GROUND-MED SEMINAR 1

Bombas geotérmicas de alta eficiencia – Casos prácticos desarrollados dentro del proyecto europeo GROUND-MED

The GROUND-MED FP7 project delivering renewable energy solutions for the Mediterranean climate

Dimitrios Mendrinos,
Centre for Renewable Energy Sources and Saving (CRES),
Coordinator of Ground-Med project

Ground-Med: a follow-up of Groundhit FP6 project

Groundhit, an FP6 project, delivered GSHPs of improved COP by 20%

КАПЕ
CRES

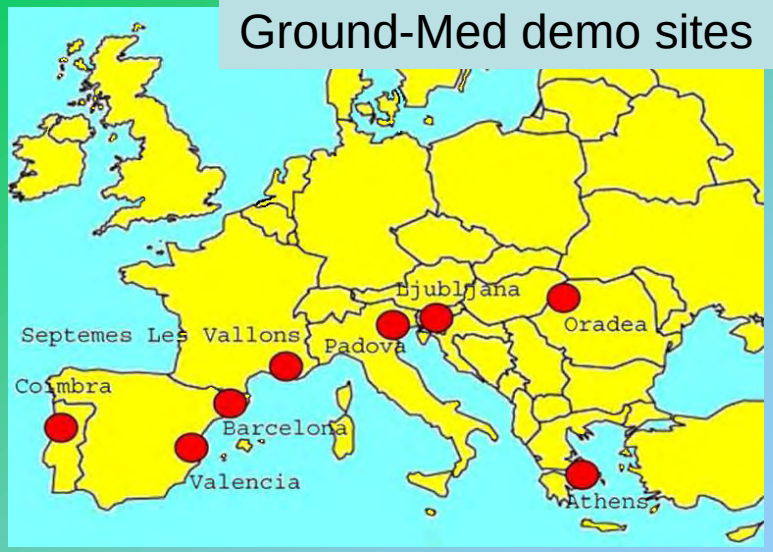
The GROUND-MED project

Advanced ground source heat pump systems for heating and cooling in Mediterranean climate

Project budget : 7.247.686 €
EC contribution : 4.299.695 € or 59,3%
Duration : 5 years, Jan 2009 – Dec 2013

Implemented by a consortium of 24 organizations across Europe, concerns the development, construction, demonstration in 8 buildings and monitoring of the next generation of ground source heat pump systems, which will deliver heating and cooling to buildings with a measured year round seasonal performance factor SPF higher than 5.

Ground-Med demo sites



Project supported by the European Commission within the SEVENTH FRAMEWORK PROGRAMME Grant Agreement No TREN/FP7EN/218895/ "GROUND-MED"

Ground-Med consortium

Centre for Renewable Energy Sources and Saving - CRES (coordinator)
Commissariat à l'Énergie Atomique - CEA
European Heat Pump Association -EHPA
Fachinformationszentrum Karlsruhe GmbH -FIZ
Compagnie Industrielle d'Applications Thermiques CIAT
Hiref Spa - HIREF
University of Oradea - UOR
Institute of Systems and Robotics - University of Coimbra - ISR
Gejzir d.o.o., Podjetje za poslovne storitve, Ljubljana -GEJZIR
Geoteam Technisches Büro für Hydro-geologie, Geothermie und Umwelt GesmbH - GEOTEAM
Universidad Politécnica de Valencia - UPV
BESEL S.A.
ECOSERVEIS
European Geothermal Energy Council - EGEC
Groupement pour la Recherche sur les Echangeurs Thermiques GRETH
University College Dublin - UCD
Università degli Studi di Padova - UNIDP
Edrasis - C. Psallidas S.A. - EDRASIS
Centre Technique des Industries Aérauliques et Thermique - CETIAT
OCHSNER Wärmepumpen GmbH - OCHSNER
Escola Superior De Tecnologia De Setubal - ESTSetubal
GROENHOLLAND geo environmental solutions - GROENHOLLAND
KTH-EGI Research and education in energy for the future - KTH
ENEREN

ΚΑΠΕ
CRES

Buildings where Ground-Med GSHPs will provide heating and cooling

Ciat subsidiary offices in Septemes les Vallons: 30 kW

Hiref factory in Padova: offices & sanitary water: 18 kW

University of Oradea campus building J: 38 kW

Coimbra Fábrica dos Mirandas (Old Milling Factory) - now regional government building: 100 kW

