Reducing the impact of noise in cogeneration

Early detection and preventative measures can mitigate the health and environmental impacts of noise in Combined Heat and Power (CHP) applications, writes Robert Lomax, sales director of Wakefield Acoustics.

Combined Heat and Power (CHP) is being adopted increasingly for power generation in applications both large and small. Driven by fears about grid reliability, facilities from hospitals to hotels, factories to office buildings and even some residential apartments are turning to CHP to meet the growing demand for electricity. But despite its efficiency and environmental advantages, CHP still has its issues, most notably, the excessive noise levels it can produce.

The benefits of cogeneration are well documented, with such systems typically cutting costs by 20% compared to the use of grid electricity and on-site boilers. CHP can also significantly reduce greenhouse gas emissions cost-effectively due to the technologies' capability to be applied to existing energy installations. Such benefits, combined with the short return on investment it can bring, has seen a rise in cogeneration installations across the UK. There are now 2,102 CHP schemes in operation in the UK alone, according to The Department of Business, Energy and Industrial Strategy (BEIS).

However, with systems typically installed on-site to supply customers with heat and power directly at point of use, excessive noise remains a critical factor to address in many CHP installations. Along with legislation regarding the issue, increasing intolerance to environmental noise has only intensified the situation, requiring reductions in noise pollution from such applications. Noise control therefore, has been a driving factor when having to meet regulatory and environmental

noise requirements.

Given the capacity to produce excessive noise levels, most cogeneration facilities fall within the remit of two key pieces of noise legislation. Firstly the Control of Noise At Work Regulations 2005 which lowered the upper and lower action levels by 5dB(A) from 90 dB(A) to 85 dB(A) and from 85dB(A) to 80 dB(A) respectively, and secondly, key legislation in the form of The Environmental Noise Directive.

Faced with these challenges and stringent legislation, most cogeneration plant operators have, over the course of recent years, been taking a proactive approach to implementing noise management and attenuation measures within their facilities.

Addressing cogeneration plant noise

The control of noise emissions from on-site power plants relies on a thorough understanding of issues and concerns around industrial noise generally. Cogeneration plant noise control and the principles of noise attenuation would apply to virtually every type of facility.

Whether installed in a commercial setting, public building, industrial zone, or as part of a district heating system, left untreated, large CHP systems emit high levels of noise which exceed the upper action limit of 85dB (A) daily exposure levels. Additionally, plant operators are now demanding even lower noise levels within the working environment to limit noise exposure for employees. This will ensure exposure to noise is at safe limits, and also assist in the wellbeing and performance of all workers.
All CHP systems contain a prime mover or electrical generator which emits noise levels considerably above the action limits stated above. This is not only an issue within the remits of the Noise at Work Regulations, but can also have a substantial environmental impact. The ambient noise emitted from the prime mover or generator often

transmits into adjacent areas; additionally, exhaust noise from the exhaust stream and noise produced via the air inlet and ventilation system can also carry into the surrounding environment unless suitably attenuated.

Most CHP schemes also have items of auxiliary equipment which generate noise either continually or intermittently. Both intermittent noise and noise sources that produce discrete tones can cause an environmental noise nuisance.

Noise attenuation solutions

Both exhaust noise and ambient noise from the prime mover must be taken into consideration. For exhaust noise from diesel and gas engines, a silencer in the ductwork or chimney is often fundamental to meet local environmental requirements. Exhaust silencer design for prime mover exhausts must take into account the sound level characteristics as noise emissions are typically higher in amplitude at low frequency.

These exhaust silencers for CHP applications must give due consideration to the system requirements, without creating an excessive pressure drop as this can affect the prime mover's performance and efficiency. Also, material selection may have to be taken into consideration to survive the extreme temperature and environmental conditions.

An acoustic enclosure can also be installed around the CHP prime mover or electrical generator to reduce ambient noise levels and, in some cases, the whole plant is installed in an acoustic housing that has been specifically designed to attenuate noise. These acoustic enclosure designs must not only take into consideration the inherent noise of equipment, but also the logistical and spatial limitations in terms of access to, from and around the power plant. Hence the correct design and selection of acoustic products in particular housings for CHP machinery is essential.

Equally fundamental to the acoustic design of enclosures, is the requirement for regular maintenance. With this in

mind, acoustic enclosures are manufactured with numerous access doors and can be designed as demountable or with large removable access panels where required. As the construction of an enclosure is typically of a structural frame design, enclosures can be designed to include for maintenance beam loads within the structure, and to take account of roof loadings where required. Furthermore, enclosures would normally also incorporate a fan assisted ventilation system to provide cooling airflow and prevent overheating of the equipment. Where required, hazardous area (ATEX) fans would be fitted.

