Solar Building XXI

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Solar Building XXI

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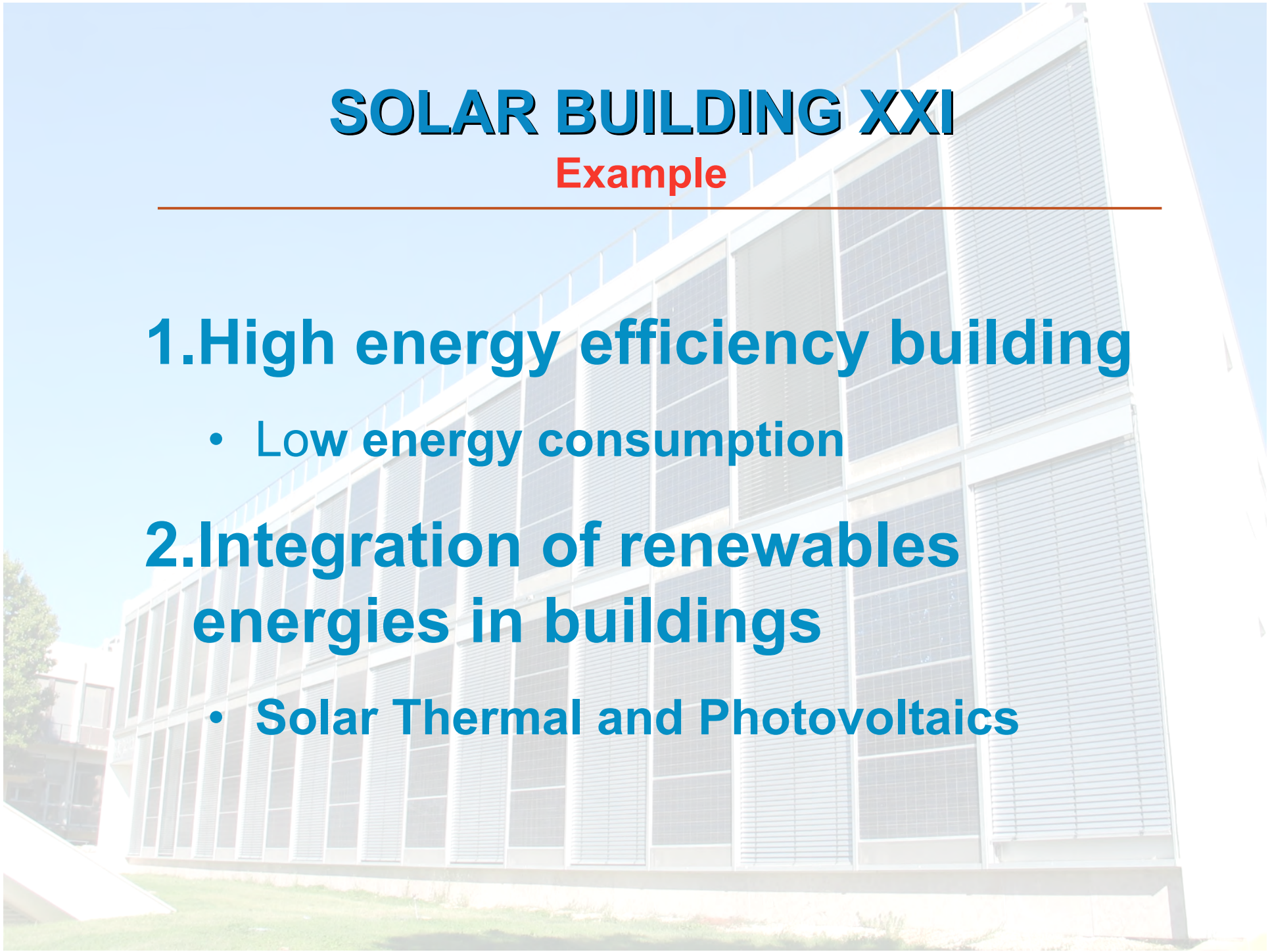
Lisbon – Portugal
2006



SOLAR BUILDING XXI

Example

1.High energy efficiency building

- Low **energy consumption**

2.Integration of renewables energies in buildings

- **Solar Thermal and Photovoltaics**

Strategy:

- **Building Shell** highly insulated envelope (walls and roof)
- **Building Design** allows for optimal use of natural sources of energy: solar energy, cooling sinks, day-lighting and natural ventilation
- **Passive Heating and Cooling Systems**, allows to reduce significantly space heating and cooling or self sufficient
- **Photovoltaic integration** provide energy for lighting and electrical appliances to the building
- **Solar Thermal System** for domestic hot water and space heating back-up
- **Day-Lighting and Natural Ventilation**

