Master Degree in Innovative Technologies in Energy Efficient Buildings for Russian & Armenian Universities and Stakeholders (MARUEEB)
Junior Intensive Course
ENERGY EFFICIENT BUILDINGS

***W*ater-refrigerated *S*olar *A*ssisted *H*eat *P*umps with hybrid *PVT* solar panels**

The pilot plant W-SAHP-PVT

PALACUS (UNIGE)
University Sporting Centre

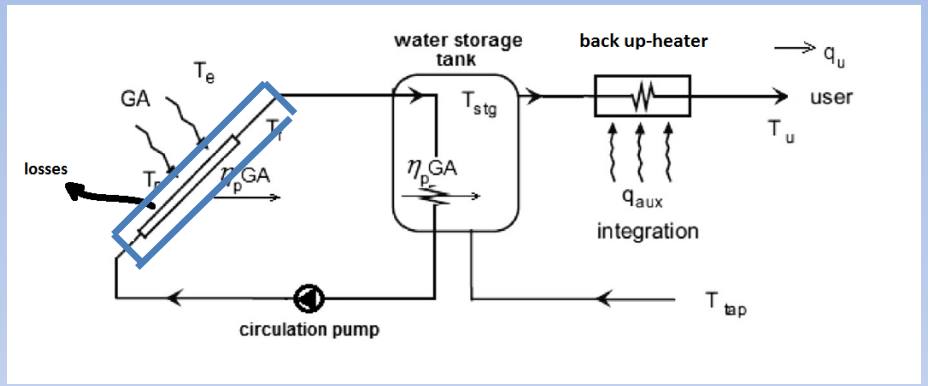
Water-refrigerated Solar Assisted Heat Pumps with hybrid PVT solar panels

Objective: ***easy and efficient production of***
-DHW (Domestic Hot Water)
-SH (Space Heating)
Using solar energy for up to
70% of energy building needs (DHW+SH)

(depending on environment, climate, geographical location)

The concept

Tp ***Tuser***



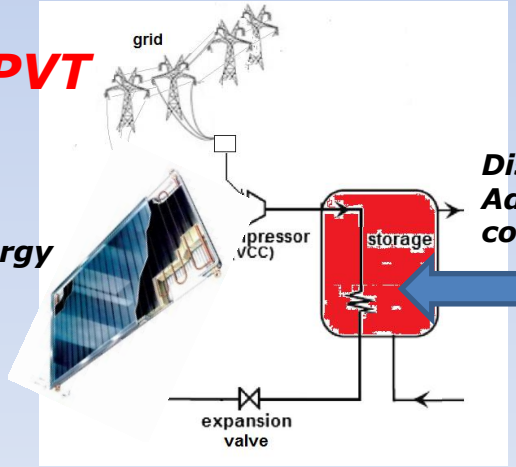
Traditional Solar Panel

-High thermal losses (up to 60%)
-Low % coverage user needs (15%)
- High cost of solar energy (insulated panels, large surfaces, huge storage tanks…..) 30€/kWh

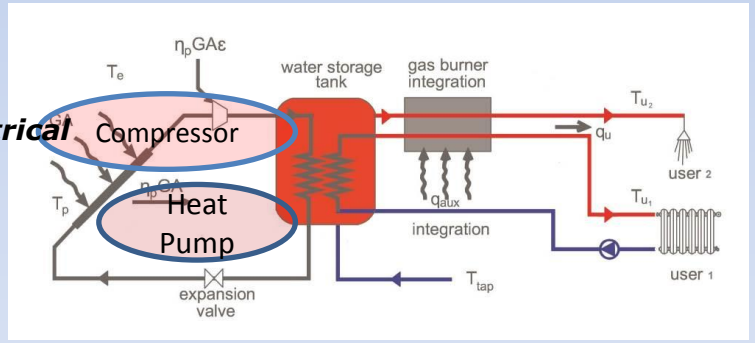
Solar Assisted Heat Pump ***SAHP***

SAHP-PVT

Hybrid PVTs for more electrical energy



Disvantage: Additional Electrical consumption



-Very low Tp and thermal losses (down to 5%)
- High % coverage user needs (up to 70%)
- Low cost of solar energy (bare panels) 10 €/kWh

