



# CARBON BITES

From the CIBSE YOUNG ENERGY PERFORMANCE GROUP

## Future of Decarbonisation of Heat – Gas vs Electric

### Decarbonisation of Heat

Heat supply is one of the most significant factors affecting the energy use and carbon emissions in the UK. Supplying heat accounts for about 40% of the total energy use and 30% of the total CO<sub>2</sub> emissions. The current government policies for the supply of the heat and reducing emissions in the coming years include: gas based district heating primarily employing a combination of CHP (combined heat & power) and gas boilers, electrically powered heat pumps, improved insulation and other passive strategies to reduce heat demand. Based on the current trends of emphasis on renewable power generation and improved system efficiencies in gas based heat generation, it is predicted that both electric and gas based heating will have reduced carbon emissions in the future with advancement in technology. Both these sources of heat or one of them may dominate the future of heat supply.

### Arguments for Gas based heating

Gas which will be utilised in CHP and boilers will always remain a major source of supplying heat even with decarbonisation of the electrical grid. This is because, in high heat density areas like cities, supplying heat via heat networks will be the way forward. The infrastructure for gas supply and district heating is already in place and the technology has advanced enough to be implemented widely. The already installed district heating networks and gas supply networks won't be decommissioned as huge investment has been made to facilitate district heating networks across the country and the benefits have been observed. Also, in the future, it is a strong possibility that natural gas as a fuel will be obsolete and other gases like syngas, anaerobic gas and perhaps hydrogen may be utilised as the gas grid decarbonises. One of the key issues for the all electric future is lack of infrastructure. To supply all the heat demand of the country, the existing electricity grid capacity may need to be doubled or tripled which is very unlikely. Also, the availability of storage solutions for heat and ease of supply makes it very unlikely that the district heat networks will become redundant. All in all the electric solution may be more feasible only for areas which are off gas-grid and are essentially low density areas. This also implies that majority of the population will be served by the gas grid and the rest of the population will be served by a combination of gas and electric solutions. In essence, it is highly unlikely that an all-electric solution will be the way forward, but a combination of electric and gas based solutions would be.

### Arguments for Electric based heating

The need for energy efficiency is a benefit of all electric solutions. Electric heat pumps should provide vast majority of heating and domestic hot water in the long term and should be made mandatory for all new developments. For all the existing developments, the electric solution should be implemented with a long term plan for retrofitting. In general, electric solutions become efficient at low flow temperatures and favour energy efficiency as against CHP based systems which become less efficient as thermal demand drops and are hence resistant to energy efficiency measures. A substantial amount of research has been carried out which proves that over a lifetime, the lowest carbon option is heat pumps followed by gas boilers and the worst of the lot being CHP. Considering this, CHP technology is on its way out of the heat supply mix. It is highly unlikely that the gas grid would decarbonise at the rapid rate which is required to meet the carbon emission reduction targets. The key issue with utilising alternative gases like syngas or hydrogen is that, it would mean changing all the appliances like gas boilers and CHP engines which will require large additional investment and pose a substantial infrastructure change challenge which may not be feasible. Also even if the gases are utilised it would first need to be ensured that these gases are generated in a renewable way to assist in any benefits of reduced carbon emissions. In essence, all new developments should be all-electric and there should be a program to improve the existing stock to a de-carbonised gas system or an all-electric solution if and when such technology becomes available.

Ranjeet Bhalerao, XCO2 energy, July 2017

### Key Issues & Considerations

- Rate of decarbonisation of the gas grid
- Rate of decarbonisation of the electrical grid
- Advancement in technology for utilising alternative gases and infrastructure change challenges
- Feasibility of doubling or tripling of the electricity grid and the infrastructure implementation challenges
- Government policies for both technologies and the influencing factors

### Further Information

- Slides of the presentation from each side will be available on the CIBSE YEPG website - <http://www.cibse.org/networks/groups/young-energy-performance-group>
- Previous debate on the topic - <https://www.cibsejournal.com/general/wrestling-with-the-future-of-heat-debate/>

### Key Lessons Learnt

- Gas and electric both are equally promising solutions
- Government policies will substantially influence the future of decarbonisation of heat
- Both technologies are significantly dependent on infrastructure changes/upgrades and additional investment would be required irrespective of which technology would dominate
- Potentially, the future of heat would be a combination of gas and electric based heating



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