Buildings where Ground-Med GSHPs will provide heating and cooling

Municipal Hall in Benedikt: 23 kW

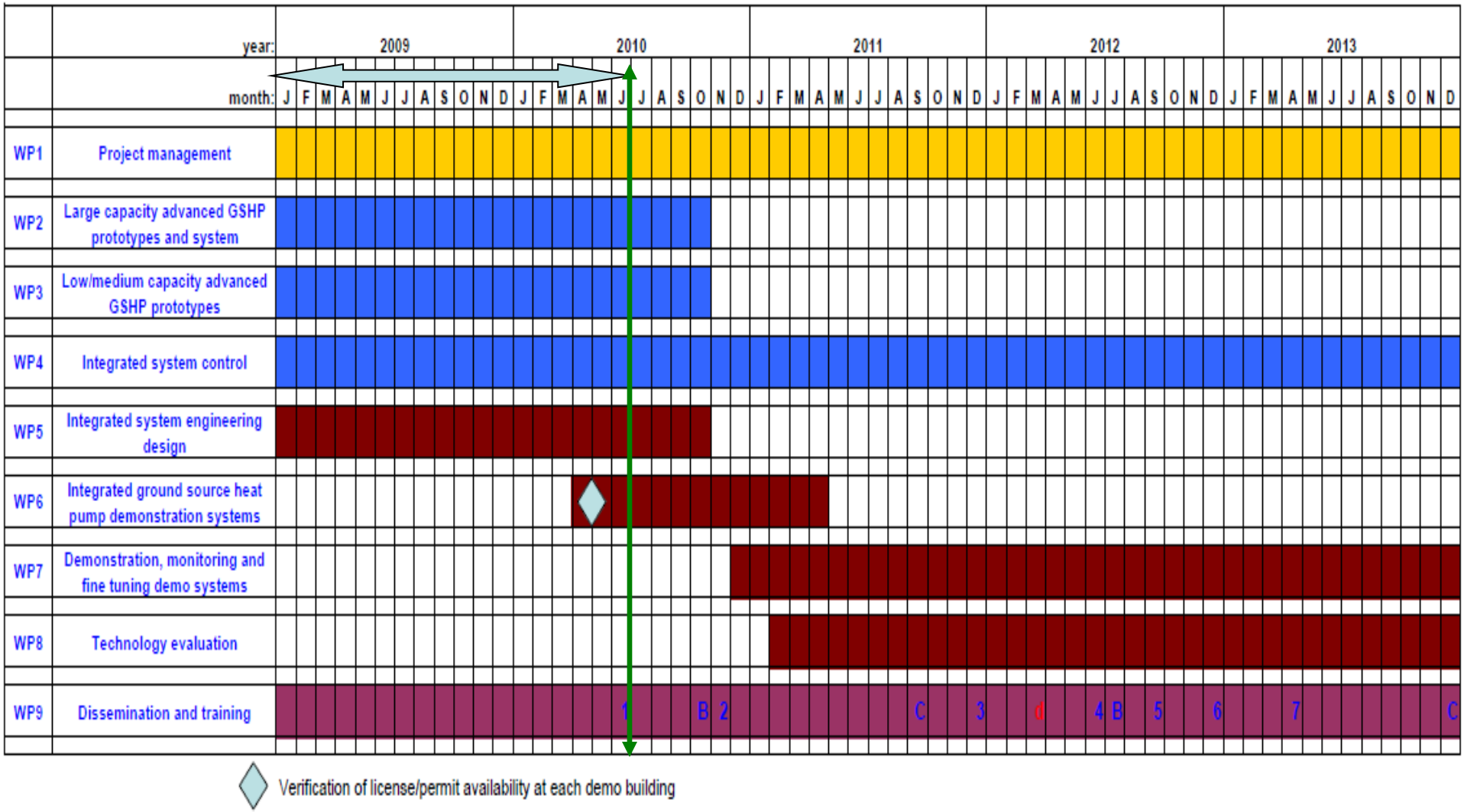
University of Valencia campus offices building: 18 kW

