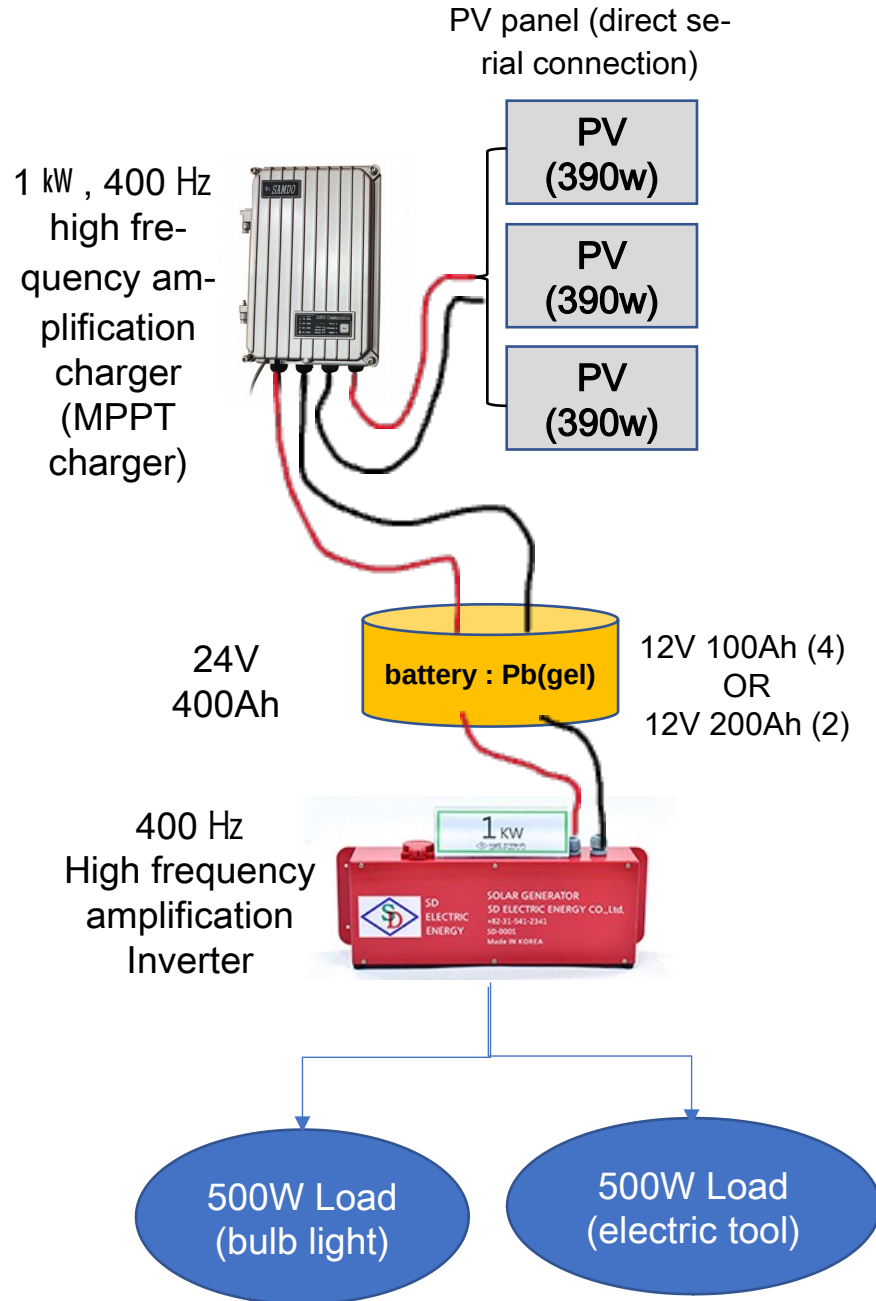


## Generation test (1 kW solar system)



## The Solar Generator System Setup

3 no. PV solar panels á 390 W

1 amplifying MPPT (Maximum Power Point Tracker) charger/regulator

4 no. 100 Ah Pb-gel batteries – 2 in series, 2 in parallel in all 400 Ah, 24 V

1 no. High Frequency amplifier and inverter, single phase, 220 V

1 no. 2 000W industrial heating blower.

## What are we going to test and verify?

Voltage and current from the solar cells

The amplifying effect of the MPPT control unit

Battery voltage

Power consumption of the load (fan or lamps)

