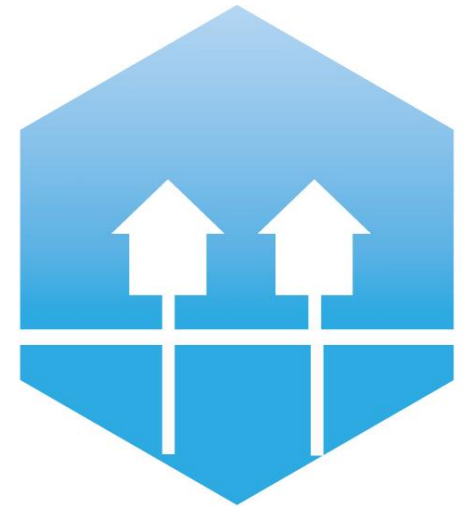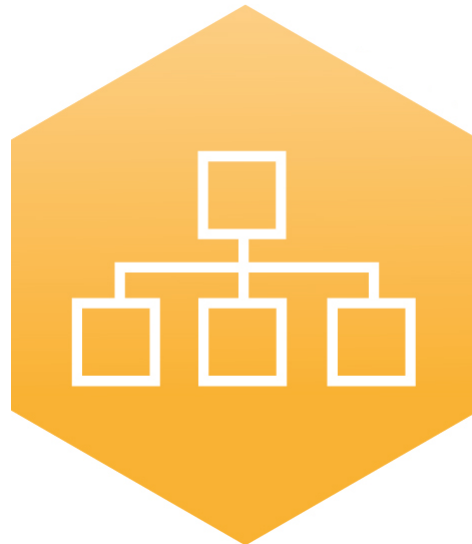2nd International Conference on Smart Energy Systems and 4th Generation District Heating
Aalborg, 27-28 September 2016

Individual house substation testing – development of a test and initial results

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4DH
4th Generation District Heating
Technologies and Systems

UK context

- Communal heating required for new buildings being constructed in London

- So aim of builder has been to meet this requirement at lowest cost.

- No city wide DH network to connect to and hence limited DH standards

- Many of the designers and installers have little DH experience
    - Systems poorly design and oversized

