reflex

Thinking solutions.

New at Reflex: Power to Heat

Heat generation using solar power with electric heating elements

- Use direct current from solar modules for heating water directly
- Increase own consumption of the solar energy generated for more efficiency and sustainability
- Can be used in Reflex hot water and buffer storage tanks

Learn more at: **www.reflex-winkelmann.com/en**

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Background

Hot water and heating from photovoltaics is a new concept. Historically, electricity was viewed negatively as a source of heat – too valuable, too expensive, too much CO_2. Things have changed. Now costing less than half in relation to electricity from the grid, electricity from photovoltaics forms the basis. A household can only consume a small share of the solar power produced by photovoltaic (PV) systems. Installing electric heating elements in a hot water storage tank enables a household to use excess solar energy to heat its water – and optimises its energy consumption by means of intelligent control systems.

Benefits at a glance

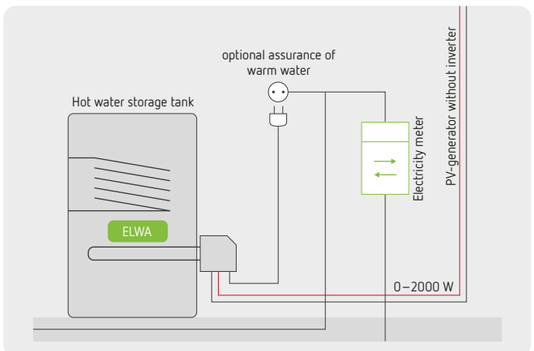
+ High efficiency by use of solar energy to generate electricity and for hot water preparation
+ Solar coverage remains high at 50–60%
+ Significant savings in operation by avoiding thermal distribution loss in pipelines
+ Low maintenance; installation couldn't be simpler
+ No noise emissions
+ Savings in fossil fuel like gas or oil
+ Low CO_2 impact and climate-friendly

Products and applications

ELWA

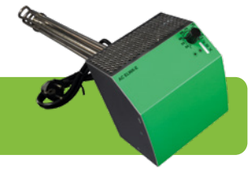
On-grid for heating water directly

- Not connected to the grid
- For systems without battery storage
- Direct connection of ELWA to PV system (DC); 230 V plug can be inserted as a backup
- No inverter, no distribution to the grid, no connection permits required
- Continuously adjustable heat output (0–2 kw)
- Suitable for PV generators with an output of up to 2.5 kWp
- Temperature adjusted using controller on ELWA



Without grid connection – without battery storage

How it works
ELWA is a heating element for generating hot water with photovoltaics. Direct current from photovoltaic modules is transferred straight to the built-in heating element and immediately converted into heat without any losses. A connection to the electricity grid is not required for this (pure off-grid operation). No distribution to the grid, no inverter, no connection permits, installation couldn't be simpler. The system provides up to 50% of the hot water required by a household with two to four people. ELWA replaces solar thermal systems of 4–10 m^2 at a photovoltaic output of up to 2.5 kWp. To safeguard the hot water supply, ELWA can automatically reheat from the grid.



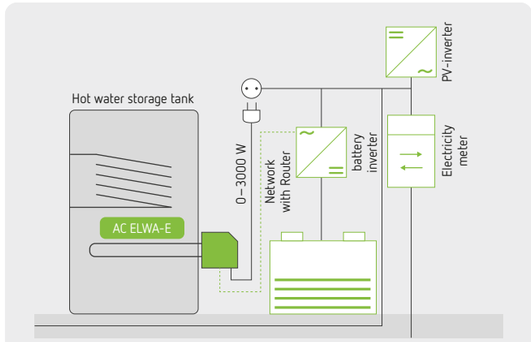
AC ELWA-E

On-grid, use of PV excess for hot water

- For systems with or without battery storage
- ELWA is connected to a power outlet
- Inverter required
- Continuously adjustable heat output (0–3 kw)
- Temperature adjusted using rotary knob on ELWA

