GREEN BROADCAST

The economic and ecological benefits of DAB+

There are several economic and ecological aspects that make it favourable to use DAB+ as a terrestrial digital radio broadcasting system. This document outlines the advantages and compares DAB+ with FM.

FM Radio

Economic usage of frequencies: A technical constraint of FM is that broadcasting the same programme content via adjacent transmitter locations requires a new transmission frequency to be used each time, (for example, for regional broadcasting stations). In topographically problematic mountain locations, additional transmitters are required due to reflections that can interfere with reception. The frequency requirement for a programme is dependent on the size of the transmission area and relatively heavily dependent on the topography. The FM frequency spectrum, which was introduced in 1949, has been completely allocated over recent decades.

FM frequencies heavily depend on topology.

Ecology: In FM, parent transmitters (transmission radius 50-100 km) with output power of up to 100 kilowatts per programme are used. To generate this power, typically transmitters of up to 10 kilowatts output power are used. The apparent increase of transmission output power to transmission power (antenna gain in this example, 10 dB or a factor of 10) occurs via the transmitting antenna, which does not radiate the power spherically in all directions, but directionally and almost concentrated in the horizontal principal direction in a circular or disk-shaped manner. The current generation of FM transmitters achieve efficiency of around 60-65 per cent; which means to produce 10 kilowatts of transmission output power, at an efficiency of 62.5 per cent, 16 kilowatts of power is required.

To broadcast an FM programme all over Bavaria: Requires at least 40 FM transmitting stations and 725 kilowatts of power

To transmit an FM radio programme all over Bavaria, around 40 FM transmitting stations (in the transmitter output range 100 watts to 100 kilowatts) with a total transmission output of around 725 kilowatts would be required. In the majority of locations, the factor of transmission output to transmission power to transmitter power is well below 10. If, however, for the sake of simplicity, we assume a similarly very favourable ratio of transmission output to electrical power as in the example cited above, it can be deduced that: to transmit an FM radio programme all over Bavaria, under the constraints mentioned, at least 116 kW of electrical power would be needed.

DAB+ digital radio

Economy: due to the ability of transmitters to be synchronised with one another, the same programme content can be broadcast via adjacent transmitters on the same transmission frequencies (Single Frequency Network). In topographically problematic mountain locations, fewer additional transmitters are required due to the reflections improving reception. The frequency requirement for a programme is therefore not dependent on the size of the transmission area and only dependent to a limited extent on the topography. The DAB frequency spectrum emerged from a frequency band previously used for analogue television, and will offer ample space in future too for wider dissemination of national, regional and/or local programme content.

In the case of DAB+, the frequency requirement is only dependent to a limited extent on topography

Ecology: In DAB+, parent transmitters (transmission radius 50 km) with output power of up to 10 kilowatts are used per multiplex or 'package of programmes'. At least 10 radio programmes can be transmitted in a multiplex. To generate this power, typically transmitters of up to 2.5 kilowatts output power are used. The apparent increase in transmission output power for a DAB+ programme covering the whole of Bavaria only requires about 22.4 kilowatts

of output power. In this case, antenna gain of 6 dB or a factor of 4 occurs via the transmitting antenna, which does not radiate the power spherically in all directions, but directionally and almost concentrated in the horizontal principal direction in a circular or disk-shaped manner.

The current generation of DAB+ transmitters achieve efficiency of up to 45 per cent using Doherty power amplifier technology; that means to produce 2.5 kilowatts of transmission output power, at an efficiency of 45 per cent, 5.6 kilowatts of electric power are required. To transmit a DAB+ programme package all over Bavaria, around 60 DAB+ transmitting stations in the transmitter output range 1000 watts to 10 kilowatts with a total transmission output of around 400 kilowatts would be required. If, however, for the sake of simplicity, we assume a similar ratio of transmission output to electrical power as in the example cited above, it can be deduced that: to transmit a DAB+ programme package all over Bavaria, under the constraints mentioned, at least 224 kW of electrical power would be needed. To transmit one DAB+ radio programme all over Bavaria, under the constraints mentioned, at least 22.4 kW of electrical power would be needed.

FM	DAB+
Bavaria-wide FM radio programme: 40 FM transmitting stations per programme, with a total output power of approx. 725 kW and around 116 kW of electric power.	**Bavaria-wide DAB+ programme:** 60 DAB+ transmitting stations (a multiplex of up to 10 programmes) with a total transmission power of approximately 400 kW and around 224 kW of electric power. Per programme, only 22.4 kW of electric power is required.

Closing remark: Transmitter network size, topography and variations in the type of transmitting antennae may change the FM/DAB+ energy balance sheet. To that extent, the considerations set out above should be taken as examples. With transmitter networks that are used in practice, in general, ratios of at least one-fifth between DAB+ and FM can be demonstrated. This reveals, and this is substantiated by the practical implementations to date, that **DAB+ is economically and ecologically cheaper and more positive than existing FM systems.** Against this background, and considering the fact that electricity supply and its cost will become vital issues in the years and decades ahead, concrete planning for the future digital terrestrial radio system will be of decisive significance for the future of broadcasting.

DAB+: Clear economic and ecological advantages, lower electricity consumption, lower costs