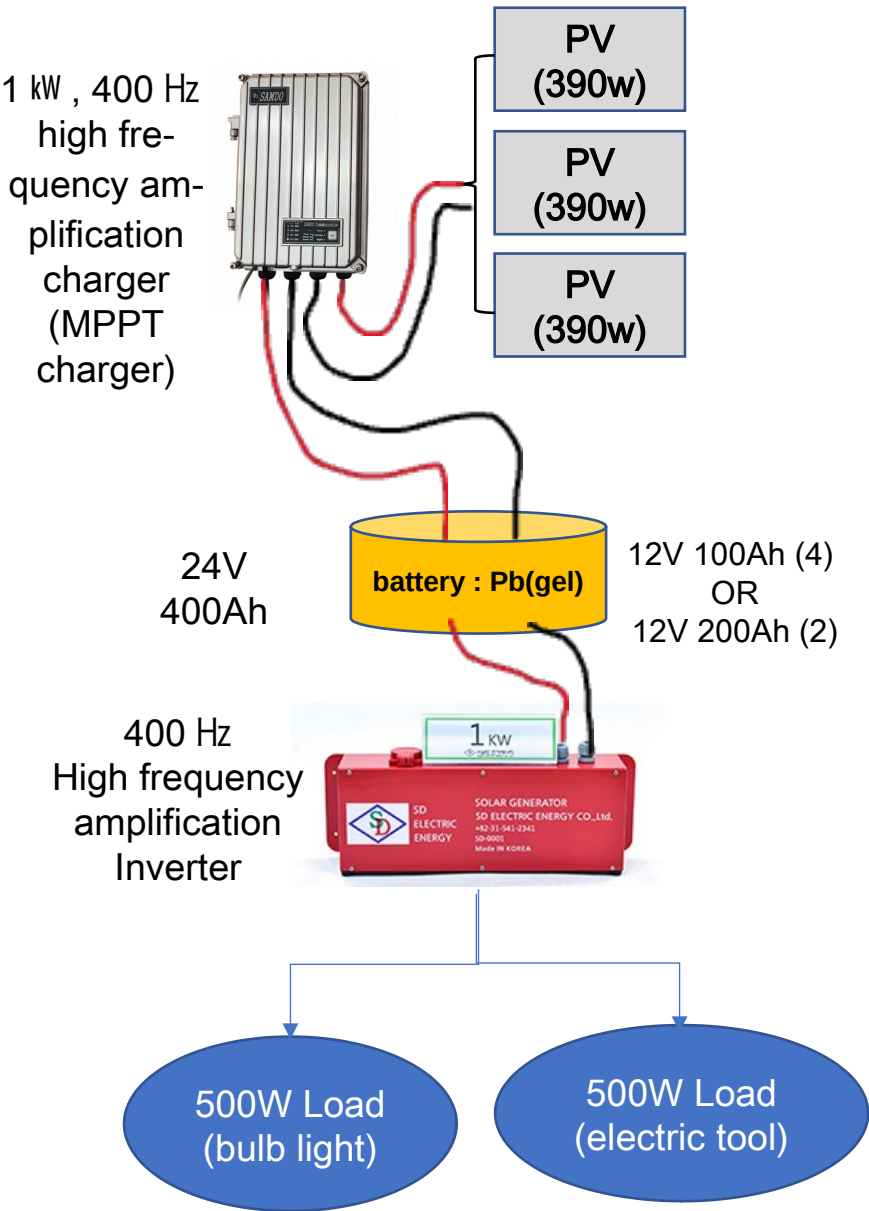
i.e. power delivered from the solar cell generator

## Expected result

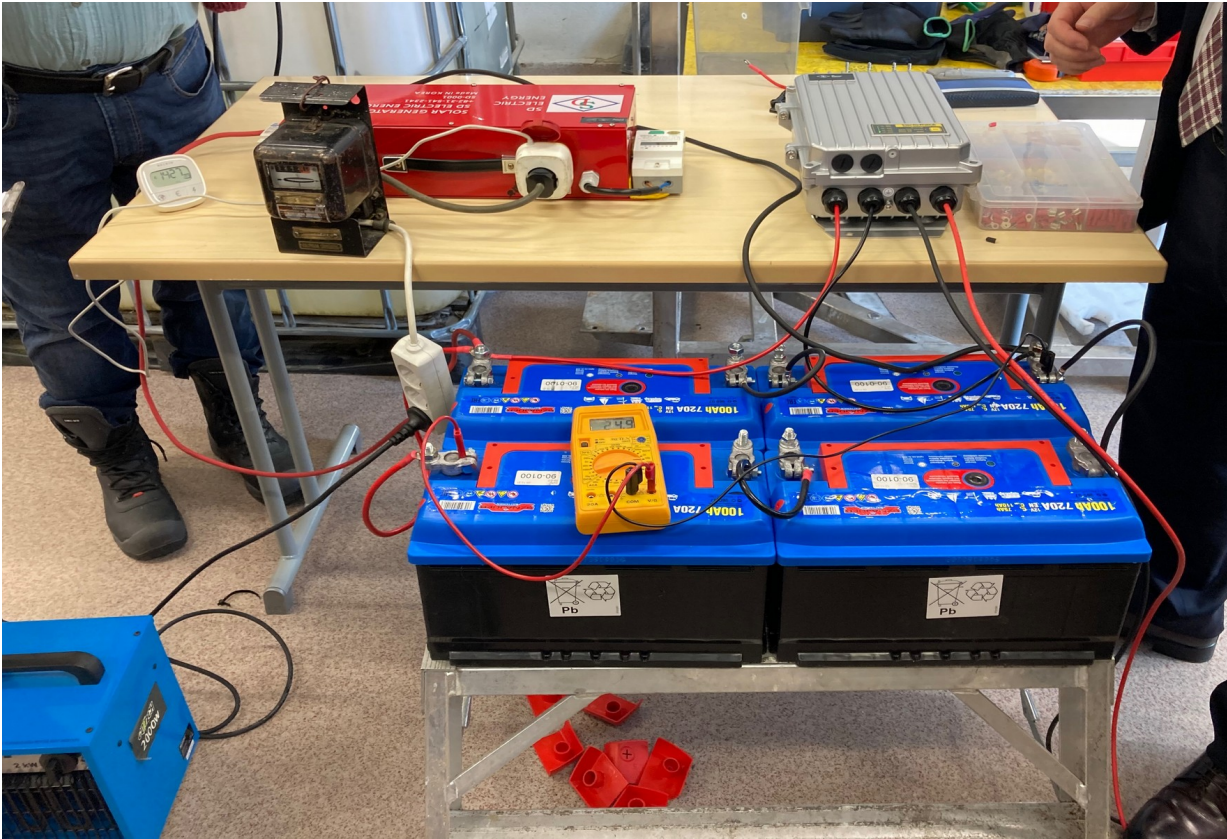
That the photovoltaic generator should be able to generate 3-4 times more energy than a traditional photovoltaic system