La Fabrica del Sol, Barcelona: 50 kW

Edrasis headquarters office building, Athens: 55 kW

КАПЕ CRES

Project structure & plan



КАПЕ CRES

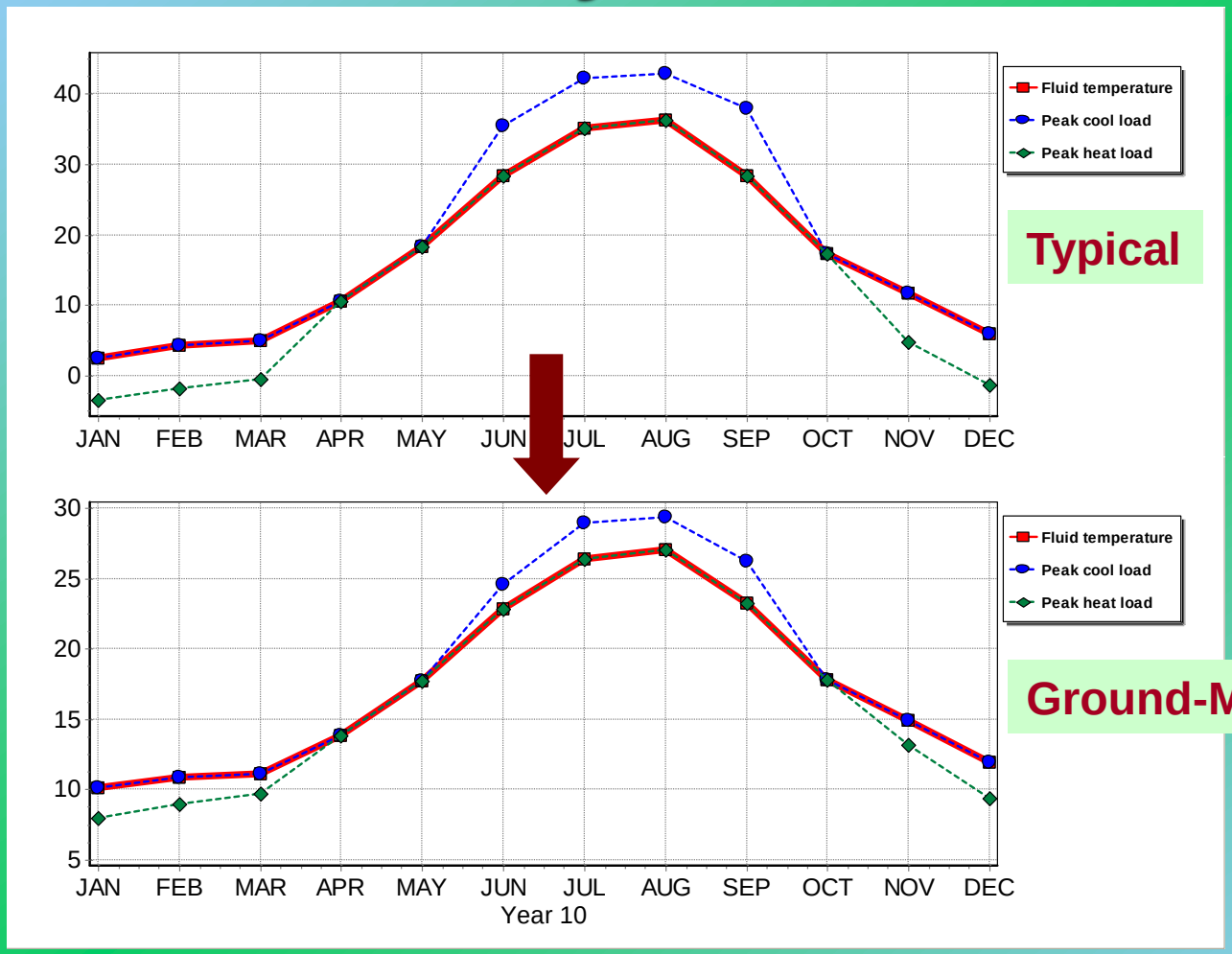
Ground-Med technology development focuses on:

- **Look into GSHP as an integrated system of**
  - **A. borehole heat exchanger (BHE)**
    - **design for fluid-T as close to ground-T as possible**
  - **B. water source heat pump**
    - **SPF instead of COP**
    - **capacity control (inverter, multiple compressors, etc.)**
    - **heat exchangers in counter-flow operation**
  - **C. indoor heating-cooling system**
    - **water circulating pumps of energy class A**
    - **low energy fan-coils of 25% power consumption**
    - **air handling units using condensing heat**
- **Advanced system control with ΔT matching the load**
- **Both heating and cooling considered**

