
Yearly Head average	4.00 meterW
Hydraulic Energy	32 kWh
PV needs (very roughly)	107 kWh

Lake/river water level variations

Yearly constant
 Seasonal values
 Monthly values

Whole Year: 4.0 meterW

Additional heads

Feeding altitude: 8 m
Dynamic heads (at flowrate = 1.6 m³/h): 0.1 meterW

Model File

Load Save Cancel OK

Chapter 4 : VC3 - System

1 Define the system

Project: DEMO _ Pumping project at Dakar_Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO : Pumping project at Dakar Client name: Not defined

Site File: Terme Sud_MNB2.SIT Meteororm 8.2 (2010-2021), Sat=100% Senegal

Weather data File: Terme Sud_MNB2_SYN.MET Meteororm 8.2 (2010-2021), Sat=100% Synthetic 0

System definition:
The Pump minimum head is over the maximum static pressure needs.

Variant

Variant n°: VC3 : Supply of drinking and sanitary water from a lake / river

Main parameters:

- Orientation *
- Water needs
- System
- Detailed losses

Optional:

- Horizon
- Near Shadings
- Economic evaluation

Simulation:

- Run Simulation
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Pumping PV System
Water Pumped	0 m ³ /year
Water needs	0 m ³ /year
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

Exit

Chapter 4 : VC3 - System (1)

- 1 Pump model selection:
 Select : «Lorentz»
 Select model : «320W / 1-40m...»
- 2 Check only «Pumps in parallel» and set «1».
- 3 Set the following values:
 Flow rate : 1.2 m³/h
 Pressure : 4.1 mWC
 Power : 0.013 kW
- 4 Click on «Sub-array design»

The screenshot shows the 'Pumping system definition' window with the following details:

Pre-sizing suggestions:

- Average daily needs :
 - Head min. : 4.0 meterW
 - Head max. : 4.1 meterW
 - Volume : 8.0 m³/day
 - Hydraulic power : 18 W (very approximative)
- Requested autonomy : 4.0 Days
- Accepted missing : 5.0 %
- Suggested tank volume : 32 m³
- Suggested Pump power : 40 W
- Suggested PV power : 50 Wp (nom.)

Pump definition / Sub-array design:

Select a pump model: Lorentz (320 W, 1-40 m, Well, DC, Progressive cavity, PS20-HR-07 - MPPT)

Pumps configuration: 1 Pumps in parallel (checked), 1 Pumps in series (unchecked)

Pump characteristics:

	Progressive cavity		
	DC motor, brushless		
Maximal power	320 W	Voltage	48 V
		Max. current	5.6 A
Head Min / Nom / Max	1	30	40 meterW
Corresp. Flowrate	1.2	1.2	1.2 m ³ /h
Corresp. Power	170	270	300 W
Efficiency	2.0	36.5	42.2 %

Units for this project: Flowrate (m³/h), Head (meterW), Power (kW), Energy (kWh)

Hydro Energy calculation tool: Flowrate (1.2 m³/h), Head (4.1 meterW), Power (0.013 kW)

Warning: The DC-AC inverter is of course designed for driving an AC-motor pump !

Chapter 4 : VC3 - System (2)

- 1 Check «Desired Pnom»
Set «0.1» kWp
- 2 Set the «Control mode»
Select «MPPT-DC converter»
- 3 Click «OK»

Pumping system definition, Variant: "Supply of drinking and sanitary water from a lake / river"

Pre-sizing suggestions

Average daily needs :		Requested autonomy	4.0	Days	Suggested tank volume	32 m ³
Head min.	4.0 meterW	Accepted missing	5.0	%	Suggested Pump power	40 W
Head max.	4.1 meterW				Suggested PV power	50 Wp (nom.)
Volume	8.0 m ³ /day					
Hydraulic power	18 W (very approximative)					

Pump definition | Sub-array design

System information

Chosen pump	PS20-HR-07 - MPPT	Head	1.0 - 40.0 meterW
Technology	Progressive cavity	Flowrate	1.22 - 1.16 m ³ /h
Max. power	320 W		

Pre-sizing Help

No sizing Planned power kWp
 or available area m²

Reshape

Select the PV module

Available Now

Generic

250 Wp 26V Si-mono Mono 250 Wp 60 cells Since 2015

Approx. needed modules: 0 Sizing voltages : Vmpp (60°C) 26.2 V
Voc (-10°C) 41.7 V

Select the control mode and the controller

Universal controller control mode: MPPT-DC converter

All manufacturers

1000 W MPPT-DC converter Universal MPPT - DC Converter Generic device Adaptabl

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

PV Array design

Number of modules and strings

Mod. in series: 1 should be: only possibility 1

2 only possibility 1

nb. modules: 2 Area: 3 m²

Operating conditions

Vmpp (60°C)	26 V
Vmpp (20°C)	31 V
Voc (-10°C)	42 V

Plane irradiance: 1000 kWh/m²

Impp	16.4 A	Max. operating power	0.4 kW
Isc	17.3 A	(at 1000 W/m ² and 50°C)	
Isc (at STC)	17.3 A	Array nom. Power (STC)	0.5 kWp

The Pump flowrate is slightly undersized with respect to the water needs.

Cancel OK

Chapter 4 : VC3 - Detailed Losses

1 Click on «Detailed losses»

Project: DEMO _ Pumping project at Dakar_Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO : Pumping project at Dakar Client name: Not defined

Site File: Terme Sud_MNB2.SIT Meteoronorm 8.2 (2010-2021), Sat=100% Senegal

Weather data File: Terme Sud_MNB2_SYN.MET Meteoronorm 8.2 (2010-2021), Sat=100% Synthetic 0 |

Ready for simulation

Variant

Variant n°: VC3 : Supply of drinking and sanitary water from a lake / river

Main parameters

- Orientation *
- Water needs
- System *
- Detailed losses

Optional

- Horizon
- Near Shadings
- Economic evaluation

Simulation

-
-
-
-

Results overview

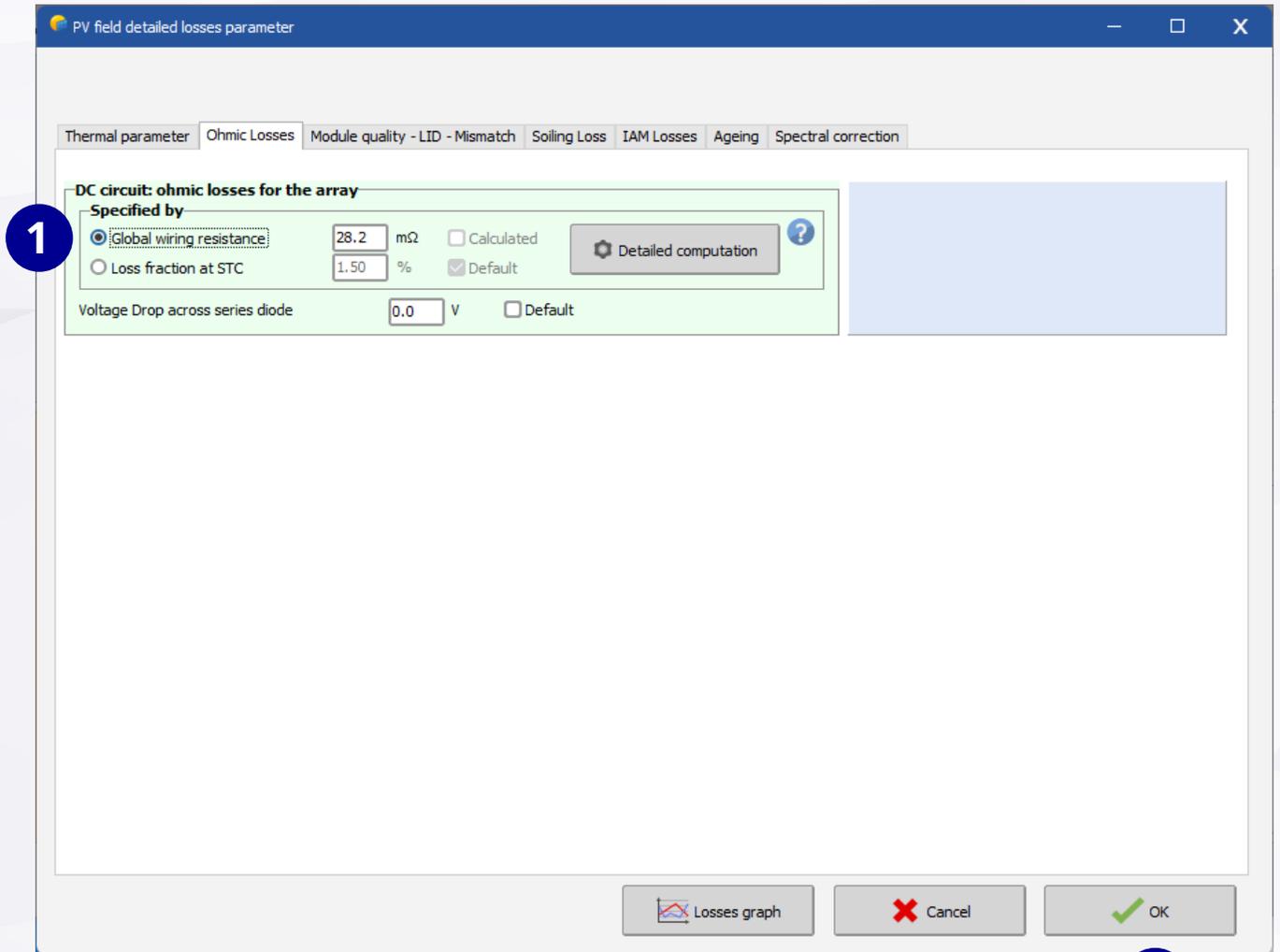
System kind	Pumping PV System
Water Pumped	0 m ³ /year
Water needs	0 m ³ /year
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

Exit

Chapter 4 : VC3 - Detailed Losses

1 In the «Ohmic losses» window, Select «Global wiring resistance»

2 Click «OK»



Chapter 4 : VC3 - Run the Simulation

1

Click on: «Run simulation»

The screenshot shows the PVsyst software interface for a project named "DEMO : Pumping project at Dakar". The interface is divided into several sections:

- Project:** Contains fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Terme Sud_MN82.SIT), and "Weather data File" (Terme Sud_MN82_SYN.MET). A "Ready for simulation" status bar is visible below this section.
- Variant:** Contains a dropdown for "Variant n°" (VC3 : Supply of drinking and sanitary water from a lake / river). It has three sub-sections:
 - Main parameters:** Includes "Orientation" (selected), "Water needs" (selected), "System" (selected), and "Detailed losses" (selected).
 - Optional:** Includes "Horizon" (selected), "Near Shadings" (selected), and "Economic evaluation" (selected).
 - Simulation:** Contains a "Run Simulation" button (highlighted with a blue circle and the number 1), "Advanced Simulation", "Report", and "Detailed results".
- Results overview:** A table showing simulation results for a "Pumping PV System":

System kind	Pumping PV System
Water Pumped	0 m³/year
Water needs	0 m³/year
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m³
System efficiency	0 %

