Mobile's Green Manifesto

In collaboration with THE CLIMATE GROUP

November 2009

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Foreword

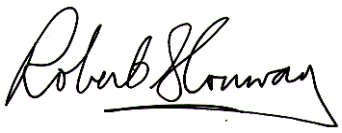
The mobile industry is both taking great strides towards improving its own energy efficiency and enabling other industries to do the same. Our Green Manifesto shows that, with the right public policies in place, the mobile industry can make a major contribution to the fight against global warming, lowering emissions in other sectors by around five times its own footprint.

Our industry has embarked on a new wave of investment that will make mobile broadband services and the Internet even more widespread and accessible than mobile voice services are today. Although this investment will see the industry grow dramatically over the next decade, building out new infrastructure and connecting many more people, it will aim to do so without increasing its greenhouse gas emissions.

The spread of mobile connectivity is generating major social and economic benefits around the world - the renowned economist Jeffrey Sachs has called mobile phones "the single most transformative tool for development". But mobile phones also have the potential to be a transformative tool for lowering greenhouse gas emissions.

The mobile phone, for example, could and should empower consumers to take control of their personal carbon footprint, enabling them to monitor and lower their power consumption in real-time using smart meters and other machines with embedded mobile devices in their homes and offices.

In a similar way, mobile technologies can be used by many businesses, big and small, to cut waste and use energy much more efficiently. To realise this vision, policy makers need to take the lead, establishing, in consultation with the private sector, common standards and measurement methodologies and ensuring that embedded mobile connectivity is widely used to cut emissions. Indeed, the public sector must be at the vanguard in stimulating demand, ensuring mobile-enabled green solutions are a core requirement of all new investments in public infrastructure.



Rob Conway
CEO and Board Member, GSMA

In February 2009, we took another step toward the internet of things, our connected 21st century future: Google announced the PowerMeter, a dashboard application that wirelessly links to home metering devices and can read and display real-time energy use on your desktop computer or mobile phone. Suddenly, checking your home energy consumption is as easy as telling the time.

The race is on for IT & telecommunications to lead the energy information revolution, when monitoring and managing energy are as common as sending email. This has huge implications for saving carbon: according to our SMART 2020 report, an energy efficiency revolution in logistics, power distribution, motor systems and buildings could save 15% of global emissions in 2020, or five times the size of the sector's own footprint from the internet, data centres, mobile phones and PCs. Energy efficiency is one of the lowest cost, quick-return options for cutting emissions, which along with halting deforestation, can achieve 70% of the reductions needed by 2020.

For companies that make saving emissions part of their core business, new markets in energy efficiency worth more than EUR 500 billion will be wide open. Already, for example, we are seeing disruptive business models that save fuel by allowing your eBay order to be shipped by otherwise empty trucks on

their return journeys. This is only the beginning of an explosion in carbon-cutting services for governments, companies and customers.

The promise of pervasive technologies is tantalizing, but the reality today is a long way from the hype. It is possible (but not yet mainstream) to turn off your home heating from the office at the touch of your mobile phone, but when it comes to optimising heating, lighting and cooling systems in buildings, applying complex traffic control systems, rolling out electric vehicles across entire cities or regions, or applying intelligence to the electrical grid, new standards for interoperability will need to be developed, and existing regulations will need to be adapted.

As we start to explore the possibilities in cyberspace, it has been said that the next generation will be 'digital natives', as well as climate conscious consumers. There is no doubt we are on the cusp of the next evolution in telecommunications, when the 4 billion people who today have access to handheld devices and the internet will double to 8 billion, and machine-to-machine connections will reach 50 billion in the coming decade. As the network infrastructure is expanded, it is essential that the industry ensure that this growth is low carbon. The global industry's goal to reduce energy consumption by 40% per subscriber from today's levels is a positive step, and some companies have gone further to set absolute emissions reduction targets even as they see their businesses grow dramatically. These targets will help the industry innovate, and create beneficial side effects – for example in solar powered base stations that also charge mobile phones in local communities.

December 2009 marks an important moment in the UN climate negotiations where future frameworks for international collaboration and targets will be advanced. The GSMA's Mobile Green Manifesto is timely. It opens a constructive dialogue between an industry that will touch everyone's lives in the coming decade and policy makers in all regions, particularly in emerging economies where mobile networks are rapidly being built. It demonstrates that some of the fastest growing companies of today and the future are ready to flourish in a low carbon world.

Steve Howard
CEO, The Climate Group

"We all know that information and communications technologies (ICTs) have revolutionised our world...ICTs are also very vital to confronting the problems we face as a planet: the threat of climate change...Indeed ICTs are part of the solution. Already these technologies are being used to cut emissions and help countries adapt to the effects of climate change...Governments and industries that embrace a strategy of green growth will be environmental champions and economic leaders in the twenty-first century."

Ban Ki-moon, UN Secretary General

Geneva, Switzerland, 5 October 2009

"ICTs are part of the solution, not part of the problem, and there are enormous gains to be made through the smart use of ICTs in virtually every single sector. Forward-thinking leaders already recognize the powerful role ICTs play in helping address climate change issues across the board. The importance of ICTs now needs to be recognized globally -- and the vital role of ICTs as we move forward in dealing with climate change issues be further promoted."

Dr Hamadoun I. Touré, Secretary-General, ITU

Geneva, Switzerland, 5 October 2009

Executive Summary

Introduction

This manifesto sets out how the mobile industry plans to lower its greenhouse gas emissions per connection, and demonstrates the key role that mobile communications can play in lowering emissions in other sectors and industries. It also makes specific policy recommendations for governments and the United Nations Climate Change Conference in Copenhagen, including the 15th Conference of the Parties (COP15), in order to realise the full potential of mobile communications' ability to enable reductions in global greenhouse emissions.