SOLAR BUILDING XXI

INNOVATION

1.Solar Facade

- Integrated Photovoltaic system

2.Heating System

- Solar thermal system in the roof
- Heat recovery from the photovoltaic

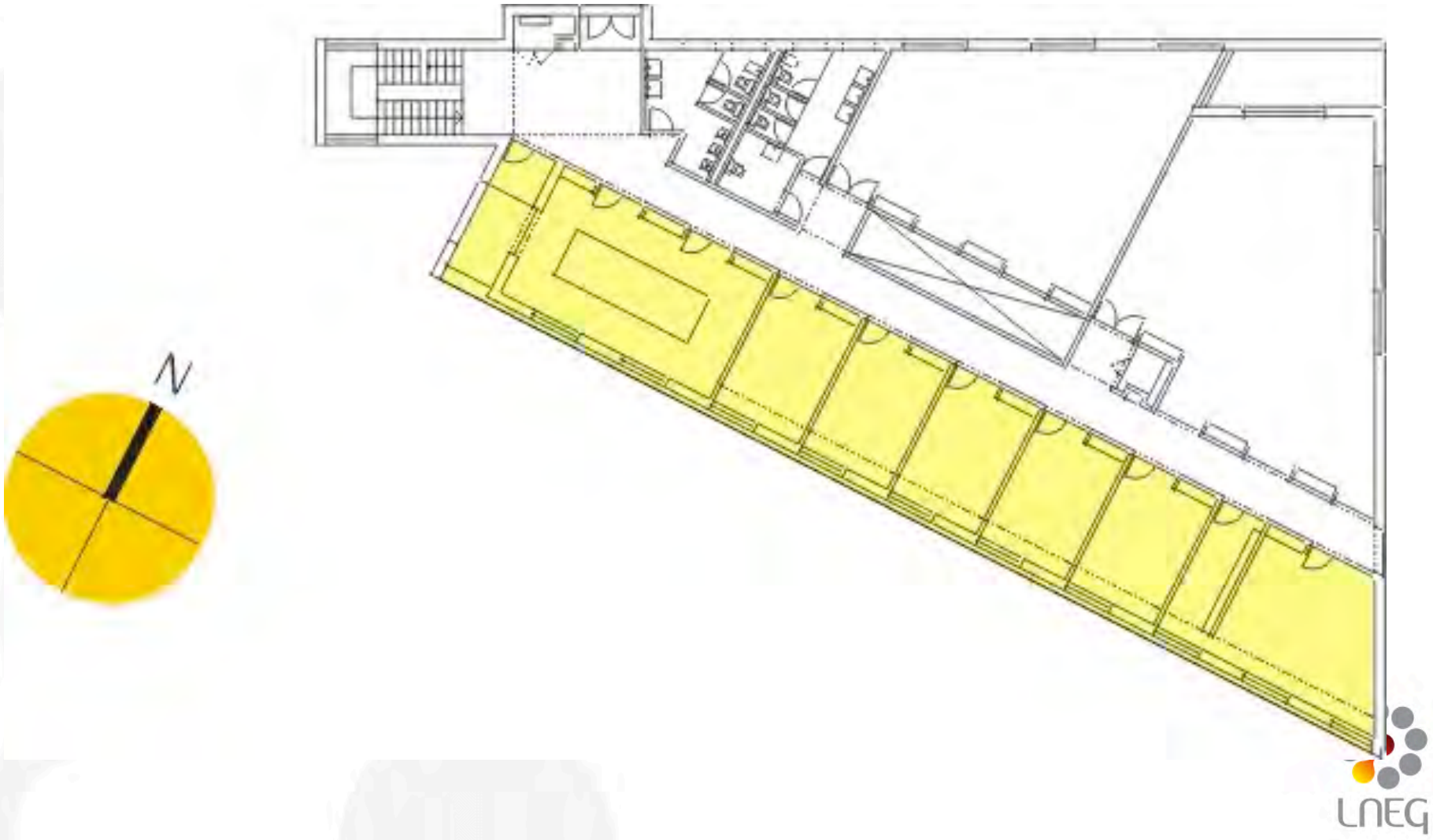
3.Cooling System

- Ground cooling system

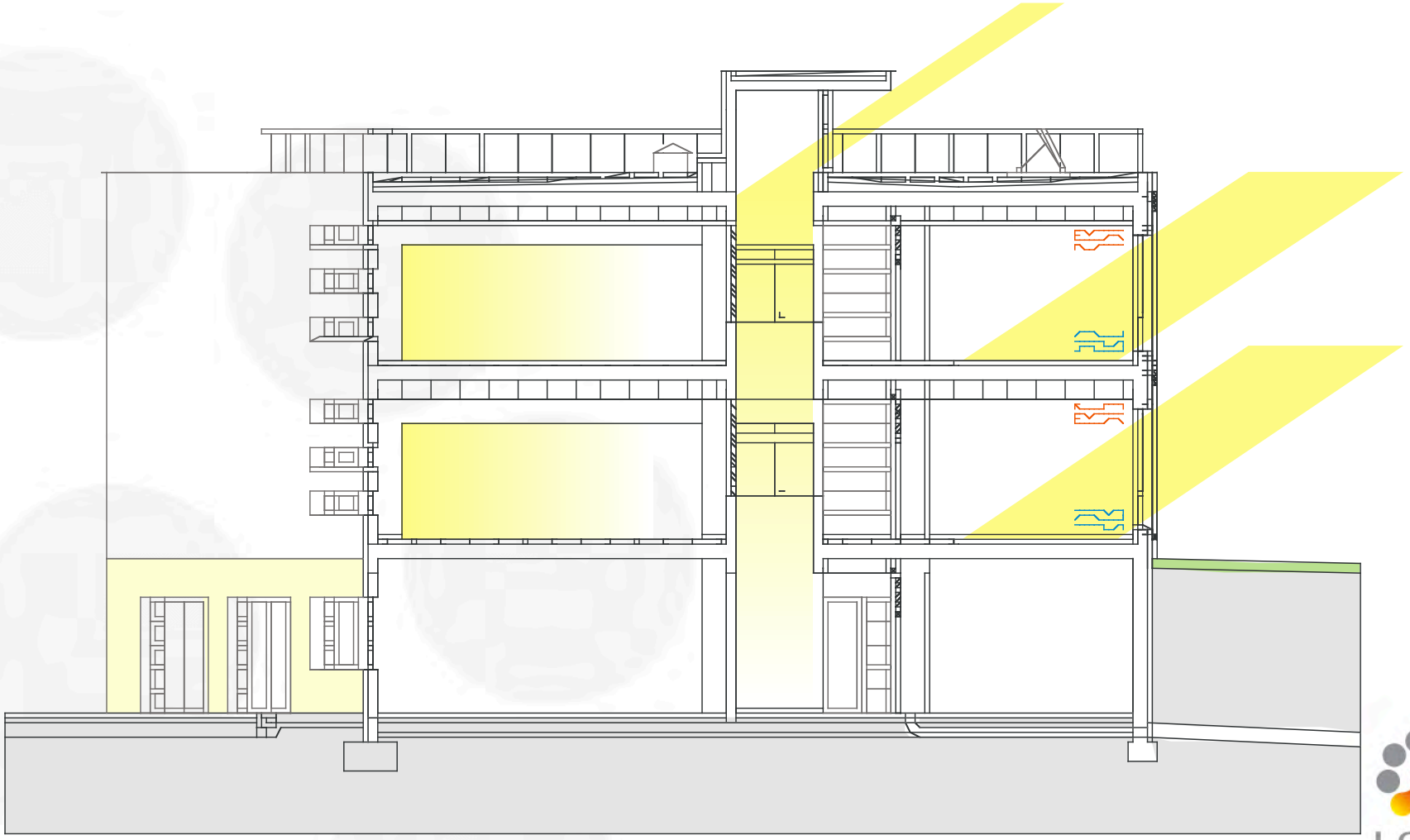

Solar Building XXI
INETI, Lisbon - Portugal
Solar Thermal
Produce Hot Water to heat the Building in Winter
Photovoltaic System
Produce electricity to be used in the building


