

Economic & Environmental Benefits of DAB+

Comparison to FM



- Main cost factors of radio operation
 - Equipment
 - Energy
 - Cooling
 - Floor Space
 - Service and maintenance
- Summary of advantages of DAB+



Main Cost Factors of Radio Operation



- Equipment

Capital Expenses (CAPEX)

- Energy

- Cooling

- Floor space

- Service & maintenance

Operational Expenses (OPEX)

- Simulcast period, operation of analog and digital Radio in parallel



The Assumptions used in following comparisons are:



- The comparison is for cost per service
- The coverage area is the same for all radio types, DAB+, FM
- The area to be covered has at least 18 services
 - 18 services is used as the basis of this comparison
- All services are 64kbps,
 - i.e. good quality audio / music

The comparison is based on cost information available in January 2014.

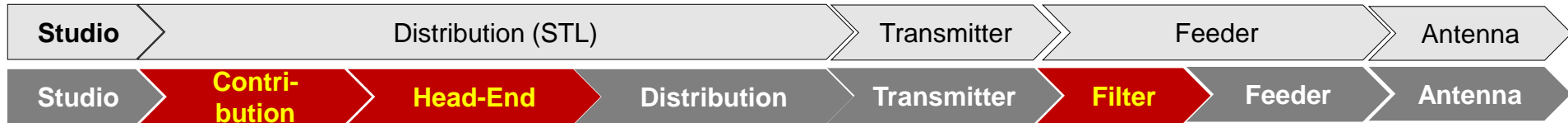
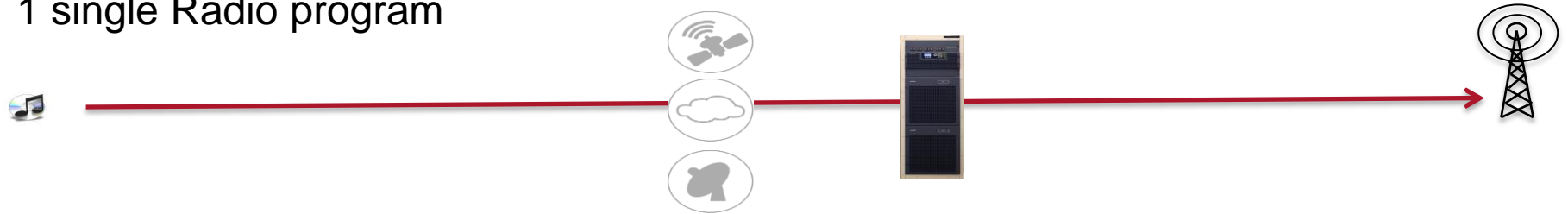