The mobile industry calls upon governments to sign a successor to the Kyoto Protocol and establish binding global long-term targets for the reduction of greenhouse gas emissions. Following from a new treaty, emissions reduction policies must be implemented or continued at a country, state and/or regional level. Greenhouse gas cap and trade schemes should deliver a stable and effective long-term price for carbon to stimulate innovation and the green economy.

The mobile industry's goals

The mobile industry forecasts that it will reduce its total global greenhouse gas emissions per connection[1] by 40% by 2020 compared to 2009. This forecast covers all emissions from energy sources under the control of the mobile operators, including energy consumption from the radio network, buildings, energy consumption and emissions from transport.

In the next 12 to 24 months, the mobile industry will build on existing frameworks to develop and agree a standardized mechanism for measuring emissions, with a view to making a commitment to carbon neutral growth. The number of mobile connections is set to rise by 70% to 8 billion by 2020 as the industry builds out a new generation of mobile broadband networks bringing billions of people into the information economy. Despite this growth, the mobile industry forecasts that its total emissions will remain constant at 245 mega-tonnes of carbon dioxide equivalent (Mt CO2e) - equivalent to 0.5%[2] of total global emissions in 2020, or the greenhouse gas emissions of the Netherlands.

Mobile operators plan to work with handset vendors to ensure that the energy consumed by a typical handset is reduced by 40% in standby and in use by 2020.

Mobile operators will also work with equipment vendors to ensure that the life cycle emissions of network equipment components are reduced by 40% in the same timeframe.

Mobile's enabling role

Mobile technologies are already being used to reduce greenhouse gas emissions and costs across a wide range of sectors of the economy, using SIM cards and radio modules embedded in machines and devices to deliver smart, intelligent solutions. By 2020 we estimate that mobile technologies could lower emissions in other sectors by the equivalent of taking one of every three cars off the road[3].

Mobile communications can also make it straightforward for individuals to monitor their own carbon footprint, while being an effective channel for advice and suggestions to consumers on how to change their behaviour to cut their emissions.

The mobile industry could enable greenhouse gas emissions reductions of 1,150 Mt CO2e - twice the emissions of the United Kingdom[4] in 2020. These emission reductions would originate in sectors such as power (350 MtCO2e), buildings (350 Mt CO2e), transportation and logistics (270 Mt CO2e), and dematerialisation (160 Mt CO2e).

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[1] Connections do not include Machine to Machine SIMs

[2] Irbaris analysis; SMART 2020, The Climate Group and GeSI, "Enabling the low carbon economy in the information age", 2008

[3] The mobile industry's 1,150mt CO2e emission reduction is equivalent to 285m cars out of 900m cars on the road worldwide in 2009, assuming annual emissions per car of 4,000 kg CO2e

[4] UNFCCC data, 2009

Policy priorities

In order to assist the mobile industry to enable emissions reductions in other sectors, it is vital that policymakers consider the following:

- Including mobile solutions in government policies and programmes with respect to smart grids, buildings and transport.
- Facilitating a common framework to measure the mobile industry's energy and environmental performance, and that of other sectors, for example by aligning national and regional methodologies with those being developed by ETSI and ITU in conjunction with the mobile industry and other private sector players.
- Supporting broadband infrastructure deployment that has become as important today as roads, railways and ports were in the 20th century, by ensuring the mobile industry has access to newly available harmonised spectrum and by supporting the roll out of energy efficient networks through the streamlining of planning approval and the provision of investment incentives.
- Encouraging cross-sector collaboration between the mobile and other ICT sectors and the transport, buildings and power sectors, especially with respect to the development of open standards to ensure interoperability and drive scale efficiencies.
- Demonstrating leadership by greening operations in the public service, e.g., by procuring embedded mobile-enabled smart building technologies in schools and government departments, and promoting increased teleworking amongst public sector employees.
- Building awareness of mobile and other ICT technologies, through education of users, and helping to facilitate the behavioural changes that will create transformative reductions in greenhouse gas emissions.
- Supporting the development and piloting of new technologies by incentivising the increased deployment of embedded mobile solutions with respect to smart grids, buildings and transport.

The social and economic impact of mobile communications

In the past two decades, the mobile industry has grown rapidly, today providing network coverage to more than 90% of the world's population and connecting more than 4 billion people, the majority for the first time. The mobile industry is forecast to invest $800 billion during the next five years; $550 billion of this is earmarked for mobile broadband, potentially connecting 2.4 billion people to the Internet. If mobile broadband were to fuel a similar productivity revolution to that generated by mobile voice services, it could boost global GDP by 3-4%, while also making a significant contribution to combating climate change, by creating a low carbon infrastructure for the 21st century[5].

The mobile industry understands governments will be discussing successor regimes to the Kyoto protocol and working to establish binding global long-term targets for the reduction of greenhouse gas emissions. Following from a new treaty, any emissions reduction policies implemented or continued at a country, state and/or regional level must deliver a stable and effective long-term price for carbon to stimulate innovation and the green economy.

