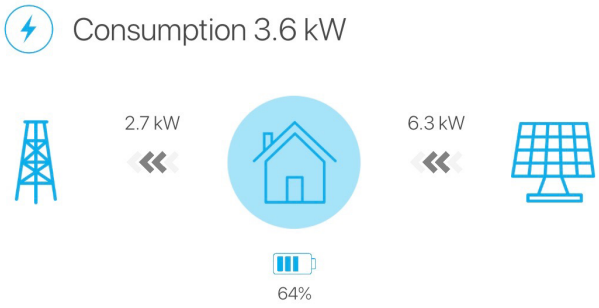
Smart Energy Manager Manual

Version 1.0 – April 2023

Smart Energy Manager introduction

With the Smart Energy Manager of xxter, you can optimize your power consumption to be more self-sufficient and lower your energy bill. You can use xxter to schedule and balance your energy endpoints (devices that consume energy) based on the available power, current pricing conditions and your power needs.



To do this, xxter will start with the capacity and actual power consumption of your energy connection together with the applicable pricing conditions. For your own energy production, like a solar panel or wind turbine, the base performance is combined with the expected weather conditions for your location to predict a realistic power availability. You can even include a battery to store excess power and use later on when it is needed. Lastly, all the energy endpoints have their own expected power consumption, duration, default schedule and priority.

Combining all this information, together with the option for the end user to dynamically add and remove endpoints to the schedule, will allow xxter to choose the optimal moments throughout the day, while always making sure that they are ready when you need them. Of course, you always have clear insight in how your energy is managed in the xxter app.

For instance, when you come home from work, you can schedule to charge your car, with the restriction that it should be fully charged before 08:00 the next morning. During the evening you can add your washing machine and dish washer to the schedule, making sure they are ready before 17:00 the next day. xxter will find the optimal moment for charging and running your devices, preferably when your solar panels will produce enough energy or otherwise when the energy prices will be lowest. Depending on the amount of available power, other power usage and the power requirements of the endpoints, xxter can enable multiple endpoints simultaneously or schedule them in sequence.

In the following chapters, we will guide you through the steps to set up and use the Smart Energy Manager of xxter.

The Smart Energy Manager requires firmware 4.0 or higher.

Setting up the elements

Energy supplier (grid)

There has to be one main power supply per xxter, defining the characteristics of the power you receive from your energy provider (grid). You can set up the following options:

- Tariff, which is either flat fee, a double tariff with fixed prices and time schedule or variable tariff, using spot prices that can vary every hour.
For spot prices, your region is required, as well as applicable price alterations.
You can also choose whether you want to show the tariff in the graphs.
For the use in actions, you can provide the tariff threshold when pricing will be considered “high” or “low” as a percentage value.

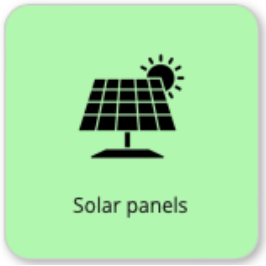
- Power circuit, which is either 1 phase or 3 phases, and the voltage.

- Per phase the maximum power that can be used, the maximum you want xxter to assign to endpoints and the expected average continuous (unmanaged) use. Additionally, for every phase an object must be linked, to determine the actual current power usage. For the actual power usage, xxter needs to know if this is the complete consumption, or the (net) consumption from which any power that is produced is already deducted. It is possible to have the Smart Energy Manager switch off managed endpoints if the total power consumption becomes too high.

Available energy sources

For every available power source, you need to define the type. This can be either solar panels, a wind turbine or other.

Solar panels
For solar panels, the maximum (realistic) production should be provided on December 21st and on June 21st. Additionally you can define if xxter should reduce the east or west side of the panels (for instance when they are not exactly facing south) and if xxter should account for weather conditions in the expected amount of power provided. Lastly an object must be linked that provides the actual power production and for which phase (if applicable).



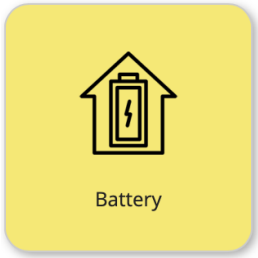
For any given day of the year, xxter will calculate the amount of power that would be produced per hour if there would be no clouds. Based on the weather forecast, this production will be reduced according to these settings. Setting a cloud factor of 100% means that a complete overcast of clouds will reduce the expected energy production to 0.