# Generation test (1 kW solar system)

PV panel (direct serial connection)

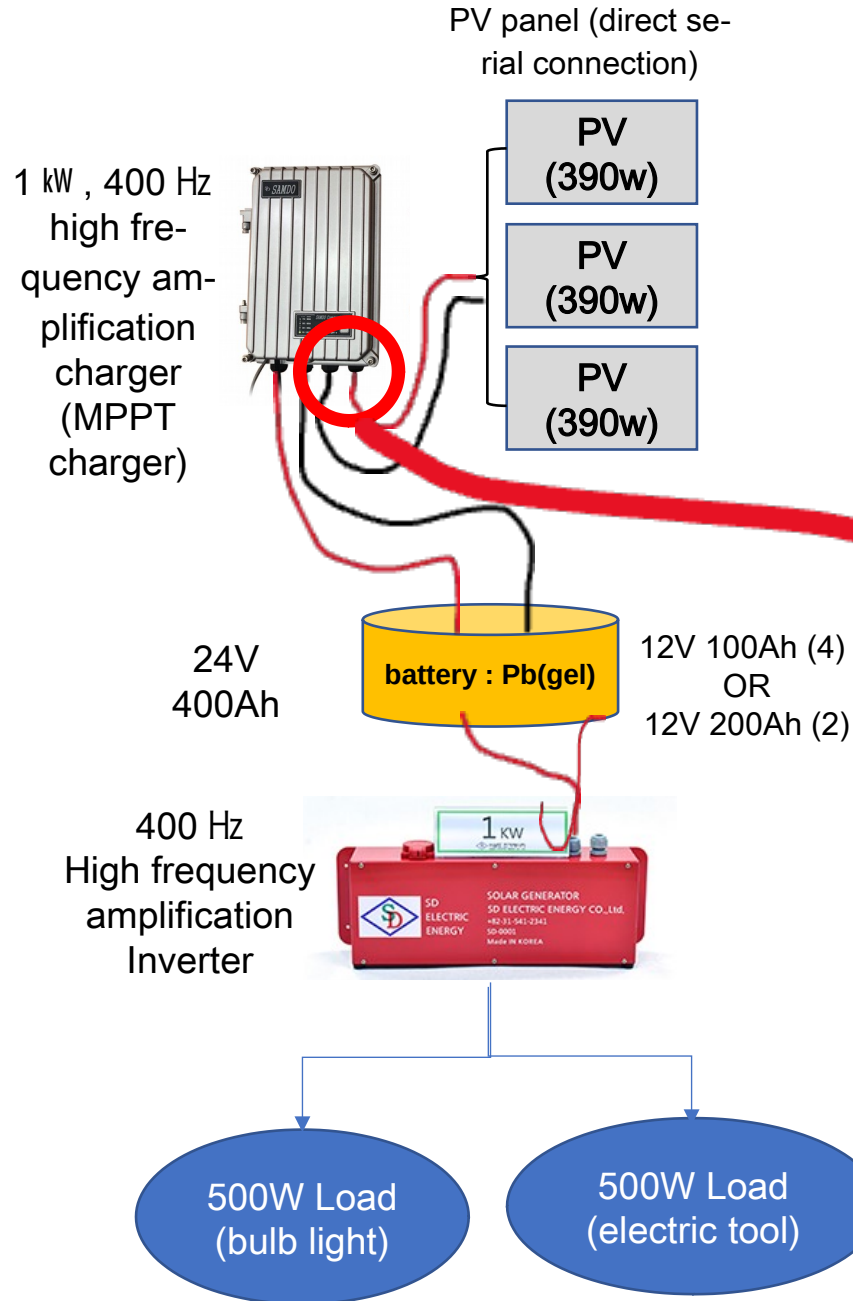


## The setup of the Test Bench



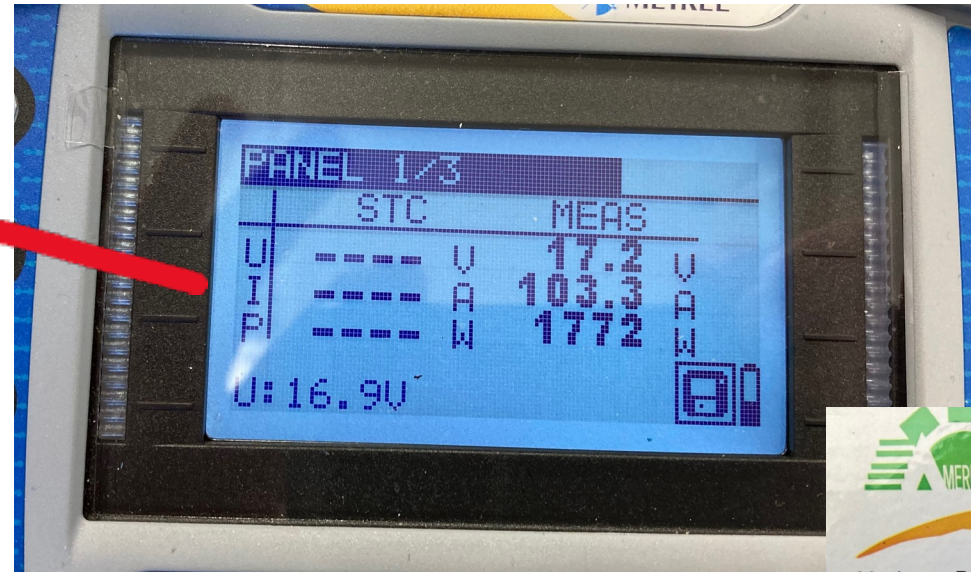


## Generation test (1 kW solar system)



## Measurement at the input point of the MPPT charger

- 3 PV panels gave too much power, even though they were at the wrong angle and partially in the shade.
- we then disconnected two panels
- incoming voltage should be 35.4V