- Typically poor heat network performance
    - High return temperatures
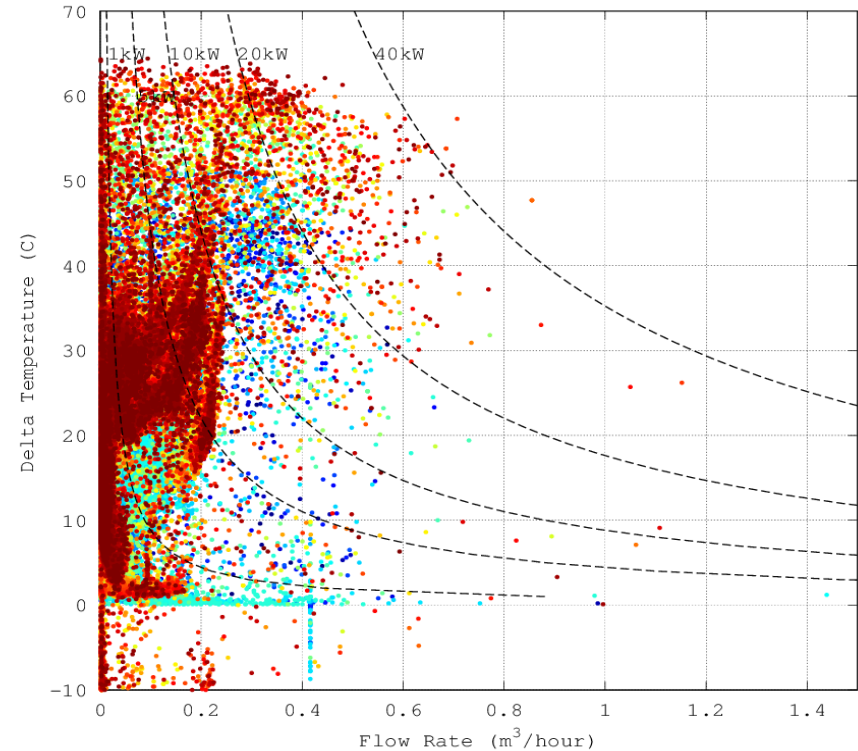   - High heat costs
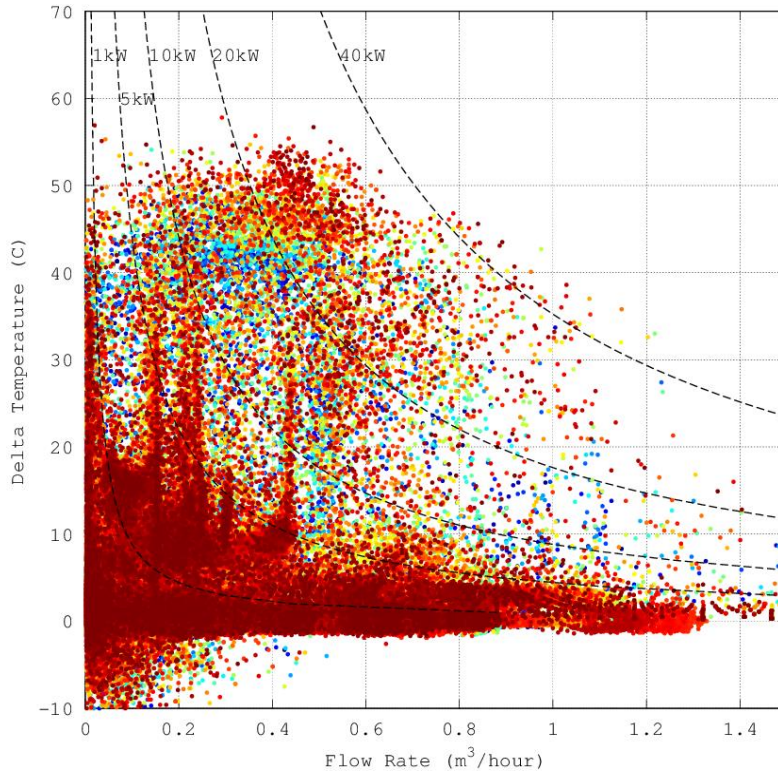
- High capital costs too

