

Examples of solar cooling innovations in SHC Task 53

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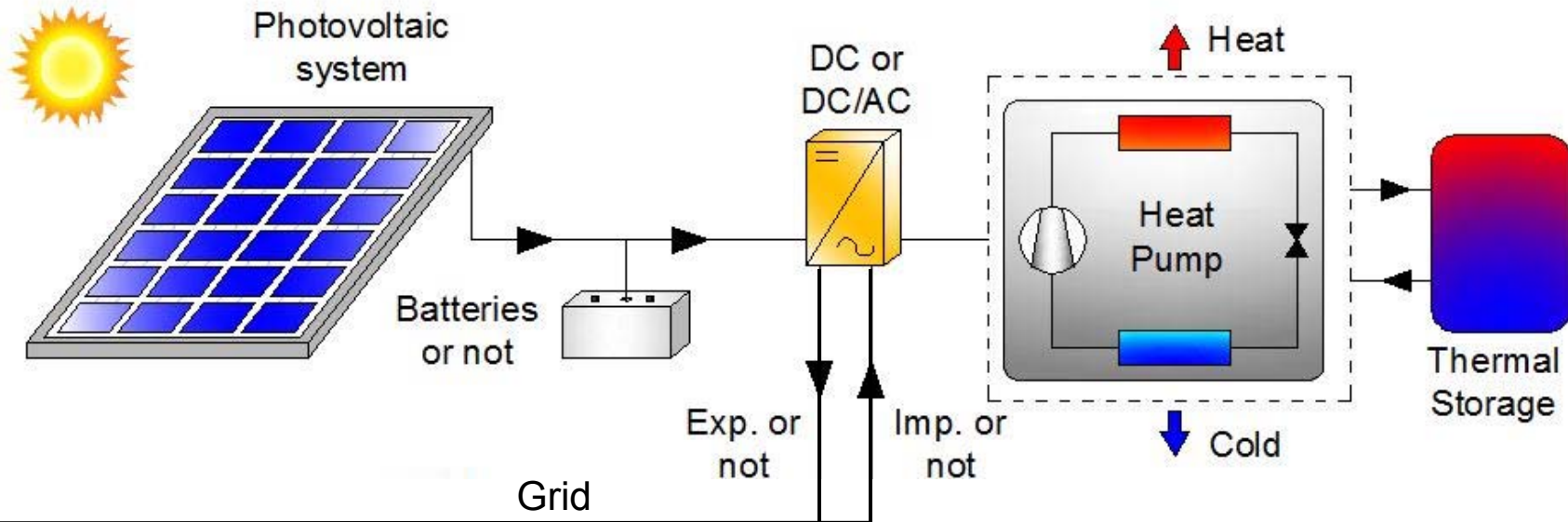
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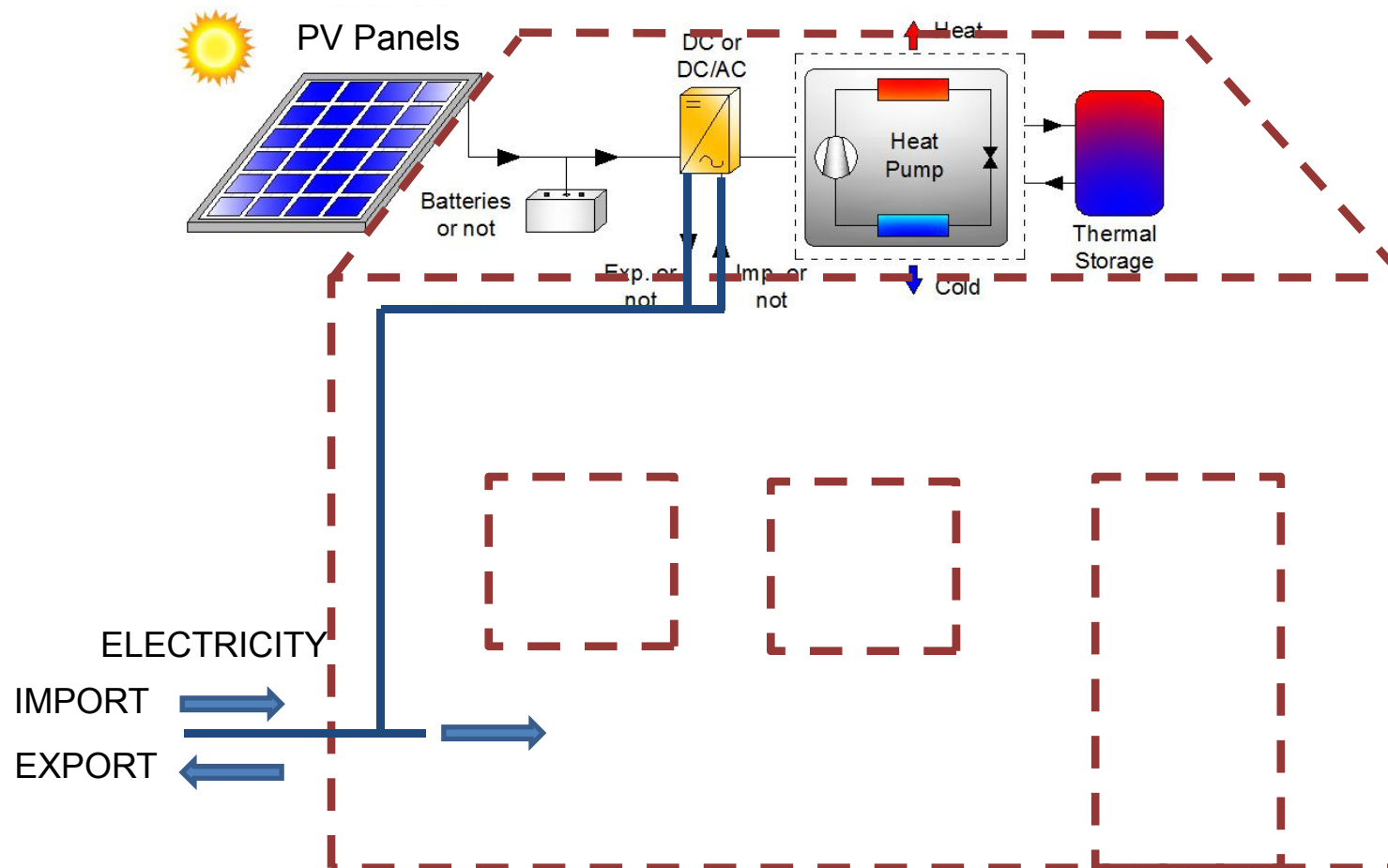
DESING CHARACTERISTICS

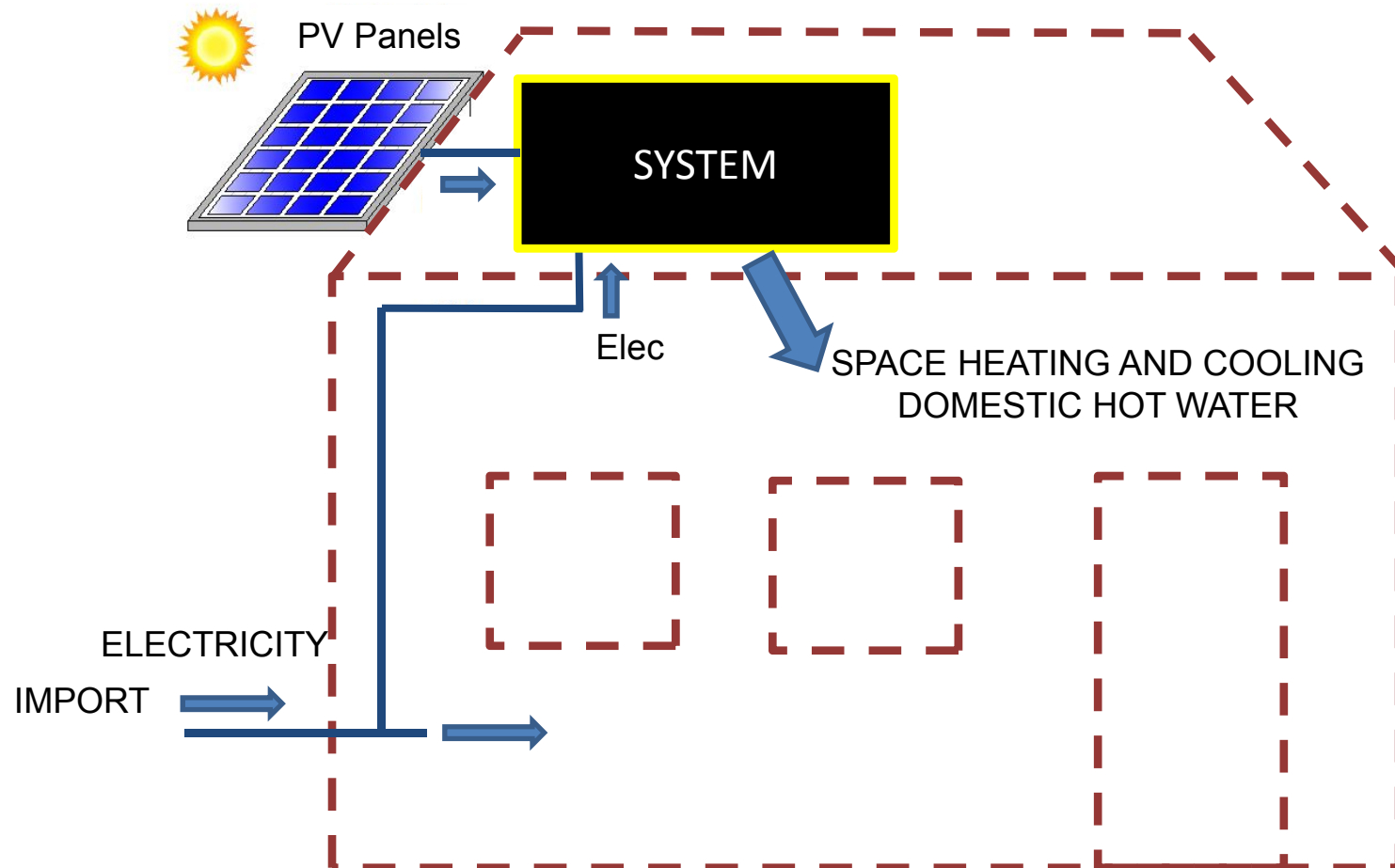
- **ELECTRICITY EXPORT: YES/NO**
- **BATTERIES: YES/NO**
- **THERMAL STORAGE: YES/NO**
- **COMPRESOR: INVERTER, W=CONSTANT**
- **IMPROVED CONTROL (SOLAR)**