Equipment Costs



Transmission System DAB+ vs. FM

1 single Radio program



Up to 18 Radio programs (64kbps) of good audio quality



Equipment demand DAB+ vs FM

- Example: 18 Radio Programs

18 x FM Transmitter

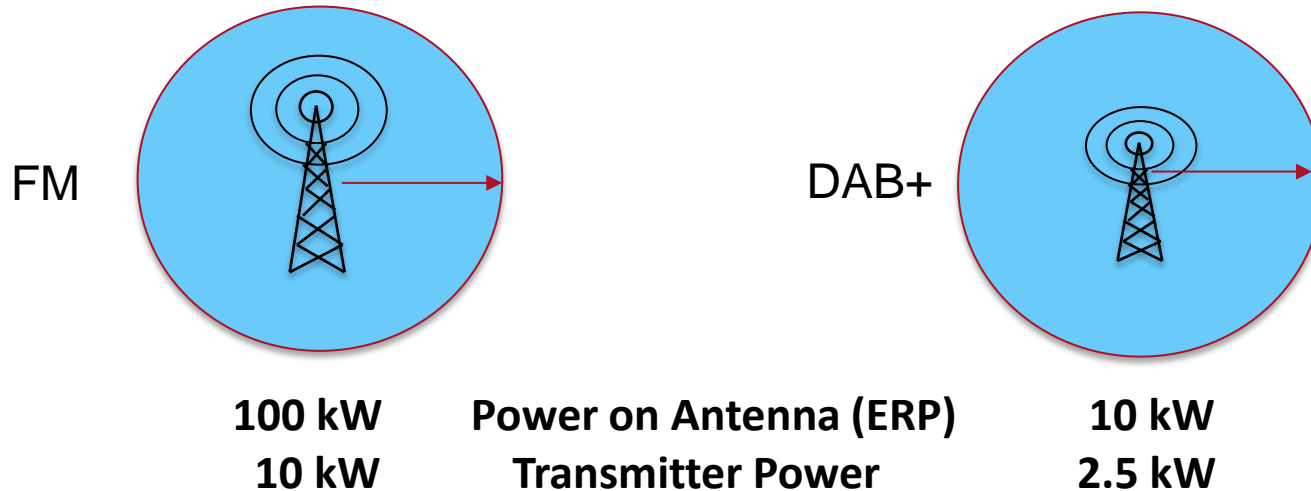


1x DAB+ Transmitter



Transmission RF power DAB+ vs FM

- 10 times less RF power in DAB+ for same coverage as FM
- Due to higher losses in Band III (Filter, RF line) the effective transmitter power of DAB+ is $\frac{1}{4}$ to FM (conservative)



Transmitter investment costs

Example: 18 Radio Programs same coverage

Transmitter	FM	DAB+
Power	10 kW peak	2.5 kW rms
Price per Transmitter	50,000 USD	80,000 USD
Transmitter	18	1
Total Price - Transmitters	900,000 USD	80,000 USD

Notes:

DRM+ transmitter cost based on DVB-T Tx of same power
The cost excludes installation and other head-end equipment

