

FIRST REVIEW MEETING

HEAT4U PROJECT

July 19th 2013
Paris, GDF SUEZ

Gas Absorption Heat Pump solution for existing residential buildings



Under the EU's Seventh Framework Programme for Research



The Consortium

Project
Coordinator



Project
Partner



The Advisory
Committee



First Review Meeting – 19th July 2013

WP 2

Speaker: Luigi Tischler



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**Gas Absorption Heat Pump solution
for existing residential buildings**

Name, Title

COMPANY LOGO

Achievement of WP 2

Task 2.1 “Development of absorption technology working elements”.

Task 2.2 “Modulating combustion train for application to GAHP technology”.

Task 2.3 “Thermal Insulation, Noise Reduction, Air Flow control and Enclosures Design”.

Task 2.4 “GAHP Appliance control”.



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**Gas Absorption Heat Pump solution
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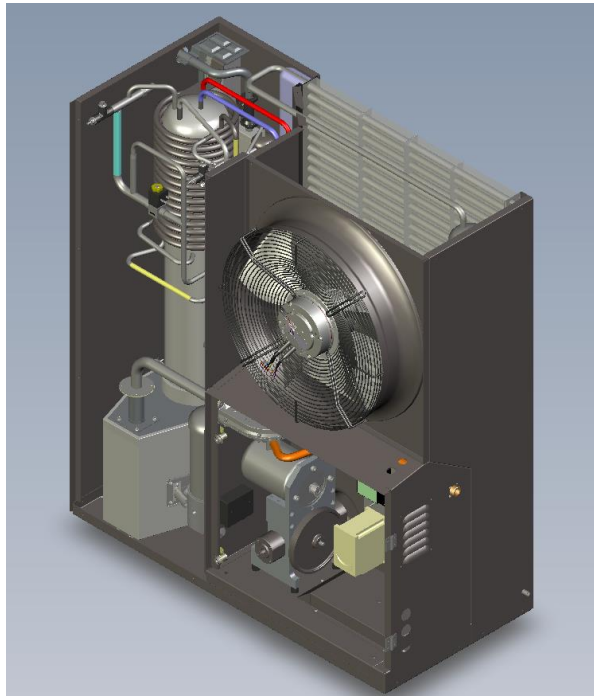
WP2 Task 2.1 “Development of Absorption technology working elements”

- Design of the sealed system hardware components of the cycle;
- Manufacturing of components and assembly of the sealed circuit;
- Purchase/construction and assembly of combustion, ventilation, oil pump and electronics control components.
- Setup of the "breadboard" fully equipped with transducers for functional preliminary testing in test room. Test room setup with instrumentation for measurement of the relevant thermodynamic parameters



Task 2.1 “Development of Absorption technology working elements”

GAHP Appliance Target specifications



Product line	Gas driven air source heat pump
Markets	North European
Brands	HEAT4U
Installation	Outdoor, Wall side
Product output range	
Thermal output (A7W50) [kW]	18
Modulation range	1:3
Lower modulation output [kW]	6
Operating limits	
Max. flow temperature	+65 °C
Min. outdoor temperature	-15 °C
Max. outdoor temperature	+40 °C
Energy efficiency (EN12309:2000)	
GUE (A7 W35) 100% output	1.66
GUE (A7 W50) 100% output	1.57
GUE (A7 W50) 33% output	1.43
GUE (A-7 W65) 100% output	1.00
Noise emission	
Noise power level [dB (A)] at 100% output	67 dB
Noise pressure level [dB (A) at 1m ; ventilation side]	59 dB@ 1 m
Gas	
Gas type	G20
Gas supply pressure	18 – 25 mbar
Flue disposal	PolyPropilene (60mm diameter)
Flue pressure	80 Pa
NOx-emission	< 20 ppm
Hydraulics	
Water content	>2,5 litres
Min. flow rate required (water pump not included)	300 l/h
Max. flow rate allowed (water pump not included)	1700 l/h
Pipe connection	Side (bottom)
Electric	
Max. power consumption	400 W
Max. stand-by power	<10 W
Electrical Supply	230 V / 50 Hz
Power line connection	Single phase
Electrical safety class	IP X5D
Others	
Height [mm]	1370
Width [mm]	1130
Depth [mm]	530
Weight [kg]	260 kg

WP2

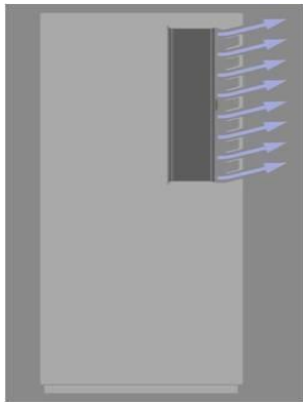
Task 2.2: Modulating combustion train for application to GAHP technology