With battery storage

- Communication with AC ELWA-E via battery inverter

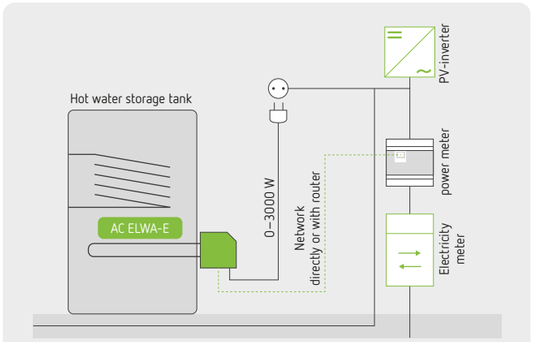


With grid connection – with battery storage

How it works
AC ELWA-E ensures optimum use of photovoltaic energy. Charging the battery storage is prioritised. As soon as the battery is full, the AC ELWA-E stores the excess energy in hot water. No excess is distributed to the grid. Water is the cheapest form of storage and perfectly complemented by chemical storage batteries.

Without battery storage

- Reflex power meter required
- The power meter decides on distribution to the grid or own use and communicates with the AC ELWA-E heating element



With grid connection – without battery storage
With power meter

How it works
In combination with the power meter, the AC ELWA-E only uses excess energy from the photovoltaic system. Continuously adjustable heat output, meaning virtually no energy is distributed to the grid and own consumption increases significantly.

The connection is made via a patch cable to the router, directly with a crossover network cable or wirelessly with commercially available powerline adapters.

The share of own consumption achieved by a PV system is 30% on average. AC ELWA-E makes it possible to increase the share to 75% (in an average household (5 kWp PV system)).

Power to Heat

Dimensioning and calculation

1. Estimate PV system's maximum size by determining the PV system's recommended output

System size

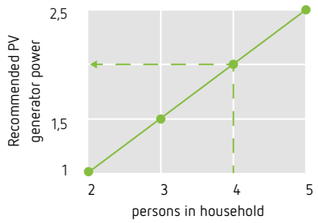
PV output [kWP]	PV size [m²]
1	about 7
2	about 17
3	about 21
4	about 28
5	about 35
6	about 42
7	about 49
8	about 56
9	about 63
10	about 70

Calculation example (estimate)*:
Maximum roof surface of 40 m²
Radiation = 1,000 W/m²*year

Max. system output
40 m² / 10 = 4 kWp

System-specific annual electricity yield:
4 kWp × 1,000 = about 4,000 kWh/year

System output



Calculation example (estimate)**:
Consumption per resident: about 50 l/day; amount of energy required: about 1,000 kWh per year/person
Gross annual yield of PV system: about 1,100 kWh/kWp per year, includes excess of about 7%.
A recommended solar hot water coverage of 50% produces a system output of 2 kWp for a household with four people.

2. Create annual energy balance, determine share of own consumption and level

Own consumption rate
Share of own electricity consumption in relation to electricity produced

$$\text{Own consumption rate [\%]} = \frac{\text{Own consumption [kWh]}}{\text{Production [kWh]}} \times 100$$

Level of self-sufficiency (coverage)
Share of own electricity consumption in relation to total electricity consumption

$$\text{Level of self-sufficiency [\%]} = \frac{\text{Own consumption [kWh]}}{\text{Total consumption [kWh]}} \times 100$$