DIMENSIONS:

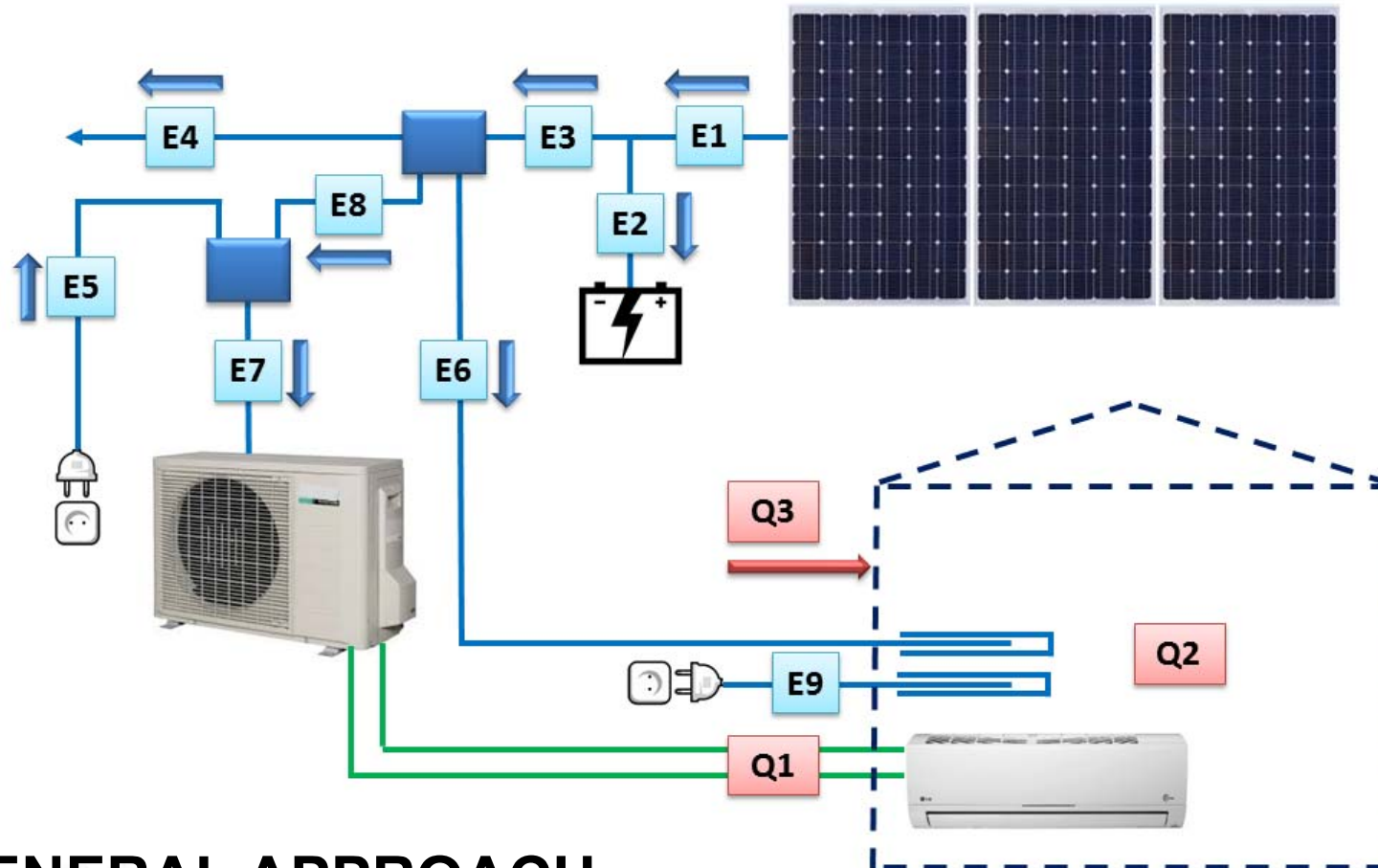
- **NUMBER OF PV PANELS**
- **COMPRESOR POWER**
- **BATTERIES: Ah**
- **STORAGE CAPACITY**