Typical system return temperatures.
From block of 110 apartments
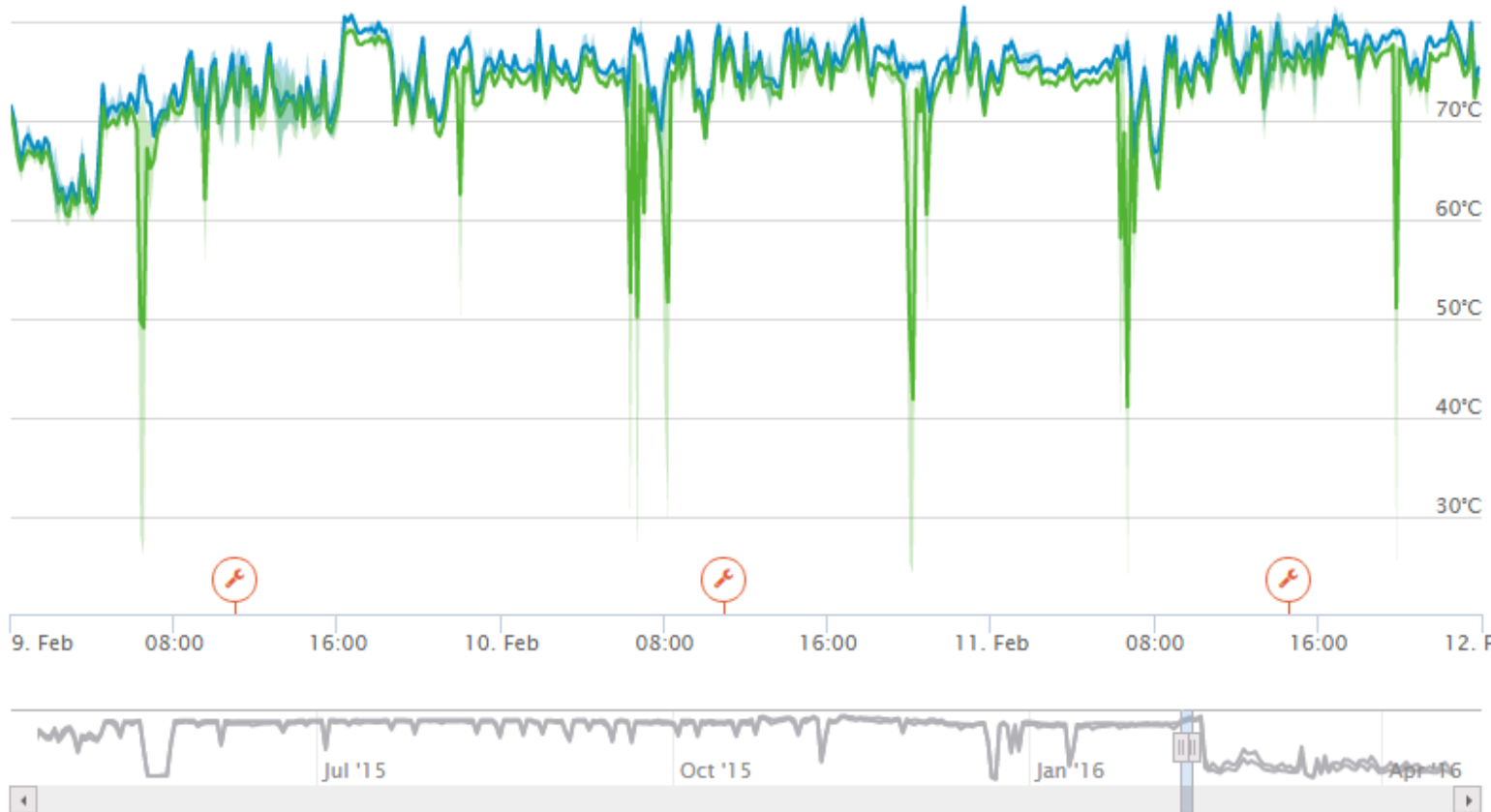
Data from
Guru
Pinpoint

Flow Temperature (°C) Return Temperature (°C) Delta Temperature (°C) Power (kW)

Substation performance in practice

Aims of substation test

- Test developed from Swedish District Heating Association test F103-7

- Evaluate performance of individual dwelling substations during:

    – space heating (indirect),

    – DHW generation (instantaneous),

    – standby

- To explore / demonstrate impacts of different design specification

    – Range of DHW and space heating temperatures

    – Maximum DHW outputs and DHW delivery time after standby period

- To provide data to research project using customer heat meter data to asses problems on network / substation / secondary system the Guru Systems project.

Substation performance metric

- The volume weighted average return temperature (VWART) was calculated for each substation function, DHW, space heating and standby

- Single VWART figure calculated based on typical DHW (1420 kWh /year) and space heating demands (1450 kWh/year) and standby operation at other times

- Real consumption data has been used make the patterns and magnitudes of demands similar to real, measured, customer demands

- Both the DHW (@ 6, 10 and 13 l/minute) and space heating loads (@ 1,2 and 4kW) used in VWART calculation are much lower than the peak substation output.