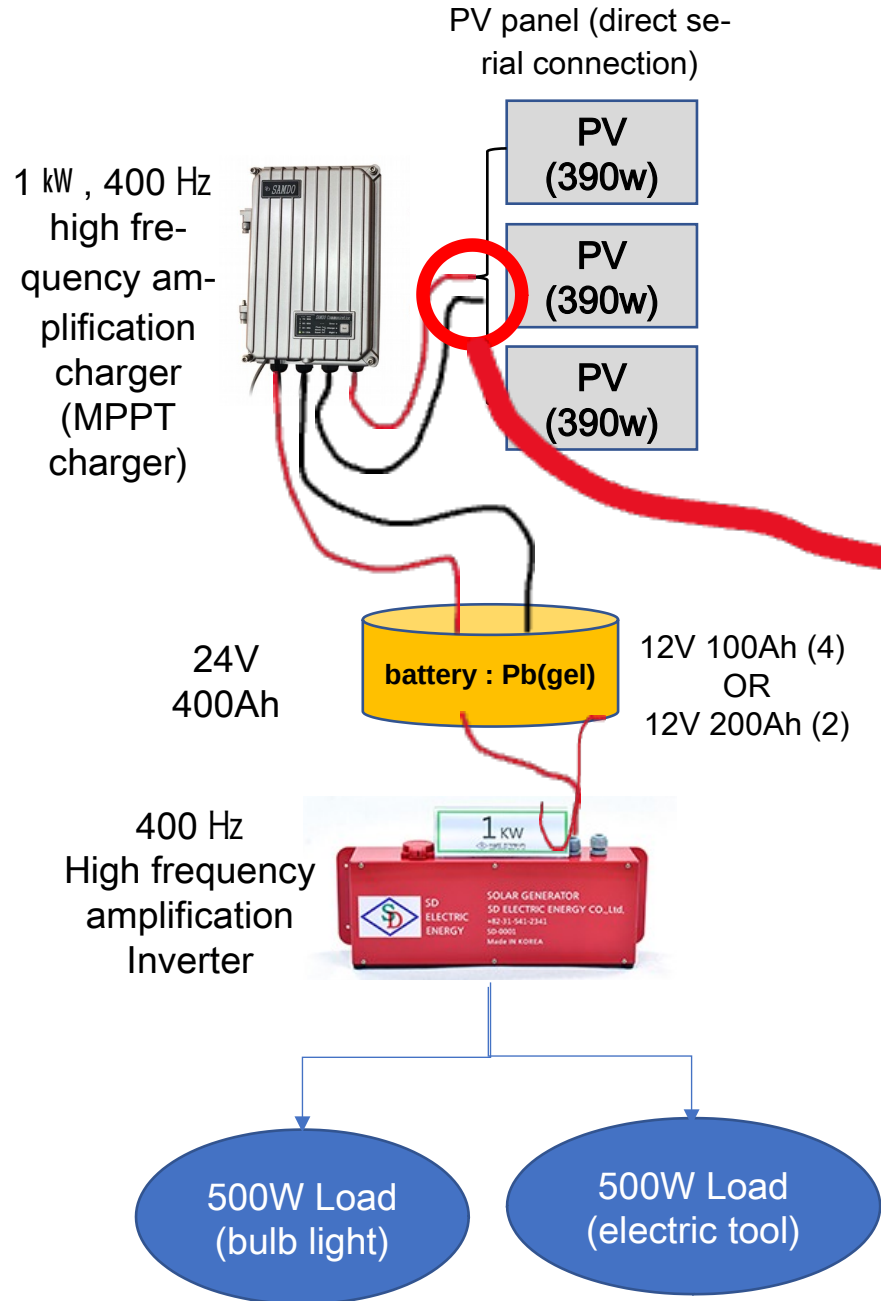


## Measurement at the input point:

- 17V instead of 35V
- 103A instead of 11A
- 1,772 kW from a single solar panel ??
- what is going on?

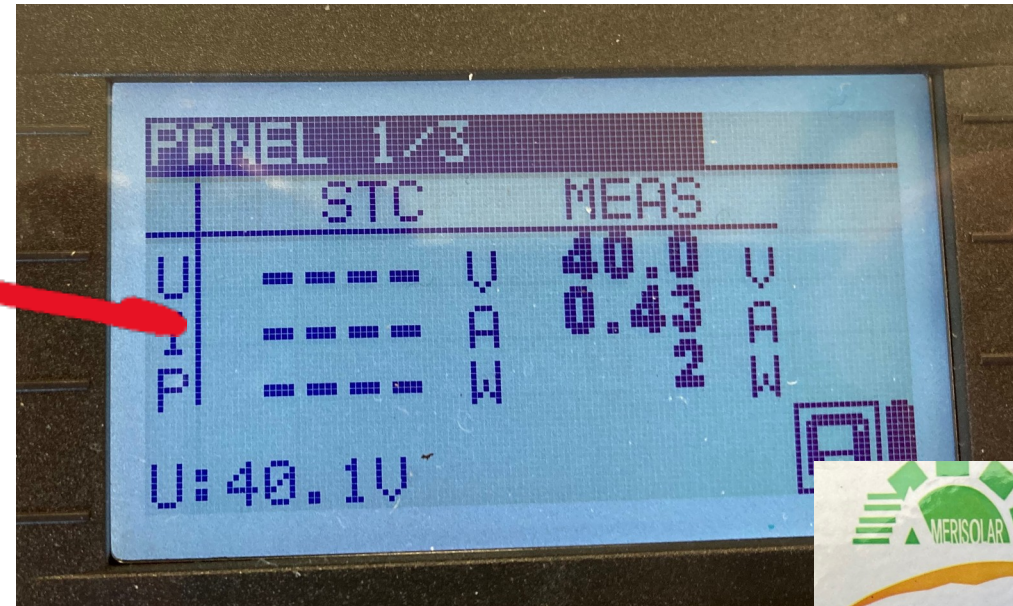
MERISOLAR AS-6M120-HC-390W PERC BLACK	
Maximum Power (Pmax)	390W
Open-Circuit Voltage (Voc)	42.4V
Short-Circuit Current (Isc)	11.58A
Maximum Power Voltage (Vmp)	35.4V
Maximum Power Current (Imp)	11.02A
Maximum System Voltage	1500V
Maximum Series Fuse Rating	20A
Safety Class	Class II
Nominal Operating Cell Temperature	43±2°C
Weight	20kg
Dimensions	1756×1039×35mm
All technical data at standard test condition (STC) (1000W/m², 25°C, AM1.5)	

