Warwick Gas Heat Pump and Thermal Transformer Update, October 2017

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Market Scenarios:

Two scenarios are considered:

- The first assumes that the market for Gas Heat Pumps will saturate at a 70% share of gas heating appliances annual sales after approximately 12 years (the rest of the market remaining as condensing boilers).

- The second assumes that after 7 years on the market, the cost of Gas Heat Pumps reaches the point where legislation requiring their use is introduced, in much the same way as was carried out for condensing boilers replacing non condensing boilers.

A 2.6% reduction in UK annual CO₂ emissions by 2040 is possible.

There is a potential for an eventual 4.2% reduction in annual CO₂ emissions if all gas boilers were replaced by gas heat pumps.
R&D at Warwick:
1: Carbon – ammonia adsorption
Experimental Results (June 2016)

Heating Power: 7.5 – 9 kW
COP: 1.19 – 1.34

<table>
<thead>
<tr>
<th>Cycle Time [s]</th>
<th>Load Inlet [°C]</th>
<th>Load Outlet [°C]</th>
<th>Evaporating Temperature [°C]</th>
<th>COP Experiment</th>
<th>COP Model</th>
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**Conclusion:**

Machine performed as predicted, however, high manufacturing cost of the generators prohibited further development.
New Generator Design

Shell and Finned Tube

Design Parameters:

- Tube diameter
- Tube pitch
- Carbon thickness
- Fin thickness
- Turbulator tube insert

Detailed simulations in Matlab
Large Temperature Jump Test

100 mm Long Test Sample
Machine Construction
Performance Predictions

Performance envelopes for each pitch

- P20
- P22.5
- P25
- P27.5
- P30

COP vs. Power (KW)
• Kebabs finished by end of October
• Testing in December?
• If successful, following steps are:
  • Use bespoke water valves
  • Use existing air source evaporator
  • Test in environmental chambers
R&D at Warwick: 2: Salt –ammonia adsorption – joint project with ECN

Phase 1: LT salt adsorbs, HT salt desorbs

Phase 2: LT salt desorbs, HT salt adsorbs

COP c. 1.3 with MUCH simpler construction, lower cost.
Thank you for your attention

• Any questions?