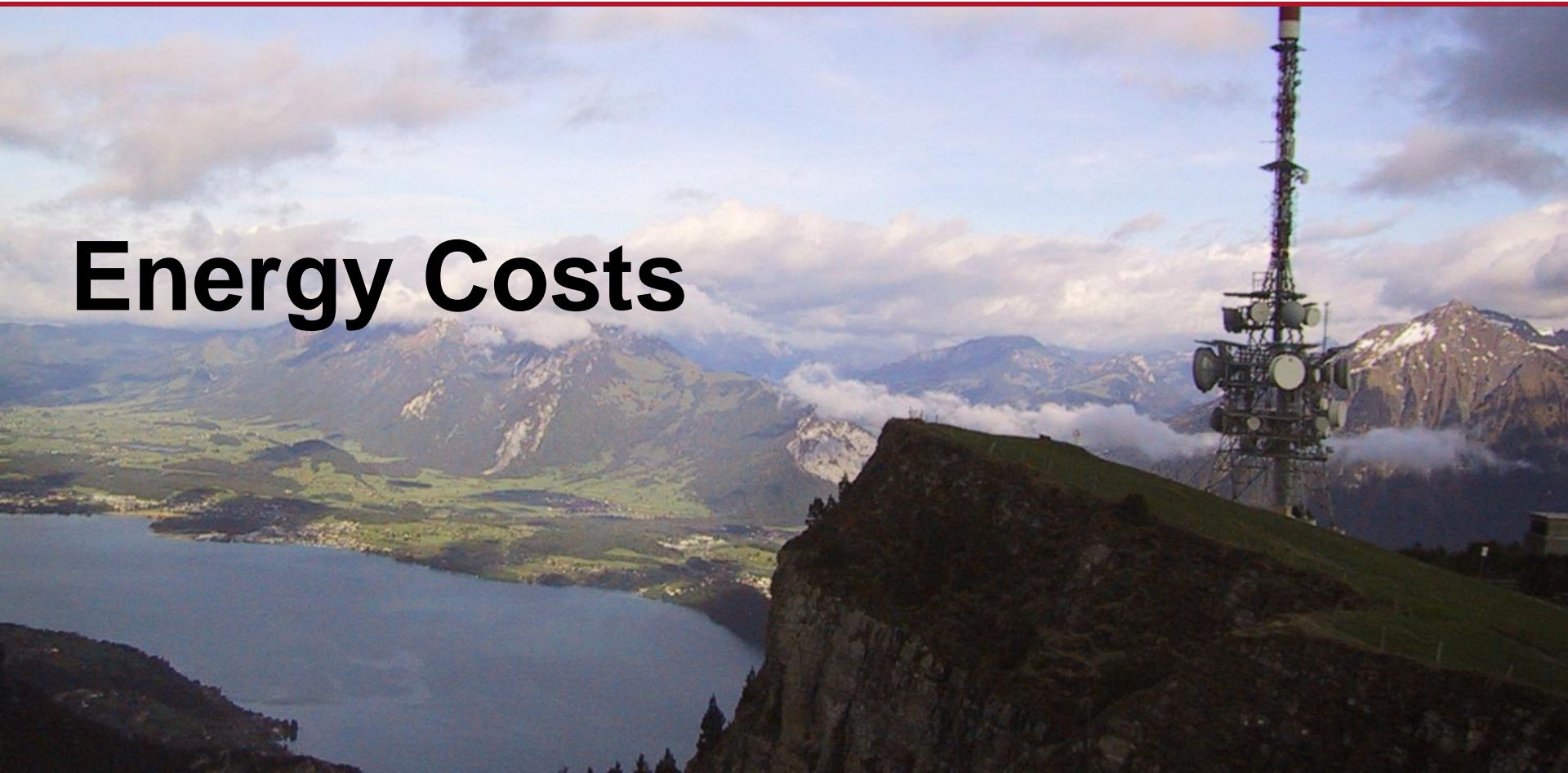
- **DAB Transmitter investment costs**

 - **11X lower compared to FM**

 - FM power is for stereo coverage
 - With an antenna gain of around 10dB the coverage area is expected to have a radius of approximately 50km depending on the antenna height above ground level and receive area terrain – enough to cover a moderate metro city or major regional area.



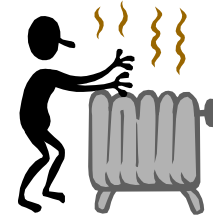
Energy Costs



Power efficiency of a transmitter

- **Efficiency, what does it mean?**

- Definition: $(\text{RF Power Out} / \text{AC Power In}) \times 100\%$



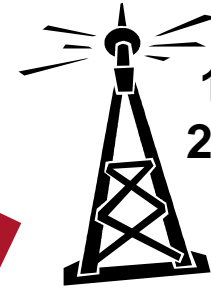
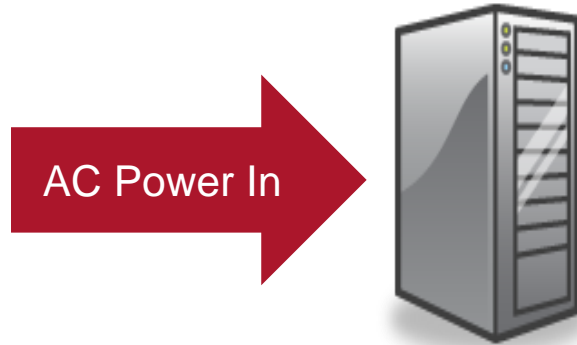
Increased efficiency: reduces power consumed and reduces energy wasted



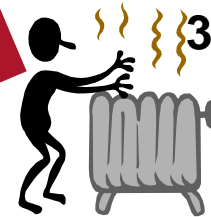
Transmitter power consumption

- State of the art transmitter are of high power efficient design
- 72% FM
- 40% DAB+

13.9 kW FM
6.25 kW DAB+



10 kW FM
2.5 kW DAB+



3.9 kW FM
3.75 kW DAB+



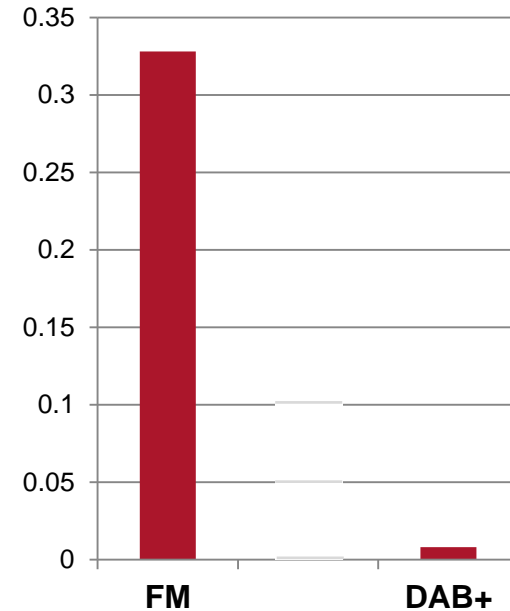
Energy consumption transmitter FM and DAB+

Example: 18 Radio Programs same coverage

- DAB+ Transmitter energy consumption 41 times less compared to FM**

Transmitter	FM	DAB+
Power	10 kW	2,5 kW rms
Efficiency	72%	40%
Energy consumption per Transmitter	13.9 kW	6.25 kW
Transmitters	18	1
Energy all Transmitters	250 kW	6.25 kW
Annual cost of energy	328,500 USD	8,000 USD

