



PVT an interesting option for the Nordic climates  
Examples of installations with DualSun





- Created in 2010 by two engineers from one of France's top engineering schools (Ecole Centrale Paris)
  - A dynamic and international team supported by national and regional governments as well as numerous prestigious institutions
- ✓ **> 1,100** installations around the world
  - ✓ **15,000 m<sup>2</sup>** of panels sold
  - ✓ **573 %** growth over 3 years (Deloitte Fast 50 Prize)
  - ✓ **4** international patents
  - ✓ **2M€** in R&D investment
  - ✓ **3,2M€** in equity capital raised



Région  
Provence  
Alpes  
Côte d'Azur



**ADEME**

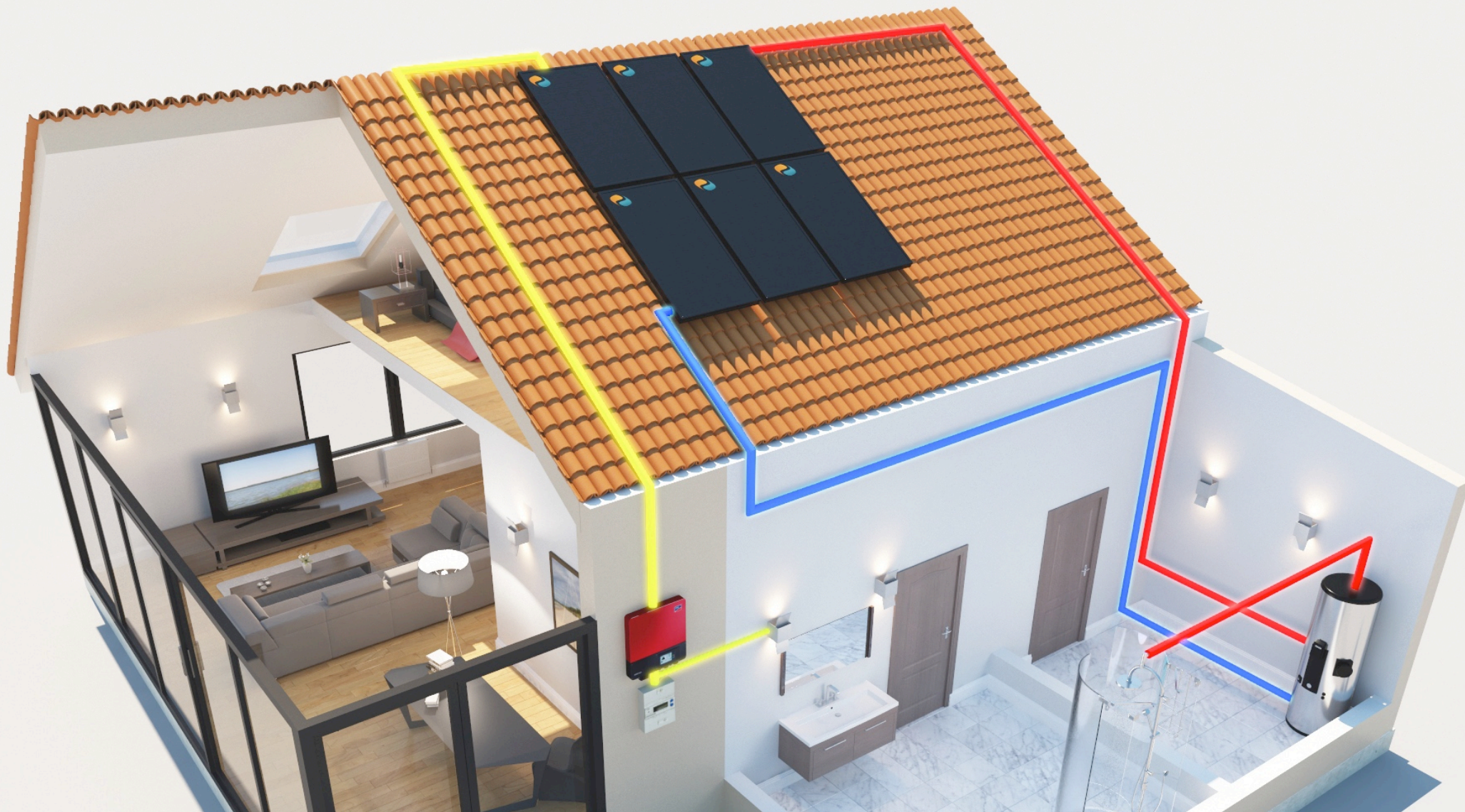


Agence de l'Environnement  
et de la Maîtrise de l'Energie

**Deloitte.** | **In Extenso**







## DualSun, meeting our daily energy needs

**Electricity and hot water are part of our everyday needs. DualSun combines in one unique panel the solution to these two essential needs!**



*"One thing is certain: we will always need to produce domestic hot water (DHW) and the space on our buildings' rooftops is not infinite..."*