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

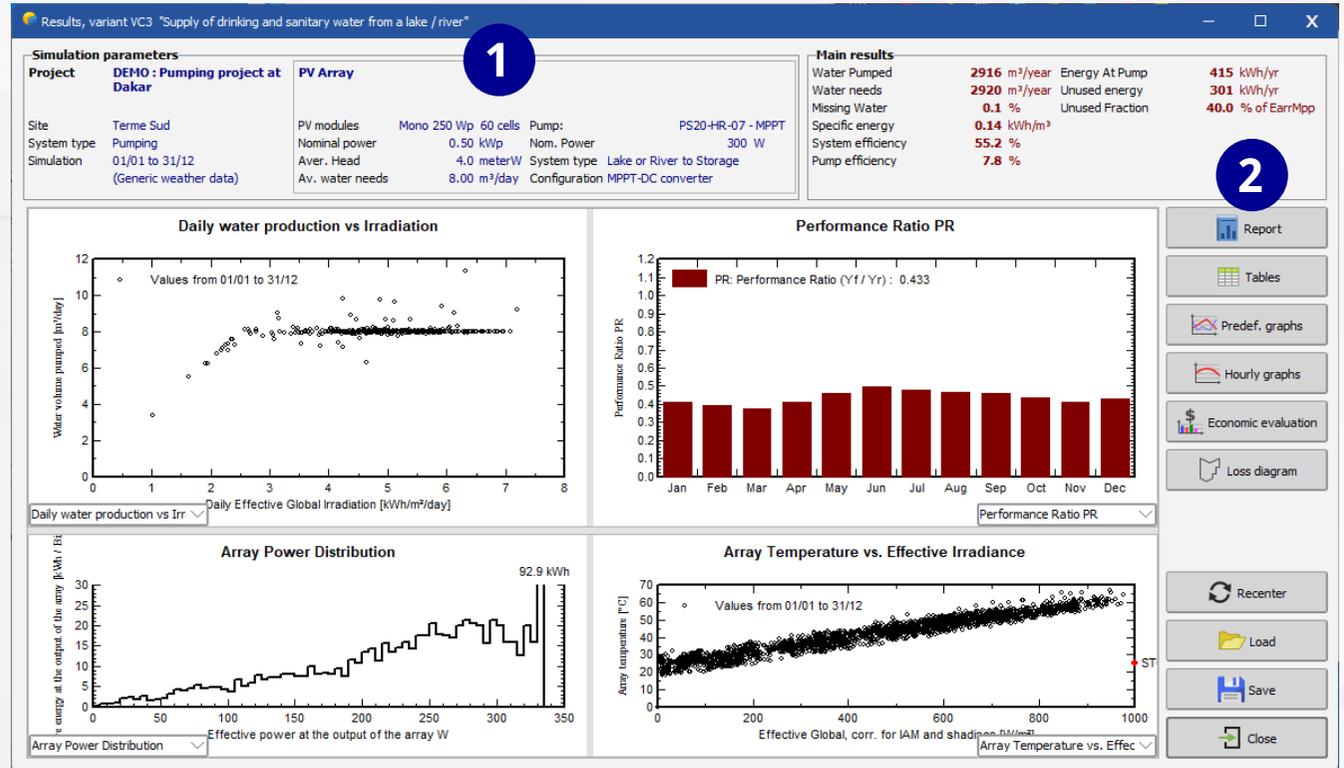
Chapter 4 : VC3 - Simulation Results

1

Main simulation results

2

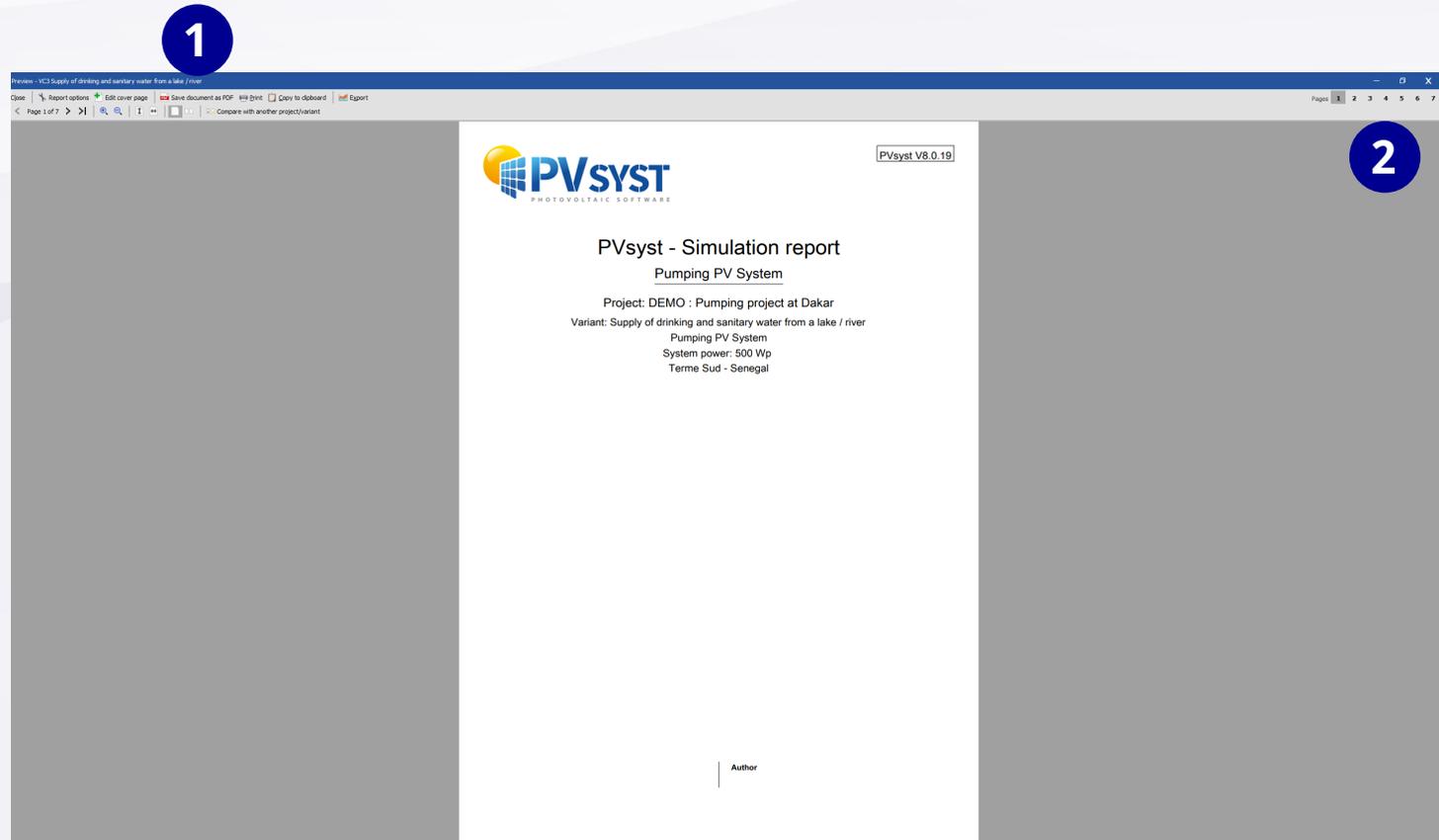
Click on «Report» to generate and view the simulation results report



Chapter 4 : VC3 - Simulation Result_Report

1 Save the PDF or print it

2 View the different pages of the report



Chapter 5 : VC4 - Project Creation

1

Click on «Save» to create a new variant.

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

- Project Section:** Contains fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Terme Sud_MN82.SIT), and "Weather data File" (Terme Sud_MN82_SYN.MET). It also shows weather data details: "Meteonorm 8.2 (2010-2021), Sat=100%" and "Senegal".
- Simulation Status:** A blue banner indicates "Simulation done (version 8.0.19, date 15/01/26)".
- Variant Section:** Shows "Variant n°" as "VC3 : Supply of drinking and sanitary water from a lake / river".
- Main parameters:** Includes "Orientation", "Water needs", "System", and "Detailed losses".
- Optional:** Includes "Horizon", "Near Shadings", and "Economic evaluation".
- Simulation:** Features buttons for "Run Simulation", "Advanced Simulation", "Report", and "Detailed results".
- Results overview:** A table showing simulation results for a "Pumping PV System":

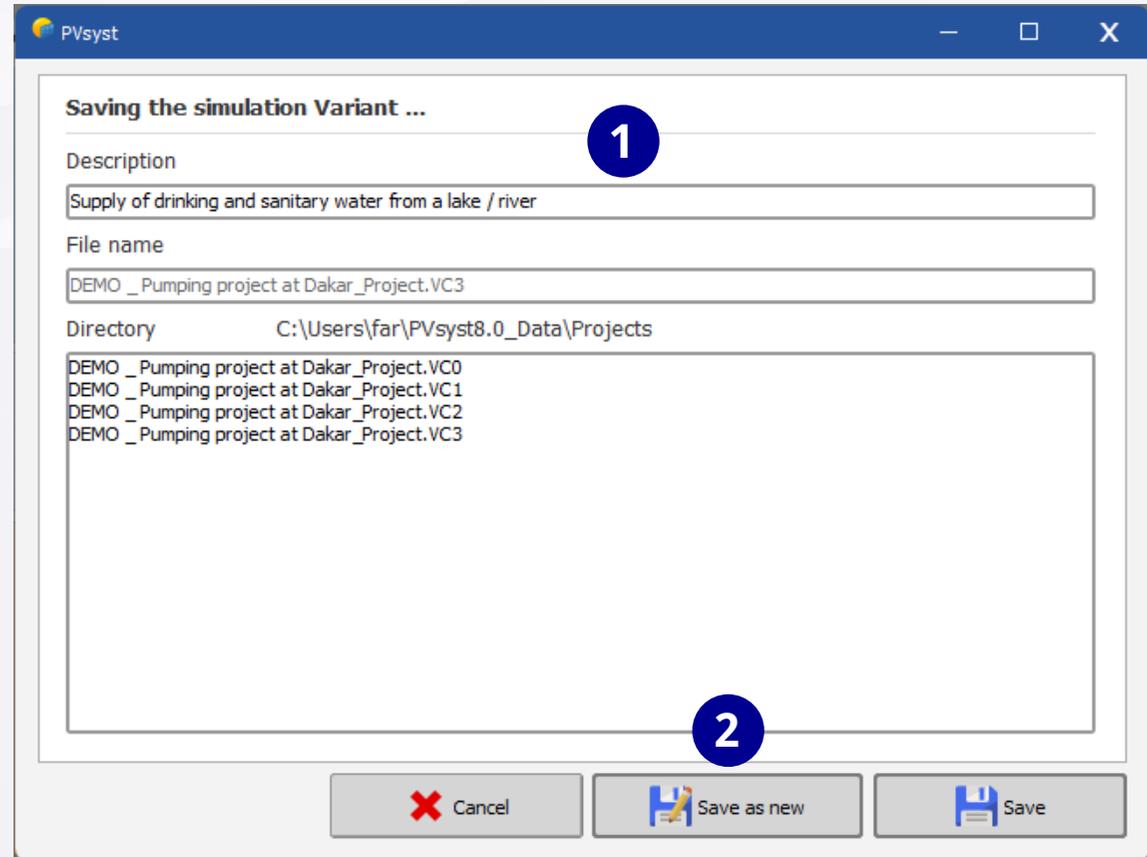
System kind	Pumping PV System
Water Pumped	2916 m ³ /year
Water needs	2920 m ³ /year
Missing Water	0.1 %
Energy At Pump	415 kWh
Specific energy	0.14 kWh/m ³
System efficiency	55.2 %