## Generation test (1 kW solar system)



### Measurement at the input point on the MPPT charger

- disconnected the input cables to the MPPT
- Measurement only on the output of the solar panels



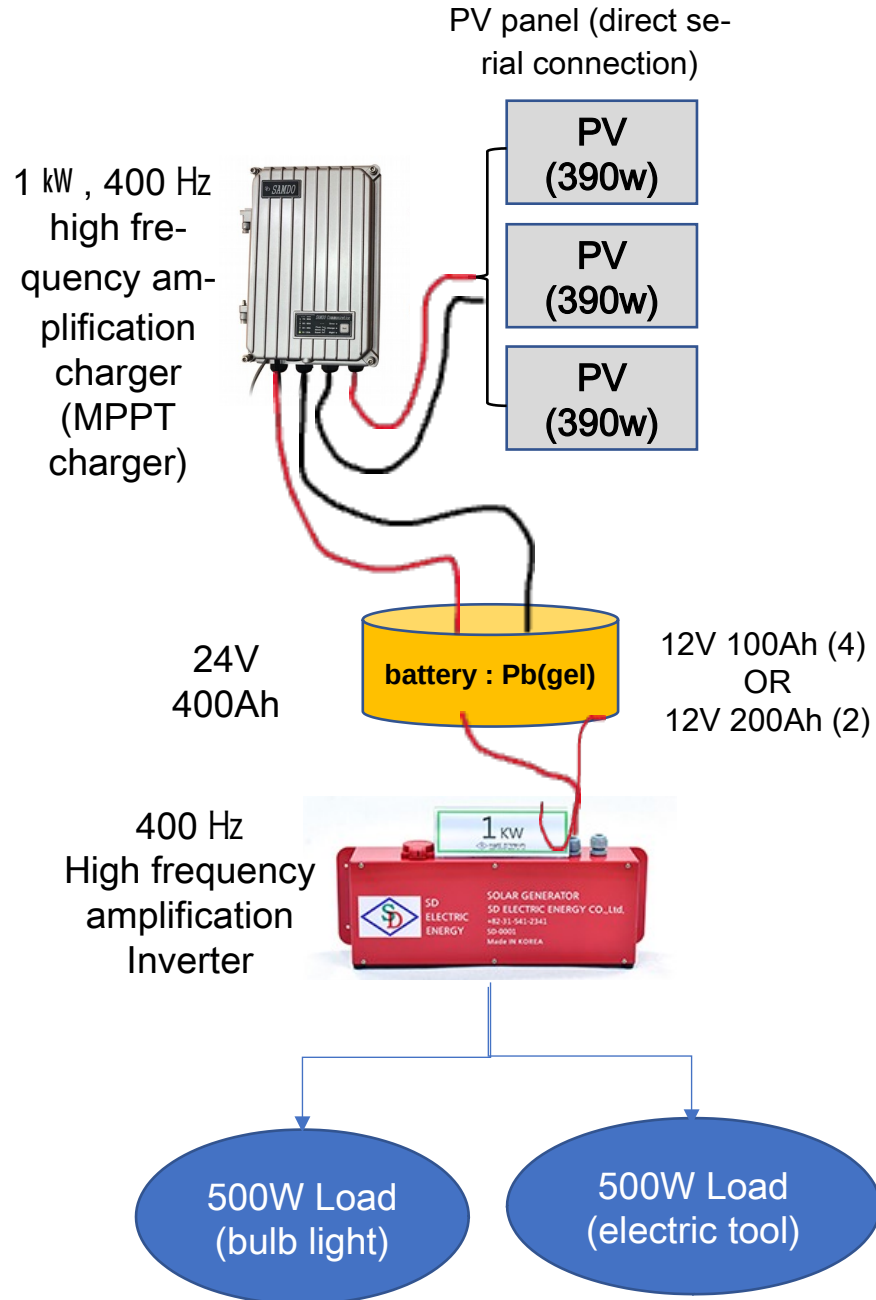
### Measurement at the output point gave:

- 40 V = OK
- 0.43A = low, but OK
- 2 W from the solar panel
- normal at sunset

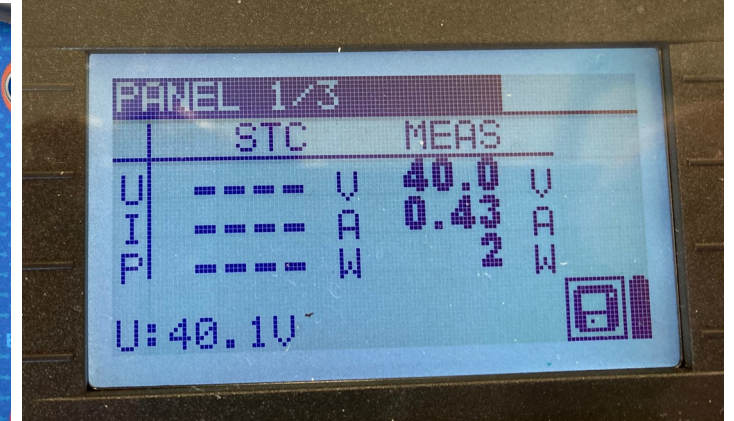
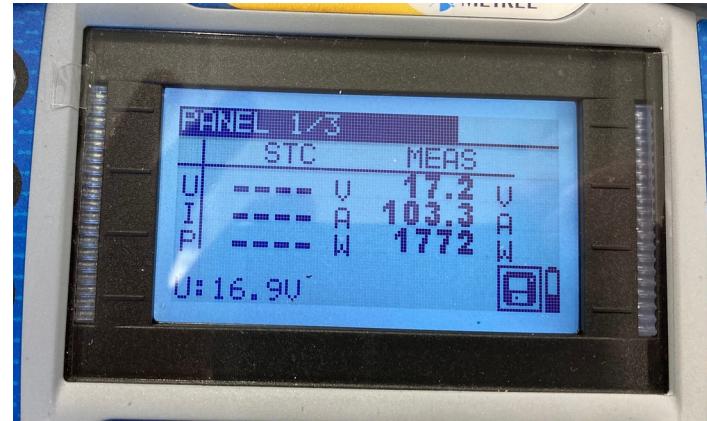
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## Generation test (1 kW solar system)



## Measurement at the input point on the MPPT charger What has happened?



## Conclusion:

- MPPT frequency amplification charger has amplified the power (kW) you can get out of a solar panel
- The condenser in the MPPT charger deceives the measuring instrument by using charging pulses of 400 Hz
- What is meant by “deceiving” ? = high frequency interferes with traditional measuring instruments

## How?

The resonance generated by the charger is 400 Hz – compare this with the resonance over the octaves of the C-string in an electric guitar or a piano

# Generation test (1 kW solar system)

PV panel (direct serial connection)

1 kW , 400 Hz  
high frequency  
amplification  
charger  
(MPPT  
charger)

- PV (390w)
- PV (390w)
- PV (390w)

24V  
400Ah

battery : Pb(gel)

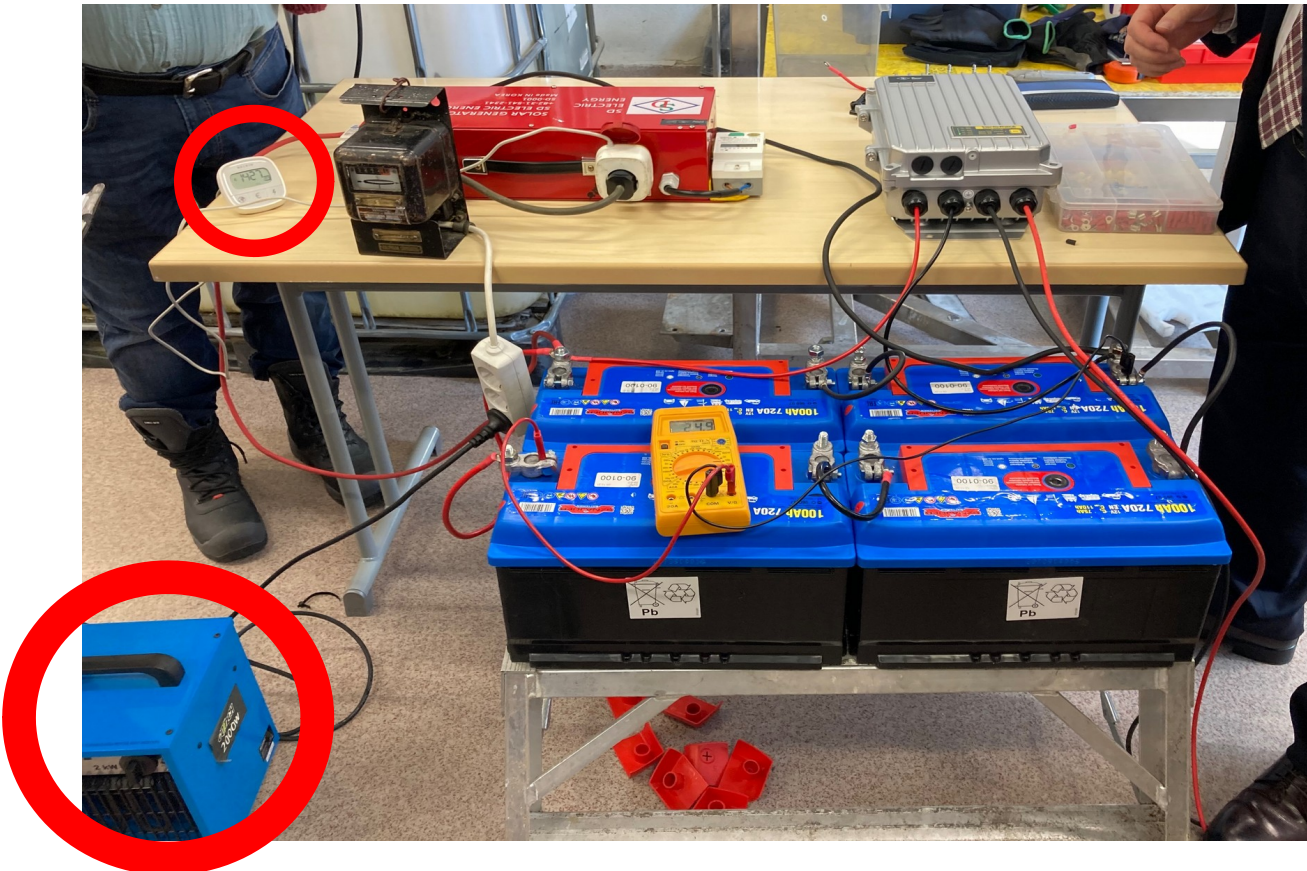
12V 100AH (4)  
OR  
12V 200AH (2)