Installed PV output [kWp]	PV's share of own consumption in %: No hot water from PV	Hot water from PV: No battery storage	Hot water from PV + battery storage [kWh]: Usable battery capacity 2 kWh	4 kWh	6 kWh	8 kWh	10 kWh	Hot water coverage in %: No hot water from PV	Hot water from PV: No battery storage	Hot water from PV + battery storage [kWh]: Usable battery capacity 2 kWh	4 kWh	6 kWh	8 kWh	10 kWh
1	63	100 ELWA autonomous						0	35	ELWA autonomous				
2	48	100 ELWA autonomous						0	50	ELWA autonomous				
3	38	89	97	99	99	99	100	0	35	22	17	14	13	11
4	31	81	91	94	95	96	97	0	45	36	31	28	27	26
5	27	74	84	88	90	91	91	0	53	46	43	40	39	38
6	23	67	77	81	83	84	85	0	60	55	52	50	49	48
7	20	61	70	74	76	78	79	0	65	61	58	57	56	55
8	18	56	64	68	70	72	73	0	69	66	64	63	62	61
9	17	52	59	63	65	67	68	0	72	70	69	68	67	66
10	15	48	55	58	60	62	63	0	75	73	72	71	70	70

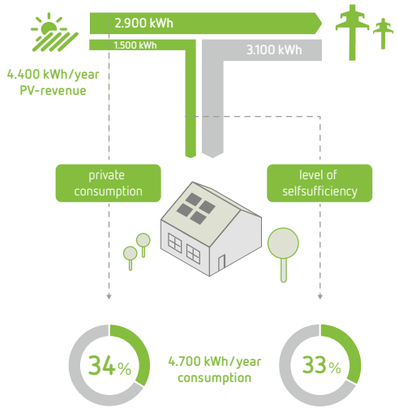
Determining PV's share of own consumption with ELWA
Example: Household with four people, average hot water requirement, PV system with battery capacity of 2 kWh available, installed PV output of 4 kWp. Basis of calculation is the radiation data for Vienna (but also for assessment in other regions).

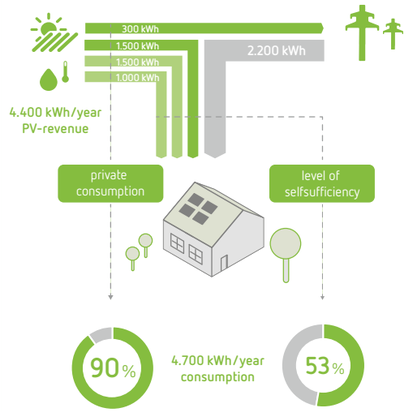
1. Select required PV system output [kWp].
2. Select system (Will PV be used to generate hot water? Is PV battery storage available?).
3. Based on the information determined, take reading of the PV's share of own consumption and hot water coverage.

Typical application for increase of own consumption of solar power produced

Location:	Germany	Expected annual PV yield:	4,400 kWh per year
Household:	Four people	Annual electricity consumption:	4,700 kWh per year
Photovoltaic system:	4 kWp		

Annual energy balance	Photovoltaic system, conventional	Photovoltaic system, with Power to Heat with hot water generation (3 kW) and intermediate storage (usable battery capacity: 2 kWh)
Direct energy consumption	1,500 kWh	1,500 kWh
Own consumption for hot water preparation	0 kWh	1,500 kWh
Own consumption by use of battery storage	0 kWh	1,000 kWh
Total own consumption	1,500 kWh	4,000 kWh
Distribution to electricity grid	2,900 kWh	300 kWh
Electricity from the grid	3,100 kWh	2,200 kWh
Share of hot water from PV electricity	0	33%
Savings in CO_2	2.1 t	2.1 t
Share of own consumption	34%	90%
Level of self-sufficiency	33%	53%