[5] GSMA letter to G20 leaders, April 2009

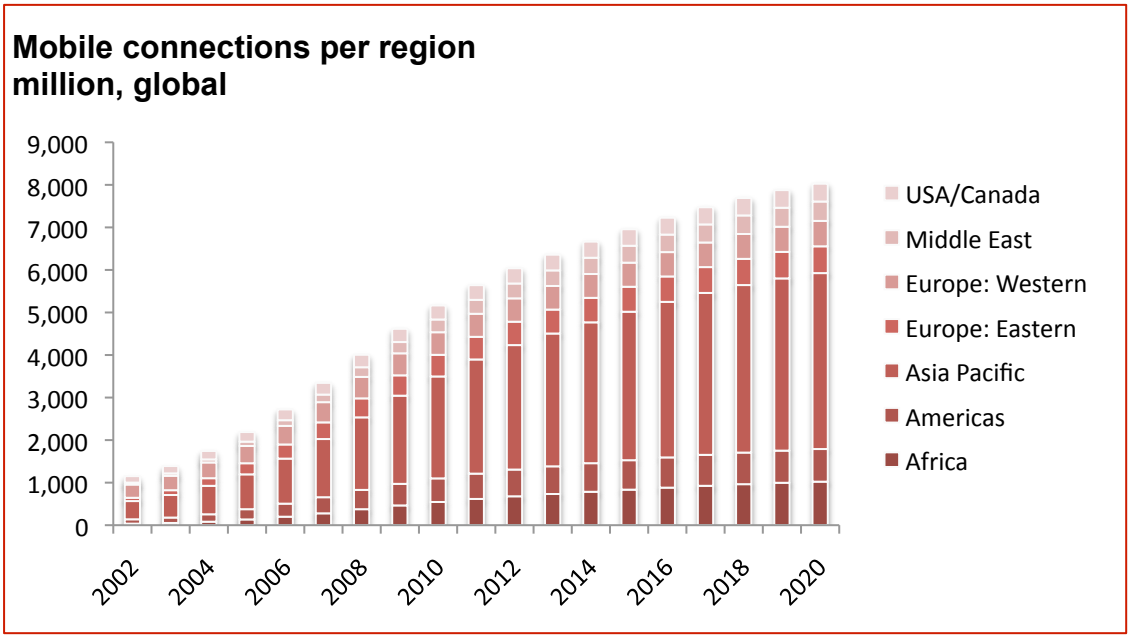
Chapter 1

Direct Impact

How the mobile industry is reducing its greenhouse gas emissions

In the past eight years, the total number of connections served by the global mobile industry has grown an average of 25% per annum to more than 4 billion today. The growth rate in Western Europe and North America has now slowed, but demand from Africa and Asia Pacific is increasing rapidly and will lead to a global market of approximately 8 billion connections by 2020 (excluding machine to machine connections, which are forecast to reach 50 billion by 2020[6]), according to an analysis by Irbaris and Wireless Intelligence. That equates to a growth in mobile penetration from 49% of the world's global population in 2009 to 76% in 2020.[7]

Figure 1 - Connections In The Mobile Industry[8]



The mobile industry is undertaking significant efforts to ensure this rapid growth is sustainable.

Greenhouse gas (GHG) emissions from the mobile industry arise from a number of sources:

- Energy consumed by the network in operation
- Embedded emissions of the network equipment, for example, emissions associated with the manufacturing and deployment of network equipment
- Energy consumed by mobile handsets and other devices, when they are manufactured, distributed and used, as well as their embedded emissions

[6] Ericsson forecast for 2020: "Ericsson predicts that there will be over 50 billion connected devices by the year 2020"

[7] This estimate assumes an average connection/subscriber ratio of 1.4 globally, in-line with Europe today

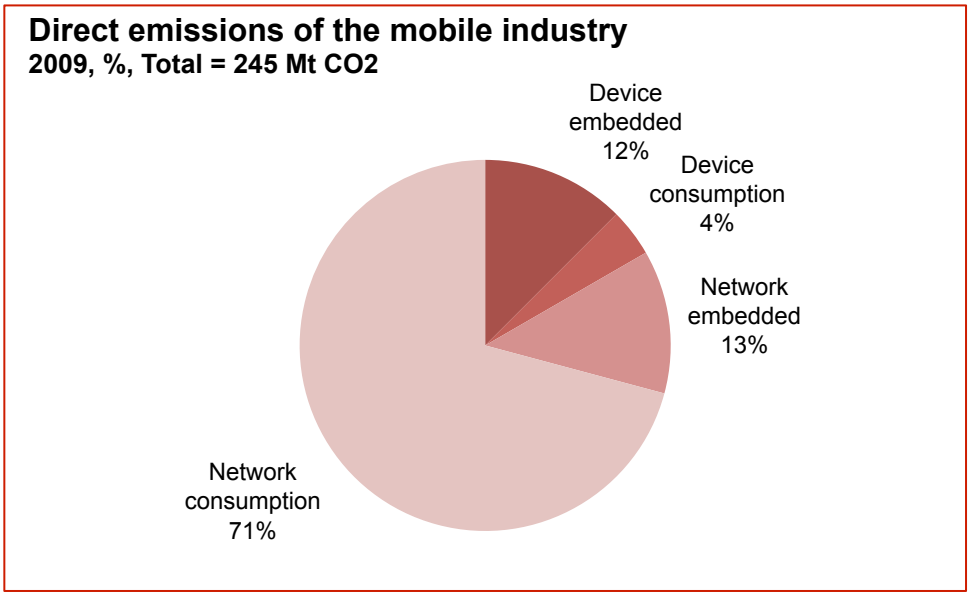
[8] GSMA Wireless Intelligence and Irbaris analysis, excludes M2M; number of connections is the number of SIMs active at any point in time. The number of connections is typically larger than the number of subscribers.