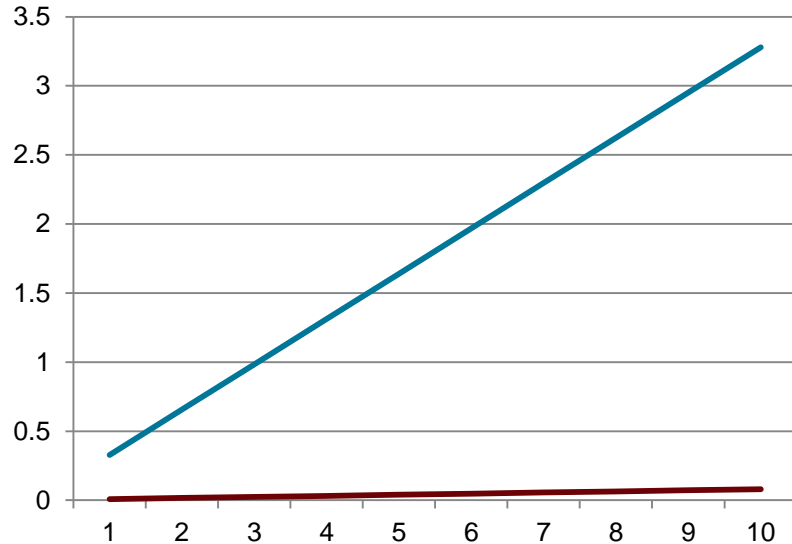
Assumes 0,15 USD per kWh



Energy costs FM and DAB+

Example: 18 Radio Programs same coverage

- **DAB+ energy savings over 10 years 3.207.000 USD compared to FM**



Assumes 0,15 USD / kWh

- Energy costs over 10 years of operation

— FM

— DAB+



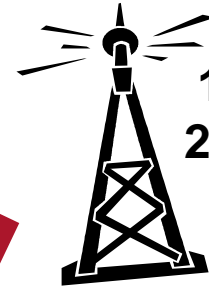
Cooling effort



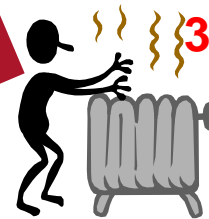
Cooling of the transmitter room

- Wasted heat of the transmitter needs to be removed from room
- Energy needed for room cooling system

