

# The **GROUND-MED project**

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

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

# Objectives:

The global aim is to demonstrate integrated ground source heat pump systems of :

- annual SPF for both heating and cooling higher than 5,0 ;
- payback time of less than 7 years compared with a system comprising natural gas boiler of 0.04 €/kWh for heating and air source heat pumps of COP=3.5 for cooling ;
- high system durability expressed as at least 20 years life span;

# The GROUND-MED project includes:

Development, design, construction and demonstration in 8 buildings of ground source heat pump (GSHP) systems of SPF>5,0 comprising:

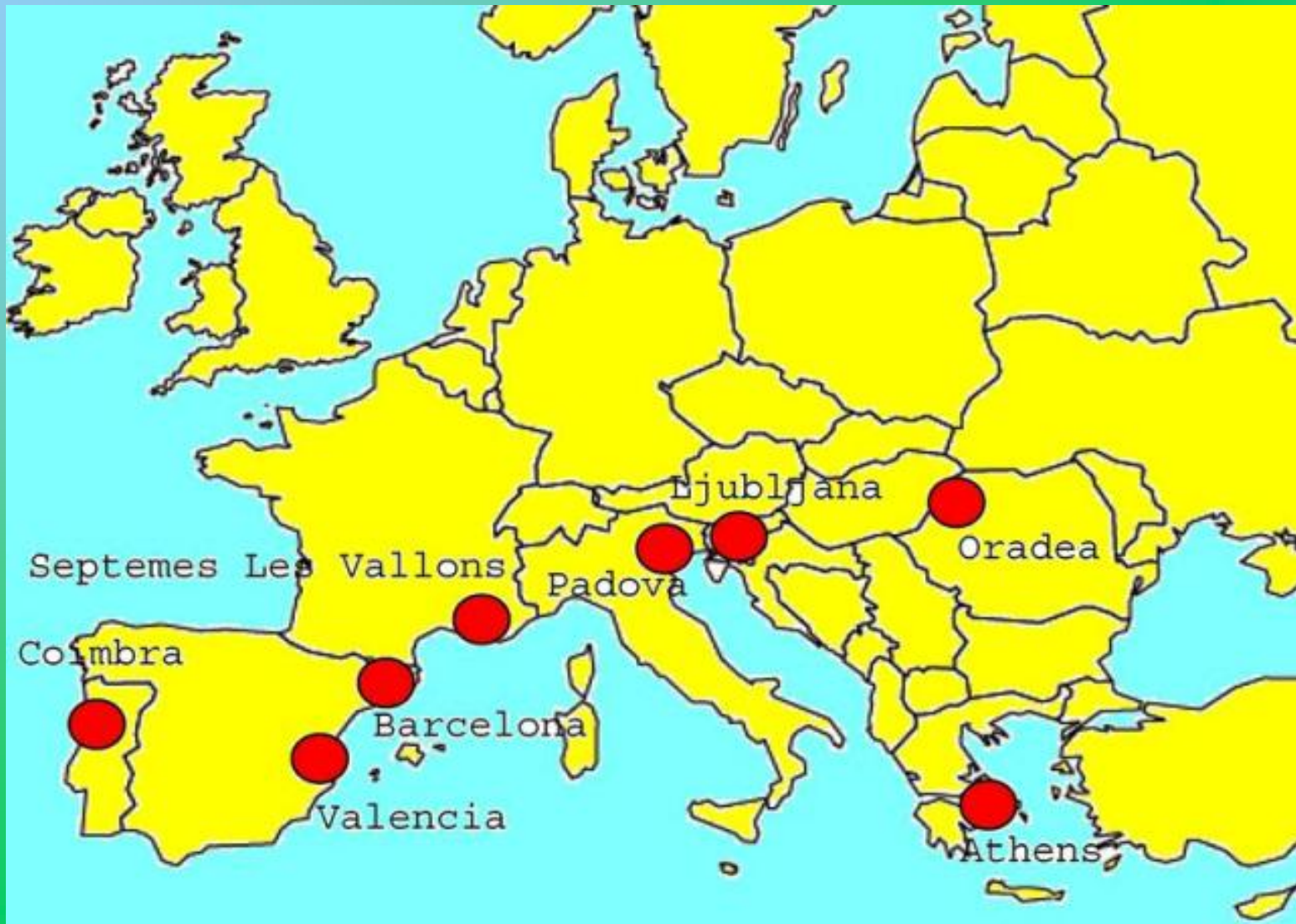
- the next generation of ground source heat pumps of improved seasonal performance;
- low electricity consumption fan-coils and air handling units;
- advanced thermal storage nodules (*in one building*);
- advanced system controls for:
  - minimum temperature difference between BHE, Heat Pump & indoor heating/cooling system;
  - water supply temperature following the thermal load;
- system design for maximum efficiency
- integration with a BEMS
- maintenance program for high reliability

