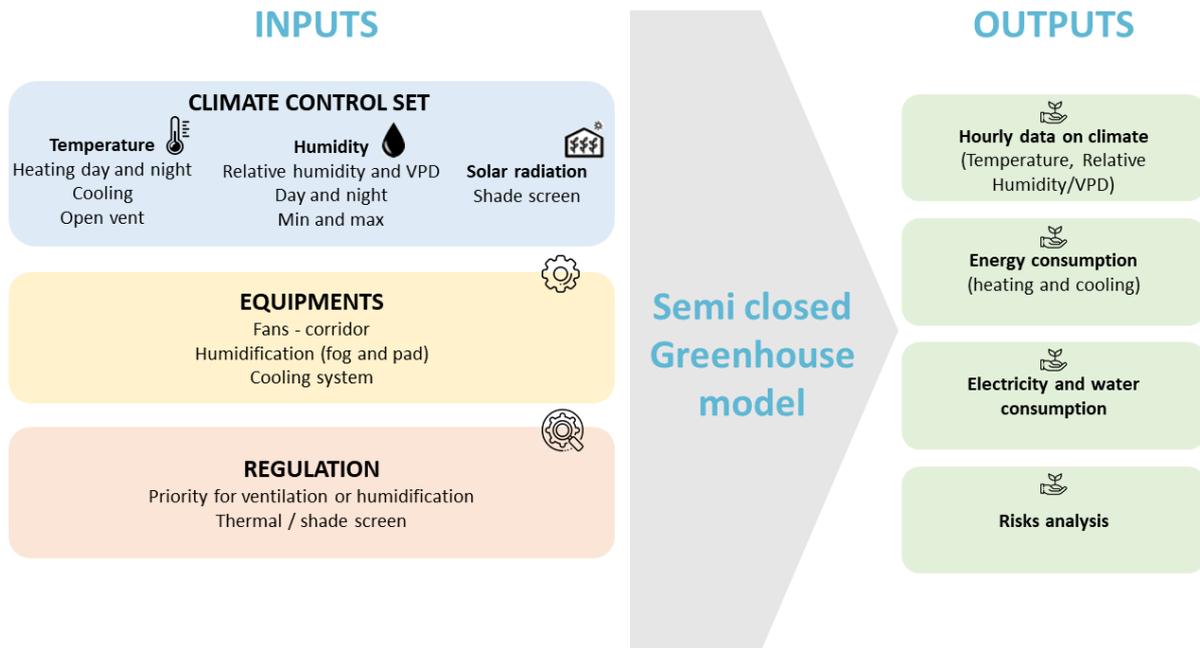


Semi-closed greenhouse

1.Semi-closed greenhouse modelling in Hortinergy

The semi-closed greenhouse model includes:

- Climate control set
- Equipments
- Regulation



The equipment below can be implemented in the semi closed model:

- Air ventilation in tubes, including electricity energy consumption,
- Controlled external ventilation for dehumidification,
- Air recirculation in tube,
- Adiabatic cooling with fog system,
- Adiabatic cooling with pad system including dimensioning

1. How many air tubes per chapel ?

Please enter a value between 1 and 20.

2. Is maximum air flow defined by user or calculated according to fan ?

- by user
 according to fan number and specification

Air renewal maximum rate

(m³/m² h)

Please enter a value between 0 and 100.

Air internal recirculation rate

(m³/m² h)

Please enter a value between 0 and 100.

Crop evapotranspiration is modelled with temperature, relative humidity, solar radiation, inner air velocity as well as type and crop development.

2. Outputs of semi-closed greenhouse model

Hortinerigy provides a comprehensive analysis of the:

- Hourly inner climate in the semi closed greenhouse
- Energy, electricity and water consumption

Here are the results of a semi-closed greenhouse located in South France in a hot and dry climate. Cooling and dehumidification are performed by a pad.

