Sepemo project: measuring GSHP system performance

Duration: 06/2009 – 06/2012
Contract

Thomas Nowak
SEPEMO-Build Background

• **lack of robust data** on the conditions in “real heat pump installations” across Europe influencing
  – reliability,
  – seasonal efficiency (SPF)
  – Contribution potential to RES use and energy savings
• **perception of heat pumps** (in particular their performance) often based on gut feeling, not on data; Historical image (1980s!) as unreliable, error prone technology still not overcome
• Mismatch of **marketing promise and reality** – often due to errors in system design and installation
Field measurements for heat pumps in Europe

- FAWA "average"
- FAWA "best of class"
- Fraunhofer "new buildings"
- Fraunhofer "existing buildings"
- Energy savings trust
- SEPEMO

Source: EHPA 2010
<table>
<thead>
<tr>
<th>Project lead partner</th>
<th>Project Coordinator</th>
</tr>
</thead>
</table>
| SP Technical Research Institute of Sweden  
Box 857, 501 15 Borås, Sweden  
www.sp.se | Roger Nordman  
Tel.:+ 46- 10- 5165544  
roger.nordman@sp.se |

| SenterNovem  
www.senternovem.nl | Electricité de France R&D  
www.edf.com |
| Armines  
www.armines.net | Fachinformationszentrum Karlsruhe  
www.fiz-karlsruhe.de |
| European Heat Pump Association  
www.ehpa.org | Centre Scientifique et Technique du Bâtiment  
www.cstb.fr |
| Arsenal research  
www.arsenal.ac.at | Centre for Renewable Energy Sources  
www.cres.gr |
| Fraunhofer ISE  
http://www.ise.fraunhofer.de/ |  |
SEPEMO-Build Objectives /1

• The project aims at
  – Overcoming market barriers to a wider application of HPs, namely the lack of robust data on the conditions “in real installations” influencing reliability and seasonal efficiency, i.e. the SPF of HP systems in Europe.
  – Developing a common methodology for field measurement of HP systems SPF. This requires a systems perspective including the efficiency of the HP unit and also the respective regional building standards and climate conditions.
The project aims at

- Improving the **understanding** of key parameters influencing the reliability and efficiency of HP systems in residential buildings, by improved quality assurance for HP systems in the building sector.

- providing the named information for all types of HPs (air, water and ground) and heat distribution systems (air, water) in residential buildings.

- **broader acceptance of heat pump systems** and **improved quality assurance for heat pump systems** in the building sector.
SEPEMO-Build  Main steps

- Collection and evaluation of *past and present field measurements* on HP systems.
- **Evaluation of existing methods** for field measurement and calculation of HP systems SPF.
- Development of a **common methodology** for field measurement of HP systems and calculation of SPF.
- **New field measurements** on HP systems using a common methodology.
- Improve existing **guidelines** for installation of HP-systems: include all HP-types, regional climates & building standards.
- Information dissemination.
The results from the SEPEMO project are expected to:

- be a valuable input to estimating SPF for the RES directive (Annex VII B), and for EUROSTAT statistics.
- Support the RES-directive (Annex IV) in development of guidelines for system quality. Also it provides input to installer training and certification.
- Lead to better insight in system concepts and their impact on differences in performance.
- Serve as input for the ErP-Directive both for the methodology planned in the directive to calculate the primary energy efficiency of heat pumps, as well as for the setting of class boundaries.
Supporting the RES-directive (Directive 2009/28/EC)

**ANNEX IV**

- Certification of installers

**Annex VII**

- $E_{RES} = Q_{usable} \times (1 - 1/SPF)$
- $SPF > 1.15 \times 1/\eta$

- 2. Biomass, heat pump, shallow geothermal ... installers shall be certified by an accredited training programme or training provider.

- By 1 January 2013, the Commission shall establish guidelines on how Member States are to estimate the values of $Q_{usable}$ and $SPF$

SEPEMO supports both these actions!
## Comparison of components measured

<table>
<thead>
<tr>
<th>Component</th>
<th>SPF H1/C1</th>
<th>SPF H2/C2</th>
<th>SPF H3</th>
<th>SPF H4/C3</th>
<th>EN14511</th>
<th>EN15316-4-2</th>
<th>VDI4650-1</th>
<th>prEN14825</th>
<th>Lot 1</th>
<th>Lot 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressor</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brine fan/pump</td>
<td>---</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>head losses</td>
<td>x</td>
<td>x</td>
<td>head losses</td>
<td>head losses</td>
<td>head losses</td>
</tr>
<tr>
<td>Back-up</td>
<td>---</td>
<td>---</td>
<td>x</td>
<td>x</td>
<td>---</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buffer tank pump</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>x</td>
<td>---</td>
<td>x</td>
<td>---</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SH DHW fans/pumps</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>x</td>
<td>head losses</td>
<td>---</td>
<td>head losses</td>
<td>head losses</td>
<td>head losses</td>
<td>head losses</td>
</tr>
</tbody>
</table>