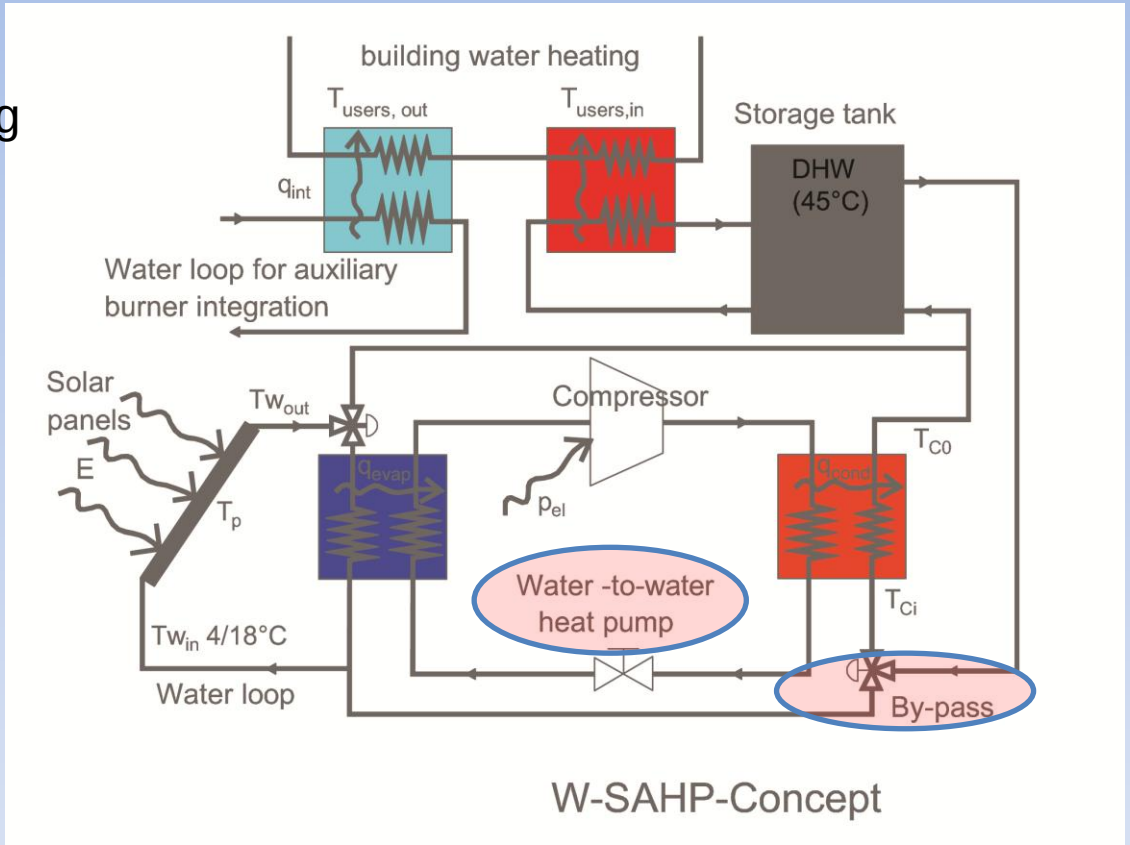
For very large systems, two-phase flow give rise to very big problems in fluid distribution, so it is mandatory to switch to water loops.