Heating temperature set	
day	night
20	18

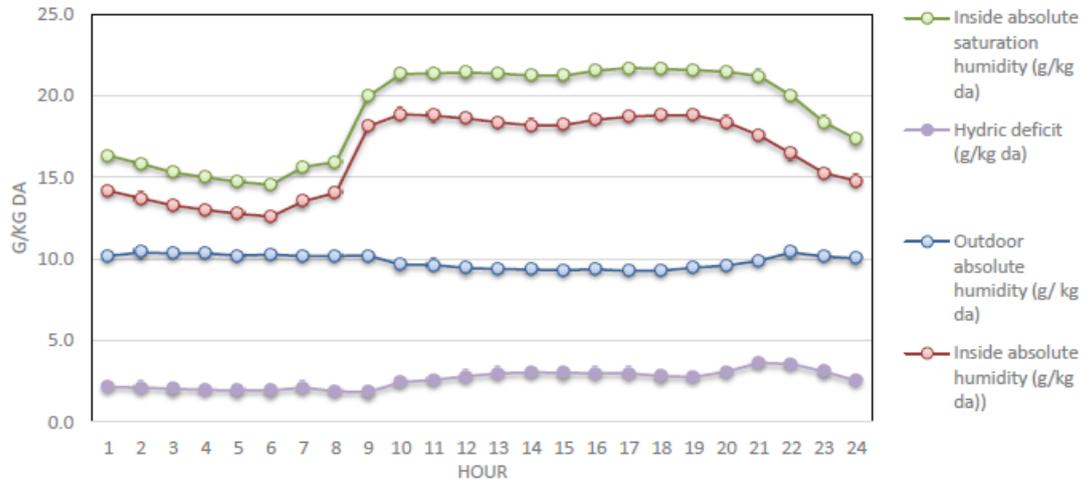
Cooling temperature set: 26°C

Period	Unit	Min	Max
Day	g water / kg dry air	2	7
Night	g water / kg dry air	2	7

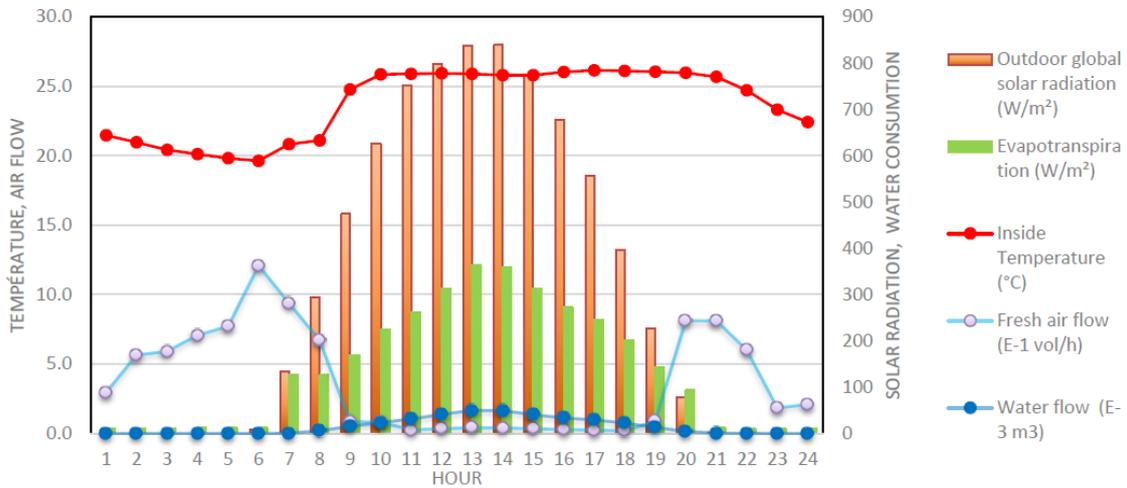
Inner climate in semi closed greenhouse

Results are temperature, relative humidity, hydric deficit and solar radiation on hourly based in the semi closed greenhouse.

Results show that the inner temperature is never above 26°C and that hydric deficit is between 2 and 4.5 g/ kg da.



Results also provide the external air flow, water flow and evapotranspiration.



During night time and morning, external air is blow in the semi-closed greenhouse to dehumidify. During day time, pad is activated to cool.

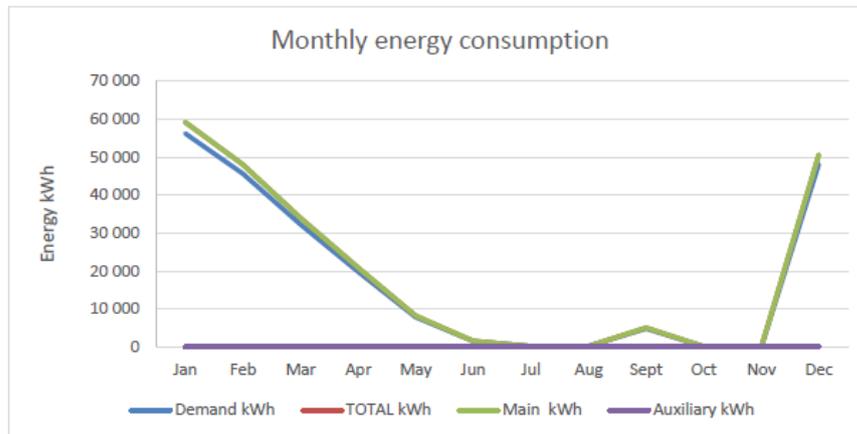
Hortinergy is also presenting an annual overview, a monthly synthesis and hourly data of heating, electricity and water consumption.

Annual overview of the energy consumption in the semi closed greenhouse

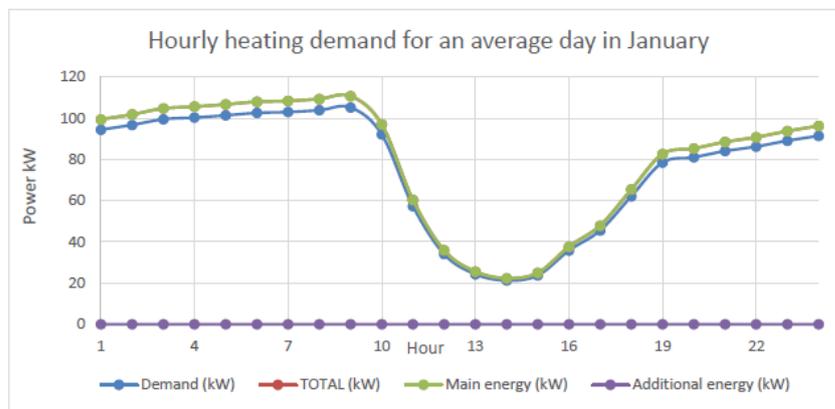
	Heating	Electricity	Water
Unit price	30 €/MWh	120 €/MWh	-
Expenditure (€)	6 842 €	2 329 €	-

€/m ²	7 €/m ²	2 €/m ²	-
Consumption	228 MWh	19 MWh	1 165 m ³
Consumpt. / unit	235 kWh/m ²	20 kWh/m ²	1,2 m ³ /m ²

Monthly synthesis of the energy consumption in the semi-closed greenhouse



Hourly data of the energy consumption in the semi-closed greenhouse



Model is being under validation with 2 semi-closed greenhouse located in CTIFL in Carquefou (wet climate) and Balandran (dry climate) in France. Results will be presented in June 2019 at Greensys.