East and North

Plant



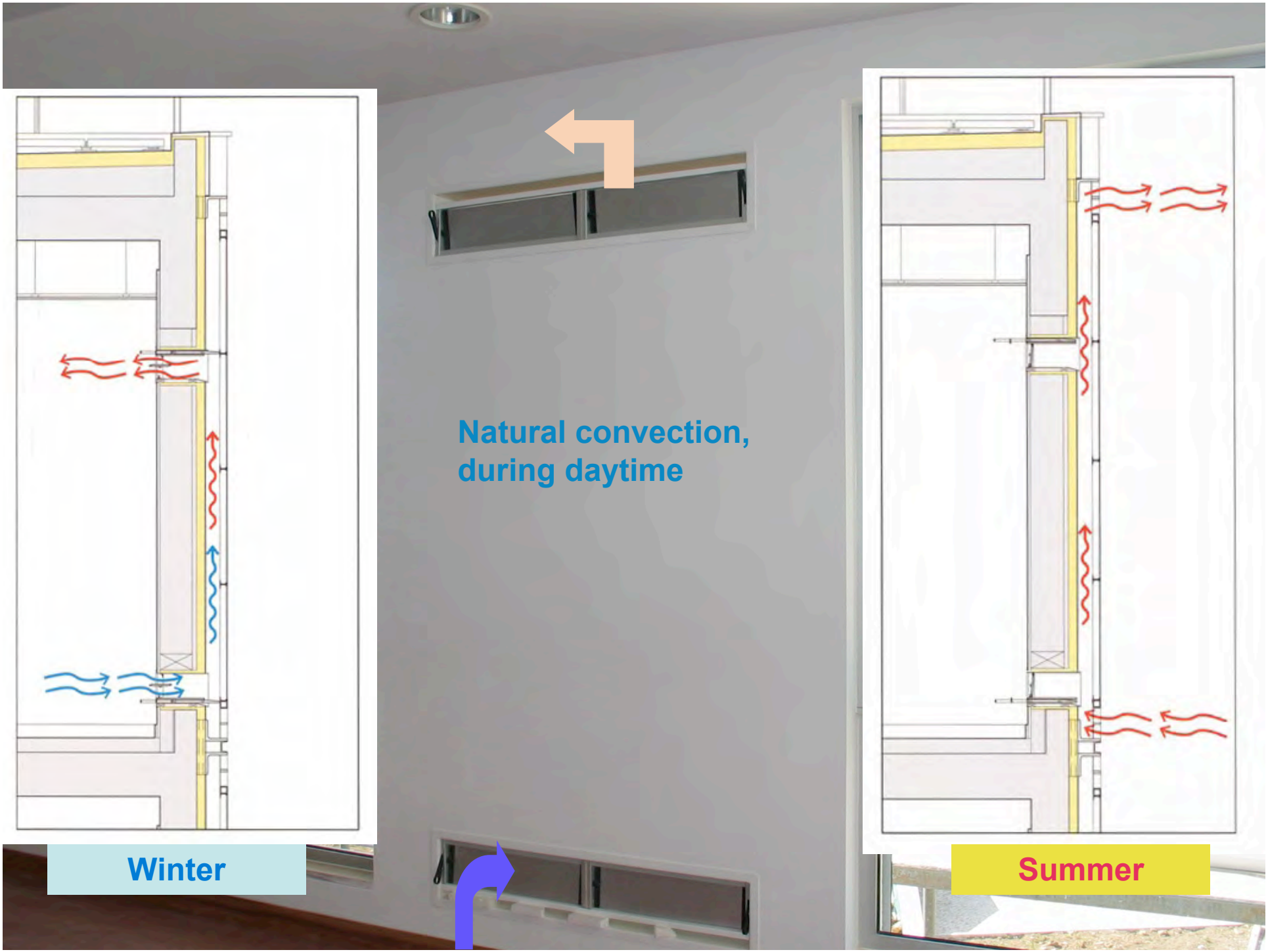
Winter



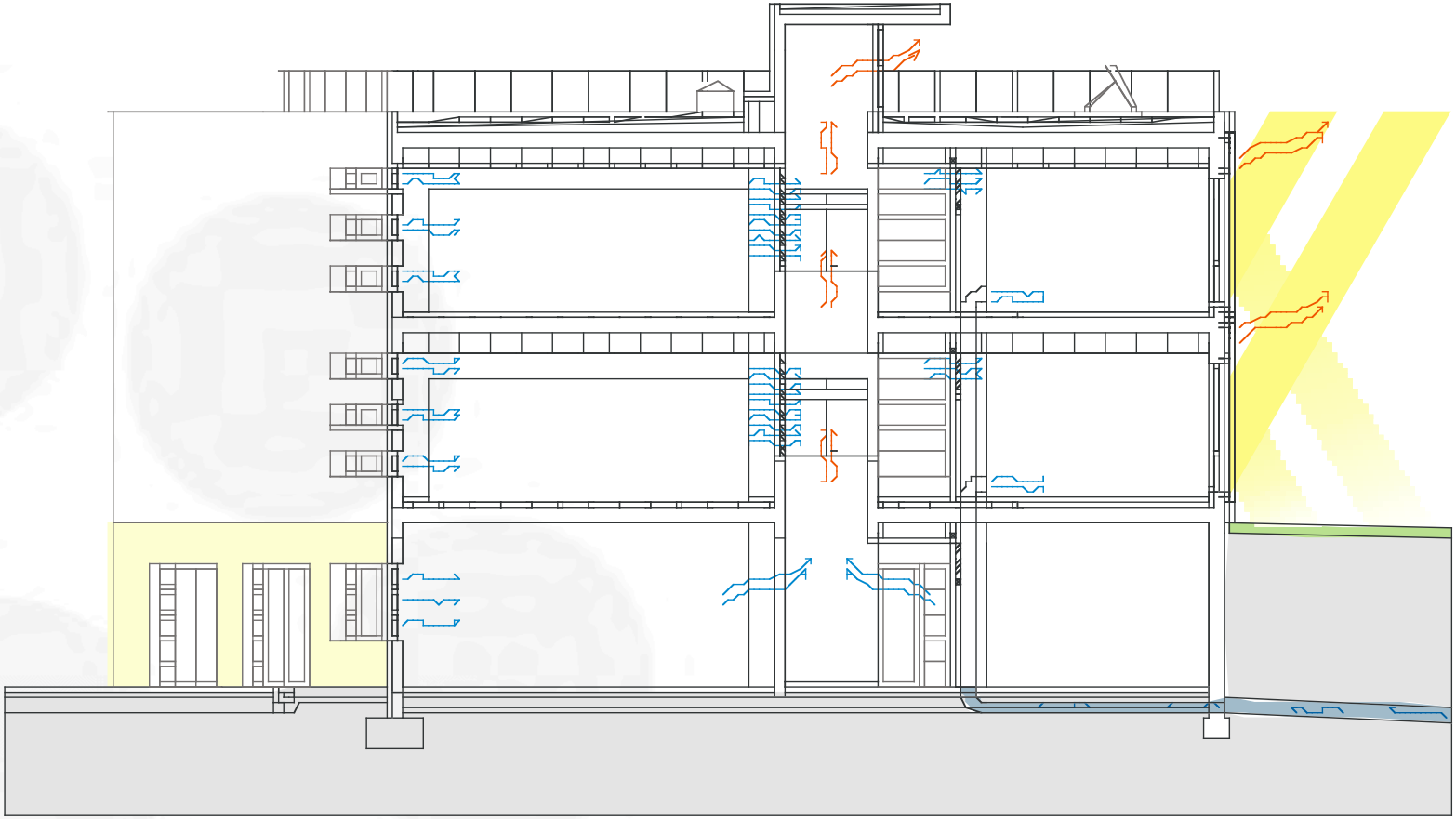
Photovoltaic System

Integrated in the south facade ;

1. PV-Polycristaline (96 m^2 de área)
2. Production for a year (Lisbon – Vertical Surface); **12 MWh**
3. Correspond to (**70-80%) consumption energy in the building.**
4. From the PV there are an **heat recovery** (natural convection) to heat the building.