**Martin Bouygues,  
CEO of Bouygues**  
Client and solar star for DualSun

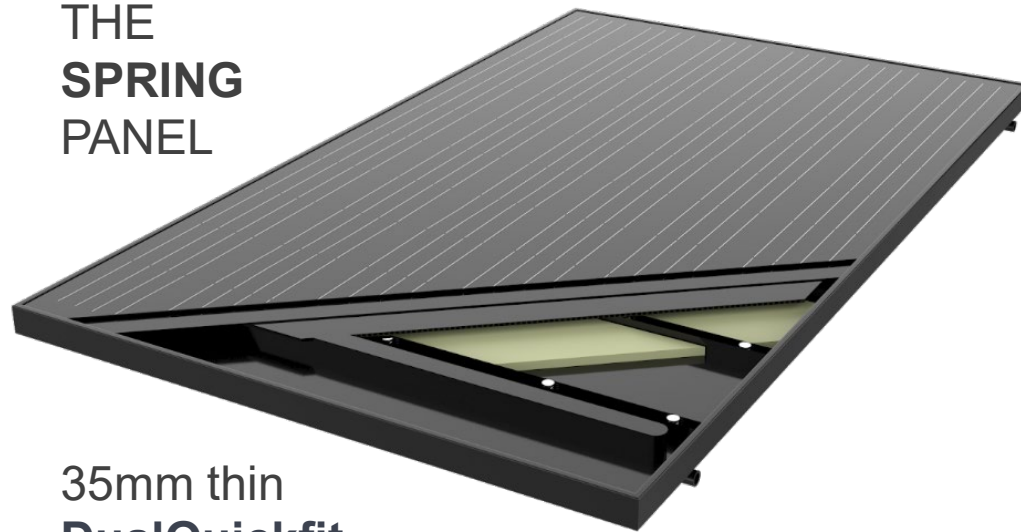




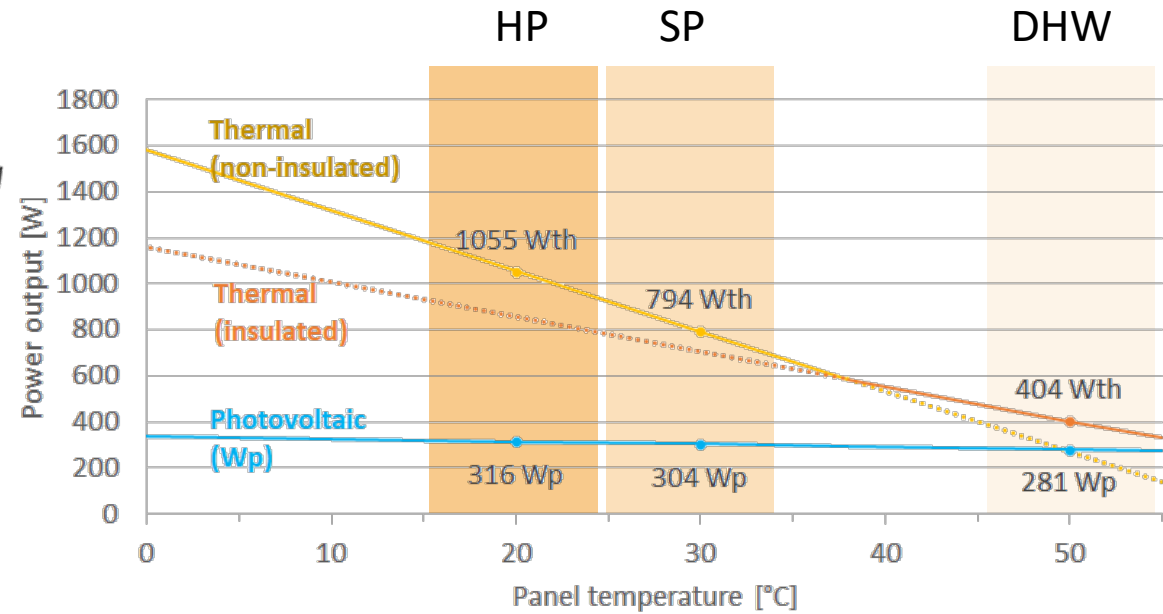
**DUALSUN : 1<sup>ST</sup> to certify a hybrid panel in the world**



THE  
**SPRING**  
PANEL



35mm thin  
**DualQuickfit**



[CEA study comparing PVT modules : DualSun panels have the best thermal performances](#) (2018)



Lead the PVT market with competitive high performance, easy to install.





**> 1,100 PVT installations around the world**

**Homes**



*Superimposed*

**Mountain Refuges**



*BIPVT - In façade*

**Apartment buildings**



*For roof terrace*

**Hotels & campgrounds**



*BIPVT - Into the roof*

**Swimming pools**



*Canopy*

**Hospitals, schools, ...**

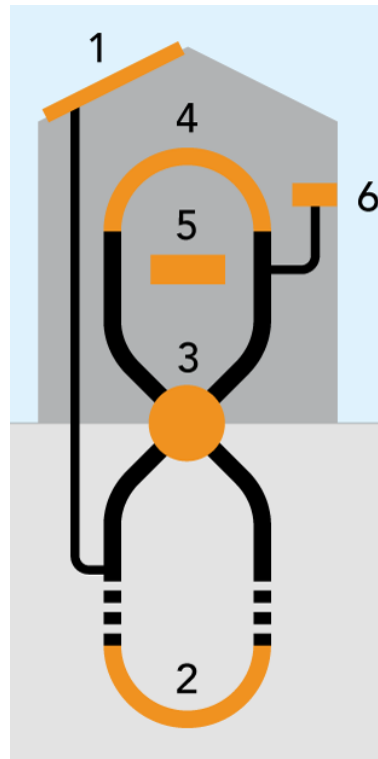


*Superimposed*





## PVT+HP : DualSun in geothermal systems



PVT + HP geothermal system :

1 :  DualSun PVT modules

2 : Geothermal probe

3 : Heat pump

4 : Heating distribution

5 : Controlling

6 : Air Conditioning





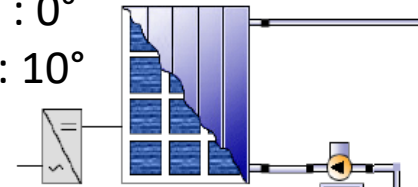
# Positive energy renovation on a tertiary building (built in the 1970s!)

