

## ESS Control

Software tool to run a battery control algorithm based on predictive control and intraday tariffs

Short manual

SW version: 0.1 beta

Developed CTU UCEEB, 2019

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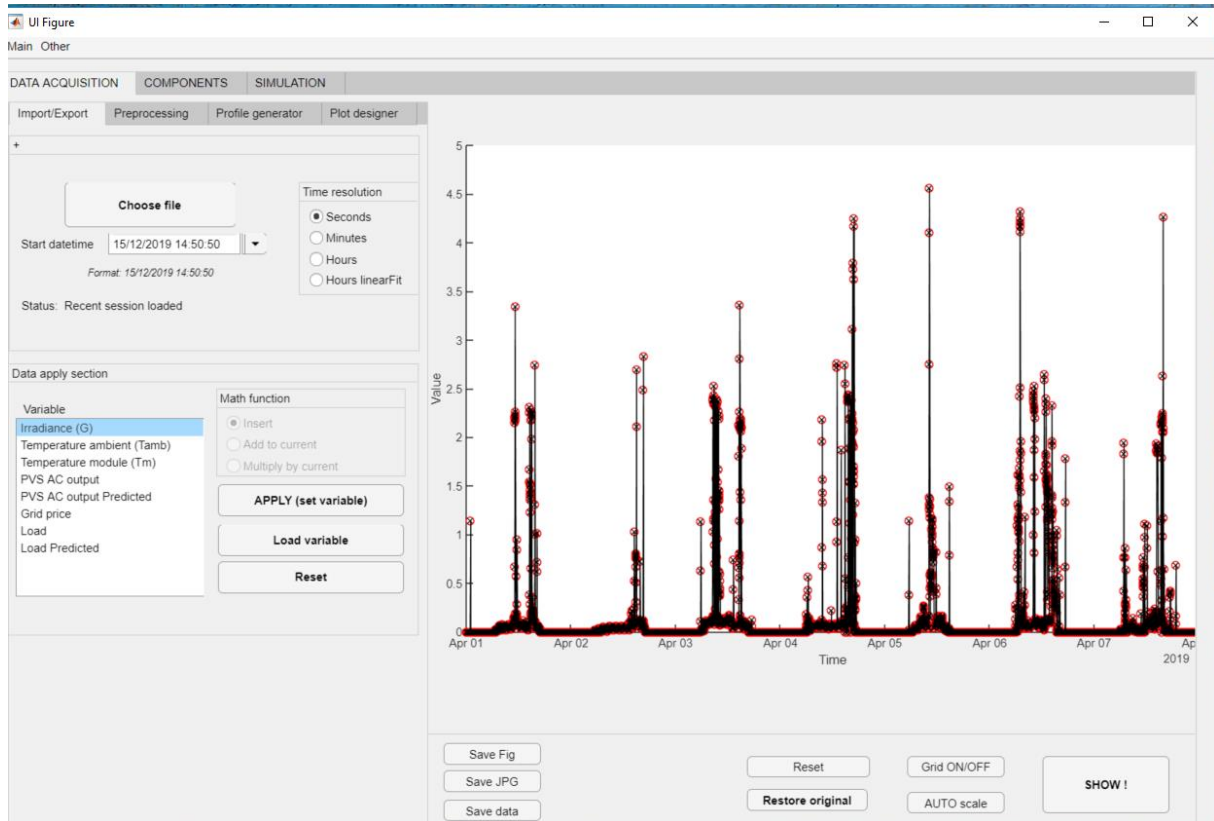
## Purpose

The software tool is intended to be used for testing a multi-source energy system based on photovoltaics (PV), battery (ESS = energy storage system), load and grid. The control of the ESS is uses a predictive algorithm – finding the cheapest way, hoe to operate a system to fully provide the load with energy taken from battery, grid and PV.

## General specification

### Sessions

Work with the tool can be anytime stored or loaded to a local file using the *Load* or *Save* session rollup menu.



## Data preparation

Input parameters can be generated in two ways:

1. Using the *Profile generator* table with hourly based resolution and start to end date.

The screenshot shows the 'Profile generator' panel with tabs for 'Import/Export', 'Preprocessing', 'Profile generator', and 'Plot designer'. The 'Create' section contains two columns: 'Days' and 'Weekends'. Each column has a list of numbers from 1 to 24. Below these columns are input fields for 'From' (01-May-2019) and 'To' (03-May-2019), a 'Set weekends' checkbox, and a 'Set value' button. A 'Set' button is at the bottom.

Days	Weekends
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22
23	23
24	24

From: 01-May-2019 ☐ Set weekends  
To: 03-May-2019  Set value  
Set

2. Data can be imported from text file in secondly (panel Import/Export, Choose file), minutely or hourly resolution. For hourly resolution one can select linear interpolation of nearby data points.

The screenshot shows the 'Import/Export' panel with tabs for 'Import/Export', 'Preprocessing', 'Profile generator', and 'Plot designer'. It features a 'Choose file' button, a 'Start datetime' field (15/12/2019 14:50:50), a 'Format' field (15/12/2019 14:50:50), and a 'Status' field (-). A 'Time resolution' section has radio buttons for 'Seconds', 'Minutes', 'Hours', and 'Hours linearFit'.

Choose file

Start datetime: 15/12/2019 14:50:50  
Format: 15/12/2019 14:50:50

Status: -

Time resolution:  
☒ Seconds  
☐ Minutes  
☐ Hours  
☐ Hours linearFit

Using the *Plot designer* panel, data can be shown in graphs, if needed aggregated to minutes, hours, days or months. Also selection of time period and filtering weekdays and weekends is possible.

Panel preprocessing can be used to filter days, limit upper and lower values, linear operation of the data (adding or multiplying by a constant), randomizing or time based data mixing.

## Setting parameters of components

In the *Components* panel, PV system parameters (*PVS*), energy storage parameters (*ESS*) and grid parameters (*GRID*) can be adjusted.

PVS	ESS	GRID
Define the parameters of PV system		
Installed power (kWp)	Capacity (kWh)	Power limit out (kW)
1000	50	10
Inverter eff (%)	Initial SOC (%)	Power limit in = injection (kW)
0.94	50	0
Inverter power AC max (%)	Cycling max (%)	
Inf	80	
Module power temp coeff (%)	Cycling min (%)	
-0.4	0	
Noct	Power max (kW)	
48	10	
Namb	Charge efficiency (%)	
15	100	
	Discharge efficiency (%)	
	100	

## Simulation

Before running the predictive algorithm the data must be prepared. This can be done by pushing the *SHOW&PREPARE DATA* button. Parameter Timesteps defines the simulation time horizon (minutes). Due to the complexity of the predictive algorithm, time horizon is limited to 200 steps in the initial software version.

If all necessary data is correctly set (profiles for *PVS AC output Predicted*, *Grid Price* and *Load Predicted* have to be defined), the lamp *Data ready* will change to green.

By pushing the *RUN SIMULATION* button, the predictive algorithm is started. In the *Status* box, the result can be seen. No suitable solution found indicated, that the parameters and power profiles do not enable any solution to fully supply the loads. In this case the typical approach is to increase the grid limitation on power.

