



SUNNY DESIGN

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SMA Solar Technology AG

Sonnenallee 1

34266 Niestetal

Germany

Phone +49 561 9522-0

Fax +49 561 9522 100

www.SMA.de

E-mail: info@SMA.de

Status: 7/4/2022

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1 Information on this Document

1.1 Validity

This document is valid for:

- "Sunny Design" as of software version 5.30

1.2 Target Group

This document is intended for PV system designers. PV system designers must have the following qualifications:

- Knowledge of how an inverter works and is operated
- Knowledge of all applicable laws, standards and directives

1.3 Symbols in the Document

Icon	Explanation
	Information that is important for a specific topic or goal, but is not safety-relevant
	Indicates a requirement for meeting a specific goal
	Desired result
	Example
	Content applies to PV systems without self-consumption.
	Content applies to PV systems with self-consumption.
	Content applies to off-grid systems.
	Content applies to PV-hybrid systems.
	Content applies to energy systems.

1.4 Typographical Elements in the Document

Typographical element	Use	Example
bold	• Messages • Terminals • Elements on a user interface • Elements to be selected • Elements to be entered	• Connect the insulated conductors to the terminals X703:1 to X703:6. • Enter 10 in the field Minutes.
>	• Connects several elements to be selected	• Go to Settings > Date.

Typographical element	Use	Example
[Button] [Key]	Button or key to be clicked on or pressed down	Select [Enter].
#	Placeholder for variable components (e.g., parameter names)	Parameter WCtHz.Hz#

1.5 Designations in the Document

Complete designation	Designation in this document
Sunny Design Desktop Version	Sunny Design
Sunny Design Pro	Sunny Design
Sunny Design Web	Sunny Design

1.6 Additional Information

For more information, please go to www.SMA-Solar.com.

Title and information content	Type of information
"Designing PV Plants Optimised for Economic Efficiency"	Technical Information
"Leading Leakage Currents"	Technical Information
Information on the Design of Transformerless Inverters	
"Grid Connection"	Technical Information
"Performance Ratio"	Technical Information
"Reverse Current"	Technical Information

2 Product Overview

2.1 Product Description

Sunny Design is a software for planning and designing PV systems with and without self-consumption option, off-grid systems, PV hybrid systems as well as energy systems. Sunny Design provides you with design recommendations for your planned systems. Sunny Design proposes a combination of PV array(s) and inverter(s) which meet, as closely as possible, your requirements regarding power class, energy yield and efficiency.

In addition, you have the option of determining and optimizing your potential self-consumption, sizing cables, evaluating efficiency and, in case of PV hybrid and off-grid systems, configuring gensets.

i Sunny Design Pro: Additional access authorization required

You require an additional access authorization for Sunny Design Pro to be able to design an energy system and to use the advanced settings. You get information by clicking on the button **[Energy systems]** on the Sunny Design home page or on your personal home page after login.

Function	Anonymous user Sunny Design	Registered user Sunny Design	Registered user Sunny Design Pro
Creating PV systems without self-consumption option	✓	✓	✓
Creating PV systems with self-consumption option	✓	✓	✓
Creating off-grid systems	–	✓	✓
Creating PV hybrid systems	–	✓	✓
Saving and managing projects	–	✓	✓
Calculating harmonics	–	✓	✓
Creating own PV modules, locations and load profiles	–	✓	✓
Creating energy systems	–	–	✓
Storage simulation for peak load shaving	–	–	✓
Managing tariffs	–	–	✓
Consumption and load profile analysis	–	–	✓
P/Q analysis	–	✓	✓
Support of SMA 360° documents	–	✓	✓
Advanced project documentation	–	–	✓
Export of time series	–	–	✓

2.2 Project Overview

Using Sunny Design, you can plan and design various project scenarios with all available SMA inverters, considering legal and industrial requirements. The following project types are available in Sunny Design:

	PV system with total power feed-in to grid	PV system that is connected to the utility grid and where self-consumption is not taken into account.
	PV system with self-consumption option	PV system that is connected to the utility grid and where self-consumption is taken into account.
	Off-grid system	PV system that is not connected to the utility grid.
	PV hybrid system	PV system to which electric generators are connected.
	Energy system	Integrated energy system; this project type is only available on Sunny Design Pro

Depending on the selected project type, Sunny Design provides the following functions:

Function					
Determining the potential fuel and CO ₂ savings	-	-	-	✓	✓
Determining and optimizing self-consumption	-	✓	-	-	✓
Enabling direct-selling function with SMA Spot	✓	✓	-	-	✓
Defining load profile	-	✓	✓	✓	✓
Configuring gensets	-	-	✓	✓	-
Sizing cables	✓	✓	✓	✓	✓
Planning energy management	✓	✓	-	✓	✓
Analyzing efficiency	✓	✓	-	✓	✓
Adding prices for PV modules and inverters	✓	✓	✓	✓	✓
Creating project templates with default values	✓	✓	✓	✓	✓
Printing project documentation or saving it as PDF file	✓	✓	✓	✓	✓
Printing extended project documentation or saving it as PDF file	-	-	-	-	✓
Cross-sectoral view	-	-	-	-	✓

Function					
Defining e-mobility for known vehicles	-	✓	-	-	✓
Defining statistical use of e-mobility	-	-	-	-	✓
Enabling Peak Load Shaving	-	-	-	-	✓

2.3 System Requirements

System requirements:

- ☐ A computer with Internet access must be available.
- ☐ A supported web browser must be installed on the computer.
- ☐ JavaScript must be enabled in the web browser.

Supported web browsers:

The following web browsers are supported without restrictions:

- Microsoft Edge with Windows 10
- Mozilla Firefox from version 17
- Google Chrome from version 24
- Opera from version 12
- Apple Safari from version 6

3 Setup and Start

3.1 Signing Up for Sunny Design

You must sign up to use Sunny Design. After having signed up, an user account for Sunny Design and Sunny Portal is created.

Use Sunny Portal user account for Sunny Design

If you have already signed up for Sunny Portal, you can also use this account to access Sunny Design. You do not need to sign up again. When you log into Sunny Design for the first time with your Sunny Portal credentials, you must agree to the terms of use and privacy policy of Sunny Design.

You can begin signing up at 3 different places on the home page:

- In the **Login** window using the button [**I do not have a user account yet - Sign up**]
- In the header of the home page **Login > I do not have a user account yet - Sign up**
- On the home page with the button [**Sign up now - free of charge**]

Procedure:

1. Start your web browser and go to **www.SunnyDesignWeb.com**.
 - ☒ The Sunny Design home page opens.
2. Log in on the Sunny Design home page by following one of the procedures listed.
3. Complete sign up form.
4. Click on [**Create user account**].
 - ☒ You receive a confirmation by e-mail.
5. Open the e-mail and click on the activation link.

3.2 Starting Sunny Design

1. Start your web browser and go to **www.SunnyDesignWeb.com**.
 - ☒ The Sunny Design home page opens.
2. In the **Login** window, sign in with your e-mail address and the password of your user account.
or
In the home page header, click on [**Login**] and log in with the e-mail address and password of your user account.
3. When you log in to Sunny Design for the first time, you must agree to the terms of use and privacy statement.

4 User Interface

4.1 Personal Home Page After Login

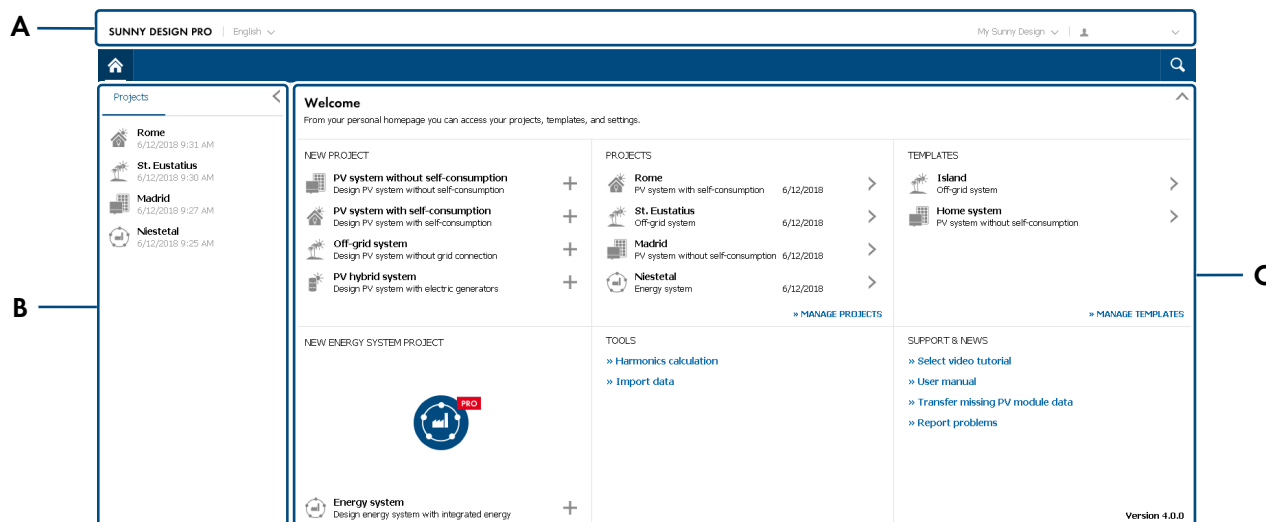


Figure 1: Personal home page in Sunny Design after login (example)

Position	Designation	Explanation
A	Header	The following functions are available here: • Language selection • My Sunny Design menu: – Settings in terms of location, notification dialogs, units of measurement, temperature units – Settings in terms of calculation of design suggestions, display of result values, letterhead on project documentation, efficiency analysis and tariff information – Creating own PV modules and favorites – Creating own locations – Creating own load profiles – Creating own price lists for inverters – Creating own charging stations – Creating own electric vehicles – Own templates e-mobility – Own customer data – Own cost items and templates – Creating user-defined tariffs This function is only available in the Sunny Design Pro version. • Menu "First name, last name": – Change password – Logout

Position	Designation	Explanation
B	Navigation area	This section contains a list of the projects you have already planned.
C	Workspace	In this section, you have access to your projects, templates and settings. On the page MANAGE PROJECTS , you can, for example, delete, rename, export, and duplicate projects and save them as templates.

4.2 Project Pages

The project pages are displayed after you have selected a project on the home page. You plan your project on the project pages.

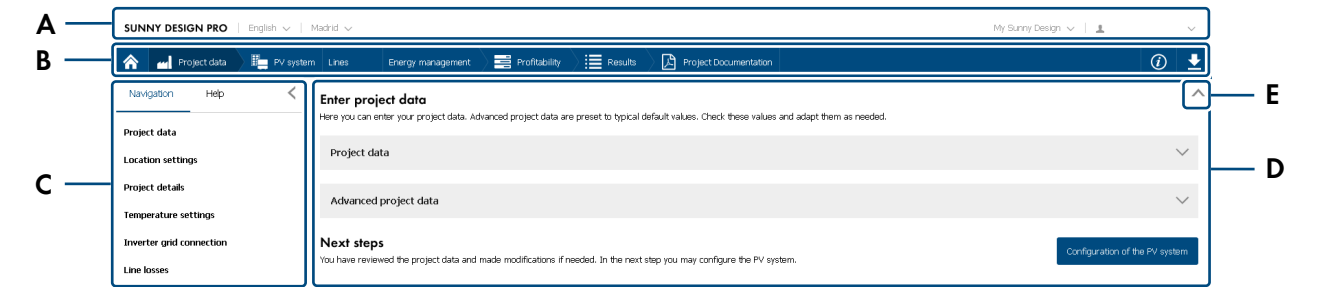


Figure 2: Project page **Enter project data** (example)

Position	Designation	Explanation
A	Header	General functions (see Section 4.1, page 13) Additional functions on the project pages: • Name of the current project and a selection of the last 3 projects processed • Add alternative: Creating and comparing alternatives (see Section 6.2.7, page 32)
B	Main navigation	Using this navigation, you can go to the project planning pages in the workspace section. The main navigation maps the steps for planning a project (see Section 6.3, page 33). Using the main navigation, you can click on the individual menu items if all previous steps were preformed. On small screens, the menu items are aggregated and the button is shown. Using this button, you can hide or display the menu items.
C	Navigation area	The entire navigation area is automatically hidden on smaller screens. The button will appear. Using this button, you can then hide or display the entire navigation area. Navigation Under the tab Navigation , jump labels are available to sections on the page currently displayed. In this section, you can switch between Detailed planning and Quick planning during the planning of your project. You can use the quick planning mode for simplified configuration of components. In the detailed planning mode, you can provide all components with detailed information. The load profile, PV systems, cables, self-consumption and energy management can be configured on separate pages.

Position	Designation	Explanation
D	Workspace	In this section, the content of the page currently selected in the main navigation is displayed. Here you make settings and plan your project. The eManual can be opened via . Next steps At the end of each page in the workspace section, the next possible steps are displayed under Next steps. The buttons in this section can only be selected if you have made the necessary settings on the page.
E	–	Button to hide and display header and main navigation

4.3 Project Tree

Project tree in navigation area

The project tree displays important project information, provides quick access to functions and enables navigation between individual elements of the project.

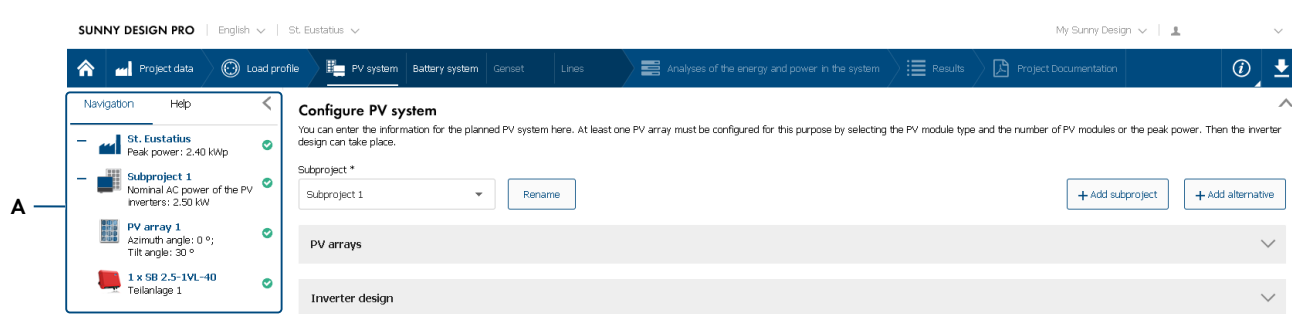


Figure 3: Project tree (example)

Position	Designation	Explanation
A	Navigation area	On the project page Configure PV System , the planned PV system is displayed in the navigation area in the form of a project tree.

Project tree functions

If you click on an element in the project tree, a menu is displayed where you can rename, delete or duplicate the element, for example. You can also remove elements from a subproject or copy them to a different subproject.

5 General Operation

5.1 My Sunny Design

You can make general settings under **My Sunny Design**. These settings are later used for future projects.

5.1.1 Settings

General Settings

The following settings can be made:

- Project type
- Selection whether the project should be started in Quick planning or Detailed planning mode.
- Region, country and city of planned project
- Linear measures, temperature units and decimal separator used
- PV modules used and certification of PV modules used

Procedure:

1. In the header **My Sunny Design > Settings**, click on **[General]**.
2. Change settings in the respective categories.
3. To change the default setting of PV modules, select the magnifying glass icon under **PV module**.
4. Click on the PV module you want and select **Apply PV module** from the appearing drop-down list.
5. To change the required PV module certification, choose between **[EU]**, **[EU+UL]** or **[UL]** under **Certification**.
6. To display deactivated messages again, click on **[Display deactivated messages again]** under **Information dialog**.
7. To hide projects and templates on your personal home page, enable the checkbox **Hide projects and templates on home page** under **Visibility of projects**.

Design settings

The following settings can be made:

- Selection whether the nominal power ratio or dimensioning factor is used for calculation
- Method for calculating suggested designs
- Determination of the portion of the costs of the inverters in the total investment costs
- Minimum cross-section for cable sizing
- Settings for the inverter used: SMA product family, specific properties and restrictions in terms of use

Procedure:

1. Go to **My Sunny Design > Settings** in the header. Then click on **[Design]** in the menu on the left.
2. To change the power ratio used, select the ratio you want under **Power ratio used**.
3. If necessary, under **Calculating and assessing suggested designs**, select the required method from the drop-down list **Method for calculating suggested designs**.
4. If necessary, under **Calculating and assessing suggested designs**, set the portion of inverters in the total investment costs in the field **Portion of the inverters on the investment costs**. The portion can be between 0% and 20%.
5. To change the minimum cross-section for cable sizing, make the required settings under **Minimum cross-section for cable sizing**.
6. To adjust the inverter filter settings, adjust the settings for the design recommendation under **Setpoint for inverter filter**.

Result values

In the following settings, you can uniformly define setpoints for which results are shown in the project information, overview and output documents:

- Definition of result values shown
- Display order

Procedure:

1. Go to **My Sunny Design > Settings** in the header. Then click on [**Result values**].
2. To define which result values are shown, enable or disable the checkbox of the respective result value.
3. If required, adjust the order of the result values using the arrows.

Letterhead

With the following settings, you can define which information is shown on the cover page of the output documentation:

- Letterhead with address field
- Additional information (e.g. phone number)
- Logo

Procedure:

1. Go to **My Sunny Design > Settings** in the header. Then click on [**Letterhead**].
2. Under **Letterhead** and **Additional information (telephone, fax)**, fill out the relevant information.
3. To add a logo, enable the checkbox **Logo** and upload a logo (permitted file formats: BMP, GIF, JPG, PNG) by clicking on [**Select logo**].