## 40m<sup>2</sup> DualSun in a Geothermal system

25PVT(40m<sup>2</sup>)

South : 0°

Slope : 10°



18MWh<sub>th</sub>  
+7MWh<sub>el</sub>

26kW

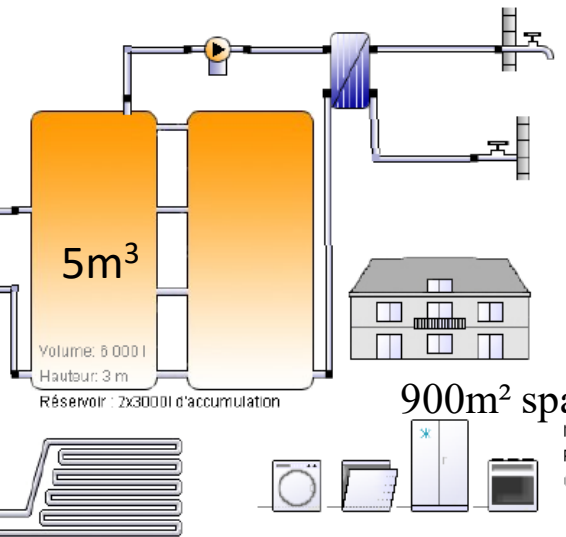
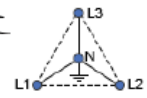
21MWh<sub>th</sub>

SP 5,9

200m

Sonde géothermique: 40 mm sonde double U  
Longueur sonde: 200 m  
Strate de terre 1: Gneiss

Capteur PVT: D8 250 M non-isolated  
Nombre de modules: 25  
Puissance nominale totale champ photovoltaïque: 6,25 kW  
Orientation (E=+90°, S=0°, O=-90°): 0°  
Inclinaison (horiz.=0°, vert.=90°): 10°



*PolySun simulation*

Headquarters, KTR France, Dardilly (FR).

## GREEN SOLUTIONS AWARDS 2018 - category : Sustainable Renovation (COP24)

<https://dualsun.com/en/realisations/lyon-fr-2018-25pvt-en/>





## PVT+HP coupling an interested solution also for Danemark



(Marseille, FR, 2013)

22PVT (36m<sup>2</sup>) +75m<sup>2</sup> black tubes  
2x12kW heat pumps  
No drilling (PVT as **direct cold source**)



(Zoetermeer, NL, 2017)

8PVT+5PV  
3kW  
90m drill



(Oslo, NW, 2019)

110PVT  
2x64kW heat pumps  
16 x 300m drill

FlexiBle user-Centric  
Energy poSitive houseS  
**H2020 EXCESS** :  
(Helsinki, FIN, 2021, 226 PVT for 3x800m)



a positive energy building with BASSO.