Ground-Med BHE design aspects

- Prefabricated U-tube
- Thermally enhanced grout (or sand if allowed)
- Deeper boreholes
- Water as heat transfer fluid instead of glycol
- Oversized BHE
- Thermal response test

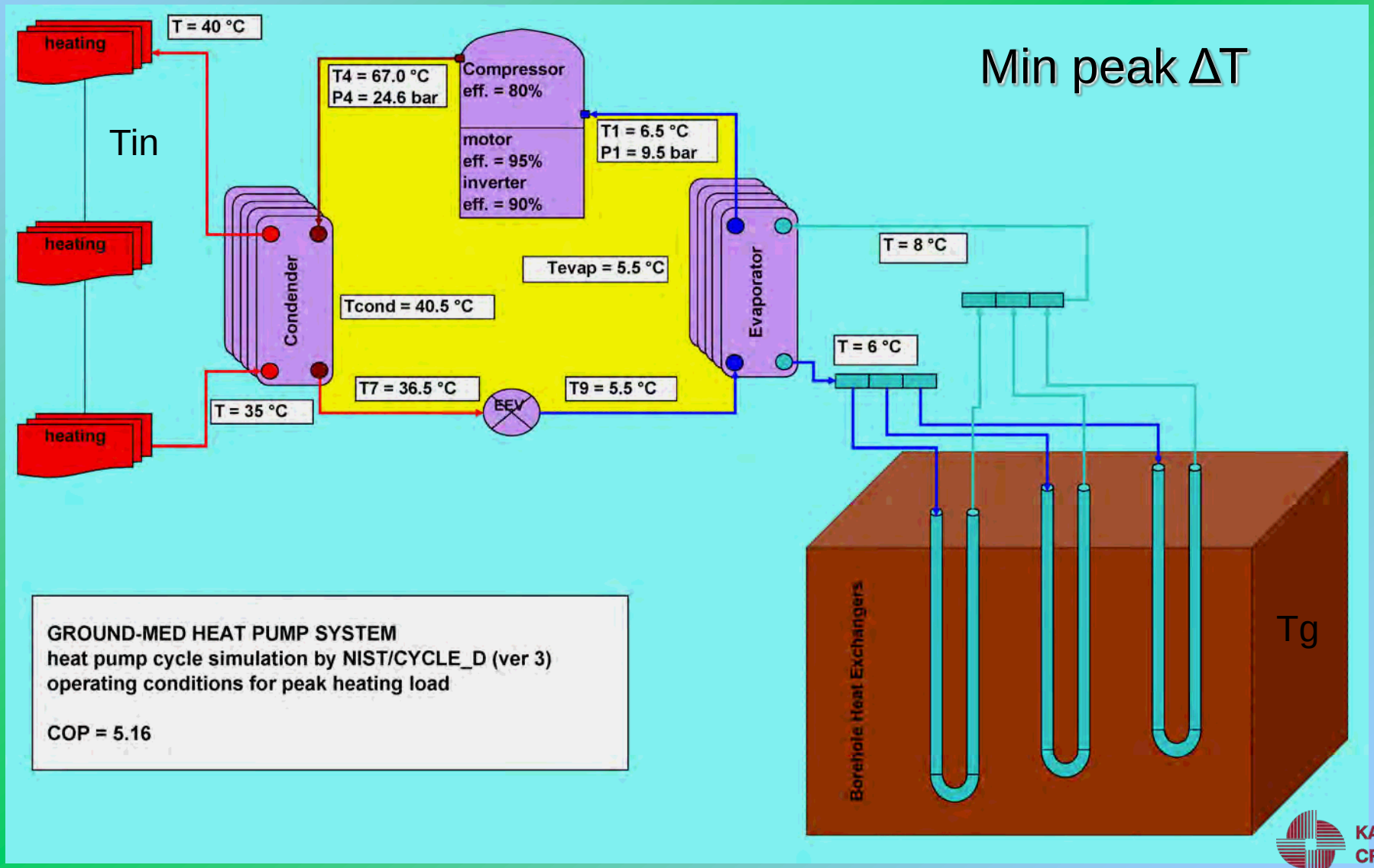
BHE temperature operating range: year round