Changing settings for profitability analysis

The following settings can be made:

- General settings:
 - Currency used
 - Equity ratio of investment costs
 - Analysis period of profitability
 - Specific investment costs of the turnkey PV system
 - Credit period
 - Specific investment costs of the turnkey PV system
 - Interest rate
 - Imputed rate of interest
 - Inflation rate
- For PV projects
 - Grant amount
 - Annual fixed costs
- For PV hybrid projects
 - OpEx
 - Effective fuel costs
 - Increase in fuel costs
 - Inverter portion of costs

Procedure:

1. Go to **My Sunny Design > Settings** in the header. Then click on **[Profitability]**.
2. Change the information with regard to the project.

Only for PV systems with self-consumption option: Change of tariff settings

The following settings can be made:

- To the basic electricity tariff
 - Electricity purchase price
 - Duration of the feed-in tariff
 - Annual rate of electricity price increase
 - In case of self-consumption: Deduction or feed-in tariff
 - Feed-in tariff
 - Feed-in revenue on expiry of feed-in tariff
- To the preferential electricity tariff
 - Information on 2 different preferential electricity tariffs
 - Activation of preferential electricity tariffs

Procedure:

1. Go to **My Sunny Design > Settings** in the header. Then click on **[Tariff information]**.
2. Change the information with regard to the project.
3. Adjust the settings for the basic electricity tariff under **[Basic electricity tariff]**.
4. Adjust settings in terms of preferential electricity tariff under **[Preferential electricity tariff]**.
5. To take a preferential electricity tariff into account, click on the respective checkbox. Both preferential electricity tariffs can be enabled.

Quotations

Standard texts for introduction and conclusion can be entered here for the quotations that are automatically created. In addition to the customer's address and the information from the profitability analysis, the texts are added to the quotation and cannot be adapted subsequently for the individual quotations.

Procedure:

1. Go to **My Sunny Design > Settings** in the header. Then click on **[Offers]**.
2. Enter the desired introductory text of the quotation on the page **Introductory text**. For this, there are several formatting options available.
3. Enter the desired concluding text on the page **Concluding text**. For this, there are several formatting options available.

5.1.2 Creating and Managing Own PV Modules**Creating a new PV module without template**

Missing PV module data can be transferred to SMA Solar Technology AG (see Section 5.6, page 28).

Procedure:

1. Go to **My Sunny Design > Own PV modules** in the header.
2. In the dialog box **Own PV modules**, click on **[Add new PV module]**.
3. Enter the manufacturer in the field **Manufacturer**.

4. Enter the PV module name in the field **PV module**.
5. If the PV module is discontinued, disable the checkbox **Current PV module**.
6. Select the cell technology from the drop-down list **Cell technology**.
7. Select the recommended grounding from the drop-down list **Grounding recommendation**.
8. Activate the available certification under **Certification**.
9. Enter the values for nominal power, length, width, MPP voltage, open-circuit voltage, temperature coefficient of open-circuit voltage, MPP current, short-circuit current and permissible system voltage under **Mandatory information**.
10. If required, enter further values under **Supplementary data**.
11. Click on **[Save PV module]**.

Creating a new PV module with template

1. Go to **My Sunny Design > Own PV modules** in the header.
2. In the dialog box **Own PV modules**, click on **[Add new PV module]**.
3. In the dialog box **New PV module**, click on **[Select a PV module]**.
4. In the dialog box **PV module selection**, select the PV module you want from the drop-down lists **Manufacturer** and **PV module**. Then click on **[Select template]**
or
In the dialog box **PV module selection**, click on the magnifying glass icon. Then click on the PV module you want. Select **Apply PV module** from the appearing drop-down list.
5. In the dialog box **New PV module**, make the relevant changes and click on **[Save PV module]**.

Editing or deleting PV modules

1. Go to **My Sunny Design > Own PV modules** in the header.
2. In the dialog box **Own PV modules**, click on the PV module you want.
3. To edit the PV module, click on **Edit** and make the necessary changes. Then click on **[Save PV module]**.
4. To delete the PV module, click on **[Delete]** and confirm the security prompt with **[Yes]**.

Adding PV module to favorites

1. Go to **My Sunny Design > PV modules favorites** in the header.
2. Click on **[Add to favorites]**.
3. To restrict the selection of PV modules, use the free text search or provide the relevant information under **Search options**.
4. Select the PV module you want and click on **[Add to favorites]**.

5.1.3 Entering Prices for PV Modules

You can enter prices for PV modules. If you use a price-tagged PV module in the project, the price of the PV module is adopted as the default setting for the efficiency analysis. Prices for PV modules can either be entered via **My Sunny Design** or while designing a project on the page **Configure PV system**.

Via My Sunny Design

1. Go to **My Sunny Design > Own PV modules** in the header.
2. In the dialog box **Own PV modules**, click on the PV module you want and click on **Edit**.
3. Under **Extended information**, enter the price in the field **Price per PV module**.

Configuring via the PV system page

Requirement:

- ☐ You must have opened a project and have it planned up to the page **Configure PV system**.

Procedure:

1. On the page **Configure PV system**, click on the magnifying glass icon.
 - ☒ The dialog box **Find PV modules** opens.
2. In the dialog box **Find PV module**, click on the PV module you want.
3. Click on **Edit price** and make the required settings.

Also see:

- > Section 5.6 "Transferring Missing PV module data", page 28

5.1.4 Entering Prices for Inverters

You can enter prices for inverters. If you use an inverter in the project, the price of the inverter is adopted as the default setting for the efficiency analysis.

Procedure:

1. Go to **My Sunny Design > Own price list** in the header.
2. To reduce the number of selected inverters in the dialog box **Own price list**, enable the required checkboxes under **Restrict inverters**.
3. Select the required inverter and enter the respective price.
4. Click on [OK].

5.1.5 Creating and Managing Your Own Locations

Locations used in the project are used for selection of meteorological data on the page **Project data**.

Creating new location without template

1. Go to **My Sunny Design > Own locations** in the header.
2. In the dialog box **Own locations**, click on [Add new location].
3. In **New location**, enter the **Region**, **Country** and **City**.
4. If required, adjust the currency under **Currency**.
5. Under **Setpoint for orientation of PV array**, enter the **Setpoint tilt angle** and **Setpoint azimuth**.
6. Enter the nominal power ratio under **Nominal power ratio**.
7. Under **Grid connection**, select the grid connection you require.
8. If required, enter the maximum unbalanced load to be taken into account under **Grid connection**.
9. To use the meteorological data stored in Sunny Design, under **Meteorological data used**, enable the button [SMA meteorological data]. Then select the region, country and city.
10. To adjust the temperature data, make the required settings under **Ambient temperature**.
11. To import meteorological data, under **Meteorological data used**, enable the button [Imported meteorological data].
12. To get further information on the import of meteorological data, click on **Further information**.
13. Click on [Import data].
14. Select the file containing the meteorological data to be imported.
15. Select [Open].

16. To adjust global irradiation to the correct time of day, enter the time correction in the field **Time correction** under **Average global radiation**.
17. To change geographical data, make the required settings under **Geographical information**.
18. To adjust the temperature data, make the required settings under **Ambient temperature**.
19. Click on **[Save location]**.

Creating new location with template

1. Go to **My Sunny Design > Own locations** in the header.
2. In the dialog box **Own locations**, click on **[Add new location]**.
3. In the dialog box **New location**, click on **[Select template]**.
4. In the dialog box **Template for location data**, add region, country and city.
5. Click on **[Select template]** and make the required changes in the dialog box **New location**.
6. Click on **[Save location]**.

Managing your own locations

1. Go to **My Sunny Design > Own locations** in the header.
2. In the dialog box **Own locations**, click on the required location.
3. To delete a location, click on **Delete**.
4. To edit a location, click on **Edit**.
5. Make the required settings and click on **[Save location]**.

5.1.6 Own Load Profiles

5.1.6.1 Importing Own Consumption Data

Requirements for the consumption data:

- The data series begins on January 1 at 00:00 a.m.
- The values cover a complete year (365 days or a leap year with 366 days) or an entire week (7 days). If the values cover 7 days, a complete year is created from this data.
- The values have a time interval of 5, 10, 15, 30 or 60 minutes.
- The power or energy values are positive and indicated in the following units: W, kW, Wh or kWh.
- All values are in the first column.
- Either a period (.) or a comma (,) is used as decimal separator.

- The data is in CSV format (.csv).

Example:

An excerpt from a CSV file containing data of 1 year (365 days) with a time interval of 15 minutes.

	A	B
1	86,8934325	
2	78,152673	
3	70,5687788	
4	64,1417497	
5	59,3857482	
6	56,0436931	
7	53,8585033	
8	52,4445569	
9	51,5447728	
10	50,9020699	
35038	117,361203	
35039	107,342563	
35040	97,4540363	
35041		
35042		

Procedure:

1. On the page **Define load profile**, click on [+ **New load profile**].
or
In the menu **My Sunny Design > Own load profiles**, click on [**Add new load profile**].
2. Under **Name**, enter a name for the load profile.
3. If required, enter a description for the load profile under **Description**.
4. If not yet enabled, enable the field **Import consumption data**.
5. Under **Import consumption data**, select how the consumption data to be imported is available:
6. Select the number of days in the year from the drop-down list **Number of days**.
7. Select the time interval of the values in minutes from the drop-down list **Time interval**.
8. Select the unit from the drop-down list **Unit**.
9. Select [**Import consumption data**].
10. Select the file containing the consumption data to be imported.
11. Select [**Open**].
☒ The message confirming that the import was successful is displayed. The calculated energy consumption per year is automatically displayed under **Default setting "Annual energy consumption"**.
12. The message confirming that the data import failed is displayed.
13. There is an error.
14. Click on [**Details**] and read the message.
15. If the number of data points is not consistent, check the settings for **Number of days** and **Time interval** and change these so that the expected number of data points corresponds to the number of data points found in the file.
16. If the consumption data in the file is not in the first column or if there is data in the other columns, open a spreadsheet program (e.g., Excel), copy the consumption data series, insert it into a new document in the first column, and save as a CSV file. Then repeat the import procedure.

5.1.6.2 Importing Consumption Data from Sunny Portal

You can import consumption data from a PV system of Sunny Portal if you have access to a PV system in Sunny Portal using the e-mail address with which you log into Sunny Design.

Procedure:

1. On the page **Define load profile**, click on [+ **New load profile**].
or
In the menu **My Sunny Design > Own load profiles**, click on [**Add new load profile**].
2. Under **Name**, enter a name for the load profile in the dialog box **New load profile**.
3. If required, enter a description for the load profile under **Description**.
4. Enter the annual energy consumption under **Default setting "Annual energy consumption"**.
5. Select [**Consumption data from Sunny Portal**].
6. Select the required Sunny Portal system from the drop-down list **Sunny Portal system**.
7. Select the time period from which the data is to be imported from the drop-down list **Time period**. You can choose whether the last 12 months (365 days retroactively from the previous day at 12 p.m.) are to be imported or the entire previous calendar year from January to December.
8. Select [**Import consumption data**].
☒ The message confirming that the import was successful is displayed. The calculated energy consumption per year is automatically displayed under **Default setting "Annual energy consumption"**.
9. The message confirming that the data import failed is displayed.
10. It is possible that no consumption data or insufficient data is available for the selected Sunny Portal system.
11. Select a different Sunny Portal system from the drop-down list **Sunny Portal system**. Then click on [**Import consumption data**].

5.1.6.3 Creating Consumption Data Manually

1. On the page **Define load profile**, click on [+ **New load profile**].
or
In the menu **My Sunny Design > Own load profiles**, click on [**Add new load profile**].
2. Under **Name**, enter a name for the load profile.
3. If required, enter a description for the load profile under **Description**.
4. Enter the annual energy consumption under **Default setting "Annual energy consumption"**.
5. Select [**Create consumption data**].
6. If required, adjust the data on the seasons under **Breakdown of seasons into months**. To do this, select the dates for the beginning and end of summer and winter.
7. Create the required number of daily load profiles and assign to the different seasons.
8. Select [**Save load profile**].

5.1.6.4 Deleting Own Load Profile

Requirement:

- ☐ The load profile to be deleted must not be in use in any current projects. An error message is displayed if the load profile is used in a project.

Procedure:

1. Select **My Sunny Design > Own load profiles**.
2. Select the load profile to be deleted.
3. Select [**Delete**] and confirm the security prompt with [**Yes**].

5.1.7 Creating and Managing Your Own Charging Stations

You can create and manage your own charging stations aside the already defined ones. These charging stations can be accessed during the e-mobility configuration process.

When a new charging station is configured during the configuration of a project, it is also saved under **Own charging stations** and can be managed from there.

Procedure:

1. Go to **My Sunny Design > Own charging stations** in the header.
2. To configure a new charging station, click on **[Add new charging stations]** (see Section 6.3.10.4, page 41).
3. To edit an existing charging station, left-click on it and select **Edit** in the context menu. Now you can modify the settings in the dialog box **Charging stations** (see Section 6.3.10.4, page 41).
4. To delete an existing charging station, left-click on it and select **Delete** in the context menu.

5.1.8 Creating and Managing Your Own Electric Vehicles

You can create and manage your own electric vehicles aside the already defined ones. These electric vehicles can be accessed during the e-mobility configuration process.

When a new electric vehicle is configured during project configuration, it is also saved under **Own electric vehicles** and can be managed from there.

Procedure:

1. Go to **My Sunny Design > Own electric vehicles** in the header.
2. To specify a new electric vehicle, click on **[Add new electric vehicles]** (see Section 6.3.10.5, page 41).
3. To edit an existing electric vehicle, left-click on it and select **Edit** in the context menu. Now you can modify the settings in the dialog box **Electric vehicles** (see Section 6.3.10.5, page 41).
4. To delete an existing electric vehicle, left-click on it and select **Delete** in the context menu.

5.1.9 Deleting User-Defined E-Mobility Templates

1. Go to **My Sunny Design > User-defined e-mobility templates** in the header.
2. Select the templates to be deleted and click on **Delete** in the context menu.
3. Click on **Yes** to delete the template.

5.1.10 Managing Own Customer Data

You can search and edit customer data already created and assign customers to a project.

Procedure:

1. Go to **My Sunny Design > User-defined customer data** in the header.
2. To search for customer data by name or address, enter the text in the upper part of the dialog. You can also search for parts of the name or address.
3. To search for a customer's last name, company or city, select the right entry from the respective field and click on **[Show results]**.
4. To edit customer data, select customer in the results list. Then click on entry **Open customer** in the context menu.
☒ The dialog **Customer data** opens (see Section 5.1.1, page 29).

5.1.11 Creating and Managing Own Cost Items and Templates

Cost items

You can create, edit and delete recurring cost items to effectively manage projects. To avoid unintentional changes to existing templates and projects, deleted cost items are stored in templates and profitability calculations even after deletion.

Procedure:

1. Go to **My Sunny Design > User-defined cost items and templates** in the header.
2. Click on the tab **Cost items** in the dialog box **Own cost items and templates**.
3. To create new cost items, click on **[Add new cost items]** and fill out the respective fields.
4. To edit existing cost items, double-click on the respective cost item. Then click on **Edit** in the context menu.
5. If cost items are to be included automatically for detailed cost entry, activate the option **Default setting** in each case.
6. To delete existing cost items, double-click on the respective cost item. Then click on **Delete** in the context menu.
There is no confirmation prompt before the cost item is deleted.

Templates

You can create your own templates from the defined cost items. These templates can be used for efficiency analysis (see Section 6.4.15, page 70).

Procedure:

1. Go to **My Sunny Design > Own cost items and templates** in the header.
2. Click on the tab **Templates** in the dialog box **Own cost items and templates**.
3. To create a new template, click **[Add new template]**.
4. Enter the name of the template.
5. Select the required cost items one after the other and add them to the template by clicking on **[+]**.
6. To change the sequence of cost items in a category, select a cost item of the category to be changed and move it in the list by clicking on the appropriate buttons.
7. To remove cost items from the template, select the respective cost item and remove it from the template by clicking on **[-]**.
8. To edit existing templates, double-click on the respective template. Then click on **Edit** in the context menu.
9. To delete existing templates, double-click on the respective template, select **Delete** from the context menu.

5.1.12 Creating and Managing User-Defined Tariffs



Add a purchasing tariff

If you select a purchasing tariff has been selected, it can be used when calculating energy purchase costs or energy consumption (see Section 6.4.7.4, page 59).

Procedure:

1. Go to **My Sunny Design > User-defined tariffs** in the header.
2. Click on **[Add a new purchasing tariff]**
3. To use a template, click on **[Select template]** and select the tariff you want from the drop-down list. Then click on **[Select template]**.

4. Fill in the field **Name**.
5. Select the energy carrier from the drop-down list **Energy carrier**.
6. Write a text under **Description**, if required.
7. Select the accounting period you require from the drop-down list **Accounting period**. The accounting period has impact on the cost-relevant monthly and annual peak-load values in terms of power prices.
8. In the fields **Portion of renewable energy**, **CO₂ emission factor**, **annual inflation rate** enter the required values.
9. Under **Basic tariff**, enter the kilowatt-hour rate and price per kilowatt.
10. To add a tariff module, click **[Add tariff module]**.
11. Select the module type you want from the drop-down list **Module type** and click on **[Use module]**.
12. Enter the required value in the dialog box of the selected module type and click on **[OK]**.
13. Click on **[Save tariff]**.

Add feed-in tariff

1. Go to **My Sunny Design > User-defined tariffs** in the header.
2. Click on **[Add a new feed-in tariff]**.
3. To use a template, click on **[Select template]** and select the tariff you want from the drop-down list. Then click on **[Select template]**.
4. Fill in the field **Name**.
5. Select the energy carrier from the drop-down list **Energy carrier**.
6. Write a text under **Description**, if required.
7. Select the accounting period you require from the drop-down list **Accounting period**.
8. Under **Basic tariff**, select the feed-in tariff model you require from the drop-down list **Feed-in tariff model**.
9. Enter the required values in the fields **Feed-in tariff / selling price**, **Duration of feed-in tariff**, **Selling price after expiry of feed-in tariff**, **Reallocation charge (-) or feed-in tariff (+) of self-consumption and fixed cost**.
10. Select the required reference value from the drop-down list **Reference value**.
11. Click on **[Save tariff]**.