- Emissions associated with buildings run by mobile operators, and emissions from transport of mobile industry employees

Irbaris estimates that mobile industry emissions were 90 mega-tonnes of carbon dioxide equivalent (Mt CO2e) in 2002 rising to 245 Mt CO2e by 2009. During this period, the industry grew from 1.1 billion to 4.6 billion connections, whilst GSM network coverage increased to over 90% of the world's population in 2009 from 50% in 2002[9] and a new generation of mobile broadband networks, 3G HSPA, began to be built out. Emissions per connection actually fell by 30% from 2002 to 2009.[10]

The mobile industry forecasts that business and technology innovations by mobile operators and vendors will ensure that emissions remain at the 2009 level in 2020, even as the industry's total connections rise to 8 billion[11].

Figure 2 – Direct emissions of the mobile industry[12]



If the number of connections globally increases by 70% from 2009 to 2020 and emissions remain flat, the industry will have achieved an overall emissions reduction of 40% per connection in the period 2009-2020. The Appendix provides the assumptions behind these calculations.

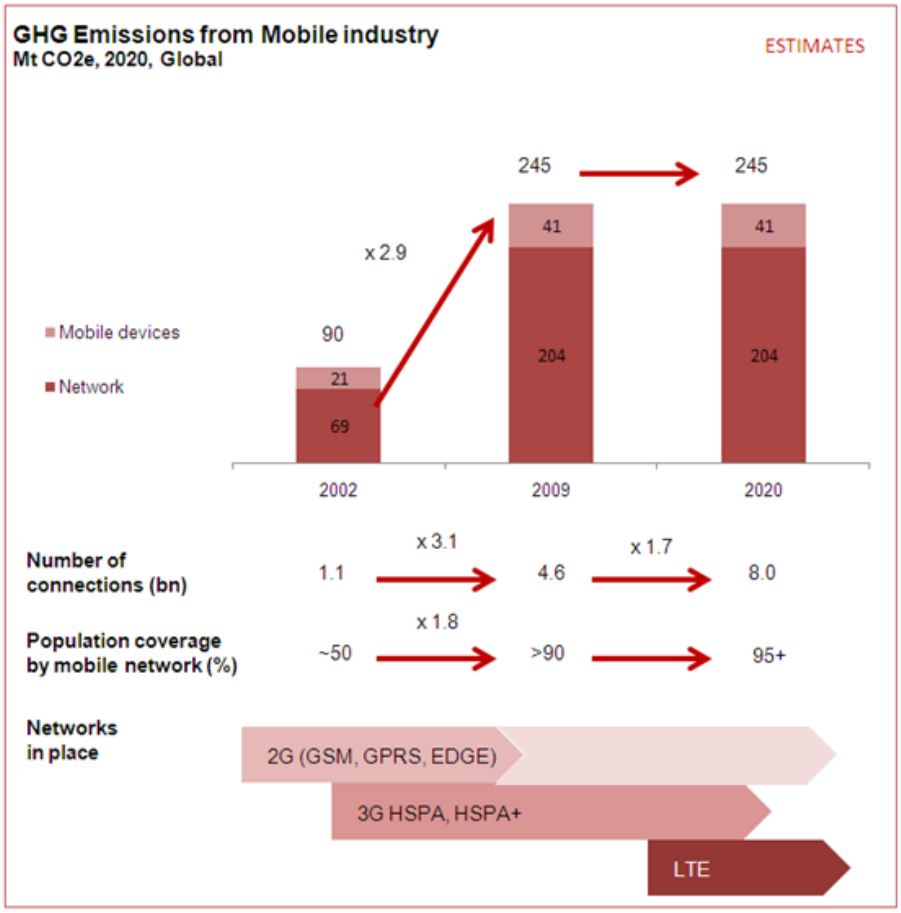
[9] Irbaris analysis; SMART 2020, The Climate Group and GeSI, "Enabling the low carbon economy in the information age", 2008; Ericsson, "Lifecycle Assessments of ICT", 2009; Nokia, "Lifecycle environmental issues of mobile phones", 2005. Emissions include full lifecycle from consumption / use and emissions tied to the manufacturing process.

[10] See Frequently Asked Questions at the end of this report for details on these estimates

[11] Excluding machine-to-machine connections

[12] Estimates; Irbaris analysis; see FAQ for complete set of assumptions; excludes emissions from office and commercial buildings and from transportation of employees

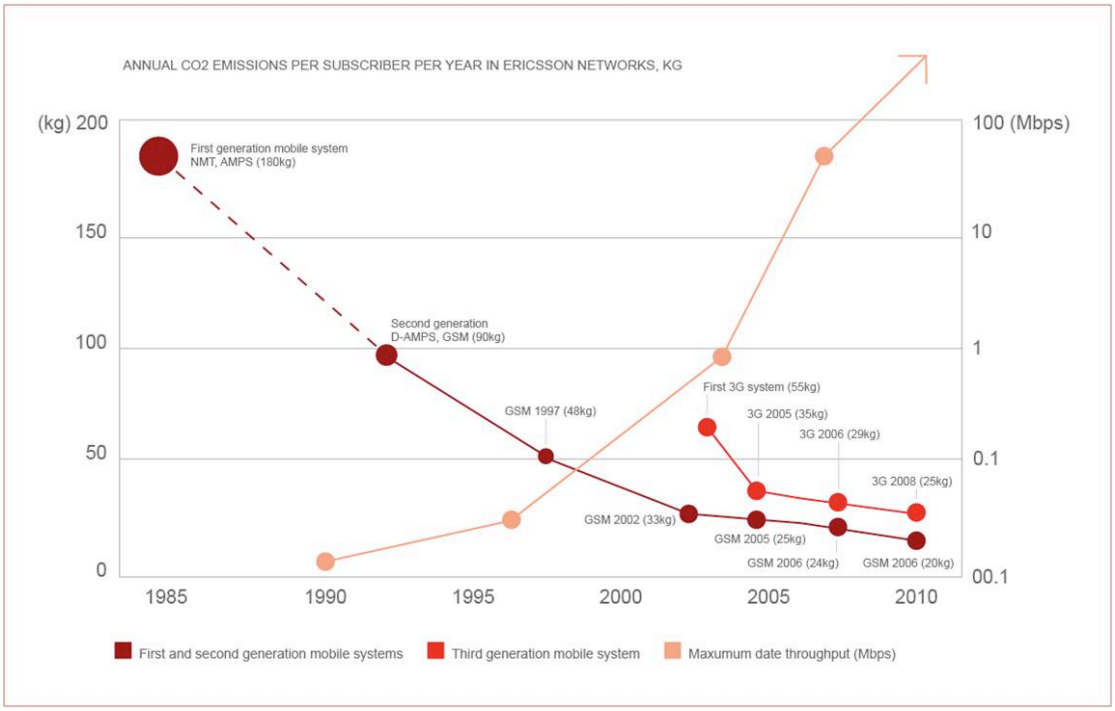
Figure 3 - GHG Emissions from mobile sector[13]