## Economical balance

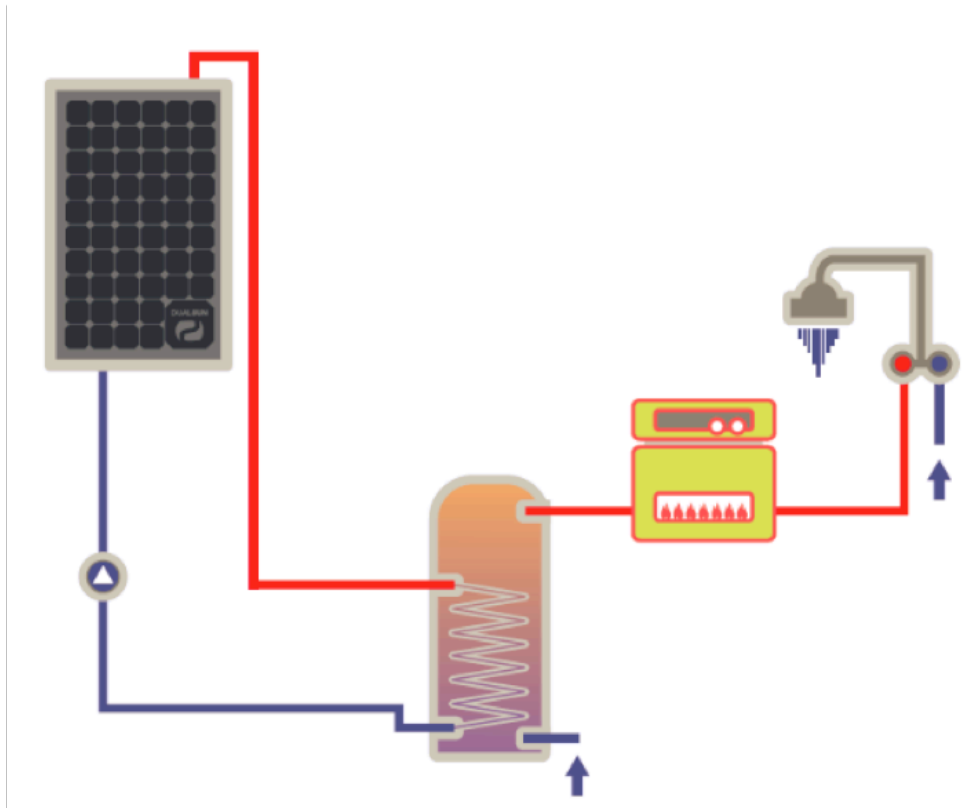
	KTR, Lyon (FR)		Zoetermeer (NL)		Marseille (Fr)		Oslo (NW)	
<b>Investment (*)</b>	<b>70 000€</b>		<b>25 000€</b>		<b>136 000€</b>		<b>1 200 000€</b>	
<b>PVT PV part</b>	6.25kWp	8,500€	3.64kWp	6,000€	5.2kWp	15,300€	34.1kWp	40,000€
<b>PVT ST part</b>	40m <sup>2</sup>	8,000€	13m <sup>2</sup>	3,800€	110m <sup>2</sup>	11,800€	180m <sup>2</sup>	30,000€
<b>HP (+drill./storage)</b>	26kW+4x150m	53,500€	3kW+90m	15,300€	24kW+4m <sup>3</sup>	108,700€	130kW+15x300m	1,130,000€
<b>Elec. Cons. kWh/yr</b>	3 560		1900		32 700		tbc	