Wind turbines
For a wind turbine, the maximum (realistic) production at the optimum windspeed should be provided. Additionally, per wind direction a reduction can be entered, for instance when there is a tree or building in a certain direction that influences the maximum output. Lastly an object must be linked that provides the actual power production and for which phase (if applicable).

Based on the forecasted wind speeds and direction, xxter will calculate the amount of power that should be produced per hour.

Other sources
For other power sources, you can provide the amount of power that is produced and link an object that provides the actual power production and for which phase (if applicable).

Energy storage



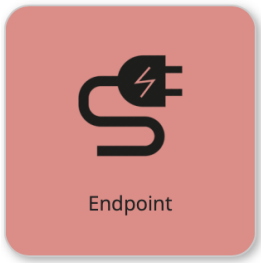
With energy storage (a battery) you can store surplus energy and use it for your energy endpoints when you need it.

Every battery should have a name and it must be clear what its maximum capacity is, the maximum power allowed to charge, and the maximum power it can provide when discharging. Additionally, the following parameters are needed:

- Recalculation interval (between 5 and 30 minutes). This time period will be used to recalculate and decide to start/stop charging and start/stop discharging. This prevents the battery from toggling between states. Please note, that if you have multiple batteries, the shortest interval provided will be used to recalculate all batteries.
- Charge battery, where you can decide if the battery should only be charged when you have a surplus production, or also when the tariff is low (30% of the cheapest bandwidth).
- Discharge battery, where you can decide if the battery should be used whenever power is needed, only when the tariff is not low (not in 30% of the cheapest bandwidth), or only when the tariff is high (30% of the highest bandwidth).
- If you have 3 phases, the system needs to know which phase the battery is connected to or if it has a three-phase connection.

Apart from these configuration options, objects should be linked for status information regarding the current capacity of the battery, the current (actual) charge power, and the current (actual) discharge power. To control the battery, objects should be linked to control charging and discharging. It requires a bit component to turn charging and discharging on/off, and the preferred amount of power at which the battery should be charged or discharged.

Energy endpoints



There are many types of endpoints you can use, for which the base parameters are the same. In the near future, a white goods integration will be added for a direct interaction with these types of devices.

- Every end point has a name and type for easy recognition by the user. These will be used to enable and prioritize endpoints to be scheduled in the next management cycle, as well as for actual and historic information.

Apart from that, the following parameters should be provided:
- The average usage (in kW) of the endpoint. This can be static or set by a component.
- If you have 3 phases, the system needs to know which phase the endpoint is connected to or if it is a three-phase endpoint.

- The average duration of a run cycle for the endpoint, for instance the amount of time for a full charge, the duration of a complete wash cycle, etc. This can be static or set by a component.

- The component by which the endpoint should be turned on or off by the Smart Energy Manager

- If the endpoint should always be finished at a certain time, for instance the car should always be charged before 08:00 in the morning, or the dish washer at 17:00 in the afternoon, you can enter this

time here. If you leave this empty and the endpoint is enabled, it will make sure the endpoint is activated within 24 hours.

Enable options:
Enabling an endpoint will add the endpoint to the schedule of the Smart Energy Manager. This means it will find the optimal moment to activate the endpoint within the next 24 hours or before the set time it should be finished (if applicable).

- You can allow the endpoint to be enabled through the app, automatically enable the endpoint at a certain time every day or use a component to enable an endpoint.

- You can also set endpoints to be mutual exclusive. This makes sure certain endpoints are never activated at the same time. This can be helpful when you want to add the same pump, heater or filter multiple times for shorter periods of time. Now you can enable one or more of these instances and the Smart Energy Manager will always schedule them in sequence when needed.

Please note: enabling an endpoint does not mean start an endpoint. When an endpoint is enabled, the Smart Energy Manager will find the optimal moment and schedule the endpoint for that time.

Shut off options:
Some endpoints will have their own runtime, and some endpoints will need to be shut off. For instance, a washing machine or dryer will have its own runtime and should never be switched off after it has been started. However, if you have a pump which should run for some hours every day, this should be shut off after the assigned period of time.