Results by EED borehole heat exchanger simulator

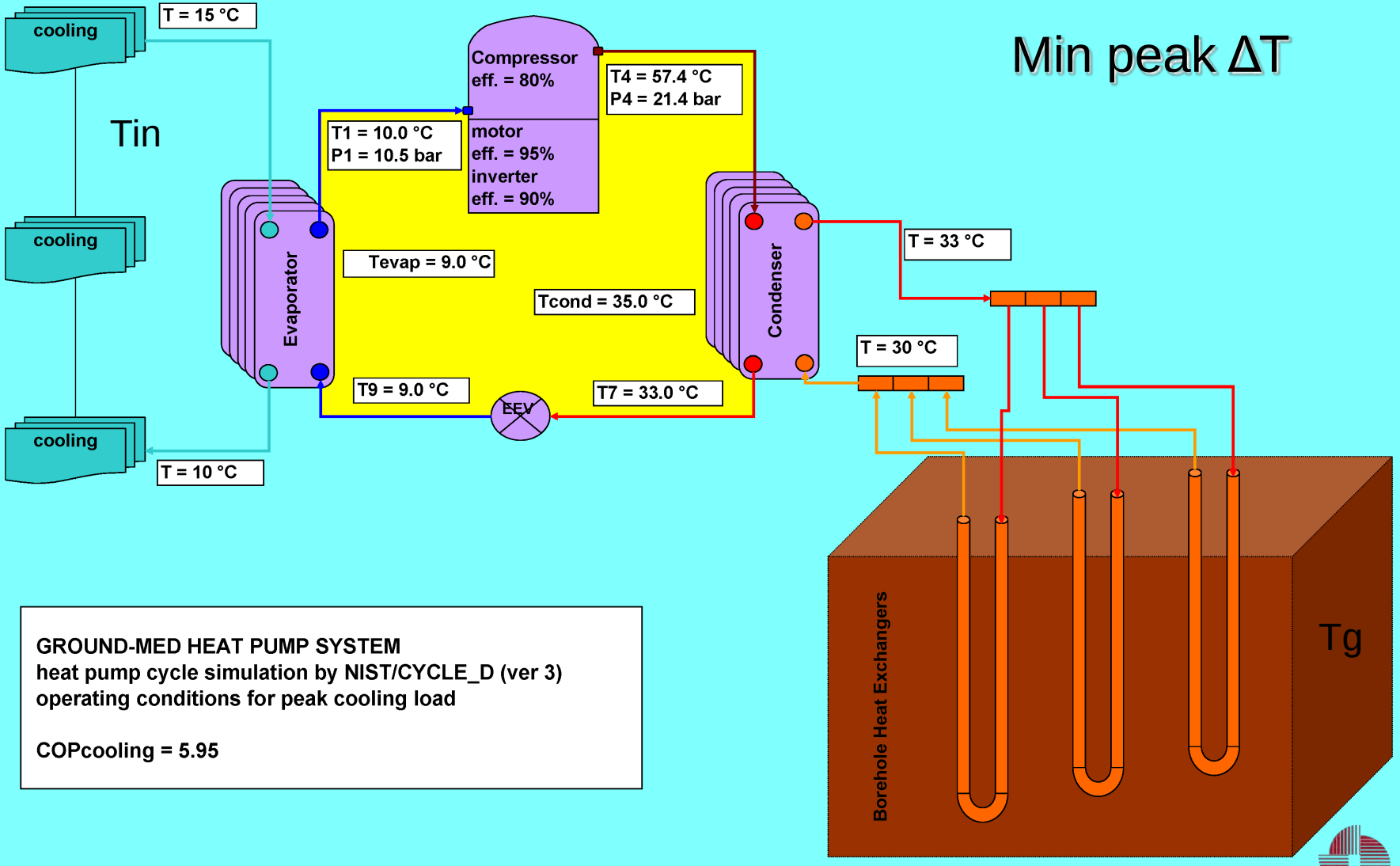
КАПЕ CRES

Ground-Med heat pump operating parameters: heating mode



КАПЕ CRES