5.2 Changing the Sunny Design and Sunny Portal Password

You can change your Sunny Design password in Sunny Design. Your Sunny Design and Sunny Portal passwords are identical.

Procedure:

1. Go to **www.SunnyDesignWeb.com**.
2. Go to **"First name, last name" > Change password** in the header.
☒ The Sunny Portal home page opens.
3. Go to **Login**, fill in **E-mail** and **Password**. Then click on **[Login]**.
4. Click on **If you want to change your password, please click here**.
5. Fill in the fields.
6. Click on **[Save]**.

5.3 Requesting Password

If you have forgotten your password, you can request a new one.

Procedure:

1. Go to **www.SunnyDesignWeb.com**.
2. Go to **First name, last name > Change password** in the header.
 - ☒ The Sunny Portal home page opens.
3. Click on **[Forgot password]** in the dialog box **Change password** and follow the instructions.

5.4 Importing Data from Sunny Design Desktop Version from Software Version 2

You can import projects, PV modules and own locations from the Sunny Design desktop version as of software version 2 into Sunny Design. The relevant data must first be saved in the database files.

Own locations and own PV modules are automatically designated with a * symbol in Sunny Design.

Importing personal databases from Sunny Design Desktop version from software version 2

Database file requirements:

- ☐ The database file must not have been imported yet.
- ☐ The database file must be available in the following file formats:
Projects are available either in the file format ".sdp2" or ".sdp3". You can first import projects in older file formats in Sunny Design 2 and save them in file format ".sdp2".
Own PV modules and own locations in file format ".sdud"
- ☐ The country of the location to be imported must be available in the country list.

Procedure:

1. Go to **www.SunnyDesignWeb.com**.
2. In the menu **TOOLS** of your personal home page, click on **[Import data]**.
3. Select the required file format in the dialog box **Import data**.
4. Click on **[Import]**.
 - ☒ The file selection window opens.
5. Select the required database file in the file selection window and click on **[Open]**.
- ☒ Data of the selected database file is imported and information on the number of imported data sets is displayed. If the database already has an own PV module with the same name as the own PV module to be imported, Sunny Design adds a sequential number to the file name of the PV module that has been imported. If the selected database file cannot be imported, it is possible that it does not meet specified requirements.

5.5 Upload SMA 360° Documents

In the SMA 360° app, additional project information can be used. You can upload the required files in Sunny Design so that it can be used by the app. Up to 6 PDF documents with maximum of 3 MB can be uploaded.

Procedure:

1. Click on **SMA 360° documents** on the personal home page under **TOOLS**.
2. Click on **[New document]** in dialog box **SMA 360° documents**.
3. Under **Name**, enter the name under which the document should be displayed in the app.
4. Click on **[Import]** and select the location of the file to be uploaded.
5. Click on **[OK]** to upload the file.

5.6 Transferring Missing PV module data

To have missing PV modules included in Sunny Design, you can transmit the product data sheet of the manufacturer to SMA Solar Technology AG. The data of the PV module will be added in Sunny Design with the next database update.

Procedure:

1. Click on **Transmit missing PV module data** on your personal home page under **SUPPORT & NEWS**.
 - ☒ An e-mail template opens.
2. Complete e-mail template, attach datasheet and send e-mail.

5.7 Exporting Time Series

To analyze simulated data, you can export the generated time series as CSV files.

Procedure:

1. Click on  on your home page in the header of the main menu navigation.
2. Select the required time series for export.
3. To carry out the export, click on **[Export]**.
 - ☒ The time series is stored in the location defined in your web browser.

5.8 Reporting Errors and Problems

1. Click on **Report problems** on your personal home page under **SUPPORT & NEWS**.
 - ☒ An e-mail template to the SMA Service Line opens.
2. Complete e-mail and send.

5.9 Entering Activation Code

By using activation codes, you get a temporary free access to Sunny Design PRO. Before the validity expires, you receive a message when you log on in Sunny Design.

After the validity of the activation code expires, Sunny Design PRO is blocked and you no longer have access to the energy system projects. These projects are not deleted and can be edited as soon as you are logged back into Sunny Design PRO.

Procedure:

1. Go to **www.SunnyDesignWeb.com**.
2. Click on **Enter activation code** on your personal home page under **SUPPORT & NEWS**.
3. Enter your personal activation code in the dialog box **Sunny Design Pro activation code**.
4. Click on **[Activation]**.
 - ☒ You are logged in to Sunny Design PRO and the time limit for access is shown.

5.10 Downloading the User Manual

You can download the user manual in PDF format on the home page in Sunny Design.

To view PDF documents, you need the Adobe Reader software. You can download Adobe Reader for free on the Internet.

Procedure:

1. To open the entire user manual, click on **User manual** on your personal home page under **SUPPORT & NEWS** or in the header .
2. Click on  to get additional support on the current page.

5.11 Editing Customer Data

The stored customer data can be edited in the project or under **My Sunny Design > Own customer data**.

Procedure:

1. To change customer data in a project, click on the symbol  on the page **Project data**.
2. To change the customer data from **My Sunny Design**, click on **My Sunny Design > Own customer data**.
Search the customer (see Section 5.1.10, page 24) and click on **[Edit]** in the dialog **Customer data**.
3. To make changes to the customer data, select the line of the customer, then select **New Project** from the selection menu and make the changes.
4. To accept the changes, leave the dialog by clicking on **OK**.
5. To create a new project for a customer, select the line of the customer, then select **Open customer** from the selection menu and select the project.
☒ The selected project is opened.
6. To delete a customer data set, click on **[Delete customer]** and confirm the confirmation prompt.

5.12 Exiting Sunny Design

- Go to **First name, last name > Logout** in the header to exit Sunny Design.

6 Projects

6.1 Quick Planning and Detailed Planning



To configure your project, you can choose between Quick planning and Detailed planning. On the page **Settings**, you can determine with which planning mode the system should start by default (see Section 5.1.1, page 16).

You can use the Quick planning mode for simplified configuration of components. You can also enter project data and define load profile on the page **Project data**. The configuration of PV arrays, PV inverters, battery systems for PV systems with self-consumption as well as energy management are carried out on the page **System**. A switch from Quick planning to Detailed planning is possible at all times. You will find the button **Detailed Planning** in the navigation area.

In the detailed planning mode, you can provide all components with detailed information. The load profile, PV systems, cables, self-consumption and energy management can be configured on separate pages. As long as no new Subproject, Alternative or 2nd consumption profile has been created in Detailed planning, or no heat pump, electric mobility or direct selling has been selected, you can switch to Quick planning. You will find the button **Detailed Planning** in the navigation area.

6.2 Project Management

6.2.1 Creating New Projects

1. Click on the required project type on the personal home page under **NEW PROJECT**.
☒ The page **Enter project data** opens (see Section 6.4.1, page 43).
2. Create a new project step by step (see Section 6.3, page 33).

6.2.2 Managing Existing Projects

1. Click on **MANAGE PROJECTS** on your personal home page under **PROJECTS**.
2. To edit the project status, select the current status from the selection list in the column **Status** in the desired project.
3. To open an individual project, duplicate, rename, export, save it as a template or to assign it to a customer, click on the desired project and select the desired option in the context menu.
4. To delete, export or zip several projects, highlight the desired projects in the checkboxes of the first column, click into the gray line and select the the desired option in the context menu.

6.2.3 Opening an Existing Project

To plan a project, proceed as follows:

- Open an existing project on your personal home page.
- Open an existing project in the header. Here, you can open a recently edited project while working on another.
- Open an existing project in section Manage projects.

Projects can also be imported (see Section 5.4, page 27). These projects can be found in your project list on your personal home page.

Opening an existing project on your personal home page

- Click on the required template on your personal home page under **TEMPLATES**.

Opening an existing project in the header

1. Click on the drop-down list of the projects in the header.
 - ☑ A list opens with the current and the 2 recently edited projects.
2. Click on the project you want.

Opening an existing project via project management tool

1. Click on **MANAGE PROJECTS** on your personal home page under **PROJECTS**.
2. Open the project you want by left-clicking **Open** in the context menu.

6.2.4 Duplicating Projects

1. Click on the link **Manage projects** on the personal home page under **PROJECTS**.
 - ☑ The **Manage projects** page opens.
2. Click on the project you want to use.
3. Click on **Duplicate**.
 - ☑ Dialog box **Duplicate project** opens.
4. Enter the required project name in the field **Project name**.
5. Click on **[Save copy]**.

6.2.5 Working with Templates

Saving a project as template

1. Click on the link **Manage projects** on the personal home page under **PROJECTS**.
 - ☑ The page **Manage projects** opens.
2. Select desired project.
3. Select **Save as template**.
4. Under **Project name**, enter the template name.
5. Click on **[Accept changes]**.

Creating a project from template

1. Click on the required template on the personal home page under **TEMPLATES**.
or
Click on the link **Manage templates** on the personal home page under **TEMPLATES**.
 - ☑ The page **Manage templates** opens.
2. Select the preferred template.
3. Click on **New project with this template**.
4. Enter the required project name in the field **Project name**.
5. Click on **[Accept changes]**.

6.2.6 Renaming Projects

1. Click on the link **Manage projects** on the personal home page under **PROJECTS**.
 - ☑ The page **Manage projects** opens.
2. Click on the project you want to use.
3. Click on **Rename**.
4. Enter the required project name in the field **Project name**.
5. Click on **[Accept changes]**.

6.2.7 Comparing Projects



It is useful to compare different project scenarios against one another when designing a system. Copy the active project to compare different project scenarios. The copy can be edited and immediately compared with other projects. However, it can also be copied and edited again instead. Several alternatives can be compared with each other.

Procedure:

1. Open the required project (see Section 6.2.3, page 30).
2. Click on the drop-down list **Add alternative** in the header and select **Add alternative**.
 - ☒ A copy is made of the current project named "Alternative 1".
3. Select the desired alternative from the drop-down list (if necessary).
4. To configure the individual system components, select the respective system component (see Section 6.4.7, page 55).
5. To edit the project design, make the required configurations (see Section 6.4, page 43).
6. To add another alternative, open the drop-down list in the header once again. Then click on the [+] button beside the project you want to copy.
7. To compare alternatives, open the drop-down list in the header once again. Then click on the option **Compare alternatives**.
 - ☒ An overview opens, showing a tabular comparison of all project alternatives.
8. To adopt the design of an alternative for further planning, click on **[Adopt design]**. A dialog box opens, confirming that the alternative has been adopted.
9. In addition, you have to choose whether to accept the current original as an alternative. If you click on **Yes**, the existing original is renamed to "Alternative *". If you click on **No**, the existing original is deleted.
10. To delete an alternative, click on the trash can icon on the right-hand side, either in the comparison overview or drop-down list.

6.2.8 Exporting Projects



You can archive projects by exporting them as database files. Projects can either be exported via the export button on the page **Manage projects** or via main navigation.

Procedure:

1. To start the export via the page **Manage projects**, click on the link **Manage projects** on your personal home page in **PROJECTS**.
 - ☒ The page **Manage projects** opens.
2. Select the project to be exported.
3. Click on **[Export (.sdp3)]**.
4. To start the export via the main navigation, click on . Then select **Save as Sunny Design project file** from the drop-down list.
 - ☒ The project file is saved under the project name in the download folder of your computer.



With energy-system projects, it is also possible to export Polysun project files. These files can be used to continue your design of thermal projects with Polysun of the company Vela Solaris AG.

Procedure:

- Click on  in the main navigation. Then select **Export Polysun project file** from the drop-down list.

6.2.9 Deleting Projects

- Click on the link **Manage projects** on the personal home page under **PROJECTS**.
 - ☒ The page **Manage projects** opens.
- Click on the project you want to use.
- Click on **[Delete]**.
 - ☒ Dialog box **Delete project** opens.
- Click on **[Delete]** and confirm the security prompt with **[Yes]**.

6.3 Procedure for Designing Projects

6.3.1 Designing a PV System with Total Power Feed-in to Grid



Detailed planning

Procedure	See
1. Starting Sunny Design	Section 3.2, page 12
2. Creating a new project or Opening an existing project	Section 6.2.1, page 30 Section 6.2.3, page 30
3. Entering project data	Section 6.4.1, page 43
4. Configuring entire system (in quick planning)	Section 6.4.2, page 45
5. Configuring PV system (in detailed planning)	Section 6.4.8.1, page 60
6. Cable sizing (optional, only in detailed planning)	Section 6.4.11, page 66
7. Planning energy management (optional)	Section 6.4.13, page 68
8. Analyzing efficiency (optional)	Section 6.4.15, page 70
9. Overview of the results	Section 6.4.17, page 73
10. Creating project documentation.	Section 6.4.20, page 74

6.3.2 Designing PV Systems with Self-Consumption Option



Procedure	See
1. Starting Sunny Design	Section 3.2, page 12
2. Creating a new project or Opening an existing project	Section 6.2.1, page 30 Section 6.2.3, page 30
3. Entering project data	Section 6.4.1, page 43
4. Configuring entire system (in quick planning)	Section 6.4.2, page 45
5. Defining load profile (only in detailed planning)	Section 6.4.4, page 52
6. Configuring PV system (in detailed planning)	Section 6.4.8.1, page 60
7. Cable sizing (optional, only in detailed planning)	Section 6.4.11, page 66
8. Determining self-consumption (optional, only in detailed planning).	Section 6.4.12, page 67
9. Planning energy management (optional)	Section 6.4.13, page 68
10. Analyzing efficiency (optional)	Section 6.4.15, page 70
11. Overview of the results	Section 6.4.17, page 73
12. Creating project documentation.	Section 6.4.20, page 74

6.3.3 Design an Off-Grid System



Procedure	See
1. Starting Sunny Design	Section 3.2, page 12
2. Creating a new project or Opening an existing project	Section 6.2.1, page 30 Section 6.2.3, page 30
3. Entering project data	Section 6.4.1, page 43
4. Defining the load profile	Section 6.4.4, page 52
5. Configuring PV system.	Section 6.4.8.1, page 60
6. Configuring the battery system (optional)	Section 6.4.9, page 65
7. Configuring genset (optional)	Section 6.4.10, page 65
8. Cable sizing (optional)	Section 6.4.11, page 66
9. Viewing analysis of the energy and power in the system (optional)	Section 6.4.16, page 72
10. Overview of the results	Section 6.4.17, page 73
11. Creating project documentation.	Section 6.4.20, page 74

6.3.4 Designing PV Hybrid Systems



Procedure	See
1. Starting Sunny Design	Section 3.2, page 12
2. Creating a new project or Opening an existing project	Section 6.2.1, page 30 Section 6.2.3, page 30
3. Entering project data	Section 6.4.1, page 43
4. Defining the load profile	Section 6.4.4, page 52
5. Configuring gensets	Section 6.4.5, page 53
6. Configuring PV system.	Section 6.4.8.1, page 60
7. Cable sizing (optional)	Section 6.4.11, page 66
8. Analyzing efficiency (optional)	Section 6.4.15, page 70
9. Overview of the results	Section 6.4.17, page 73
10. Creating project documentation.	Section 6.4.20, page 74

6.3.5 Designing Energy Systems



Procedure	See
1. Starting Sunny Design	Section 3.2, page 12
2. Creating a new project or Opening an existing project	Section 6.2.1, page 30 Section 6.2.3, page 30
3. Entering project data	Section 6.4.1, page 43
4. Defining scenario	Section 6.4.6, page 54
5. Configuring energy system	Section 6.4.7.1, page 55
6. Overview of the results	Section 6.4.17, page 73
7. Viewing summary	Section 6.4.18, page 73
8. Creating project documentation.	Section 6.4.20, page 74

Also see:

- > Section 6.4.13 "Planning the Energy Management", page 68

6.3.6 Special Battery Applications

6.3.6.1 Optimizing Self-Consumption through Storage of PV Energy



To increase self-consumption and to be as independent as possible from the utility grid, the excess PV energy can be stored in batteries for later use.

Procedure:

1. In terms of projects with self-consumption option, click on **Intermediate storage of excess PV energy** on the page **Determine self-consumption** (see Section 6.4.12, page 67).
2. In terms of energy systems, ensure that the item **Self-consumption increase** is selected from the drop-down list under **Application** on the page **Battery system**.

6.3.6.2 Activating Peak Load Shaving



With the "Peak Load Shaving" function, you can optimize the behavior of the battery inverter with respect to the power exchange at the point of interconnection. This is mostly useful when a higher supply of energy would lead to a higher electricity cost. With the "Peak Load Shaving" function, certain grid-exchange power outputs to which the battery inverter is adjusted depending on its power and battery capacity available can be set. Power peaks and additional costs can thus be avoided.

To use Peak Load Shaving function, a purchasing tariff including demand charges is necessary.

Procedure:

1. On the **Energy system** page, the **System** (quick planning) page or the **Self-consumption** (detailed planning) page, click the **[BATTERY SYSTEM]** button in the central workspace.
2. If the option **Take battery-storage systems into account** has been selected on the page **Defining the battery system**, select **Peak Load Shaving** from the drop-down list under **Application**. In the field **Grid-supply limit**, enter the value of the grid-supplied power at which the battery system begins to reduce the grid-supplied power by discharging the energy storage system.
3. To have a proposal for the grid-supply limit calculated, select **[Determine grid-supply limit]**.
4. To accept the calculated grid-supply limit, click **[Accept proposal]**.

6.3.6.3 Defining Battery Charge Time Window



The Sunny Home Manager can control the battery system in such a way that costs can be saved in terms of time-of-use electricity tariffs. For this purpose, time windows must be defined in which the battery is charged with energy drawn from the utility grid.

