GREENROCK
DER SALZWASSER STROMSPEICHER

GREENROCK Webinar

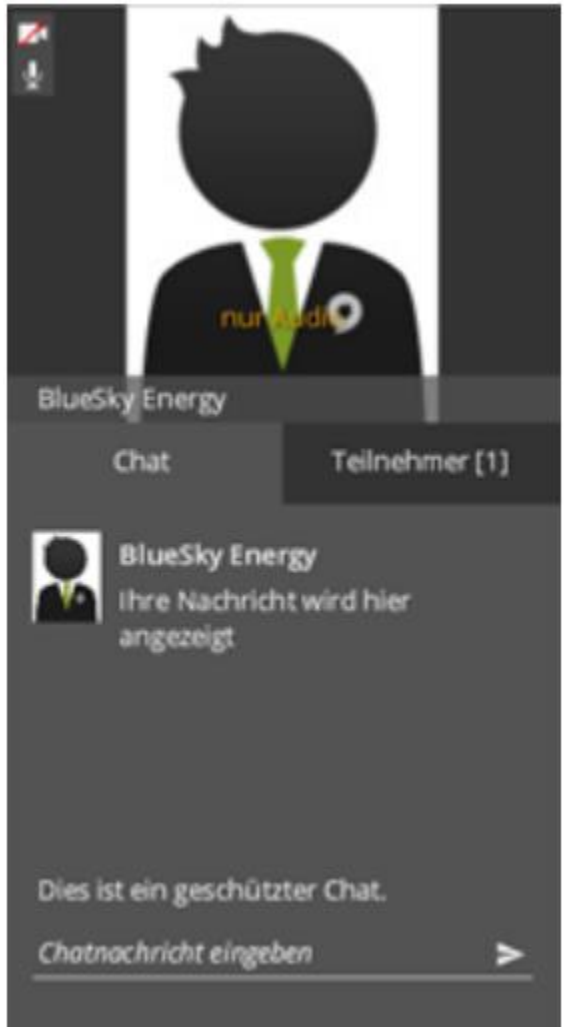
Dimensioning of GREENROCK saltwater storage

Basics about the webinar

List of attendees as well as the chat are hidden and only für BlueSky Energy visible

Please ask questions via the chat, at the end of the topic those questions will be adressed

please take part in the survey after the webinar, this enables us to improve, based on your feedback



Presenter at this webinar

Dr. Thomas Krausse

Managing Director – BlueSky Energy Gmbh

Content

- ✓ Terminology
  - ✓ Self consumption / direct consumption
  - ✓ Degree of energy self-sufficiency
  - ✓ Potential for optimizing
- ✓ Dimensioning of systems
  - ✓ PV/Photovoltaic/Solar System
  - ✓ Self-consumption / direct consumption
  - ✓ Correct Sizing of energy storage system / battery
  - ✓ Results

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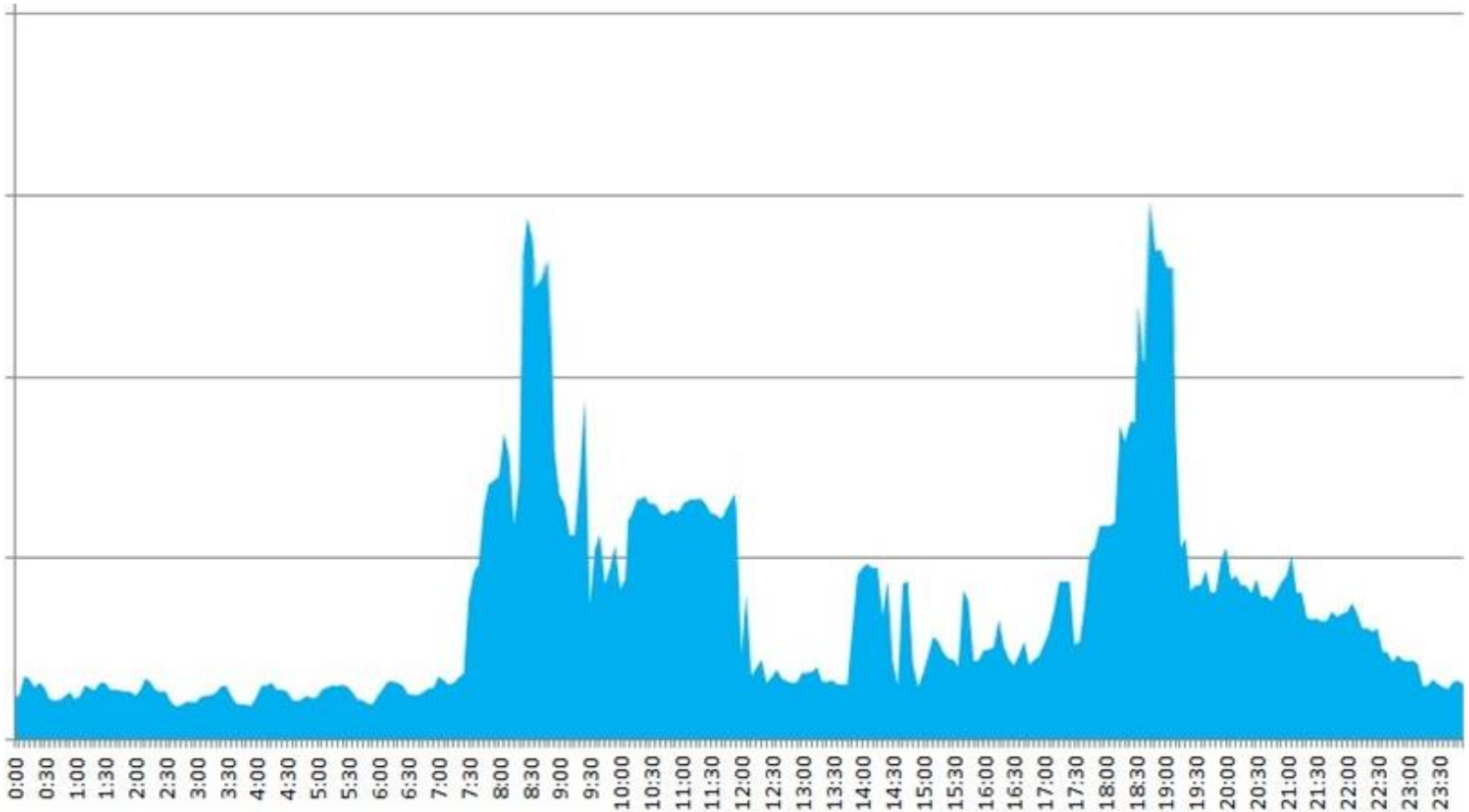
Exemplary Load Profile
without Photovoltaic/Solar