Ground-Med heat pump operating parameters: cooling mode

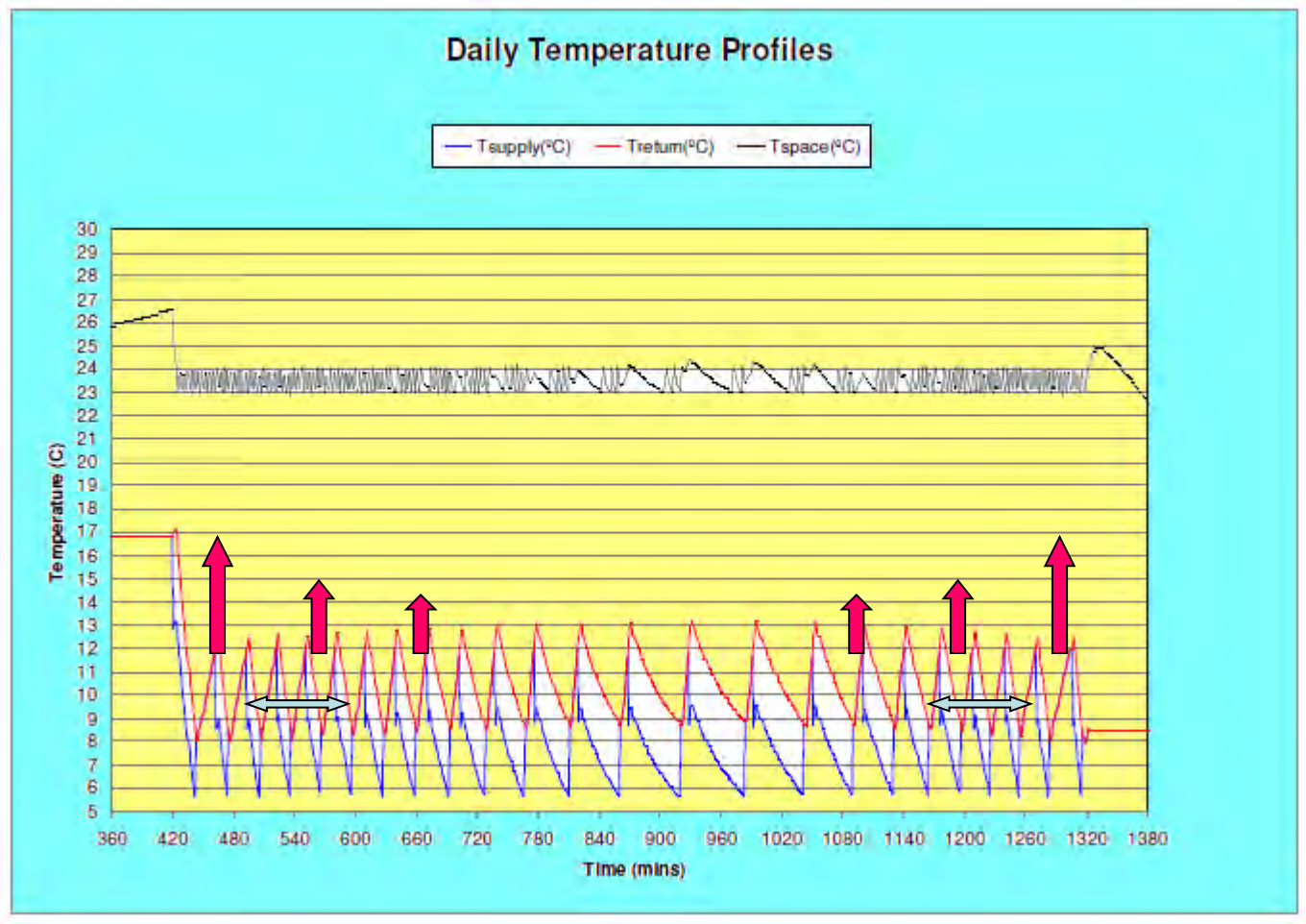


GROUND-MED HEAT PUMP SYSTEM
heat pump cycle simulation by NIST/CYCLE_D (ver 3)
operating conditions for peak cooling load