Dissemination, training and support actions

# GROUND-MED demonstration buildings

Owner	description	capacity
CIAT	Region: Septemes les Vallons	large
HIREF	Canteen room	small
U. of Oradea	Students residence	medium
ISR-UCoimbra	Classrooms, offices	large
M. of Benedikt	Benedikt cultural centre	medium
UPValencia	Offices, computer/common room	small
Barcelona City Council	Renewable Energy demo site	large
EDRASIS	Head offices	medium

# GROUND-MED demonstration buildings



# Ground-Med innovations

## Advanced water source heat pumps of high efficiency:

- capacity modulation;
- new generation of compressors matching high efficiency motors with superior isentropic efficiency;
- heat exchangers optimized for both heating & cooling;
- use of natural refrigerants in one prototype:

Innovative system controls integrating all components (heat pump, all pumps & fans)

Smooth system start-up

Advanced fan-coils

- low temperature operation in heating mode;
- efficient fan-coil motor

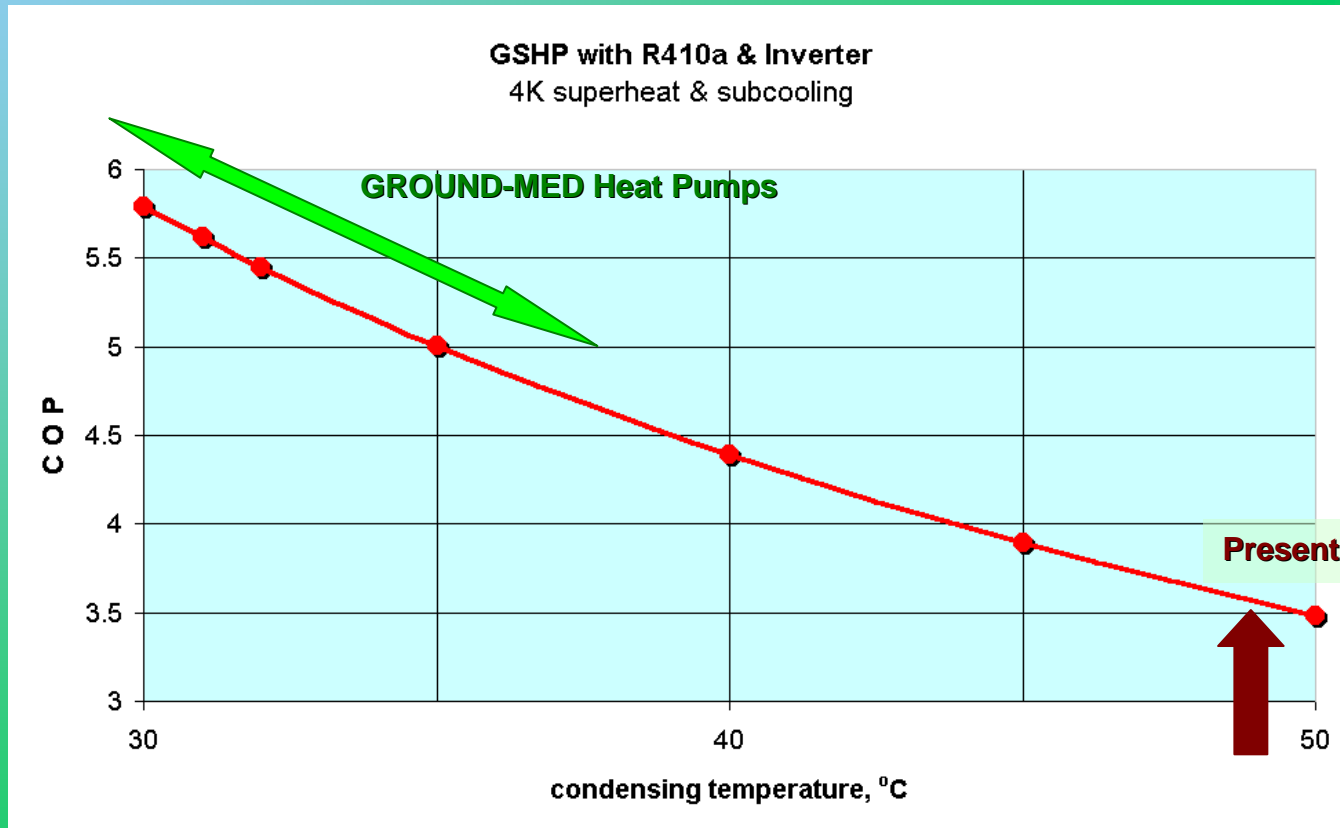
# Ground-Med innovations, cont.