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

Chapter 5 : VC4 - Project Creation

1 Give a new name to the new variant:
«Supply of drinking and sanitary water _ Vil-
lage supply well depth = 115 m _ Basic Econo-
mic evaluation»

2 Click «Save as new» to create the new variant
using the previous parameters



Chapter 5 : VC4 - Orientation Definition (1)

1 Set the orientation

Project: DEMO _ Pumping project at Dakar _ Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO : Pumping project at Dakar Client name: Not defined

Site File: Terme Sud_MN82.SIT Meteororm 8.2 (2010-2021), Sat=100% Senegal

Weather data File: Terme Sud_MN82_SYN.MET Meteororm 8.2 (2010-2021), Sat=100% Synthetic 0 k

Simulation done (version 8.0.19, date 15/01/26)

Variant

Variant n°: VC4 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Basic Economic evaluation

Main parameters:

- Orientation
- Water needs
- System
- Detailed losses

Optional:

- Horizon
- Near Shadings
- Economic evaluation

Simulation:

- Run Simulation
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Pumping PV System
Water Pumped	2916 m ³ /year
Water needs	2920 m ³ /year
Missing Water	0.1 %
Energy At Pump	415 kWh
Specific energy	0.14 kWh/m ³
System efficiency	55.2 %

Exit

Chapter 5 : VC4 - Orientation Definition (2)

- 1 Choice between several possible configurations: select «Fixed tilted plane»
- 2 Set the field parameters: define the plane tilt at 36.0° and the azimuth at 0°
- 3 Click «OK»

The screenshot shows the 'Orientations management' window with the following details:

- Orientation #1 - Fixed, Tilt 36.0° , Azim. 0.0°** (Status: OK)
- Field type:** Fixed Tilted Plane
- Name:** Fixed, Tilt 36.0° , Azim. 0.0°
- Field parameters:** Plane tilt: 36.0 , Azimuth: 0.0 , Base tilt angle: 0.0
- Module area:** System: 3 m^2 , 2 modules; 3D scene: 0 m^2 , 0 modules
- Quick optimization (acc. to clear-sky model):** Optimization with respect to: Winter (Oct-Mar) selected. Winter incident irradiation: Transposition Factor FT: 1.16, Loss with respect to optimum: 0.0%, Global on collector plane: 1042 kWh/m^2 .
- Diagrams:** A 3D diagram shows a plane tilted at 36.0° . A 2D diagram shows the azimuth at 0° relative to a West-East axis.
- Graphs:** Two graphs show the transposition factor and loss with respect to optimum versus plane tilt and orientation.

Chapter 5 : VC4 - Definition of Water Needs

1 Define the water needs

Project: DEMO _ Pumping project at Dakar _ Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO : Pumping project at Dakar Client name: Not defined

Site File: Terme Sud_MN82.SIT Meteororm 8.2 (2010-2021), Sat=100% Senegal

Weather data File: Terme Sud_MN82_SYN.MET Meteororm 8.2 (2010-2021), Sat=100% Synthetic 0 k

Ready for simulation

Variant

Variant n°: VC4 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Basic Economic evaluation

Main parameters:

- Orientation *
- Water needs
- System
- Detailed losses

Optional:

- Horizon
- Near Shadings
- Economic evaluation

Simulation:

- Run Simulation**
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Pumping PV System
Water Pumped	0 m ³ /year
Water needs	0 m ³ /year
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

Exit

1

Chapter 5 : VC4 - Water Needs (1)

1 Select the system type: «Deep Well to Storage»

2 Define the lake or river characteristics:

Static level : -100 m
 Drawdown level : -0.80 m/m³/h
 Maximum flow rate : 12.5 m³/h

3 Define the tank characteristics:

Volume : 50 m³
 Diameter : 3.50 m

4 Define the hydraulic circuit:

Pipe length : 280 m
 Number of bends : 7

5 Click on:
 «Definition of water needs and pressure»

Water Needs and Hydraulic Head / Pressure, Variant: "Supply of drinking and sanitary water _ Village supply well depth = 115 m ...

Comment: New User's needs

Pumping Hydraulic Circuit: Water needs and Head definitions

Pumping System Type: Deep Well to Storage

Well characteristics

Static level	-100.0 m
Specific drawdown	-0.80 m/m ³ /h
Max. flowrate	12.5 m ³ /h
Lower dynamic level	-110.0 m
Pump level	-115.0 m
Borehole diameter	20.0 cm

Storage tank

Volume	50.0 m ³
Diameter	3.50 m
Water full height	5.20 m
Feeding altitude	8.00 m
Bottom alimentation	<input type="checkbox"/>

Hydraulic circuit

Pipe choice: PE50 (2")

Customized pipe

Piping length	280 m
Number of elbows	7
Other friction losses	0.00

Model File

Load Save Cancel OK

Diagram

The diagram shows a cross-section of a well and a storage tank. The ground level is indicated. The well has a static level at -100 m and a maximum depth at -115 m. The storage tank has a feeding level at 8.00 m. The pumping level is shown at the well's static level. The drawdown limit is indicated by a red dashed line.

Graph

The graph plots head [m] on the y-axis (0 to 140) against flowrate [m³/h] on the x-axis (0.0 to 1.8). The curves shown are:

- Total with friction loss (green line)
- Altitude diff. Injection - static (blue line)
- Well drawdown (purple line)
- Drawdown limit (red dashed line)

Chapter 5 : VC4 - Water Needs (2)

1

Select the water needs:

Check «Annual average»
Set 40.0 m³/day

2

Define the lake or river level variations:

Check «Constant over the year»

Set 100 mWC

3

Click «OK»

Water Needs and Hydraulic Head / Pressure, Variant: "Supply of drinking and sanitary water _ Village supply well depth = 115 m ...

Comment: New User's needs

Pumping Hydraulic Circuit | Water needs and Head definitions

Water needs

Yearly Average
 Seasonal values
 Monthly values

Whole Year needs: 40.0 m³/day

Well static depth variations

Yearly constant
 Seasonal values
 Monthly values

Whole Year: 100.0 meterW

Additional heads

Feeding altitude	8 m
Dynamic heads (at flowrate = 8.0 m ³ /h)	5.0 meterW
Drawdown	6.4 meterW

Hydraulic units

Flowrate: m³/h
Pressure: meterW

Yearly summary

Water needs average	40.0 m ³ /day
Yearly water needs	14600 m ³
Yearly Head average	108 meterW
Hydraulic Energy	4297 kWh
PV needs (very roughly)	14511 kWh

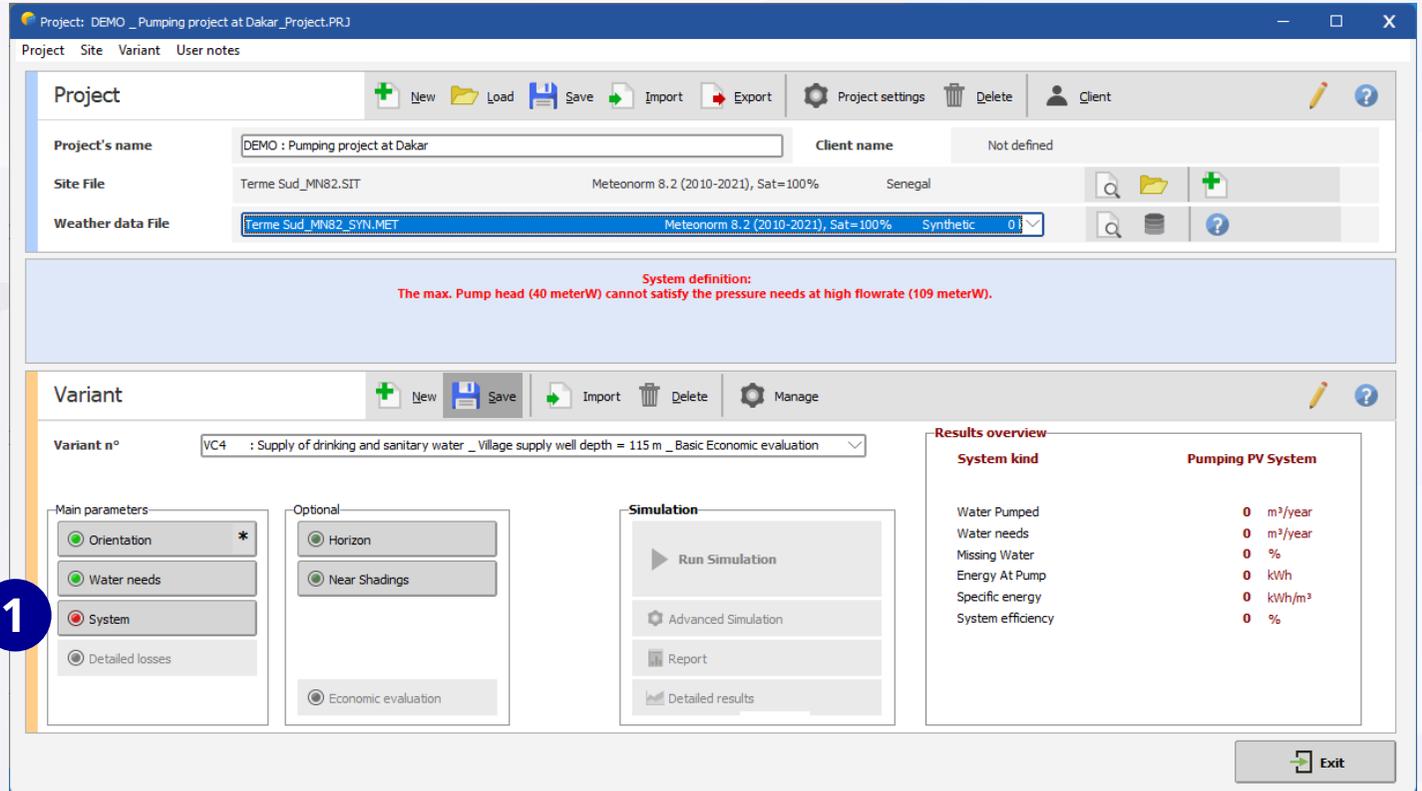
Model File

Load Save Cancel OK

3

Chapter 5 : VC4 - System Definition

1 Define the system



Project: DEMO _ Pumping project at Dakar _ Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO : Pumping project at Dakar Client name: Not defined

Site File: Terme Sud_MN82.SIT Meteororm 8.2 (2010-2021), Sat=100% Senegal

Weather data File: Terme Sud_MN82_SYN.MET Meteororm 8.2 (2010-2021), Sat=100% Synthetic 0

System definition:
The max. Pump head (40 meterW) cannot satisfy the pressure needs at high flowrate (109 meterW).

