

# Tools and Methods

## PVopti – Hourly-based design tool for determining personal consumption

- Calculation of self-consumption for different building types and designs
- Climate data according to SIA 2028 and load profiles according to SIA 2024
- A daylight criterion is added
- Good agreement with measurements of single family houses and apartment buildings

### Development

Regarding the increasing volatile electricity generation, the mismatch between production and consumption can be a major challenge for utilities and influence the economical viability. Therefore, as part of subtask B of IEA EBC Annex 67, a methodology called “Enerflex” has been developed which allows the calculation of electricity self-consumption. Minergie® as advanced Swiss label stimulated the enhancement to a freely available easy-to-use excel-tool “PVopti” as part of its requirements.

### Methodology

- Input and output data: yearly or monthly values
- Calculation: hourly values

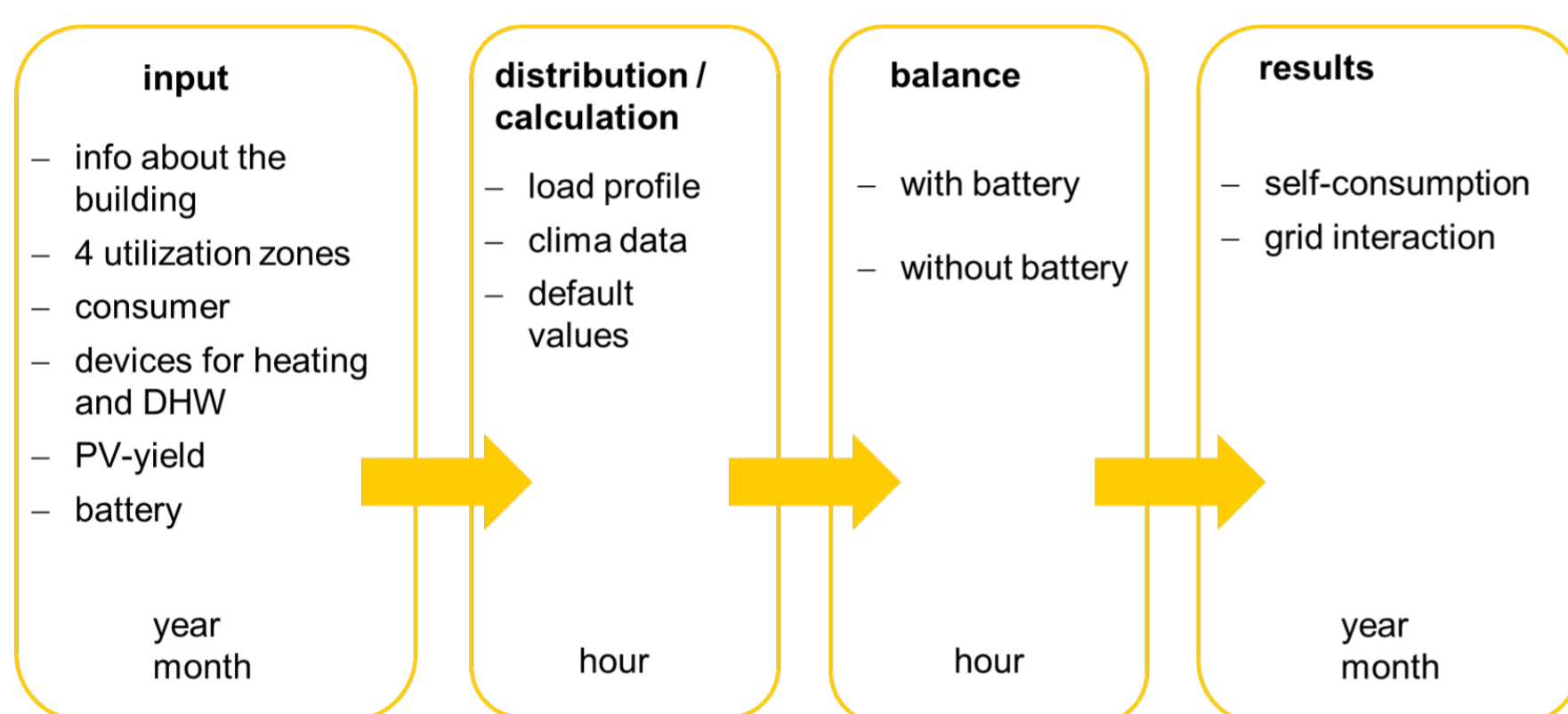


Fig. 1 Workflow of PVopti.