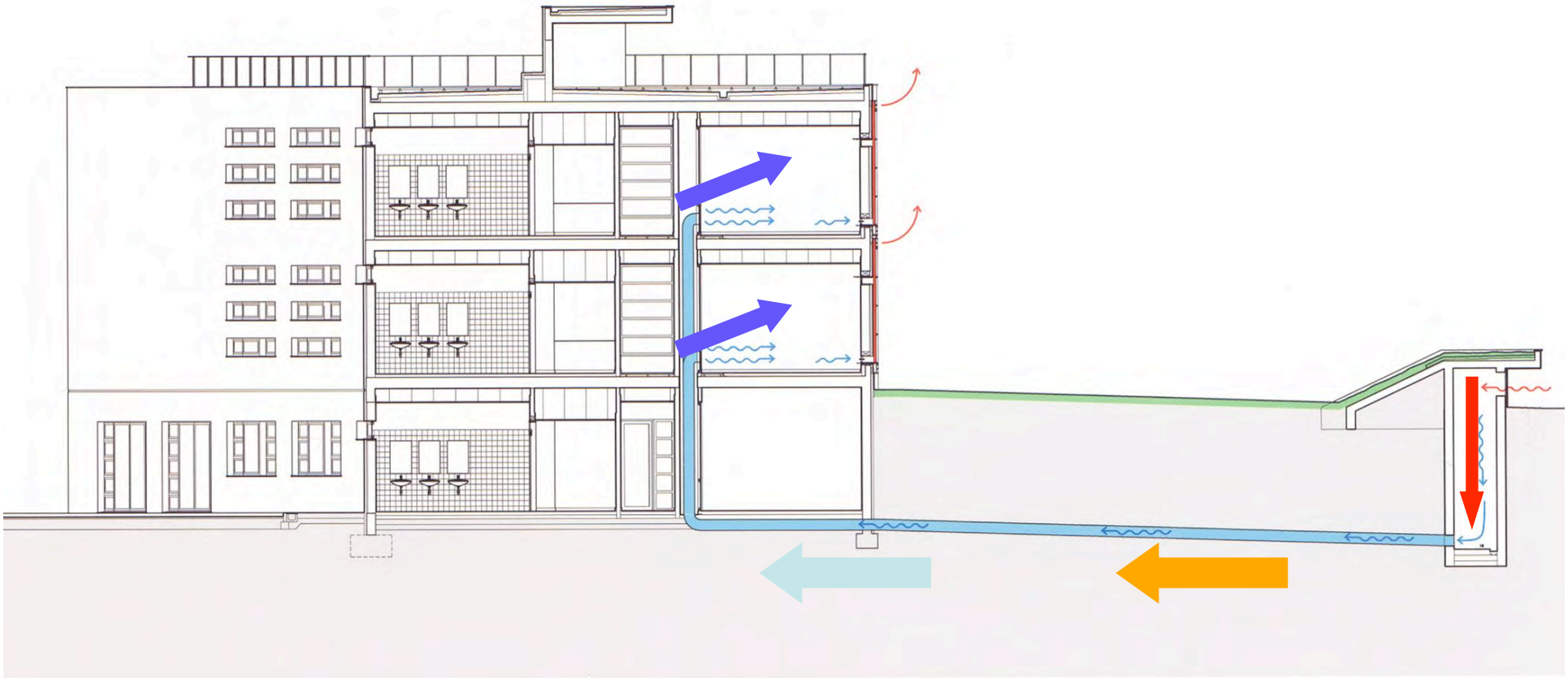

Natural convection,
during daytime
Winter
Summer

Summer

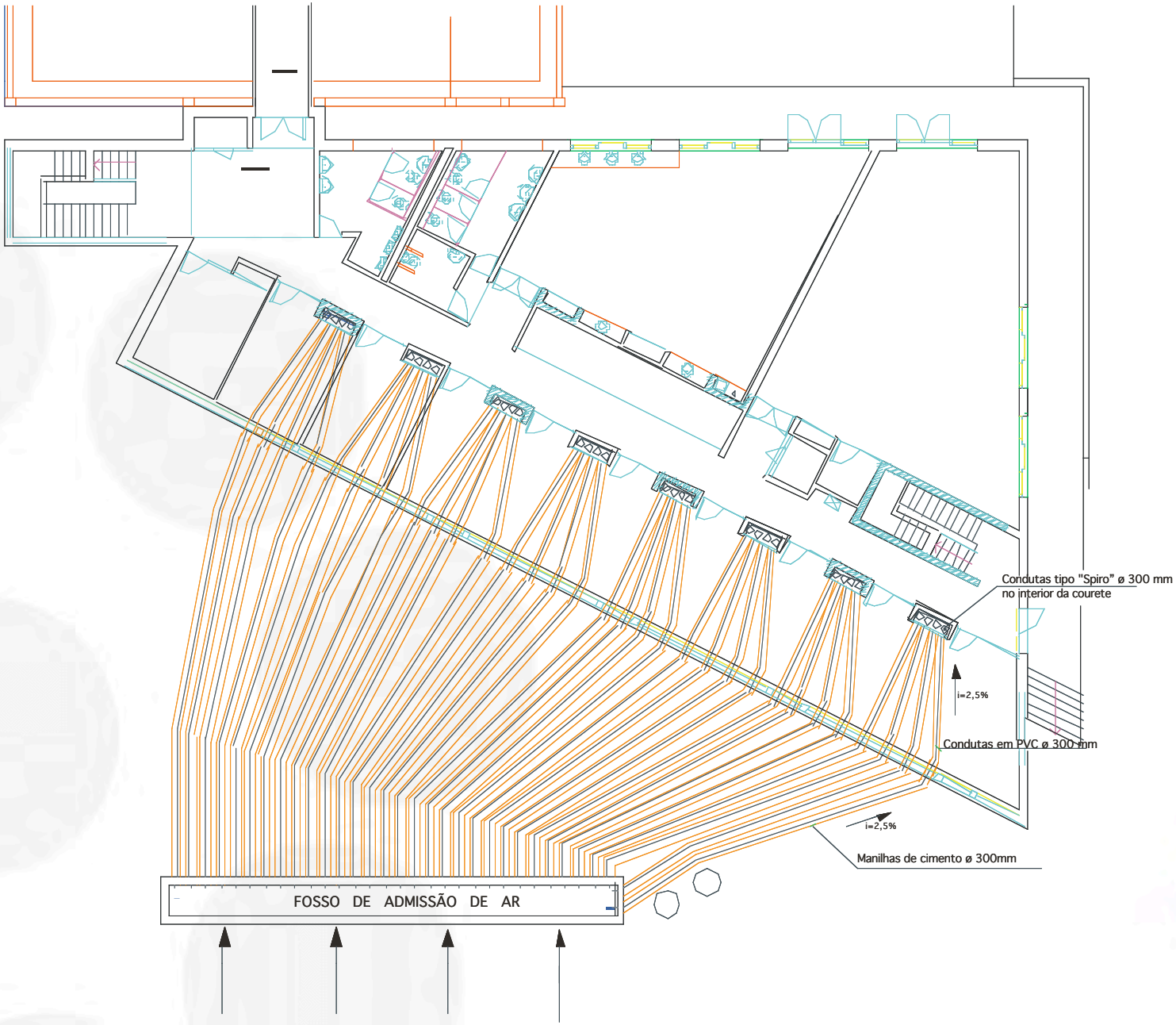



LNEG, Lisboa
South facade in summer

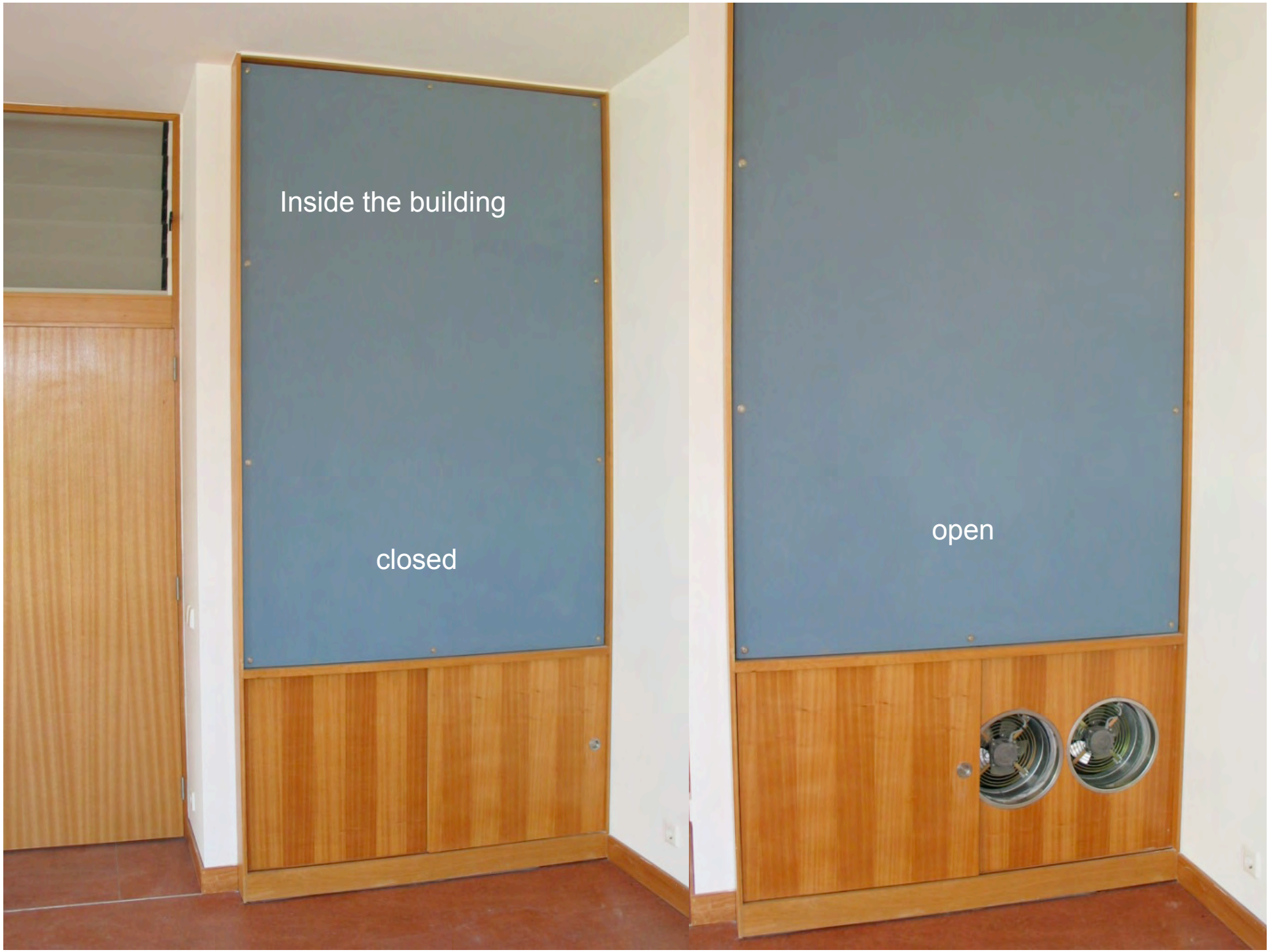
No Air Conditioning



Ground Cooling



Pipes inside the building


Inside the building
closed
open

Ventilations and Lighting strategies


Natural Ventilation and Lighting

