Considering cogeneration and thermal storage within UK community context [Poster].

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Introduction

• Combined Heat & Power (CHP) generation is an efficient method of supplying a site’s demand [1]. CHP has proven to be effective in applications where the intra-diary and seasonal demand variation is minimal [2].

• Domestic demand have high load fluctuation and reaching an efficient CHP operation has proven to be challenging [4].

• The domestic demand vary considerably based on factors such as number & type of occupancy and building insulation level [3].

Aim & objectives

• To develop a CHP dispatch model which would control the unit considering high resolution stochastically generated heat and electricity demand data.

• To compare the outcome (CHP dispatch) for different generation and storage unit sizes.

• To compare the outcome between different sites: a site consisted of old non-insulated flats and another site consisted of PassivHaus flats.

Results

Fig. 7 Cumulative heat demand by its components for different sites

Fig. 8 CHP dispatch for a winter day: 25 old flats, 15kW ICE, 1 m3 TES

Fig. 9 CHP dispatch for a winter day: 25 PassivHaus flats, 15kW ICE, 1 m3 TES

Fig. 10 Generation sources for varying building, CHP & TES capacities

Conclusion & further work

• Data from the previous field trial indicates a strong correlations: between overall efficiency and load factor; overall efficiency and generation cycle (figure 3 & 4).

• In order to see the effect of varying domestic load factor on generation units, high resolution stochastic data is generated to represent the site demand (figure 5).

• The comparisons were all conducted by dividing the heat supply to its generation components and storage: CHP, boiler and thermal energy storage.

• When comparing the cumulative site heat demand, it is clear that the site consisted of PassivHaus flats space heating component is considerably smaller (figure 7).

• Therefore a more insulated site is likely to have a demand more consistent inter-seasonally. However, the heat demand peaks caused by domestic hot water usage (mostly in the morning) is covered by peak boilers in both cases.

• The high heat to power ratio of old flats pushes an electrically led CHP to be either undersized or oversized. Where in case of PassivHaus TS has a higher utilisation rate since the heat to power ratio becomes lower (figure 10).

• Further work will includes annual analysis, calculating economic profitability and carbon emission savings.

References