Procedure:

1. Click on **Energy management** on the page **Determine self-consumption**. If necessary, select a Sunny Home Manager 2.0 or Sunny Home Manager as an energy-management device. If an SMA Cluster Controller or SMA Data Manager M has been selected on the page **Configure PV system**, this option can not be selected.
2. Click on **Intermediate storage of excess PV energy** on the page **Determine self-consumption**.
3. Click on **Battery charge time window** on the page **Determine self-consumption**.

4. Select the days for which the time window is to be defined in the dialog box **Battery charge time window**.
5. Select the beginning of the time window from the drop-down list.
6. Select the end of the time window from the drop-down list.
7. Enter the maximum charging power.
8. If another battery charge time window has to be defined, click on [+ **Add a time period**]. Then make the required adjustments to your settings.
9. To delete a time period, click on the trash can icon.
10. Click on [**OK**] in order to save your settings.

6.3.6.4 Enable peak shaving with increased self-consumption (multi-use)



With the "multi-use" function, the inverter behavior to the power exchange at the point of interconnection can be optimized. In the process the "peak shaving" function and increased self-consumption are combined to further reduce the energy costs.

The "multi-use" function divides the useful range of the battery area of use into 2 sections:

- Section below the SOC limiting value

If the battery state of charge is below the limiting value, the battery is used for peak shaving.

To do this, the battery-storage system is discharged in this range if the grid-supplied power exceeds the specified grid-supply limit. The battery is charged from the utility grid or with surplus PV energy if the feed-in power is higher than the specified feed-in limit.

If the battery is charged with energy drawn from the utility grid, a negative value must be entered for the load limit. Example: If the peak load must be limited above 50 kW and the battery must be charged below 50 kW, 50 kW must be entered as the grid-supply limit and -50 kW as the load limit.

- Section above the SOC limiting value

If the state of charge of the battery is above the limiting value, self-consumption must preferably be optimized.

To do so, the battery-storage system is discharged in this range to limit the utility grid-supplied power to the specified maximum value. As a rule, this is 0 kW. The battery is typically charged using excess PV energy. In the case of increased self-consumption, the battery-storage system can be discharged up to the specified SOC limiting value. If the battery is not charged with energy drawn from the utility grid, 0 kW must be entered for the feed-in limit.

The "multi-use" function can be defined with the following settings:

Parameter	Description
Grid-supply limit	Definition of the maximum power that may be obtained from the utility grid. If this power is exceeded, the battery is discharged to reduce the peak load. The supply limit can be separately defined for both ranges.
SOC limiting value	Distributing the total capacity of the battery to use "peak shaving" or for increased self-consumption

Parameter	Description
Hysteresis	Extension of the range for the switching limit defined by the SOC limiting value. This extension is applied symmetrically around the SOC limiting value. A hysteresis of 3% at a SOC limiting value 50% means a switching range of 47% to 53%. This setting is only possible for Sunny Tripower Storage 60.
Feed-in limit	Definition of the power from which the battery is recharged. This value depends on the peak loads to be expected and must be defined on a project-by-project basis. Positive values indicate the feed-in power above which the battery is charged. Negative values indicate a power draw level below which the battery is charged. The feed-in limit can be separately defined for both ranges. This setting is only possible for Sunny Tripower Storage 60.

To use Peak Load Shaving function, a purchasing tariff including demand charges is necessary.

Procedure for three-phase battery-storage system:

1. For energy systems on the **Energy system** page, click the **[BATTERY SYSTEM]** button in the central workspace.
2. For PV systems with self-consumption, on the **System** page in the central workspace, click the option button **Take battery-storage systems into account** in the **[Battery system]** area.
3. Click the **three-phase** option button.
4. In the **Device** field, select **Sunny Tripower Storage 60** on the drop-down list.
5. In the **Use** field on the drop-down list, click **Peak load shaving and increased self-consumption (multi-use)**.
6. To have a suggestion for the peak shaving limit calculated, select **[Determine grid-supply limit]**. It only makes sense to configure the following settings with a grid-supply limit that is suitable for the system.
7. Click **[Accept proposal]**.
8. Click **[Settings]** to define the "multi-use" function. The suggestion for the grid-supply limit is applied in the dialog.
9. In the **Grid-supply limit** field for the "increased self-consumption" range, enter the value of the grid-supplied power at which the battery system begins to reduce the grid-supplied power by discharging the energy storage system. We recommend entering a value of **0.0 kW**.
10. Enter the required values in the **SOC limiting value**, **Hysteresis** and **Load limit** fields. For the load limit for the "peak shaving" range, we recommend entering the value of the grid-supply limit with a negative sign and for the "increased self-consumption" range, enter **0.0 kW**.
11. Click on **[OK]** in order to save your settings.

Procedure for single-phase battery-storage system:

1. For energy systems on the **Energy system** page, click the **[BATTERY SYSTEM]** button in the central workspace.
2. For PV systems with self-consumption, on the **System** page in the central workspace, click the option button **Take battery-storage systems into account** in the **[Battery system]** area.
3. Click the **single-phase** option button.
4. In the **Device** field on the drop-down list, select the required device.
5. In the **Use** field on the drop-down list, click **Peak load shaving and increased self-consumption (multi-use)**.
6. To have a suggestion for the peak shaving limit calculated, select **[Determine grid-supply limit]**. It only makes sense to configure the following settings with a grid-supply limit that is suitable for the system.
7. Click **[Accept proposal]**.
8. Click **[Settings]** to define the "multi-use" function. The suggestion for the grid-supply limit is applied in the dialog.
9. In the field **SOC limiting value**, enter the desired value.

10. If necessary, click the **Adaptive increase of the grid-supply limit** options.
11. If the **Adaptive increase of the grid-supply limit** was clicked, if necessary click the **Automatic reset at the end of the accounting period** option button and select the duration of the accounting period.
12. Click on [OK] in order to save your settings.

6.3.7 Defining E-Mobility for Projects with Self-Consumption Option



Procedure	See
In the Load profile , click on Take electric vehicle into account . Now enter details on driving profile and average mileage per day.	Section 6.4.4, page 52
Click on the charging station to be used or configure a new one.	Section 6.3.10.4, page 41
Click on the electric vehicle to be used or configure a new one.	Section 6.3.10.5, page 41
Adding absences of more than 24 hours	Section 6.3.10.3, page 41

6.3.8 Defining E-Mobility for Known Vehicles



Procedure	See
Configuring charging stations	Section 6.3.10.4, page 41
Click on the driving profiles of the electric vehicles used or configure a new driving profile in the dialog box Energy system under Mobility .	Section 6.3.10.1, page 40
Click on the electric vehicle to be used or configure a new one.	Section 6.3.10.5, page 41
Adding absences of more than 24 hours	Section 6.3.10.3, page 41

6.3.9 Defining E-Mobility for Unknown Consumption Behavior



Procedure	See
Click on Take e-mobility into account in the dialog box Energy system under Mobility .	Section 6.4.7.4, page 59
Configure statistical usage of charging stations in the dialog box Energy system under Mobility .	Section 6.3.10.6, page 42

6.3.10 E-Mobility

6.3.10.1 Defining Driving Profile



For self-consumption projects, driving profiles can be added on the page **Load profile** under **Electric vehicle** (see Section 6.4.4, page 52).

For energy-system projects, charging stations and electric vehicles are added on the page **Energy system** (see Section 6.4.7, page 55).

Procedure:

1. To use an existing standard template, click on **[Select template]**.
2. To define a new driving profile, enter the profile name in the field **Driving profile**.
3. To save an adjusted profile as a template, click on **[Save as template]**. Thus, this profile can be used with other projects.
4. To define e-mobility including known consumption behavior, define the charging stations in the **Charging station** area and select the right charging stations from the drop-down list.
5. If the required charging station is not available, click on **[New charging station]** to configure it (see Section 5.1.7, page 24).
6. To subsequently change your selected charging station, click on  to configure it (see Section 5.1.7, page 24).
7. Select the right electric vehicle from the drop-down list under **Vehicle type**.
8. If the required electric vehicle is not available in the drop-down list, click on **[New electric vehicle]** to configure it (see Section 6.3.10.4, page 41).
9. To subsequently change your selected electric vehicle, click on  to configure it (see Section 6.3.10.5, page 41).
10. To define the time window for the different uses of the electric vehicle or charging station, click on the required time window. You can also click on **[+ New time period]** to define the time window (see Section 6.3.10.2, page 40).
11. If at least one time window is defined for **Driving** in the usage profile, adjust the data in the field **Average mileage per day**.
12. Click on  under **Absences** to add absences of more than 24 hours or to delete past absences (see Section 6.3.10.3, page 41).

Also see:

- > Section 5.1.8 "Creating and Managing Your Own Electric Vehicles", page 24

6.3.10.2 Defining Time Windows



You must define time windows with regard to the different types of use of electric vehicles and availability of charging stations. You may add a certain tolerance to each time window. Potential shortages in terms of self-consumption can be better identified.

Procedure:

1. To define a time window for charging an electric vehicle, click on **Charging**.
2. Select the days for which the time window is to be defined. If the time window applies to any day of the week at the same time, select the option **Every day**.

3. Select the beginning of the time window from the drop-down list.
4. Select the end of the time window from the drop-down list.
5. Possible delays to the start or end of the time window can be selected from the respective drop-down list.
6. If **Charging** has been selected for the time window, select the location of the charging station you want to use.
The calculation of e-mobility uses only the consumption for charging on site.
7. Click on **[OK]** in order to save your settings for the time window.

6.3.10.3 Defining Absences



To better plan self-consumption using electric vehicles, you can specify absences on a daily basis. Up to 10 time periods can be specified in which the defined time windows are not taken into account. These absences are not specified for 1 year. They should be deleted when dealing with non-recurring absences (e.g. fixed company holidays).

Procedure:

1. To define absences, click on **[+ Add absence]**. In case of absences that are no longer valid, click on .
2. Enter the required data in the fields **First day of absence** and **Last day of absence**.
3. To delete absences that are no longer valid, click on the trash can icon.
4. Click on **[OK]** in order to save your settings for absences.

6.3.10.4 Adding and Managing Charging Stations



There are 3 ways to define a charging station:

- In the dialog box **Own charging stations**
- On the page **Energy system** page under **Charging station**
- On the page **Load profile**

Procedure:

1. Enter the type of charging station in the field **Type**.
2. Enter the charging power of the charging station in the field **Maximum charging power**.
3. Adjust the number of charging points of the charging station in the field **Number of charging points**.
4. Click on **[OK]** in order to save your input.
5. To reject input, click on **[Back to own charging stations]**.

6.3.10.5 Adding and Managing Electric Vehicles



There are 3 ways to define an electric vehicle:

- In the dialog box **Own electric vehicles**
- On the page **Energy system** under **Mobility**
- On the page **Load profile**

Procedure:

1. Select the manufacturer of the electric vehicle from the drop-down list in the field **Manufacturer**.

2. Enter the type of electric vehicle in the field **Vehicle type**.
3. Enter the electric vehicle's consumption in the field **Consumption**.
4. Enter the battery capacity of the electric vehicle in the field **Battery capacity**.
5. Enter the charging power of the electric vehicle in the field **Maximum charging power**.
6. Click on **[OK]** in order to save your input.
7. To reject input, click on **[Back]**.

6.3.10.6 Defining Statistical Charging Station Usage



Driving profiles including statistical usage behavior can be added on the page **Energy system** page under **Loads > Mobility** (see Section 6.4.7.4, page 59).

To improve charging behavior planning, 2 different options are available:

Option	Explanation
Queuing	It is assumed that the majority of vehicles is waiting for a free charging station.
Skipping the charging process	It is assumed that the majority of vehicles is skipping the charging process.

To improve charging time planning, 2 different options are available:

Option	Explanation
Vehicle leaves the charging station upon completing the length of stay (e.g., grocery store)	It is assumed that the majority of vehicles is not charging to full capacity.
Vehicle is being fully charged.	It is assumed that the majority of vehicles is charging to full capacity.

Procedure:

1. To select a template regarding the statistical usage of the charging station, click on **[Select template]**.
2. Enter the maximum charging power range of the arriving vehicles in the respective fields.
3. Select the desired option button in the **Behavior when more vehicles are arriving than charging stations are available** field.
4. Select the expected charging behavior of the vehicles under the **Charging time** option button.
5. To configure the number for vehicles and distribution of their arrival times over the course of 24 hours, click on **[Add new arrival profile]** and make the corresponding settings.
6. To assign an arrival profile to a certain day of the week, enable or disable the corresponding weekdays within the required arrival profile. Enabled weekdays are highlighted in blue.
7. To delete profiles, click on the trash can icon of the corresponding arrival profile

6.4 Project Design

6.4.1 Entering Project Data



Section: Project data

You can add project images to the project data in terms of project documentation. Six images with a maximum of 12 MB can be uploaded in Sunny Design. You can either upload images or take photos during the visual roof planning.

Procedure:

1. Enter the required project name in the field **Project name**.
2. Select the current project status from the selection list in the field **Project status**.
3. Enter customer data in the field **Customer**. A selection list of all customers appears if you enter the field and there are already saved customer data.
4. To add a new customer, click on **[New customer]**.
 - ☒ The dialog **Customer data** opens (see Section 5.11, page 29).
5. To edit a selected customer, click on .
6. Click  to assign a customer from the customer database.
7. Enter parts of the address in the free-text field and click on **[Show results]**.
8. Alternatively, it is possible to search the last name, company or location of a customer. To do so, open the relevant field, click the corresponding entry and click **[Show results]**.
9. To assign customer data to the project, select customer in the results list. Then click on entry **Open customer** in the context menu.
10. Upload images if required.
11. In the section **Location of building**, select the required location.
12. Select **[Low voltage]** or **[Medium voltage]**.
13. If you have selected **[Low voltage]**, select the required grid voltage from the drop-down list **Grid voltage of the inverters**. You can adjust this entry as required after selecting the inverter.
14. If you have selected **[Medium voltage]**:
15. If required, make additional settings under **Advanced project data**.

Upload images

1. Click on **[Upload images]**.
 - ☒ The dialog box **Upload project images** opens.
2. To select a file, click on **[Upload different image]**.
3. In the file selection window, select the required file and click on **[Open]**.
 - ☒ The image is displayed in the preview.
4. To select an image for project documentation, click on the image you want to use and select the option **Apply as project image**.
 - ☒ The selected image can be identified by the red frame under Project data.
5. If necessary, enter an image title and a caption for the current image in the relevant fields.
6. To crop the image, click on **[Edit image]**.
7. Change the cropped image using the gripping points and click on **[Accept changes]**.

8. To delete an image, select the respective image and click on **[Delete image]**.
9. Select **[Accept changes]**.

Configuring systems with medium voltage

1. Depending on which inverters you wish to use in the PV system, select either **Decentralized inverters** or **Central inverters** under **System type**.
2. Enter the required medium voltage in the field **Medium voltage**.
3. If you have selected the **Decentralized inverters** option, select the required output voltage of the inverters from the **Inverter grid connection** drop-down list.
4. If required, enable the checkbox **Carry out optimized reactive power adjustment with Integrated Plant Control**.

Only in case of quick planning: Load profile section

1. Under **Load profile type**, select the required option. You can only select the option **Own load profile** if you have already created an own load profile (see Section 5.1.6, page 21).
2. Select the required load profile from the drop-down list **Load profile**. You find a description of the selected load profile in the field **Description**.
3. If required, adjust the setting in the field **Annual energy consumption**.

Section: Advanced project data

In this section you can make further settings if required. There are some default settings in this area already in accordance with your settings under **Project data**. Depending on the selected project, you can also provide details on: grid connection, electrical connection in terms of off-grid systems and specifications laid down in legislation and standards.

Procedure:

1. Click on **[Edit]** in the required area and adjust the settings.
2. Click on **[Edit]** under **Location settings** if you want to sell energy directly to the grid in terms of PV systems in Germany with an installed power of at least 100 kWp.
3. Enable the option **Take offer for integrated direct marketing (SMA SPOT) into account**. In doing so, you activate the page **Direct selling** (see Section 6.4.14, page 70).

Section: Next steps

Project type	Next steps
	• In terms of Quick planning: Click on [Configure the PV system] in the system (see Section 6.4.2, page 45). • In terms of Detailed planning: Click on [Configure the PV system] (see Section 6.4.8.1, page 60).
	• In terms of Quick planning: Click on [Configure the PV system] in the system (see Section 6.4.2, page 45). • In terms of Detailed planning: Click on [Define the load profile] (see Section 6.4.4, page 52).

Project type	Next steps
	Click on [Define the load profile] (see Section 6.4.4, page 52).
	Click on [To scenario] (see Section 6.4.6, page 54).

6.4.2 Configuring the System



Quick planning

In Quick planning, all components of the planned PV system can be planned on this page. If required, you can switch to Detailed planning at any time during the planning process (see Section 6.4.8.1, page 60). Up to 6 PV arrays can be created.

Procedure:

- To plan the PV array using Visual roof planning, either select **[Visual roof planning]** or click on the photo (see Section 6.4.3, page 46).
- To define the PV array components without further planning of the roof area, click **[Manual roof planning]**.
- Click on **Manufacturer/PV module** and select the required PV module. Click on the magnifying glass icon to start the search.
- To configure monitoring, disconnection and optimization in the event of shading, select the corresponding options in the dialog box **Change the manufacturer and type of PV module**.
- To get information on the selected PV module, click on the info symbol.
- Click on **Number of PV modules/Peak power** and determine the size of the PV array using the number of PV modules or the peak power.
- Click on **Orientation/Mounting type** and select the required properties.
- To add more PV modules, select **[Add PV array]** and make the appropriate settings.
- To select inverters manually, click **[Manual design]**.
 - ☒ The dialog box **Select an inverter** opens.
- To restrict the list of displayed inverters, enable the required checkboxes under **Set inverter limits**.
- Under **Additional inverters**, select the row of the required inverter.
 - ☒ The activated row is displayed in a different color.
- Click on **[Adopt inverter]**.
 - ☒ The selected inverter is added and displayed under **Inverter**.
- To add further inverters, click on **[Manual design]**.
- To select inverters from design suggestions, have design suggestions displayed (see Section 6.4.8.4, page 64).
- To have inverters selected automatically by Sunny Design, select **[Automatic design]**.
- To restrict the selection of inverters, click on **[Inverter filter]** and enable the required checkboxes.
 - ☒ The dialog box **Design** opens.
- If required, change the displacement power factor and the method for calculating design suggestions.
- Click on **[Accept changes]**.
 - ☒ If the PV system is operated in Germany and provides a DC power of at least 100 kWp, a message appears asking you whether you want to sell unused energy directly to the grid.