<b>PV Energy kWh/yr</b>	<b>7 000</b>		<b>3 700</b>		<b>7 450</b>		<b>31 000</b> (tbc)	
<b>Th Energy kWh/yr</b>	<b>SF5.9</b>	<b>17 450</b>	<b>SF3.8</b>	<b>5 300</b>	<b>SF4.2</b>	<b>103 300</b>	<b>SF~4</b>	<b>75 000</b>
<b>Cost of PV over 20y</b> <i>undiscounted</i>	6,1c€/kWh		8,1c€/kWh		10,2c€/kWh (2013)		6,4c€/kWh	
<b>Overcost on Th</b>	13%		20%		10%		3%	

(\*) no subsidies taken into account

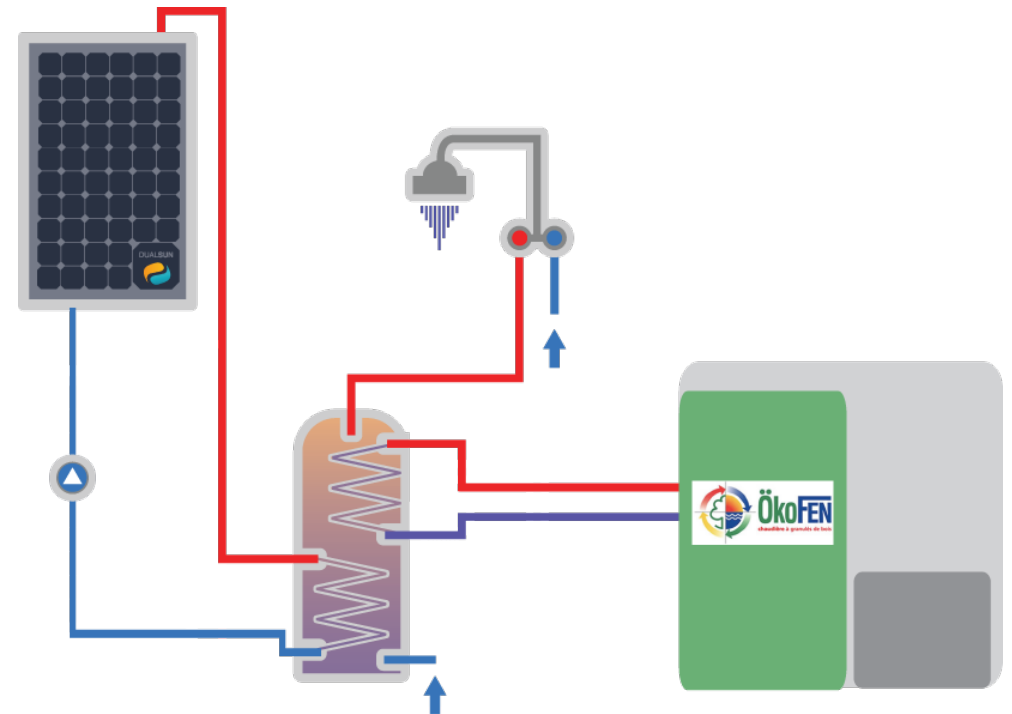
The photovoltaic is profitable, and compensate (a part of) the electrical consumption of the heat pump. The thermal part of PVT is a small overcost to regenerate or avoid the drilling.