In recent years, the energy efficiency of mobile network equipment has improved markedly. By way of example, Figure 4 shows how the annual CO2e emissions per subscriber in Ericsson networks has declined over the past 20 years, at the same time as the data throughput of mobile communication technologies has increased dramatically.

[13] Ibidem

Figure 4 - Annual CO2e emissions per subscriber[14]



Current initiatives in the telecom industry

Mobile operators and vendors are working on a number of initiatives to develop energy efficient networks and ensure that their customers use energy-efficient handsets. Examples of these activities include:

- Designing low energy base station sites
- Deploying base-stations powered by renewable energy
- Implementing infrastructure optimisation and sharing
- Reducing mobile device life cycle emissions through design and recycling

Low energy base station sites

Cell sites account for most of the energy consumed by a mobile telecoms network. Typically, the power consumption of the support systems is more or less proportional to the power consumption of the telecom equipment. As the power consumption of the base transceiver station (BTS) is reduced, the power consumption of the infrastructure equipment, such as cooling systems, can be reduced. Considerable improvements in energy efficiency of base stations have been realised in recent years. For example, Ericsson has reduced the annual direct CO2e emissions per subscriber in the mobile broadband base stations it supplies from 31 kg in 2001 to 17 kg in 2005 and to 8 kg in 2007[15]. Nokia Siemens Networks announced in 2009 a new GSM/WCDMA cabinet-based BTS with a power consumption of 790 W, versus 4,100 W for the equivalent model from 2005.[16] Alcatel-Lucent also

[14] Ericsson, "Life Cycle Assessments of ICT", May 2009 OECD Conference; New network data and use of average network characteristics; Diesel operation excluded; Note that 3G is deployed at higher frequencies; has a much higher data traffic and has lower emissions than GSM at the same frequency and traffic

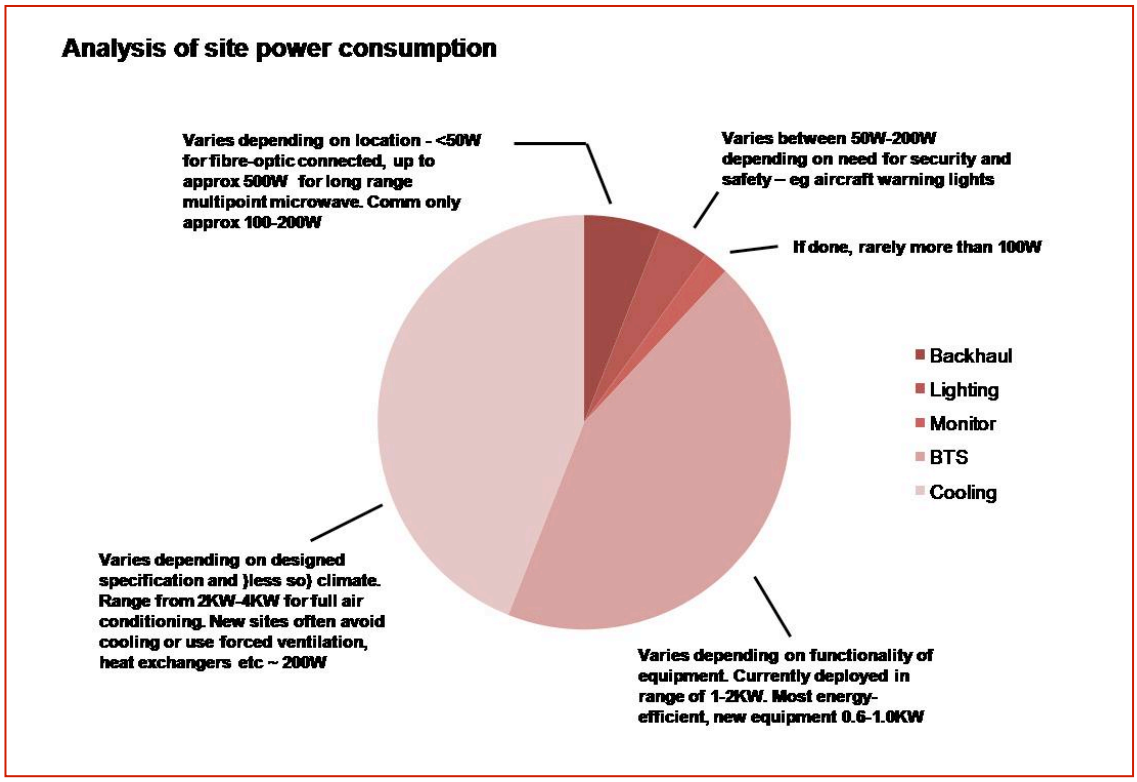
[15] Ibidem

[16] Nokia Siemens Networks, interview

developed innovative techniques such as the Dynamic Power Save feature on their GSM/EDGE mobile networking portfolio, which reduces power consumption when the traffic drops with no impact on service quality. This enhancement reduces average power consumption by 25-to-30%, and can be installed on all Alcatel-Lucent base stations deployed since 1999.[17]

Historically, approximately half of the energy consumed by a cell site has been used for cooling the telecom equipment as per Figure 5.