13,9 kW FM
6,25 kW DAB+



10 kW FM
2,5 kW DAB+



3,9 kW FM
3,75 kW DAB+

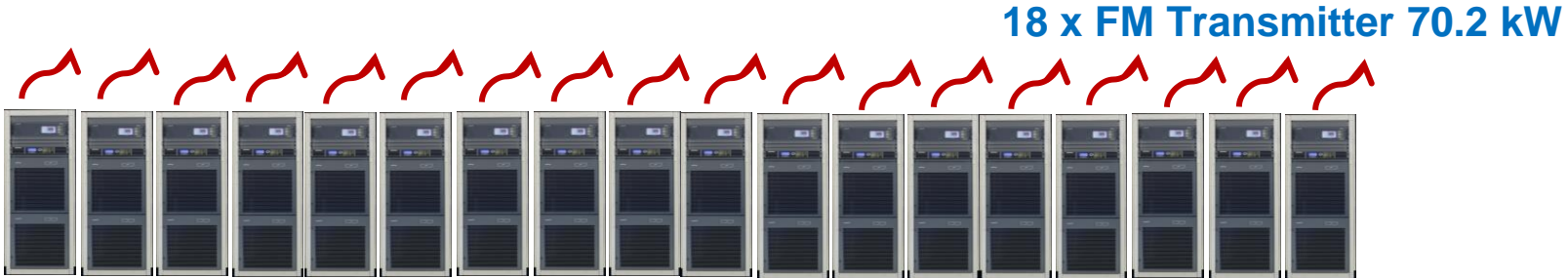


Energy saving for room cooling FM and DAB+

Example: 18 Radio Programs same coverage



1x DAB+ Transmitter, 3.75 kW

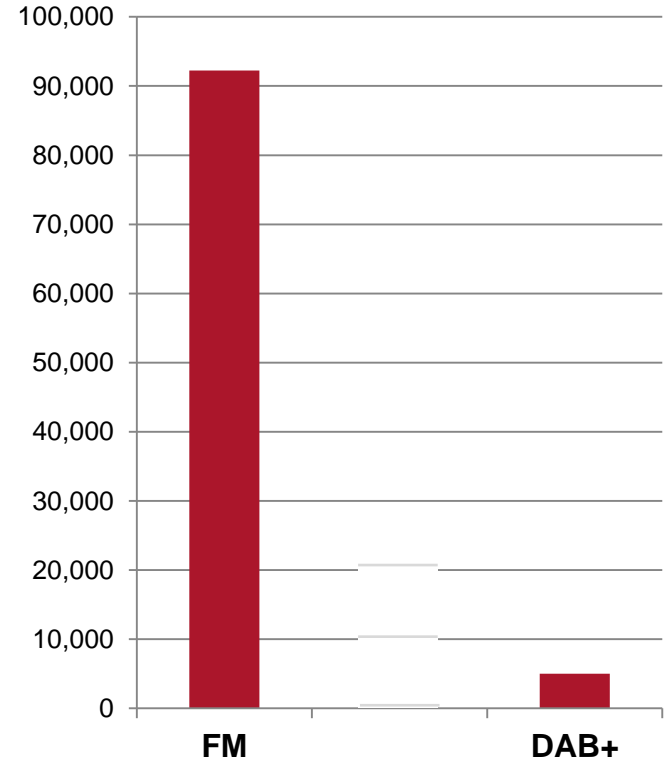


Energy saving for room cooling FM and DAB+

Example: 18 Radio Programs same coverage

- **DAB+ cooling effort 18 times lower than FM**

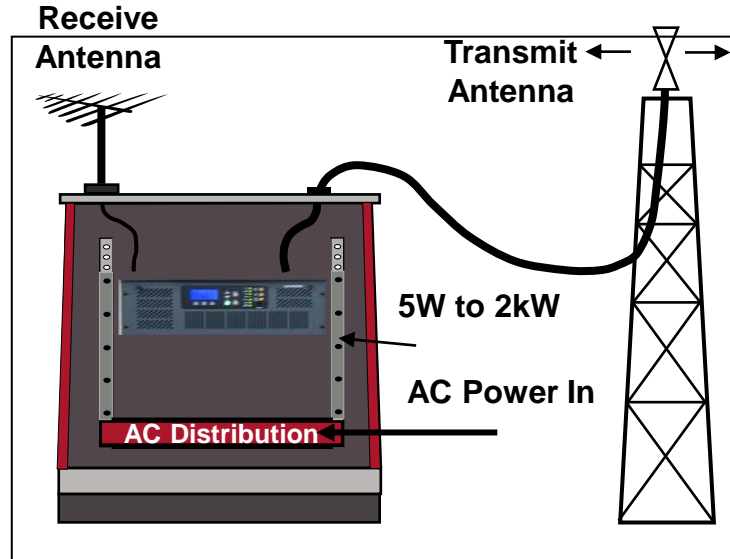
Transmitter	FM	DAB+
Power	10 kW	2.5 kW rms
Power consumption (rms)	13.9 kW	6.25 kW
Dissipated Power	3.9 kW	3.75 kW
Transmitter for 18 Radio programs	18	1
Dissipated power for 18 programs	70.2 kW	3.75 kW
Cost per annum	92,250 USD	5,000 USD