- You can enter if the endpoint is allowed to be shut off by the Smart Energy Manager, for instance when there is not enough available power.

- You can set if the Smart Energy Manager should always shut off the endpoint after a designated time, either as long as the average duration, or another period of time.

Priority options:
When there are multiple endpoints enabled, the Smart Energy Manager will schedule them according to their priority. Higher priorities are scheduled sooner, and if an endpoint should be finished at a certain time, the priority will be automatically increased to ensure this.

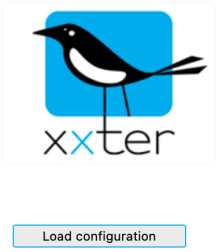
- You can set the default priority of the endpoint, as a number between 1 and 100.

- It is possible to allow the priority to be requested through the app, or by a component. When requesting priority (of an enabled endpoint), the Smart Energy Manager will reschedule the endpoint to be started as soon as possible.

For OCPP car chargers, all these parameters are also used, however the average usage does not need to be provided, since that is available in the OCPP configuration.

Commissioning the Smart Energy Manager

When you have set up all your sources and endpoints for the Smart Energy Manager, it needs to be made available on the xxter controller.



By loading the appropriate xxter project, for which you have set up the Smart Energy Manager, on the xxter controller it will become active.

To do this, log into the xxter controller and press “Load configuration”. You can also go to the main project page on *My xxter* and click “Push configuration to xxter device”.

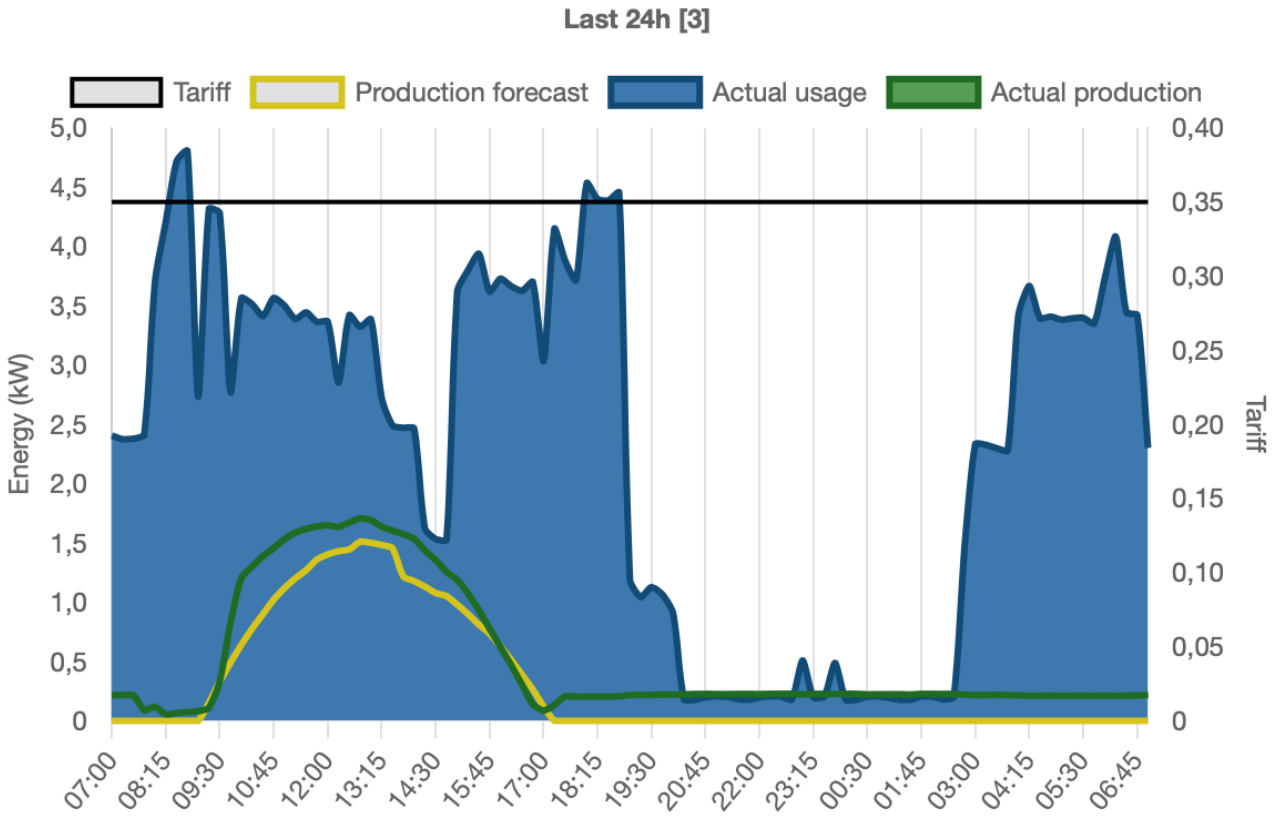
Smart Energy Manager on the xxter controller