Figure 5 - Analysis of site power consumption[18]



Cooling systems are an integral part of the telecoms infrastructure. Without cooling, the telecom equipment is likely to overheat and fail or suffer a greatly shortened life. In the past, equipment providers specified equipment operating temperatures of up to 25°C. But 45°C is now common, enabling operators to reduce the overall energy consumption of the BTS by using passive cooling (fresh air) as opposed to active cooling (air conditioning). Examples include:

- Swisscom has successfully implemented its "Mistral-Mobile" cooling system at 30 of its BTS, leading to a reduction of up to 80% in the energy needed for cooling mobile network equipment.[19]
- Bharti has also been rolling out its "Green Shelter" concept leading to major savings in energy consumption by its network in India.[20]
- At Alcatel-Lucent, Bell Labs scientists have developed novel thermal solutions, such as three-dimensional heat sinks and thermal interface materials to more efficiently conduct heat at the

[17] Alcatel-Lucent 2008 CSR Report

[18] GSMA Green Power for Mobile initiative; inputs from GSMA Member Operators

[19] Press releases, Swisscom website

[20] Press releases, Bharti website

electronic components level, and modular liquid cooling solutions that decrease the power required to cool electronics at the racks and data centre level.

- Ericsson has developed the Ericsson Tower Tube, which uses natural convection cooling, to greatly reduce feeder loss, resulting in a reduction of up to 40% in power consumption. Furthermore, the Tower Tube is designed so that backup-batteries can be placed below ground, thus lowering their operating temperature and increasing their lifetime significantly.

Operators are also working closely with equipment vendors to undertake other measures to reduce the energy consumed by base stations, such as:

- Reducing the number of separate hardware components and improving those components, leading to gradual reductions in energy consumption.
- Deploying "intelligent" antennas, such as those developed by Telecom Italia and Nokia Siemens Networks, which draw less power by monitoring customers' bandwidth requirements and using this information to allocate transmission capacity.
- Deploying BTS power savings features, where unused resources are put on stand-by, as developed by Ericsson since 2007, saving up to 25% of the power in the radio access network. Relying on dynamic energy management control and monitoring, the Ericsson solutions reduce energy consumption by putting on stand-by the power amplifiers not required for operation. In addition, site energy management software allows operators to pre-configure specific site energy profile for extraordinary conditions such as local events increasing traffic and, in turn, minimize energy consumption at other times.
- Deploying software-defined base-stations which can quickly adapt to support different mobile network technologies or even several such technologies at the same time. America Movil found that deploying Huawei's reconfigurable SingleRAN hardware reduced the power consumption of its base-stations by 50% and the volume of equipment needed by 70%. ZTE makes a similar system, which reduces power consumption by 40% and has already been deployed by CSL in Hong Kong. [21]
- Using remote radio heads, where the BTS is mounted on the tower next to the antenna, which reduce the energy loss associated with the feeder cable connecting the radio to the antenna. Alcatel-Lucent has developed "active antenna arrays" that save energy in wireless base stations by integrating power-hungry radio frequency equipment within each antenna element, thus reducing power losses.
- Switching off network components required for excess capacity at times of low traffic. Both T-Mobile and Bharti have undertaken work to systematise this aspect of network optimisation

Base-stations powered by renewable energy

An estimated 1.6 billion people live without electricity and a further 1 billion people live in areas with unreliable access to power. In order to expand into areas without a reliable source of electricity, mobile operators have primarily used diesel generators for power. However, as the price of diesel has risen and concern about GHG emissions has risen, operators have experimented with solar and wind powered base stations in both remote off-grid areas and in on-grid areas prone to blackout or brown out.

CASE STUDY 1 - GREEN POWER FOR MOBILE, GSMA AND OPERATORS, GLOBAL

In September 2008, the GSMA Development Fund launched its Green Power for Mobile programme. The programme aims to advance the use of renewable energy sources by the mobile industry to power 118,000 new and existing off-grid base stations in developing countries by 2012. When this target is achieved, up to 2.5 billion litres of diesel fuel per year will be saved, annual carbon emissions of up to 6.8 Mt CO2e will be avoided and 118 million people in developing countries will be connected to mobile networks using green power.

The GSMA Green Power for Mobile programme has been recognised by the Clinton Global Initiative for its exemplary approach to accelerating solutions to address climate change, and has been profiled in the CGI's 2004-2008 commemorative publication, "Action Speaks Louder than Words".

[21] From The Economist print edition, Sept 24th 2009, China has made huge strides in network equipment

The programme consists of three work streams: Market clarification, capital expenditure financing and ongoing innovation:

Market clarification: The objective is to give mobile operators a full understanding of the opportunities for green power in their specific markets and demonstrate how using renewable energy poses less risk than may be perceived. This work stream is based around a web portal, a working group of 25 mobile operators, and a tool-kit to guide decision-making.