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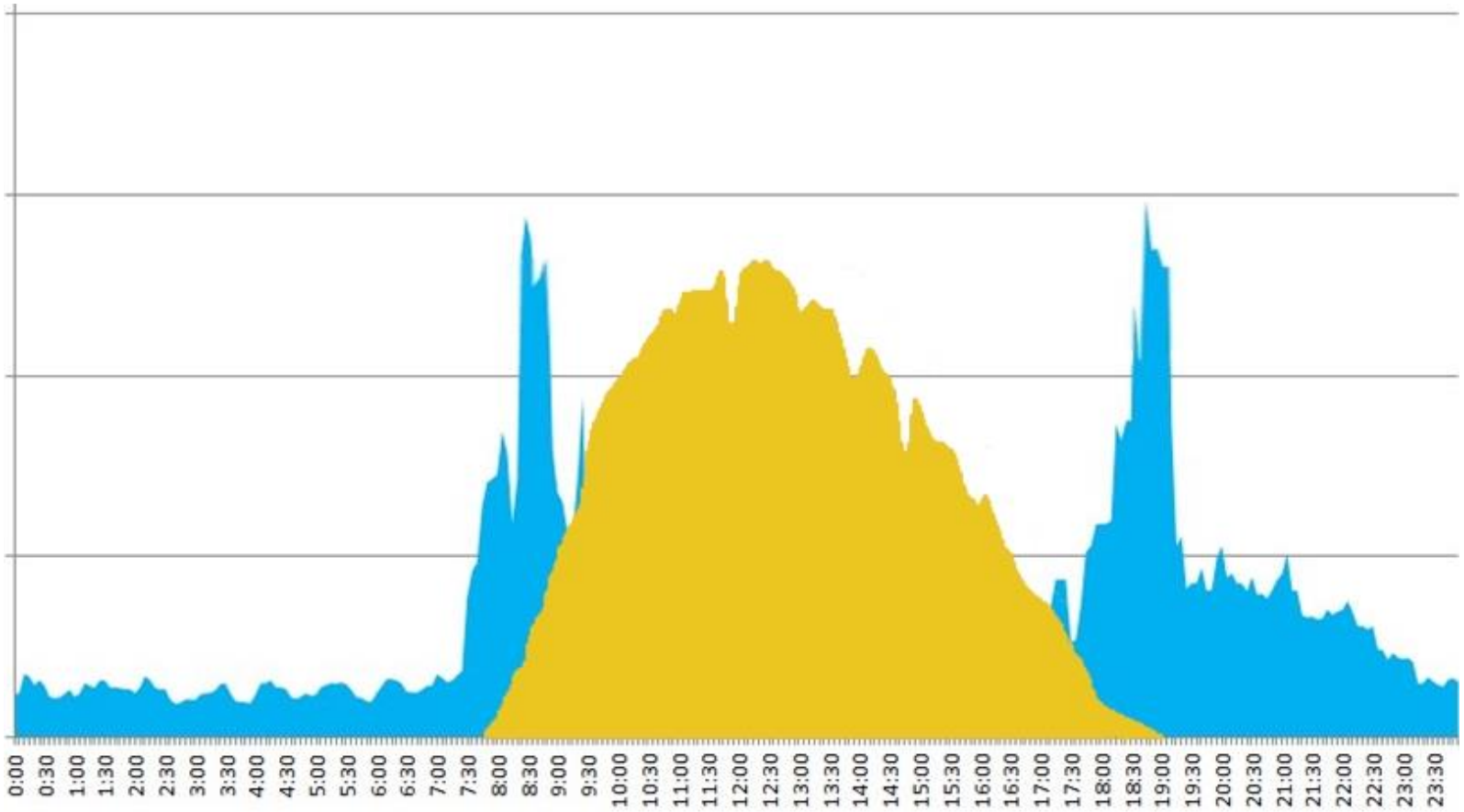
Exemplary Load Profile
with Photovoltaic/Solar



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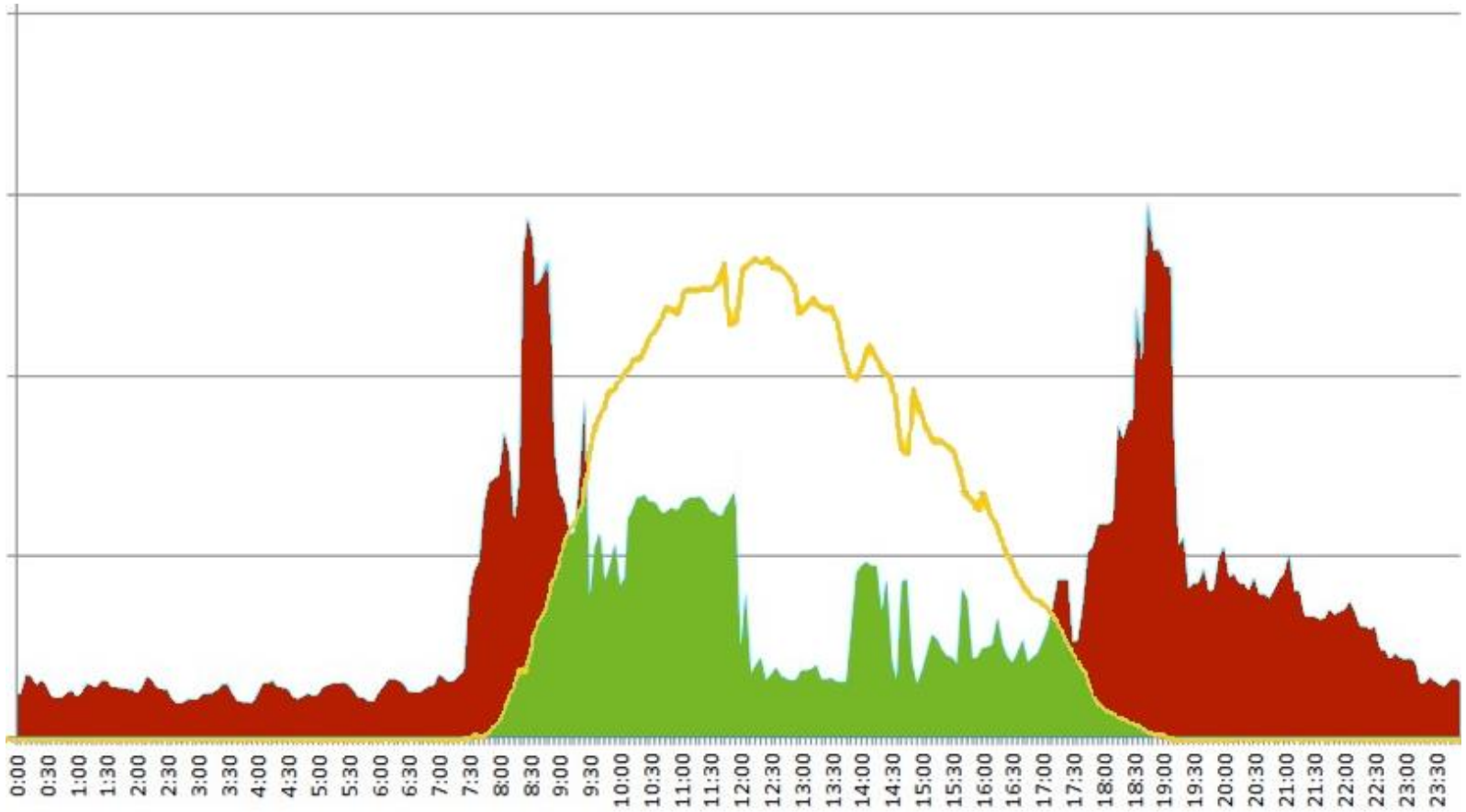
Exemplary Load Profile
with Photovoltaic/Solar



Self consumption / direct consumption

Definition

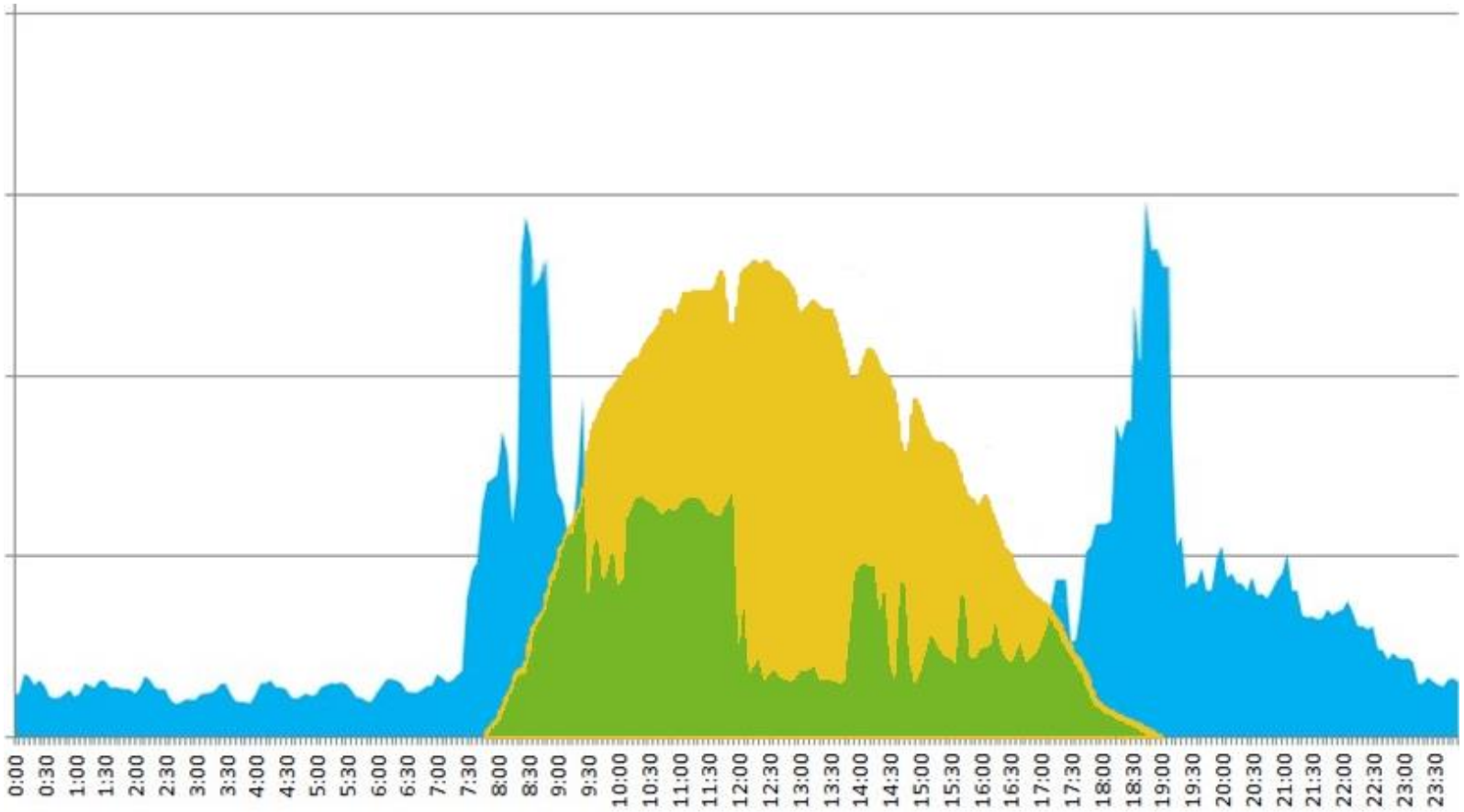
Self consumption/ direct consumption is the share of produced energy through the PV/Solar, which is either consumed instantly or used to charge the battery. The higher the own consumption / direct consumption the less energy is fed back into the grid.