COPcooling = 5.95

ΚΑΠΕ
CRES

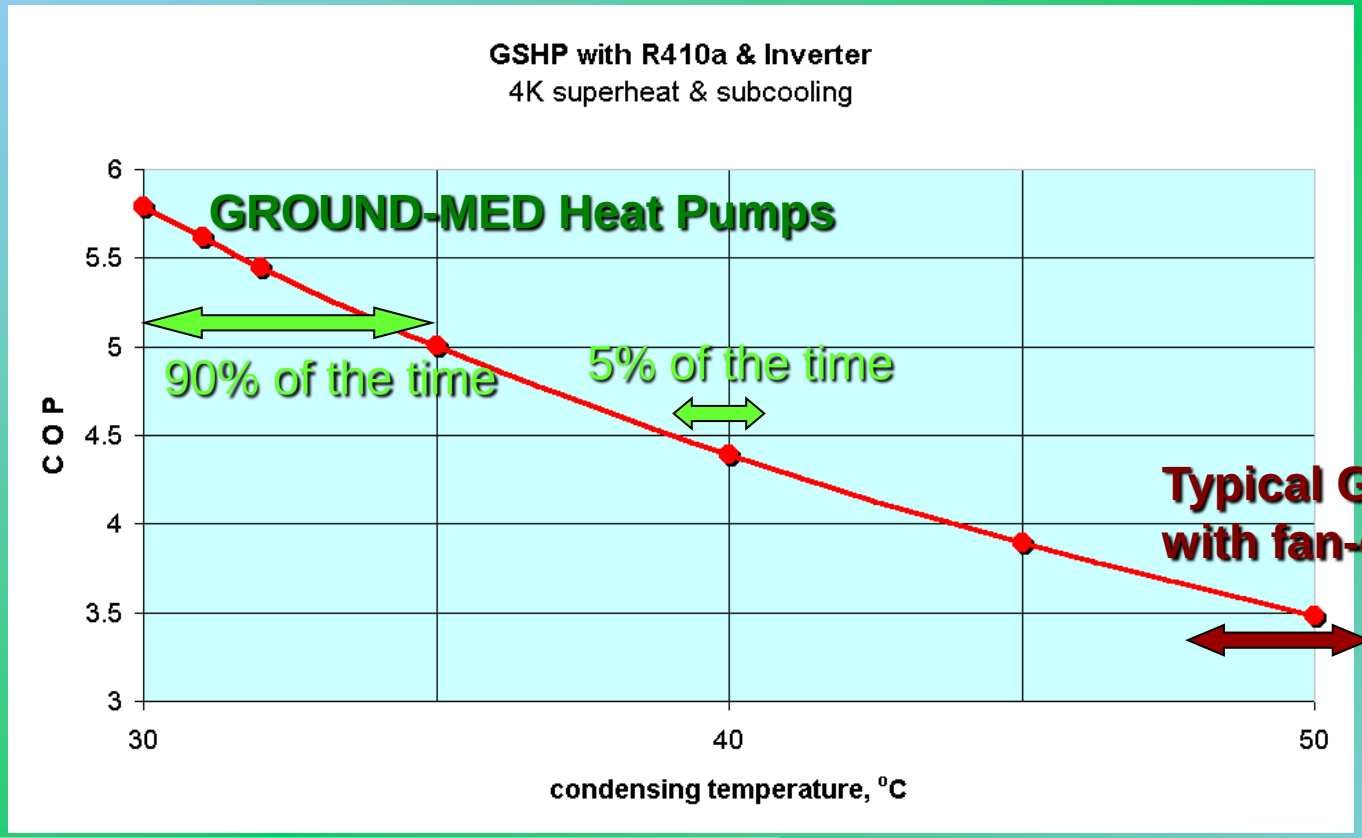
Ground-Med control according to the heating/cooling load



Transient temperatures in an ON-OFF regulated cooling heat pump system

Figure 5.3 of Ground-Med deliverable D4.1: Generalised Dynamic Control Model

Ground-Med heat pumps: max system SPF



GROUND-MED Heat Pumps

Compressors of high efficiency (>80%)
Motor of high efficiency (>90%)
Capacity modulation
Variable temperature output
Low auxiliary power consumption
High evaporation temperature (>-3°C)

Results by NIST/CYCLE_D heat pump cycle simulator

КАПЕ
CRES

Project impact

- A successful GROUND-MED project will result in improving competitiveness and widen market opportunities of geothermal heat pumps especially for cooling in South Europe.

- Furthermore, the knowledge gained, will also effectively aid technology development of other heat pumps in the same direction.

Thank you for your attention