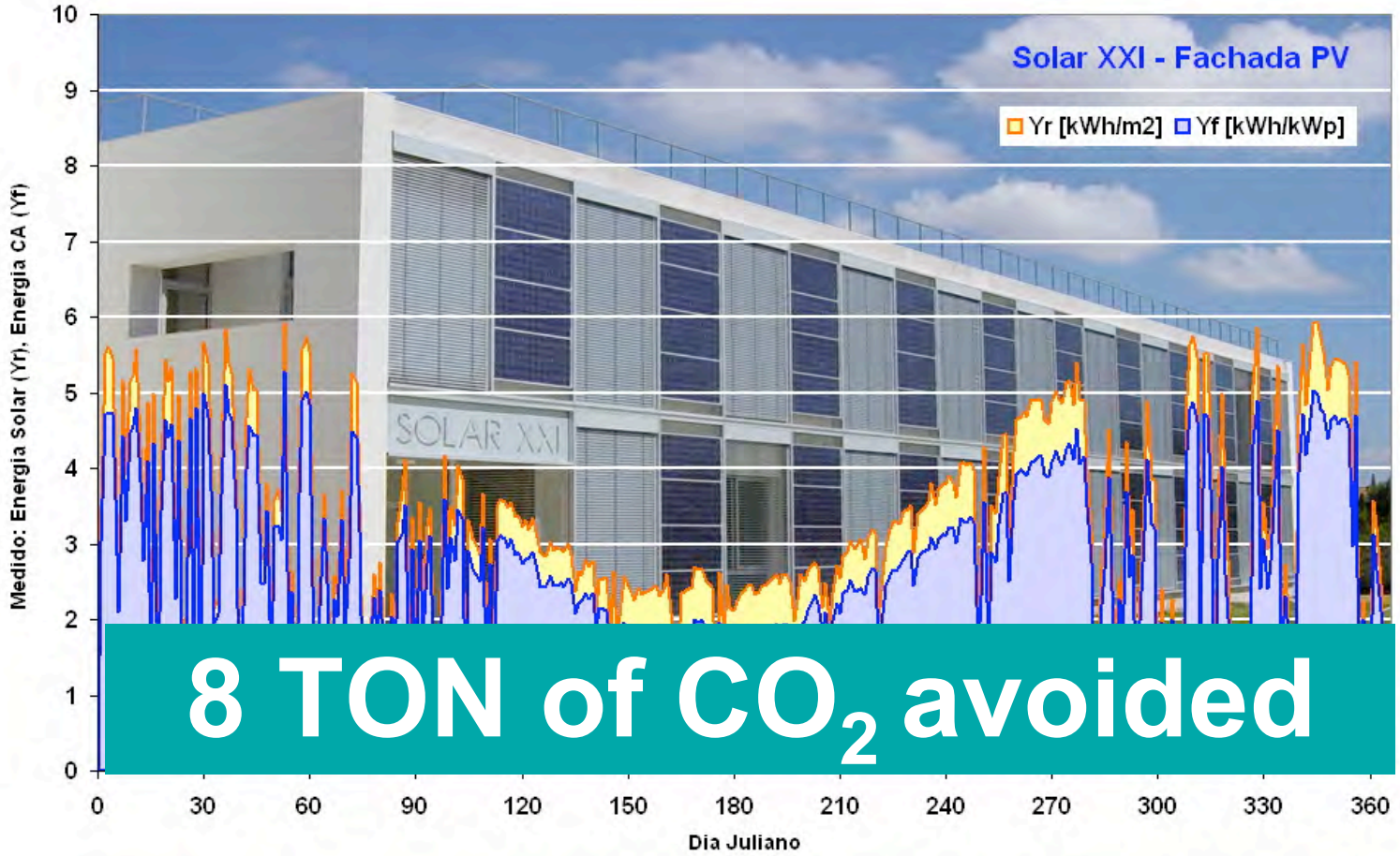
Openings for Natural Ventilation


Natural Ventilation and Daylighting
Solar Thermal (CPC)
Auxiliary Heating System


Car parking with 6 kWp PV

Energy Production in 2007; 12 + 8.4 MWh

80 % of the electricity consumption produced by the PV system



8 TON of CO_2 avoided

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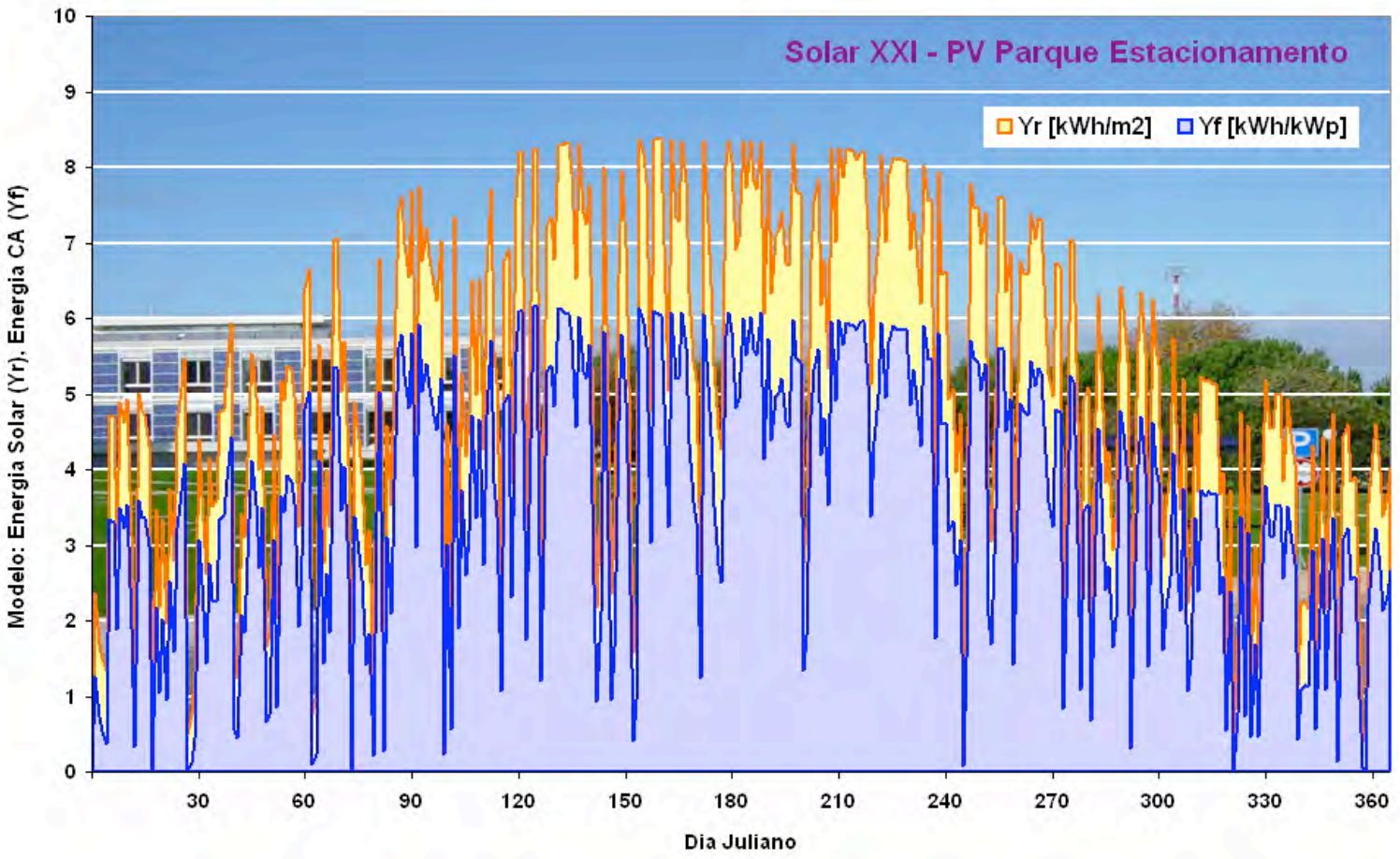
Car Parking - PV 6 kWp