Variant

Variant n°: VC4 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Basic Economic evaluation

Main parameters:

- Orientation *
- Water needs
- System
- Detailed losses

Optional:

- Horizon
- Near Shadings
- Economic evaluation

Simulation:

- Run Simulation
- Advanced Simulation
- Report
- Detailed results

Results overview:

System kind	Pumping PV System
Water Pumped	0 m ³ /year
Water needs	0 m ³ /year
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

Exit

Chapter 5 : VC4 - System Definition (1)

1

Pump model selection:

Select : «_Generic»
Select model : «6.3kW / 60-160m...»

2

Set the following values:

Flow rate : 8.8 m³/h
Pressure : 121.0 mWC
Power : 2.904 kW

3

Click on «Sub-array design»

Pre-sizing suggestions

Average daily needs :

Head min.	108.0 meterW	Requested autonomy	4.0 Days	Suggested tank volume	160 m ³
Head max.	117.6 meterW	Accepted missing	5.0 %	Suggested Pump power	6.4 kW
Volume	40.0 m ³ /day			Suggested PV power	8.1 kWp (nom.)
Hydraulic power	2459 W (very approximative)				

Pump definition | Sub-array design

Select a pump model

_Generic

6.3 kW 60-160 m Well, AC, Centrifugal Multistage Well 6 kW Head 60-160 - FR 1 Since 2021

1 Pumps in series
1 Pumps in parallel

Pump characteristics

Pump Technology	Centrifugal Multistage		
Motor	AC motor, triphased		
Maximal power	6300 W	Voltage	700 V
		Max. current	9.0 A
Head Min / Nom / Max	60	100	160 meterW
Corresp. Flowrate	12.8	10.2	6.2 m ³ /h
Corresp. Power	6300	6300	6300 W
Efficiency	33.2	44.2	42.8 %

Units for this project

Flowrate	m ³ /h
Head	meterW
Power	kW
Energy	kWh

Hydro Energy calculation tool

You can type here any values, not necessarily related to your project

Flowrate	8.8 m ³ /h
Head	121.0 meterW
Power	2.902 kW

The DC-DC converter is of course designed for driving a DC-motor pump !

Cancel OK

Chapter 5 : VC4 - System Definition (2)

1 Check «No pre-dimensioning»

2 Set the number of modules and strings:

Modules in series : 20
Strings : 2

3 Click «OK»

Pre-sizing suggestions

Average daily needs :		Requested autonomy	4.0 Days	Suggested tank volume	160 m ³
Head min.	108.0 meterW	Accepted missing	5.0 %	Suggested Pump power	6.4 kW
Head max.	117.6 meterW			Suggested PV power	8.1 kWp (nom.)
Volume	40.0 m ³ /day				
Hydraulic power	2459 W (very approximative)				

Pump definition | Sub-array design

System information

Chosen pump	Well 6 kW Head 60-160 - FR 10	Head	60.0 - 160.0 meterW
Technology	Centrifugal Multistage	Flowrate	12.79 - 6.19 m ³ /h
Max. power	6300 W		

Pre-sizing Help

No sizing Planned power 6.3 kWp
 or available area 0 m²

Select the PV module

Available Now

Generic 250 Wp 26V Si-mono Mono 250 Wp 60 cells Since 2015

Approx. needed modules N/A Sizing voltages : Vmpp (60°C) 26.2 V
Voc (-10°C) 41.7 V

Select the control mode and the controller

Universal controller control mode MPPT-AC inverter

All manufacturers 1000 W MPPT-AC inverter Universal MPPT - AC Inverter Generic device Adaptabl

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

PV Array design

Number of modules and strings

Mod. in series 20 should be: only possibility 20

nb. modules 40 Area 65 m²

Operating conditions

Vmpp (60°C)	52.4 V	
Vmpp (20°C)	62.6 V	
Voc (-10°C)	83.3 V	
Plane irradiance	1000 kWh/m ²	
Imp	16.4 A	Max. operating power 9.0 kW
Isc	17.3 A	(at 1000 W/m ² and 50°C)
Isc (at STC)	17.3 A	Array nom. Power (STC) 10.0 kWp

Cancel OK

3

Chapter 5 : VC4 - Definition of Detailed Losses

1 Define the detailed losses

The screenshot shows the PVsyst software interface. The window title is "Project: DEMO _ Pumping project at Dakar _ Project.PRJ". The interface is divided into several sections:

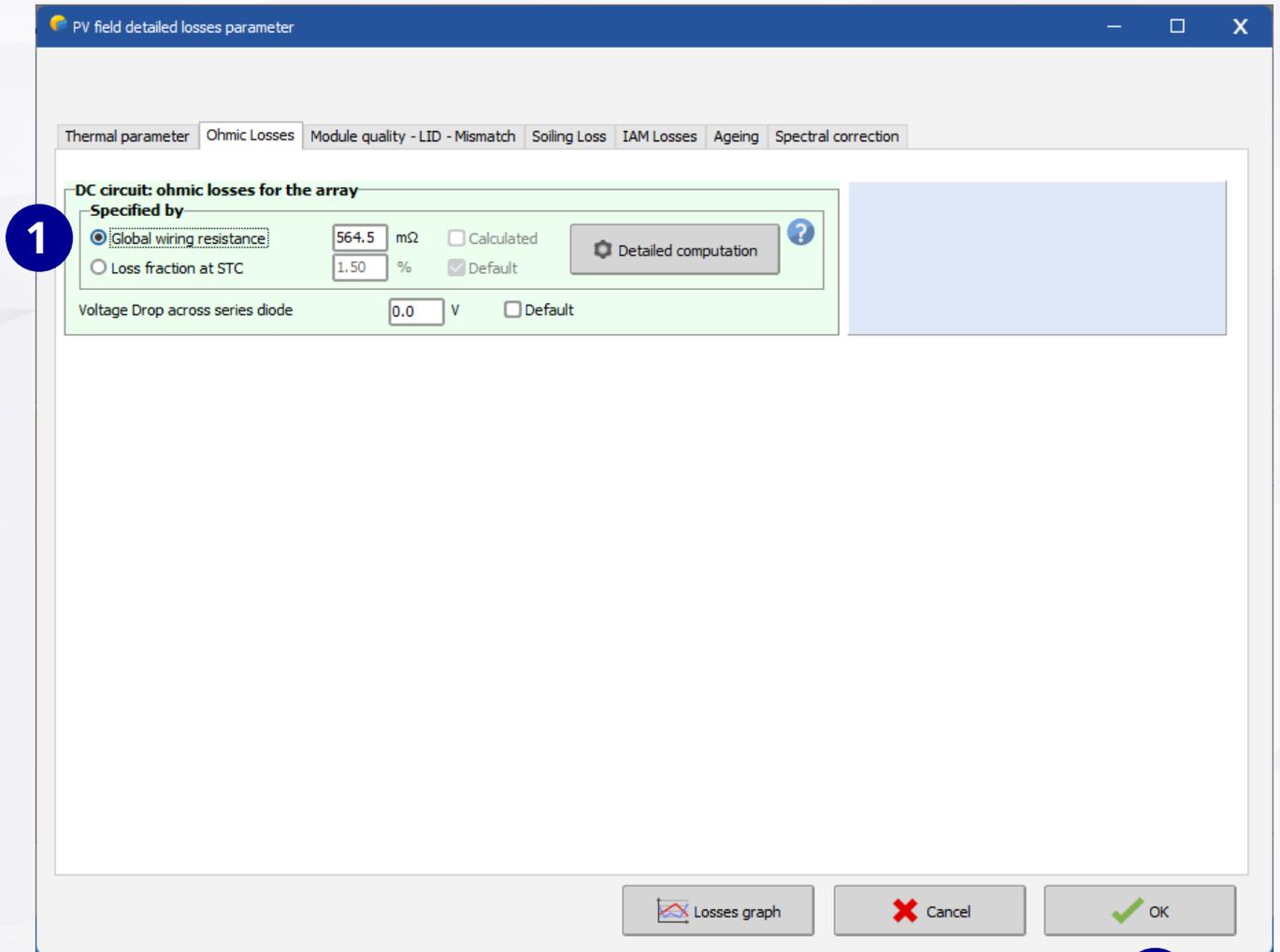
- Project Section:** Contains fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Terme Sud_MN82.SIT), and "Weather data File" (Terme Sud_MN82_SYN.MET). A "Ready for simulation" status bar is present below these fields.
- Variant Section:** Contains a dropdown for "Variant n°" (VC4 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Basic Economic evaluation). It has two sub-sections: "Main parameters" and "Optional".
- Main parameters:** A list of parameters with radio buttons and asterisks: Orientation, Water needs, System, and Detailed losses. The "Detailed losses" option is selected.
- Optional:** A list of optional parameters: Horizon, Near Shadings, and Economic evaluation.
- Simulation:** A section with buttons for "Run Simulation", "Advanced Simulation", "Report", and "Detailed results".
- Results overview:** A table showing simulation results for a "Pumping PV System".

System kind	Pumping PV System
Water Pumped	0 m ³ /year
Water needs	0 m ³ /year
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

Chapter 5 : VC4 - Detailed Losses

1 In the «Ohmic losses» window, Select «Global wiring resistance»

2 Click «OK»



Chapter 5 : VC4 - Run the Simulation

1 Click on «Run simulation»

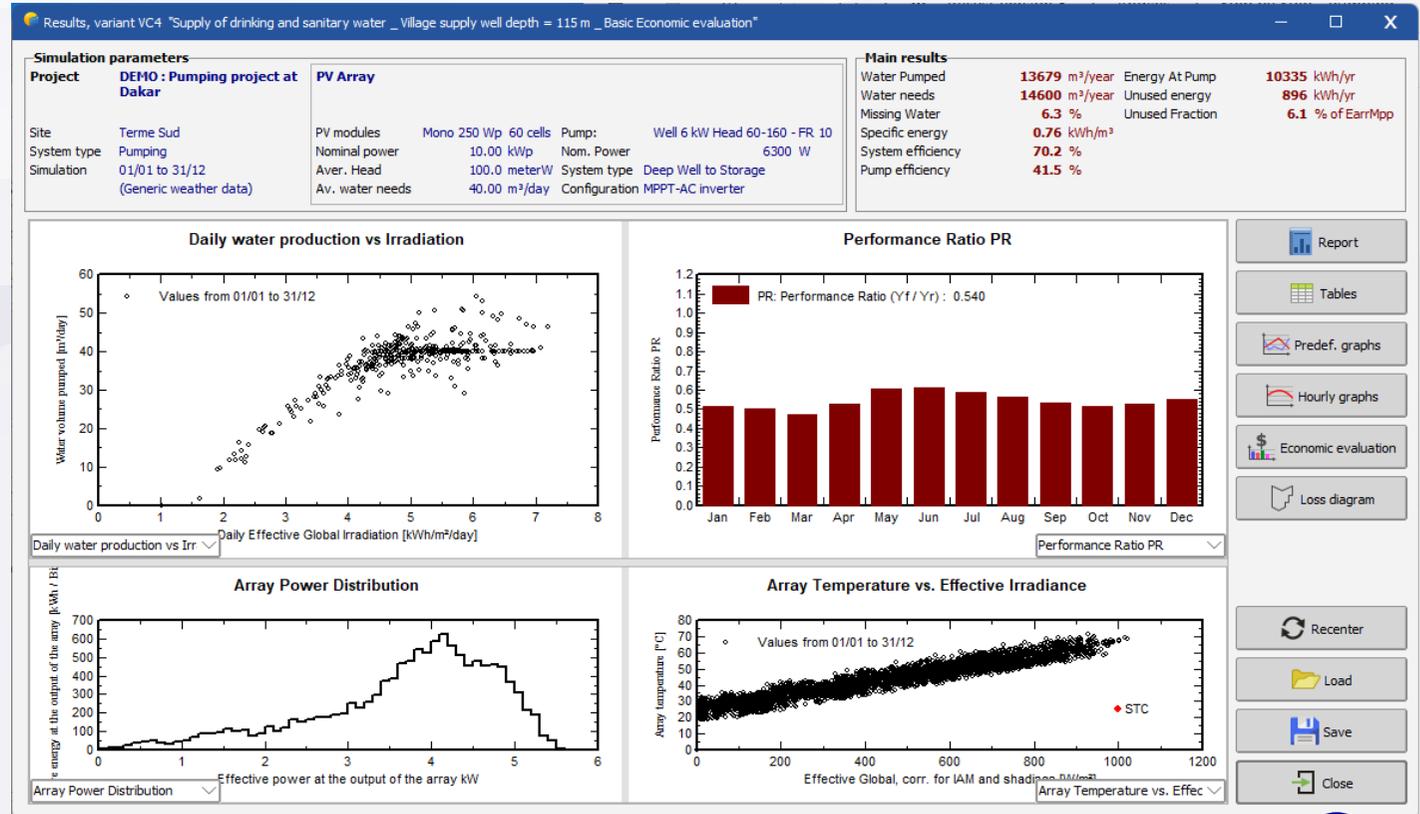
The screenshot shows the PVsyst software interface for a project named "DEMO : Pumping project at Dakar". The interface is divided into several sections:

- Project Section:** Contains fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Terme Sud_MN82.SIT), and "Weather data File" (Terme Sud_MN82_SYN.MET). A green bar below this section indicates "Ready for simulation".
- Variant Section:** Contains a dropdown for "Variant n°" (VC4 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Basic Economic evaluation). It has sub-sections for "Main parameters" (Orientation, Water needs, System, Detailed losses), "Optional" (Horizon, Near Shadings, Economic evaluation), and "Simulation" (Run Simulation, Advanced Simulation, Report, Detailed results).
- Results overview Section:** A table showing simulation results for a "Pumping PV System".

System kind	Pumping PV System
Water Pumped	0 m ³ /year
Water needs	0 m ³ /year
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

Chapter 5 : VC4 - Run the Simulation

1 Click «Close»



1

Chapter 5: VC4 - Economic Evaluation

1

Click on «Economic evaluation»

The screenshot shows the PVsyst software interface. The 'Project' tab is active, displaying project details: Project's name (DEMO : Pumping project at Dakar), Client name (Not defined), Site File (Terme Sud_MN82.SIT), and Weather data File (Terme Sud_MN82_SYN.MET). A status bar indicates 'Simulation done (version 8.0.19, date 15/01/26)'. The 'Variant' tab is selected, showing 'Variant n°' as 'VC4 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Basic Economic evaluation'. Under 'Main parameters', 'Orientation', 'Water needs', 'System', and 'Detailed losses' are selected. Under 'Optional', 'Horizon', 'Near Shadings', and 'Economic evaluation' are selected. The 'Simulation' section includes buttons for 'Run Simulation', 'Advanced Simulation', 'Report', and 'Detailed results'. A 'Results overview' table is displayed on the right.

System kind	Pumping PV System
Water Pumped	13679 m ³ /year
Water needs	14600 m ³ /year
Missing Water	6.3 %
Energy At Pump	10335 kWh
Specific energy	0.76 kWh/m ³
System efficiency	70.2 %

1

Chapter 5: VC4 - Economic Evaluation (1)

1

Enter the following values:

Mono 250 Wp 60 cells : 4,000.00
 Module supports : 1,400.00
 Pumps : 4,200.00
 Tank : 900.00
 Hydraulic circuit : 7,500.00
 Controllers : 1,100.00

Permits and other fees : 250.00

Installation cost;
 per module : 600.00
 per inverter : 350.00

Transport : 200.00

2

Enter the following values:

Salaries : 600.00
 Cleaning : 200.00
 Replacement provision : 420.00
 Land rental : 120.00
 Bank fees : 80.00

System summary
 Project: DEMO : Pumping project at Dakar
 PV Array, Pnom = 10.0 kWp Pumping PV System

Water Cost
 Water Pumped 13697.58 m³/year
 Total yearly cost 2 048.55 EUR/year
 Water Cost 0.22 EUR/m³

Installation costs

Description	Quantity	Unit price	Total
PV modules			5 400.00 EUR
Mono 250 Wp 60 cells	40.00	100.00	4 000.00 EUR
Supports for modules	40.00	35.00	1 400.00 EUR
Pumps	1.00	4 200.00	4 200.00 EUR
Controllers	1.00	900.00	900.00 EUR
Tank	1.00	7 500.00	7 500.00 EUR
Hydraulic circuit	1.00	1 100.00	1 100.00 EUR
Studies and analysis			250.00 EUR
Engineering	0.00	0.00	0.00 EUR
Permitting and other admin. ...	1.00	250.00	250.00 EUR
Environmental studies	0.00	0.00	0.00 EUR
Economic analysis	0.00	0.00	0.00 EUR
Installation			1 150.00 EUR
Transport	1.00	600.00	600.00 EUR
Accessories, fasteners	1.00	350.00	350.00 EUR
Wiring	1.00	200.00	200.00 EUR
Settings	0.00	0.00	0.00 EUR
Well (drilling, building)	0.00	0.00	0.00 EUR
Insurance			0.00 EUR
Building insurance	0.00	0.00	0.00 EUR
Transport insurance	0.00	0.00	0.00 EUR
Liability insurance	0.00	0.00	0.00 EUR
Delay in start-up insurance	0.00	0.00	0.00 EUR
Land costs			0.00 EUR
Land purchase	0.00	0.00	0.00 EUR
Land preparation	0.00	0.00	0.00 EUR
Land taxes (%)	0.00%	of 0.00	0.00 EUR
Loan bank charges			0.00 EUR
Taxes			0.00 EUR
VAT (%)	0.00%	of 0.00	0.00 EUR
Federal taxes (%)	0.00%	of 0.00	0.00 EUR
State taxes (%)	0.00%	of 0.00	0.00 EUR
Local taxes (%)	0.00%	of 0.00	0.00 EUR
Other taxes (%)	0.00%	of 0.00	0.00 EUR
Total installation cost			20 500.00 EUR
Depreciable asset			0.00 EUR

Operating costs (yearly)

Description	Yearly cost
Maintenance	1 220.00 EUR
Salaries	600.00 EUR
Reparation	0.00 EUR
Cleaning	200.00 EUR
Provision for pump repla...	420.00 EUR
Security fund	0.00 EUR
Land rent	120.00 EUR
Insurance	0.00 EUR
Facilities insurance	0.00 EUR
Liability insurance	0.00 EUR
Business interruption ins...	0.00 EUR
Lack of sunlight insurance	0.00 EUR
Loan insurance	0.00 EUR
Bank charges	80.00 EUR
Administrative, accounti...	0.00 EUR
Taxes	0.00 EUR
Federal taxes	0.00 EUR
State taxes	0.00 EUR
Local taxes	0.00 EUR
Property taxes	0.00 EUR
Other taxes	0.00 EUR
Subsidies	- 0.00 EUR
Operating costs (OPEX)	1 420.00 EUR/year

Chapter 5: VC4 - Economic Evaluation (2)

1 Enter the following values:

Project duration : 20 years
 Starting year : 2021
 Inflation : 1.00 %/year
 Discount rate : 0.50 %/year

2 Enter the following values:

Equity capital : 5,000.00
 Subsidies : 8,000.00

3 Click on the «Add» icon,

then add:

Constant annuity : 4,500.00 / 20 years / 2.00 %
 In fine : 3,000.00 / 10 years / 4.00 %

System summary

Project: DEMO : Pumping project at Dakar
 PV Array, Pnom = 10.0 kWp Pumping PV System

Water Cost

Water Pumped 13697.58 m³/year
 Total yearly cost 2 048.55 EUR/year
 Water Cost 0.22 EUR/m³

Simulation period

Project lifetime 20 years Start year 2021

Projected variations

Inflation 1.00 %/year Discount rate 0.50 %/year

Income dependent expenses

Income tax 0.00 %/year Dividends 0.00 %/year
 Other income tax 0.00 %/year

Tax depreciation

Asset	Type	Depreciation period	Depreciable
Total redeemable			0.00 EUR

Financing

Investment 20 500.00 EUR
 Own funds 5 000.00 EUR
 Subsidies 8 000.00 EUR

Loans

- Redeemable with fixed annuity 4 500.00 EUR 20 years 2.00 %
- Interest-only bullet loan 3 000.00 EUR 10 years 4.00 %

Financing Breakdown (Pie Chart):

- Own funds: 24.39 %
- Subsidies: 39.02 %
- Loan 1: 21.95 %
- Loan 2: 14.63 %

Chapter 5 : VC4 - Economic Evaluation

1

1

The financial results are available in the window:

«Financial results»

Economic evaluation

System summary
 Project: DEMO : Pumping project at Dakar
 PV Array, Pnom = 10.0 kWp Pumping PV System

Water Cost
 Water Pumped 13697.58 m³/year
 Total yearly cost 2 048.55 EUR/year
 Water Cost 0.22 EUR/m³

Investment and charges | Financial parameters | Water sale | Financial results

Installation costs (CAPEX)
 Total installation cost 20 500.00 EUR
 Depreciable asset 0.00 EUR

Financing
 Own funds 5 000.00 EUR
 Subsidies 8 000.00 EUR
 Loans 7 500.00 EUR
 Total 20 500.00 EUR

Expenses
 Operating costs(OPEX) 1 563.35 EUR/year
 Loan annuities 395.21 EUR/year
 Total 2 048.55 EUR/year
 Water Cost 0.22 EUR/m³

Return on investment
 Net present value (NPV) -43 882.17 EUR
 Internal rate of return (IRR) 0.00 %
 Payback period Unprofitable
 Return on investment (ROI) -351.1 %

Detailed economic results

Detailed results | Yearly cashflow | Cumulative cashflow | Income allocation

Detailed economic results (EUR)

Year	Own funds	Loan principal	Loan interest	Run. costs	Cumul. profit	% amorti.
0	5 000	0	0	0	-5 000	0.0%
1	0	185	210	1 420	-6 806	-13.0%
2	0	189	206	1 434	-8 617	-25.9%
3	0	193	203	1 449	-10 434	-38.9%
4	0	197	199	1 463	-12 255	-51.9%
5	0	200	195	1 478	-14 082	-64.9%
6	0	204	191	1 492	-15 914	-78.0%
7	0	209	187	1 507	-17 751	-91.0%
8	0	213	182	1 522	-19 594	-104.0%
9	0	217	178	1 538	-21 442	-117.1%
10	0	3 221	174	1 553	-26 149	-129.0%
11	0	226	49	1 569	-27 895	-141.1%
12	0	230	45	1 584	-29 646	-153.3%
13	0	235	40	1 600	-31 404	-165.5%
14	0	240	36	1 616	-33 168	-177.7%
15	0	244	31	1 632	-34 938	-189.9%
16	0	249	26	1 649	-36 714	-202.1%
17	0	254	21	1 665	-38 496	-214.3%
18	0	259	16	1 682	-40 285	-226.6%
19	0	265	11	1 699	-42 080	-238.8%
20	0	270	5	1 716	-43 882	-251.1%
Total	5 000	7 500	2 204	31 267	-43 882	-251.1%

Chapter 6 : VC5 - Project Creation

1

Click on «Save» to create a new variant.