- The combustion chamber configuration has been reviewed to optimize geometrical aspects and behavior at partial loads (in particular for heat losses) and several insulation solutions and materials have been prototyped to identify optimal choice in terms of temperature limits, thickness, cost and heat losses. Optimization and Testing of combustion chamber have been completed by exploring and characterizing appliance behavior at all possible operating conditions (ambient temp, heat output, output temp, etc.).
- Design reviews have been performed to verify if all design parameters of the combustion train (emissions of CO, CO₂, NO_x, flue temperatures on the different heat exchangers, form factors, environmental temperatures, etc.) would have been met with the anticipated design.
- The design that will represent the basis for the Field Test units will therefore not only meet those performance criteria, but also already incorporate only “off-the-shelf” components.



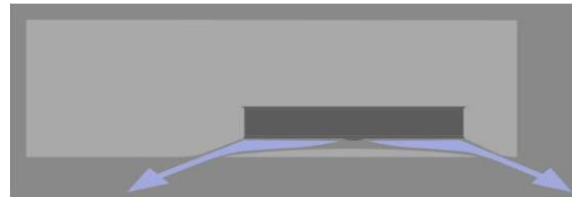
WP2 Task 2.3: Thermal Insulation, Noise Reduction, Air Flow control and Enclosures Design

Starting from a preliminary conceptual prototype of GAHP appliance provided by Robur, Pininfarina developed 3 main concept architecture solutions based on different fan-shading strategies:



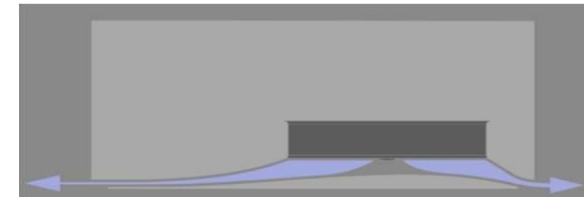
A) Grills shading strategy:

the fan is shielded by shaped grills that operate as a safety protection for the fan blades and as flow diverter



B) Partial fan shielding strategy:

Fan shielded by a specific form of the fairings. The coupling of the shield and the body creates the flow diverter and the opening of the flow. The shield operates also as a noise suppression system.



C) Total fan shielding strategy:

Fan complete shielded and flow diverted toward the machine perimeter to achieve the maximum noise suppression

WP2 Task 2.3: Thermal Insulation, Noise Reduction, Air Flow control and Enclosures Design

Among all strategies B and C have been selected for further investigation and development and in particular, among 14 different alternative design solutions, two solutions (Solution 4 and Solution 14) have been selected as the best representatives of the two strategies.

The two selected concepts have been correctly proportioned and modeled in virtual 3D environment to verify packaging and define shapes.

In order to test the performances of the selected concepts two full scale models have been developed and tested in the wind tunnel to understand the degree of noise reduction achieved with the set of improvements.



WP2 Task 2.3: Thermal Insulation, Noise Reduction, Air Flow control and Enclosures Design

Noise Reduction due to application of the “total shielding” enclosure was investigated in depth. The results of the noise reduction was mapped on all sides of the GAHP Appliance assembled with the enclosure “Solution 14”. The diagrams generated by spatial subtraction of noise levels of product with and without enclosure were developed.

While contribution to reduction is reached on all sides of equipment is it relevant to highlight:

- 10 to 12 dB reduction in correspondence to the ventilation fan
- Noise emission from sides has been reduced as well by 0 to 4 dB



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Task 2.4:GAHP Appliance Control

Appliance On Board Control Hardware (GAHP10, UI10 and Flame Control Boards) and Firmware.

During the first 18 months Robur has carried out major advancement in the creation of an on-board Appliance Control that is responsible to guarantee:

- the safe operation,
- the proper functionality of the appliance by controlling the different functions (combustion, ventilation, pumping of refrigerant, circulation of water flow)
- maximization of the efficiency by optimizing ideal Appliance response the environmental conditions.

The achievements of the first 18th months of the program can be summarized in several different areas:

- Hardware Architecture: 100% completed
- Hardware Design: 70% completed
- Firmware Architecture: 90% completed
- Firmware Design: 70% completed



Future plans

- Material procurement and assembly of the GAHP Appliances for field test launched. GAHP appliance development activities are planned to be completed for the delivery of Lab Test and Field Test units on month 24th (October 2013)
- Still to be finalized are the thermal insulation studies, the mechanical engineering and the verification of serviceability and overall weight of the conceived enclosure.