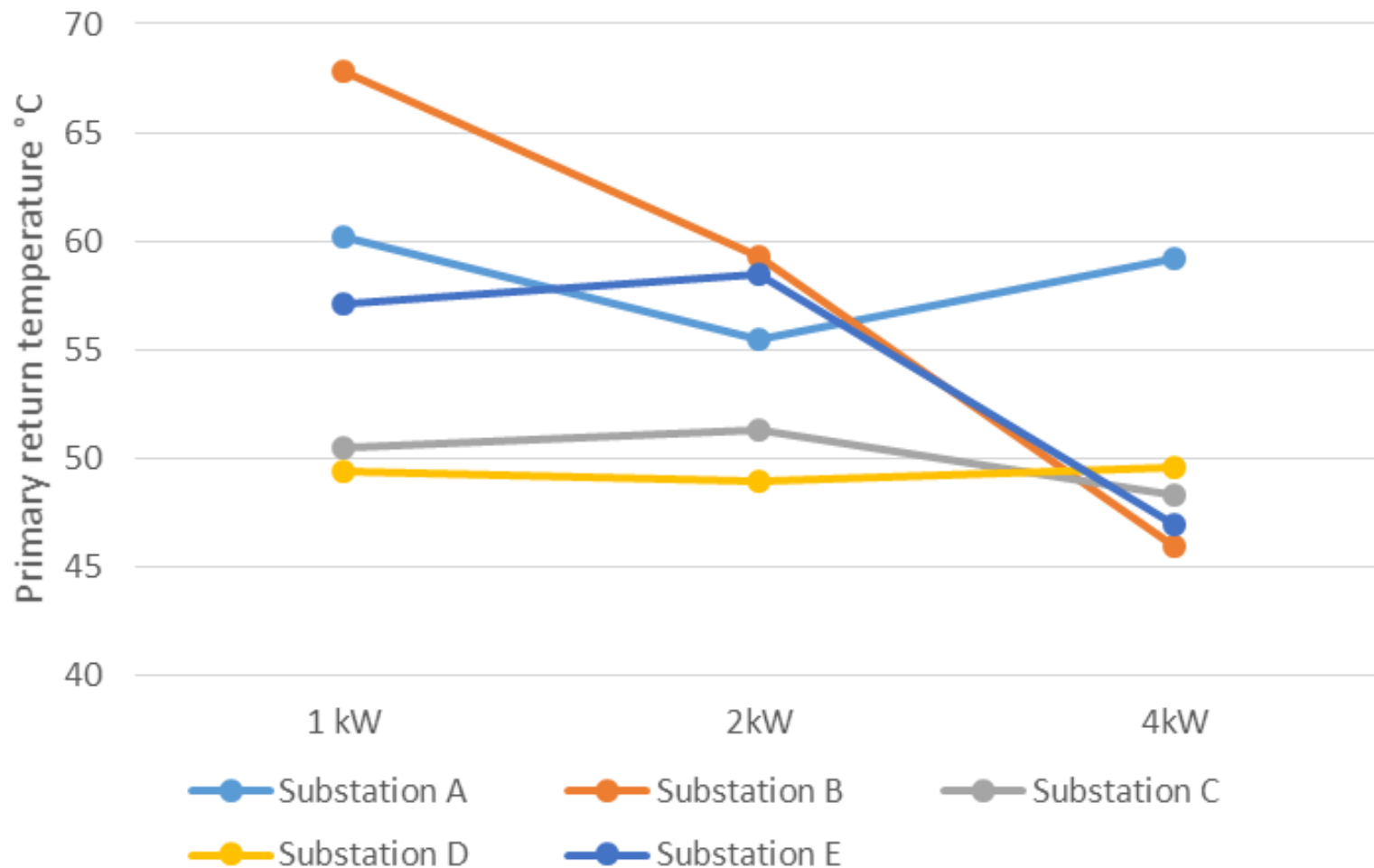- Overall VWART is single figure indication of a substation's annual performance
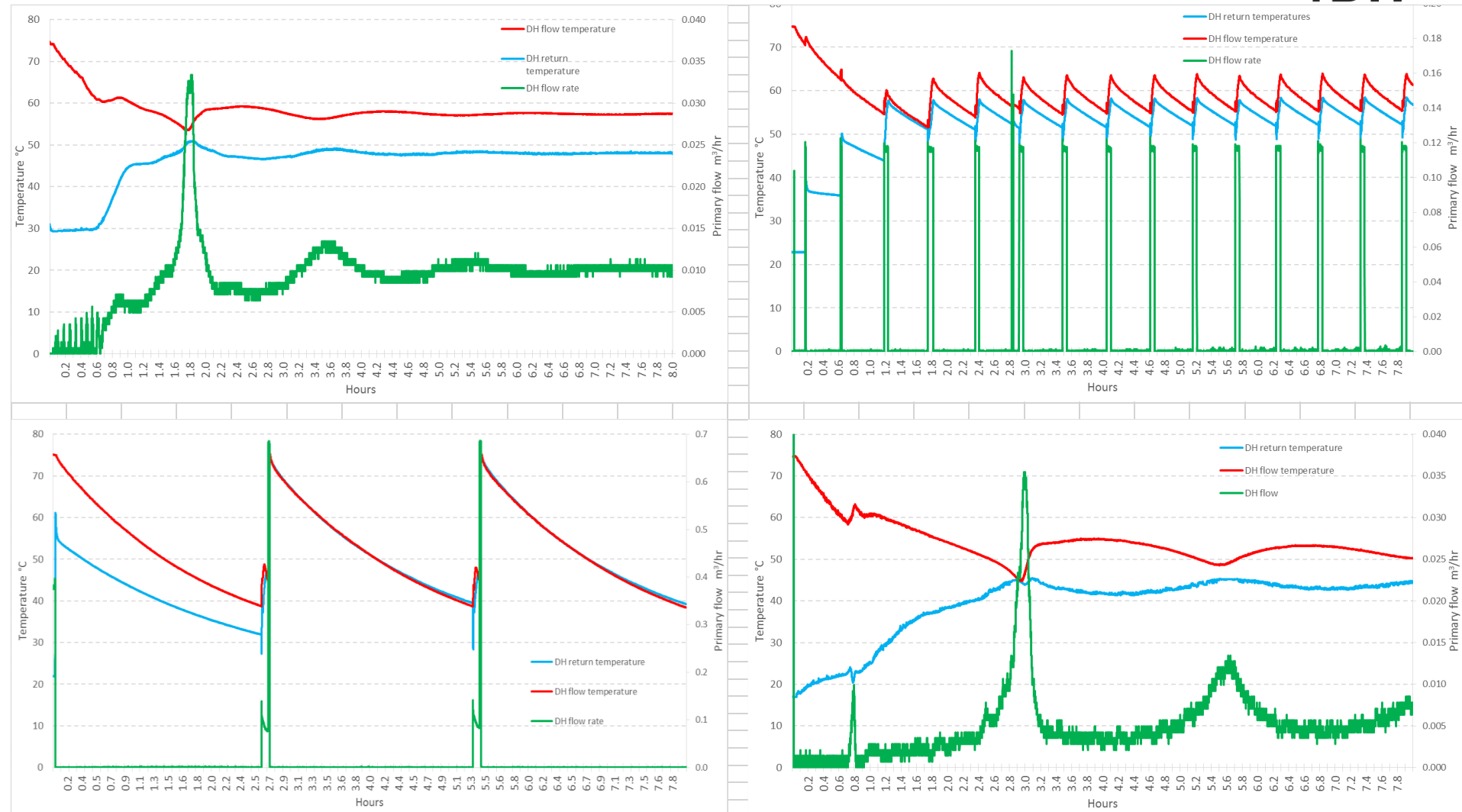
VWART results
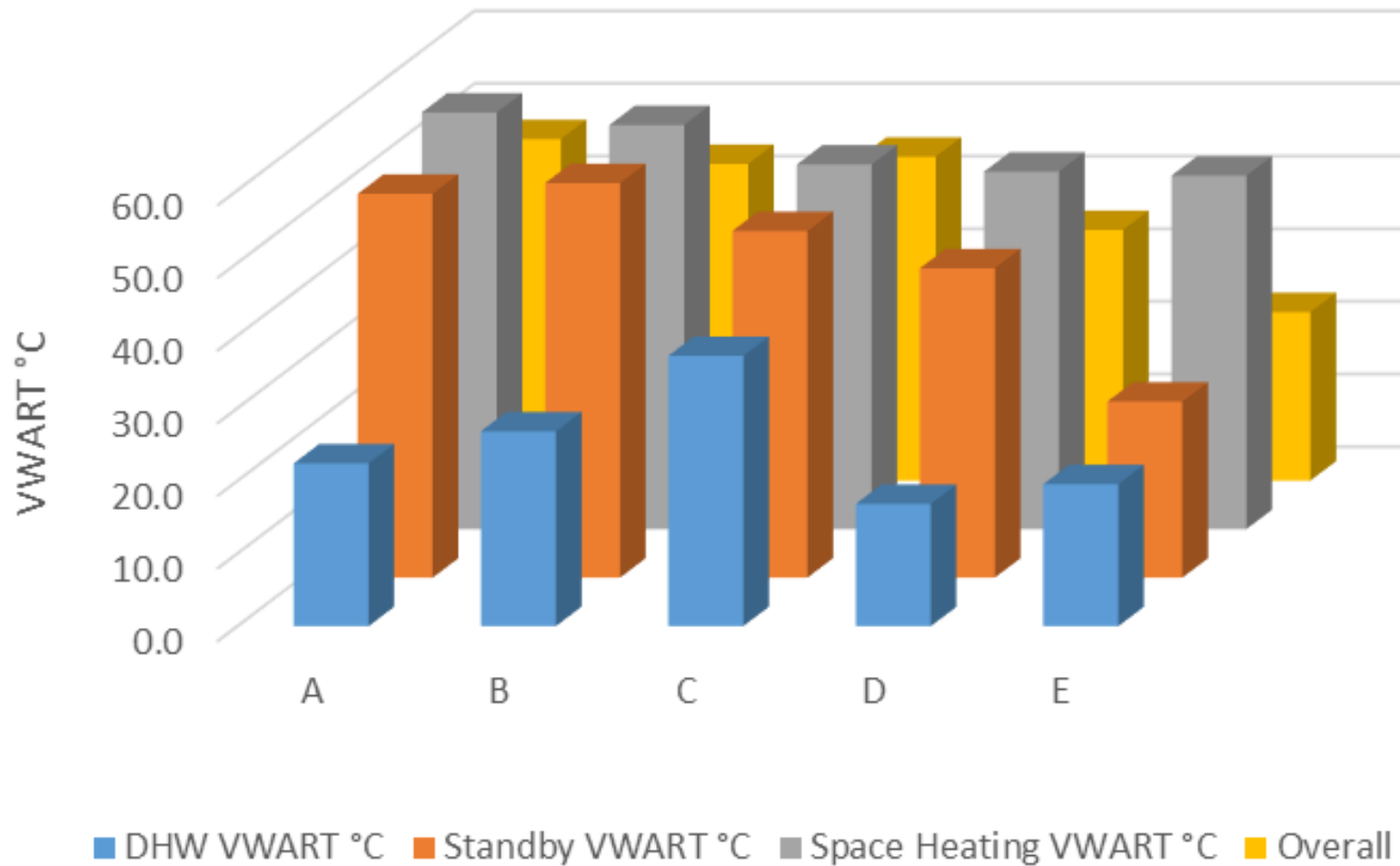
Results – annual primary flow
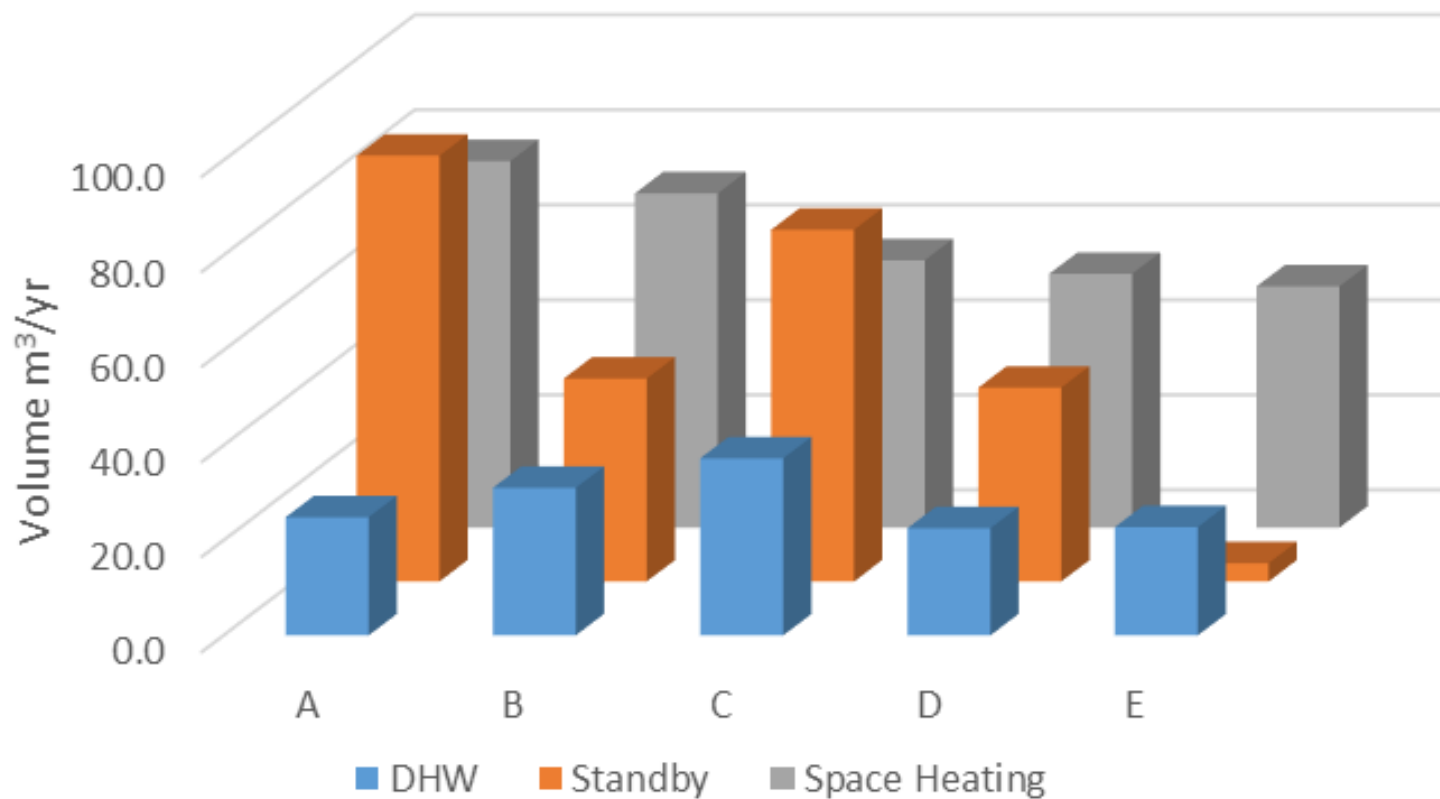
Primary return temperatures from space heating simulation - 40°C secondary return

Standby operation

Initial impacts and the future

- Initial impacts

  - VWART results being used in substation marketing

  - 6 substations tested – 5 manufacturers now making changes to substations

  - Started a good debate on many issues e.g. requirement for keep warm / standby

- Future

  - Committee of large UK DH operators to discuss future development of the test

  - Develop into a standard?

  - Include tests for lower temperatures? Variable temperatures?

  - How to evaluate benefits of more sophisticated electronically controlled substation / benefits of variable speed pumps

  - Collaboration to further develop ? Eg IEA DHC Annex XII

Substation test regime and VWART calculation method at http://www.fairheat.com/hiu-testing/

(individual house substations called 'HIUs'in the UK)

Guru Pinpoint open access UK load profiles and load diversity data https://pinpoint.gurusystems.com/user/sign-in

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