### Easy to use

- Only two pages visible: input data and results
- Very limited amount of input data necessary
- Proposed standard values can be replaced if known better

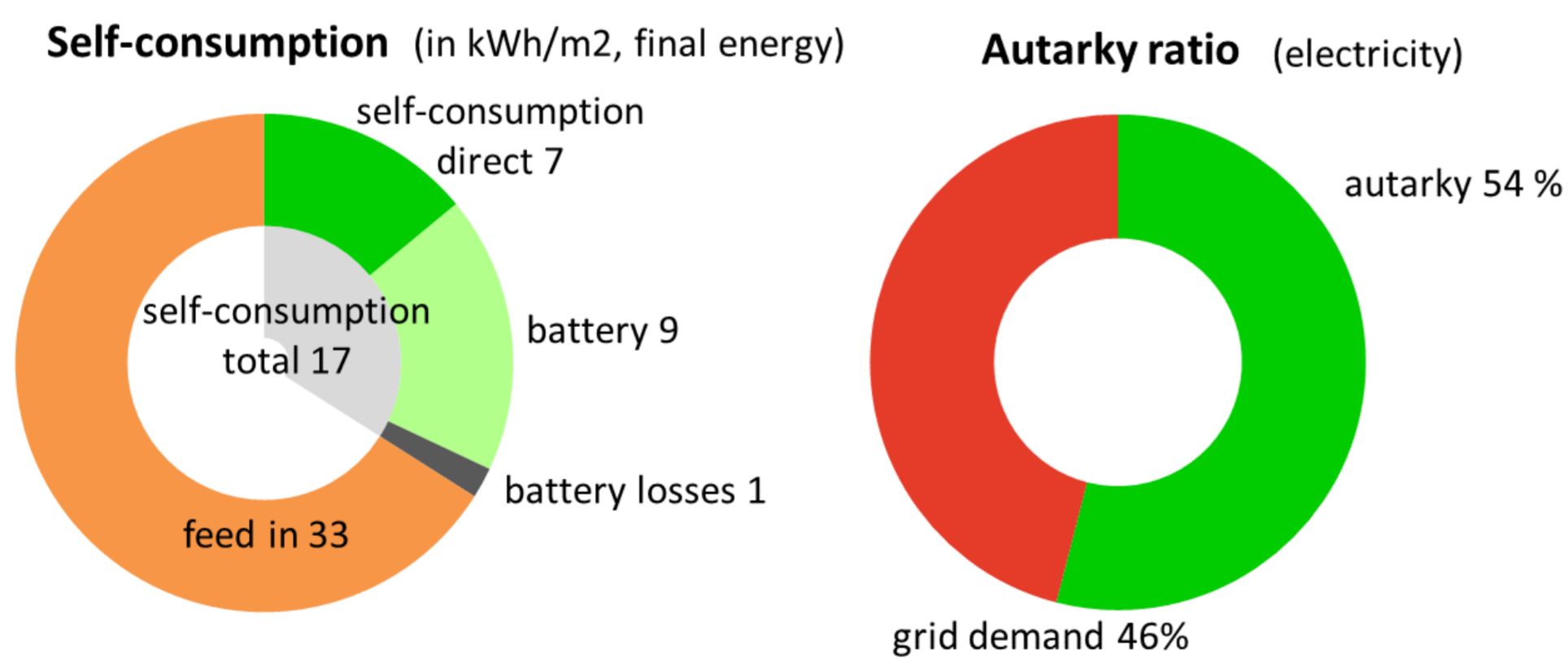


Fig. 2 Example of self-consumption and autarky ratio.

### Options for load-shifting

- Time control of heating and hot water production
- Load-shifting of appliances
- Electricity storage
- Orientation and slope of PV modules

### Improving load profiles for lighting: adaption for daylight

- SIA 2024: demand for lighting for each daily hour independent of actually available daylight
- Added criterion: no demand when global irradiation > 200 W/m<sup>2</sup>
- predefined parts of floor space without daylight criterion (e.g. 40% for apartment buildings)