Capital expenditure financing: Green Power for Mobile acts on behalf of its members to secure funding through development banks. As a nascent market, capital costs to implement green technology as a source of power for base stations can appear too risky an investment for many mobile providers. The aim of securing capital expenditure financing from development banks, rather than commercial lenders, is to provide mobile operators with lower cost loans in order to encourage investment in green technology. Green Power for Mobile is financially supported by a major development bank.

Ongoing innovation: The programme promotes continued innovation and technology transfer in the field of renewable power by supporting trials and testing the potential of renewables in a specific countries or regions. The programme is on target to complete projects for 15 different operators using 1,000 solar, wind and biofuel base stations by 2010.

Infrastructure optimisation and sharing

Historically mobile networks have been designed in a way that optimises traffic flows. Increasingly operators now design networks, and specifically the number and location of BTS, in a way that optimises both traffic flow and energy consumption. However, they are often constrained by planning policies that make it difficult to site base stations in optimal locations.

To reduce both their costs and their emissions, mobile operators are also looking to share more infrastructure, but this can also be restricted by regulation. There are two levels of infrastructure sharing: passive and active. Passive sharing involves components such as the tower mast or pylons, cables, physical site or rooftop, shelter cabinets, power supply, air conditioning, alarm systems, etc. Active sharing includes antennas, antenna systems, backhaul transmission systems and the BTS equipment itself.[22]

Passive sharing is becoming increasingly common and reduces the environmental footprint of mobile networks by cutting the number of BTS sites required by each company.[23] In March 2009, Telefonica and Vodafone announced that they would share network infrastructure in Germany, Spain, Ireland and the UK. Active sharing, which shares the site electronics, can have a much larger impact on the networks' carbon footprints, but it has only been implemented in a few mature markets to date. Active sharing agreements include T-Mobile and 3 Group in the UK, Telstra and 3 Group, as well as Vodafone and Optus, in Australia, Tele2 and Telia, as well as Tre and Telenor, in Sweden. In South Korea, all three operators KT, SK Telecom and LGT invested in KRTnet Corporation in 1996 to construct and manage base station sites jointly used by all operators, leading to co-location of sites and tower sharing. Currently, there are more than 1,000 sites co-located in Korea.

In many countries however, active sharing is not possible because of competition rules.

Mobile device life cycle emissions

Several major initiatives are underway to reduce emissions from mobile devices. These include a universal charging solution; production of "green" handsets; and improved industry recycling.

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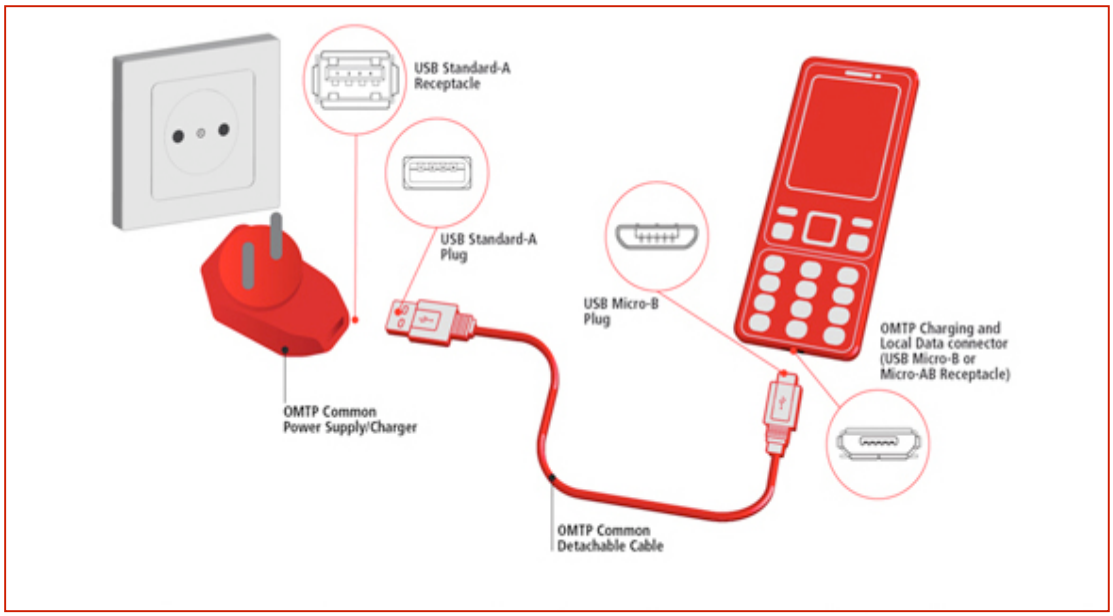
[22] GSMA, "Infrastructure Sharing", 2007

[23] A report from the UK Green Party estimated that unnecessary duplication of network equipment was wasting 300 GWh per year (http://www.greenparty.org.uk/news/20-04-2009-better-together-mobile-masts-report.html)

CASE STUDY 2 - UNIVERSAL CHARGING SOLUTION, HANDSET VENDORS AND OPERATORS, GLOBAL[24]

The GSMA and 23 leading mobile operators and manufacturers have committed to implementing a cross-industry standard for a Universal Charging Solution for new mobile phones. This will enable the mobile industry to adopt a common format for mobile phone charger connections and energy-efficient chargers, resulting in an estimated 50% reduction in standby energy consumption, the potential elimination of up to 51,000 tonnes of duplicate chargers[25] every year, and the enhancement and simplification of the end-user experience. The initiative was launched by the GSMA at the Mobile World Congress 2009 in Barcelona, supported by 3 Group, AT&T, HTC, KT, LG, Mobilkom, Motorola, Nokia, NTT DOCOMO, Orange, Orascom, Qualcomm, Rogers Wireless, Samsung, Softbank Mobile, SonyEricsson, TIM, Telefonica O2, Telenor, Telstra, T-Mobile, Vodafone, Wind.