Water Solar Assisted Heat Pump with hybrid PVT panels

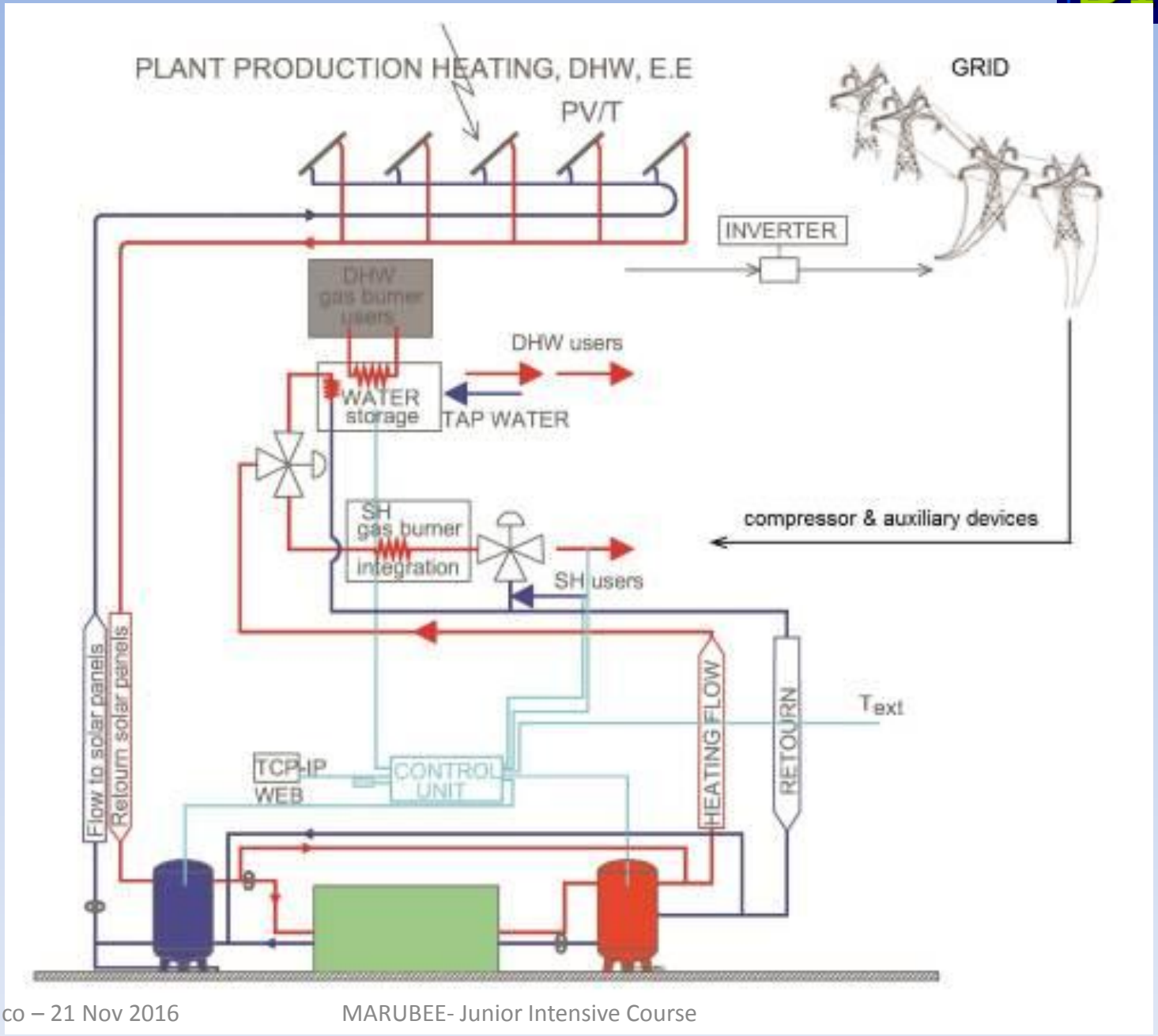
W-SAHP-PVT

Advantages:
-easy installation also with long distances
-possibility to use standard components
-Possibility to use a by-pass (winter / easter)