GENERAL APPROACH



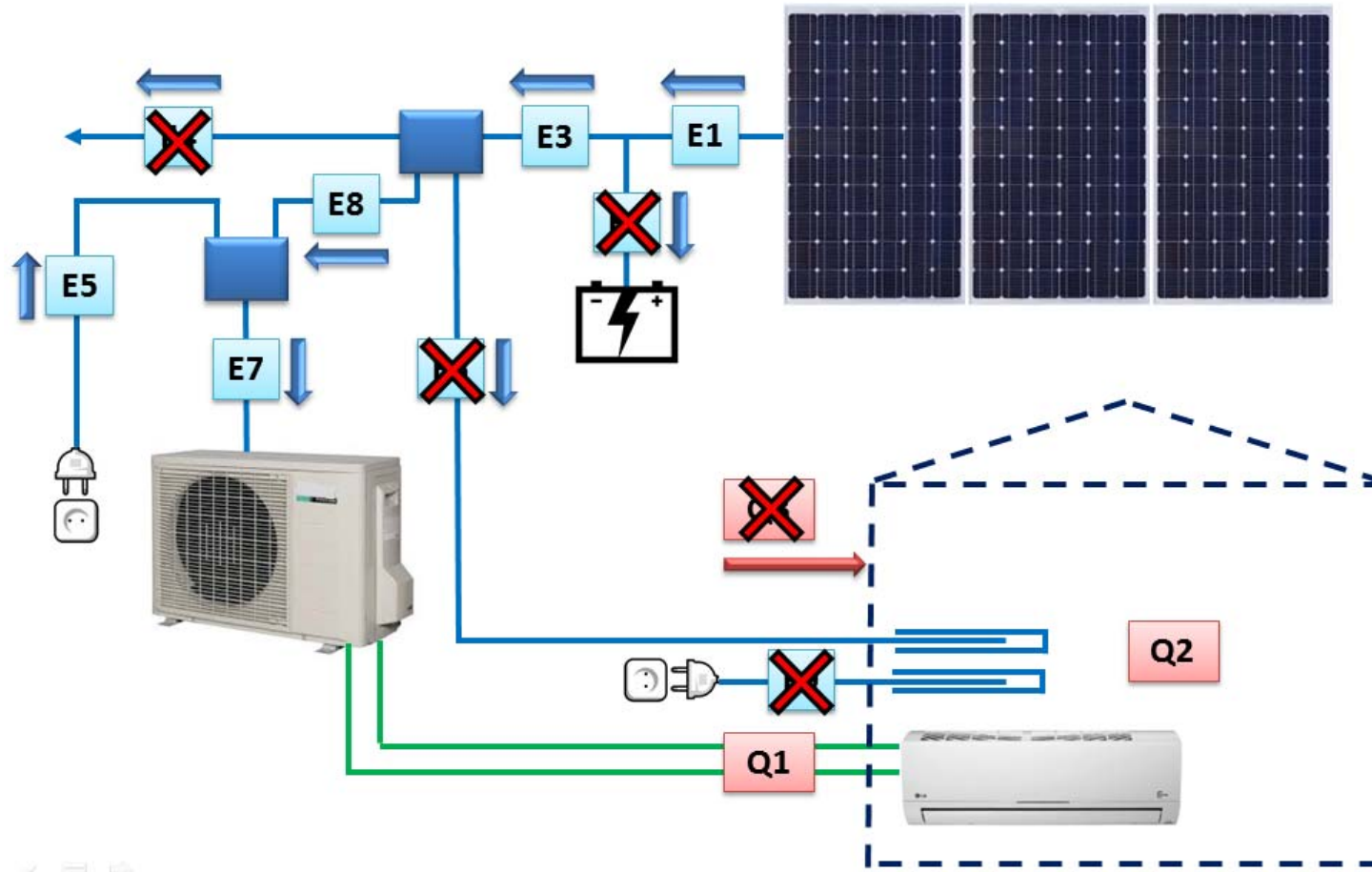


SOLAR AIRCONDITIONERS

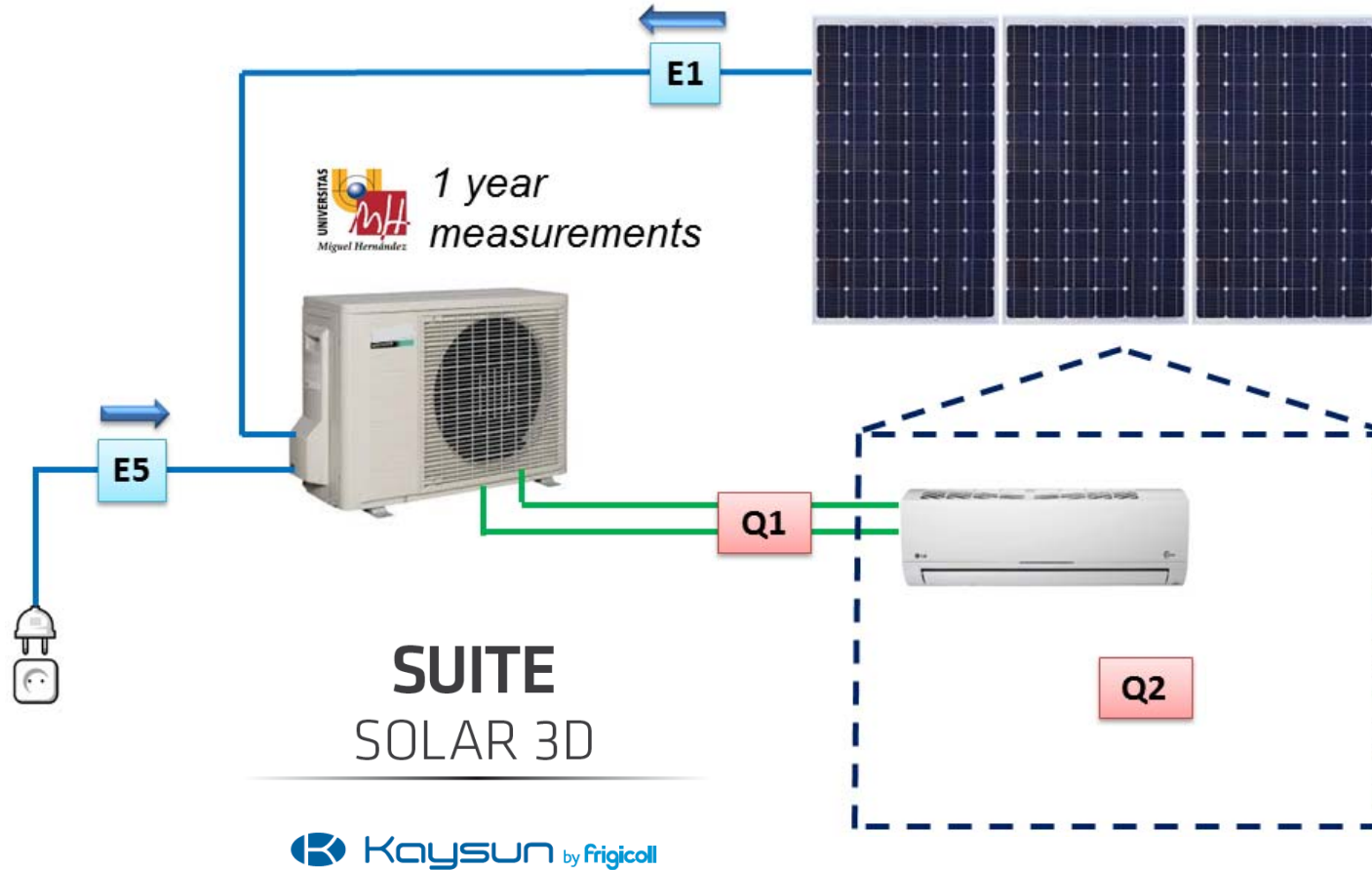


GENERAL APPROACH

SOLAR AIRCONDITIONERS

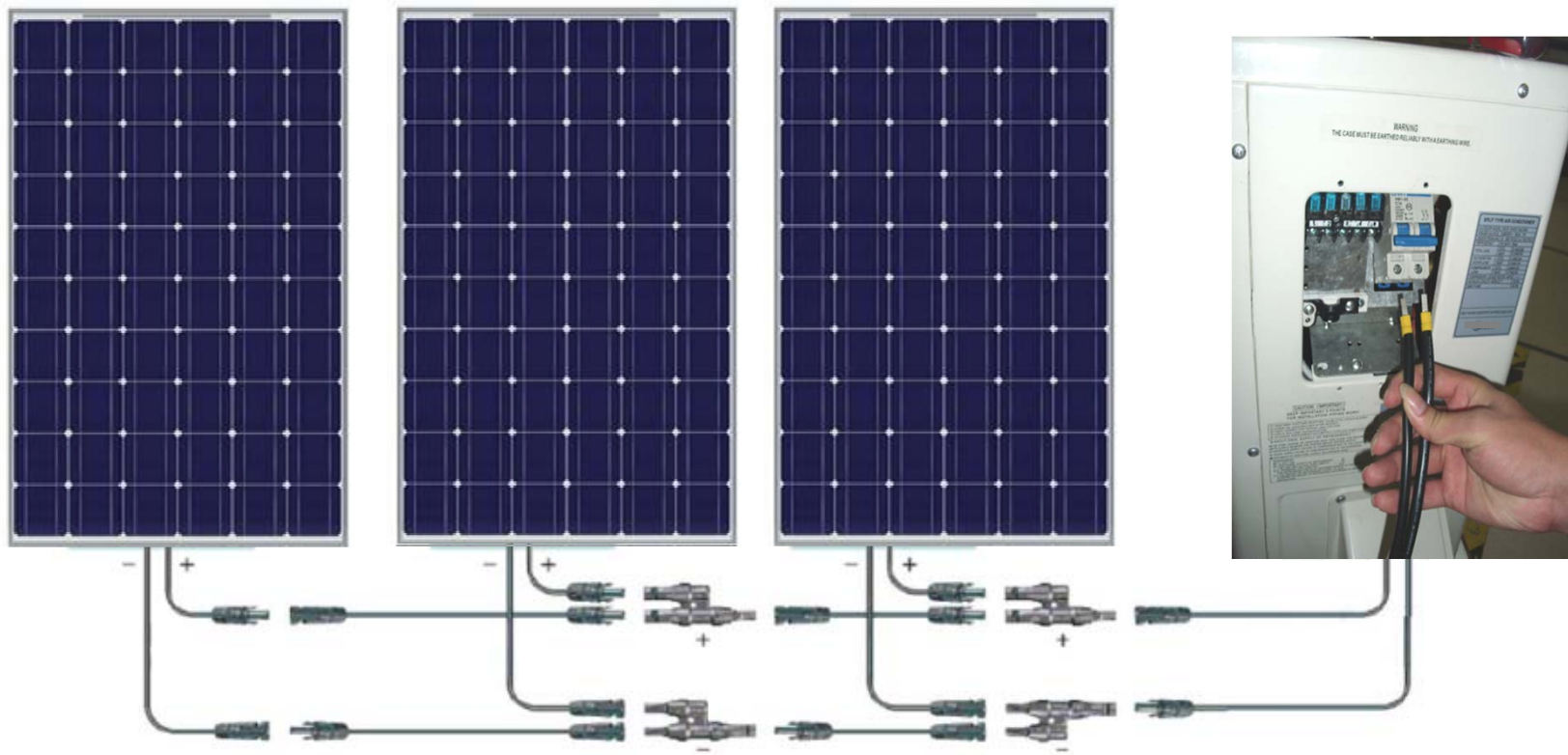


SOLAR AIRCONDITIONERS



INSTALLATION

Cables connection

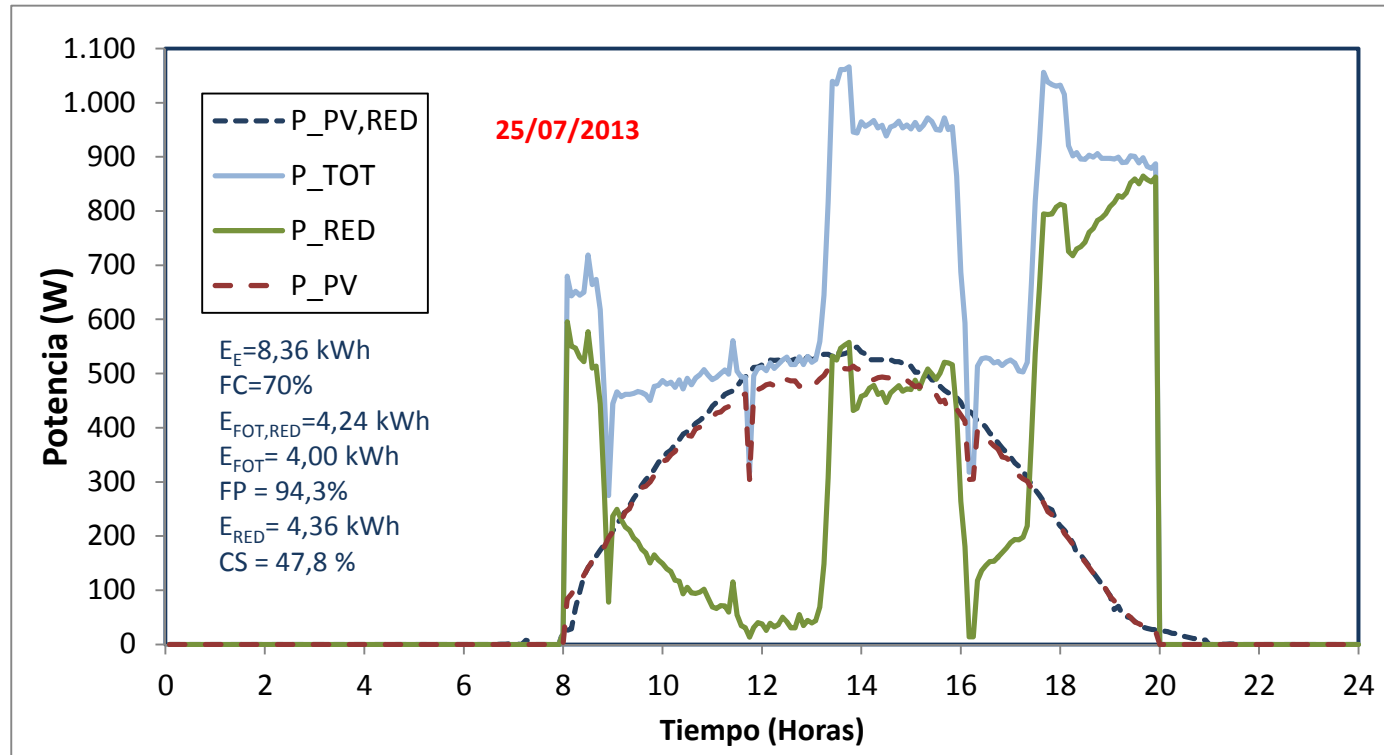


ELECTRONICS









P_{PV} → Electrical power from photovoltaic panels

P_{GRID} → Electrical power from the electrical grid

P_{TOT} → Total Electrical power

$P_{PV,GRID}$ → Electrical power from photovoltaic panels connected to the electrical grid