…a rough calculation can be found:…

https://pvspeicher.htw-berlin.de/unabhaengigkeitsrechner/

Self consumption / direct consumption

- see the green parts....



Self consumption / direct consumption

Formula

$$\% \text{ self consumption} = PV_{direct} / PV_{total}$$

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Self consumption / direct consumption

Formela degree of self consumption

$$\text{SC-Share} = PV_{direct} / PV_{total}$$

$$PV_{direct} = PV_{total} - \text{Grid feedback}$$

Data Sources:

PV_{total} from PV inverter

Grid feedback from electricity bill

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Self consumption / direct consumption

EU Average ~30%

SC-Share = 1500 / 5250

PV_{direct} = 5250– 3750

Data Sources:

PV_{total} from PV inverter = 5250kWh

Grid feedback from electricity bill= 3750kWh

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Degree of energy self-sufficiency
Definition

Is the % of energy consumption, which is supplied by the PV directly or through a battery/energy storage system. The higher the degree of energy self sufficiency, the less energy is consumed from the grid.

A rough calculation of energy autarky:

https://pvspeicher.htw-berlin.de/unabhaengigkeitsrechner/

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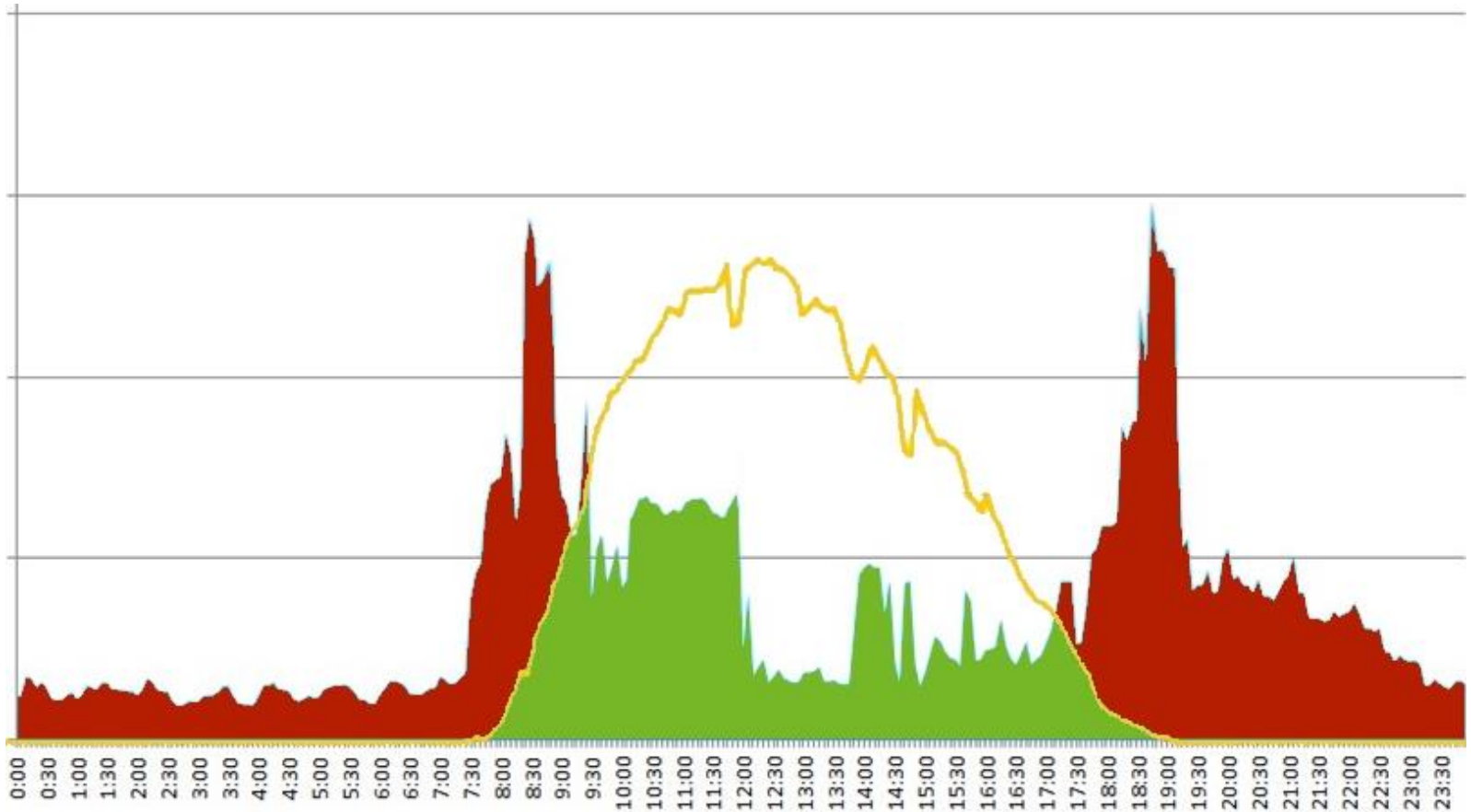
Degree of energy self-sufficiency



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Degree of energy self-sufficiency
Formula

$$\text{Autarky} = PV_{direct} / Consumption_{total}$$

Degree of energy self-sufficiency
Formula

$$\text{Self sufficiency} = PV_{direct} / \text{Consumption}_{total}$$

$$PV_{direct} = PV_{total} - \text{Grid Feedback}$$

Degree of energy self-sufficiency
What does that mean?

