# Control strategies study of a complete solar assisted air conditioning system in an office building using TRNSYS.


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*Objective :* Evaluate energy savings of Solar-air conditioning in an office building

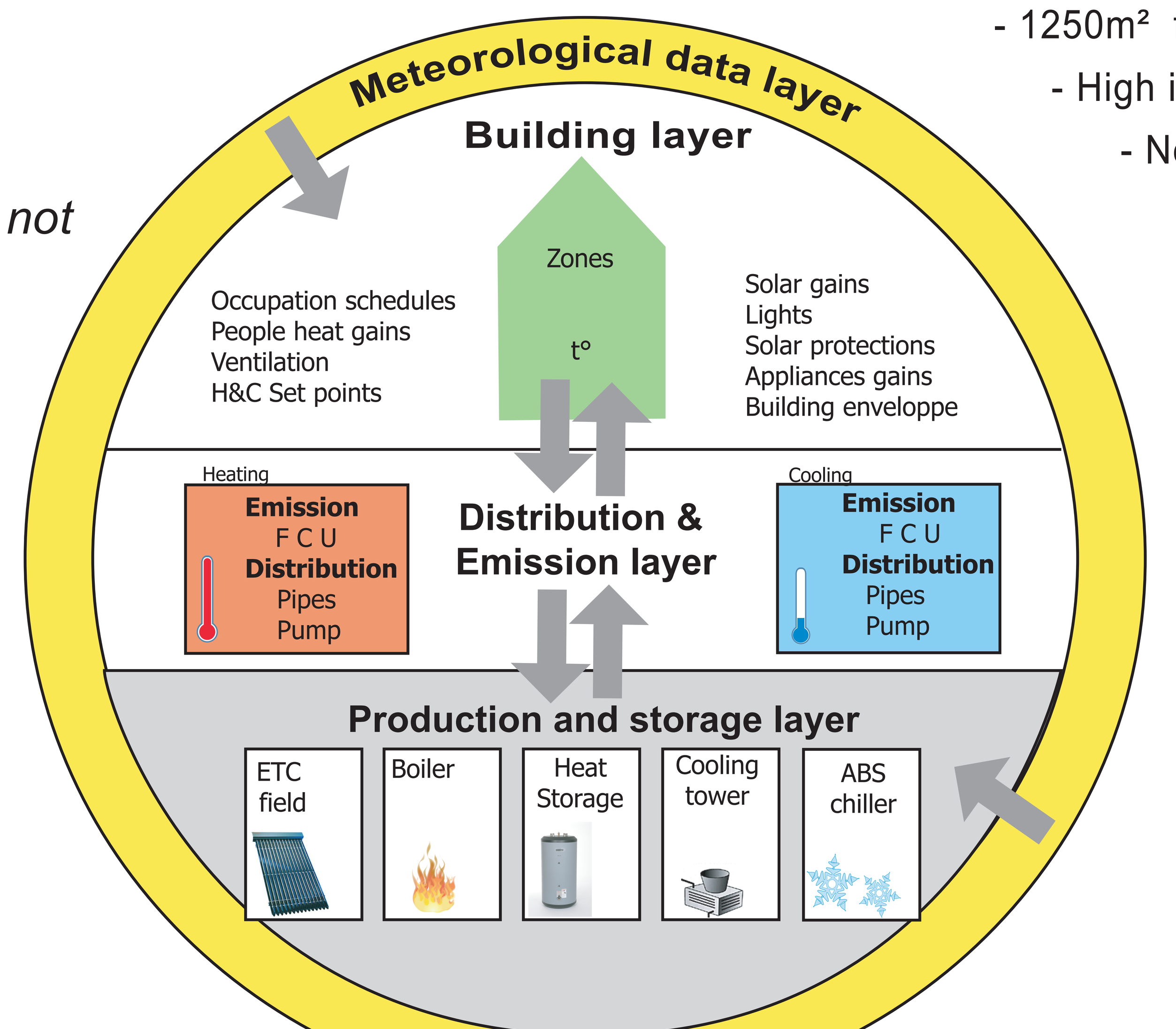
## Methodology

The development of solar air conditioning (SAC) technology is closely linked to its economical profitability. To check what are the real benefits of SAC installation, it is important to compute the energy savings as well as their essential parameters.