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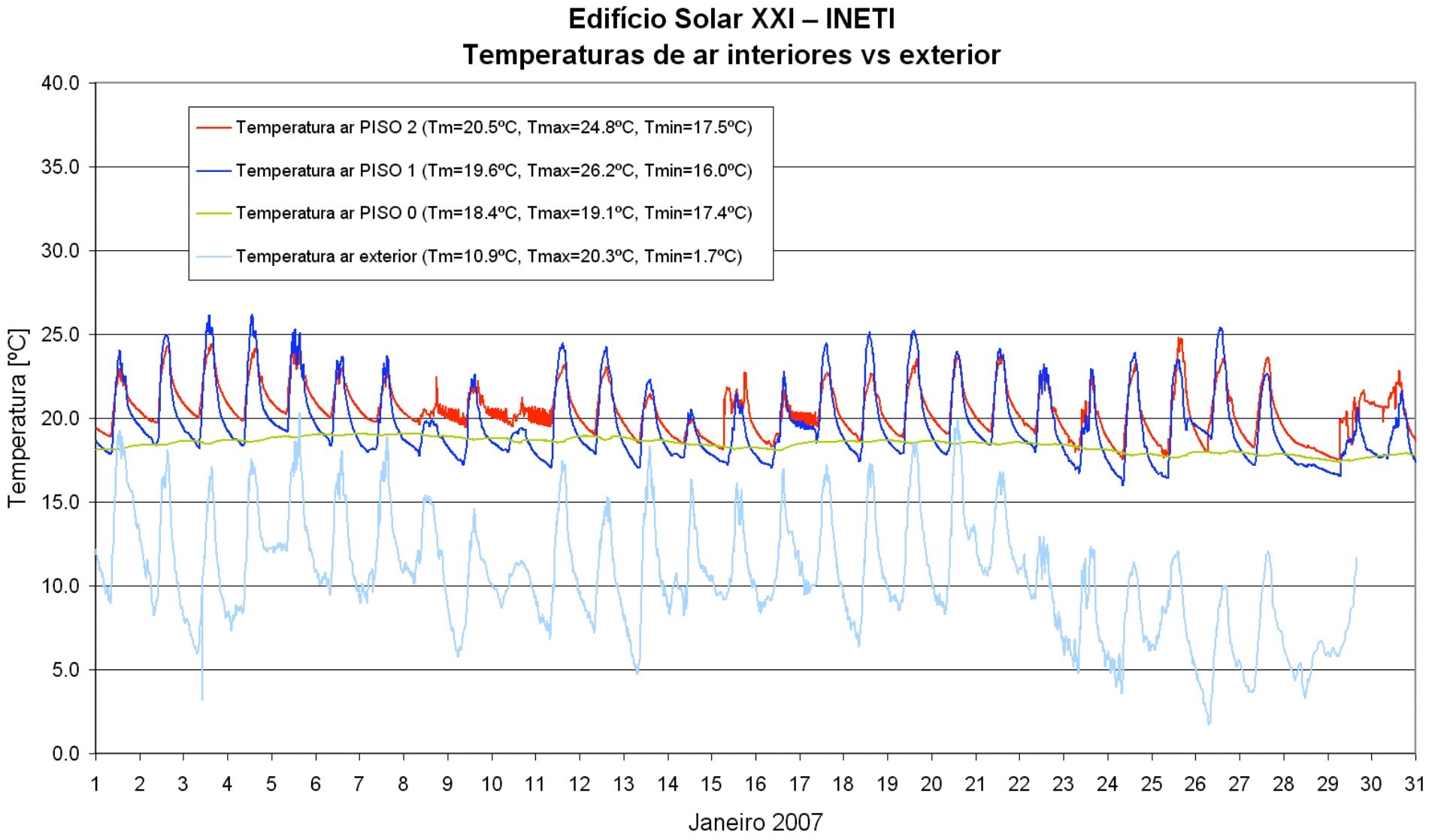
Measurements

Winter 2007


Edifício Solar XXI – INETI
Temperaturas de ar interiores vs exterior
Temperatura ar PISO 2 (Tm=20.5ºC, Tmax=24.8ºC, Tmin=17.5ºC)
Temperatura ar PISO 1 (Tm=19.6ºC, Tmax=26.2ºC, Tmin=16.0ºC)
Temperatura ar PISO 0 (Tm=18.4ºC, Tmax=19.1ºC, Tmin=17.4ºC)
Temperatura ar exterior (Tm=10.9ºC, Tmax=20.3ºC, Tmin=1.7ºC)
Temperatura [ºC]
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Janeiro 2007

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	Fev 06	Nov 06	Dez 06	Jan 07	Fev 07	Nov 07	Dez 07	Jan 08	Fev 08
Text	10.3	16.0	10.8	10.9	12.9	12.8	9.8	11.5	12.2
Tint	21.4	21.5	19.4	19.6	19.7	20.3	18.7	19.9	19.7
Tmax	23.7	24.0	23.0	23.3	22.6	22.9	21.6	22.8	22.6
Tmin	16.0	20.1	17.4	17.6	18.0	18.7	17.1	18.3	18.0
Tdiurno	20.7	22.5	20.8	21.1	20.9	21.6	19.9	21.2	20.9