19. Click on **[Yes]** if you want to sell unused energy directly to the grid. In doing so, you activate the page **Direct selling** (see Section 6.4.14, page 70).
20. To define the battery systems, click the **Take battery-storage systems into account** option button.
21. Select whether a single-phase or a three-phase system should be defined.
22. In the **Device filter** dialog, select the devices that are to be considered for the design.
23. Select the battery inverter you want to use from the drop-down list **Devices**.

6.4.3 Visual roof planning

6.4.3.1 Define the building

1 building with a rectangular floor space is automatically placed at the address entered on the page **Project data**. Below you can define the shape and dimensions of the building, the shape and pitch of the roof and the orientation of the building on the lot. You can either work with the mouse or enter the values in the input fields. In addition to the automatically created building, you can also create other buildings in the surrounding area. During this process, you can also plan PV modules on 5 further roof areas. You can use the remaining buildings to create shading.

Objective	Operation with the mouse
Changing the scaling of the display	• Use the mouse wheel to change the size of the map. - or • You can change the size of the map using the buttons [+] and [-] at the upper right edge of the map.
Switching the view between 2D and 3D (possible during the entire planning process)	• To display the map in top view, switch off the option 3D with the mouse. This makes it easier to adjust the floor plan and orientation of the building.
Orientation of map to the north	• Click on the symbol .
Changing the display view	• Move the map with the left mouse button pressed down. • With the right mouse button pressed down, change the inclination of the map.
Changing size of the house and roof pitch	• Click on the house using the mouse. This will turn the house blue. • Move the mouse over the edge to be changed. The edge that can be changed turns yellow and the cursor becomes a hand. • With the left mouse button pressed down, drag the respective edge in the appropriate direction. The dimensions change both in the graphic and in the overview in the right part of the screen.
Changing positioning of house	• Click on the house using the mouse. This will turn the house blue. • With the left mouse button pressed down, move the house to required position. During positioning, the house appears green. • With the right mouse button pressed down, move the house to required position. During positioning, the house appears green.

The roof plan is only accepted when you exit the window on the page **Layout of PV modules** by clicking on **[Save]**.

Procedure:

1. If necessary, select the option **L-shape building**. The house is adjusted automatically. The angle at which the house parts stand to each other and the size of the house parts can be defined in the following.

2. Select the shape of the roof. If you cannot find the required roof shape, select the roof with the strongest similarity.
Note: It is not possible to define asymmetrical roof halves for gable roofs. If the roof halves are very different and possibly no PV modules should be mounted on one part, the choice of a pitched roof and the corresponding change in house dimensions is recommended.
3. Adjust the size of the house and roof pitch.
4. Adjust the orientation of the house with regard to the direction. This information is also used for further calculations.
5. Create another building, if necessary. To do this, click on **[New building]** and define the building.
6. Continue planning of obstacles by clicking on **[Continue]**.

6.4.3.2 Defining restrictions

On this page, you can set restrictions for the roof. These can be dormers, skylights or similar objects that influence the installation of PV modules or also chimneys, trees or walls that might shade the roof. In addition, you can define distances that should be kept to the ridge, the roof edge and the eaves. Ask a roofer for his or her roof recommendations.

PV modules may be planned on the different dormers if needed. Restrictions such as skylights, round dormer windows or building blocks are regarded exclusively as interfering objects. No PV modules can be planned on them.

Procedure:

1. Select the type of obstacle and place it in the required position. Dormers, skylights, building blocks and cylinders can only be placed on the roof. Chimneys, trees and walls can be placed on the lot. As long as the surface is not large enough to insert the obstacle and in case of intersections with other objects, the obstacle appears red.
2. In the case of dormers, skylights, building blocks and cylinders, enter the dimensions and the distances of the obstacles to the edges of the roof.
3. To change the position and size of a dormer, click on the respective dormer with the mouse and adjust it. If several identical dormers are to be adjusted at once, the dormers can be selected one after the other by clicking on them and pressing the [Ctrl] key simultaneously. To make the entries easier, an input field opens on the right side.
4. In the case of chimneys, buildings and walls, enter the dimensions and the position of the obstacles.
5. To use a defined obstacle multiple times, select the required obstacle and copy it by clicking the **[Copy]** button in the upper left corner.
6. Move the mouse pointer to the place where the obstacle is to be inserted. If the obstacle can be inserted at the location, it will appear green. As long as the roof surface is not large enough to insert the obstacle and in case of intersections with other objects, the obstacle appears red.
7. To remove an obstacle, click on the respective obstacle and delete it. Click on either **Del** on the keyboard or on **[Delete]** in the upper left corner.
8. To continue the selection of PV modules, click on **[Continue]**.

6.4.3.3 Defining the layout of PV modules

Up to 6 areas with PV modules can be defined. The areas can be laid out on the roof surfaces and on dormers. This allows you to plan for several roofs, select different PV modules and specify different orientations of the PV modules. Here, you can define 1 module type and 1 orientation per surface. For flat roofs with an east-west inclination, 2 PV arrays are automatically set up. This reduces the number of individual surface areas in the project that PV modules can be planned for.

The PV modules can be automatically arranged, moved and copied. In order to provide corridors for the maintenance of the PV modules on the roof, the option **Additional separations** can be used to insert spaces between a definable number of rows and columns.

When planning the PV modules, the shading caused by obstacles can be taken into account. The shading of the PV modules can be displayed on this page. Here, the different sun position during the various seasons is taken into account.

You can edit the modules using the mouse.

Objective	Operation with the mouse
Move individual PV modules on the grid	Click the required module and drag.
Moving all PV modules on the module field grid	Use [Ctrl] +A to select all PV modules and drag them.
Free movement of individual PV modules	Use [Strg] to click the required PV module and drag.
Canceling the module selection	Select [Esc] .

Procedure:

1. If necessary, add additional areas. This is possible as long as a maximum of 2 areas are defined.
2. Resize the already defined module area so that the additional area can be added. For this purpose, click on the corresponding module area with the mouse. Marker points appear at the corners of the area, which you can use to adjust the size.
3. In the right side of the dialog, under **Select area**, select **+** and click on a free area on the roof. Thus, another roof area is added.
4. If necessary, adjust the names of each individual area.
5. To calculate the maximum number of PV modules according to the selected module type, orientation and available area, click on the option **Maximum peak power**. This means that the number of PV modules can no longer be changed manually.
6. To define the PV modules, select the **PV modules** tab.
7. If the number of PV modules for the activated area should be defined manually, enter the number of modules.
8. Click on PV modules used and alignment via the button under **PV modules and alignment**. Select the respective options in the dialog box **Manufacturer and type of PV module**.
9. In case of a flat roof: Under **Mounting type**, select whether the modules should be mounted horizontally or with substructure.
10. Enter data for row spacing, gaps and distance between modules and obstacles. In case of a flat roof: Additionally enter the inclination of the modules and the azimuth of the module field.
11. Click on **[Align PV modules]** wählen. This automatically arranges the PV modules according to roof surface specifications.
12. To add corridors for maintenance or thermal separation, click on **Additional separations**.
13. To define the width and arrangement of the corridors, enter the desired values in the fields **Row separation**, **Gap separation** and **Frequency**. Frequency means how many modules per row or gap should be arranged per corridor.
14. If the arrangement or selection of PV modules has been changed, click on **[Accept change]**.
15. To view the shading of the PV modules, select the **Shading** tab.
16. To have the shading calculated throughout the year, select the **Annual shading** option.
17. Select **[Calculate shading]**.
 - ☒ The calculated shading of the selected area can be displayed in false colors with the **Shading of the roof area** option or as a percentage of shading.
18. To visualize the path of the shading, select the **Sun position indicator** option.

19. Select the date and time of the required shading display. The time does not take daylight savings time into account.
20. To complete the visual roof planing, click on **Save**.
 - ☒ You return to the page **Configure PV system** (for Detailed planning) (see Section 6.4.8.1, page 60) or the page **Configure system** (for Quick planning).

Also see:

> Section 6.4.2 "Configuring the System", page 45

6.4.3.4 Defining the electrical design

On this page, you can wire the PV modules and assign them to the inverters or make changes in the design suggestions.

Creating a new electrical design

The electrical design can be created in 3 different ways:

- **Design suggestions:** Different design suggestions are automatically calculated and shown on a list. The list can be sorted by the number of inverters, efficiency or by energy yield to make it easier to select the design (see Section 6.4.8.5, page 64). The inverters used can be limited in retrospect based on various properties and restrictions. On the list of calculated designs, the recommended inverters, nominal power ratio, energy yield and efficiency are included. Based on this information, one of the suggestions can be selected for the further design or multiple suggestions can be compared to each other. An additional design suggestion replaces a previously available electrical design.

If more than 3 PV arrays are designed, users must decide which 3 PV generators a design should be calculated for.

- **Automatic design:** Different design suggestions are automatically calculated and the suggestion that the system rates as optimal will be selected. An additional automatic design replaces a previously available electrical design. This type of calculation is only possible if a maximum of 3 PV arrays are designed.
- **Manual design:** It is possible to manually select the inverters used. The inverter selection can be limited by SMA product family, various properties and restrictions. Each system section is selected separately. The design refers to the PV modules or PV arrays that have not yet been connected to inverter inputs. In manual design, new system sections are created.

For all design suggestions, the individual PV modules are connected to form strings and assigned to system sections. The preferred string alignment and starting point can be selected in the **String design** gewählt dialog. In the process, a unique designation is assigned to each individual PV module. The string designation is assigned automatically in accordance with the selection in the settings:

- **Inverter.String.Module:** The string designation refers to the inverter that the strings are connected to (e.g. 1A.1.3: at inverter 1 at input A on string 1 the 3rd module).
- **Roof.String.Module:** The string designation refers to the roof area on which the strings are located (e.g. 2.2.3: on roof area 2 on string 2 the 3rd module).

System sections are created if necessary. System sections can contain multiple inverters of the same type with the same configuration. The results of the design are shown in the right-hand section of the user interface.

Representation of PV modules and strings

Display	Explanation
Red outline	The PV module is not connected to a string. There are no connection lines between PV modules.
Red connection line	The string is not connected to an inverter input.

Display	Explanation
Red module surface	The string is too short or too long.
Yellow connection line	The string is connected to an inverter input.
Green module surface	The string is selected and the string length is correct.

Procedure:

1. To calculate the design suggestions, click the button for the desired type of calculation.
2. Select the rules for string design in the **String design** dialog.
3. For the "Design suggestions" type of calculation, click multiple suggestions and click [**Compare selection**] if necessary.
 - ☒ The selected design suggestions will be juxtaposed for better comparison.
4. For the "Design suggestions" type of calculation in the **Compare alternatives** dialog, click the [**Apply design**] button for the desired alternative.
5. For the "Design suggestions" or "Manual design" types of calculation, select the desired design and click [**Adopt design**].
 - ☒ The strings are calculated and represented in the roof area planning as yellow lines. In the right-hand section, the system section are shown with the inverters whose inputs the strings are connected to.

Changes to existing electrical design

Various changes can be made to the existing electrical design. If a string on the roof area or at the inverter input is clicked, the icon  appears. The following changes can be made to the existing design:

Modification	Icon	Explanation
Recalculation		The electrical design can be recalculated for the selected string, the current roof area or all roof areas, as required.
Switching poles		The poles of the selected string are switched. The assignment does not have an effect on the design: only the representation is changed.
Disconnecting the string		The selected string is disconnected from the current input and represented as an unconnected string. This function can also be selected in inverter design.
Deleting		For strings: The selected string is deleted and the modules are represented as unconnected again. This function can also be selected in inverter design.

Editing a system section

1. In order to edit the system section, click  in inverter design.
 - ☒ The **Edit system section** dialog will open.

2. Make the required changes. If you reduce the number of PV modules at an input, the PV modules will be removed at the negative pole of the string. If you increase the number of PV modules at an input, the number is compared to the PV modules that are available. In case of error, a warning is output and the change cannot be saved.
3. Click on **[OK]**.
4. To delete as system section, click .

Manually connecting PV modules to strings

1. In the inverter overview, select the inverter input that the string should be assigned to if necessary.
2. Select the first unconnected PV module of the string. This PV module is automatically assigned to the positive pole and drawing mode is activated.
3. Select the PV modules to be connected one after the other, and click to add them.
4. To complete string creation, select the **[Enter]** button or **[OK]**.
5. Alternatively, you can draw the string by clicking and holding the left mouse button. The PV modules will automatically be connected to the string by a mouseover across the middle of the PV module.
 - ☒ When you release the mouse, the string is saved.
6. To switch the pole assignment to the first and last PV module of the string, click  in the **Edit**  menu.

Connecting the string to the inverter input

To connect a string to an inverter input, various options are available.

Procedure:

1. Select the unconnected string and click the symbol  for the required inverter input or
2. Select the unconnected string, select the system section from the drop-down list of the system sections of the required inverter and select the required input from the drop-down list of the inputs.

Recalculating strings

The strings can be recalculated at any time. You can select whether the selected string, current roof area or all roof areas should be recalculated.

Strings must have the right system voltage in order to be connected to the inverter.

Procedure:

1. Select the required string and click  > .
 - ☒ The **String calculation** dialog opens.
2. Select the strings to be recalculated.
3. Select the preferred string design and starting point.
4. Click on **[OK]**.
- ☒ The calculation will be carried out and the result will immediately be shown on the bottom of the screen in the 3D area.

Editing a string

1. To change the length of a string, carry out a mouseover on the beginning or end point of the required string. The string must not be selected.
 - ☒ Drawing mode is activated.
2. To remove the last connected PV module from the string, click the required module.
3. To add an unconnected PV module to the string, click the required module.
4. To apply the change, select the **[Enter]** button or **[OK]**.

6.4.4 Defining Load Profiles

You can select typical load profiles or create and edit your own load profiles. 2 load profiles can be combined in case of off-grid and self-consumption projects. 5 templates can be combined in case of energy systems. In the menu **My Sunny Design > Own load profiles**, you can create or manage your own load profiles.

Section: Load profile details



Detailed planning

1. Under **Load profile type**, select the required option. You can only select the option **Own load profile** if you have already created an own load profile (see Section 5.1.6, page 21).
2. Select the required load profile from the drop-down list **Load profile**. To get information on the selected load profile, click on **[Profile information]**.
3. If required, adjust the setting in the field **Annual energy consumption**.
4. To edit the load profile, click on **[Edit load profile]** under **Own load profile**. Then adjust the load profile.

Only with off-grid projects:

Sunny Design calculates an expected output of 30 minutes from the sum of defined load profiles. You can define a power reserve here to ensure that your system is supplied with energy as planned during peak loads.

Procedure:

- Enter the expected peak load under **Specification peak load**.

Section: Specific loads



Detailed planning

1. If you are using a heat pump, activate the checkbox **Heat pump** and, from the drop-down list, select the use of the heated water.
2. Under **Hot water requirement**, enter the number of persons and the hot water requirement.
3. Under **Details of building**, enter the type of building, the number of floors and the surface area of each floor.
4. To get information on the load profile with heat pump, click on **[Profile information]**. The button can only be clicked on if the checkbox **Heat pump** is enabled.

Section: Electric vehicle



Detailed planning

Self-consumption can be increased using a charging station. You may select 1 charging station and one vehicle for the system. You may also define a new driving profile or select a template.

Procedure:

1. If you use an electric vehicle, enable the checkbox **Take electric vehicle into account**.
2. Define the driving profile of the electric vehicle.
3. To obtain information on the load profile of the electric vehicle, click on **[Profile information]**. The button can only be clicked on if the checkbox **Take electric vehicle** is enabled.

Section: Next steps

Project type	Next steps
 	Click on [Configure the PV system] (see Section 6.4.8.1, page 60).
	Click on [Configure gensets] (see Section 6.4.5, page 53).

Also see:

- > Section 5.1.7 "Creating and Managing Your Own Charging Stations", page 24
- > Section 5.1.8 "Creating and Managing Your Own Electric Vehicles", page 24
- > Section 6.3.10.2 "Defining Time Windows", page 40
- > Section 6.3.10.3 "Defining Absences", page 41
- > Section 6.3.10.1 "Defining Driving Profile", page 40

6.4.5 Configuring Gensets (PV Hybrid System)**Section: Gensets**

- To adjust the parameters of a genset, click on any field in the row of the required genset.
 - ☒ The dialog box **Genset** opens.
- If required, change the name of the genset under **Name**.
- In the drop-down list **Fuel**, select the fuel for the genset.
- If required, change the other settings for the genset.
- Click on [**Accept changes**].
- To add additional gensets, click on [**+ Add genset**].
- To delete a genset, click on the trash can icon in the row of the genset to be deleted. One genset remains permanently present, it cannot be deleted.
- Under **Details**, check whether the gensets can provide sufficient power for the load profile previously selected.

Section: Design conditions

- In the field **Load-related minimum power**, enter the minimum power that the gensets are to make available to the loads. You should also take account of the power reserve.
- In the field **Minimum PV power to be expected**, enter the minimum PV power to be expected for the PV system location.

Section: Next steps

- Click on [**Go to cable sizing**] (see Section 6.4.11, page 66).

6.4.6 Defining Scenarios



Section: Details of building

The information on this page defines the absolute energy requirement and the technical features of the energy system. System components and energy requirements are proposed according to the selected building type and dimension. When defining the scenario, the system components can be chosen freely.