Horario de 8 a 20 h	E_PV (kWh)	E_RED (kWh)	E_TOT (kWh)	E_PV,RED (kWh)	E_U (kWh)	EER_Maq (-)	EER_Inst (-)	Cont. Sol CS (%)	F. Prod F (%)	T_ext (°C)	T_int (°C)
MAYO	66,0	25,8	91,8	116,8	519,5	6,50	23,12	82,5%	64,9%	24,0	23,3
JUNIO	67,1	18,7	85,7	125,1	514,1	6,00	27,54	78,2%	53,6%	26,8	23,1
JULIO	95,1	75,6	170,7	129,5	720,0	4,22	9,52	55,7%	73,4%	31,1	25,0
AGOSTO	84,8	57,0	141,8	114,7	655,2	4,62	11,49	59,8%	73,9%	30,6	25,0
SEPTIEMBRE	68,2	29,9	98,2	101,0	545,1	5,55	18,21	69,5%	67,5%	27,8	24,3
OCTUBRE	55,4	32,2	87,7	83,6	524,4	5,98	16,26	63,2%	66,3%	26,1	24,1
MODO FRÍO	436,5	239,3	675,8	670,7	3478,4	5,15	14,54	64,6%	65,1%	27,7	24,2

Horario de 8 a 20 h	E_PV (kWh)	E_RED (kWh)	E_TOT (kWh)	E_PV,RED (kWh)	E_U (kWh)	COP_Maq (-)	COP_Inst (-)	Cont. Sol CS (%)	F. Prod F (%)	T_ext (°C)	T_int (°C)
NOVIEMBRE	49,36	65,31	114,64	56,49	465,24	4,06	7,12	43,1%	87,4%	14,9	25,9
DICIEMBRE	51,73	89,47	141,18	56,44	551,67	3,91	6,17	36,6%	91,7%	15,2	24,1
ENERO	61,88	84,97	146,84	70,36	575,30	3,92	6,77	42,1%	87,9%	15,1	25,4
FEBRERO	63,98	83,02	147,00	75,74	532,98	3,63	6,42	43,5%	84,5%	13,6	25,2
MARZO	68,87	72,00	140,87	93,02	531,46	3,77	7,38	48,9%	74,0%	16,8	25,7
ABRIL	58,53	44,79	103,32	101,76	387,67	3,75	8,65	56,6%	57,5%	19,1	24,0
MODO CALOR	354,4	439,6	793,8	453,8	3044,3	3,83	6,93	44,6%	78,1%	15,8	25,0
TOTAL	790,9	678,9	1469,7	1124,5	6522,7	4,44	9,61	53,8%	70,3%	21,7	24,6

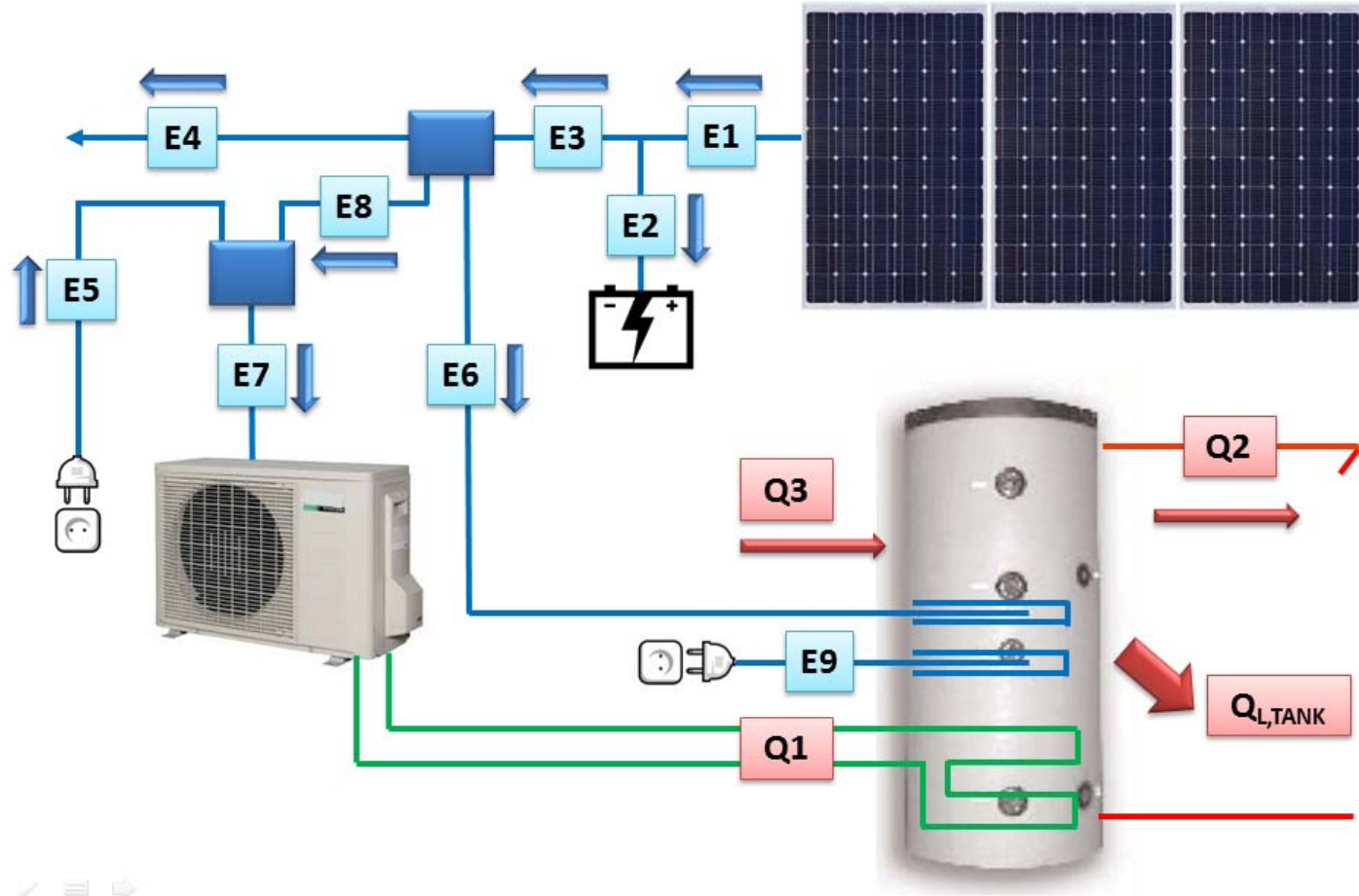
CONCLUSIONS

- SOLAR CONTRIBUTION (SC%)
Definition: % of consumed energy which is solar: **54%**
- PRODUCTION FACTOR (PF%)
Definition: % of employed PV energy compared to maximum: **70%**
- EFFICIENCY (SPF)
Definition: Heat + Cool compared to grid electricity: **9,6**