400 Hz  
High frequency  
amplification  
Inverter



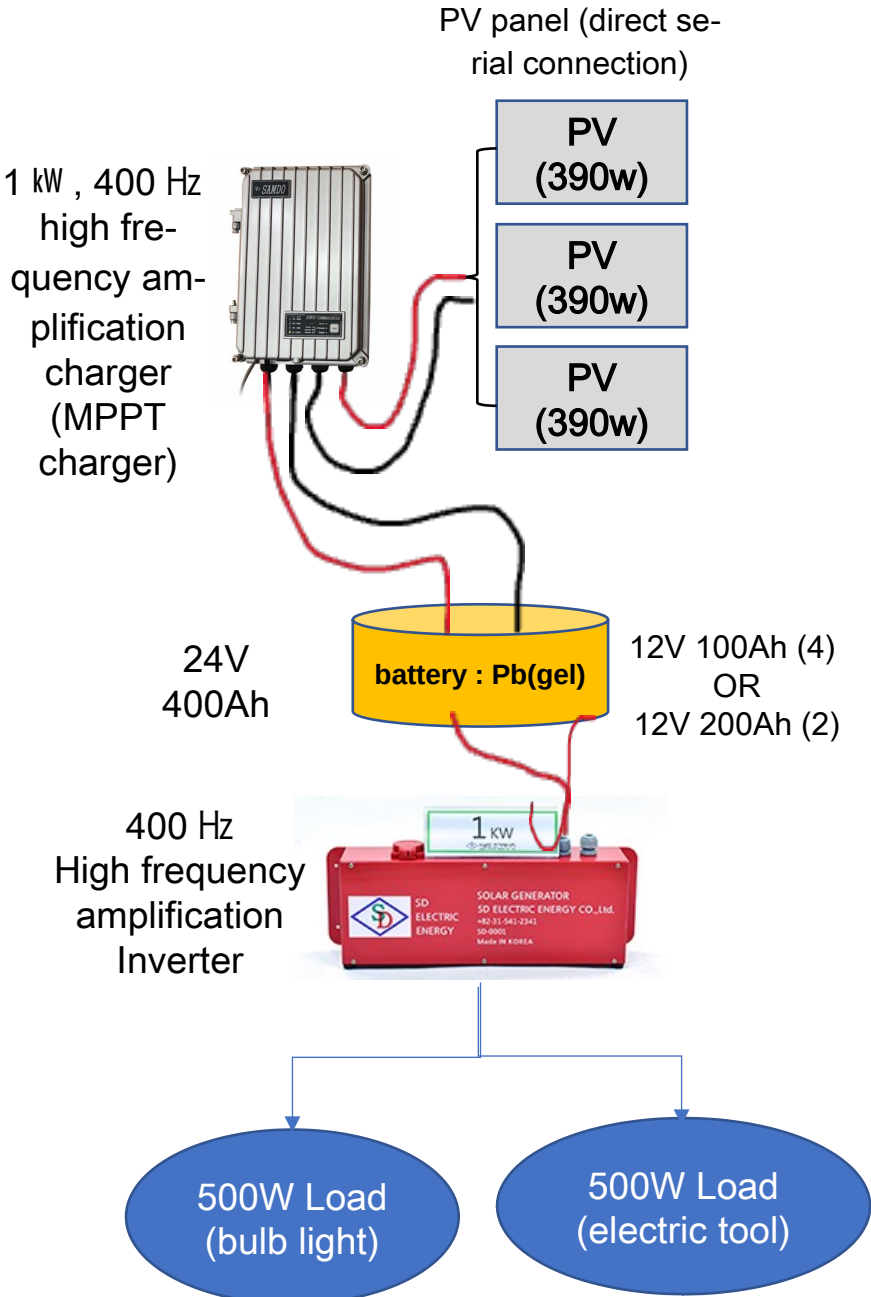
- 500W Load (bulb light)
- 500W Load (electric tool)

How much electricity was produced by the Solar Generator?