Temperatures (ºC) - Winter

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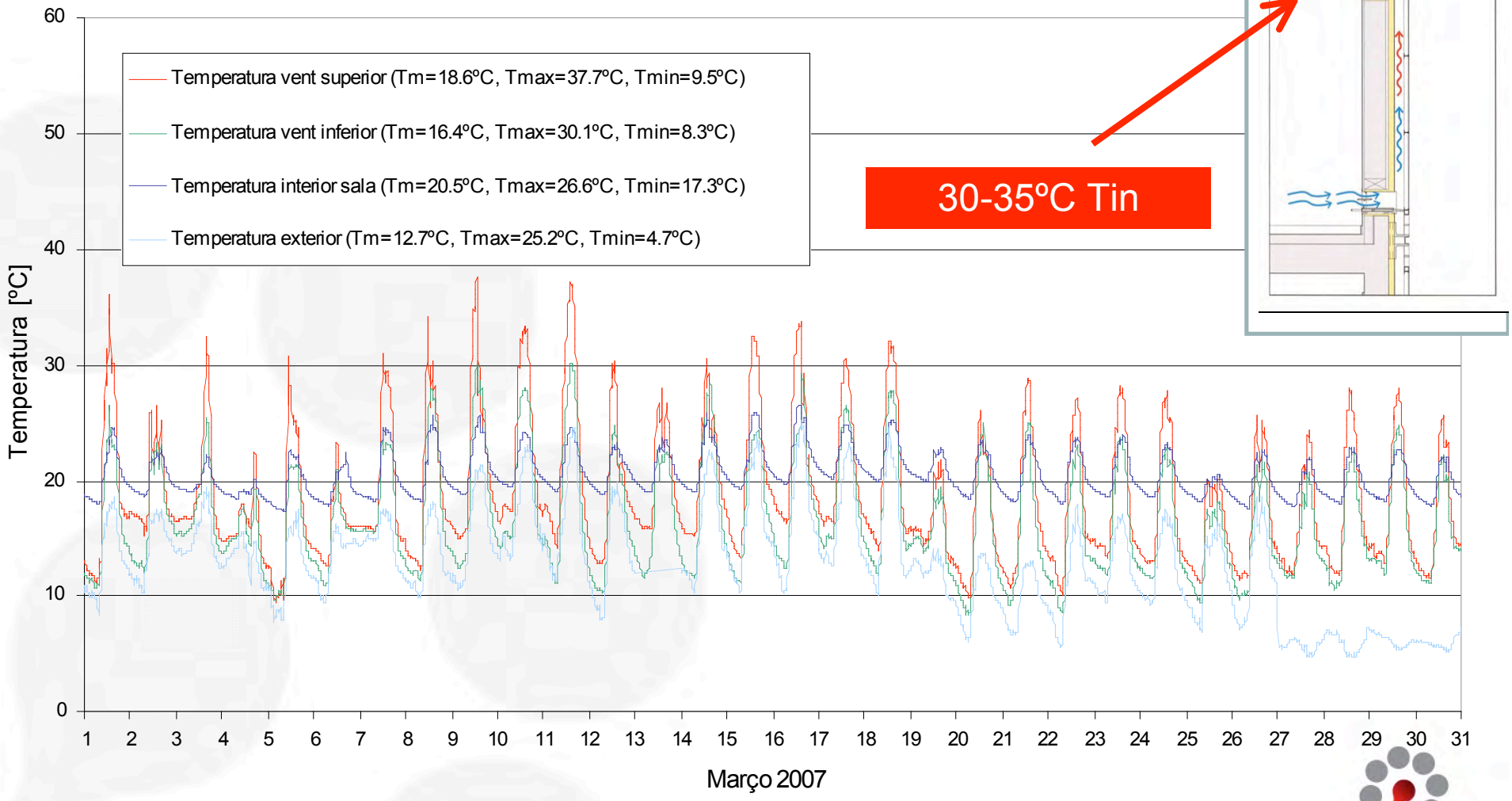
Temperaturas do Sistema de Recuperação de Calor dos Módulos PV



30-35ºC Tin

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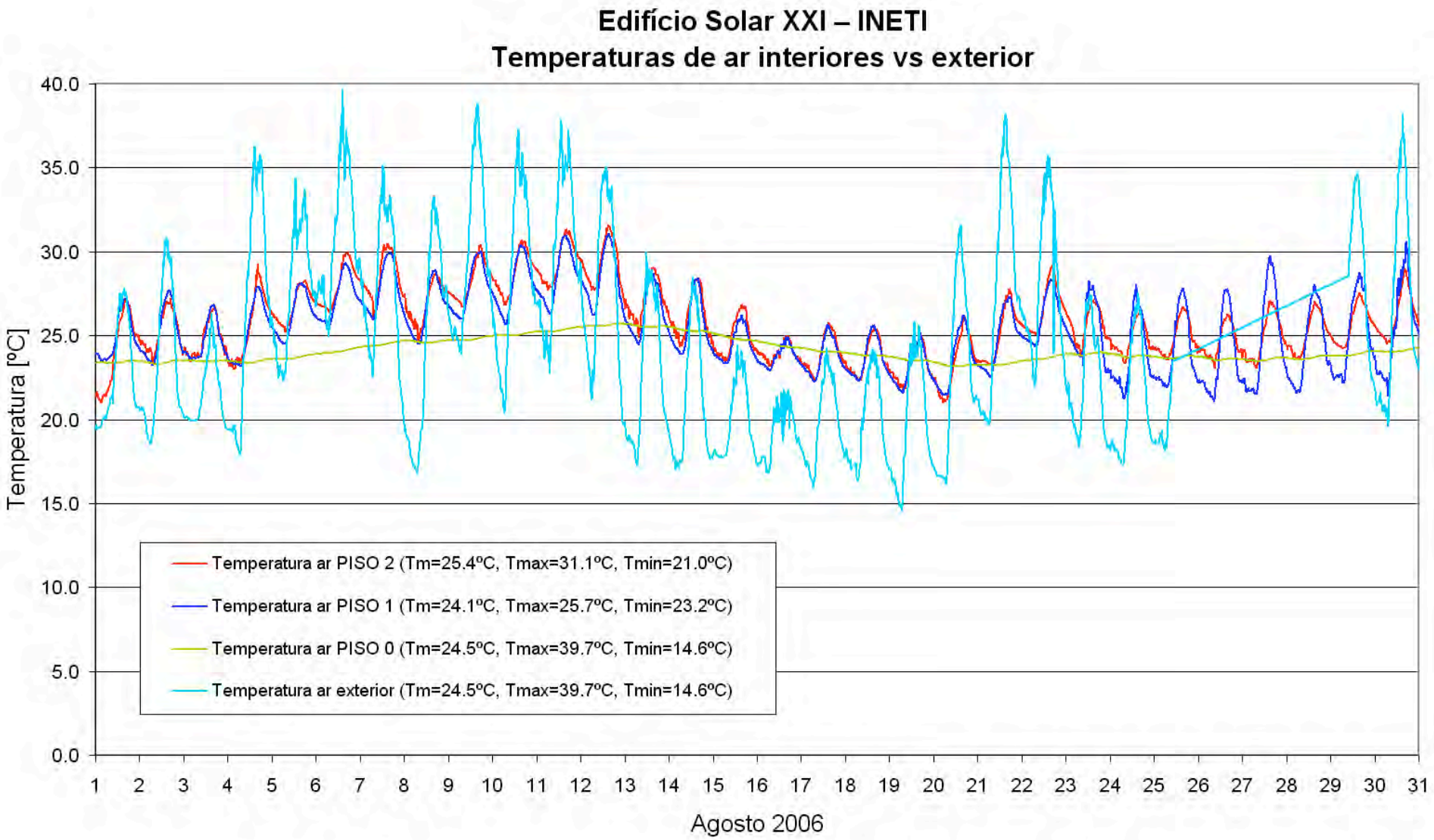
Summer 2006



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	Jul 06	Ago 06	Set 06	Jul 07	Ago 07	Set 07
Text	23.7	24.5	22.3	21.8	21.5	21.2
Tint	25.1	25.4	24.2	24.1	24.7	24.2
Tmax	27.3	28.1	27.1	26.4	26.7	26.7
Tmin	23.3	23.3	21.5	22.3	23.2	21.5
Tdiurno	26.3	26.8	25.5	25.3	25.6	25.4

