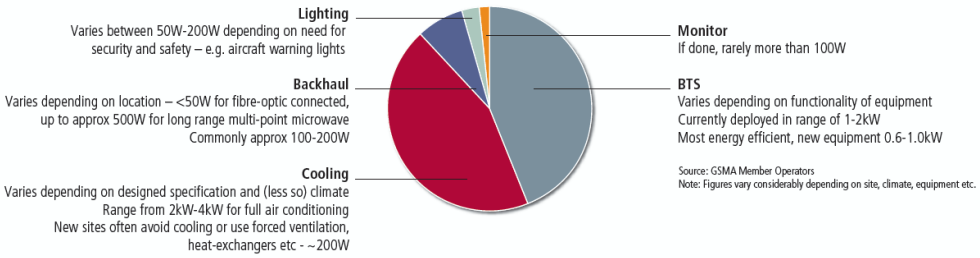
Environmental Impact of Mobile Communications Networks

The mobile industry is a relatively low energy intensity industry, contributing much more to the economy than its proportion of national energy usage. For example, in the case of the UK the mobile industry is responsible for about 0.3% of greenhouse gas emissions and around 1.8% of gross domestic product (GDP).[1]

Energy use is growing as subscriber numbers increase. The Global e-Sustainability Initiative estimates that in 2002, the mobile industry composed about 43% of the global information and communications technology (ICT) energy related emissions and this could rise to 51% by 2020.[2]

More than 80% of a typical mobile network operator's energy requirements are associated with operating the network. Technology evolution has delivered greater capacity, about an 8 fold increase between the original analogue services and 3G. This has been accompanied by improvements in equipment efficiency, with a 3 fold increase in the efficiency for 3G base station amplifiers between 2001 and 2007. The typical annual CO2 emissions per average GSM subscriber is now about 25kg CO2, which equates to the same emissions created by driving an average European car on the motorway for around one hour.[3]

Figure 1. Overall site power consumption[4]



However, the mobile industry continues to look for ways to reduce energy needs. Air conditioning is being replaced by fans or passive air flows whenever possible.

There are several industry initiatives evaluating alternative energy options to power base stations and about 1,000 pilot sites are in operation around the world. This is also driven by the demand for new mobile services in areas with no or unreliable grid electricity. Many network upgrade contracts now include take-back provisions for used equipment that may be resold in another market.

1 Earth Calling…The Environmental Impacts of the Mobile Telecommunications Industry, Forum for the Future, 2006.

2 SMART 2020: Enabling the low carbon economy in the information age, report by The Climate Group on behalf of the Global e-Sustainability Initiative, 2008.

3 125 km per 10.5 litres of petrol.

4 http://www.gsmworld.com/developmentfund/

5 MtCO2e = million tonnes of carbon dioxide equivalent. The global warming potential of all greenhouse gases is measured in terms of the equivalent impact of carbon dioxide (CO2).

A 2007 trial in Namibia showed the feasibility of a combined wind and solar system to power a base station with a return on investment period of three years. It was estimated that such a solution would save roughly 4,580 kg CO2 annually versus grid electricity and an additional 649 kg of CO2 annually by removing backup Diesel Generators.[4]

Overall, a decrease in power consumption of mobile networks per user is expected, owing to the adoption of efficiency measures. For example, network optimisation upgrades currently can reduce energy consumption by 44% and solar-powered base stations could reduce carbon emissions by 80%. The expected adoption of these measures by 2020 would lead to the avoidance of almost 60 MtCO2e[5] in 2020. Optimisation of the physical network through improved planning, minimising the number of actual base stations or using a more effective mix of base station types will also contribute to significant energy savings.

Mobile communications has the potential to make direct and indirect contributions to reducing the environmental impacts of other industries. For the total ICT sector the potential indirect benefits are estimated to about 5 times the direct benefits. As an example, it has been estimated that the environmental burden of a business roundtrip travel between Berkeley and Chicago is 10 to 1,000 times greater than conducting the meeting as a wireless teleconference.

Areas of potentially larger contribution include using wireless broadband to improve active load management for more efficient use of alternative energy sources; support for teleworking; using a person's mobile phone to register their presence so that heating or lighting can respond; real-time freight management and dematerialisation– replacing physical items (such as CDs) with digital downloads.

Figure 2. Effect of frequency of operation on number of base stations needed

Frequency	Cell Radius	Relative Capex
700 MHz	10 km	100%
850 MHz	8.9 km	126%
2100 MHz	5.5 km	328%
2500 MHz	4.7 km	455%
3500 MHz	3.9 km	675%
5800 MHz	2.9 km	1230%

Where to go for more information

GSMA website: **www.gsmworld.com/environment**

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