On the Smart Energy Manager page of the xxter controller, you can see your configuration and graphs of the last 24 hours and the coming 24 hours. If you have a three-phase set-up, you can either show one graph per phase, or a combined graph.

On this page, you can also manually schedule and unschedule endpoints, as well as request priority.

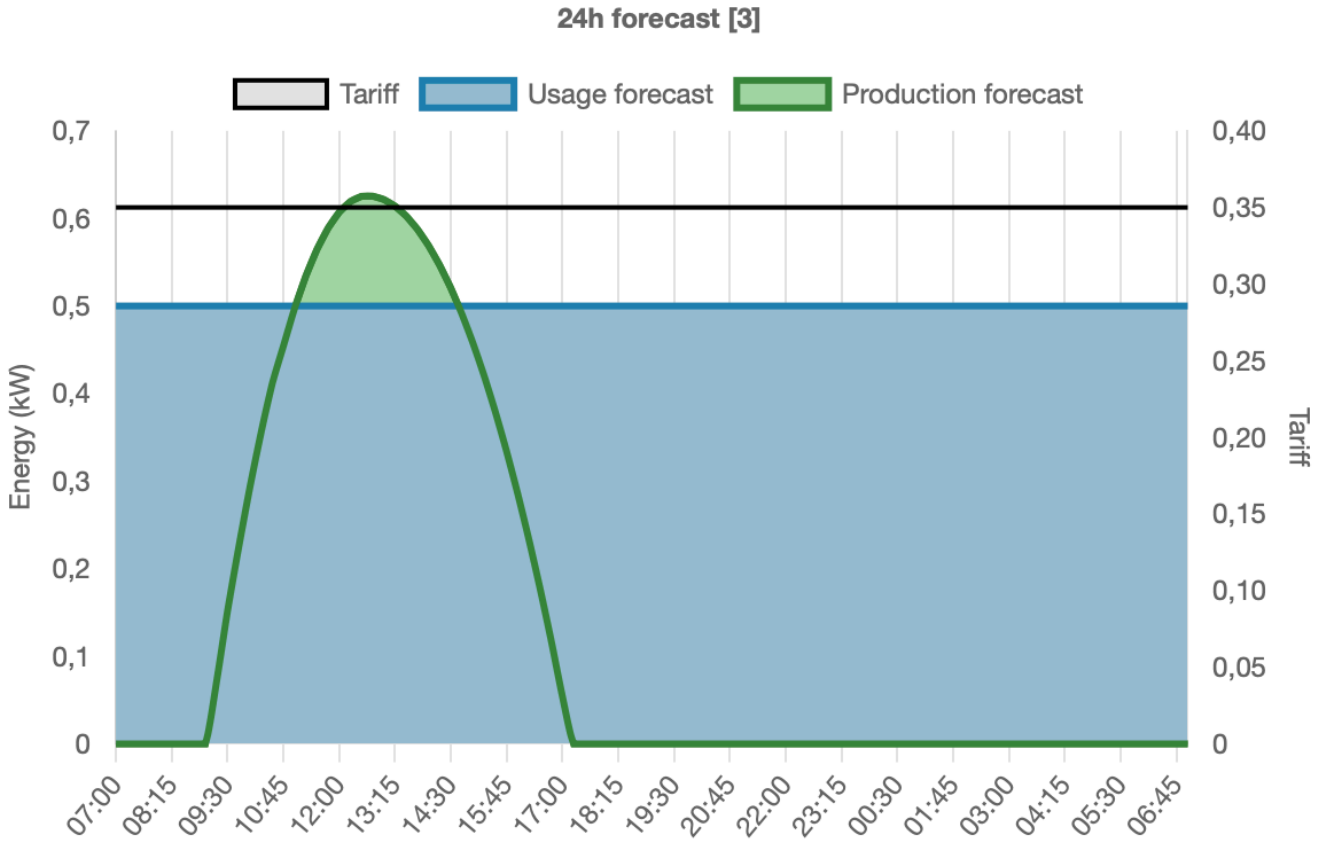
In the graph for the previous 24 hours, you will see:

- The tariff for that period
- The forecasted production
- The actual production
- The actual power usage
- The endpoints that have been active during this period (if available)



For the coming 24 hours, you will see:

- The tariff for that period
- The production forecast
- The usage forecast (based on the average consumption, plus the scheduled endpoints)
- The endpoints that are scheduled for this period (if available)



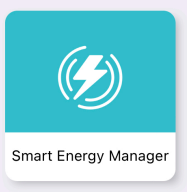
Additionally, you will see a table of all the configured endpoints and their current state and schedule. Here, you can enable an endpoint and request priority.

When you enable an endpoint, the Smart Energy Manager will find the optimal moment for its activation.

When you request priority for an enabled endpoint, the Smart Energy Manager will reschedule the endpoint to be activated as soon as possible.

Smart Energy Manager in the app

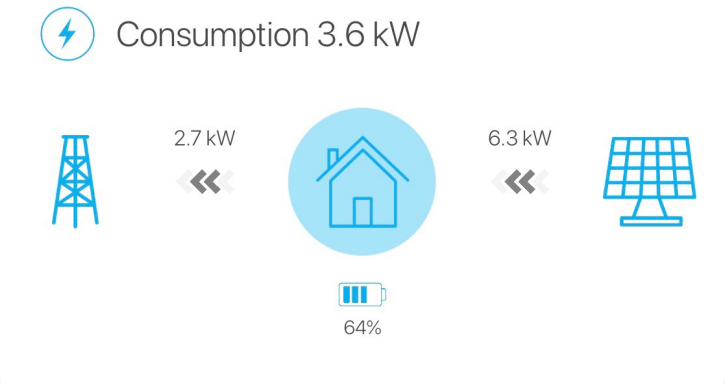
After the Smart Energy Manager is configured, a button will become available in the configuration menu of the xxter app to access the Smart Energy Manager. Here the same graphs are available as on the xxter controller (see previous chapter) and you can also enable endpoints for the Smart Energy Manager or request priority for an enabled endpoint.



You can also add the Smart Energy Manager directly in the visualization, called Smart Energy Control.

You can add specific endpoints, to include on a page. This shows its current status, and you can enable an endpoint, see the actual schedule, and request priority.

You can also use the Smart Energy Control to include an overview of all your energy flows, overall consumption and production and energy storage. This provides an overview at a glance of the actual energy performance of your home or building.



All these functions combined, allow you to use xxter to manage your energy efficiently, while still retaining complete control and oversight in how this is done.

Additional automation options

For the Smart Energy Manager, there have been added some additional options for scripts and actions.

For scripts:
There is a new function:

```
xxter.gettariff(delta_min)
```

Description:
Gets the actual tariff for the provided moment in time in the future (in minutes), as set for the Smart Energy Manager. If a variable tariff is configured this will be a dynamic value, otherwise it will return the single or split tariff applicable for that time.

Parameters:
delta_min : The amount of minutes in the future (number)

Returns:
value : The actual tariff, as set for the Smart Energy Manager.

Example:

```
var = xxter.gettariff(60)
```

For actions:
There is a new trigger available:

"Energy tariff changes" – a trigger that uses the actual tariff to trigger other actions. The thresholds can be set in the Energy supplier (grid) settings and has a default setting of 30%.

This has the following options:

- Low price start
  - The start of the period, where the pricing is below the low tariff threshold.
- Low price end
  - The end of the period, where the pricing is below the low tariff threshold.
- High price start
  - The start of the period, where the pricing is above the high tariff threshold.
- High price end
  - The end of the period, where the pricing is above the high tariff threshold.

Obviously, when you have set the Smart Energy Manager to a single tariff, this trigger is never activated.