Procedure:

1. Select type of building from the drop-down list **Building type**. Depending on the selection, the system components and the absolute energy requirement are suggested.
2. Under **Substance**, click on **[New building]** or **[Existing building]**. Depending on the selection, the system components and the absolute energy requirement are adjusted.
3. Under **Dimension**, choose between **[Small]**, **[Medium]** and **[Large]**. Depending on the selection, the system components and the absolute energy requirement are adjusted.
4. Select the components used within the system under **System components**. The selected components can be identified by the checkmark underneath the icon. They can be viewed in the overview of the energy system (see Section 6.4.7.1, page 55).
5. From the drop-down list **Heat transfer system**, select the system used for space heating.
6. If you selected two power generators in the **System components** area, select within the **Feed-in priority** area the system component whose current is primarily fed in.
7. Enter the volume of the buffer storage in liters under **Volume buffer storage**. The program suggests a volume based on building type and size, and heating energy requirements.

Section: Heat demand

This section is only available if thermal components, such as heat pump or combined heat and power plant, have been selected.

In thermal systems with 2 heat generators, the combined heat and power plant or the heat pump accepts the base load and the boiler the peak load. In systems with a combined heat and power plant and a heat pump, the heat pump absorbs the peak load. Combined heat and power plants are heat-operated.

Procedure:

1. Click on **[Heating energy requirement]** or **[Building size]** under **Basis for calculation**.
2. If you have clicked on **[Heating energy requirement]** under **Basis for calculation**, click on **[Absolute]** or **[Specific]** and enter the heating energy requirement per year.
3. Under **Heating energy requirement**, click either on **[Absolute]** or **[Specific]** and enter the heating energy requirement per year.
4. If you clicked on **[Specific]** under **Heating energy requirement**, enter the heated area and specific heating energy requirement.
5. If you clicked on **[Building size]**, select the proper building type from the drop-down list. Then enter the following values: building length and width, number of floors, average height of floors, target room temperature for day and night, and daily hot water demand.
6. Enter the average hot water requirement per day in liters under **Hot water requirement**.

Section: Next steps

- Click on **[Configure energy system]** (see Section 6.4.7.1, page 55).

6.4.7 Energy System

6.4.7.1 Structure of Energy System Page



The project page for energy systems serves as a starting point for the configuration of the system components. The page is divided into the central workspace and the section **Key figures relating to the energy system**. The central workspace is divided into the areas ENERGY SYSTEM, GRIDS and LOADS. The key figures relating to the energy system can be found in the lower area. You can access the configuration of the system components either via the main navigation or via the buttons of the respective components in the central workspace.

When you move the pointer of the mouse over the arrows between the components, the determined values are shown. The meaning of the various arrows and connecting lines between the components is explained in the bottom section of the central workspace.

Quick configuration and detailed configuration for PV system and battery system

For the configuration of the system components PV system and battery system, you can choose between a quick configuration and a detailed configuration. You can use the quick configuration for a simplified configuration of your PV system and battery system. You can provide detailed information in the tab **Technical configuration** with the detailed configuration. The tab **Technical configuration** in the detailed configuration for the PV system matches the page **Configure PV system**. The tab **Technical configuration** in the detailed configuration for the battery system matches the page **Configure battery system** (see Section 6.4.9, page 65).

When you switch from the quick to the detailed configuration, the data from the quick configuration are transferred to the detailed configuration. Switching from detailed configuration to quick configuration is no longer possible.

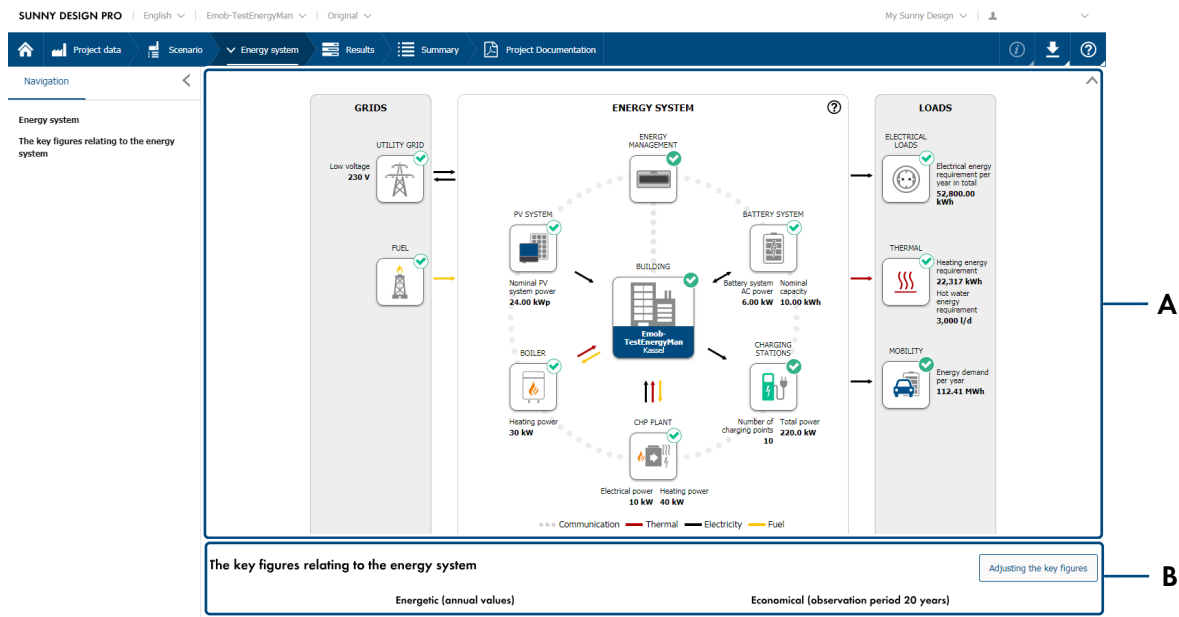


Figure 4: Configure energy system (example)

Position	Designation	Explanation
A	Central workspace for energy systems	In this section, you can access system components and key figures of the energy system. The system components shown have been defined on the page Scenario (see Section 6.4.6, page 54). This section is divided into ENERGY SYSTEM, GRIDS and LOADS for a better overview.
B	Section for 'Key figures relating to the energy system'	In this section, you can view and configure the key figures of the energy system. By clicking on [Adapt key figures] , you can select up to 10 key figures for your energy system. All other figures and information can be viewed on the results page and in the summary.

The individual components are indicated by symbols in the overview of the energy system, showing the configuration status.

Symbol	Explanation
	The system component is not configured or disabled.
	The system component is configured correctly. Default values have been used.
	The system component is configured correctly and tested.
	The system component is not optimally configured.
	The system component is incompatible.

6.4.7.2 Configuring Grid Components



Configuring the electrical grid connection

1. Click on [**UTILITY GRID**].
2. Make the required changes and click on [**Apply changes**].

Entering information on fuel consumption and costs

1. Click on [**FUEL**].
2. Make the required changes and click on [**Apply changes**].

Section: Next steps

- Click on [**Overview of the results**] (see Section 6.4.17, page 73).

6.4.7.3 Configuring Energy System Components

Adapting the building properties

1. Click on [**BUILDING**] in the central workspace.
2. To adapt the project data, click on **Adapt project data** (see Section 6.4.1, page 43).
3. To adapt the scenario, click on **Adapt scenario** (see Section 6.4.6, page 54).

Configuring the PV system

1. In the central workspace, click on [**PV SYSTEM**].
☒ The window **Quick configuration PV system** opens.
2. Make the required settings in the tab **Technical configuration**.
or
 Click on [**To detailed configuration**] and make the required settings in the tab **Technical configuration** (see Section 6.4.8.1, page 60).
3. Make the required settings in the tabs **Investment costs**, **Financing** and **Tariffs**.
4. If you designed the PV system in the quick configuration, click on [**Apply changes**].
5. If you designed the PV system in the detailed configuration, in the tab **Technical configuration** click on [**To wire sizing**] under **Next steps**.

Configuring the battery system

1. In the central workspace, click on [**BATTERY SYSTEM**].
☒ The window **Quick configuration battery system** opens.
2. If the project is to be designed without battery system, disable the checkbox **Take battery-storage system into account** and click on [**Apply changes**].
3. Make the required settings in the tab **Technical configuration**.
or
 Click on [**To detailed configuration**] and make the required settings in the tab **Technical configuration** (see Section 6.4.9, page 65).
4. Make the desired settings in the tabs **Battery inverter**, **Financing** and **Tariffs**.

5. If you designed the battery system in the quick configuration, click on **[Apply changes]**.
6. If you designed the battery system in the detailed configuration, click on **[To energy system]** in the tab **Technical configuration** under **Next steps**.

Configuring energy system

1. Click on **[ENERGY SYSTEM]** in the central workspace.
2. Make the required settings (see Section 6.4.13, page 68).
3. Click on **[Link to energy system]**.

Configuring combined heat and power plant (CHP plant)

1. Click on **[CHP plant]** in the central workspace.
2. Make the required settings under the tabs **Technical configuration**, **Investment costs**, **Financing** and **Tariffs**.
3. Click on **[Accept changes]**.

Configuring heat pump

1. Click on **[HEAT PUMP]** in the central workspace.
2. Make the required settings under the tabs **Technical configuration**, **Investment & operating costs** and **Financing**.
3. Click on **[Accept changes]**.

Configuring the boiler

1. Click on **[BOILER]** in the central workspace.
2. Make the required settings under the tabs **Technical configuration**, **Investment & operating costs**, **Financing** and **Tariffs**.
3. Click on **[Accept changes]**.

Configuring charging station

For planing the strategy when charging stations are overcrowded, there are 2 options:

Option	Explanation
When reaching full charge, clear for other vehicles.	No waiting times are expected in terms of the calculation of charging station utilization.
Clear for other vehicles only when leaving	Waiting times are expected in terms of the calculation of charging station utilization.

Procedure:

1. Click on **[CHARGING STATION]** in the central workspace.
2. Select the type and number of used charging stations under the tab **Technical configuration**. A charging station can be selected from a list of typical charging stations. You can also select defined charging stations under **Own charging stations**.
3. If you cannot find the required charging station on the list, define a new one if necessary (see Section 6.3.10.4, page 41).
4. To add additional charging stations, click on **[+ Add charging station]**.
5. To delete charging stations, click on the trash can icon.

6. To limit the total power of the charging stations, click on option **[Intelligent charging power limitation]** and enter the charging power you want to limit. When the charging station is limited to the entered value, the provided charging power is distributed among the individual vehicles.
7. Select one of the two options to define the strategy when charging stations are overcrowded.
8. In the field **Calculation charging tariff**, you can select whether and how the energy charged or usage time should be offset.
9. If the charging tariff is calculated per kWh or per minute, enter the tariff in the field **Charging tariff**. The positive values indicate a yield increase. A negative value corresponds to costs incurred as a result of operating the charging stations.
10. To define the time window for the different uses of the charging station, click on the required time window. You can also click on **[+ New time period]** to define the time window (see Section 6.3.10.2, page 40).
11. Make the desired settings under the tabs **Investment & operating costs** and **Financing**.
12. Click on **[Accept changes]**.

Section: Next steps

- Click on **[Overview of the results]** (see Section 6.4.17, page 73).

6.4.7.4 Configuring Loads



Up to five electrical loads can be configured.

Configuring electrical loads

1. Click on **[ELECTRICAL LOADS]**.
2. Make the required changes under the tab **Electrical load profiles**.
3. Make required changes under the tab **Electricity purchase and costs (before)**.
4. To copy the electricity purchase from the information provided under the tab **Load profiles**, enable the checkbox **According to load profiles**.
5. To calculate the electricity purchase costs according to the defined purchasing tariff, select the option **Calculation using purchasing tariff**.
6. Select **[Accept changes]**.

Configuring the heating energy needs of the building and the hot water needs

1. Click on **[THERMAL ENERGY]**.
2. Make the required changes under the tab **Heating demand**.
3. Make the required changes under the tab **Fuel (before)**. To apply the heating energy requirement from the information given under the tab **Heat requirement**, enable the checkbox **According to fuel consumption**.
4. To calculate the energy consumption according to the defined purchasing tariff, select the option **Calculation using purchasing tariff**.
5. Select **[Accept changes]**.

Configuring the e-mobility feature for vehicles with known consumption behavior

1. Click on **[MOBILITY]**.
2. Ensure that the option **Take e-mobility into account** is selected.
3. Make the required changes under the tab **Known vehicles and their usage**.

4. Make required changes under the tab **Mobility and costs (before)**. Enable the checkbox **As e-mobility (calculated)** to adopt the mobility costs from the tab **Electric vehicles and usage profile**.
5. Select **[Accept changes]**.

Configuring the e-mobility feature for vehicles with unknown consumption behavior

1. Click on **[MOBILITY]**.
2. Ensure that the option **Take e-mobility into account** is selected.
3. Make the required changes under the tab **Statistical charging station usage** (see Section 6.3.10.6, page 42).
4. Make required changes under the tab **Mobility and costs (before)**.
5. Click on **[Accept changes]**.

Section: Next steps

- Click on **[Overview of the results]** (see Section 6.4.17, page 73).

Also see:

- > Section 6.4.6 "Defining Scenarios", page 54
- > Section 6.3.10.1 "Defining Driving Profile", page 40

6.4.8 PV System

6.4.8.1 Configuring the PV System



Detailed planning

The settings on the page **Configure PV system** always refer to the currently selected subproject. A subproject consists of 1 to 6 PV arrays and at least 1 inverter per PV array. In the project types PV system with total power feed-in to grid and with self-consumption option, off-grid system and PV hybrid system, you can add alternatives for each subproject, for example, to compare alternative designs.

The entire system can be configured by a system assistant in terms of PV hybrid systems. If the settings in terms of the profitability, genset configuration and load profile enable the operation of a PV hybrid system, the system assistant appears automatically after you select the page **Configure PV system** (see Section 6.4.8.3, page 63).

Section: PV arrays

If necessary, you can define PV modules as a standard (see Section 5.1.1, page 16). On this page, these modules are configured automatically under **PV arrays**.

The specification of the roof and assignment of the PV modules can be done by visual planning or manual planning. When you select visual planning, a new window opens (see Section 6.4.3.1, page 46). The following specifications are possible here:

- Specifying buildings
- Adding possible objects on the roof or terrain that restrict the mounting of PV modules or create shading
- Selecting the PV modules used

When planning PV arrays manually, it is not possible to specify objects on the roof or the terrain.

Configuring a subproject

1. To change the name of the subproject, click on the **[Rename]** button on the page **Configure PV system**, enter the name you want to use and confirm with **[OK]**.

2. To add a subproject, click on [+ **Add subproject**], enter the name you want to use and confirm with [OK].
 - ☒ The subproject is then added to the drop-down list **Subproject**.
3. To add an alternative, click on [+ **Add alternative**].
 - ☒ The alternative is added as a tab.

Configuring PV modules

1. On the line of the PV array, click the **Manufacturer/PV module** field and select the required PV module. Click on the magnifying glass icon to start the search.
2. To configure monitoring, disconnection and optimization in the event of shading, select the corresponding options in the dialog box **Change the manufacturer and type of PV module**.
3. To get information on the selected PV module, click on the info symbol.
4. Click on **Number of PV modules/Peak power** and determine the size of the PV array using the number of PV modules or the peak power.
5. Click on **Orientation/Mounting type** and select the required properties.
6. To add a further PV array, select [+ **Add PV array**]. The settings of the existing PV array are copied automatically. Up to 6 PV arrays can be added to the PV system.
7. If required, change the settings of the added PV array. You can change the settings for all PV arrays at the same time by enabling the checkbox **Change all PV arrays** in the relevant dialog box for entering changes.
8. To delete a PV array, click on the trash can icon in the row of the PV array. When all PV arrays have been removed, you can switch to visual roof planning.

Section: Inverter design

In this section, you select suitable inverters for the current subproject. There are several options for designing the inverter:

- Using design suggestions

Suggestions are calculated for the current PV arrays with the various inverters. If more than 3 PV arrays have been created, the plan includes distributing the PV arrays among several inverters.
- Automatic design

A suggestion for optimal use of the PV arrays is calculated. If more than 3 PV arrays have been created, this option is not available for selection.
- Manual design

It is possible to manually select the inverters used.

The inverter design can be configured by a system assistant in terms of off-grid systems.

Selecting inverters manually

1. Click on [**Manual design**].
 - ☒ The dialog box **Select an inverter** opens.
2. To restrict the list of displayed inverters, enable the required checkboxes under **Set inverter limits**.
3. Under **Additional inverters**, select the row of the required inverter.
 - ☒ The activated row is displayed in a different color.
4. Click on [**Adopt inverter**].
 - ☒ The selected inverter is added and displayed under **Inverter**.
5. To add further inverters, click on [**Manual design**].

6. Click on **[Yes]** if you want to sell unused energy directly to the grid. In doing so, you activate the page **Direct selling** (see Section 6.4.14, page 70).
7. To generate a system proposal for off-grid systems, click on **[System assistant]** (see Section 6.4.8.2, page 63).
- ☒ The proposed inverters are added to the subproject and displayed under **Inverter**.

Selecting inverters from design suggestions

1. To select inverters from design suggestions, have design suggestions displayed (see Section 6.4.8.4, page 64).
- 2.
3. To restrict the selection of inverters, click on **[Inverter filter]** and enable the required checkboxes.
4. Click on **[Design suggestion]**.
 - ☒ If more than 3 PV arrays have been selected, the **Select PV array** dialog box opens. Here you need to choose the PV arrays that will be considered for the design of the first inverter. After that, the **Design** dialog box opens.
 - ☒ If a maximum of 3 PV arrays have been selected, the **Design** dialog box opens.
5. If required, change the displacement power factor and the method for calculating design suggestions.
6. Click on **[Accept changes]**.
 - ☒ If the PV system is operated in Germany and provides a DC power of at least 100 kWp, a message appears asking you whether you want to sell unused energy directly to the grid.
7. If more than 3 PV arrays have been selected, click on **[Design suggestion]** again. This automatically calculates a design suggestion for the remaining PV generators.
8. Click on **[Yes]** if you want to sell unused energy directly to the grid. In doing so, you activate the page **Direct selling** (see Section 6.4.14, page 70).
9. To generate a system proposal for off-grid systems, click on **[System assistant]** (see Section 6.4.8.2, page 63).
- ☒ The proposed inverters are added to the subproject and displayed under **Inverter**.