Advanced air handling units utilizing condensing power for heating and humidity control

Innovative integrating system design:

- **minimum temperature difference between the BHE and the building indoor heating/cooling system;**
- **operation at variable temperature matching the heating /cooling load**

# Ground-Med innovations: result



## 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)

**Project budget: 7.247.686 €**

**EC contribution: 4.299.695 €**

**or ~59,3%**

**Duration: 5 years**

**Jan 2009 – Dec 2013**

# Ground-Med consortium

Centre for Renewable Energy Sources - 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

# Work packages

**WP#1: project management**

**WP#2: large capacity advanced GSHP prototypes & system components**

**WP#3: low/medium capacity advanced GSHP prototypes**

**WP#4: integrated system control**

**WP#5: integrated demo-systems engineering design**

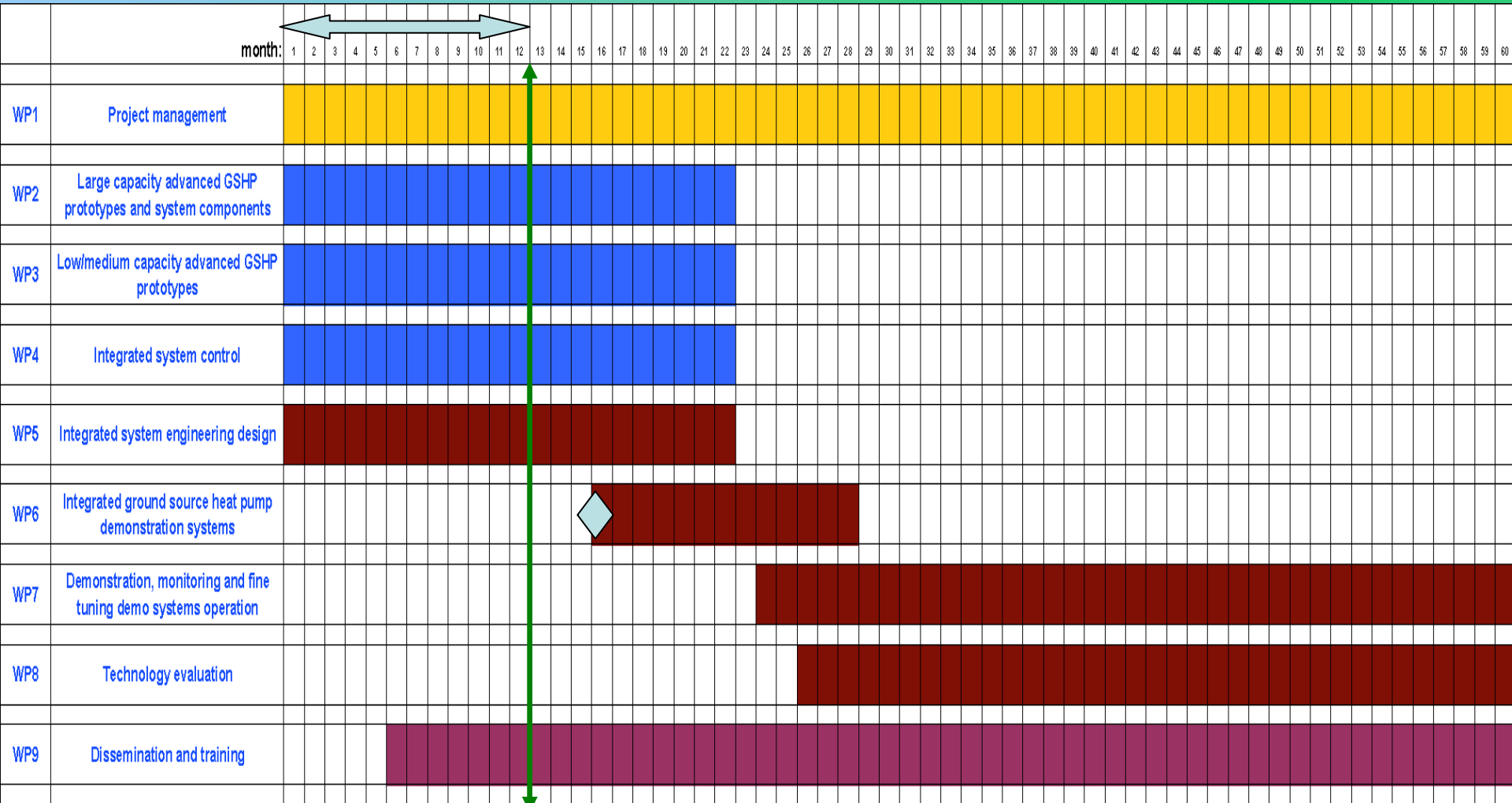
**WP#6: integrated GSHP demonstration systems**