Self sufficiency =

PV_{direct} / $Consumption_{total}$

PV_{direct} = PV_{total} – Grid Feedback

$Consumption_{total}$ = Grid + PV_{direct}

Data Sources:

PV_{total} PV inverter

Grid supply and feedback from electricity bill

Degree of energy self-sufficiency
Formula

EU average ~ 31%

Self sufficiency = 1500 / 4500

PV_{direct} = 5250 – 3750

$Consumption_{total}$ = 3000 + 1500

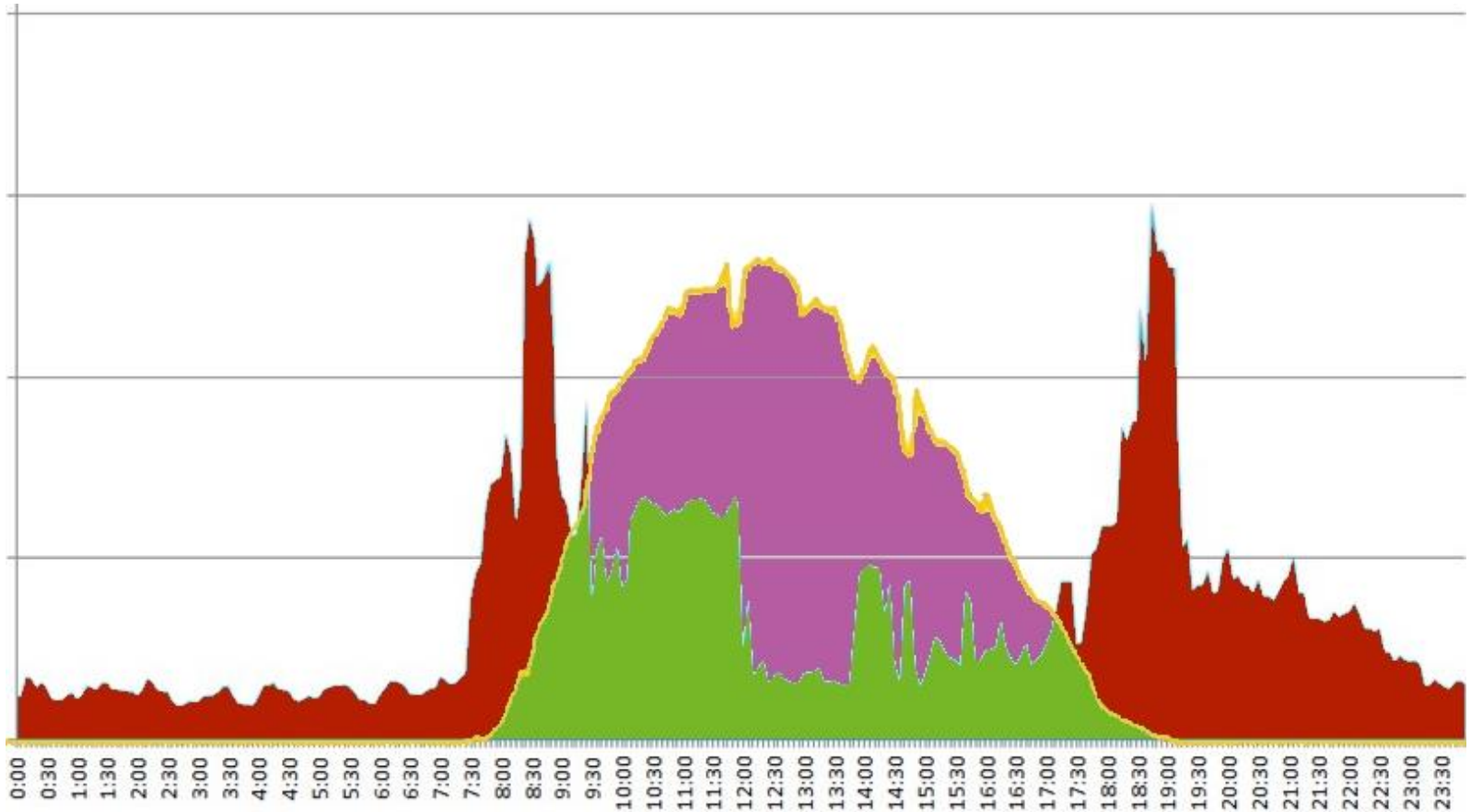
Data Sources:

PV_{total} PV inverter

Grid supply and feedback from electricity bill

Potential for optimizing

How?