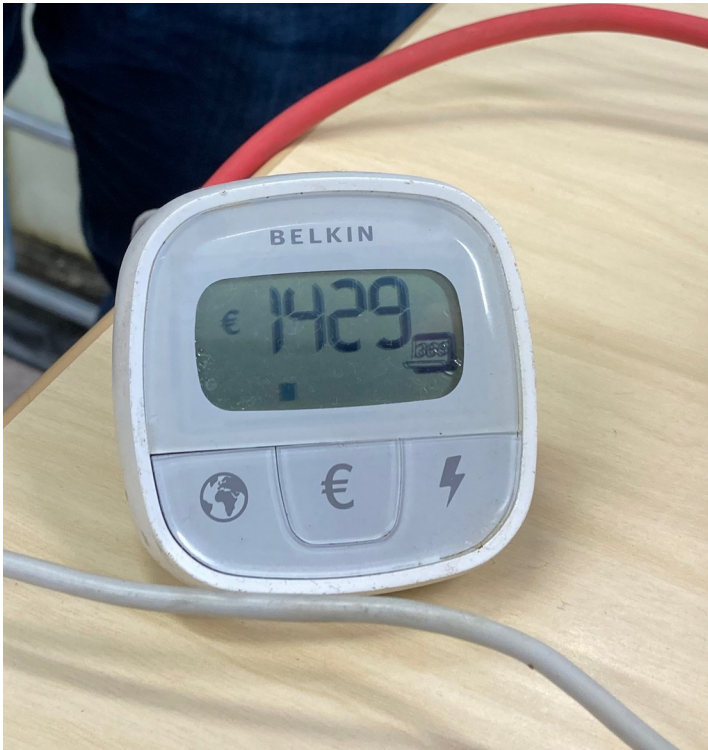
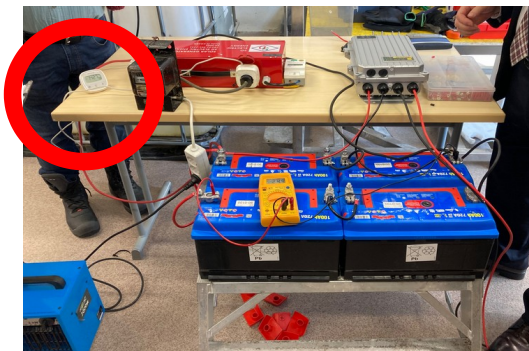




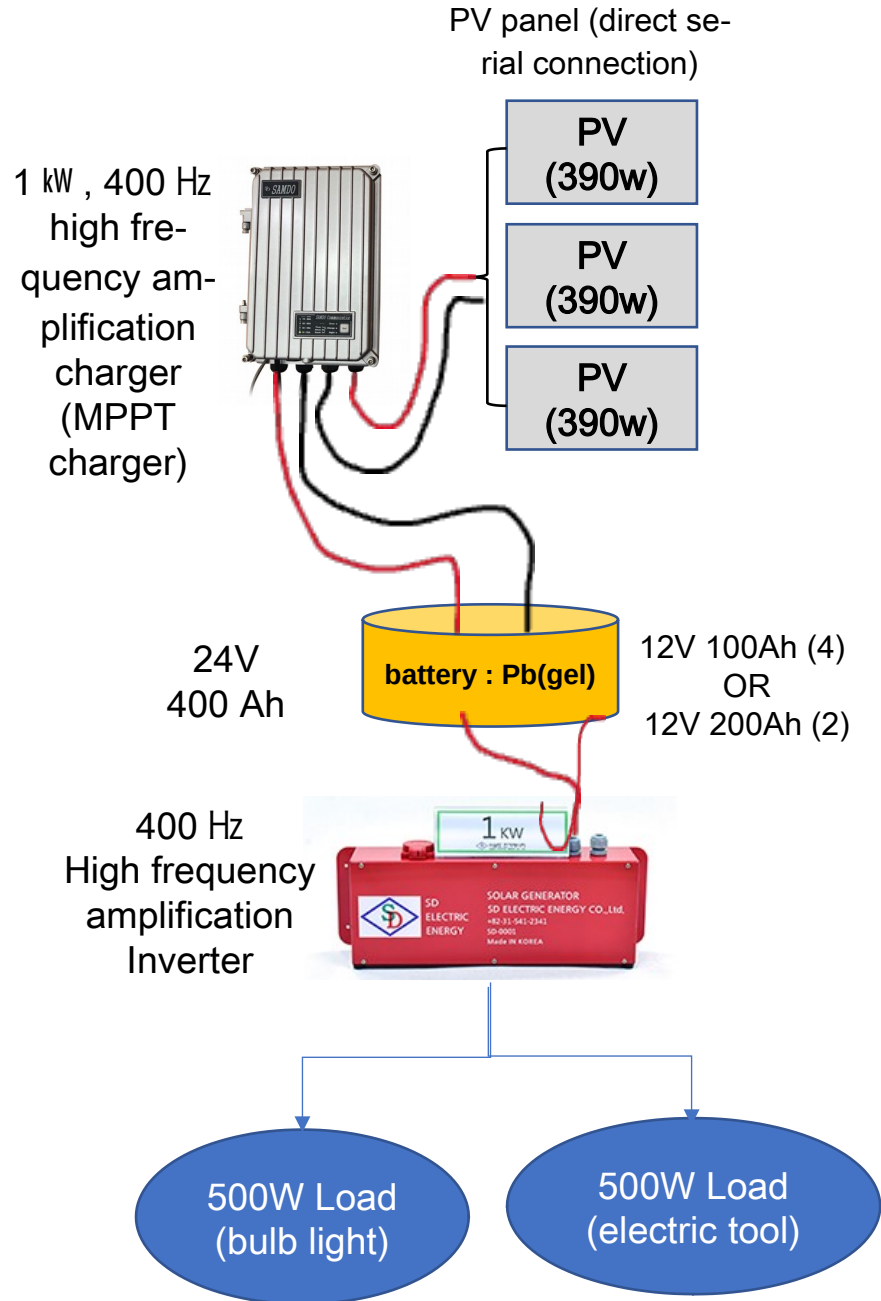
# Generation test (1 kW solar system)



How much electricity was produced by the Solar Generator?



## Generation test (1 kW solar system)



## How much electricity was produced by the Solar Generator?



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Dimensions	1756×1039×35mm
All technical data at standard test condition (STC) (1000W/m², 25°C, AM1.5)	

## Theoretical maximum power from the solar panel:

$$35.4V \times 11.02A = 389 W$$

## Estimated power from the solar panel:

200W

## Measured power from the solar cell generator:

1 429 W

## Power increase:

$$1429/389 = 3.67 \text{ times or } 367\% \text{ (theoretical)}$$

$$1429/200 = 7 \text{ times (probable)}$$