Calculating automatic design suggestions

1. Click on **[Automatic design]**.
2. Click on **[Yes]** if you want to sell unused energy directly to the grid. In doing so, you activate the page **Direct selling** (see Section 6.4.14, page 70).
3. To generate a system proposal for off-grid systems, click on **[System assistant]** (see Section 6.4.8.2, page 63).
4. To generate a system proposal for off-grid systems, click on **[System assistant]** (see Section 6.4.8.2, page 63).
- ☒ The proposed inverters are added to the subproject and displayed under **Inverter**.

Inverter area

1. If notes are displayed, observe the notes and solution suggestions.
2. To configure the DC strings, click on the buttons next the inverter icon. If you selected the option **Optimization** during PV array configuration, the shaded modules can be adjusted. If the DC string design does not fit the planned PV system, the settings are shown in red after leaving the dialog.
3. To adjust the displacement power factor and limit the AC active power, click on the corresponding button of the respective inverter.
4. If required, check the design under **Details**.
5. To delete an inverter, click on the trash can symbol in the row of the inverter.
6. To add a new inverter, click on the **[+ Add inverter]** button. Now you can select the required inverter.

Section: Device for active power limitation

1. To limit active power or define the battery charge time window, you have 2 options: you can either click on [+ **Add a device for active power limitation**] or on the button with the current device for active power limitation.
2. To delete the device for active power limitation, click on the trash can icon.

Section: Next steps

Project type	Next steps
   	• To skip optional steps, click on [Results overview] (see Section 6.4.17, page 73). • To carry out optional steps, click on [Cable sizing] (see Section 6.4.11, page 66).
	• To skip optional steps, click on [Results overview] (see Section 6.4.17, page 73). • To perform optional steps, click on [To the configuration of the storage system] (see Section 6.4.9, page 65).

6.4.8.2 Configuring Off-Grid Systems with System Assistant

A valid system configuration for an off-grid system is calculated based on your project-related requirements and specifications. This system configuration can be adjusted manually to better meet your needs.

Requirements and specifications

1. Select whether the system must be able to withstand the conditions of the month with the most unfavorable weather.
2. Enter the nominal power ratio.
3. Enter the required autonomous time.
4. If requested, click on **Take gensets into account** and make the respective settings.
5. Enter the required solar coverage rate.
6. To adopt these changes for the system proposal, click on [**Calculate system proposal**].

System proposal

1. If requested, change settings for nominal AC power of PV inverter and storage system, usable storage capacity, and battery type.
 2. To calculate the design parameter using the current settings, click on [**Recalculate**].
- ☒ The dialog box **Design** for inverter design opens after closing the system assistant (see Section 6.4.8.4, page 64).

6.4.8.3 Configuring PV Hybrid Systems with System Assistant

With the system assistant for PV hybrid systems, you can determine the optimum PV share according to system requirements. If no system has been configured, the system assistant start automatically. It creates an optimum proposal in terms of AC and DC power. The proposal can adopted directly or adjusted (if necessary).

To guarantee smooth operation with the gensets, the share of PV power in the PV hybrid system must not exceed the maximum apparent power of 60% of the gensets operated at the same time during the day.

Procedure:

1. Enter the nominal AC power of the inverters.

2. Enter the peak power of the inverters.
 - ☒ The current estimation results are calculated and shown.
3. To calculate the system proposal, click on **[OK]**.
- ☒ On the page **Configure PV system**, the proposals for the inverters and, if necessary, possible change notes are shown. These changes can be directly made on the page (see Section 6.4.8.1, page 60).

6.4.8.4 Viewing Design Suggestions

Requirements:

- ☐ You must have opened a project and have it planned up to the page **Configure PV system**.
- ☐ You must have set the required PV arrays on the page **Configure PV system**.

Procedure:

1. On the page **Configure PV system**, under **Inverter design**, click on **[Design suggestions]**.
 - ☒ The dialog box **Design** opens.
2. If required, adjust the settings in the dialog box **Design** and click on **[Accept changes]**.
 - ☒ The dialog box **Design suggestions** opens.
3. To restrict the selection of inverters, select the **Restrict inverters** area and enable the required checkboxes.
4. Go to the section **Select an inverter** and enable the required checkboxes.
5. Select **[Recalculate]**.
6. To change the criterion for sorting the design suggestions, select the required type of sorting from the drop-down list **Sorting** (see Section 6.4.8.5, page 64).
7. To compare design suggestions, select **[Compare selection]**.
 - ☒ The dialog box **Compare suggested designs** opens.
8. To adopt a design suggestion, select **[Adopt design]** in the column of the required design suggestion.
9. To save a design suggestion as an alternative design, click on **[Apply as alternative]** in the column of the required design suggestion.
 - ☒ Above the section **PV arrays**, the tab **Original** is added and also a numbered tab **Alternative** for each design suggestion. In addition, the button **[Compare alternatives]** is added to the right of the tabs.
10. To add a design suggestion as an alternative design, enable the checkboxes of the required design suggestions in the column **Selection** and click on **[Add selection as an alternative]**.
 - ☒ Above the section **PV arrays**, the tab **Original** is added and also a numbered tab **Alternative** for each design suggestion. In addition, the button **[Compare alternatives]** is added to the right of the tabs.
11. To adopt a design suggestion, enable the checkbox of the required design suggestion in the column **Selection** and click on **[Adopt design]**.
 - ☒ The selected design is displayed under **Inverter**.

6.4.8.5 Setting Criterion for Sorting the Design Suggestions

You can select a criterion in Sunny Design to form the basis for the evaluation and sorting of design options. The following criteria are possible:

- **Energy yield** (energetic optimum)
- **Profitability** (in consideration of the nominal power ratio and the inverter portion in investment costs)

Requirements:

- You must have opened a project and have planned the project up to page **Configure PV system**.
- You must have set the required PV arrays on the page **Configure PV system**.

Procedure:

1. On the page **Configure PV system**, under **Inverter design**, click on **[Design suggestions]**.
2. Make the required settings in the dialog box **Design**.
3. Click on **[Accept changes]**.
4. In the dialog box **Design suggestions**, select the required criterion from the drop-down list **Sorting**. The more a design suggestion corresponds to a criterion, the higher up the list it is displayed.

6.4.9 Configuring Battery Systems

**Storage system area**

Depending on the selected inverter, up to 3 different batteries can be selected here.

Procedure:

1. If a three-phase system has been selected, enable the checkbox **Multiclustert-Box** on the page **Battery system**, and select the required device type of the Multiclustert-Box from the drop-down list (if required).
2. Select the required battery inverter from the drop-down list **Devices**.
3. With multiclustert systems, click on **[+ add clustert]** to add additional clusters. With multiclustert systems, all batteries are automatically configured identically.
4. To adjust the parameters of a battery, click on the field **Settings** in the row of the required battery.
 - ☒ The dialog box **Configure battery** opens.
5. Select the required battery type from the drop-down list **Batteries**.
6. If required, change the other settings for the battery.
7. Click on **[Accept changes]**.
8. For stand-alone grid projects: Check the system compatibility under **Details**.

Section: Next steps

Project type	Next steps
	• To skip optional steps, click on [Results overview] (see Section 6.4.17, page 73). • To carry out optional steps, click on [Configuration of genset] (see Section 6.4.10, page 65).
	• Click on [Go to energy system] (see Section 6.4.7.1, page 55).

6.4.10 Configuring Gensets (Off-Grid System)

**Section: Genset**

1. To adjust the parameters of a genset, click on any field in the row of the required genset.
 - ☒ The dialog box **Genset** opens.
2. If required, change the name of the genset under **Name**.
3. Select the fuel for the genset from the drop-down list **Fuel**.

4. If required, change the other settings for the genset.
5. Click on **[Accept changes]**.
6. Check the system compatibility under **Details**.

Section: Next steps

- Click on **[Configure the PV system]** (see Section 6.4.8.1, page 60).

6.4.11 Cable Sizing



Detailed planning

Section: Overview

1. If a subdistribution is required in the PV system, enable the checkbox **Project subdistribution available (LV3)**. The **Graphic** section is adjusted and the **AC2 cables** tab is added.
2. If an MV transformer is to be present in the PV system, enable the checkbox **Medium-voltage line and MV transformer available (MV)**. The **Graphic** section is adjusted and the **MV transformer** tab is added.

Section: Configuration

The diagram shows the cable identification in the planned PV system:

- **DC** indicates the cables from the first PV module in the string to the inverter.
- **LV1** indicates the cables from the inverter to a possible subdistribution, to the MV transformer or to the feed-in point.
- **LV2** indicates the cables from a possible subdistribution in the subproject to the subdistribution of the total project, to the MV transformer or the feed-in point.
- **LV3** indicates the lines from the possible subdistributions to the possible MV transformer or to the feed-in point.
- **MV** indicates the cables from a possible MV transformer to the feed-in point.

The tabs DC cables, Cables LV1, Cables LV2, Cables LV3, MV Transformer

1. To take account of the line losses in the yield forecast, click on **Enter project data** in the main menu navigation. Go to **Advanced project data > Line losses**, click on the **[Edit]** button and enable the checkbox **DC** or **AC**.
2. Click on the tab of the required cable.
3. Select the required fields in the **Cable material**, **Single length** and **Cross-section** columns and make the required settings. The values for **Current**, **Voltage**, **Voltage drop** and **Rel. power loss** are calculated automatically.

Section: Next steps

Project type	Next steps
	• Click on [To energy management] (see Section 6.4.13, page 68).
	• To skip optional steps, click on [Results overview] (see Section 6.4.17, page 73). • To carry out optional steps, click on [Self-consumption] (see Section 6.4.12, page 67).
	• To skip optional steps, click on [Results overview] (see Section 6.4.17, page 73). • To carry out optional steps, click on [To the analysis of energy and power in the system] (see Section 6.4.16, page 72).

Project type	Next steps
	Click on [To profitability] (see Section 6.4.15, page 70).
	Click on [Go to energy system] (see Section 6.4.7.1, page 55).

6.4.12 Determining Self-Consumption



Detailed planning

Section: Increased self-consumption

In this section, you can select devices to better assess self-consumption.

Procedure:

- To change the selection of devices, click on **[Devices filter]** and enable the required checkboxes.
- With multicluster systems, click on **[+ add cluster]** to add additional clusters. With multicluster systems, all batteries are automatically configured identically.
- For increased self-consumption with the Sunny Home Manager, enable the checkbox **Energy management**.
- To configure increased self-consumption with systems for intermediate storage of energy, enable the **Intermediate storage of excess PV energy** checkbox.
- In the column **Device**, select the required device.
- Click on **Settings** in the row of the required device and configure the storage.
- If energy management and intermediate storage of excess PV energy has been selected, click on **Battery charging time window** under **Settings**.

Section: Specific Loads

In this section, you can select devices to better assess self-consumption. The consumption of these devices is taken into account in the calculation with and without optimization in the section **Result**.

Procedure:

- To configure self-consumption with specific loads, enable the checkbox **Specific loads**. The checkbox is already enabled if you have selected a heat pump as a load on the page **Define load profile**. If required, you can adjust the settings here.
- Click on **Settings** in the line of the required device and adjust the properties.
- To configure self-consumption with an electric vehicle, enable the checkbox **Electric vehicle**. The checkbox is already enabled if you have selected an electric vehicle as a load on the page **Define load profile**. If required, you can adjust the settings here.
- Click on the field **Settings** and adjust the driving profile (see Section 6.3.10.1, page 40).

Section: Result

In this section, the increased self-consumption details are displayed graphically.

Section: Load profile analysis

This section is shown if you are logged in as a Sunny Design Pro user.

Procedure:

- To open the load-curve analysis for the load profile, click on **[Open load-curve analysis]**.

Section: Next steps

- Click on **[To energy management]** (see Section 6.4.13, page 68).

6.4.13 Planning the Energy Management**Detailed planning****Specifications area**

Various requirements can be selected for the energy system. Multiple requirements can be selected.

Requirement	Explanation
Optimizing self-consumption	You wish to obtain action recommendations for manual switching of loads in order to make optimal use of own PV energy on site (self-consumption).
Analysis of consumption and management of loads	You wish to obtain an analysis of your consumption. You also wish to have automatic intelligent switching of loads in order to make optimal use of own PV energy on site.
Energy management via the internet and visualization of PV system data	You wish to monitor the PV system via the Internet and visualize the PV system data in the Internet.
Online archiving	You wish to archive the PV system data in the Internet.
Remote diagnosis	You wish to analyze PV system faults via the Internet.
Visualization of PV system data on site	You wish to view the PV system data on site.
PV system maintenance and parameterization on site	You wish to enable maintenance and parameterization of the PV system on site.
Storage of PV system data on site	You wish to store the PV system data on site.
Connecting external sensors	You wish to connect sensors from third-party manufacturers to the PV system (e.g. anemometer, ambient temperature sensor).
Measuring global irradiation	You wish to measure the global irradiation.
Reading out energy meters	You wish to read out the data of the feed-in meter, the PV production meter and the purchased electricity meter.
Feed-in management	You wish to or need to participate in feed-in management with your PV system. In accordance with the Renewable Energy Sources Act (EEG) 2012, PV system operators with installed power of 30 kW to 100 kW must participate in feed-in management (variable active power limitation). PV system operators with installed power less than 30 kW have a choice: they can participate in feed-in management or they can limit the active power of their PV system to 70% (fixed active power limitation).
Control of large-scale PV power plants	You wish to control and regulate your large-scale PV power plant (connection to a SCADA system).

Requirement	Explanation
Wireless data transmission	You would like to wirelessly call-up the PV system data.
Notification in case of disturbances	You wish to be notified if disturbances occur in the PV system.

Various requirements can be selected for the PV system. Multiple requirements can be selected.

Requirement:	Explanation
Internet access is available	The PV system can be connected to the Internet.
Own operation control system is available	A control room (SCADA system) is available.
S0 meter interface is available	An S0 meter interface is available in the PV system.
D0 meter interface is available	A D0 meter interface is available in the PV system.

Procedure:

1. Depending on your energy management requirements, enable the required checkboxes.
2. Depending on the requirements that apply to your PV system, enable the required checkboxes.

Section: Design

In this section, you select the communication products for energy management. There are various procedures:

- **[Automatic design]**: The communication products are automatically selected.
- **[Design alternatives]**: From a list of suggestions with communication products, the required design alternative can be selected in the **[Adopt design]** column.
- **[Add communication product]**: A communication product can be selected from the list of all communication products. If you have enabled the checkbox **Only take current communication products into account**, you can only select current communication products in the list.

Procedure:

1. In order to only use current (not discontinued) communication products in the design, enable the checkbox **Only take current communication products into account**.
2. You have the following options for selecting the communication products:
3. To remove all added communication products from the section **Result**, click on **[Delete system monitoring]**.

Section: Result

In this section, you obtain an overview of the internal and external communication products used in the project and the type of data transmission.

Procedure:

1. If a communication product is to be included in the design alternatives, click on the lock icon next to the communication product. The lock icon is displayed closed.
2. To undo the setting, click on the lock icon again.
3. To delete a communication product, click on **[X]** next to the communication product.

Section: Next steps

Project type	Next steps
 	Click on [Profitability analysis] (see Section 6.4.15, page 70).
	Click on [Go to energy system] (see Section 6.4.7.1, page 55).

6.4.14 Direct-Selling Order with SMA SPOT

Detailed planning



PV systems in Germany that provide a DC power of 100 kWp cannot offer unused energy via the platform SMA SPOT for direct selling.

You can directly download the contract between operator and MVV Energie AG after entering all details on the operator, PV system, bank (optional), costs and revenues. This contract must then be sent by mail to our partner MVV Energie AG.

The calculations for direct selling will be carried out exclusively in euro. If USD is selected as currency in the personal settings under **My Sunny Design**, calculation errors occur because the units are not converted internally.

Procedure:

1. Enter the name and address of the operator under **Operator**.
2. Enter the name and location of the PV system as well as the planned commissioning date under **PV system**.
3. Enter the location of the measurement, the generation profile and the number of measuring points under **Details on measuring point operation**.
4. Enter the details of your contact person for queries under **Customer master data**.
5. Enter the bank details for the transfer of payments of remuneration for direct sales under **Bank details**.
6. Enter the name and contact data of the responsible installer for queries under **Contact person of installer business**.
7. To download the direct-selling documents, click on **[Download contract documents]**.
8. Enter the system type and market value under **Costs and revenues**.
 - ☒ The calculated revenues are updated automatically.

Section: Next steps

- Click on **[To profitability]** (see Section 6.4.15, page 70).

6.4.15 Analyze Profitability

6.4.15.1 Analyzing Profitability (PV System with Total Power Feed-in to Grid and with Self-Consumption)



Section: Costs

In this section, you can determine the costs for the system planned. You can choose between simplified cost entry and detailed cost entry. After you have completed the cost entry, you can have a quotation generated automatically for the current customer in the detailed cost entry (see Section 6.4.19, page 74).

Simplified costs entry

For a simplified calculation, the following standard values can be entered:

- Standard costs for the PV system in Euros/kWp
- Standard costs for the storage system in Euros/kWp
- Other costs as standard amount
- Standard annual fixed costs as a proportion of capital expenditure

Procedure:

1. Click on **[Simplified costs entry]**.
2. If you want to continue calculating the project with a fixed price, click on the option **Fixed price**. This means that no entries are necessary for the various components.
3. Enter standard costs for PV system, storage system, other costs fixed costs.
4. To include a financing model in the calculation, click on **[Add financing model]** and make the necessary entries. The entries defined under **My Sunny Design > Settings > Profitability** are used as templates (see Section 5.1.1, page 16).