Temperatures (ºC) - Summer

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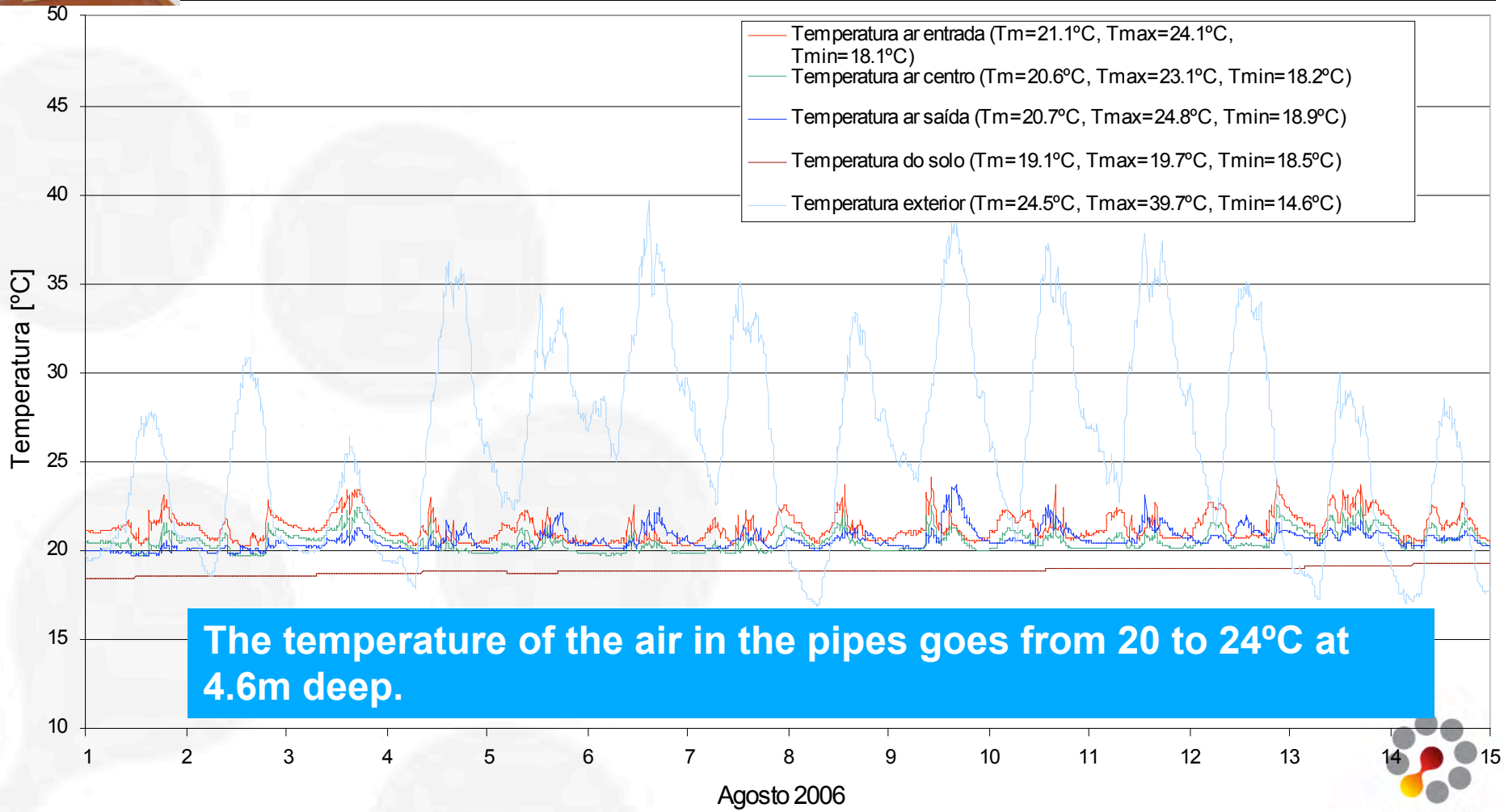
Temperatures in the buried pipes vs air temperature outside



The temperature of the air in the pipes goes from 20 to 24ºC at 4.6m deep.

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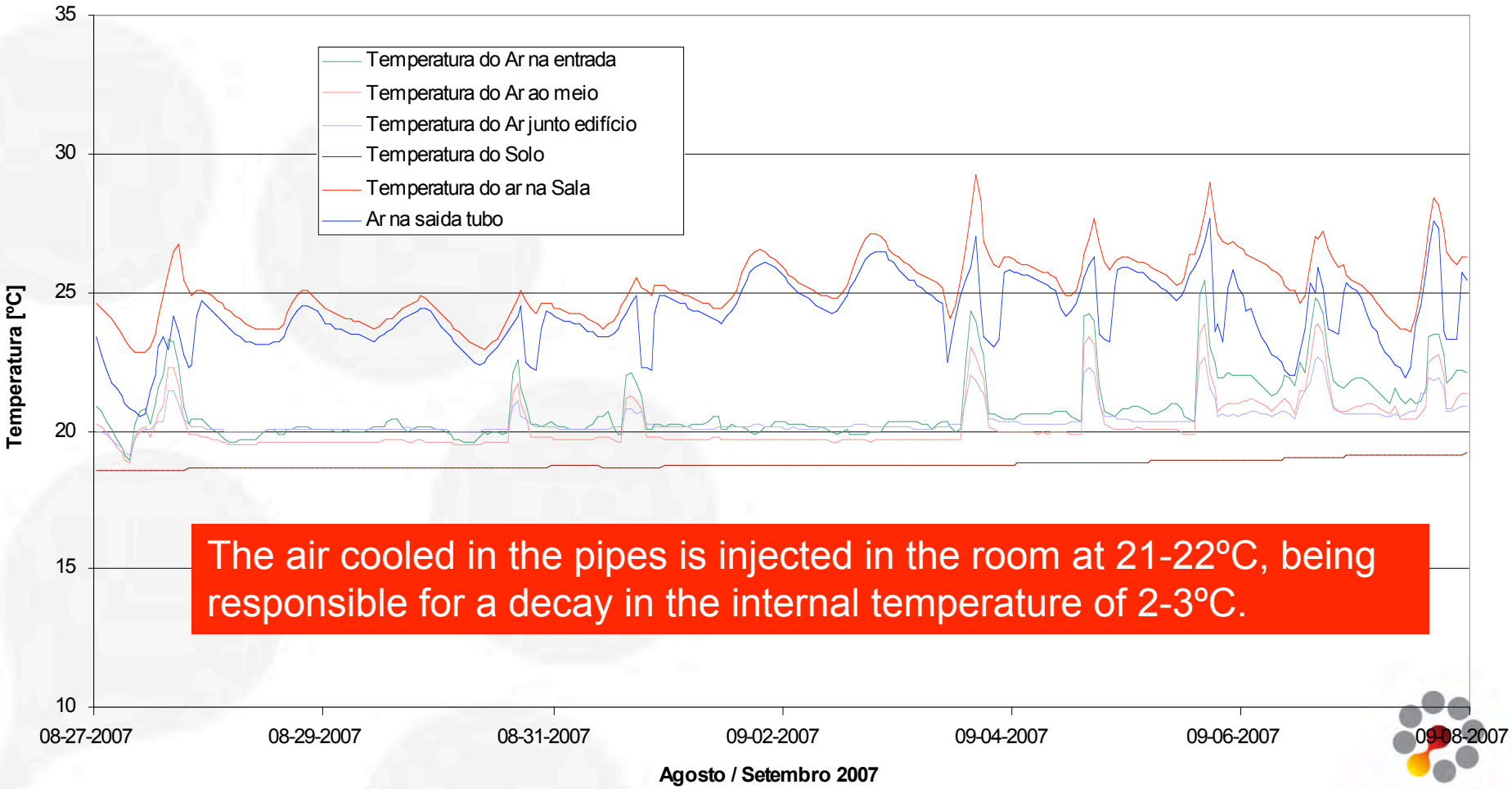
Temperatures in the buried pipes vs air temperature outside



The air cooled in the pipes is injected in the room at 21-22ºC, being responsible for a decay in the internal temperature of 2-3ºC.

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Thank you

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Laboratório Nacional de Energia e Geologia, I. P.

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