

NOX emissions and decentralised energy production

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Energy production in the UK is responsible for over 50% of total UK CO₂ emissions (37% from centralised power generation, and 14% from domestic heat generation from fossil fuels). Over 90% of UK electricity is currently generated in large power stations, and around three-quarters of heat comes from a nationwide gas network.



► Upgrading an old mCHP to a Totem T20 in central London has reduced air pollution and improved system efficiency.

There has recently been a growing focus on the issue of air pollution in our cities. Air pollution in London and other UK cities remains well above UK and European legal limits, giving rise to a significant impact to health in the area.

There are a number of existing and upcoming schemes that aim to tackle the problem, such as the Ultra Low Emission Zone and the Congestion Charge Zone, restrictions on old and polluting vehicles and continual public transport improvements, as well as strict regulations to limit emissions from retrofitted and new buildings.

A major contributing factor to pollution is Nitrogen Dioxide (NO₂), atmospheric levels of which are considerably higher than European legal limits in large parts of the UK. NO₂ is a by-product of the combustion of fossil fuels and is a common pollutant in high-traffic areas. It is known to cause lung irritation and respiratory infections, and according to the Royal College of Physicians, contributes to approximately 40,000 premature deaths a year. There has been widespread recognition that more needs to be done to address the issue of NO_x, not only for transport but also relating to energy production, distribution, and consumption.

Decentralised energy in London

The Mayor of London's report, Powering London into the 21st Century, pursues the application of decentralised energy to achieve projected energy demand and CO₂ emission targets by 2025. It concludes that CO₂ emissions from London could be cut by 27.6% by adopting a low-carbon decentralised energy programme.

This became a driving factor in Advoco Ltd's expansion into micro cogeneration systems with the TOTEM, a new generation of micro-combined heat and power unit developed and manufactured in Italy. Featuring a Fiat automotive engine built for use with natural gas, the TOTEM is designed by experienced industry professionals using innovative technologies, resulting in a unit that meets the Euro 6 standards for emissions. This ensures that emissions are up to 20 times lower compared with condensing boilers, and that the TOTEM is compliant with the most stringent national

standards. Micro CHP is one of the "distributed energy" technologies that can effectively generate both energy and heat at the point of consumption.

A fundamental difference between power from a power plant and from a CHP unit is that a large scale power plant does not tend to be in the centre of a city, but rather on the outskirts for the exact reason of reducing air pollution. In London, most of the current air pollution and NO_x arises from road traffic and buildings rather than from power generation, however a decentralised energy scheme will soon make emissions from energy production an additional factor.

While NO_x emissions from the production of electricity can be reduced on a national scale by the introduction of micro-CHP, this may result in increased concentrations on a local scale. It is therefore of great importance that the NO_x emissions from new CHP units within built-up areas are limited as much as possible.

The 2018 EcoDesign directive sets a NO_x emission limit for CHP units at 240mg/kWh. This level of emissions is approximately equal to those that would result from producing heat from a boiler and electricity from conventional power plants, however under a decentralised energy scheme these emissions would be within city boundaries. Any CHP with emissions lower than this 240mg/kWh limit, such as the TOTEM at 10mg/kWh, is therefore highly desirable to reduce the impact of decentralised energy, as well as reducing pollution levels on a national scale.

The extent of possible emissions reductions can be estimated by comparing two mCHP units, using one that meets the 2018 EcoDesign limit of 240mg/kWh versus an ultra-low emission unit such as the TOTEM at 10mg/kWh. Using a unit of 20kW electrical output, a gas input of 70kW, in situation with an average annual run time of 6,500 hours for a standard application such as a hotel or apartment block, the yearly NO_x emission from the first unit will be 109.2kg/year, compared to 4.55kg/year for the ultra-low NO_x alternative unit. This is 24 times lower than units matching the EcoDesign standard, an emission reduction of almost 96%.

Nearly 50% of NO_x pollution in London is currently attributed to automobiles, however the scheme to decentralise 25% of power by 2025 will result in many new mCHP installations.

Decentralisation of energy production through use of micro CHP is an effective way of reducing Carbon Dioxide emissions on a countrywide scale, but the risk of increasing air pollution in the local area must be acknowledged. It is therefore vital to choose the lowest NO_x emitting equipment available when designing CHP systems. The Totem mCHP has the highest total efficiency and lowest NO_x emissions of any small scale CHP in its class. Advoco have partnered with Totem Energy because of their commitment to the environment and engineering excellence.

The impact of a low-NO_x mCHP such as the TOTEM in terms of equivalent vehicle emissions can be determined through a simple calculation. Considering an average driving distance of 30km (according to the 2011 UK census), using a 240mg/kWh CHP compared to a 10mg/kWh unit is equivalent to the emissions caused by an additional 193 Euro-6 diesel cars, or 86 Euro-5 diesel cars.

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