Greener Live Performances
through energy efficiency

Factsheet

Energy Efficient Sound

This factsheet has been designed to provide entry level information for Production Managers, Festival Coodinators and Venue Managers, when engaging with sound system specialists about energy efficiency.

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Introduction

A sound system used for live performances may be as simple as one microphone and one amplifier but is more often made up of more complex systems using multiple microphones, instruments, mixing processors, amps and loudspeakers. The typical venue, concert tour or festival utilises the specialist skills of a team of audio engineers and technicians to oversee the use of these systems.

Sound systems are powered using electricity from temporary generators or mains power. Energy costs – electricity, diesel and transport fuels - are continuing to increase; therefore it is important for technical teams to integrate more energy efficiency aspects when planning performance sound.A general understanding of how much energy system components use will help technical teams to identify relevant opportunities for energy consumption reduction.

A typical system is made up of:

- **Input transducers** (e.g. microphones), which convert sound energy into an electric signal, are usually smaller pieces of equipment powered by batteries or electricity generated by mains power or generators;
- **Signal processors** alter the signal characteristics and include equalizers and compressors that are generally referred to Front-of-House mixing consoles. These run independently of other equipment requiring electricity for power;
- **Amplifiers** add power to the signal without otherwise changing the content of the signal and are usually multiple pieces of equipment that support the work of the loudspeakers; and
- **Output transducers** or loudspeakers, which convert the signal back into sound energy at an amplified rate. Usually two or more in number with each individual piece requiring electricity to power them.

What is an energy efficient sound system?

There are an increasing number of 'energy efficient' sound systems available. When considering the purchase of a new system that will reduce energy consumption, consider installing a system that is:

- More powerful with better quality sound output; and
- More compact and weighs less.

The criteria for an energy efficient system includes:

- Reduced power consumption with increased audio performance
- Improved acoustic transparency with dynamic response
- Amplifier efficiency increased to 90%
- Higher sound pressure levels (SPL)
- Reduced heat dissipation
- Lower system weight and packaging requirements

Electrical current requirements have a direct effect on power consumption, therefore technicians will achieve better efficiency outcomes if they aim for an optimum combination of: low power consumption, lower weight, high-efficiency amplifiers, high-efficiency speakers and total system tuning.

Efficient use of energy means reducing wasted energy. This includes reducing the heat given off by the equipment – thereby decreasing the need for cooling systems. Once heat is reduced, then heavy heat sink housings and cooling fans can be replaced with lightweight housings. A more compact design makes installation easier where space may be limited – such as in a theatre and as part of tour freight.

Look for…

Speakers with lower power consumption but high sound pressure levels (SPL) to increase dynamic sound quality.

Speaker efficiency is not energy efficiency

Speaker efficiency indicates the speaker system's acoustic output in decibels(db)[1] for a given amplifier input signal at a given distance. This is usually measured with one watt[2] input at a distance of one metre. This indicates how much amplifier power you will need and how loud the speaker will play with a given amount of amplifier power.

Typical specifications might be "85 db at 1 watt / 1 meter," or "101 db @ 1w / 1M."

Remember that decibels are logarithmic so 101 db is many times louder than 85 db.

Power handling is relatively unimportant for sound technicians. Speakers do not produce watts, amplifiers do. A 400 watt speaker is NOT better than a 100 watt speaker and does not necessarily play louder.

The speaker system's *efficiency* indicates how loud it will play with a given input. Power handling indicates how much power it takes to overdrive the speaker; and this is not the desired outcome. The aim is louder and clearer sound – this means more SPL and sub-bass.

Compact high-efficiency transducers require less input power and therefore make an important contribution to energy savings.

1 *Usually at around 500-1000 Hz, on axis, in an anechoic chamber.*

2 *1 watt - 2.83 volts into 8 ohms*

Self-Powered Speakers

Performance audiences are demanding sound be delivered clearer but louder. Speakers have evolved to become fully-integrated systems, housing drivers and amps within the one enclosure.

The benefits of a self-powered speaker include:

- Increased ability of the amp to convert line power into available signal for the drivers.
- Flow-on ability of the driver converting electricity into sound pressure.
- Amps are housed within the enclosure – removing the need for separate air-conditioned rooms to house amp racks (known to produce a lot of heat and therefore wasted energy).
- Less heavy speaker cabling required. The only cabling needed is power from the point of origin to the desk, then smaller branches to equipment.

The advantages of self-powered systems have became clear: no amplifier racks or loudspeaker cables, no calibration, fast setup and teardown, and efficient truck packs.

Touring

Some of the largest opportunities for energy efficiency – in relation to sound systems – apply directly to touring.

Technological improvements in recent decades have seen sound systems increase in output while diminishing in size, weight and energy requirements. These improvements have reduced the transportation requirements for sound systems by taking less equipment on the road. It also helps that more venues are in the process of upgrading to newer generation, good quality consoles supported with state of the art sound equipment.

The movement away from analog desks – which weigh an average of 250kg plus another 180kg for the case and power supply – to digital consoles that have power switching functions and weigh only 150kg including the case - immediately achieves freight fuel savings as equipment is lighter and less voluminous.

Speaker enclosures remain primarily manufactured using a poly wood composite product, but the change in their size and what is housed within has improved overall efficiency.

New Generation Equipment

Genlec M Series Monitors and Amplifers

Natural Composite Enclosure™

Natural Composite Enclosure (NCE) is made from a fully recyclable fibre composite material. Half of this is wood, which has the right acoustical properties to reduce vibrations and deliver exceptional sound quality. In addition, the enclosure is manufactured using injection moulding to optimise the shape and structural rigidity for high-quality acoustical performance, also maximising the internal volume, vital for achieving high output at low frequencies.

Intelligent Signal Sensing

The Intelligent Signal Sensing (ISS) feature reduces power consumption to less than 0.5 watts by automatically switching the active monitor to standby when no audio signal has been detected for some time. When it receives an audio signal again, the loudspeaker turns back on.

Investigate Certification

Companies such as Powersoft Audio have established an internal certification program called *Green Audio Power*.

As a Powersoft registered trademark, Green Audio Power identifies environmental friendly audio products within their product range. The certification looks at two aspects in the development of power amplifiers:

- Power Factor Correction (PFC) integrated into switching mode power supply.
- Class D PWM (Pulse Width Modulation) high efficiency output stage.

Power Factor Correction (PFC) Integration

Powersoft Audio has stated that amplifiers with PFC functionality consume up to 40% less energy than other amplifiers for the same output power.

Class D PWM

The key aspect of this technology transforms all the energy drawn from the power supply into usable power, whilst recycling the reactive energy coming back from the loudspeakers.

Speaker drivers have doubled SPL output, which in turn has halved the number of speakers required to achieve the desired ‘louder’ output.