Creation of complete simulation environment let us discover interactions between all sub-parts of the system and gives the possibility to vary many parameters and check their influence on energy consumption for heating and cooling.

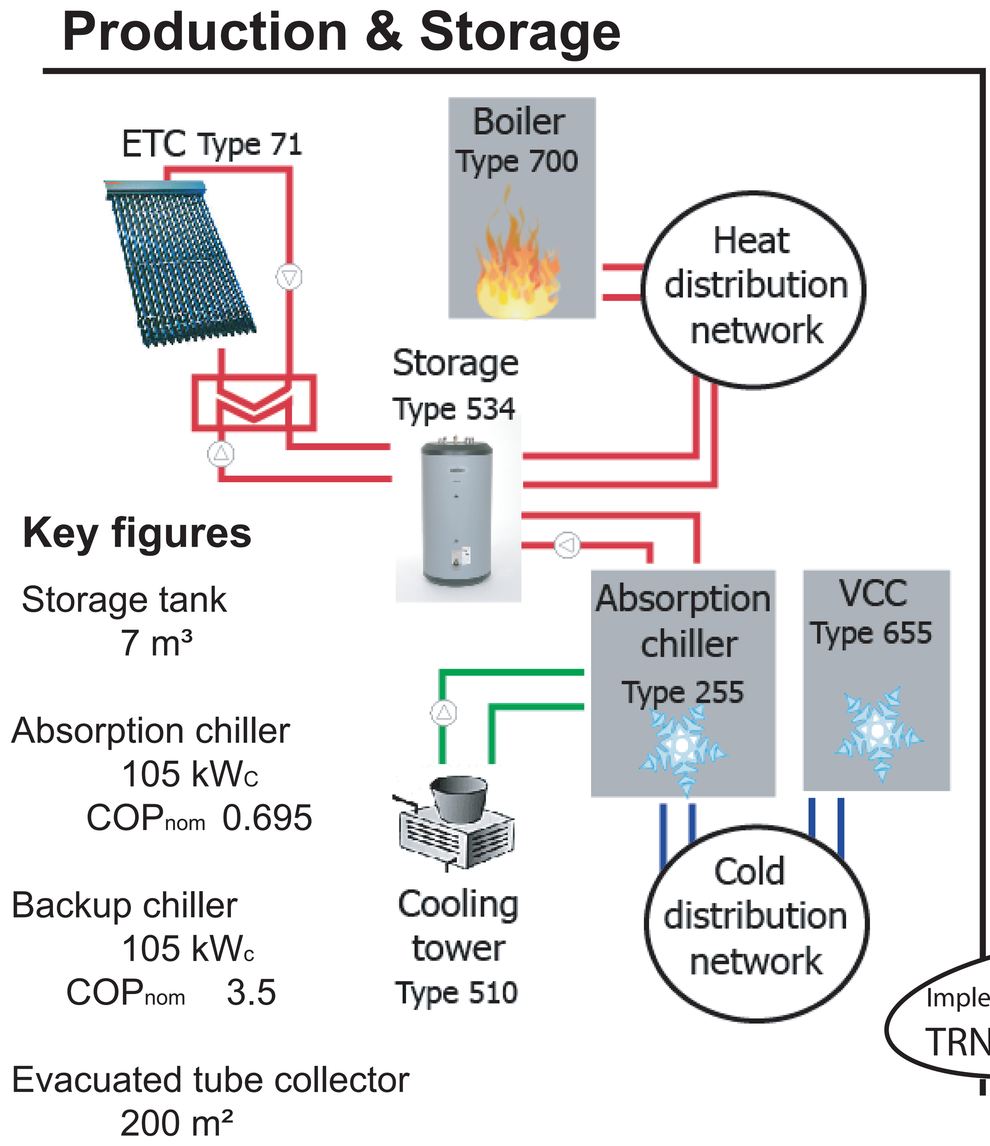
These strategies concern following devices operation :

- **Solar thermal field**
  *mass flow variation*
- **Heat storage**
  *utilization of heat for building heating or not*
- **Absorption chiller**
  *hot water temperature variation*
- **Emission devices**
  *cooling set point variation*