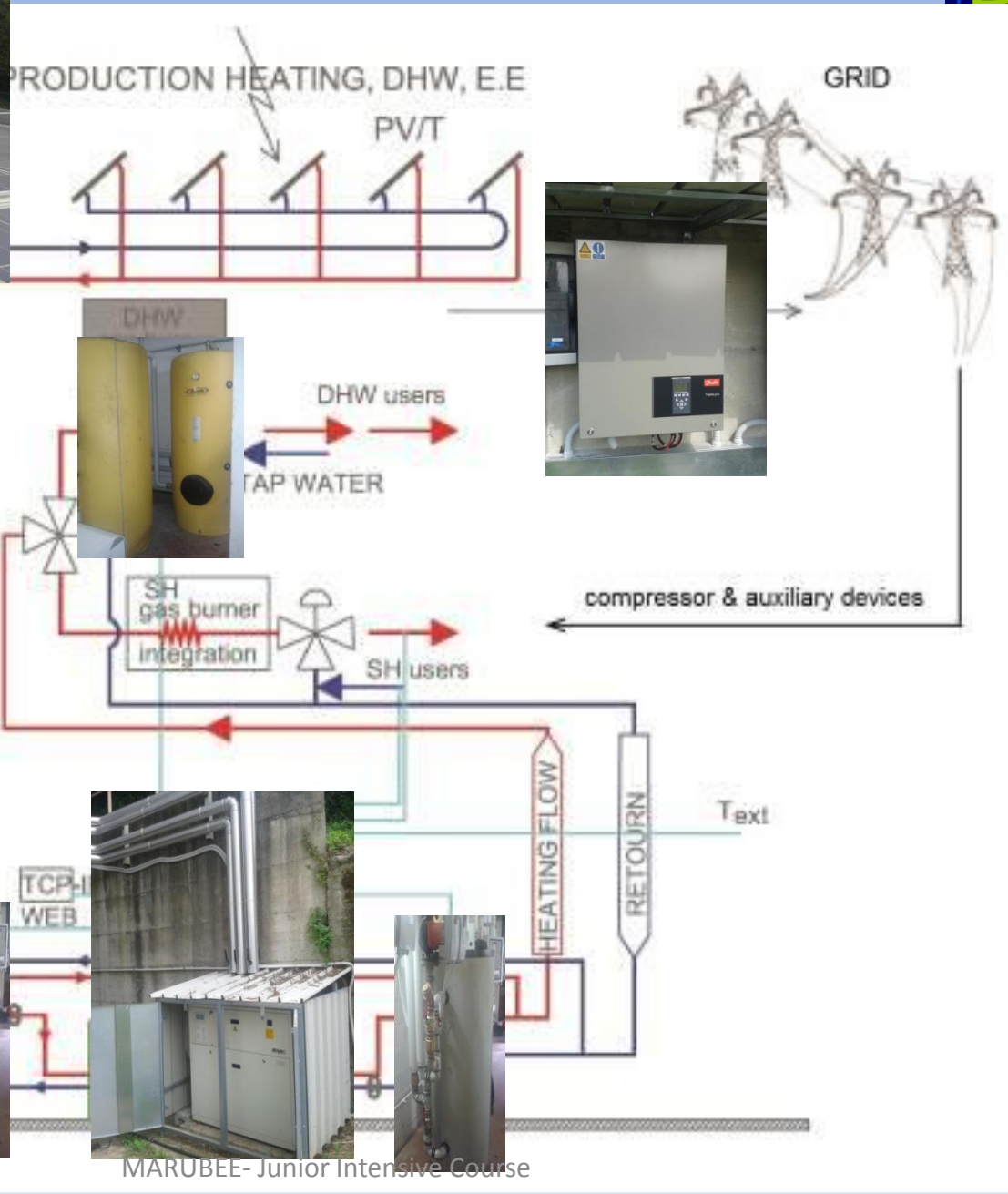
Disvantages:
- auxiliary heat exchangers
- Complexity
- smart control is needed
- interface with auxiliary heaters



PALACUS PILOT PLANT



PALACUS PILOT PLANT



PALACUS PILOT PLANT – SOME DATA

The pilot plant was built at PALACUS, the Sporting Centre of University of Genoa.