## PVT for domestic hot water (PVT preheating + additional heating)



External additional heating  
(for example gas heater)

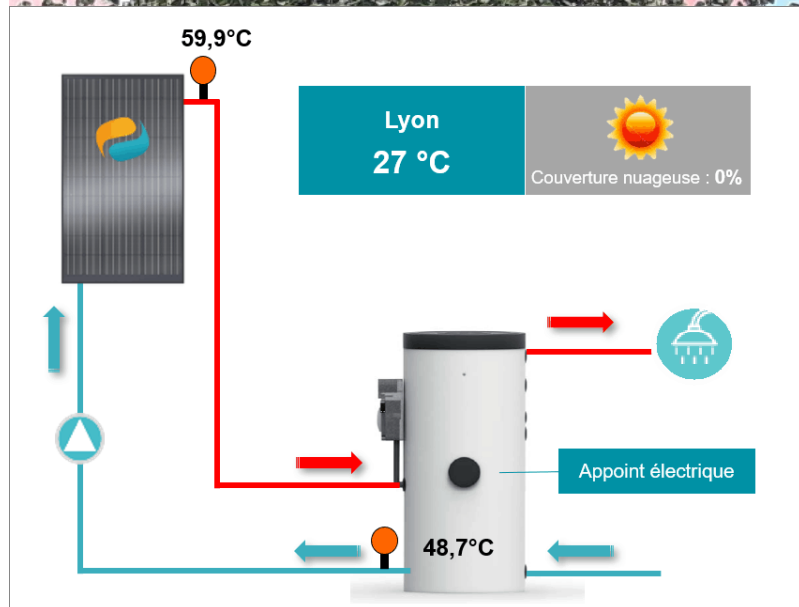


Internal additional heating  
(for example wood heater)