Month													Month												
Hour	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez	Hour	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Dez
1	1.8	1.7	1.8	1.7	1.8	1.7	1.8	1.8	1.7	1.8	1.7	1.7	1	2.2	2.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	
2	1.8	1.6	1.8	1.7	1.8	1.7	1.8	1.8	1.7	1.8	1.7	1.8	2	2.2	2.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	
3	1.8	1.6	1.8	1.7	1.8	1.7	1.8	1.8	1.7	1.8	1.7	1.8	3	2.2	2.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	
4	1.8	1.6	1.8	1.7	1.8	1.7	1.8	1.8	1.7	1.8	1.7	1.8	4	2.2	2.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	
5	1.8	1.6	1.8	1.7	1.8	1.7	1.8	1.8	1.7	1.8	1.7	1.8	5	2.2	2.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	
6	1.8	1.6	1.8	1.7	1.8	1.7	1.8	1.8	1.7	1.8	1.7	1.8	6	2.2	2.0	2.2	2.2	2.2	2.1	2.2	2.2	2.2	2.2	2.2	
7	1.8	1.6	1.8	1.7	1.8	1.7	1.8	1.8	1.7	1.8	1.7	1.8	7	2.2	2.0	2.2	2.1	1.7	1.3	1.5	2.0	2.2	2.2	2.2	
8	38.0	34.3	38.0	36.8	38.0	36.8	38.0	38.0	36.8	38.0	36.8	38.0	8	47.8	43.1	40.4	30.5	28.9	22.1	38.9	25.7	37.8	45.7	46.2	
9	38.0	34.3	38.0	36.8	38.0	36.8	38.0	38.0	36.8	38.0	36.8	38.0	9	47.8	41.0	36.2	25.2	24.7	17.9	24.7	18.3	28.4	35.4	46.2	
10	38.0	34.3	38.0	36.8	38.0	36.8	38.0	38.0	36.8	38.0	36.8	38.0	10	45.7	31.6	29.9	21.0	24.7	16.8	19.4	19.4	22.1	29.9	36.8	
11	38.0	34.3	38.0	36.8	38.0	36.8	38.0	38.0	36.8	38.0	36.8	38.0	11	36.2	25.3	24.7	21.0	23.6	16.8	19.4	19.4	20.0	28.9	30.5	
12	38.0	34.3	38.0	36.8	38.0	36.8	38.0	38.0	36.8	38.0	36.8	38.0	12	35.2	25.3	21.5	18.9	24.7	16.8	17.3	17.3	18.9	28.9	32.6	
13	38.0	34.3	38.0	36.8	38.0	36.8	38.0	38.0	36.8	38.0	36.8	38.0	13	38.3	26.3	26.8	20.0	22.6	17.9	19.4	15.2	22.1	26.8	31.5	
14	38.0	34.3	38.0	36.8	38.0	36.8	38.0	38.0	36.8	38.0	36.8	38.0	14	38.3	23.2	23.6	20.0	24.7	16.8	20.5	15.2	23.1	27.8	37.8	
15	38.0	34.3	38.0	36.8	38.0	36.8	38.0	38.0	36.8	38.0	36.8	38.0	15	44.6	27.4	26.8	20.0	26.8	20.5	19.4	27.3	29.9	41.1	47.8	
16	38.0	34.3	38.0	36.8	38.0	36.8	38.0	38.0	36.8	38.0	36.8	38.0	16	47.8	37.9	29.9	23.1	26.8	21.0	22.6	23.6	31.5	42.5	46.2	
17	38.0	34.3	38.0	36.8	38.0	36.8	38.0	38.0	36.8	38.0	36.8	38.0	17	47.8	43.1	41.5	29.4	28.9	25.2	26.8	23.6	44.1	47.8	46.2	
18	38.0	34.3	38.0	36.8	38.0	36.8	38.0	38.0	36.8	38.0	36.8	38.0	18	47.8	43.1	47.8	46.2	36.2	31.5	35.2	45.7	46.2	47.8	46.2	
19	81.3	73.4	81.3	78.7	81.3	78.7	81.3	81.3	78.7	81.3	78.7	81.3	19	102.2	92.3	102.2	98.9	102.2	98.9	102.2	102.2	98.9	102.2	98.9	
20	81.3	73.4	81.3	78.7	81.3	78.7	81.3	81.3	78.7	81.3	78.7	81.3	20	102.2	92.3	102.2	98.9	102.2	98.9	102.2	102.2	98.9	102.2	98.9	
21	81.3	73.4	81.3	78.7	81.3	78.7	81.3	81.3	78.7	81.3	78.7	81.3	21	102.2	92.3	102.2	98.9	102.2	98.9	102.2	102.2	98.9	102.2	98.9	
22	1.8	1.6	1.8	1.7	1.8	1.7	1.8	1.8	1.7	1.8	1.7	1.8	22	2.2	2.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	
23	1.8	1.6	1.8	1.7	1.8	1.7	1.8	1.8	1.7	1.8	1.7	1.8	23	2.2	2.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	
24	1.8	1.6	1.8	1.7	1.8	1.7	1.8	1.8	1.7	1.8	1.7	1.8	24	2.2	2.0	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	

Fig. 3 Electric load (kWh) for lighting (apartment building) according Merkblatt SIA 2024 (left) and with improved daylight criterion (right).