Power Saving cooling installations – Air Cooled

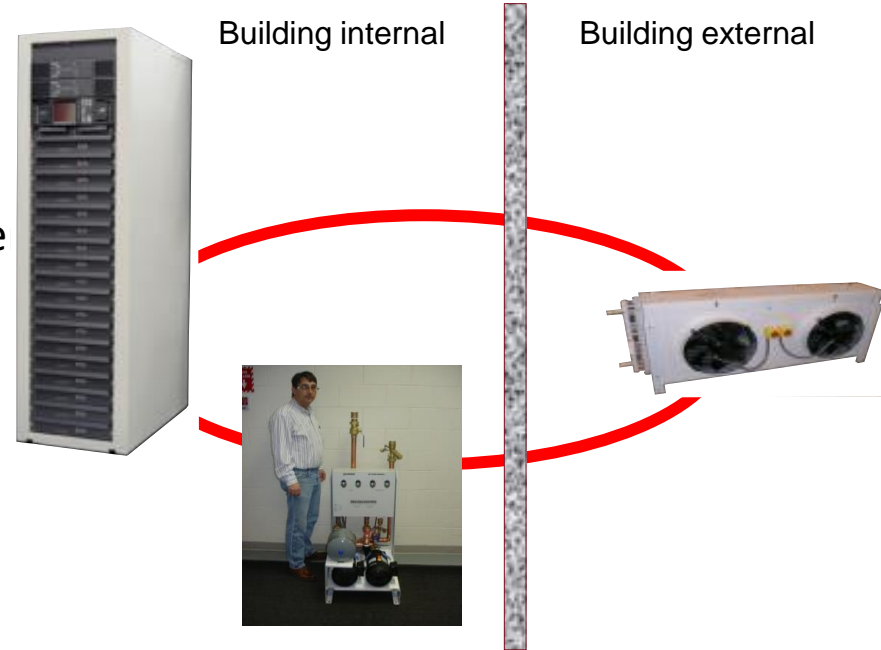


- Ducted Air racks
 - Evacuate the heat from the building
 - Reduces Cooling costs
- Outdoor shelter
 - Reduces site costs
 - Fast deployment
- Both solutions reduces operating costs



Further savings using transmitter with liquid cooling system

- Drastic reduced building cooling costs
- Directly evacuate heat outside of the building
- Reduced space & installation effort
- Variable speed fans and pumps to reduce power consumption
- Flexible hose for easy installation
- Redundant system can support multiple transmitters
- Silent, low acoustic noise
- Low maintenance effort



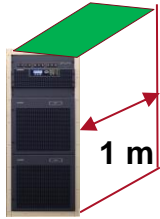
Floor and Transmitter Tower Space



Space savings on transmission site FM and DAB+

Example: 18 Radio Programs same coverage

- In not owned stations the operator need to pay for occupied floor space



0,6 m²

1x DAB+ Transmitter

18 x FM Transmitter



Save tower & antenna space with DAB+

Analogue FM, DRM+

- Many towers
- Interferences



DAB+

- Single Antenna
- No interferences



Service & Maintenance



There are a number of options for operations and maintenance including

- Broadcaster provides internal staff to conduct the work, often the case for commercial broadcasters
- A managed service is used, often the case for multiplexes which have multiple broadcasters, e.g. DAB+
- A mixture where the operations aspects are conducted by the broadcaster but maintenance is done by a contract organization, this occurs in large metro transmission sites as well as remote sites



Reduced Service & Maintenance Cost FM and DAB+GATESAIR



1x DAB+ Transmitter

Drastic Service cost reductions using DAB+

- reduced spare part stock
- reduced part diversity
- reduced maintenance effort

18 x FM Transmitter



Service & repair of DAB+ transmitter

Light & universal parts for cost effective repair & logistic

RF Pallet

identical for
Air cooled and
Liquid cooled



500 g

Power Amplifier

Air cooled



2 kg

Power Supply

Air cooled
Liquid cooled



1 kg



250 g

- Low spare part costs
- Low shipment costs
- Low import fee
- Easy to carry and replace



Summary economical advantages of DAB+

Drastic cost reductions using DAB+ compared to FM for:

1. Equipment
2. Energy
3. Cooling
4. Space
5. Service & Maintenance
6. RF transmission License Fees



- The cost comparison will often involve higher power systems than used in the example in this presentation and hence the cost savings when using DAB+ rather than FM or DRM+ for multi-service radio delivery will scale accordingly.



Summary economical advantages of DAB+



Drastic cost reductions using DAB+ compared to FM for areas which have 18 or more services.

	Transmitter	FM	DAB+
	Number of transmitters	18	1
,000 USD	CAPEX: Cost of transmitters	900	80
,000 USD pa	OPEX		
	Power	328.5	8
	Cooling	92	5
,000 USD pa	Total OPEX	420.5	13



Summary economical advantages of DAB+

- The approximate OPEX cost **SAVINGS** of operating 18 services over a 10 year period using DAB+ are:

	DAB+ vs. FM
OPEX Savings	4.07M USD

- Note that we have not considered further savings from:
 - Rental of floor and antenna space if site is not owned by broadcaster
 - Higher cost of keeping spares and the amount of maintenance effort



Thank you for your attention!



It's time for DAB+ !

