



# CICS: ENERGIA GEOTÉRMICA NO CONDICIONAMENTO

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## Agenda

- Main concepts
- Types of geothermal cooling systems
- Conventional air conditioning system
- Geothermal cooling system
- Conventional air conditioning system and Geothermal cooling system
- Geothermal cooling system CICS



#### Main concepts





#### Main concepts





#### Main concepts

#### **Ground Temperatures**







Curitiba







## Closed circuit with indirect cooling





Open circuit with direct air cooling (low depth geothermal system)



## Open circuit with indirect cooling





#### Conventional air conditioning system





#### Geothermal cooling system





Geothermal cooling system

# Heating mode







# Conventional air conditioning system

#### and Geothermal cooling system



- COP=3,6
- Higher energy consumption
- Increase on CO<sub>2</sub> emissions

- COP=4,8 (increase of 33%)
- Lower energy consumption
- Reduction on CO<sub>2</sub> emissions
- Clean energy
- Multidisciplinary project



Geothermal cooling system - CICS CICS-Living Lab





#### Geothermal cooling system - CICS



## 18 pyles with a length of 11 m

Heat rejection: 40 to 70 W/m



Geothermal cooling system - CICS

- Heat rejection capacity: 10,890 W
- Cooling capacity: 8,377 W (≈2.4 TR)
- Nominal capacity: 2.5 TR
- Equipment to be used: a 2.5 TR heat pump (closed circuit)
- Area to be conditioned:  $\approx 50 \text{ m}^2$



#### Geothermal cooling system - CICS



Research goals:

- Analysis of the performance of a geothermal heat pump under Brazilian climatic and soil conditions
- Development of a grey model for the prediction of the performance of a geothermal heat pump
- Evaluation of the degradation of the performance of a geothermal heat pump due to variation on the soil heat rejection capacity