### Validation

- Improved correlation of seasonal demand according to profile H0 (BEDW) because of criterion for daylight
- Good correlation with the online-tool „Solarstromspeicher-Unabhängigkeitsrechner“
- Good correlation between calculation with PVopti and measurements
- Correlation between calculation and measurement is better when measured demand and electric yield is used as input

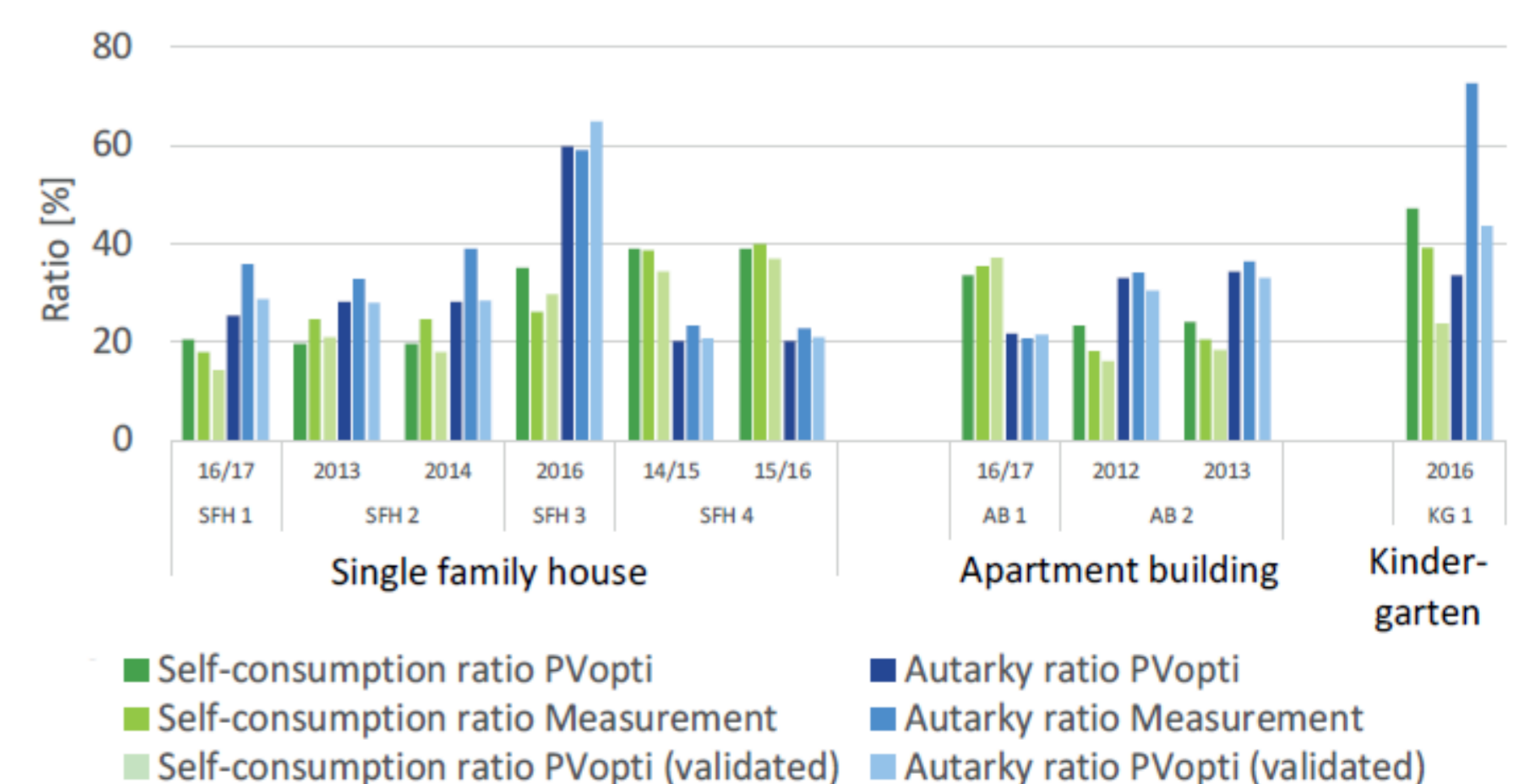


Fig. 4 Comparison of PVopti and measurements.

### Free available

- Available languages: german, french, italian, english
- [https://www.minergie.ch/media/pvopti\\_1.05\\_de.xlsx](https://www.minergie.ch/media/pvopti_1.05_de.xlsx)