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

- Project Section:** Contains fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Dakar/Talkou), and "Weather data File" (Dakar_MNB2_SYN.MET). It also shows "MeteoNorm 8.2 station" and "Senegal".
- Simulation Status:** A blue banner indicates "Simulation done (version 8.0.0, date 31/10/24)".
- Variant Section:** Shows "Variant n°" as "VC4 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Basic Economic evaluation".
- Main parameters:** Includes "Orientation", "Water needs", "System", and "Detailed losses".
- Optional:** Includes "Horizon", "Near Shadings", and "Economic evaluation".
- Simulation:** Features buttons for "Run Simulation", "Advanced Simulation", "Report", and "Detailed results".
- Results overview:** A table showing simulation results for a "Pumping PV System".

System kind	Pumping PV System
Water Pumped	13698 m ³ /year
Water needs	14600 m ³ /year
Missing Water	6.2 %
Energy At Pump	10365 kWh
Specific energy	0.76 kWh/m ³
System efficiency	70.5 %

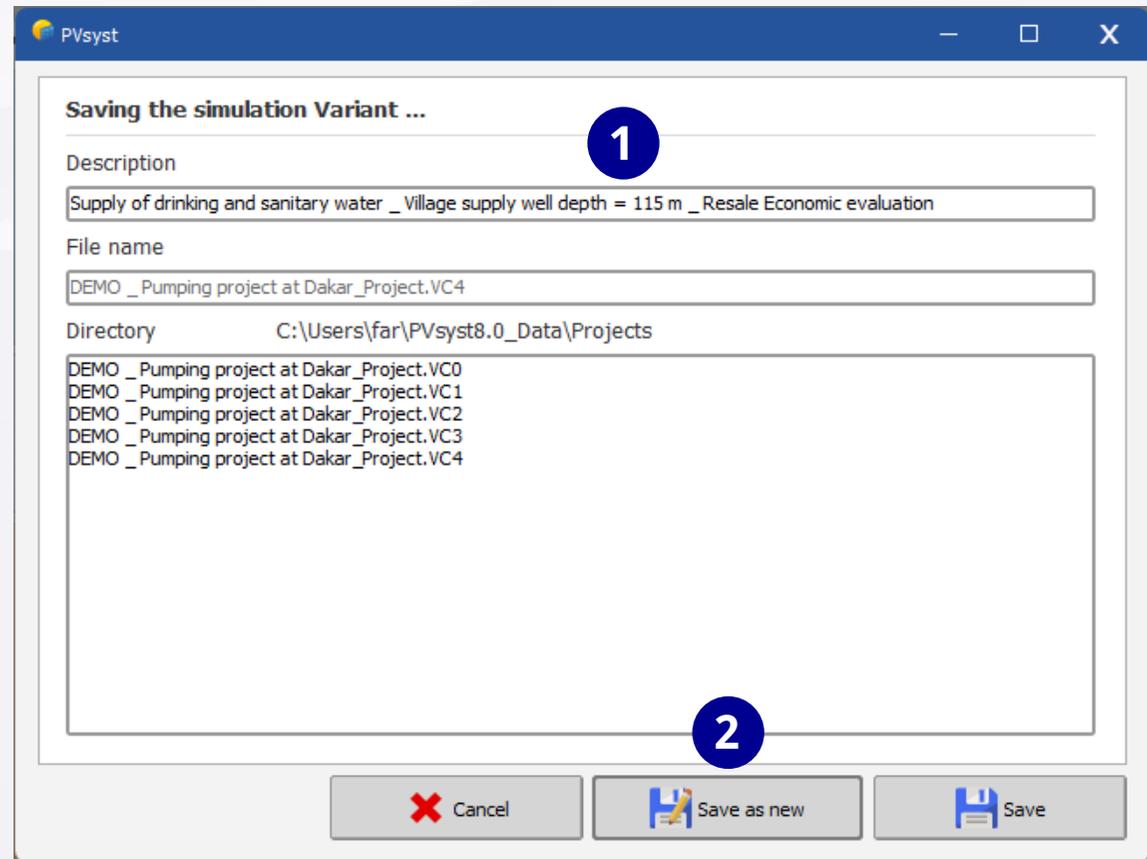
Chapter 6 : VC5 - Project Creation

1

Give a new name to the new variant:
«Supply of drinking and sanitary water _
Village supply well depth = 115 m _ Resale
Economic evaluation»

2

Click «Save as new» to create the new variant
using the previous parameters



Chapter 6 : VC5 - Orientation Definition (1)

1 Set the orientation

Project: DEMO _ Pumping project at Dakar _ Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO : Pumping project at Dakar Client name: Not defined

Site File: Terme Sud_MN82.SIT Meteororm 8.2 (2010-2021), Sat=100% Senegal

Weather data File: Terme Sud_MN82_SYN.MET Meteororm 8.2 (2010-2021), Sat=100% Synthetic 0 k

Simulation done (version 8.0.19, date 15/01/26)

Variant

Variant n°: VC5 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Resale Economic evaluation

Main parameters:

- Orientation
- Water needs
- System
- Detailed losses

Optional:

- Horizon
- Near Shadings
- Economic evaluation

Simulation:

- Run Simulation
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Pumping PV System
Water Pumped	13679 m ³ /year
Water needs	14600 m ³ /year
Missing Water	6.3 %
Energy At Pump	10335 kWh
Specific energy	0.76 kWh/m ³
System efficiency	70.2 %

Exit

Chapter 6 : VC5 - Orientation Definition (2)

- 1 Choice between several possible configurations: select «Fixed tilted plane»
- 2 Set the field parameters: define the plane tilt at 36.0° and the azimuth at 0°
- 3 Click «OK»

The screenshot shows the 'Orientations management' window with the following details:

- Orientation #1 - Fixed, Tilt 36.0° , Azim. 0.0°** (Status: OK)
- Field type:** Fixed Tilted Plane
- Name:** Fixed, Tilt 36.0° , Azim. 0.0°
- Field parameters:** Plane tilt: 36.0° , Azimuth: 0.0° , Base tilt angle: 0.0°
- Module area:** System: 65 m^2 , 40 modules; 3D scene: 0 m^2 , 0 modules
- Quick optimization (acc. to clear-sky model):** Optimization with respect to: Winter (Oct-Mar) selected. Winter incident irradiation: Transposition Factor FT: 1.16, Loss with respect to optimum: 0.0%, Global on collector plane: 1042 kWh/m^2 .
- Diagrams:** A 3D diagram shows a plane tilted at 36.0° . A 2D diagram shows the azimuth at 0° relative to a West-East axis.
- Graphs:** Two graphs show the transposition factor and loss with respect to optimum versus plane tilt and orientation. A text box in the graphs indicates: FT_{transpos.} = 1.16, Loss/opt. = 0.0%.

Chapter 6 : VC5 - Definition of Water Needs

1 Define the water needs

Project: DEMO _ Pumping project at Dakar _ Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO : Pumping project at Dakar Client name: Not defined

Site File: Terme Sud_MN82.SIT Meteororm 8.2 (2010-2021), Sat=100% Senegal

Weather data File: Terme Sud_MN82_SYN.MET Meteororm 8.2 (2010-2021), Sat=100% Synthetic 0 k

Simulation done (version 8.0.19, date 15/01/26)

Variant

Variant n°: VCS : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Resale Economic evaluation

Main parameters:

- Orientation
- Water needs
- System
- Detailed losses

Optional:

- Horizon
- Near Shadings
- Economic evaluation

Simulation:

- Run Simulation
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Pumping PV System
Water Pumped	13679 m ³ /year
Water needs	14600 m ³ /year
Missing Water	6.3 %
Energy At Pump	10335 kWh
Specific energy	0.76 kWh/m ³
System efficiency	70.2 %

Exit

Chapter 6 : VC5 - Water Needs (1)

1 Select the system type : «Borehole to tank»

2 Define the lake or river characteristics:

Static level : -100 m
 Drawdown level : -0.80 m/m³/h
 Maximum flow rate : 12.5 m³/h

3 Define the tank characteristics:

Volume : 50 m³
 Diameter : 3.50 m

4 Define the hydraulic circuit:

Pipe length : 280 m
 Number of bends : 7

5 Click on:
 «Definition of water needs and pressure»

The screenshot shows the 'Water Needs and Hydraulic Head / Pressure, Variant: Supply of drinking and sanitary water _ Village supply well depth = 115 m ...' window. The 'Pumping System Type' is set to 'Deep Well to Storage'. The 'Well characteristics' section includes: Static level (-100.0 m), Specific drawdown (-0.80 m/m³/h), Max. flowrate (12.5 m³/h), Lower dynamic level (-110.0 m), Pump level (-115.0 m), and Borehole diameter (20.0 cm). The 'Storage tank' section includes: Volume (50.0 m³), Diameter (3.50 m), Water full height (5.20 m), Feeding altitude (8.00 m), and an unchecked 'Bottom alimentation' option. The 'Hydraulic circuit' section includes: Pipe choice (PE50 (2")), a 'Customized pipe' button, Piping length (280 m), Number of elbows (7), and Other friction losses (0.00). The graph on the right plots head (m) from 0 to 160 against flowrate (m³/h) from 0 to 10. It shows four curves: 'Total with friction loss' (green), 'Altitude diff. Injection - static' (blue), 'Well drawdown' (purple), and 'Drawdown limit' (red dashed line). A schematic diagram above the graph shows a well with a pump at the bottom, a static level, a feeding level, and a maximum depth.

Chapter 6 : VC5 - Water Needs (2)

1

Select the water needs:

Check «Annual average»
Set 40.0 m³/day

2

Define the lake or river level variations:

Check «Constant over the year»

Set 100 mWC

3

Click «OK»

Water Needs and Hydraulic Head / Pressure, Variant: "Supply of drinking and sanitary water _ Village supply well depth = 115 m ...