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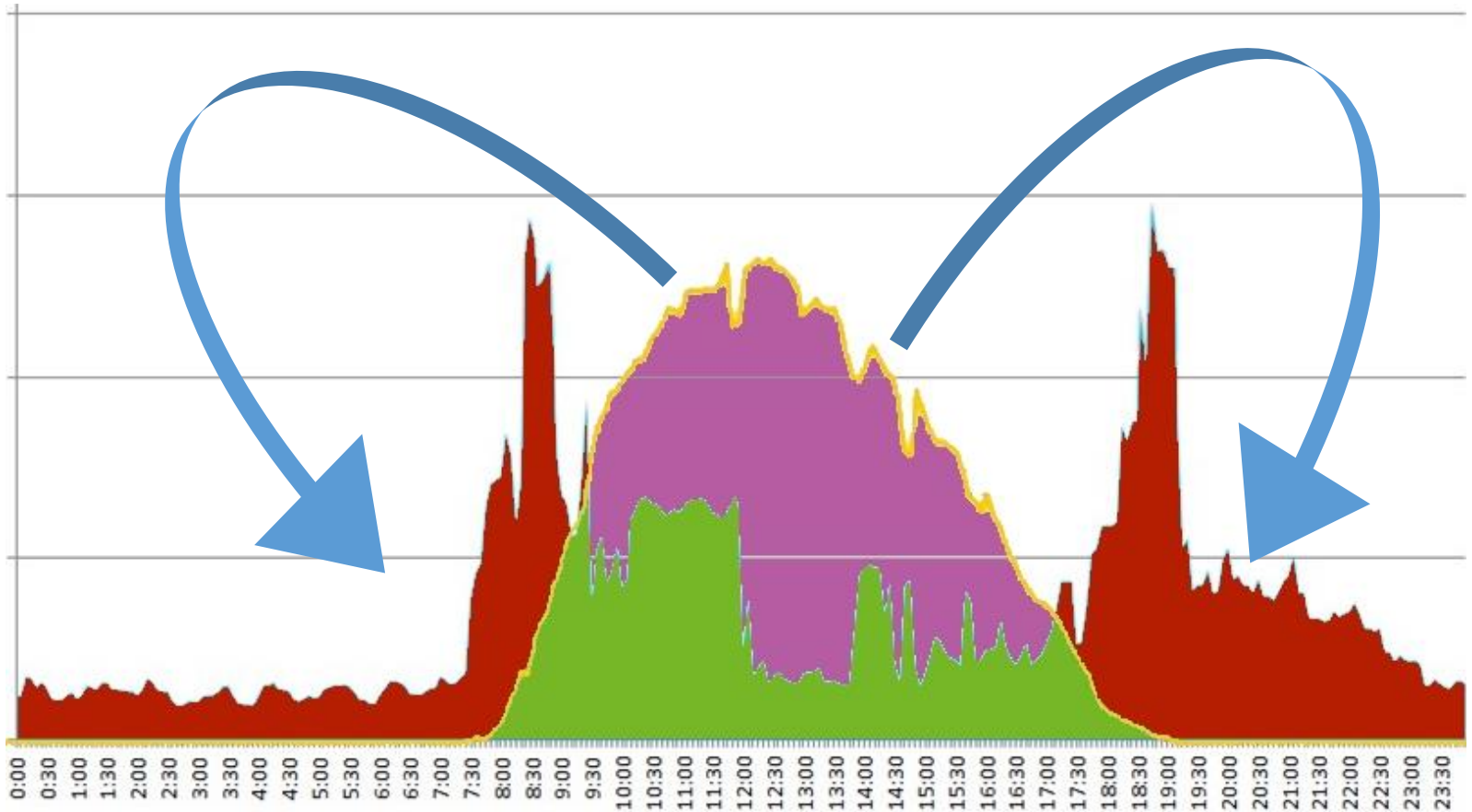
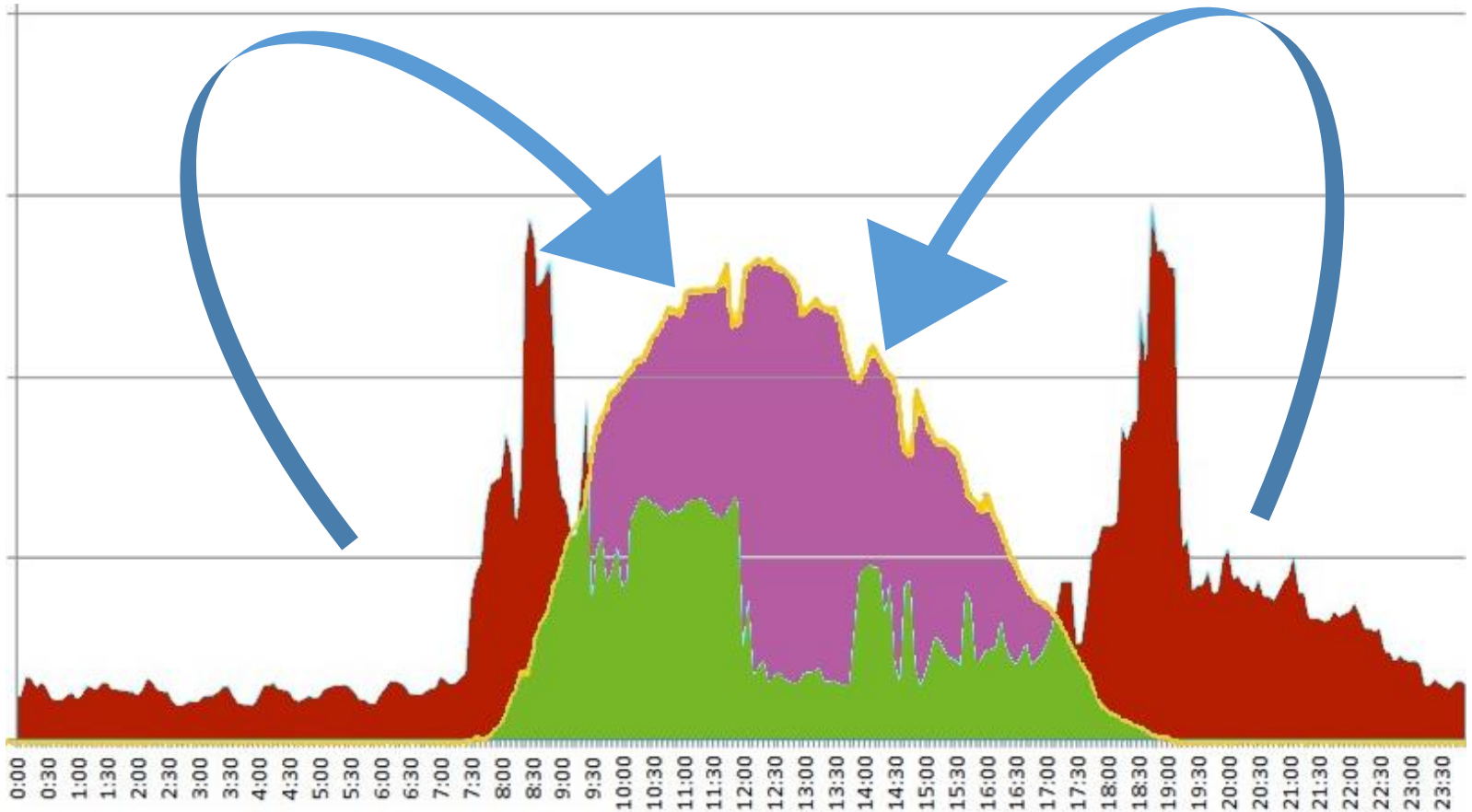
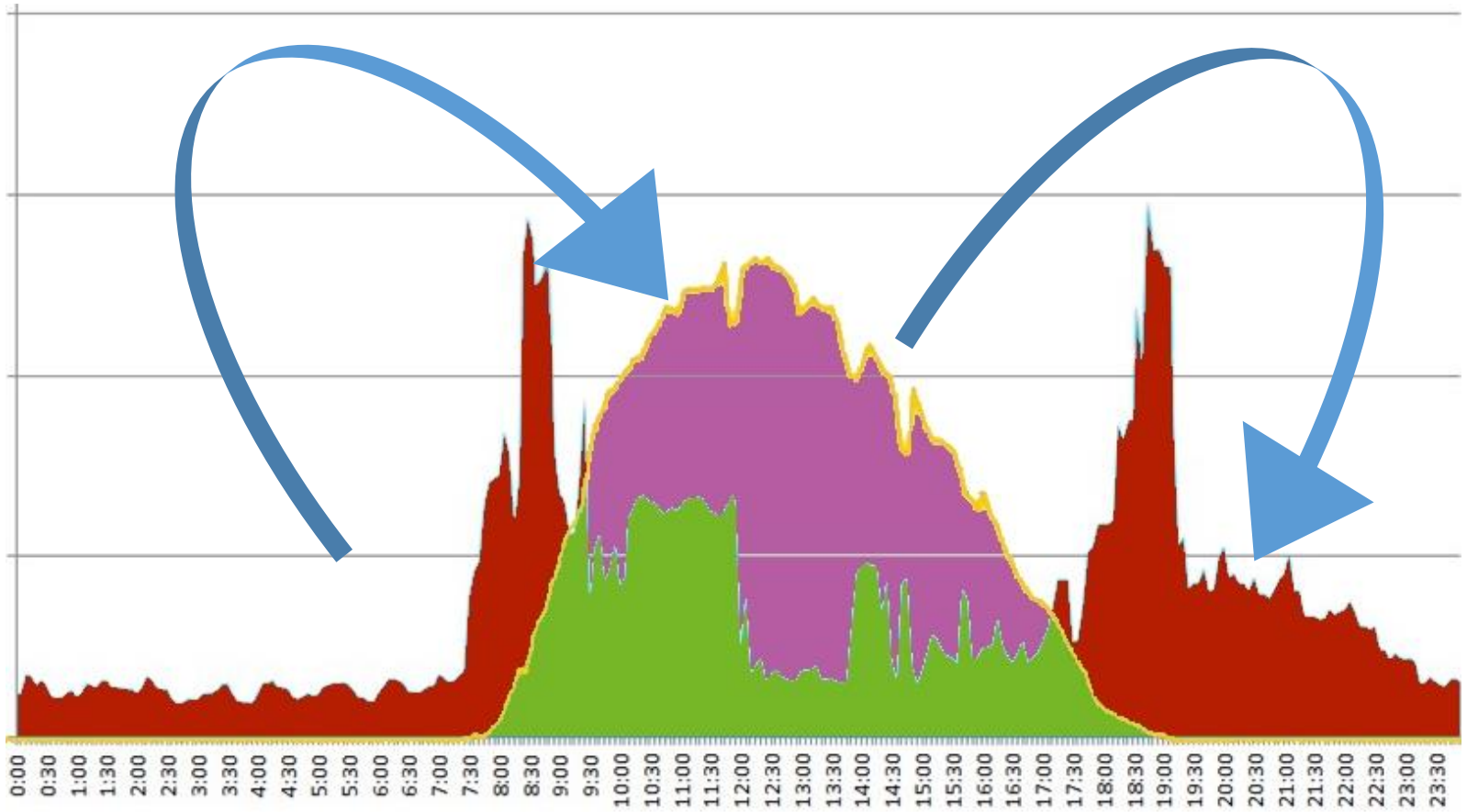
Potential for optimizing
through energy storage