ELECTRICITY EXPORT: NO
BATTERIES: NO
THERMAL STORAGE: NO
COMPRESOR: INVERTER
IMPROVED CONTROL (SOLAR): NO

NUMBER OF PV PANELS: 3
COMPRESOR POWER: 1 kW

DOMESTIC HOT WATER SYSTEMS



PROTOTYPE UMH-DHW1

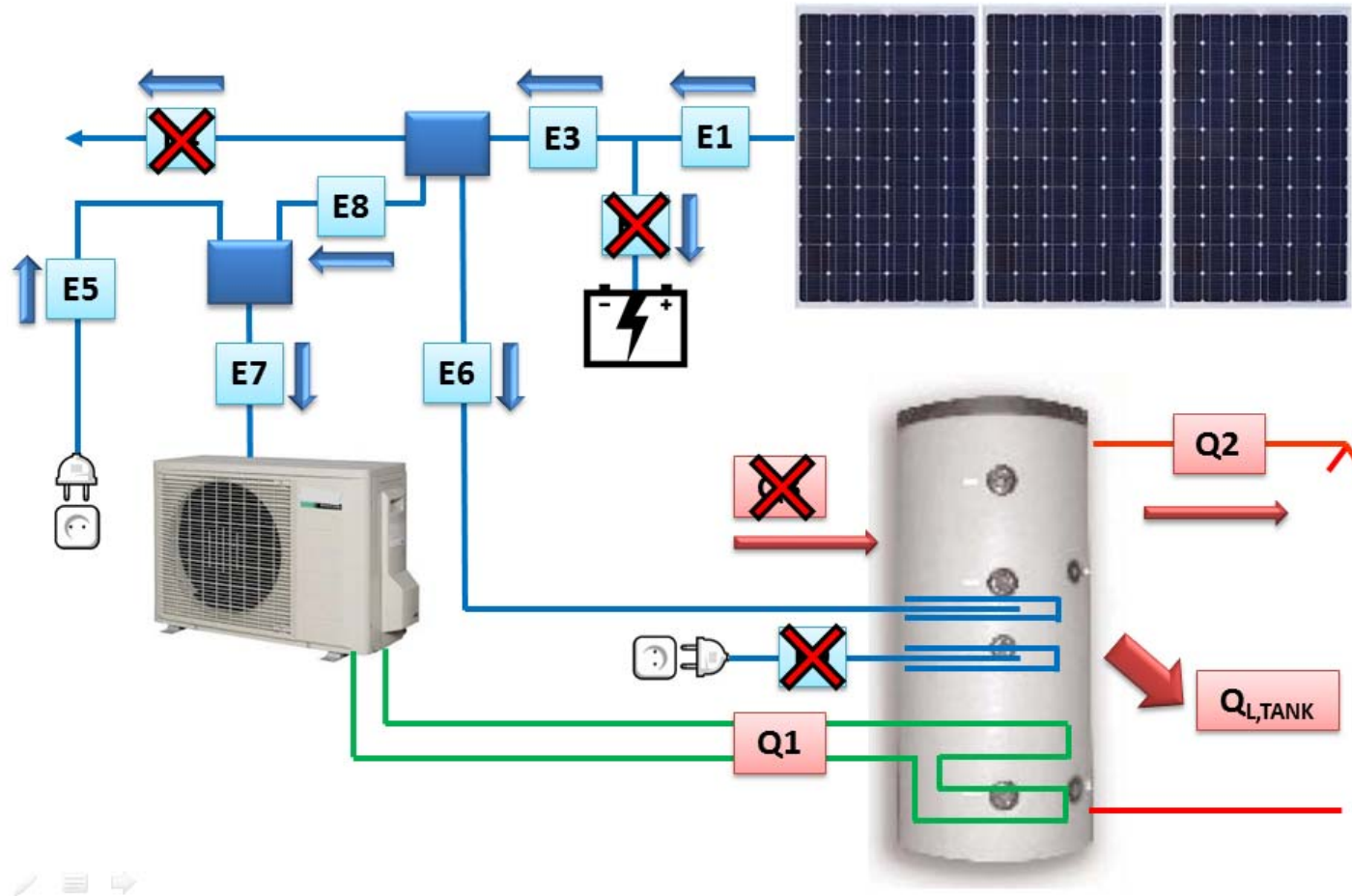
DHW consumption of a 4 member family

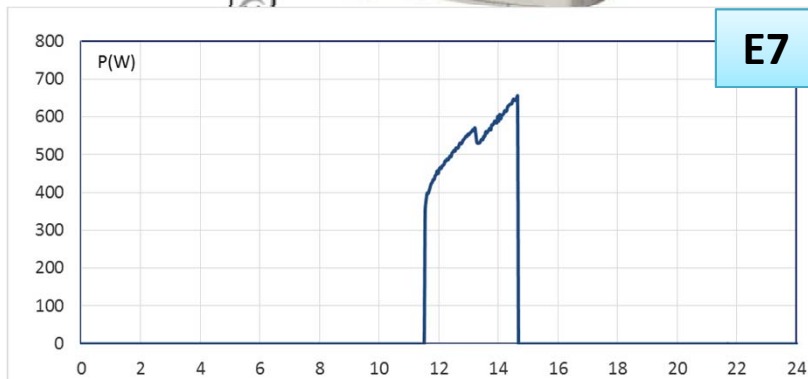
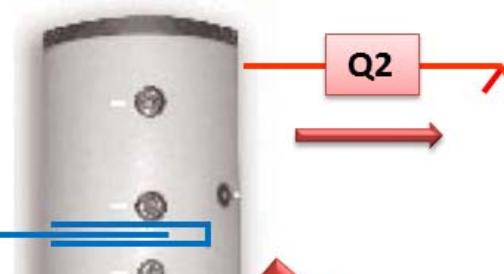
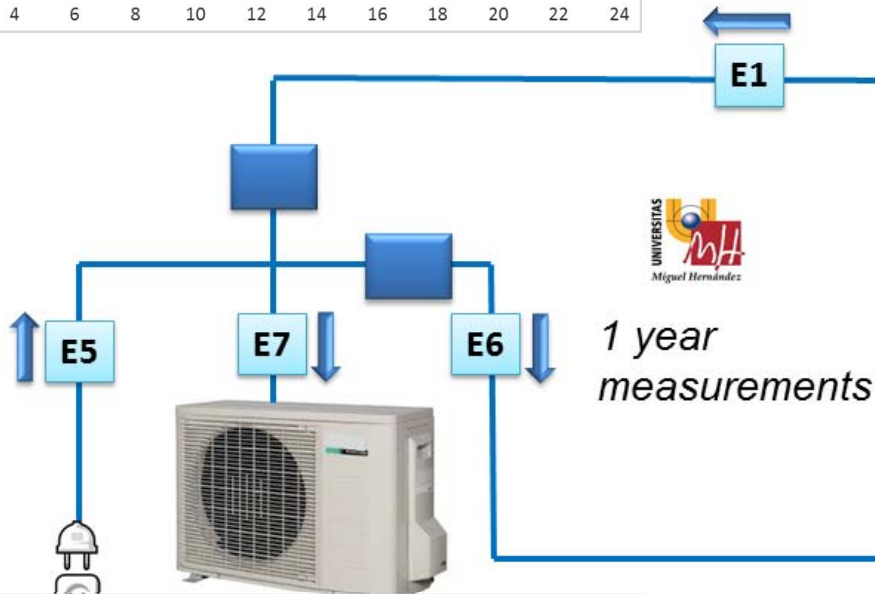
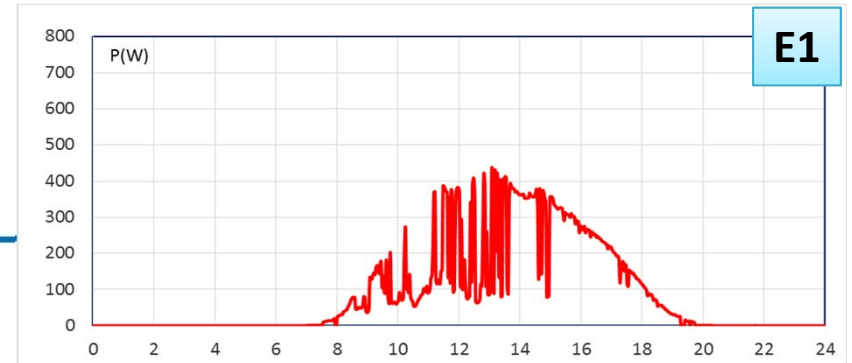
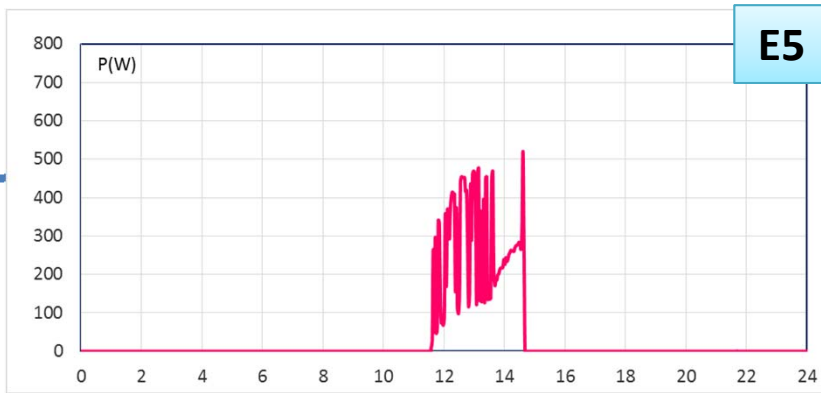
$P_{PV}=470Wp$

$P_{HP}=1.5kW$



PROTOTYPE UMH-DHW1





Experimental Results

MONTLY RESULTS

Month	Vol. (L)	Q _s (Kwh)	E _{TANK} (Kwh)	E _w (Kwh)	Q _s (Kwh)	E _T (KWh)	E ₁ (kWh)	E ₂ (kWh)	E ₃ (kWh)	E _{1-E2} (kWh)	Q ₁ (KWh)	Q _{1-Q2} (kWh)	COP _{HP}	COP _{SIST}	T _{M,24h} (°C)	T _{M,HP-ON} (°C)	E _{SOLAR} (kWh/m ²)	SC (%)
January	123,49	5,56	2,15	0,01	7,71	2,30	2,02	0,90	0,61	1,40	6,94	7,55	3,01	8,38	11,40	16,83	5,20	69,11
February	131,67	6,70	2,21	0,42	8,34	2,68	2,08	1,23	0,60	1,44	8,38	8,99	3,30	8,01	13,66	16,28	3,16	62,00
March	133,26	6,92	1,99	0,03	8,93	2,38	2,37	0,88	0,88	1,49	8,54	9,42	3,60	10,68	15,61	19,37	6,17	72,91
April	128,23	6,68	1,74	0,07	8,31	2,03	2,38	0,68	1,22	1,87	7,31	8,74	3,67	12,81	18,73	23,78	6,77	78,16
May	125,73	6,38	1,71	-0,01	8,08	1,96	2,19	0,87	1,10	1,09	7,17	8,27	3,67	9,54	19,53	24,16	5,88	71,61
June	130,83	6,33	1,86	-0,01	7,88	1,77	2,21	0,81	1,24	0,97	6,48	7,72	3,63	8,36	23,78	27,88	3,90	73,21
July	133,61	6,69	1,19	0,01	7,88	1,68	2,39	0,71	1,41	0,98	6,39	7,80	3,80	11,07	26,34	30,32	6,53	77,21
August	133,64	6,66	1,14	0,02	7,82	1,64	2,33	0,76	1,33	0,88	6,48	7,78	3,82	10,24	28,80	30,73	6,23	74,37
September	129,97	6,42	1,20	-0,01	7,62	1,67	2,14	0,80	1,27	0,87	6,34	7,61	3,81	9,56	25,76	29,85	5,86	72,89
October	128,28	6,31	1,44	0,02	7,77	1,80	2,18	0,76	1,13	1,04	6,41	7,36	3,33	8,82	22,12	26,82	3,82	74,20
November	129,06	5,74	1,77	0,02	7,53	2,03	1,62	1,13	0,72	0,89	6,54	7,26	3,23	6,41	16,09	20,29	4,14	58,83
December	123,80	3,67	2,08	0,01	7,70	2,23	1,82	1,04	0,72	1,20	6,78	7,30	3,04	7,23	12,02	16,82	4,88	64,91
TOTAL	47281,70	2318,98	604,95	16,32	2940,25	734,27	787,88	320,73	373,80	414,08	2577,64	2951,44	3,51	9,17	19,41	23,61	2089,71	71,07
AVERAGE	128,86	6,36	1,68	0,04	8,06	2,01	2,16	0,88	1,02	1,13	7,06	8,08	3,61	8,17	18,41	23,61	6,73	71,07

