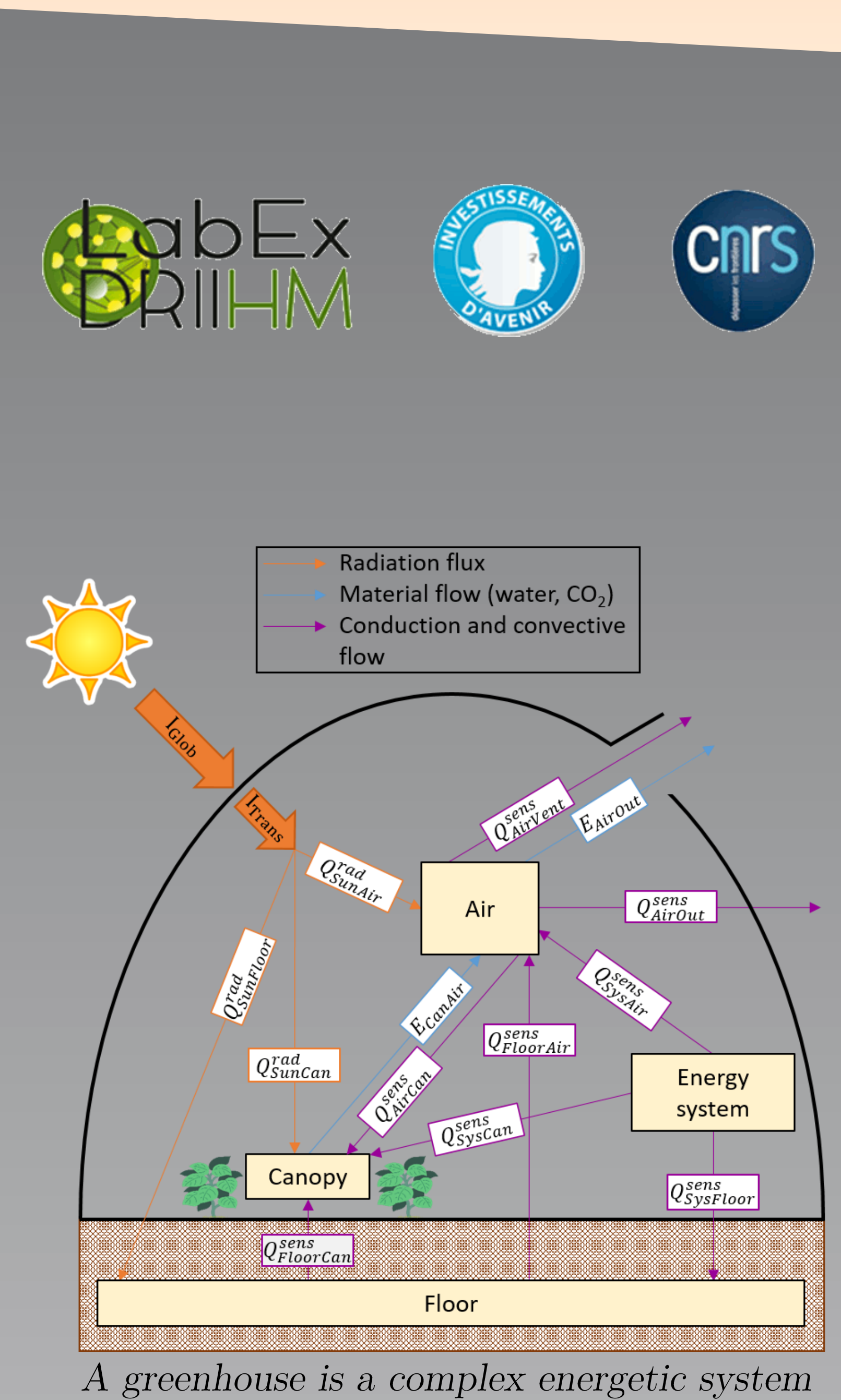


On the way to developing northern greenhouses adapted to population and climate: energy issues