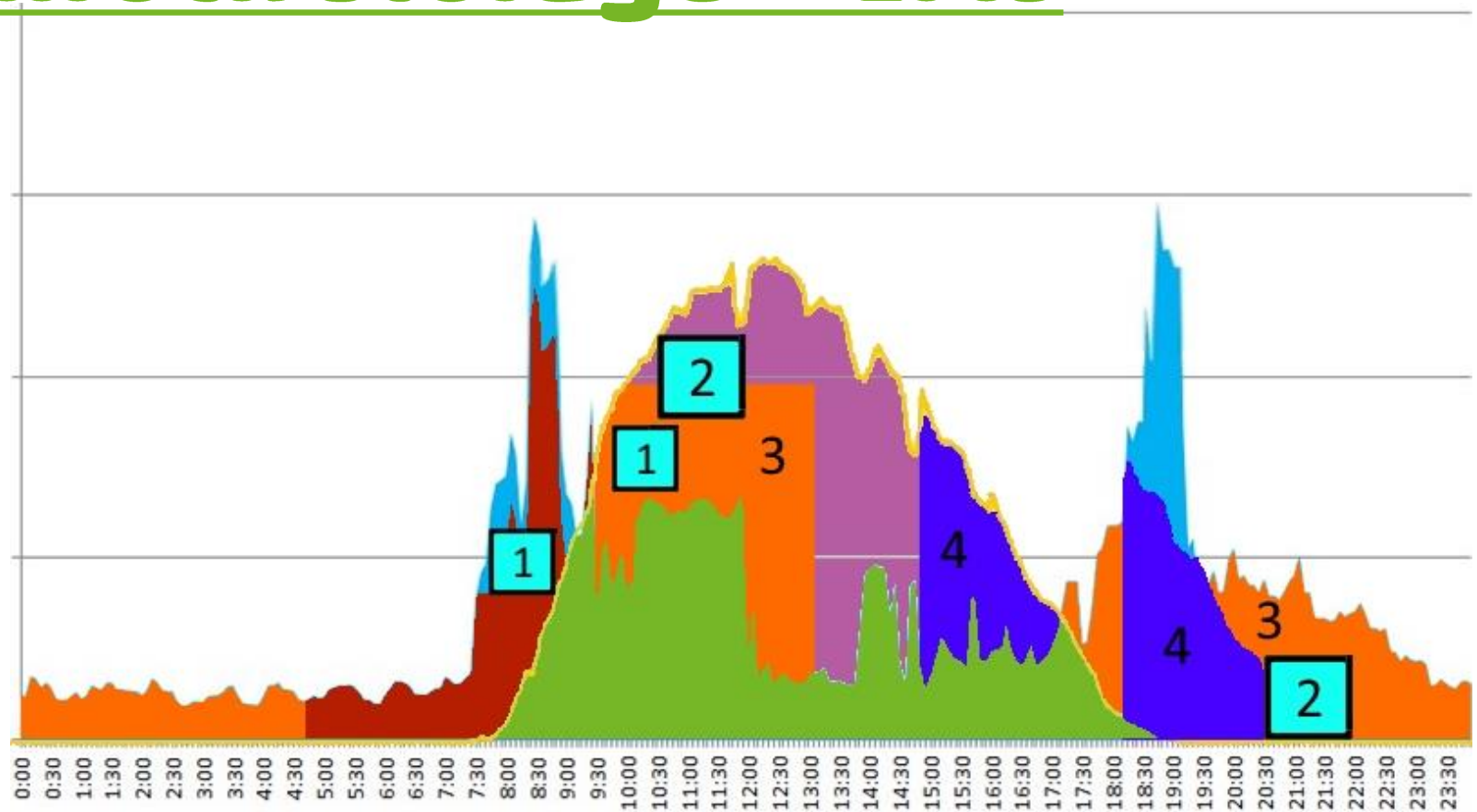
Potential for optimizing
through load shifting



Potential for optimizing Greenrock storage + EMS



Potential for optimizing Greenrock storage + EMS



1 = washing machine
2 = dishwasher
3 = storage / battery
4 = E-Mobility

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Potential for optimizing Greenrock storage + EMS

- ✓ **More than** storing the surplus energy: It means adjusting consumers to **time** and **power availability**
  - ✓ Remote/Radio sockets (Washing machine, Dishwasher, Dryer)
  - ✓ E-charging for e-Mobility (power controlled)
  - ✓ Hot water heating – power – to - heat (power controlled)
  - ✓ Heat pump
  - ✓ All variable consumers
  - ✓ Integration of multiple energy sources

Self consumption >90% easy to achieve

Dimensioning of system
Photovoltaic/Solar

- ✓ Size of PV should match consumption
  - ✓ Too big PV systems lead to energy surplus, which decreases in value due to lower feedback tariffs into the grid
  - ✓ Too small PV systems cannot support energy demand and offer small possibility to charge the battery
  - ✓ Dimensioning should take into account future demand…
    - ✓ E.g. e-mobility

Dimensioning of systems
Photovoltaic/Solar

- ✓ Rough guideline per 1000kWh annual consumption → 1kWp PV
  - ✓ Most common in private houses → 5kWp
    - ✓ Statistically (3 to 4 persons ca. 4500 to 5000kWh/year)
  - ✓ Due to increased energy demand an increase to 1,2 to 1,5kWp is expected

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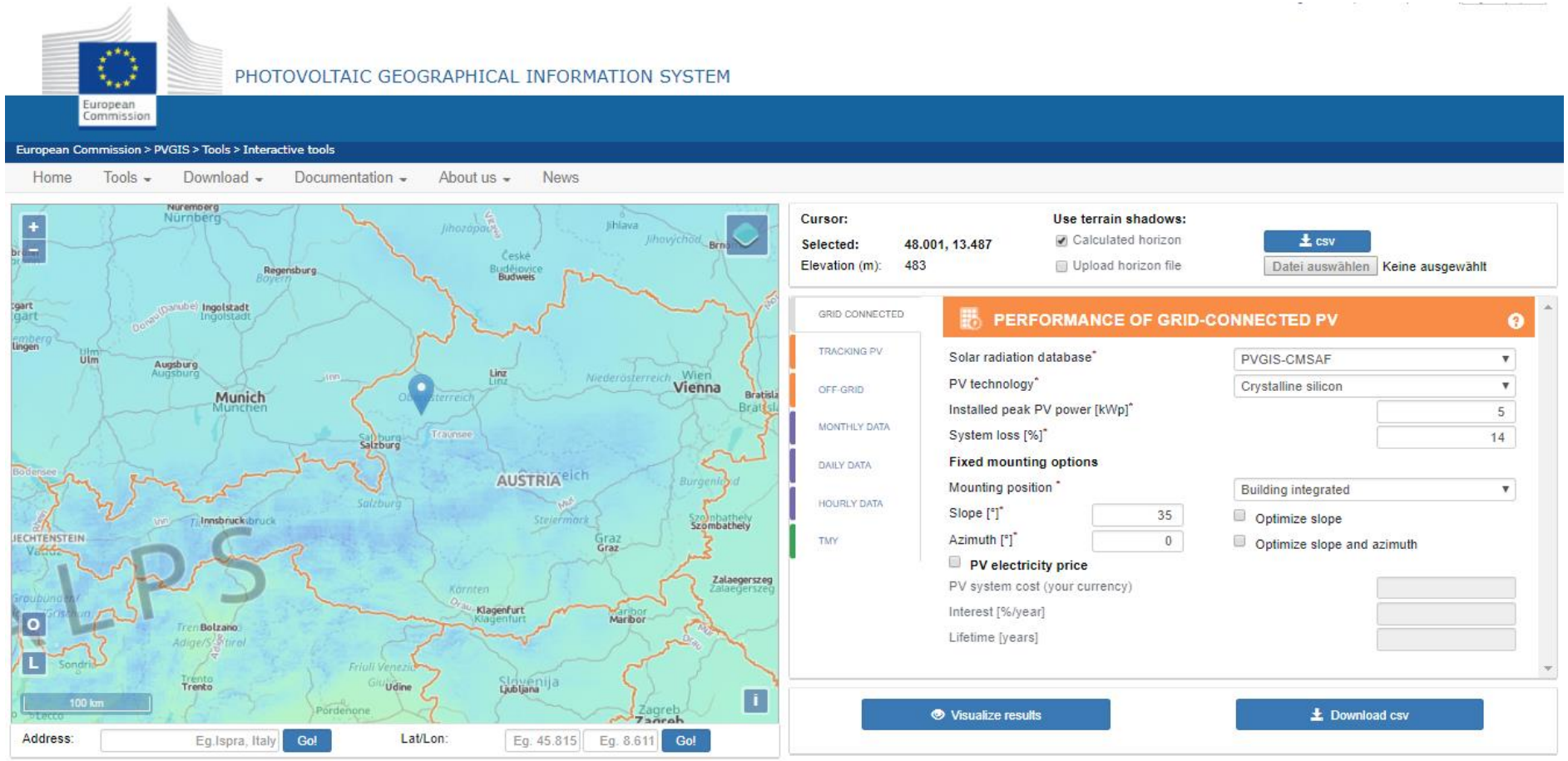
Dimensioning of systems
Photovoltaic/Solar

- ✓ Additional factors to be considered
  - ✓ installed kWp (planned or installed)
  - ✓ Current peak performance (measured)
    - ✓ Installation requirements to be considered
  - ✓ Shading
    - ✓ Already smaller shadows falling on the PV, such as shadows caused by transmission lines have a substential impact on peak performance

PHOTOVOLTAIC GEOGRAPHICAL INFORMATION SYSTEM
http://re.jrc.ec.europa.eu/pvg_tools/en/tools.html

