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Efficiencies in Broadcast Transmitters

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Everywhere in the world, there is an increasing interest in saving energy. Power is now a significant budget item for any business – and that includes broadcasters. Organisations now look at the total cost of ownership of any major piece of equipment, and that calculation will include the cost of the energy to drive it over its lifetime.

According to the US Energy Information Administration, global energy demand is set to grow by 56% between 2010 and 2040. That very high level of demand is certain to push prices up.

Power is not only a significant cost item. There is growing concern about environmental responsibility. Generating electricity can involve serious pollution and the creation of greenhouse gases, particularly when it is generated by burning fossil fuels like coal and oil.

Finally, energy efficiency has a double benefit. First is the direct saving in power cost, but second is the difference between power in and power out of a device – a significant part of which is wasted, ending up as heat. That excess heat has to be removed from the equipment cabinet and probably the surrounding area, which means air conditioning is required - also needing power to run.

Terrestrial transmission remains the most effective way of reaching mass audiences. But transmitters have also been very inefficient in converting input power to output power. It is time for new approaches.

Transmitter efficiency

Early digital television transmitters had a power efficiency in the 15% to 18% range. That means for 10kW of radiated power, they consumed about 66kW of electrical energy, with 56kW dissipated as waste heat, meaning that the transmitter building needed efficient air conditioning too.

Recent advances in transmitter design have had a major impact on power efficiency. At GatesAir we now design the power stages of our amplifiers using the latest 50 volt LDMOS chips to significantly reduce energy consumption.

With related improvements in amplifier design, we can now achieve efficiencies of up to 38%. That means a 10kW transmitter might require only 26kW of power, resulting in just 16kW of heat to remove. This waste heat can be easily removed by simple air-ducting, as in the new GatesAir Maxiva™ VAX series, or very efficiently using liquid-cooling methods, as in the new GatesAir Maxiva™ ULXT series.

But pure transmitter efficiency is not the only factor that needs to be considered when looking at the economics of a new transmitter network. As already noted, you need to consider what the sum of the costs will be over the predicted lifetime of the transmitter, or total cost of ownership.

Total cost of ownership

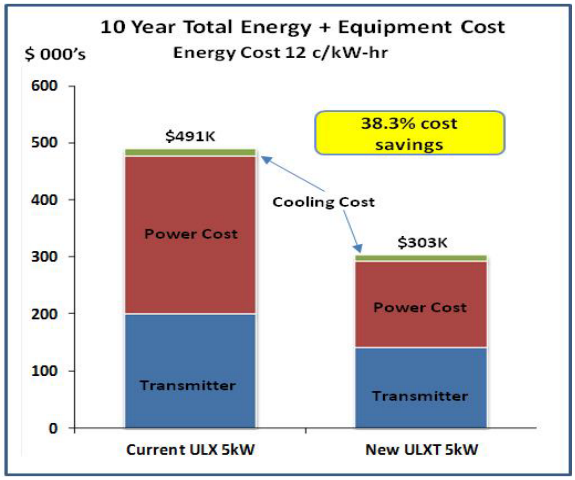
The total cost of ownership of a transmission facility is the actual cost to operate the system over time. As well as the capital cost of the transmitter, associated electronics and any building and electrical work to set up the site, the calculation should also include:

- power consumption for the transmitter and all associated electronics
- power losses through any uninterruptible power supplies, or voltage regulation equipment and in any transformers in the power feed, plus the cost for switchgear for alternative power feeds, or standby generators
- cooling and ventilation, including the capital cost of the equipment, the running costs in terms of power consumption, and routine maintenance
- maintenance of the transmitter, including routine visits to site and the cost of repairs and replacement parts
- any costs relating to the footprint of the equipment, such as rental of rack space or the building.

These calculations will be different for every installation. They depend on the site location, the outside temperature range, what other equipment is already installed in the room, and accessibility to the transmitter for maintenance and repairs, as well as obvious items such as power costs and labour rates.

To help broadcasters and transmission companies make these calculations, GatesAir has developed a total cost of ownership tool. It enables you to make comparisons between transmitters, as well as work out the significance of each element of the cost.

The tool can also help determine when is the right time to replace a transmitter with a more modern, energy efficient design. The diagram shows that, even compared with an earlier generation GatesAir Maxiva transmitter, the latest design Maxiva ULXT represents a total operating cost saving over a 10 year period of more than 38.3%.



PowerSmart™ 3D

For over 30 years, GatesAir has been leading the market in developing energy-efficient broadcast transmitters. PowerSmart™ is the name given to this continuing initiative to create the most efficient products possible. GatesAir uses the most innovative components and design techniques to develop cost, energy and space efficient solutions.

For radio, the GatesAir Flexiva family of FM transmitters can offer operating efficiencies up to a remarkable 72%. It was the first FM design to use 50V LDMOS devices, and consequently has the smallest footprint on the market for transmitters of 10kW and higher power.

For television transmission the GatesAir Maxiva family is the flagship product line. These transmitters now incorporate the latest developments, known as PowerSmart 3D. Benefits include:

- unique GatesAir high efficiency amplifier design
- better than 38% overall power efficiency for COFDM TV
- broadband operation
- new-technology switch-mode AC to DC converters, providing 96% conversion efficiency
- systems design concepts for lowest total cost of ownership.

These advantages are now available in two products, the Maxiva VAX (for Band III VHF) and the Maxiva ULXT (for UHF transmission).

Other efficiencies

It may not be under the direct control of the transmission company, but the migration from analogue to digital is one of the most effective power efficiency decisions that can be taken.

A DVB-T2 transmitter needs 35% less power than the equivalent analogue transmitter for the same coverage area. And of course, the DVB-T2 broadcast can include a multiplex of a number of programs and services rather than the single service allowed by analogue transmission, so there are more revenue opportunities.

With a sophisticated modern transmitter, each programme can be broadcast with its own modulation scheme, allowing it to be tailored for service area and type of reception. So a single transmitter could be broadcasting services optimised for fixed rooftop aerials, portable indoor aerials and mobile devices, as well as a mix of SD and HD channels.

And while the transmitter may be the big consumer of power, do not neglect energy savings in the rest of the signal chain. Using IP rather than multiple video circuits to connect the broadcast centre to the transmitter can reduce complexity and, when devices such as the GatesAir Selenio Media Convergence Platform (MCP) are used, will simplify the system.

The Selenio MCP is a unique product which handles signals simultaneously in the real time video and audio domains. Its high performance processing capabilities mean it can provide all the signal conditioning, multiplexing and distribution tasks involved in transporting television streams from a broadcaster to a transmitter.

Because all the functionality can be handled by a single device, the overall power consumption is significantly reduced. The latest version of the MCP can be pre-configured to handle specific tasks – such as distribution networks for transmission – and occupies only 1U of rack space as well as consuming little power.

The broadcast industry needs to take steps to improve its power efficiency for economic and environmental reasons. By taking a total cost of ownership approach to equipment selection and systems design, allied with the latest high-efficiency equipment, broadcasters can achieve real improvements.