**WP#7: monitoring and fine-tuning operation**

**WP#8: technology evaluation**

**WP#9: dissemination & training**

# Time schedule



◆ Verification of license/permit availability at each demo building

# Deliverables – 2009

## June

**D3.1: Report on methods for improving COP (UNIPD)**

**D9.3: web-site (FIZ)**

**D9.2: presentations at conferences (all partners)**

## October

**D4.1: Generalised Control Module software (UCD)**

## December

**D9.9: Training course in Portugal (ISR)**

**D9.16: Dissemination Plan (CRES)**

**D1.1: 1<sup>st</sup> technical and financial report (CRES)**

# Deliverables – 2010

D9.2: presentations at conferences (all partners)

## April

D2.3: Low energy fan coil units (CIAT)

D4.2: Report on the validation studies of the GCM (UCD)

## June

D9.6: First meeting with EC officials in Brussels (EHPA)

D9.10: Training course in Spain (BESEL)

## July

D2.4: Air handling units using condensing heat (CIAT)

## October

D2.1: 3 HP prototypes of large capacity (CIAT)

D2.2: Low temperature heat storage nodules (CIAT)

D3.2: 3 HP prototypes of medium capacity (OCHSNER)

D3.3: 2 heat pump prototypes of low capacity (HIREF)

# Deliverables – 2010 cont.

## October

**D4.3: Suite of control strategies for demonstration (UCD)**

**D4.4: Data management system (BESEL)**

**D4.5: Microprocessor control Board (ISR)**

**D5.1: Eng. design of CIAT demo system in Sept. les Vallons (CIAT)**

**D5.2: Eng. design of University of Oradea demo system (UOR)**

**D5.3: Eng. design of University of Coimbra demo system (ISR)**

**D5.4: Eng. design of Cultural Centre Benedikt demo system (GEJZIR)**

**D5.5: Eng. design of University Polytechnic of Valencia demo system (UPV)**

**D5.6: Eng. design of sun-factory demo system in Barcelona, (ECOSERVEIS)**

**D5.7: Eng. design of HIREF demo system (ENEREN)**

**D5.8: Eng. design of Edrasis head offices demo system, (EDRASIS)**

## December

**D9.11: Training course in France (CETIAT)**

**D1.1: 2<sup>nd</sup> Technical and financial report (CRES)**

# Deliverables – 2011

D9.2: presentations at conferences (all partners)

## April

D6.1: CIAT demo system in Sept. les Vallons (CIAT)

D6.2: University of Oradea demo system (UOR)

D6.3: University of Coimbra demo system (ISR)

D6.4: Cultural Centre Benedikt demo system (GEJZIR)

D6.5: University Polytechnic of Valencia demo system (UPV)

D6.6: Sun-factory demo system in Barcelona, (ECOSERVEIS)

D6.7: HIREF demo system (ENEREN)

D6.8: Edrasis head offices demo system, (EDRASIS)

## September

D9.4: Intermediate Ground-Med European conference (GRETh)

## December

D9.12: Training course in Italy (UNIPD)

D1.1: 3<sup>rd</sup> Technical and financial report (CRES)

# Deliverables – 2012

D9.2: presentations at conferences (all partners)

## March

D9.1: Information displays and brochures in each demonstration building (CIAT, UOR, ISR, GEJZIR, UPV, ECOSERVEIS, ENEREN, EDRASIS)

## June

D9.8: Design guides for typical Mediterranean buildings. (GRETh)

D9.13: Training course in Slovenia (GEJZIR)

## July

D9.7: Second meeting with EC officials in Brussels (EHPA)

## December

D9.14: Training course in Romania (UOR)

D1.1: 4<sup>th</sup> Technical and financial report (CRES)

# Deliverables – 2013

## April

**D7.1: Operation and performance of each GROUND-MED system over a period of 12 months (CRES)**

## June

**D9.15: Training course in Greece (CRES)**

## October

**D7.2: Report on the control strategies which minimize environmental impact (CRES)**

## December

**D8.1: Synthesis of the system performance evaluation in the various types of buildings (CETIAT)**

**D8.2: Analysis of users feedback from the successive surveys in relation with actual measured indoor conditions (CETIAT)**

**D9.5: Final project European conference (UPV)**

**D9.2: presentations at conferences (all partners)**

**D1.1: 4<sup>th</sup> Technical and financial report (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*