Dimensioning of systems
Photovoltaic/Solar



Dimensioning of systems
Photovoltaic/Solar

PERFORMANCE OF GRID-CONNECTED PV: RESULTS

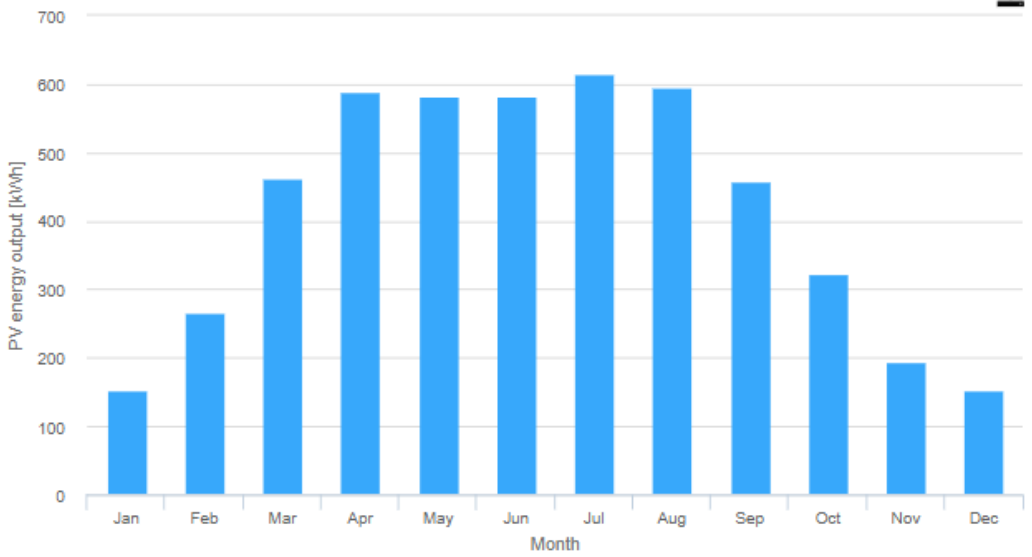
PV output | Radiation | Info | PDF

Summary

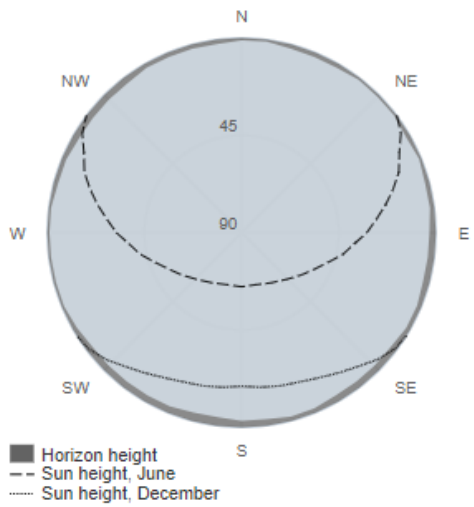
Provided inputs:	
Location [Lat/Lon]:	48.001, 13.487
Horizon:	Calculated
Database used:	PVGIS-CMSAF
PV technology:	Crystalline silicon
PV installed [kWp]:	5
System loss [%]:	14

Simulation outputs:	
Slope angle [°]:	35
Azimuth angle [°]:	0
Yearly PV energy production [kWh]:	4970
Yearly in-plane irradiation [kWh/m²]:	1310
Year to year variability [kWh]:	204.00
Changes in output due to:	
Angle of incidence [%]:	-3
Spectral effects [%]:	1.5
Temperature and low irradiance [%]:	-10.7
Total loss [%]:	-24.4

Monthly energy output from fix-angle PV system



Outline of horizon



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Dimensioning of systems
Consumption

- ✓ Self Consumption
  - ✓ Easy: Energy bill (annual consumption)
  - ✓ Ideal: load profile
  - ✓ Tracking the counter (7:00 / 12:00 / 17:00)
    - ✓ Customer engages for best results…

WÄRME- UND ENERGIEBEDARF (Standortklima)

Referenz-Heizwärmebedarf	9.892	kWh/a	$HWB_{Ref, SK}$	53,5	kWh/m²a
Heizwärmebedarf	9.892	kWh/a	HWB_{SK}	53,5	kWh/m²a
Warmwasserwärmebedarf	2.360	kWh/a	WWWB	12,8	kWh/m²a
Heizenergiebedarf	17.514	kWh/a	HEB_{SK}	94,8	kWh/m²a
Energieaufwandszahl Heizen			$e_{AWZ, H}$	1,44	
Haushaltsstrombedarf	3.035	kWh/a	HHSB	16,4	kWh/m²a
Endenergiebedarf	20.549	kWh/a	EEB_{SK}	111,2	kWh/m²a
Primärenergiebedarf	28.557	kWh/a	PEB_{SK}	154,6	kWh/m²a
Primärenergiebedarf nicht erneuerbar	24.957	kWh/a	$PEB_{n.ern., SK}$	135,1	kWh/m²a
Primärenergiebedarf erneuerbar	3.600	kWh/a	$PEB_{ern., SK}$	19,5	kWh/m²a
Kohlendioxidemissionen (optional)	5.094	kg/a	$CO2_{SK}$	27,6	kg/m²a
Gesamtenergieeffizienz-Faktor			f_{GEE}	0,87	
Photovoltaik-Export		kWh/a	$PV_{Export, SK}$		kWh/m²a

Dimensioning of systems
Consumption

- ✓ Other factors…
  - ✓ Consumer behaviour (At which hours people are at home, when are certain activities carried out (cooking, washing machine, dryer)
  - ✓ Heating System (eg. PV connected to heat pumpt, Infrared heating, hot water heating, etc.)
  - ✓ E-mobility (when is the car charged)
    - ✓ Planned purchase of e-car

Dimensioning of System
Data requirement at minimum

- ✓ Total PV-Production
  - ✓ PV-inverter
- ✓ Feedback Energy – into the grid
  - ✓ Energy bill
- ✓ Consumed energy
  - ✓ Energy bill
- ✓ Technical Details
  - ✓ kWp, alignement, etc.

Dimensioning of System
annual average

Annual PV-Production 5250kWh

30% self consumption (Surplus = 3675kWh) → ca. 10kWh/Day

Nov - Jan: ca. 50% / Apr – Aug = ca. 200%

Annual consumption 4500kWh

30% direct from PV = 3150kWh from Grid → ca. 8,5kWh/Day

When existing PV systems are used, the current self consumption ratio can be used based on actual data

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Dimensioning of System
rough guideline

Storage capacity = 1x to 1,5x of PV kWp-Performance

@ 5kWp = 5kWh to 7,5kWh recommended capacity

Annual consumption 4500kWh

4500 / 365 = ca. 12kWh/day

30% direct PV-usage = ca. 3,6kWh

70% from grid = 8,4kWh

When existing PV systems are used, the current self consumption ratio can be used based on actual data

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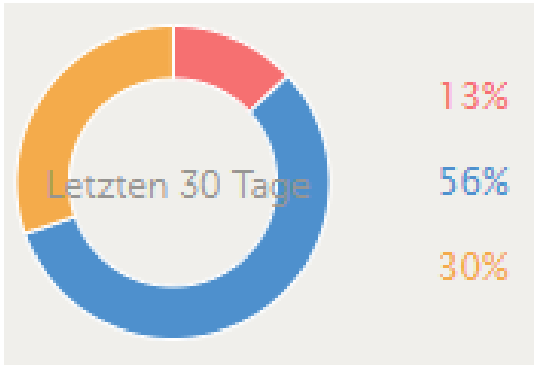
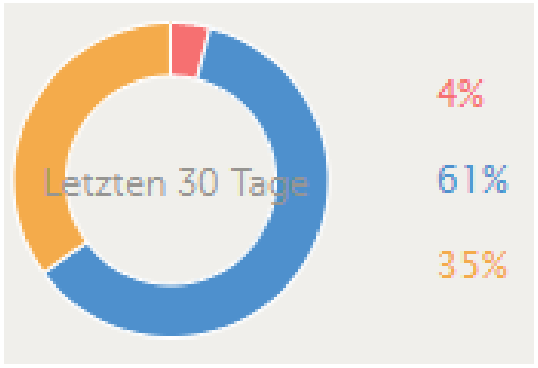
Dimensioning of System
Dimensioning of storage

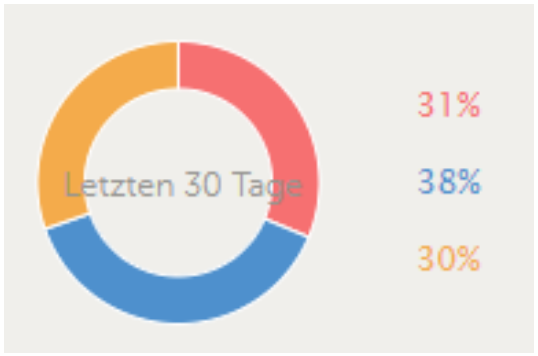
- ✓ Consider both: production and consumption (Photovoltaic or others and consumption)
  - ✓ Large PV and small consumption, storage is always fully charged but never fully used, long amortisation time.
  - ✓ Small PV and relatively high consumption, little impact on energy self-sufficiency.