Detailed costs entry

For the detailed calculation of the project, you can enter the following costs for each project:

- Specific costs for PV modules
- Specific costs for inverters
- Specific costs for storage system
- Use templates for regular costs
- Other costs, broken down by individual cost units as required
- Standard annual fixed costs as a proportion of capital expenditure

No price management is available for energy management products. You can make default settings for the cost structure in the menu **My Sunny Design > Own cost items and templates**.

Procedure:

1. Click on **[Detailed cost entry]**.
2. To use already defined templates, click on **[Select template]** and select the the respective template from the list.
3. Enter specific costs for PV modules, inverters, storage system, other costs and fixed costs.
4. To create a new position, select **[New position]**.
5. Make the respective entries for the cost item.
6. Select the category under which the costs should be listed in the cost entry.
7. If you want to save the cost item as default and use it for other projects, select the option **Default setting for projects**. This cost item is now stored in the user-defined cost items and can be used in the templates (see Section 5.1.11, page 25).
8. To include a financing model in the calculation, click on **[Add financing model]** and make the necessary entries. The entries defined under **My Sunny Design > Settings > Profitability** are used as templates (see Section 5.1.1, page 16).

Section: Results

In this section, the electricity purchase costs and the feed-in tariff can be adjusted for the current project. To make default settings regarding the feed-in tariff, electricity purchase costs and financing model, go to **My Sunny Design > Settings > Profitability** and **My Sunny Design > Settings > Tariff information**.

Procedure:

1. To adjust entries in terms of financing conditions, click on **[Settings]**. This button can be found in the upper part of the dialog.
2. To adjust the electricity purchase price used and the feed-in tariff to the actual tariffs, click on **[Edit tariff]**.
3. To change the view of the first diagram, click on **[Savings]** or **[Cumulative savings]**.

Section: Next steps

- Click on **[Results overview]** (see Section 6.4.17, page 73).

6.4.15.2 Analyzing Profitability (PV Hybrid Project)**Section: Profitability**

In this section, the results of the efficiency analysis are displayed.

Section: Cash flow

- To change the view of the first diagram, click on **[Nominal cash flow]** or **[Discounted cash flow]**. The type of cash flow has an effect on the expected amortization period under **Efficiency**.

Section: Next steps

- Click on **[Results overview]**.

Also see:

- > Section 6.4.17 "Overview of Results", page 73

6.4.16 Analysis of Energy and Power in System**Section: Power**

In this section, the compatibility of the system configuration will be displayed.

Procedure:

- If notes are displayed, observe the notes and solution suggestions and adjust the design.

Section: Energy

In this section, details of the energy flows will be displayed.

Section Solar fraction

In this section, the solar energy flows and solar fraction rate per month will be displayed.

Section: Next steps

- Click on **[Results overview]** (see Section 6.4.17, page 73).

6.4.17 Overview of Results



Section: Information

This section is displayed if information on the design is available.

Procedure:

- Note the information and adjust the design.

Section: Results

1. Select the required tab to view the results for the PV system or for performance.
2. To save the values from this section as a CSV file, click on **[Export]**.
3. Click on **[Project documentation]** (see Section 6.4.20, page 74).



In this page you will find all results on the energetic and profitable key figures of the energy system.

Section: Results

In the load-curve analysis, the results in terms of peak load shaving and increased self-consumption are taken into account.

Procedure:

1. Click on the tab **Energetic (annual values)**.
 - ☒ By hovering the cursor over **Generation and consumption** and **Thermal energy**, a table appears for each diagram with corresponding values.
2. To view the exact analysis of purchased electricity, load profile, maximum power and power chart, click on **[Open load-curve analysis]** under the tab **Energetic (annual values)**. Then click on the required tab in the analysis window.
3. Click on  to view the individual values throughout the year.
4. Click on the tab **Economical (observation period # years)**. Here you can view the time period selected in the project data.
5. To save the values from this area as a CSV file, click on **[Export]**.
6. Click on  to view the individual values throughout observation period.
7. Click on **[Go to summary]** (see Section 6.4.18, page 73).

6.4.18 Viewing Summary



Section: Project data

- Click on the relevant tab to view the project data on location settings, project details, efficiency, temperature settings and grid connection.

Section: Key figures

- Click on the relevant tab to view the energetic and economic key figures.

Section: Information

This section is displayed if information on the design is available.

Procedure:

- Note the information and adjust the design.

Section: Energy system schematic

In this section, the project setup is summarized. An overview in terms of the energy system structure is also shown.

Section: PV system

- Click on the relevant tab to view the data on system overview, design, grid connection, performance and conductor dimensioning relating to the PV system or performance.
- To save the values from this section as a CSV file, click on **[Export]**.

Section: Next steps

- Click on **[Project documentation]** (see Section 6.4.20, page 74).

6.4.19 Create quotation



After entering all information on profitability, a quotation can be automatically generated. For this, the customer data of the project are used (see Section 5.1.1, page 16) as well as the texts for introduction and conclusion of the quotation entered at **My Sunny Design > Settings > Quotations**. These texts cannot be adapted to the individual quotations.

The quotation contains the customer's address, the quotation number, a project cost overview, the standardized texts and a field for your signature.

Procedure:

- Determine the planned project costs by using **Detailed costs entry** (see Section 6.4.15, page 70).
 - On the page **Analyze profitability** enter the number of the quotation intended for the customer at **Detailed cost entry** in the field **Quotation no..**
 - Click on the button **[Create quotation]** to have the quotation form generated.
- ☒ Depending on the web browser, a message appears asking how you would like to proceed with the quotation. You can save, open or discard it.

6.4.20 Creating the Project Documentation



Sunny Design outputs the project documentation and a mounting overview as a PDF file.

To view PDF documents, you need the Adobe Reader software. You can download Adobe Reader for free on the Internet.

Section: Settings

- To download the product documentation as a PDF file, open the **Product documentation** page.

2. Under **Documents**, enable the checkboxes that should be contained in the project documentation. If you created project images during the project configuration or roof planning, these will be added on separate pages with the title **Project images** at the end of the project documentation.
3. Click on [**Refresh preview**] to create a preview of the current selection.
4. If you have saved design alternatives on the page **Configure PV system**, you can choose between the original design and the design alternatives by clicking on **Select** and enabling the required design.
5. Under **Paper size**, select the required paper size.
6. Click on [**Download project documentation**].
7. To download the mounting overview, open the **Mounting overview** page.
8. Click [**Download mounting overview**].

Section: Preview

- To scroll through the project documentation preview, click on [**<**] or [**>**].

Section: Next steps

- To open your personal home page of Sunny Design, click on [**To personal home page**].

6.5 Creating Harmonics Calculation

With the harmonics calculation you can check whether the harmonic currents at the point of interconnection are within the thresholds. The harmonics calculation can be performed single- or multi-phase for SMA inverters of various device types. If you would like a harmonics calculation for medium-voltage systems or if overstepping of the thresholds occurs, contact the sales department of the SMA subsidiary for your country. When you select a project from the overview, you can edit or delete the harmonics calculation or save the harmonics calculation report as a PDF document.

To view PDF documents, you need the Adobe Reader software. You can download Adobe Reader for free on the Internet.

Procedure:

1. Select the option **Harmonics calculation** on the personal home page under **TOOLS**.
2. Click on [**New harmonics calculation**] in the dialog box **Harmonics calculation**.
3. To transfer data from an existing project, select [**Select project template**].
4. Enter the required project name in the field **Project name**.
5. If available, enter the registration number of the planned PV system in the field **Registration number**.
6. Enter the editor's name in the field **Calculation performed by**.
7. Select the grid voltage from the drop-down list **Grid voltage**.
8. Enter the short circuit power indicated by the grid operator in the field **Short circuit power**.
9. Enter the total connectable feed-in power indicated by the grid operator in the field **Connectable feed-in power**. If you did not receive a value, enter a **0**.
10. Under **Inverter**, click on the [**+ Add inverter**] button.
 - ☒ The dialog box **Select an inverter** opens.
11. To restrict the list of displayed inverters, enable the required checkboxes under **Set inverter limits**.
12. Under **Additional inverters**, select the row of the required inverter.
 - ☒ The activated row is displayed in a different color.
13. Click on [**Adopt inverter**].
 - ☒ The selected inverter is added and displayed under **Inverter**.
14. To add further inverters, click on [**+ Add inverters**].

15. Select the required report template from the drop-down list **Select report template**.
16. Select [**Show report**].

7 Glossary

Energy key figures

Specific yield

The estimated specific annual yield specifies how much energy the PV system can supply per installed kilowatt peak.

Self-consumption

The self-consumption specifies the amount of self-generated energy that is not fed into the grid but consumed by the customer. The energy can be consumed immediately or after being stored intermediately.

Self-consumption quota

The self-consumption quota describes which proportion of the energy generated is used by the customers themselves.

Self-sufficiency quota

The self-sufficiency quota indicates what proportion of the energy demand can be covered by self-generated energy.

Solar fraction (SF)

Solar fraction is the amount of energy provided by the solar technology divided by the total energy required.

Renewable energies share

With system components (e.g. heat pump): percentage of the renewable energy of the energy generation. At system level: percentage of renewable energy of the annual total energy consumption.

Generated renewable energy

Energy produced from power generating units of the energy system from renewable sources

Electrical energy generated

Electrical energy produced from the power generating units of the energy system

Heating energy generated

Thermal energy produced from the power generating units of the energy system per year

Electrical energy requirement of the load profiles

Sum of the electrical energy demand of all load profiles used in the project per year

Heating energy requirement

Thermal energy requirement for heating element

Hot water energy requirement

Thermal energy requirement for the hot water production

Total heating energy requirement

The annual thermal energy demand for heating and hot water production

Total energy requirement

The sum of the electrical energy demand from the load profiles used in the project and the thermal components per year

Energy consumption heating element

Thermal self-consumption of heating element

Energy consumption hot water

Thermal self-consumption for hot water production

Total energy consumption

The total annual consumption of electrical energy and energy from fuels

Total fuel energy consumption

The total annual energy consumption of fuels

Total electrical energy consumption

The total annual power consumption is calculated from the purchased electricity and the electric current generated, minus grid feed-in and the change in the energy quantity in the electrical storage between the start and the end of the calculation period.

Electricity and fuel consumption

The total annual consumption of electrical energy and energy from fuels

Total purchased energy

The total electrical energy drawn from the grid and energy from fuels

Grid supply

Electrical energy drawn from the utility grid

Max. purchased electricity power

The maximum value of the electrical power drawn from the grid during the period under review

Grid feed-in

Electrical energy fed into the utility grid

Energy consumption saving percentage

Percentage change of the total energy consumption: $(\text{before} - \text{after}) / \text{before} \times 100$. Positive values represent savings.

Percentage of purchased energy savings

Percentage change of the total purchased energy from electric current and fuels: $(\text{before} - \text{after}) / \text{before} \times 100$. Positive values represent savings.

Reduction of the purchased power peak

Change of the maximum value of the electrical power drawn from the grid during the analysis period of profitability: $\text{maximum value before} - \text{maximum value after}$. Positive values represent a reduction.

Purchased electricity savings

Percentage change of the purchased electricity $(\text{before} - \text{after}) / \text{before} \times 100$. Positive values represent savings.

Fuel savings

Percentage change of the purchased fuel: $(\text{before} - \text{after}) / \text{before} \times 100$. Positive values represent savings.

CO₂ emissions

Annual carbon dioxide (CO₂) emission due to using fossil fuels

CO₂ reduction

Percentage change of the annual CO₂ emission: $(\text{before} - \text{after}) / \text{before} \times 100$. Positive values represent a reduction.

Electrical energy withdrawn

The electrical energy drawn from the battery system per year

Annual nominal energy throughputs of the battery

The annual nominal energy throughputs of the battery are calculated from the total electrical energy stored intermediately per year, divided by the battery's nominal energy.

Intermediately stored electrical energy

The intermediately stored electrical energy in the battery system per year

Operating time

The operating time is calculated from the ratios of the total energy demand of electric current during a twelve-month period and the highest load within this period.

Annual performance factor

The annual performance factor is a measure for the efficiency of a heat pump. It states how much thermal energy is generated by the heat pump in relation to the current used in the course of a year.

Economic key figures**Energy cost savings**

The absolute energy saving costs versus the previous energy costs (user input) or versus an alternative interpretation.

Relative energy cost savings

The energy savings costs as a percentage versus the previous energy costs (user input) or versus an alternative interpretation.

Electricity purchase costs avoided

The difference in the electricity purchase costs (costs before - costs after)

Avoided fuel costs

The difference in the fuel purchase costs (costs before - costs after), taking into account the specified inflation rates

Heating cost savings

The absolute heating cost savings versus the previous heating costs (user input) or versus an alternative interpretation.

Relative heating cost savings

The heating cost savings as a percentage versus the previous heating costs (user input) or versus an alternative interpretation.

Total savings

The total savings over the period under consideration is made up of the total energy cost savings and the feed-in tariffs. The investment costs, the financing costs and the operating costs incl. replacement investments are deducted from this. Here, the inflation rate is included in the operating expenditure and the electricity price increase rate is included in the electricity purchase costs. Furthermore, the degradation of the PV modules is taken into consideration in the feed-in remuneration.

Energy purchase costs

The energy purchase costs are composed of the electricity purchase costs and the fuel purchase costs.

Electricity purchase costs

The costs calculated from the energy drawn from the utility grid according to the selected purchase cost tariff and the tariff components defined therein (e.g. fixed costs or demand rate). The annual rate of electricity price increases is taken into account.

Specific electricity purchase costs

The costs calculated from the energy drawn from the utility grid per kWh according to the selected purchase cost tariff and the tariff components defined therein (e.g. fixed costs or demand rate). The annual rate of electricity price increases is taken into account.

Fuel costs

The calculated fuel purchase costs according to the selected purchase cost tariff and the tariff components defined therein (e.g. fixed costs). The annual rate of price increases is taken into account.

Heating costs

The absolute heating costs are composed of the purchase and generation costs.

Specific heating costs

The specific heating costs are composed of purchase costs and generation costs per kWh.

Total energy supply costs

The total energy supply costs includes, in addition to the costs for the purchased energy carriers (more specifically, the energy costs) all costs for the internal energy conversion, distribution, storage and disposal. They also include the capital costs, the replacement investments and the operating expenditure. The impacts of the inflation rate and the energy price increase are taken into account throughout the analysis period of profitability. The total energy supply costs of the operational energy supply are also referred to as input energy costs.

Energy production costs

The energy production costs determine the costs for the generation of 1 kWh energy. When calculating the energy production costs, the LCOE calculation method is used. The running costs of the year under review are calculated and added up throughout the observation period. They are then discounted to the reference date using the imputed rate of interest and the one-time costs are added. The discounted costs are divided by the energy amount discounted to the reference date. LCOE is a customary calculation method for power generation costs which is used here to calculate the production costs of all energy types.

Operating costs

The operating costs (operating expenditure) of the system component throughout the analysis period of profitability. These are composed of the annual fixed costs taking into account the inflation rate and the costs for replacement investments due to limited technical service life. This is the sum of operating costs of all system components for the overall system.

Investment costs

One-time investment costs (CAPEX) for the system component (turnkey PV system) At the overall system level, it is the sum of the investment costs (CAPEX) of all system components

Specific investment costs

One-time investment costs for the system component per activity unit or capacity, depending on the component under review.

Debt capital

The credit costs (borrowing costs) specify the interest charges for a loan at nominal terms. They are independent from the inflation. The total interest charges depend on the type of loan.

Residual value

The residual value of the system component or of the system at the end of the period under review with linear depreciation and amortization. The service life, the system components and the replacement investments are taken into account in the calculation.

Grant amount

The subsidy amount stated with the system component or the sum of the subsidy amounts of all system components for the overall system.

Feed-in tariff

The feed-in tariff of the electrical energy fed in and possibly self-consumed as well as the sales after expiry of the feed-in tariff according to the selected feed-in tariff. The degradation of the PV modules is taken into account in the calculation for the PV system.

Return on assets (IRR)

The calculation of return is based on the return on assets. The return on assets refers to the total capital employed (capital expenditure) and puts this in relation to the profit (feed-in tariff + savings in purchasing costs + self-consumption tariff – self-consumption apportionment – operating costs). The financing costs through debt capital are not included in the return on assets. Long-term influences on the rate of return due to inflation, module degradation and the electricity price increase rate are also taken into account. For energy system projects, this also includes replacement investments and residual values. The rate on return is therefore calculated dynamically using the IRR method over the entire period under review (internal interest rate, internal rate of return). It indicates the average mean annual return on the investment and corresponds to the interest at which the discounted returns represent the capital employed.

Annual return

The return is calculated as an internal interest rate (internal rate of return). This effective rate of return reflects the economic advantageousness of the investment as the mathematically calculated return of all payment flows of the investment during the selected period under review compared to the before-after values or an alternative interpretation.

Net present value

The net present value method is used to add up all income and expenses of a planned system within the selected period under review and with the interest rate adjusted. The income takes into account the feed-in tariffs, energy procurement costs savings, subsidy amounts and credits compared to the before values or to an alternative. The payments in the individual years are discounted to the current point in time with the selected imputed rate of interest. From this, the so-called present values of the payments result. The net present value (or present value) is a possible way of expressing the economic advantageousness of an investment.

Amortization time

The amortization time is the period in years within which the capital tied up in an investment is returned or from which the effective savings become positive.

Amortization time (discounted)

The discounted amortization period is the time period in years after which the discounted savings become positive.

8 Contact

You can find your country's contact information at:



<https://go.sma.de/service>

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