Often, CHP plants and their prime movers are placed into older plantrooms, meaning the use of an enclosure is not always viable due to space constraints. In cases such as these, a greater level of acoustical consideration must be undertaken as these plantrooms are generally constructed using blockwork or concrete. The materials used within these buildings often leads to high reverberation levels that only exacerbate the situation. To alleviate this, operators can install acoustical treatment or lining within the plantroom walls – greatly reducing both noise output by controlling the reverberant noise level within the plantroom.

Dependent upon the scale of the plant, enclosures can be provided as drop-over, or can be provided flat-packed, so that installation can be conducted on site. The selection of these are often driven by either road constraints for delivery or whether there is the headroom and crane height available for a drop-over enclosure to be installed. Enclosures can be supplied weatherproofed for continuous external use, whether these are drop-over or flat-packed.

For smaller CHP installations, a range of bespoke, and standard acoustic enclosures can be designed and manufactured to be skid mounted. These enclosures reduce the ambient noise emissions from CHP units to 70dB(A) and 65 dB(A) typically, but can be adapted to suit the requirements of the most onerous of noise specification requirements.

Ventilation requirements should also be given careful consideration – especially when plantrooms are located within building basements. In such cases, large ducting necessities can be extremely restrictive and constrain the size of the CHP plant that is installed on-site. This ducting design will place a pressure drop onto the system, leading to challenges for the forced ventilation system and an increase in the associated noise levels. These noise levels can increase significantly if care is not taken during the design.

Ventilation noise must be taken into consideration during the design of any CHP scheme. Key to this is the specification of purpose-designed attenuators, which are fitted into the ventilation system. These attenuators can achieve a substantial reduction of noise from both fans and the CHP plant itself, but installation of such measures can pose a substantial challenge.

Meeting the demand

With a growing demand for energy saving CHP technology across many sectors, increasingly stringent noise at work and environmental noise legislation, paired with a public less willing to accept environmental noise from industrial facilities, the cost effective implementation of noise control solutions is becoming a necessity for companies looking to significantly reduce their noise output.

Improved health and safety also remains at the forefront of the cogeneration sector, meaning noise reduction has become a major factor to address for plant operators. The requirement for Combined Heat and Power (CHP) to adopt noise control solutions beyond conventional personal protective equipment (PPE) has never been more critical. Add to the mix legislation, which places an added emphasis on reducing environmental noise, and that requirement becomes even more apparent. Noise therefore needs to be addressed through the design and development of CHP schemes.

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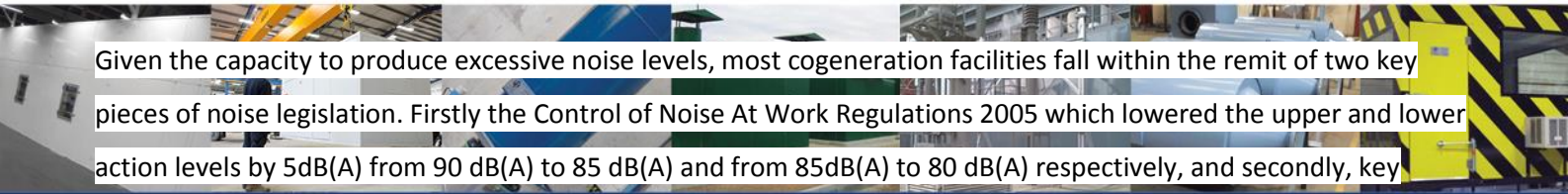

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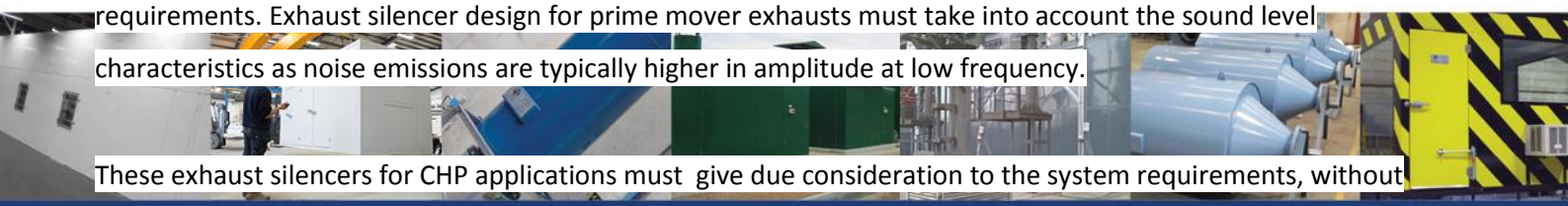

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