Comment: New User's needs

Pumping Hydraulic Circuit | Water needs and Head definitions

Water needs

Yearly Average
 Seasonal values
 Monthly values

Whole Year needs: 40.0 m³/day

Well static depth variations

Yearly constant
 Seasonal values
 Monthly values

Whole Year: 100.0 meterW

Hydraulic units

Flowrate: m³/h
Pressure: meterW

Yearly summary

Water needs average: 40.0 m³/day
Yearly water needs: 14600 m³
Yearly Head average: 108 meterW

Hydraulic Energy: 4297 kWh
PV needs (very roughly): 14511 kWh

Additional heads

Feeding altitude: 8 m
Dynamic heads (at flowrate = 8.0 m³/h): 5.0 meterW
Drawdown: 6.4 meterW

Model File

Load Save Cancel OK

Chapter 6: VC5 - System Definition

1 Define the system

Project: DEMO - Pumping project at Dakar_Project.PRJ

Project Site Variant User notes

Project

Project's name: DEMO : Pumping project at Dakar Client name: Not defined

Site File: Terme Sud_MN82.SIT Meteororm 8.2 (2010-2021), Sat=100% Senegal

Weather data File: Terme Sud_MN82_SYN.MET Meteororm 8.2 (2010-2021), Sat=100% Synthetic 0 k

Ready for simulation

Variant

Variant n°: VC5 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Resale Economic evaluation

Main parameters:

- Orientation *
- Water needs
- System
- Detailed losses

Optional:

- Horizon
- Near Shadings
- Economic evaluation

Simulation:

- Run Simulation
- Advanced Simulation
- Report
- Detailed results

Results overview

System kind	Pumping PV System
Water Pumped	0 m ³ /year
Water needs	0 m ³ /year
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

Exit

Chapter 6 : VC5 - System Definition (1)

1

Pump model selection:

Select : «_Generic»
Select model : «6.3kW / 60-160m...»

2

Set the following values:

Flow rate : 8.8 m³/h
Pressure : 121.0 mWC
Power : 2.904 kW

3

Click on «Sub-array design»

Pre-sizing suggestions

Average daily needs :

Head min.	108.0 meterW	Requested autonomy	4.0 Days	Suggested tank volume	160 m ³
Head max.	117.5 meterW	Accepted missing	5.0 %	Suggested Pump power	6.3 kW
Volume	40.0 m ³ /day			Suggested PV power	8.0 kWp (nom.)
Hydraulic power	2457 W (very approximative)				

Pump definition | Sub-array design

Select a pump model

_Generic

6.3 kW 60-160 m Well, AC, Centrifugal Multistage Well 6 kW Head 60-160 - FR 1 Since 2021

1 Pumps in series
1 Pumps in parallel

Pump characteristics

Pump Technology **Centrifugal Multistage**
Motor **AC motor, triphased**

Maximal power **6300 W** Voltage **700 V**
Max. current **9.0 A**

Head Min / Nom / Max	60	100	160 meterW
Corresp. Flowrate	12.8	10.2	6.2 m ³ /h
Corresp. Power	6300	6300	6300 W
Efficiency	33.2	44.2	42.9 %

Units for this project

Flowrate m³/h
Head meterW
Power kW
Energy kWh

Hydro Energy calculation tool

You can type here any values, not necessarily related to your project

Flowrate 8.8 m³/h
Head 121.0 meterW
Power 2.904 kW

Cancel OK

Chapter 6 : VC5 - System Definition (2)

1 Check «No pre-dimensioning»

2 Set the number of modules and strings:
Modules in series : 20
Strings : 2

3 Click «OK»

Pre-sizing suggestions

Average daily needs :		Requested autonomy	4.0 Days	Suggested tank volume	160 m ³
Head min.	108.0 meterW	Accepted missing	5.0 %	Suggested Pump power	6.3 kW
Head max.	117.5 meterW			Suggested PV power	8.0 kWp (nom.)
Volume	40.0 m ³ /day				
Hydraulic power	2457 W (very approximative)				

Pump definition | Sub-array design

System information

Chosen pump	Well 6 kW Head 60-160 - FR 10 m3/h
Technology	Centrifugal Multistage
Max. power	6300 W
Head	60.0 - 160.0 meterW
Flowrate	12.79 - 6.19 m ³ /h

Pre-sizing Help

No sizing Planned power 6.3 kWp
 or available area 0 m²

Select the PV module

Available Now

Generic 250 Wp 26V Si-mono Mono 250 Wp 60 cells Since 2015

Approx. needed modules N/A Sizing voltages : Vmpp (60°C) 26.2 V
Voc (-10°C) 41.7 V

Select the control mode and the controller

Universal controller control mode MPPT-AC inverter

All manufacturers 1000 W MPPT-AC inverter Universal MPPT - AC Inverter Generic device Adaptabl

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

PV Array design

Number of modules and strings

Mod. in series 20 should be: only possibility 20

Strings 2

nb. modules 40 Area 65 m²

Operating conditions

Vmpp (60°C)	52.4 V
Vmpp (20°C)	626 V
Voc (-10°C)	833 V

Plane irradiance 1000 kWh/m²

Imp	16.4 A	Max. operating power	9.0 kW
Isc	17.3 A	(at 1000 W/m ² and 50°C)	
Isc (at STC)	17.3 A	Array nom. Power (STC)	10.0 kWp

Cancel OK

3

Chapter 6: VC5 - Definition of Detailed Losses

1 Define the detailed losses

The screenshot displays the PVsyst software interface for a project named 'DEMO : Pumping project at Dakar'. The 'Project' section is configured with the following details:

- Project's name:** DEMO : Pumping project at Dakar
- Client name:** Not defined
- Site File:** Terme Sud_MN82.SIT (Location: Senegal)
- Weather data File:** Terme Sud_MN82_SYN.MET (Type: Synthetic)

The 'Variant' section is set to 'VC5 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Resale Economic evaluation'. The 'Main parameters' are configured as follows:

- Orientation:** Selected (marked with an asterisk)
- Water needs:** Selected
- System:** Selected
- Detailed losses:** Selected (highlighted with a blue circle and the number '1')

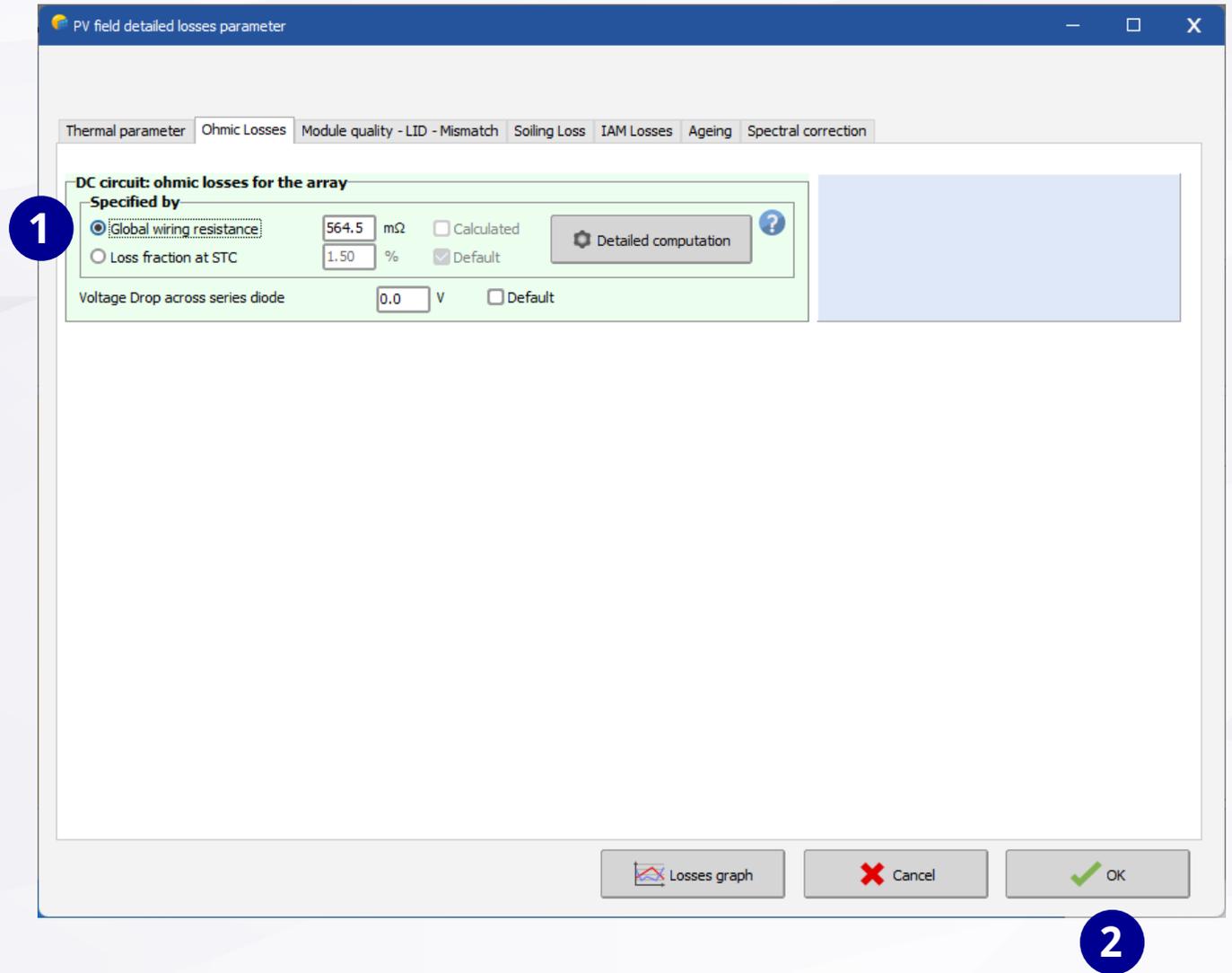
The 'Optional' parameters include 'Horizon', 'Near Shadings', and 'Economic evaluation'. The 'Simulation' section contains buttons for 'Run Simulation', 'Advanced Simulation', 'Report', and 'Detailed results'. The 'Results overview' table on the right shows the following data for the 'Pumping PV System':

System kind	Pumping PV System
Water Pumped	0 m ³ /year
Water needs	0 m ³ /year
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

Chapter 6: VC5 - Detailed Losses

1 In the «Ohmic losses» window, Select «Global wiring resistance»

2 Click «OK»



Chapter 6 : VC5 - Run the Simulation

1 Click on «Run simulation»

The screenshot shows the PVsyst software interface for a project named "DEMO : Pumping project at Dakar". The interface is divided into several sections:

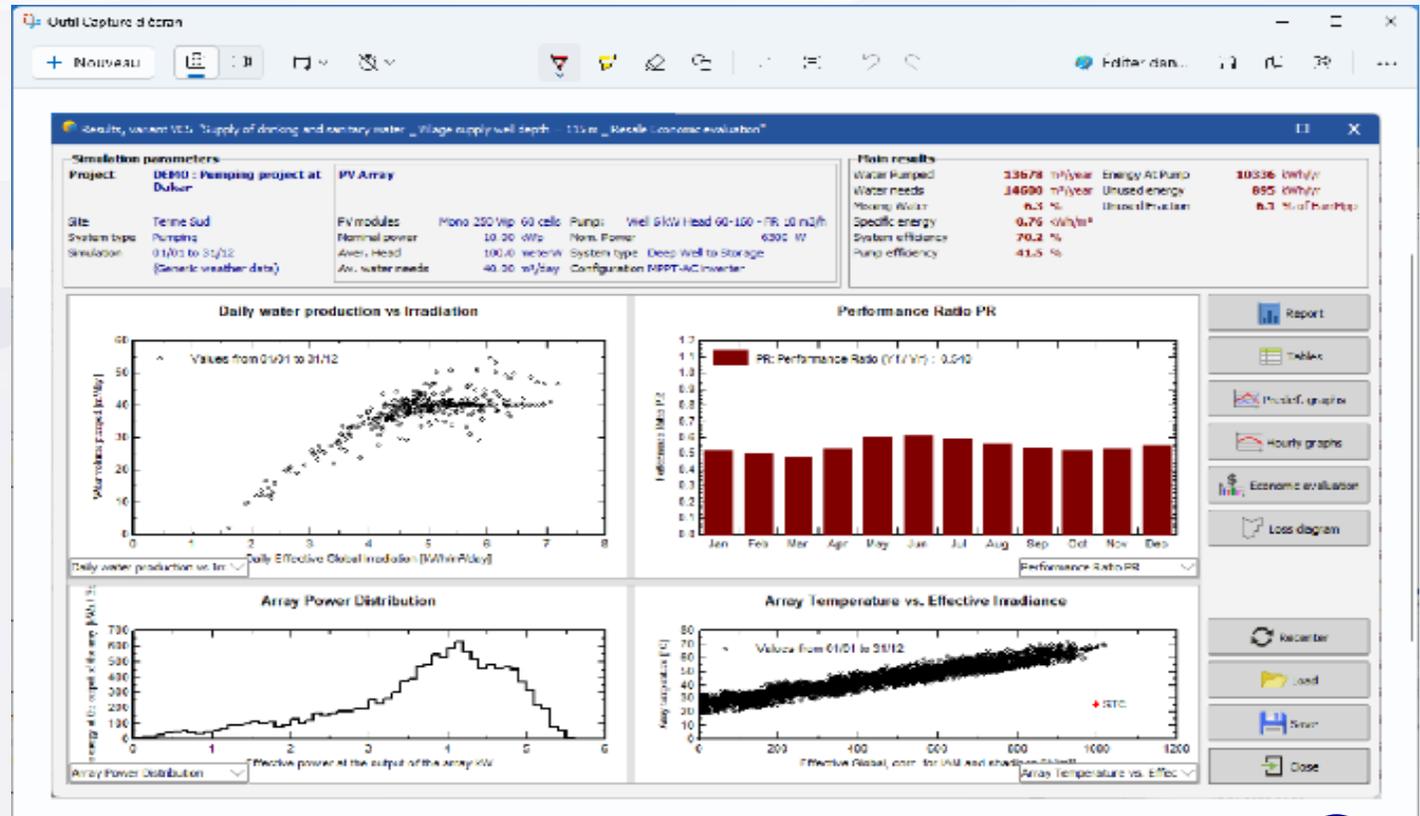
- Project Section:** Contains fields for "Project's name" (DEMO : Pumping project at Dakar), "Client name" (Not defined), "Site File" (Terme Sud_MN82.SIT), and "Weather data File" (Terme Sud_MN82_SYN.MET). A green banner below this section reads "Ready for simulation".
- Variant Section:** Contains a dropdown for "Variant n°" (VC5 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Resale Economic evaluation). It has sub-sections for "Main parameters" (Orientation, Water needs, System, Detailed losses), "Optional" (Horizon, Near Shadings, Economic evaluation), and "Simulation" (Run Simulation, Advanced Simulation, Report, Detailed results).
- Results overview Section:** A table showing simulation results for a "Pumping PV System".

System kind	Pumping PV System
Water Pumped	0 m ³ /year
Water needs	0 m ³ /year
Missing Water	0 %
Energy At Pump	0 kWh
Specific energy	0 kWh/m ³
System efficiency	0 %

The "Run Simulation" button in the Simulation section is highlighted with a blue circle and the number 1, corresponding to the instruction on the left.

Chapter 6 : VC5 - Run the Simulation

1 Click «Close»



1

Chapter 6 : VC5 - Economic Evaluation

1

Click on «Economic evaluation»

The screenshot shows the PVsyst software interface for a project named "DEMO : Pumping project at Dakar". The "Variant" tab is active, displaying a list of variants. The selected variant is "VC5 : Supply of drinking and sanitary water _ Village supply well depth = 115 m _ Resale Economic evaluation".

The "Main parameters" section includes:

- Orientation *
- Water needs
- System *
- Detailed losses

The "Optional" section includes:

- Horizon
- Near Shadings
- Economic evaluation

The "Simulation" section includes:

- Run Simulation
- Advanced Simulation
- Report
- Detailed results

The "Results overview" section shows the following data for the "Pumping PV System":

System kind	Pumping PV System
Water Pumped	13678 m ³ /year
Water needs	14600 m ³ /year
Missing Water	6.3 %
Energy At Pump	10336 kWh
Specific energy	0.76 kWh/m ³
System efficiency	70.2 %

A blue circle with the number "1" is overlaid on the "Economic evaluation" option in the "Optional" section.

Chapter 6 : VC5 - Economic Evaluation (1)

1

Enter the following values:

Mono 250 Wp 60 cells : 4,000.00
 Module supports : 1,400.00
 Pumps : 4,200.00
 Tank : 900.00
 Hydraulic circuit : 7,500.00
 Controllers : 1,100.00

Permits and other fees : 250.00

Installation cost;
 per module : 600.00
 per inverter : 350.00

Transport : 200.00

2

Enter the following values:

Salaries : 600.00
 Cleaning : 200.00
 Replacement provision : 420.00
 Land rental : 120.00
 Bank fees : 80.00

Chapter 6: VC5 - Economic Evaluation (2)

1 Enter the following values:

Project duration : 20 years
 Starting year : 2021
 Inflation : 1.00 %/year
 Discount rate : 0.50 %/year

2 Enter the following values:

Equity capital : 5,000.00
 Subsidies : 8,000.00

3 Click on the «Add» icon,

then add:

Constant annuity : 4,500.00 / 20 years / 2.00 %
 In fine : 3,000.00 / 10 years / 4.00 %

The screenshot shows the 'Economic evaluation' software interface. It is divided into several sections:

- System summary:** Project: DEMO : Pumping project at Dakar, PV Array, Pnom = 10.0 kWp, Pumping PV System.
- Water Cost:** Water Pumped: 13732.58 m³/year, Total yearly cost: 2 048.55 EUR/year, Water Cost: 0.22 EUR/m³.
- Simulation period:** Project lifetime: 20 years, Start year: 2021.
- Projected variations:** Inflation: 1.00 %/year, Discount rate: 0.50 %/year.
- Income dependent expenses:** Income tax: 0.00 %/year, Dividends: 0.00 %/year, Other income tax: 0.00 %/year.
- Tax depreciation:** A table with columns for Asset, Type, Depreciation period, and Depreciable. The total redeemable is 0.00 EUR.
- Financing:** Investment: 20 500.00 EUR. Own funds: 5 000.00 EUR. Subsidies: 8 000.00 EUR. Loans: Redeemable with fixed annuity (4 500.00 EUR, 20 years, 2.00 %), Interest-only bullet loan (3 000.00 EUR, 10 years, 4.00 %).

A pie chart in the bottom right corner shows the financing breakdown:

Category	Percentage
Subsidies	39,02 %
Own funds	24,39 %
Loan 1	21,95 %
Loan 2	14,63 %

Chapter 6 : VC5 - Water Sale

- 1 Pricing mode : Fixed rate
- Share of water sold : 70%
- Fixed selling price : 0.40000 EUR/m³

Economic evaluation

System summary

Project: DEMO : Pumping project at Dakar
PV Array, Pnom = 10.0 kWp Pumping P

Water Cost

Water Pumped	13732.58 m ³ /year
Total yearly cost	2 048.55 EUR/year
Water Cost	0.22 EUR/m ³

Investment and charges | Financial parameters | **Water sale** | Financial results

Pricing type

No sale Fixed tariff Variable tariff

Hourly peak/off-peak tariff Seasonal tariff

Sold water ratio %

Water selling price

Fixed selling price EUR/m³

This analysis should appear on printed report

Cancel OK

Chapter 6: VC5 - Economic Evaluation

1

The financial results are available in the window:

«Financial results»

Economic evaluation

System summary

Project: DEMO : Pumping project at Dakar
 PV Array, Pnom = 10.0 kWp Pumping PV System

Water Cost

Water Pumped **13732.58** m³/year
 Total yearly cost **2 048.55** EUR/year
 Water Cost **0.22** EUR/m³

1

Installation costs (CAPEX)

Total installation cost 20 500.00 EUR
 Depreciable asset 0.00 EUR

Financing

Own funds 5 000.00 EUR
 Subsidies 8 000.00 EUR
 Loans 7 500.00 EUR
Total 20 500.00 EUR

Expenses

Operating costs(OPEX) 1 563.35 EUR/year
 Loan annuities 395.21 EUR/year
Total 2 048.55 EUR/year

Water Cost **0.22 EUR/m³**

Return on investment

Net present value (NPV) **29 126.80 EUR**
 Internal rate of return (IRR) **39.03 %**
 Payback period **5.8 years**
 Return on investment (ROI) **233.0 %**

Detailed economic results

Detailed results
Yearly cashflow
Cumulative cashflow
Income allocation

Year	Water sale incom	Own funds	Loan principal	Loan interest	Run. costs	Deprec. allow.	Taxable income	Taxes	After-tax profit	Cumul. profit	% amorti.
0	0	5 000	0	0	0	0	0	0	0	-5 000	0.0%
1	3 845	0	185	210	1 420	0	2 215	0	2 030	-2 980	17.6%
2	3 845	0	189	206	1 434	0	2 205	0	2 016	-984	35.1%
3	3 845	0	193	203	1 449	0	2 194	0	2 001	987	52.4%
4	3 845	0	197	199	1 463	0	2 183	0	1 987	2 935	69.6%
5	3 845	0	200	195	1 478	0	2 173	0	1 972	4 859	86.6%
6	3 845	0	204	191	1 492	0	2 162	0	1 957	6 758	103.4%
7	3 845	0	209	187	1 507	0	2 151	0	1 943	8 634	120.1%
8	3 845	0	213	182	1 522	0	2 140	0	1 927	10 486	136.6%
9	3 845	0	217	178	1 538	0	2 129	0	1 912	12 315	153.0%
10	3 845	0	3 221	174	1 553	0	2 118	0	-1 103	11 265	170.3%
11	3 845	0	226	49	1 569	0	2 227	0	2 001	13 160	187.3%
12	3 845	0	230	45	1 584	0	2 216	0	1 986	15 030	204.1%
13	3 845	0	235	40	1 600	0	2 205	0	1 970	16 876	220.8%
14	3 845	0	240	36	1 616	0	2 193	0	1 954	18 698	237.3%
15	3 845	0	244	31	1 632	0	2 182	0	1 938	20 496	253.6%
16	3 845	0	249	26	1 649	0	2 171	0	1 921	22 270	269.8%
17	3 845	0	254	21	1 665	0	2 159	0	1 905	24 020	285.8%
18	3 845	0	259	16	1 682	0	2 148	0	1 888	25 746	301.7%
19	3 845	0	265	11	1 699	0	2 136	0	1 871	27 448	317.4%
20	3 845	0	270	5	1 716	0	2 124	0	1 854	29 127	333.0%
Total	76 902	5 000	7 500	2 204	31 267	0	43 431	0	35 931	29 127	333.0%

This analysis should appear on printed report

✖ Cancel
✔ OK