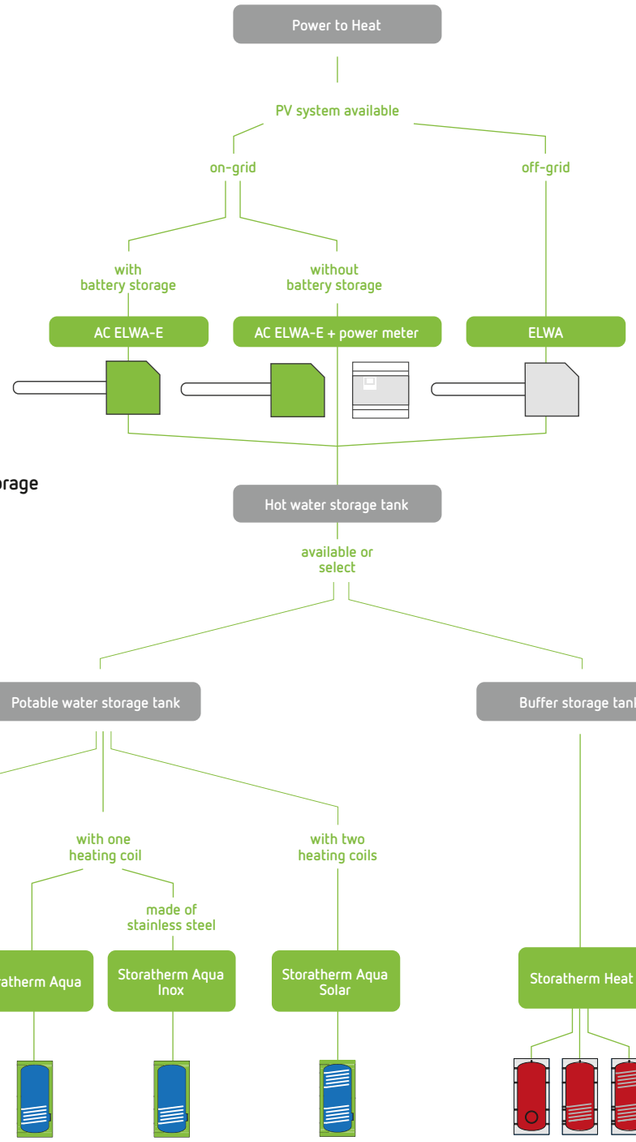
Assessment of the dimensioning

- A balanced PV system that is designed to match the consumer profile is always crucial.
- A very high own consumption rate (>80%) is not necessarily useful when the installed PV output is very low in relation to annual electricity consumption, for example. In such cases, an increase in PV output to a meaningful level is worth considering.
- For the second example, a relatively large battery storage capacity is not absolutely essential, as unnecessary costs may arise. A battery capacity appropriate to the consumer profile must be chosen.
- If the own consumption rate is very low (<30%), it would make sense to reduce PV output or build a storage tank or hot water preparation into the system. The share of hot water also increases accordingly by use of PV.
- Instead of simply orienting the PV system in a southerly direction, east-west orientation should be considered because the PV generation curve is usually a better match for the load profile.

* Rough estimate of the maximum possible PV electricity yield per year in kilowatts peak (kWp) that can be installed on existing roof surface. System size and surface requirement depend on site-specific solar radiation, PV module type and module efficiency.
** For recommended solar hot water coverage of 50% at a hot water consumption of 50 l per day/person