CONCLUSIONS

- SOLAR CONTRIBUTION (SC%)
Definition: % of consumed energy which is solar: **71%**
- PRODUCTION FACTOR (PF%)
Definition: % of employed PV energy compared to maximum: **100%**
- EFFICIENCY (SPF)
Definition: Heat + Cool compared to grid electricity: **9,1**

ELECTRICITY EXPORT: NO
BATTERIES: NO
THERMAL STORAGE: YES
COMPRESOR: W=CONSTANT
IMPROVED CONTROL (SOLAR): YES

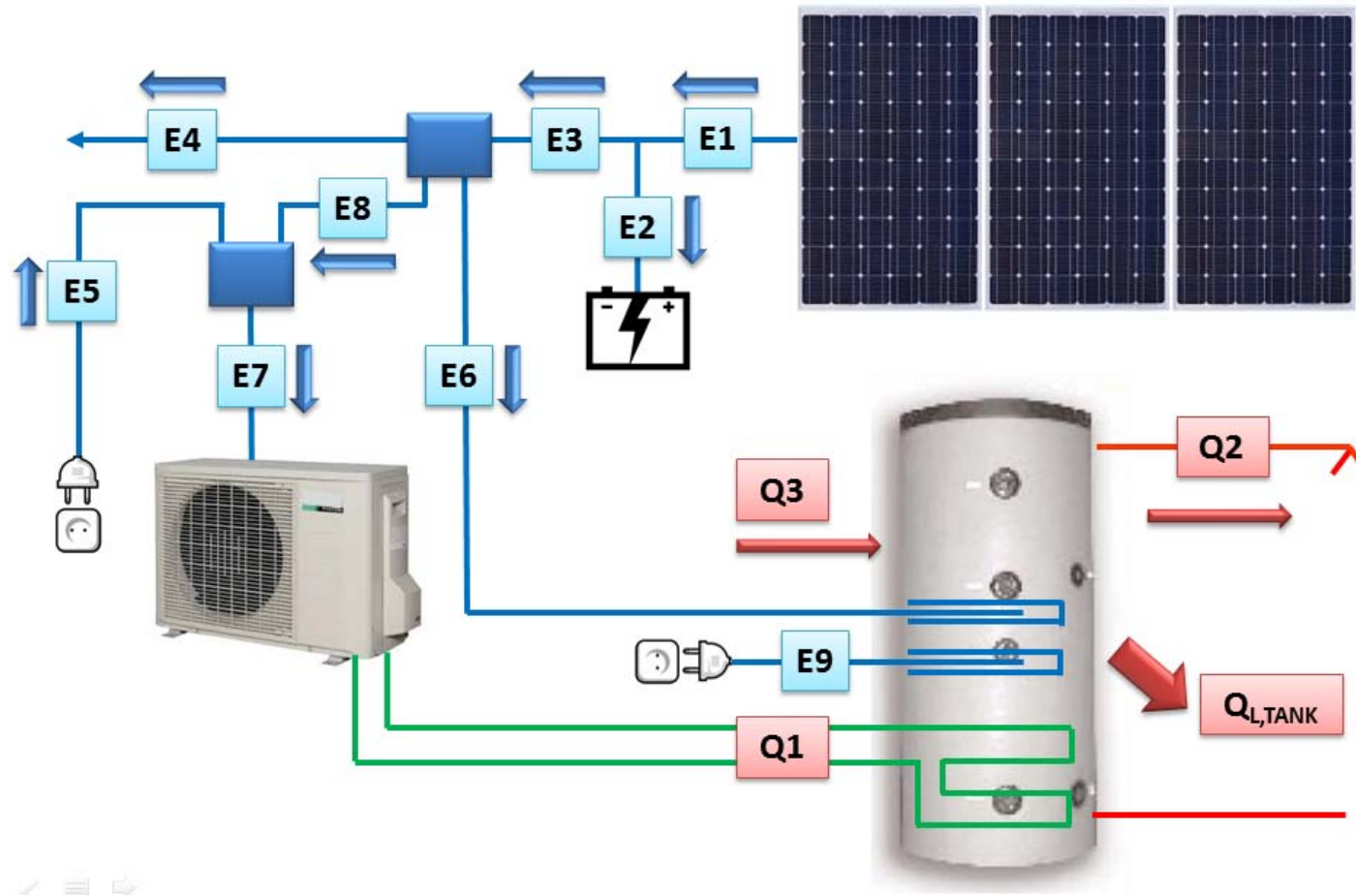
NUMBER OF PV PANELS; 2
COMPRESOR POWER: 500 W
STORAGE CAPACITY: 200 LITERS

PROTOTYPE UMH-DHW2

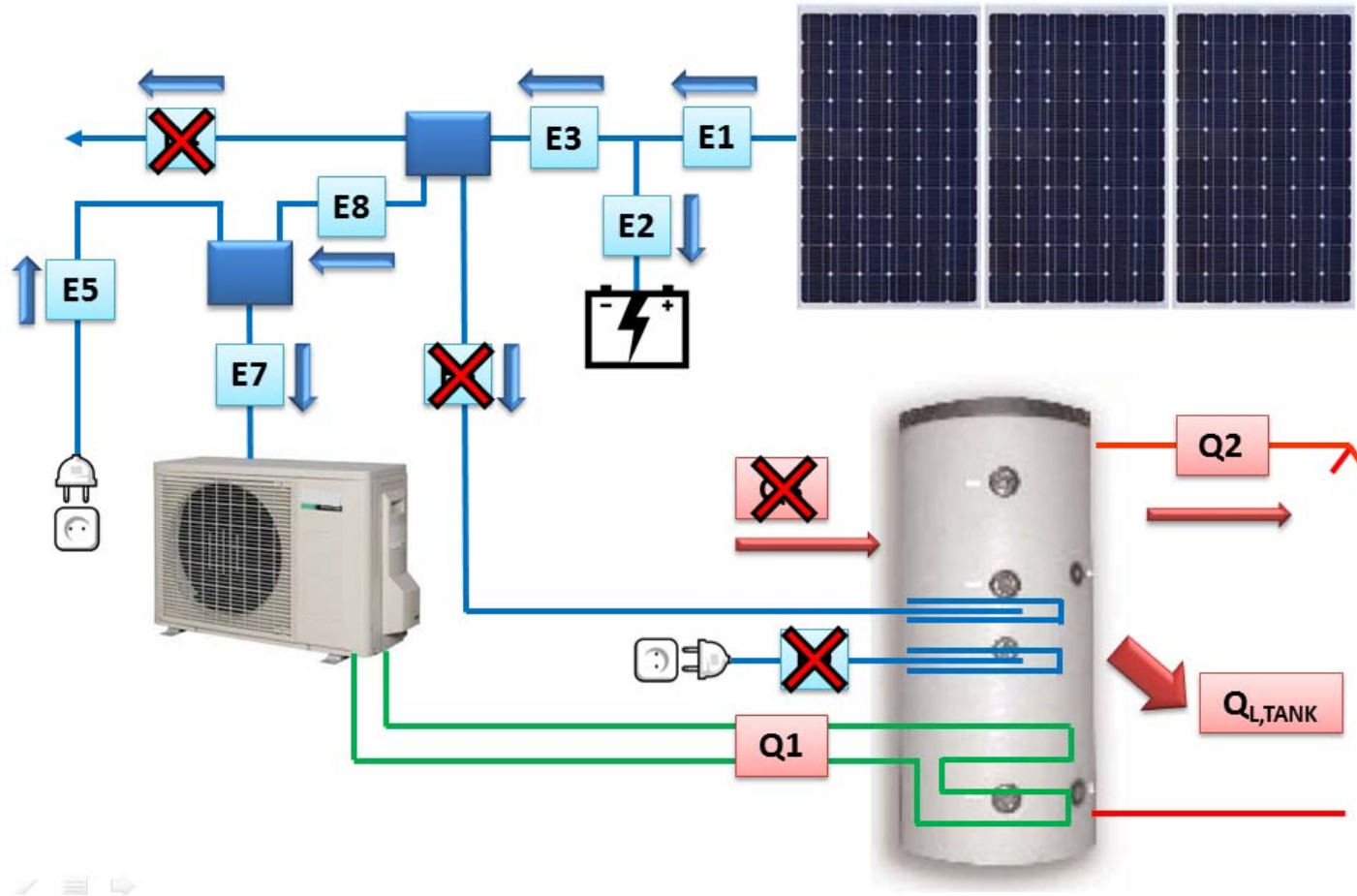
DHW consumption of a 4 member family



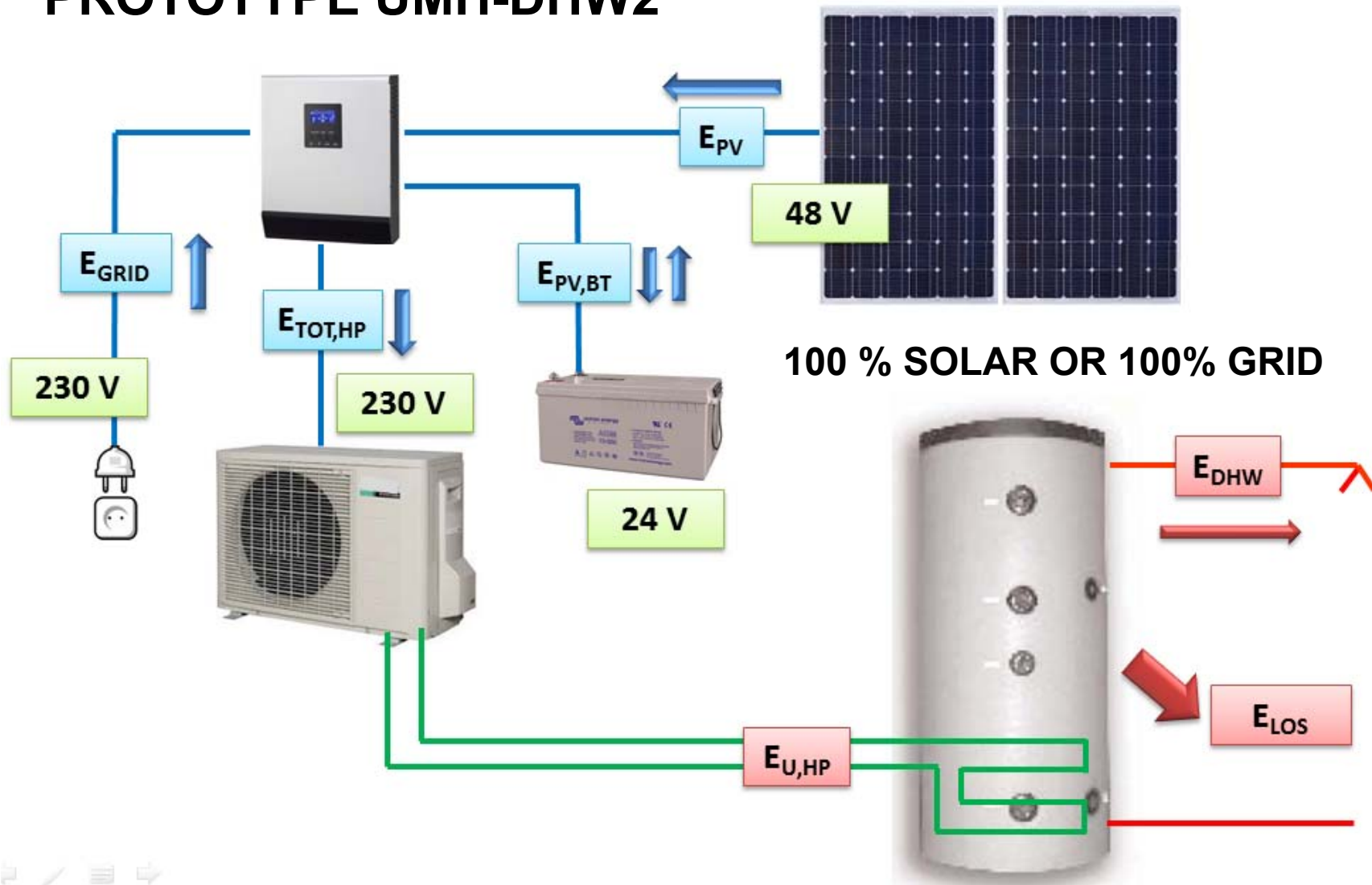