Results:
Definition of measurement setup

- **Non-technical**
  - Logbook
  - Questionnaire

- **Technical**
  - Type & accuracy of sensors
  - Datalogger
  - Data-transmission
SPF_{heating/cooling}: simplified visualization

- SPF 4
- SPF 3
- SPF 2
- SPF 1

- heat source pump / fan
- heat pump
- back up heater
- heat sink pump
Field measurements

- Type of units: GSHP, ASHP, Air-Air units
- Mostly residential buildings
- Duration: one year in appr. 45 places in Europe
  - 7 Austria
  - 8 Sweden: incl. Air-Air!
  - 13 France: incl. Air-Air!
  - 13 Netherlands
  - 6 Greece
- Measurements are started in the 4th quarter 2010
Results:
Evaluation of quality schemes (D5.2)

• **Evaluation across Europe**: Qualicert, EUCERT, detailed for 6 countries (AT, DE, FR, GR, NL, SE).

• **Discussion points**
  – Voluntary or mandatory
  – Company or personal certification
  – Size of small scale renewable
  – Auditing and renewing the certification
  – Training
  – Relation to other European directives
  – Role of government and stake
  – Relation to conventional fossil technologies
D5.2
Conclusions

• Training and certification should harmonized (EUCERT)
• one-stop shopping for certification
• Accommodate existing training infrastructure into RES training programs
• Execute training via accredited private and public bodies as well as industry or associations
• Ensure regular update of training
• Voluntary/mandatory certification vs. schemes coupled to a subsidy scheme or building code
• Lack of consumer interest in quality needs to be tackled
Results in dissemination

- Website: www.sepemo.eu
- Quarterly Newsletter
- Test site database
- Expert group
- Dissemination meetings
  - Stakeholders (architects, planners, installers ...)
  - Policy makers
Next steps

- Continuation of Field measurements
- Evaluation of measurements
- Revision of education and training material (INPUT to EUCERT in 3/2012)
- Compilation of deliverables
- Ongoing dissemination
  - Expert group meetings
  - Stakeholder meetings in Brussels
  - Website & Newsletter
- Final reports & recommendations: Conference 2012
Dissemination conference 18.10.2011

14:00 Welcome | Bogdan Marcinkiewicz, MEP

14:10 Heat pumps contribution towards meeting the Polish Energy challenge
Janusz Pilitowski, Deputy Director
Polish Ministry of Economy, Energy dpt.

14:30 Polish experience in the heat pumps market, perspectives of development
Andrzej Oczos, PORT PC

14:50 Increasing recognition, growing markets, increasing contribution: the European heat pump market
Thomas Nowak, EHPA

15:10 The importance of quality installations on performance: SEPEMO build
Roger Nordman, SP

16:00 Lessons learned from field trials to improve installer knowledge
Onno Kleefkens, Agentschap NL

16:20 Lessons learned from field trials on system design
Marek Miara, Fraunhofer ISE

16:40 Panel discussion: “How can we boost heat pumps recognition and contribution to Polish and EU targets?” Moderation: Sonja van Renssen
To find out more

Contact the project lead partner:

Dr. Roger Nordman
SP Technical Research Institute of Sweden
Box 857, 501 15 Borås, Sweden
www.sp.se | Roger.Nordman@sp.se

or visit: www.sepemo.eu
EHPA was established in the year 2000 to promote awareness and proper deployment of heat pump technology in the European market place for residential, commercial and industrial applications. EHPA aims to provide technical and economic input to European, national and local authorities in legislative, regulatory and energy efficiency matters. All activities are aimed at overcoming market barriers and dissemination of information in order to speed up market development of heat pumps for heating, cooling and hot water production.

Contact:
Thomas Nowak
Renewable Energy House | Rue d’Arlon 63-67
B-1040 Brussels

phone: +32 24 00 10 17 / fax: +32 24 00 10 18
mail: thomas.nowak@ehpa.org
http://www.ehpa.org