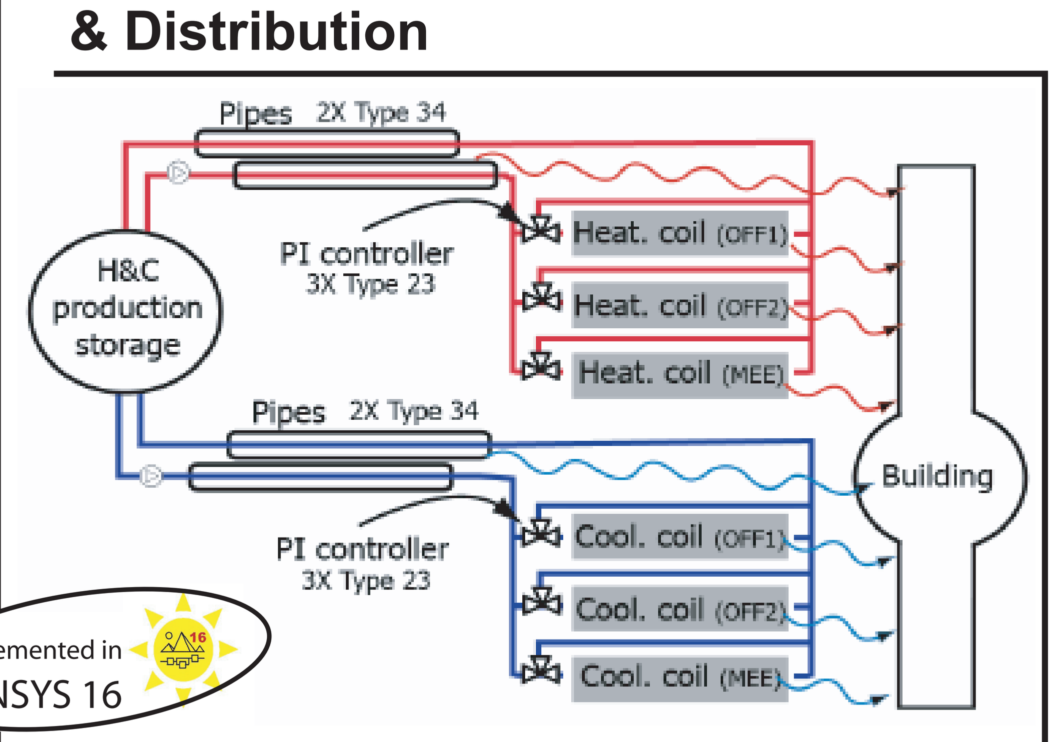



## Sub-system implementation

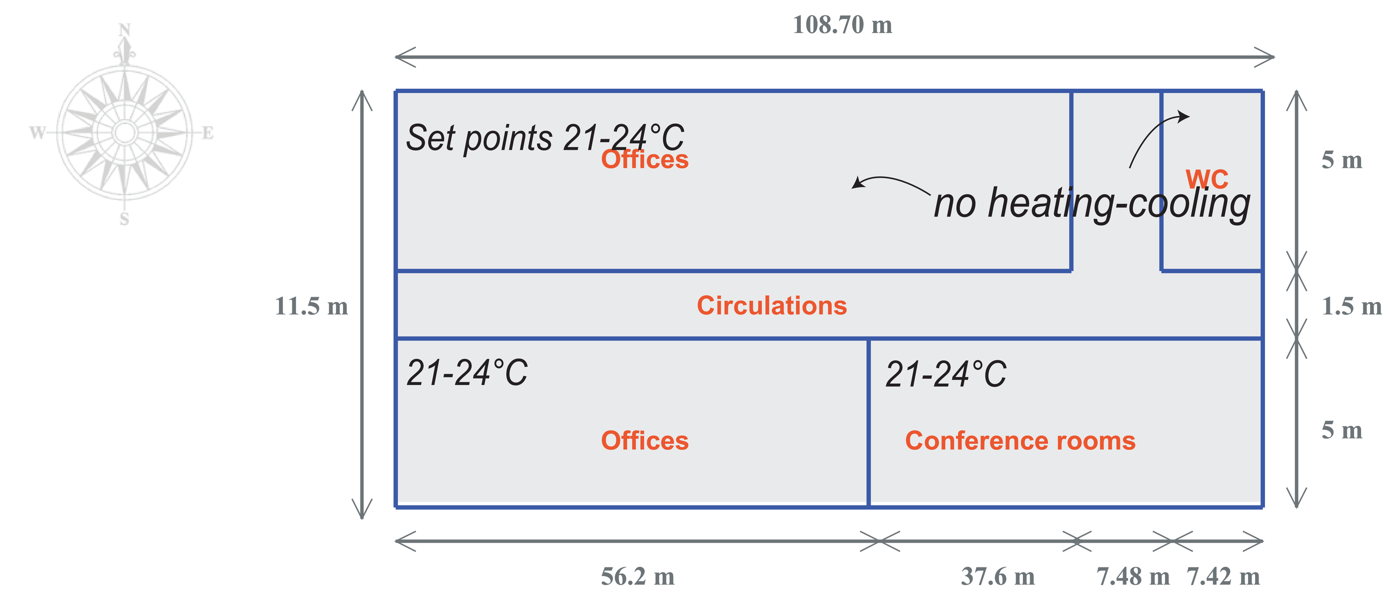
### Production & Storage




### Emission & Distribution




## Building characteristics

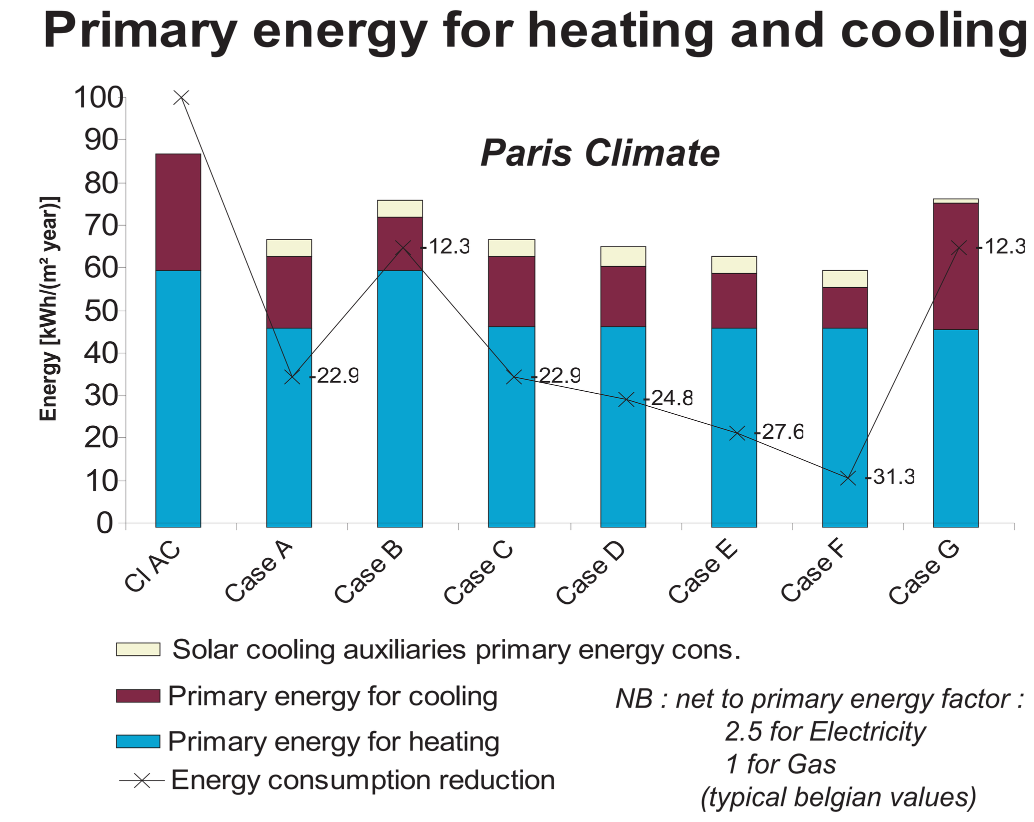



**Important features:**

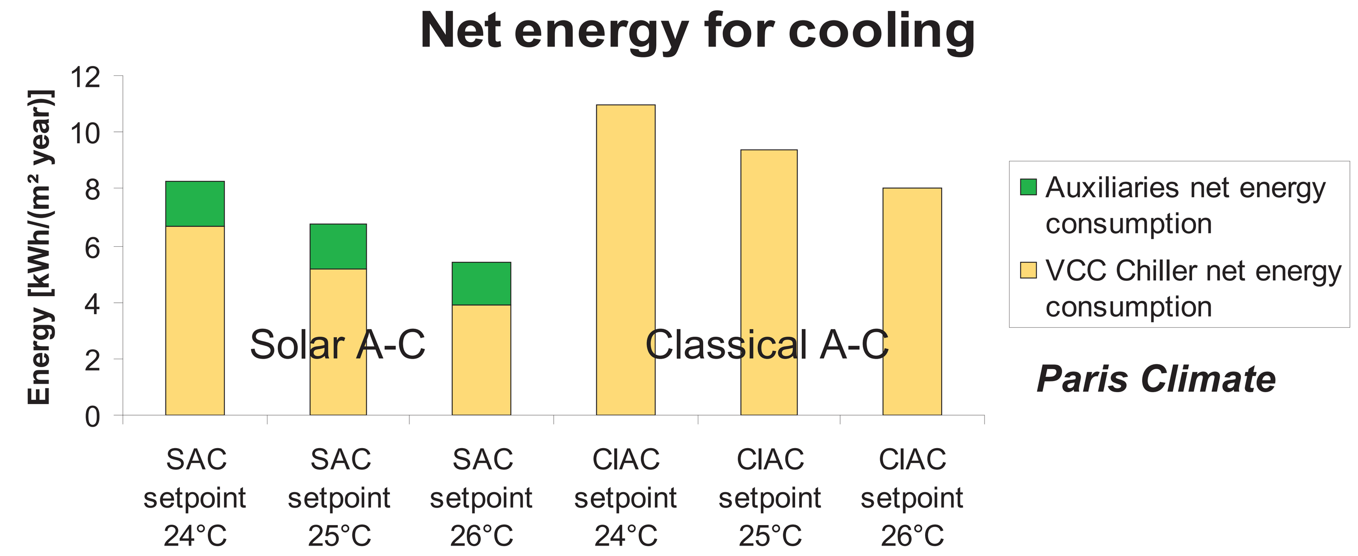
- Typical European office building (Case study IEA ECBCS 48)
- 1250m² floor (one floor of 12 floor building)
- High internal loads (appliances 15 W/m² ; light 6-18 W/m²)
- North-South largely glazed
- U value of walls = 0.80 W/(m².K) ; U windows = 2.95 W/(m² K)

## Results

### Primary energy for heating and cooling




### Net energy for cooling




## Test cases

| Case | Features | Primary energy H&C |
|---|---|---|
| ClAC | Classical Air-conditioning (Boiler for heating ; Vapour compression chiller for cooling) | 87.9 |
| A | Base case<br>Cooling setpoint 24°C – 60% RH hour)<br>Absorption chiller is switched on when top tank temperature >83°C | 67.7<br>[kWh/(m² year)] |
| B | Solar energy not used for heating building | 77.1 |
| C | Collector mass flow variation : linear value between 0 and 30 kg/($m^2_{coll}$ hour) depending on output collector temperature | 67.7 |
| D | Absorption chiller can be fed with water from 70 to 83°C depending on the cooling load | 66.1 |
| E | Set point is 25°C – 60% RH | 63.7 |
| F | Set point is 26°C – 60% RH | 60.4 |
| G | Solar energy only used for heating building | 77.1 |

## Conclusion

**Different scenarios are defined and revealed impact of control on energy consumption. Compared to classical air conditioning, energy savings reach 20 to 30% using solar air-conditioning. Room temperature set point has also great impact.**

**Other investigations about control can be done in further work. For example, cooling circuit flow and cooling set point variations seems to be crucial for energy savings.**