GENERAL APPROACH

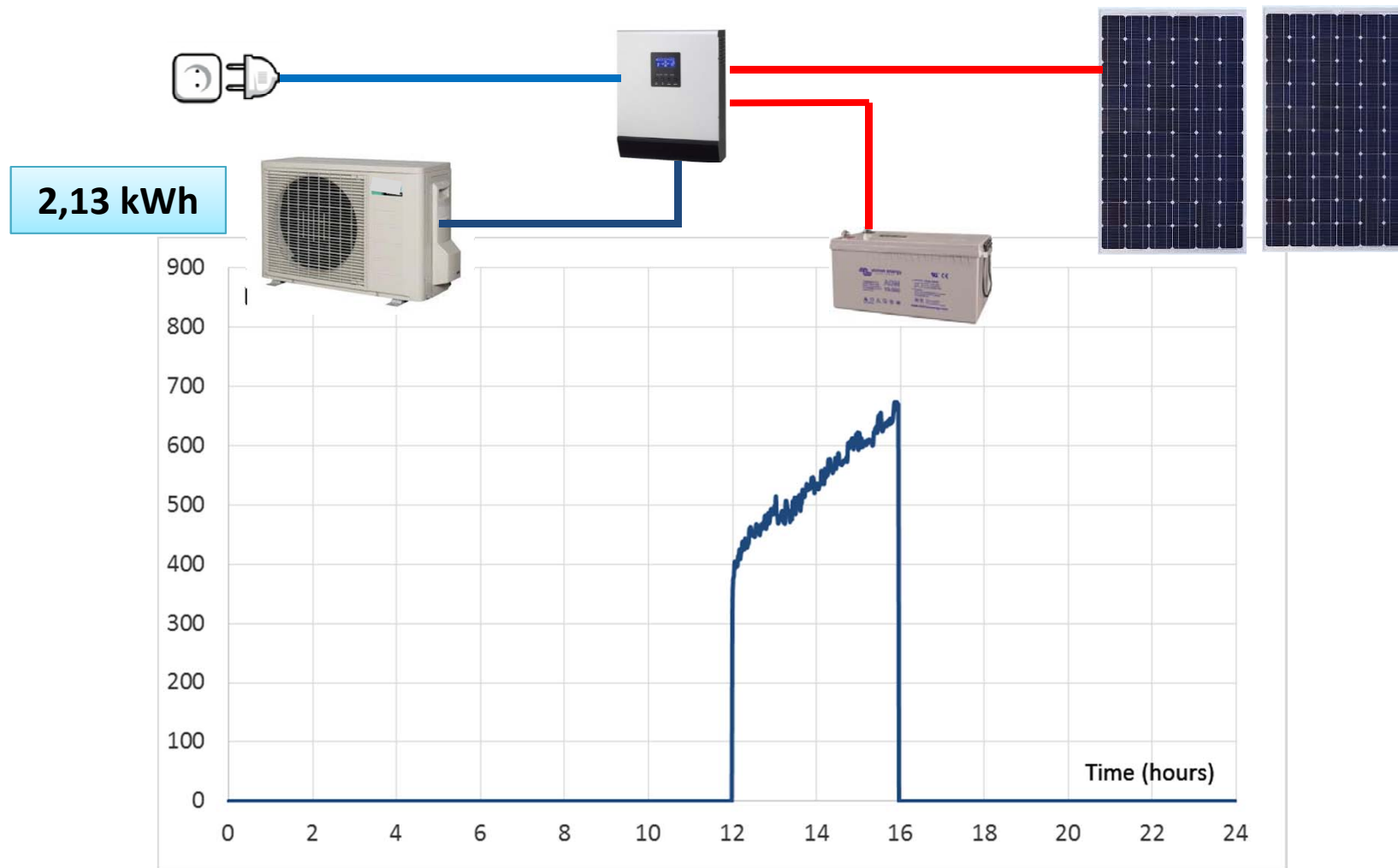


PROTOTYPE UMH-DHW2

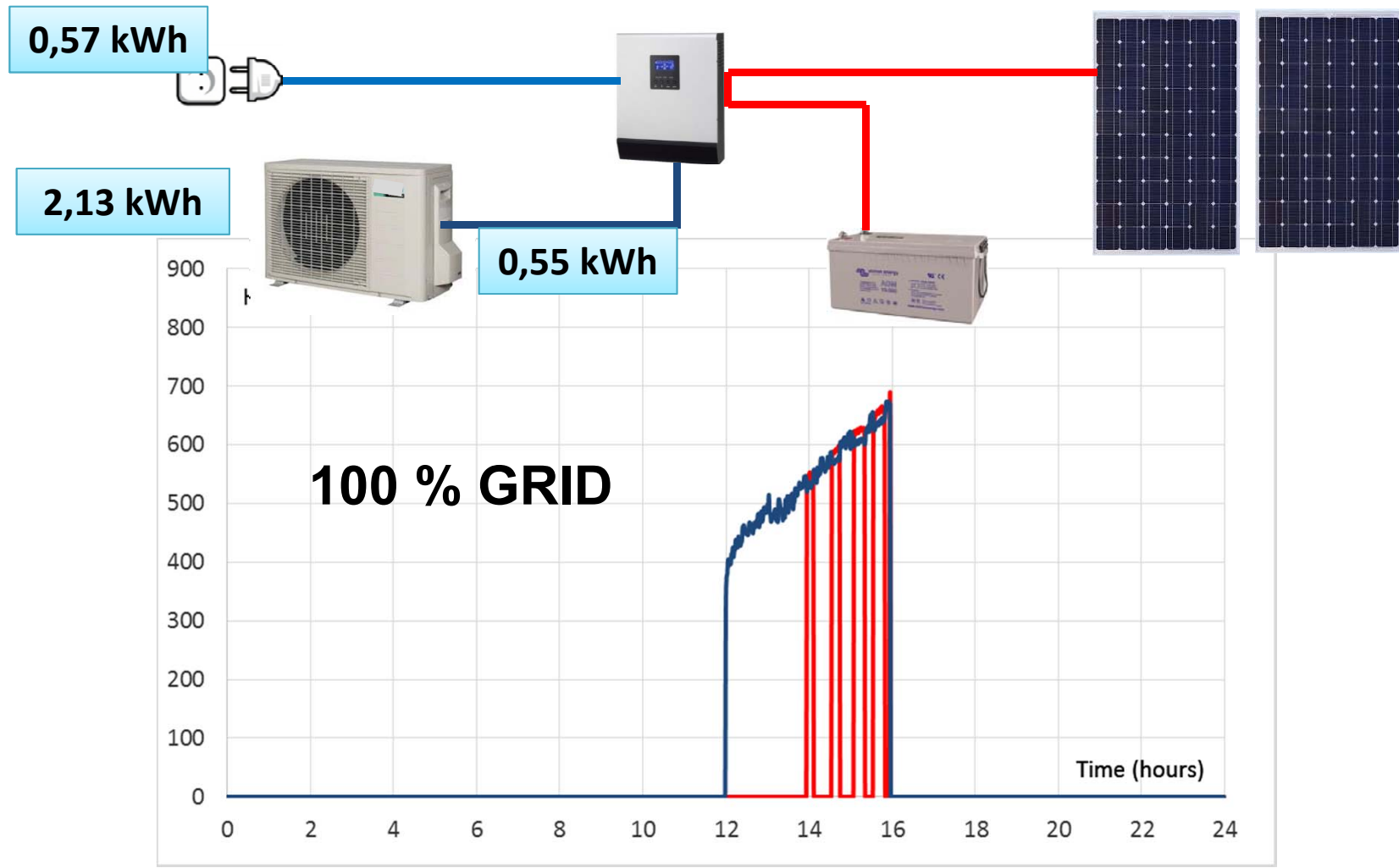


PROTOTYPE UMH-DHW2

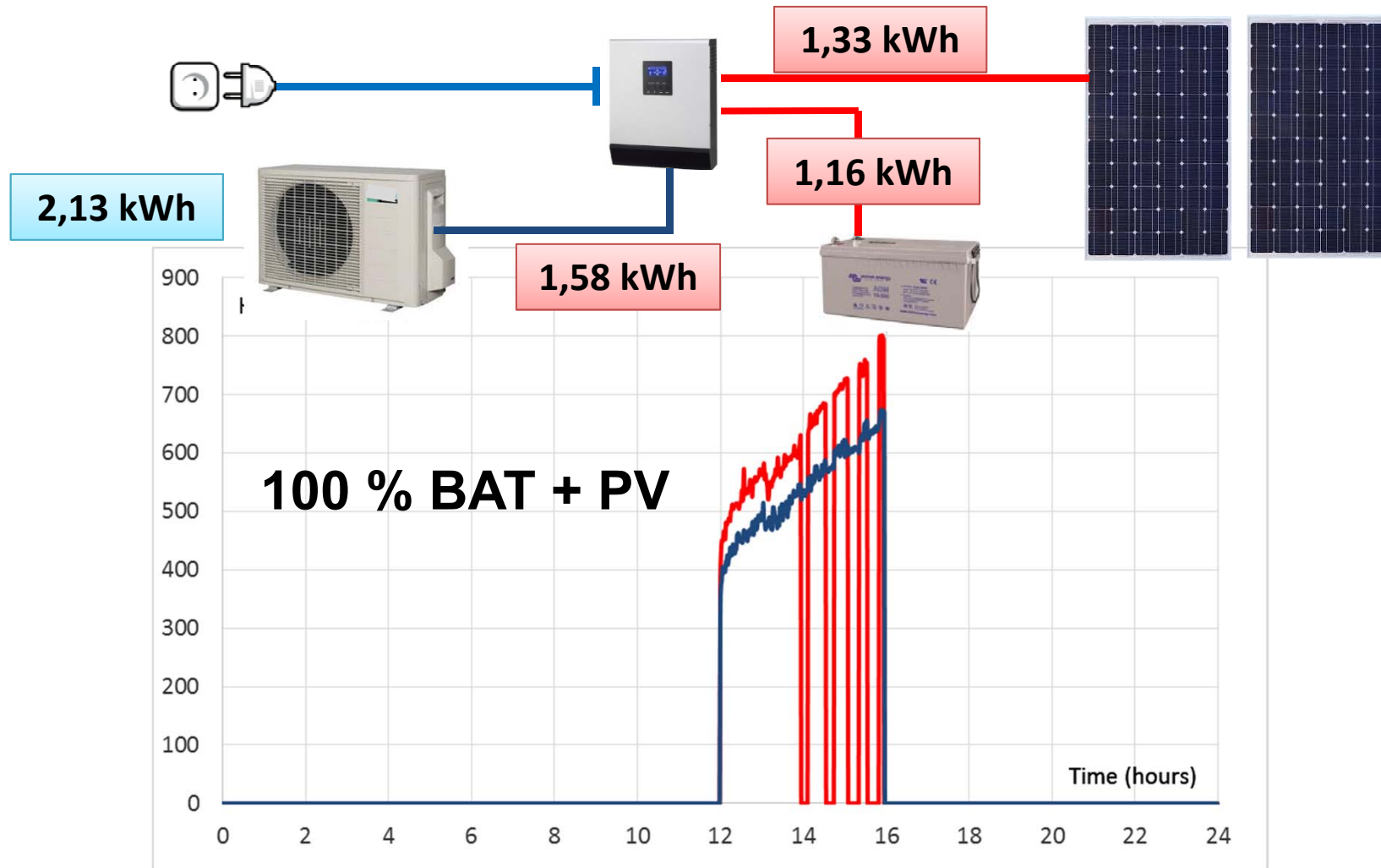




16/SEP/2015



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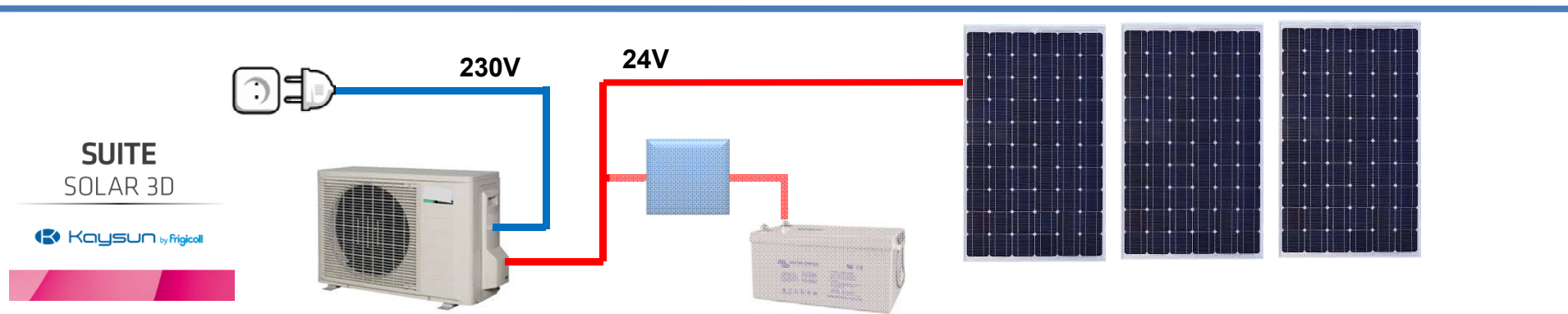
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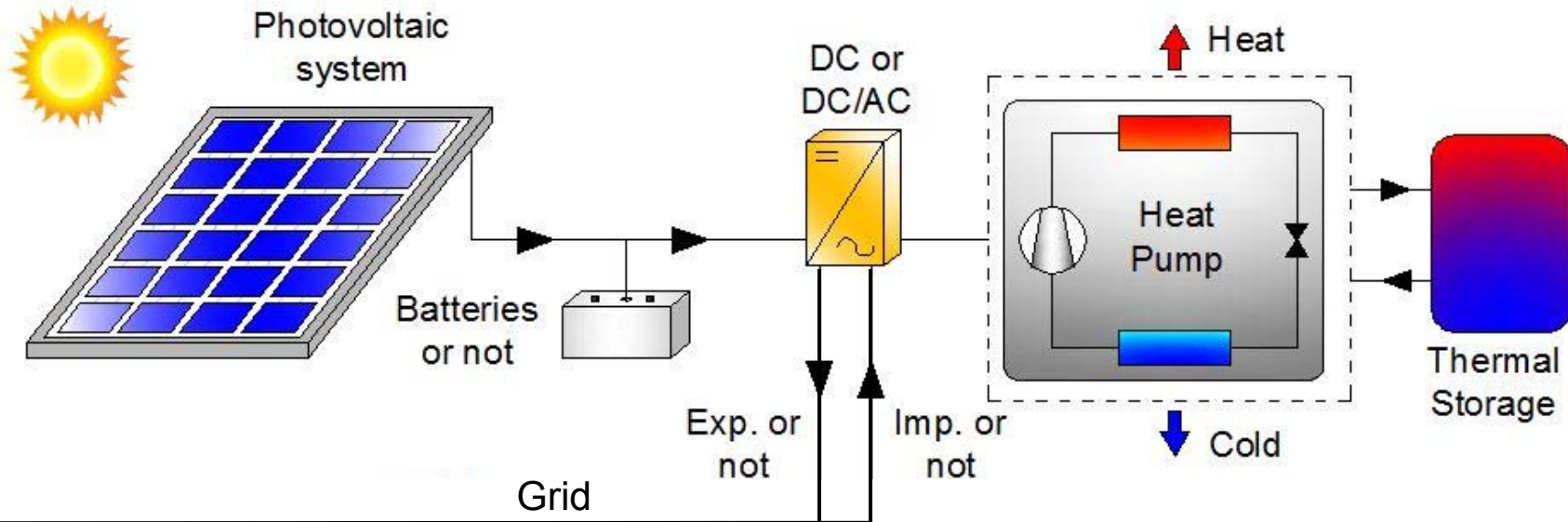
CONCLUSIONS 1 DAY 16/SEP/2015!!!!!!

- SOLAR CONTRIBUTION (SC%)
Definition: % of consumed energy which is solar: **74%**
- PRODUCTION FACTOR (PF%)
Definition: % of employed PV energy compared to maximum: **100%**
- EFFICIENCY (SFP)
Definition: Heat + Cool compared to grid electricity: **10,8**

ELECTRICITY EXPORT: NO
BATTERIES: YES
THERMAL STORAGE: YES
COMPRESOR: W=CONSTANT
IMPROVED CONTROL (SOLAR): YES

NUMBER OF PV PANELS: 2
COMPRESOR POWER: 500 W
BATTERIES CAPACITY: 150 Ah
STORAGE CAPACITY: 200 LITERS





DESING CHARACTERISTICS

- ELECTRICITY EXPORT: YES/NO
- BATTERIES: YES/NO
- THERMAL STORAGE: YES/NO
- COMPRESOR: INVERTER, W=CONSTANT
- IMPROVED CONTROL (SOLAR)

DIMENSIONS:

- NUMBER OF PV PANELS
- COMPRESOR POWER
- BATTERIES: Ah
- STORAGE CAPACITY

Examples of solar cooling innovations in SHC Task 53

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