Based on a co-funding initiative of Liguria Region the pilot plant has a total cost of approximately € 260k€.

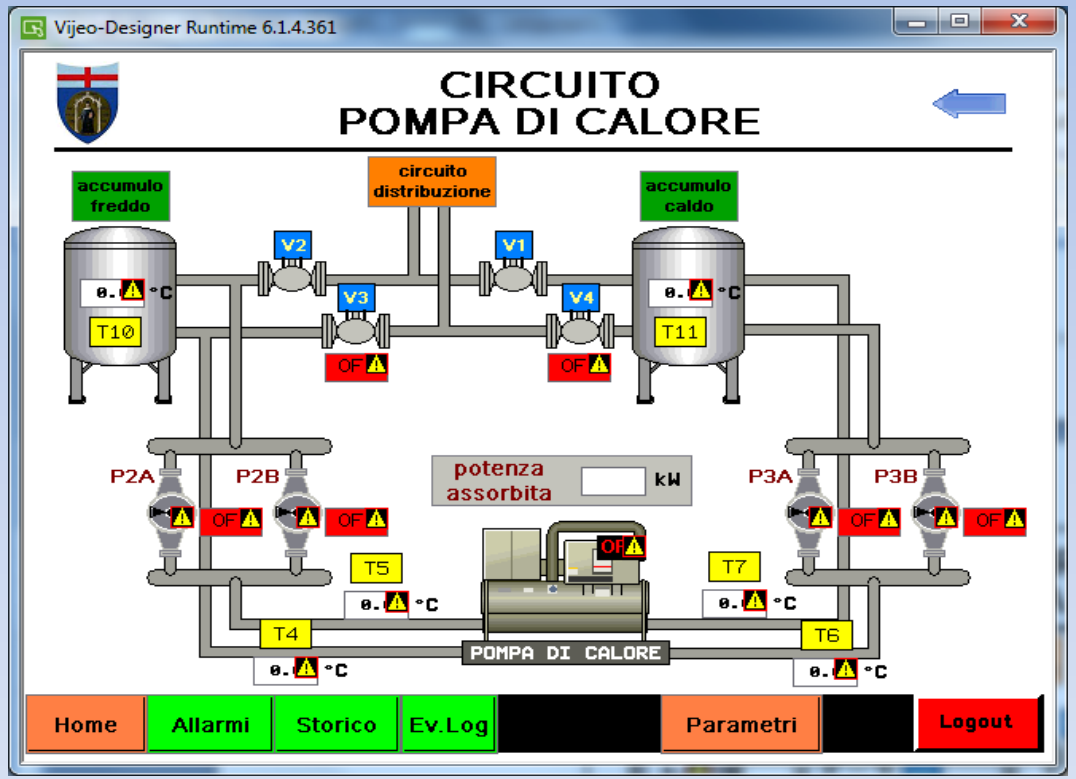
The system integrates W-SAHP-PVT into existing gas boilers for space heating and domestic hot water. It has a nominal power of 20kWep and 60kWt, with 140m2 of deployed PVTs. Here the summary of expected energy performance and economic data:

- Thermal energy supplied by the PCEA-PVT to users (kWh / year) 92,515.5
- PV Electricity supplied 25000 kWhel/year
- Electrical energy consumption by PCEA-PVT 14000 kWhel/year
- Net yearly electricity saved 11000 kWhel/year
- Total net primary energy savings 9.37 toe / year
- total annual budget saving € 6,162 / year
- Time of return with 80% funding 7.1 years
- Average cost facility / toe € 27,358 / toe