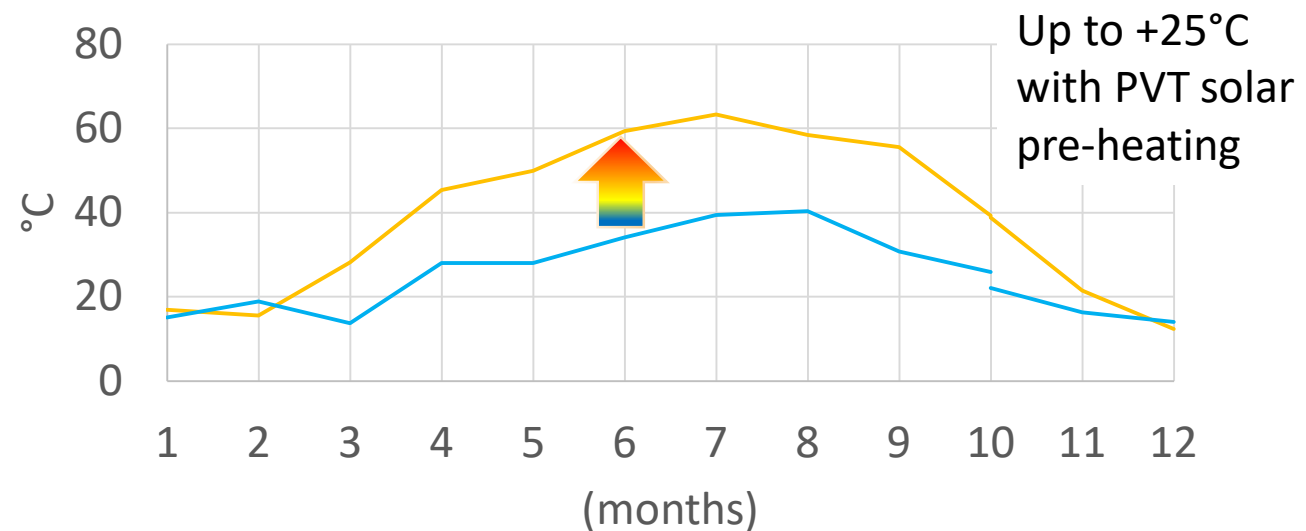
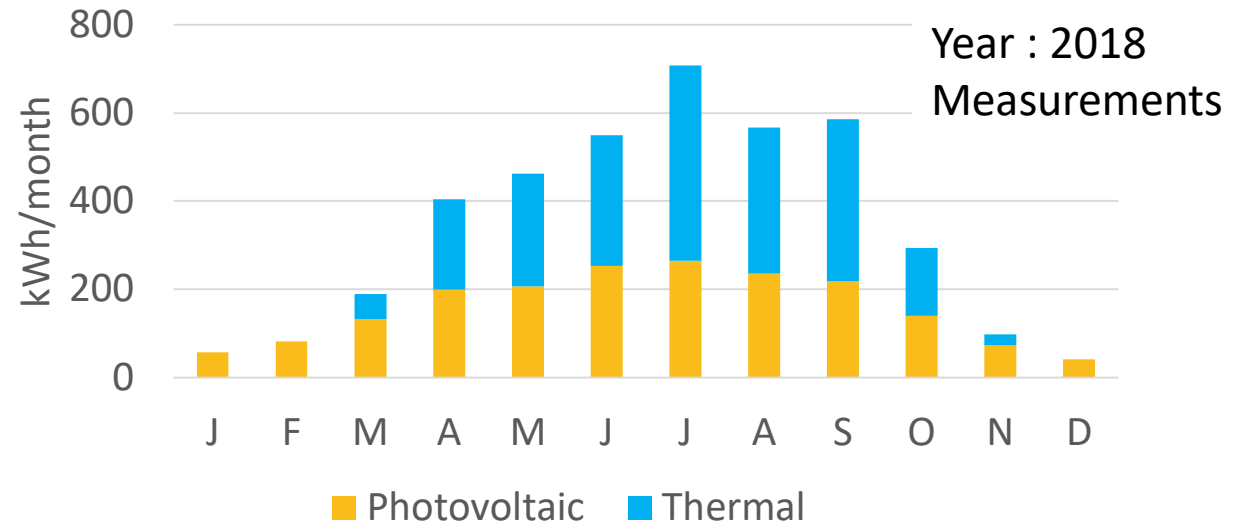




## PVT to pre-heat DHW for homes (Lyon, 2017)



External additional heating : Heat Pump



Average temperatures : — cold water — after solar pre-heating


<https://dualsun.com/fr/realisations/lyon-fr-2017-6pvt/>





## A lot of dual self-consumer with DualSun around the world



**H2020**  **SunHorizon** : installation in Riga (Latvia) for domestic hot water pre-heating (next year 2020)





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