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Kuujjuaq Greenhouse

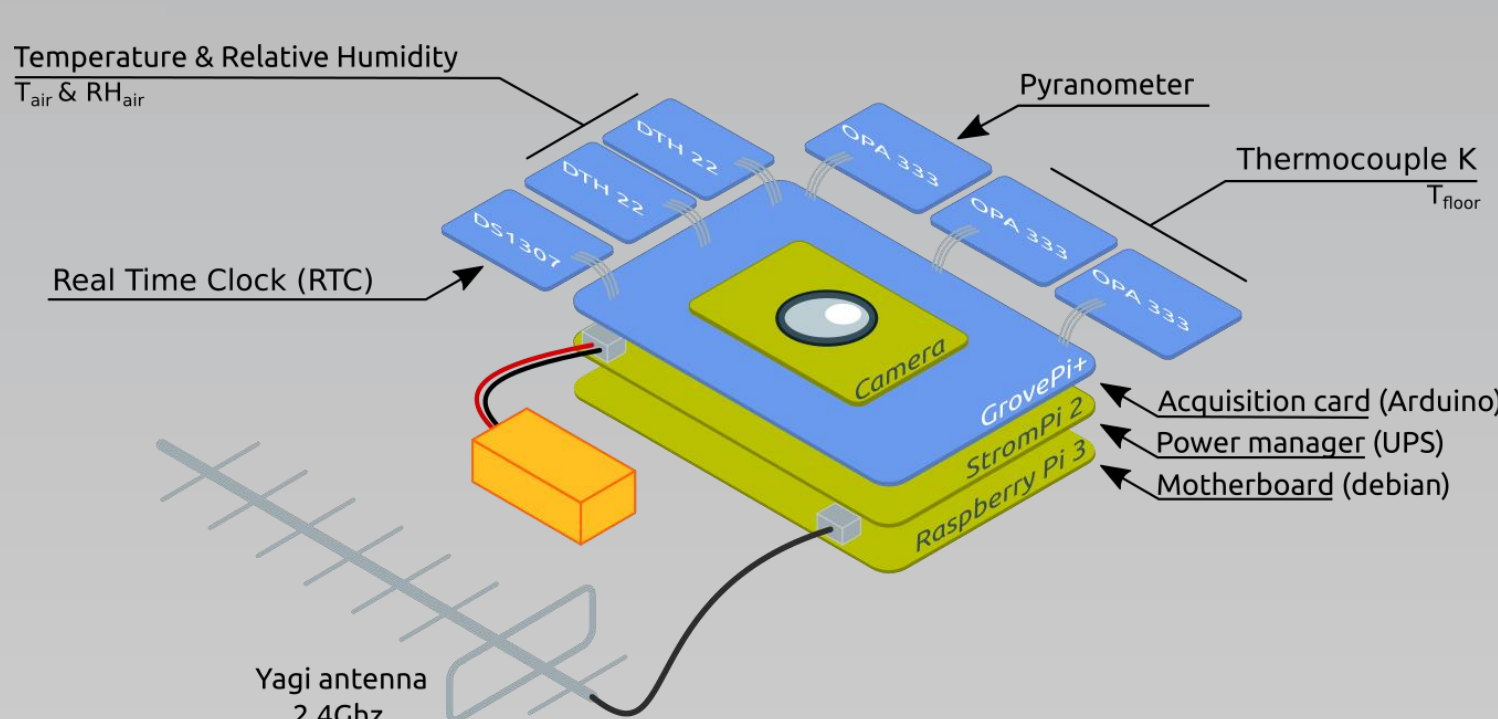
- Built in 2012
- Ground surface of **1500 sq. ft** (140 m²)
- Made of **polycarbonate**
- Growing season from June to September (no heating system)
- In 2016, **one ton** of fresh vegetable were collected



Seqineq objectives

- **Increase the culture period** and the production with a **fossil fuel consumption as low as possible**
- However a greenhouse is a **complex energetic system** due to multiple and strong interactions between canopy, indoor climate and outdoor weather
- A **numerical model** is necessary to quantify the impact of energy systems to be added
- **Instrumentation** is needed :
 - 1) To better understand the thermal behavior of the greenhouse
 - 2) To obtain unknown data (input of the model)
 - 3) To validate the numerical model

Instrumentation



Acquisition system using electronic boards which are:

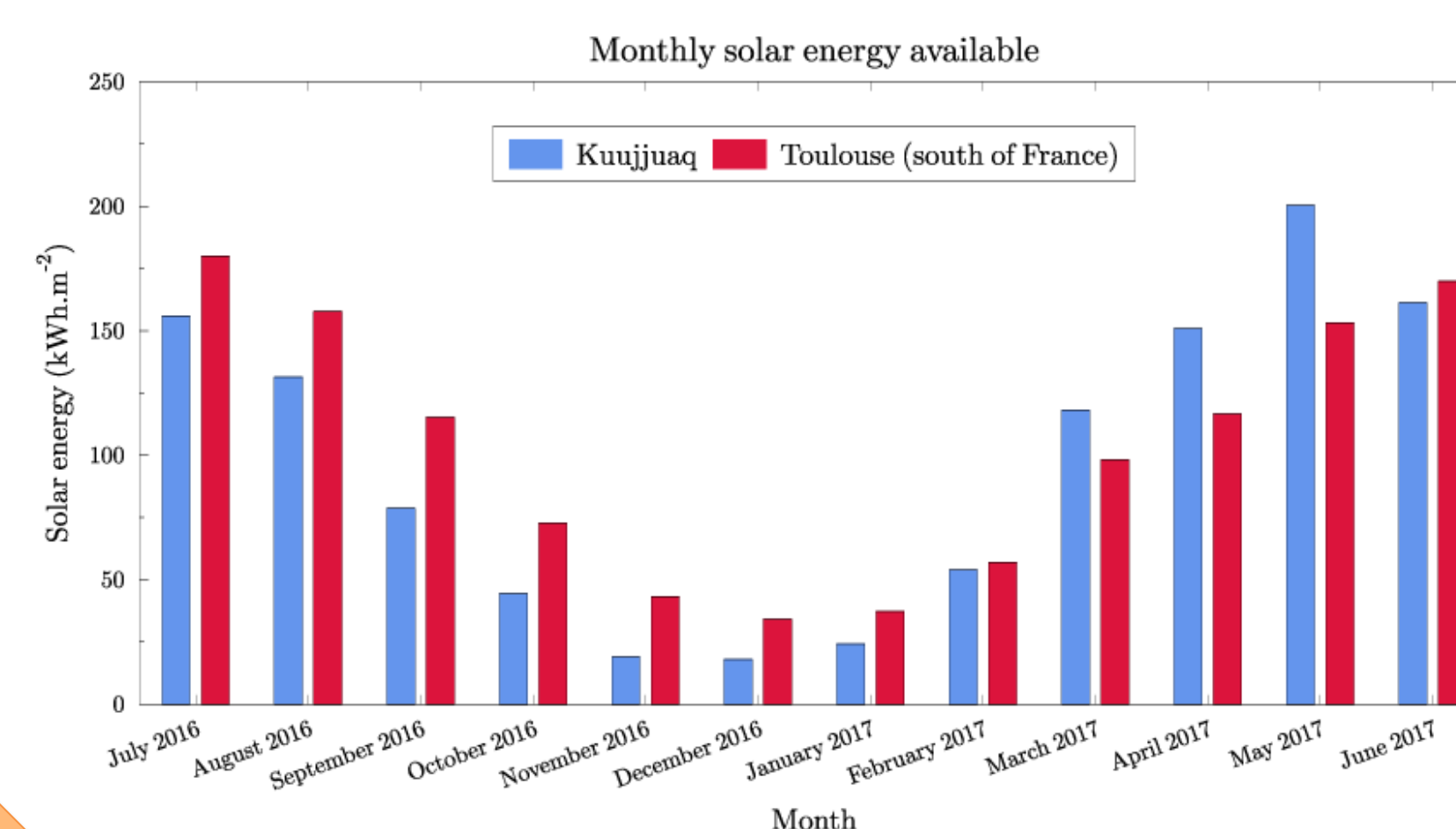
- Cheap, robust, lightweight, small and standardized
- Using open source environment

Automation in real time of the following data:

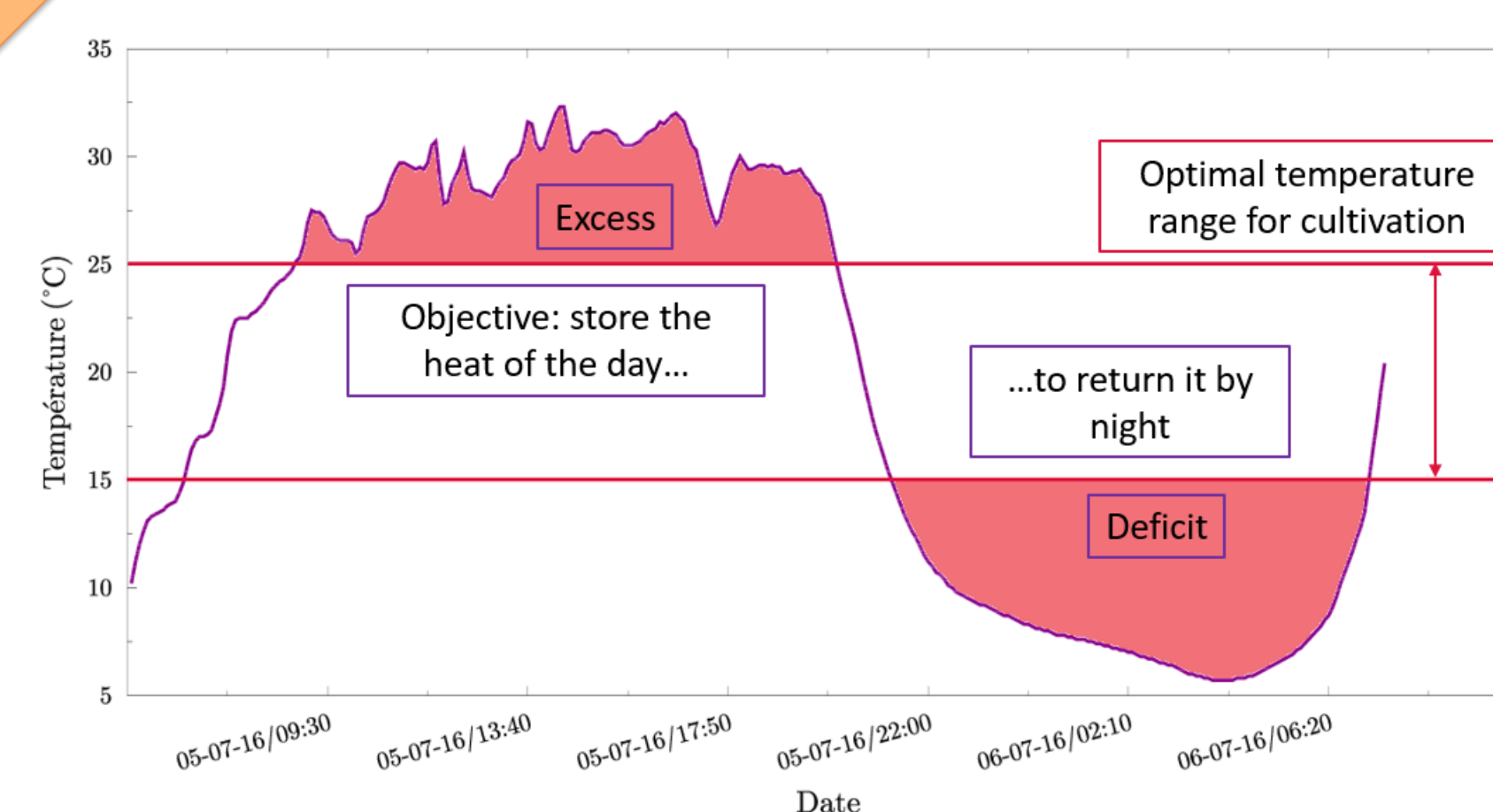
- Solar fluxes inside and outside the greenhouse
- External temperature and RH
- Ambient temperature and RH
- Soil temperature
- One photo a day



Data



- More than **one year of new data**, unavailable in the literature, were collected
- Important potential of **solar energy** to produce electricity or heat



- No thermal gradient but the **temperature difference** is high between **day and night**: mean difference of 25 °C (77 °F)
- Solution: increase **thermal inertia** thanks to water or rock in order to **store the daily heat** to release it by night

CONTACT

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Outlook

- Complete the instrumentation by **adding anemometers and CO₂ sensors** in order to have a better understanding of the interaction between plants and climate
- Develop an **online tool** (which include the greenhouse model) to design **optimized northern greenhouses**
- This project is part of a **large-scale project** currently in development

