

## THE SHERHPA PROJECT

The global aim of the SHERPHA project is to develop the next generation of heat pump systems using natural refrigerants such as ammonia, carbon dioxide and propane. These refrigerants have zero ozone depletion and low global warming potential.

The project is an unusual partnership in that it is a collaboration between 19 small manufacturing enterprises and 10 research and technical institutions with two International Organisations as coordinators (GRETH and EHPA). 13 countries are represented. The project is partly funded by the EC Framework 6 program.

The technical challenges are quite clear in that natural refrigerants have different thermodynamic and chemical properties to existing refrigerants. This requires redesigning the principal components like heat exchangers and compressors to optimise the heat transfer. At the same time, appropriate control strategies are developed considering both the application and the types of components used. Other challenges involve material compatibility and requirements imposed by EU regulations to minimise the amount of refrigerant in the system. The initial performances of components have been checked in laboratory. This will help to determine parameters like mass flow rates, durability, leakage and control parameters and will also build confidence in the ability of the various components to be successfully integrated. As a result of various preliminary studies it is likely that as many as 8 prototype systems will be evaluated with sizes ranging from 3 to 100 kW.

The project will also cooperate with various compressor manufacturers who are not part of the project and who are developing prototype components which can be evaluated as part of the rig and field testing. The outputs of the project will be widely disseminated in order to build confidence in the use of natural refrigerants and reports will be released periodically including background studies. Some of these reports will have restricted circulation and only be available to EHPA and GRETH members.

More information: [www.sherhpa.com](http://www.sherhpa.com)

## VENUE

The course will take place at the Royal Institute of Technology, Stockholm, Sweden.  
KTH, street Brinellvägen 64, Room M3

## REGISTRATION FEES

Registration fees are 600 euros per person and 500 euros for Greth., EHPA and SVEP members. It includes the short-course participation, a copy of the course notes, coffee-breaks and 2 lunches.

Send the registration form to the Greth secretariat [info@greth.fr](mailto:info@greth.fr) and or fill in-line the form on Greth web-site [www.greth.fr/sherhpa](http://www.greth.fr/sherhpa) before April 30, 2007

## ACKNOWLEDGEMENT

This short course is organised within the SHERHPA project (COLL-CT-2004-500229), which is supported by the EU FP6 Horizontal Research Activities involving SMEs.

## INFORMATION

The short course is jointly organised by Greth and the Royal Institute of Technology within the SHERHPA project. For further information, please contact GRETH or KTH

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# NATURAL REFRIGERANT HEAT PUMPS THEORY AND DESIGN OF HYDROCARBON, AMMONIA AND CARBON DIOXIDE SYSTEMS

**21-22 MAY 2007**  
**STOCKHOLM**  
**SWEDEN**



## ABOUT THE SHORT COURSE

Sustainable energy systems, such as heat pumping technologies, provide an efficient use of renewable energy from the ambient and of waste heat sources. Typical applications are space heating, domestic hot water and processes with combined heating and cooling. Natural refrigerants such as ammonia, hydrocarbons or carbon dioxide can be used for heat pumps applications, which are cost-energy efficient and in compliance with the future EC environmental regulations.

This two-day short course will cover theory, design and practical aspects of the use of Hydrocarbon, Ammonia and CO2 for heat pump applications. Invited experts from research institutes and industry will contribute as well as the Sherhpa partners

## PROGRAMME

### Part 1: Theory and Design

- Background and overview of heat pump market
  - The heat pump market in Europe
  - Introduction to natural refrigerant heat pumps
  - The F-gas regulation
- Natural refrigerant heat pump design
  - Thermodynamics
  - Heat transfer and fluid flow

### Part 2: Technology and applications

- Hydrocarbon heat pump
  - Technology
  - Design and safety issues
  - Case studies
- Ammonia heat pump
  - Technology
  - Design and safety issues
  - Case studies
- CO2 heat pump
  - Technology
  - Design and safety issues
  - Case studies

## THE LECTURERS

- Prof. Clark Bullard, USA*  
*Prof. José Miguel Corberan, UPV, Spain*  
*Prof. Björn Palm, KTH, Sweden*  
*Prof. Jörgen Rogstam, KTH, Sweden*  
*Dr. Samer Sawalha, KTH, Sweden*  
*Dr. Bernard Thonon, GRETh, France.*

The list of speakers will be completed.

## THE COURSE

The lectures will be given in English. A complete set of documents will be distributed to the participants in form of a bound volume and CD.

Details on the short-course programme will be available on the Greth web site: [www.greth.fr/sherhpa](http://www.greth.fr/sherhpa)

## REGISTRATION FORM NATURAL REFRIGERANT HEAT PUMP SHORT-COURSE 21-22 MAY 2007 STOCKHOLM

### Registrant:

Last name: \_\_\_\_\_

First name: \_\_\_\_\_

Company: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_

City: \_\_\_\_\_ Zip: \_\_\_\_\_

Country: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_

E-mail: \_\_\_\_\_

Dietary requirements: \_\_\_\_\_

### Early Registration: before April 31, 2007

Full Euro 600  
+25% VAT for Swedish participants only

Greth, EHPA, SVEP member Euro 500  
+25% VAT for Swedish participants only

### Late Registration: after April 31, 2007

Full Euro 700  
+25% VAT for Swedish participants only

On-line registration at [www.greth.fr/sherhpa](http://www.greth.fr/sherhpa)

Payment by bank transfer at : KTH  
SWIFT Code: NDEASESS  
IBAN: SE05 9500 0099 6034 0015 6539  
Quote "MJEB/Sherhpa-course" on all bank transfer

NOTE : The participant registration will be effective only after receipt of the payment.