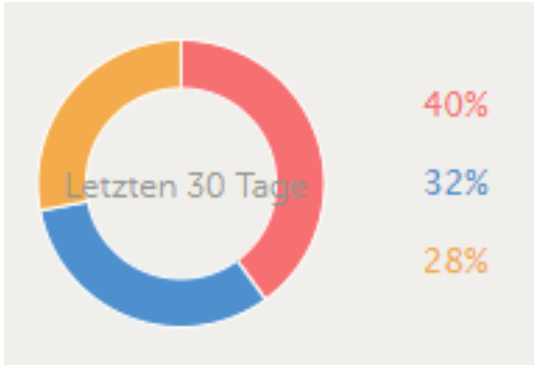
Dimensioning of System

Self consumption quota from Greenrock Systems



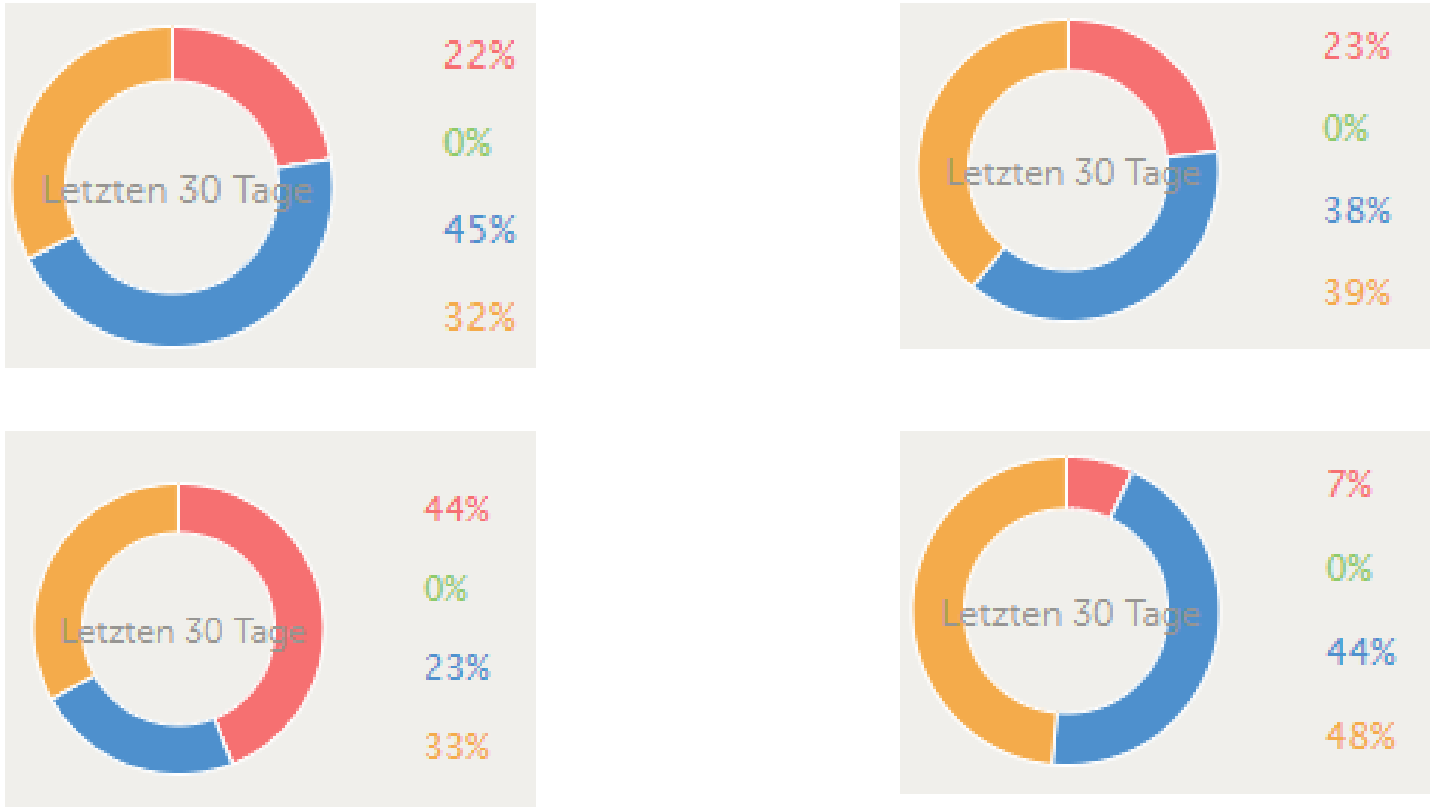






Dimensioning of System

Self consumption quota from Greenrock Systems



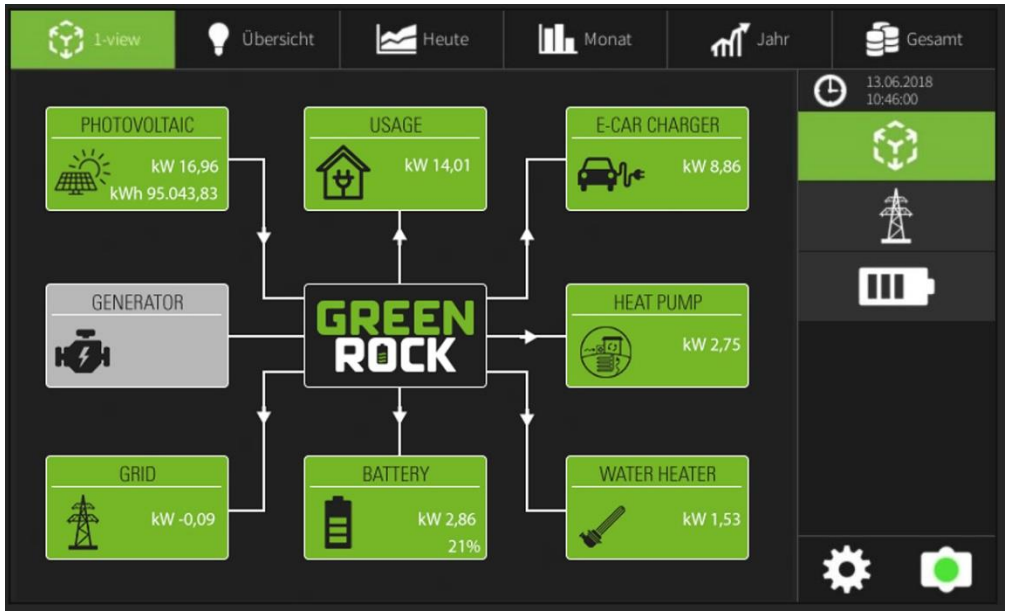
Dimensioning of Systems
correct dimensioning....

- ✓ Increase self consumption quota to 60% up to 65%
- ✓ Increase energy self-consumption to 55% up to 65%

- ✓ With Greenrock EMS self consumption can be increased to>90% and self-sufficiency to > 70%
  - ✓ Hot water heating with PV's surplus lowers electricity and heating bill, especially in spring, summer and autumn
  - ✓ Automatically managing flexible consumers like dishwasher, washing machine or dryer decreases the energy costs.

Optimising PV surplus
first step.....GREENROCK EMS

- ✓ Increase self consumption
- ✓ Increase energy self-sufficiency



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- ✓ Automatically managing flexible consumers like dishwasher, washing machine or dryer decreases the energy costs.

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Questions?

GREENROCK Webinare
further content

- ✓ Product presentation (done)
- ✓ Battery Dimensioning (Deep Dive) (this Webinar)
- ✓ Installation
- ✓ Calculating the costs of energy storage

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Vielen Dank