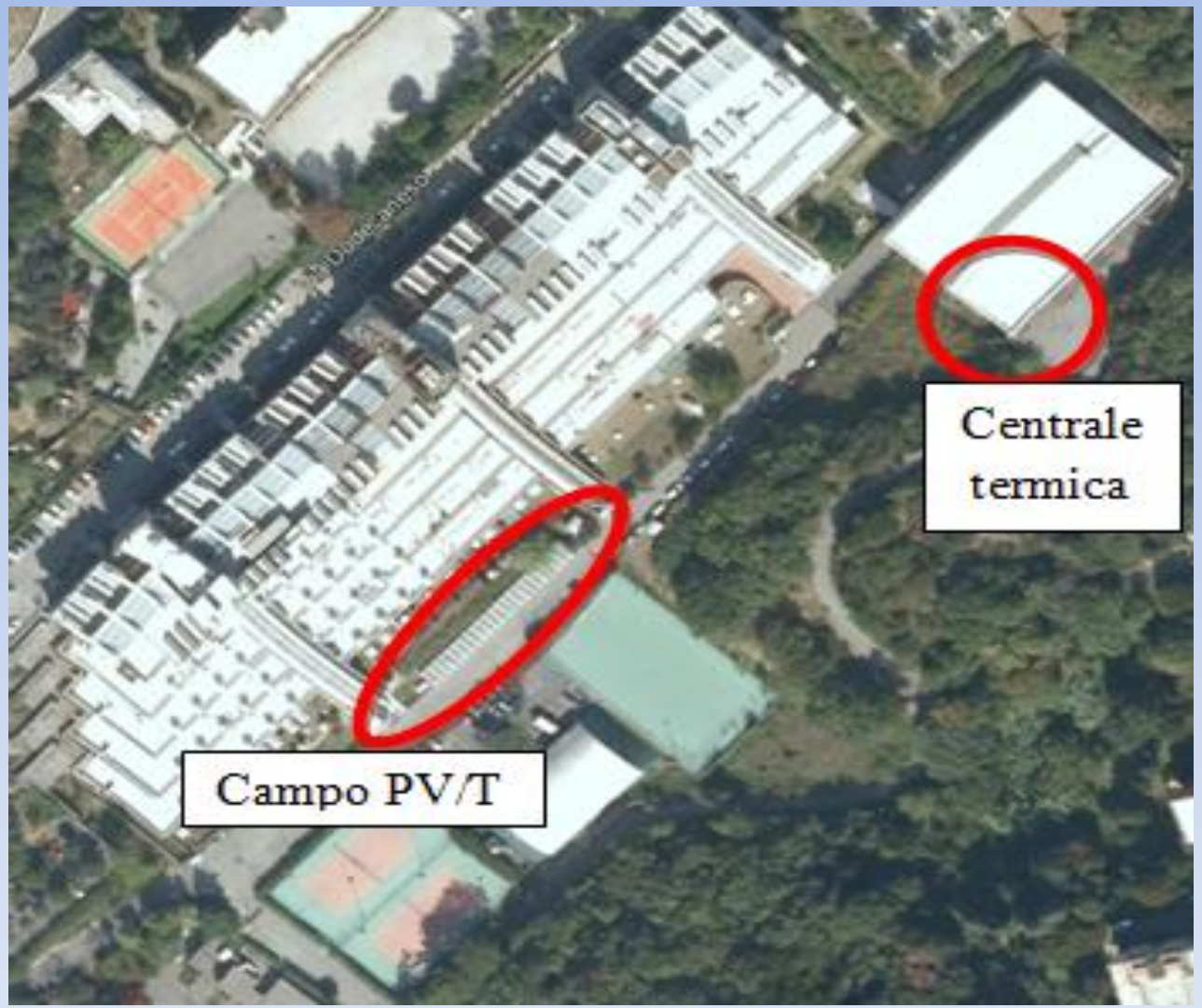
PALACUS PILOT PLANT

How can all the plant components be properly operated and monitored?

By means of smart control sytem



PALACUS PILOT PLANT AERIAL VIEW



Thank you Luca A. Tagliafico tgl@ditec.ungie.it

See you next time in Genoa!!!!