INFORMAL GROUND-MED MEETING IN BRUSSELS

Date: Thursday 3 September 2009

Time: 14:00 – 19:00

Venue: Renewable Energy House,
rue d'Arlon 63-65, B-1040 Brussels.

Agenda: BHE design for WP5
Cost estimation of BHE construction
Data Management System for WP4
Discussion and decisions for WP4 and WP5
Contract amendment
Planning next actions

Participants: D. Mendrinos, CRES
C. Karytsas, CRES
D. Finn, UCDublin
C. Montagud, UPValencia
G. Van Gelder, GROENHOLLAND
R. Cerdeira, ESTSetubal

MINUTES

1. Work Package 4

Work progress on WP4 was reviewed by D. Finn. The main points and conclusions drawn were:

- CONTROL: It was noted that heat pump control would consider each of the following technical options: set-point control of space temperature, set-point control of building water return temperature, optimisation of space temperature bandwidth, optimisation of building water temperature bandwidth, ambient temperature compensation. It was also suggested that pump speed control could be used as either an anti-freeze measure in the ground loop or as a temperature compensation control mechanism in the building loop.
- Data Management System: The following variables should be measured by the BESEL DMS system for each demonstration installation:

  Temperature sensors:

  - water inlet/outlet temperatures for the building circuit
  - water inlet/outlet temperatures for the ground circuit
  - outside ambient temperature
  - air temperature for each conditioned space

It would be prudent to (i) double the amount of temperature probes at each measurement point and (ii) to allow for easy access and wiring flexibility for calibration of the temperature sensors.

Pressure sensors:

- a differential pressure sensor for the ground and building circuits.

Fluid flow sensors:

- a fluid flow rate sensor for the ground and building circuit.

Power consumption:

- power consumption sensors for each of the following: the compressor, the building circulation pump, the ground circulation pump and the fan coil units.

- DMS Template

A common technical template should be used for the DMS system for each demonstration heat pump as far as is feasible. This commonality should extend to include: individual sensors, sensor conditioning systems, the DMS-sensor interface/connectivity, the DMS interface software, the DMS software programme.

ACTION: BESEL to draw up a DMS sensor template as per task T4.4 in conjunction with WP4 partners and demonstration site partners and circulate to all interested parties for comment.

- DMS Sampling Rate / Control Activation Time

From a control perspective a sampling / reaction period of 5 minutes is proposed at this point. If feasible, it may be best to sample on a 30 or 60 second basis, but to average the data over a 5 minute period.

ACTION: BESEL/ISR to confirm data storage capability of their DMS/micro-processor systems.

- Control / Microprocessor

ISR/UCD/BESEL to discuss with each heat pump provider and site provider issues pertaining to the integration of each ISR microprocessor control board (Task 4.5) with the heat pump system and the DMS system. This could be done either by email or meeting as required.

ACTION: UCD to initiate discussion with ISR/BESEL to deal with this issue.

- Circulation Pumps

Wherever feasible and relevant, a common pump – controller interface specification should be utilised for each building and ground circulation pump.

- Deliverable D4.1 Generalized Control Model Software

This will be delivered by UCD on 31 October according to schedule. It will be officially submitted to DG-TREN with the first annual report in January 2010. A revised version may be prepared and re-submitted later on if necessary.

2. Work Package 5: BHE design

BHE design by EED simulation was presented by D.Mendrinos for the following demo sites. Costs were estimated by C.Karytsas. G. van Gelder made extensive comments on the BHE design details. Main points are:

BHE costs

For single-U: 25-30 €/m in Netherlands and Ireland; 40 €/m in UK; 50 €/m for Greece and South Europe.

For double-U: 55-60 €/m for Greece and South Europe. Double-U can be considered in cases of high thermal conductivity and subsurface water flow.

For all demo sites:

- Partners should examine the possibility to back-fill the borehole heat exchanger from bottom to the water level with a gravel/sand mixture, instead of grouting in case this is allowed by local regulations and in cases where mixing of water from different horizons is not a problem. This will enhance considerably the performance of the BHE and the heat pump SPF.
- Spacers should be used, otherwise longer BHEs should be considered.

Barcelona Demo Site: La Fabrica del Sol.

- The cost of the ground heat exchanger (14 boreholes x 100m depth) is estimated at around 70.000 € very close to the budgeted amount of 72.000 €.
- The minimum temperature of 1.5°C is marginal for using water as BHE fluid. A longer BHE should be considered. CIAT should also be consulted on the matter.
- Due to proximity to the sea, salt water intrusion to underground water is possible; in that case a marine type of cement should be used to avoid clay flocculation.
- Flow of 0.214 lt/s per borehole is at the lower allowable limits. CIAT should be consulted for heat pump flow requirements.
- For fine design, building loads are very important; minimum temperatures during winter are also important; a small increase in the cooling load would have large impact to BHE fluid temperature and heat pump SPF; available gas or electricity consumption data would help.

Benedikt demo site

- Deeper BHEs with 40mm PE pipe and gravel/sand back-fill instead of bentonite grout should be considered.
- Using the flux option of the EED should be considered here.
- During operation, maintaining a very low flow will store heat from below in upper geologic layers would increase BHE performance.
- Due to the low thermal conductivity of the clay, the borehole distance can be reduced to 6 meters in order to simplify the surface transmission piping.
- A shorter BHE is possible, as winter peak load temperatures can be further relaxed.

Coimbra demo site

- Cooling loads seem extremely underestimated
- Details on indoor heating/cooling system to be replaced to be sent to UPV
- Geological data from local boreholes should be obtained from local geological society
- Due to the long distance between the boreholes and the building the hydraulics of the system (flows, pressure drop, etc.) should be calculated properly
- The flow per borehole should be checked with CIAT
- Re-running with higher cooling loads is necessary, as the system performance is very sensitive to cooling load.

Edrasis demo site

- EED has calculated a wrong Reynolds number; probably the flow per borehole mentioned in EED corresponds to flow per loop; to be checked for EED version 3.
- Desired Reynolds numbers should be in the range 2300-2500.

Oradea demo site

- Thermal response tests performed in Cyprus indicated a thermal conductivity equal to 1.5 W/m°C for Marls.
- Cooling loads are very low.
- A small capacity heat pump should be used; check for a possible contract amendment.
- Monoethyleneglycol is more toxic than monopropyleneglycol but has better performance.
- The system can be provided with a heat exchanger for free-cooling during the summer period.

Ciat demo site

- Detailed load information is expected from CIAT

UPV and HIREF demo sites

- C. Montagud presented the BHE design aspects there