3. Select heating element and hot water storage tank and estimate heat-up times for hot water storage tanks

1. Select PV heating elements

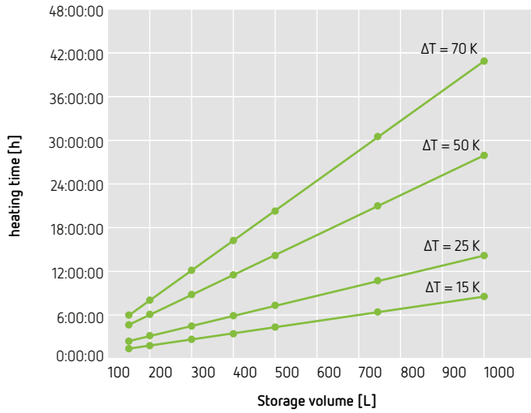


2. Select hot water storage tank for PV heating elements

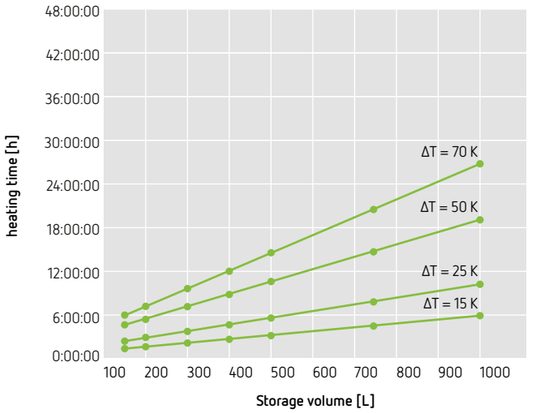
The electric heating elements can be used in all Storatherm Aqua tanks up to 500 l with 1 ½" sleeve or flange opening (DN 110 + DN 150) and in all Storatherm Heat buffer storage tanks up to 1,000 l.

Heat-up times

Heat-up times with a heat output of 2 kW



Heat-up times with a heat output of 3 kW

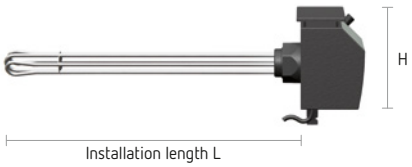


Installation

- Assembly using a 1 ½" sleeve or the flange opening (DN 110 + DN 150) as far as possible toward the bottom of the storage tank
- Flat seal (included in package)
- Please note the installation length of 470 mm and the unheated length of 90 mm (length of installation sleeve)
- Voltages and currents must be observed; ELWA operates in a voltage range of 100–360 VDC
- For faster hot water availability, two Reflex ELWAs can be used to charge buffer storage tanks (stratified charging). One unit is installed in the storage tank's upper part and the other in the lower part

More information on Reflex storage tanks can be found in the Hot Water Storage Tank brochure, which you can download at www.reflex-winkelmann.com/en/services-downloads/ or order as a printed document:

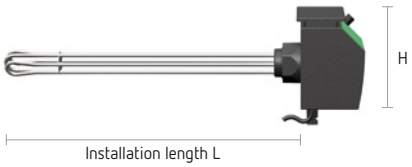
Technical data



AC ELWA

Technical features

- For off-grid systems, off-grid
- Direct connection of ELWA to PV system (DC); 230 V plug can be inserted as a backup
- No inverter, no distribution to the grid, no connection permits required
- Continuously adjustable heat output (0–2 kw)
- Suitable for PV generators with an output of up to 2.5 kWp
- Temperature adjusted using rotary knob on ELWA



AC ELWA-E

Technical features

- For systems with or without battery storage
- ELWA is connected to a power outlet
- Inverter required
- Continuously adjustable heat output (0–3 kw)
- Temperature adjusted using rotary knob on ELWA

Technical features

Type	Art. no.	Height H [mm]	Width [mm]	Depth T [mm]	Heat output [kW]	Length [L]	Operating temperature [°C]	Protection class	Weight [kg]
PV heating element, ELWA 2 kW	9127099	180	130	600	2,00	450	10–40	IP 20	2,0
PV heating element, AC ELWA-E 3 kW	9127101	180	130	600	3,00	450	10–40	IP 21	2,0

Accessories

Reflex 3-phase power meter

- Analysis of the current flows in the PV system
- Transmission of excess output to AC ELWA-E (excess management)
- Connection using a router / switch directly and via powerline possible
- Assembled directly downstream of the utility meter in the distribution cabinet; measures the power flow via three external clamp-on current transducers (assembled without disconnecting phases).

Reflex USB Interface

- USB interface for ELWA data retrieval software (e.g. yield in kWh, temperature behaviour during operating days)

Typ	Prod. no.
Reflex USB Interface	9127103
Reflex 3-phase power meter (to record the energy distributed back to the grid for the AC ELWA-E)	9127104

9128901 / RE19S7en / 11-19 / 2,000
Subject to technical alterations