The working group has set a target that by January 2012 the majority of all new mobile phone models available will support a universal charging connector and the majority of chargers shipped will meet the high efficiency targets set out by the OMTP (Open Mobile Terminal Platform). These include the re-use of chargers across multiple phones, reduced wastage by enabling mobile phones to be sold with no charger in the box and removal of the requirement for every new phone to be sold with a dedicated charger.

A universal charger will also make life much simpler for the consumer, who will be able to use the same charger for future handsets, as well as being able to charge their mobile phone anywhere from any available charger. UCS chargers will also include a 4-star[26] or higher efficiency rating, which is up to three times more energy-efficient than an unrated charger. [27]

To ensure the uptake of the UCS, the operators and manufacturers who have partnered with the GSMA to launch this initiative are working alongside the OMTP and trade associations, such as the CTIA, to meet the targets set for 2012. The initiative will also work with the wider operator and manufacturing communities to secure global participation and commitment as well as educating the industry and promoting the benefits of a universal charger via a targeted marketing campaign.

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[24] GSMA, "Mobile Industry Unites To Drive Universal Charging Solution For Mobile Phones", February 2009

[25] GSMA analysis from UNEP, Gartner, European Commission Integrated Product Policy Pilot on Mobile Phones, University of Southern Queensland data

[26] The Star Scheme is an initiative by some manufacturers based on EU and US requirements. It is more stringent than the requirements of the European Commission Code of Conduct on Energy Efficiency of External Power Supplies (Version 3) or the US Environmental Protection Agency ENERGY STAR V

[27] IPP Project on the Efficiency of a Mobile Device Charger developed a star rating system with unrated chargers having a no-load power consumption of >0.5W and a 4-star charger having a no-load consumption of between 0.03 and 0.15W

CASE STUDY 3 - GREEN HANDSETS, HANDSET VENDORS, GLOBAL

Handset vendors are also working on a variety of "green" handsets, with features ranging from simple reminders to unplug the phone when it is fully charged to using solar energy for charging. Some new models are made from recycled materials or from biodegradable plastics.

Solar mobile handsets have been launched this year by a range of manufacturers, including LG, Samsung, Sharp and ZTE. The solar panels are located on the back of the handsets and the phone charges simply by pointing the solar panel at natural light. Charging handsets is typically done using electricity from a grid, which in most countries is a cause of GHG emissions. Solar charging not only eliminates these emissions, it also helps customers in emerging countries who are off-grid or where the grid power is only intermittent.

Other handsets, such as SonyEricsson's new GreenHeart portfolio of phones, build on a "green core", which aims to eliminate the use of hazardous chemicals. Additional "green" features include an e-manual that reduces paper usage by more than 90%, smaller packaging that decreases transport-related CO2e emissions by more than 80%, recycled plastics and a low-power charger. Motorola has launched a "carbon neutral" phone with a housing made of plastics that contain recycled water bottles. The phone's carbon-neutral designation comes from the reductions and offsets acquired through a partnership with Carbonfund.org.

The GSMA and several of its operator members are analysing what steps could be taken collectively at a global level to reduce the volume of excess packaging associated with the more than one billion mobile devices sold worldwide each year. As well as achieving a substantial reduction in GHG emissions, the GSMA believes reducing the packaging and the number of unnecessary components that are shipped with a mobile device would result in major financial savings through lower raw material, manufacturing and distribution costs.

CASE STUDY 4 - RECYCLING, OPERATORS AND HANDSET VENDORS, GLOBAL

When it comes to mobile phone take-back, refurbishment and reuse, which extend the life of the product, are clearly preferential to recycling. On average, more than 70% of collected handsets from developed countries could be refurbished. However, take-back rates are low as research shows that old mobile phones are typically kept by customers, while relatively few are dumped in landfills sites.

A 2008 survey[28] of 6,500 people in 13 countries reported that 44% kept their old phone, 25% gave it to friends or family, 16% sold their used phone (especially in emerging markets), 3% are recycled and 4% are thrown into landfill. About 16% (by weight) of a typical mobile phone is considered 'high value' materials. For example, 1 tonne of electronic circuit boards yields about the same amount of gold as 110 tonnes of gold ore.

Industry-led take-back schemes have existed in Asia-Pacific, Europe and the USA since the late 1990s and predate legislative requirements[29]. There are now provisions for the collection of used phones in more than 80 countries around the world. In countries without a strong tradition of recycling, the number of intact phones returned is likely to be small unless there is substantial investment in awareness raising and infrastructure.

In developing countries, the informal repair sector tries to reuse phone parts as spares and only components that can't be recycled in this way will become available for collection. A pilot recycling project[30] was run by Vodafone in Kenya in 2007/08 and collected, on average, half a kilogram of waste per week from each repairer. Nearly a quarter of the waste collected was phone casings, 22% batteries and 20% chargers.

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[28] http://www.nokia.com/A4136001?newsid=1234291

[29] GSMA, "Mobile Phone Lifecycles", 2006

[30] http://www.vodafone.com/ start/responsibility/environment/ reuse_recycling/ reusing_and_recycling/ recycling_mobile_phones.html

Recycling of network equipment is also important. While regulated in the EU according to the WEEE Directive[31], some telecom equipment suppliers, such as Ericsson, have chosen to offer product take back of network equipment globally, and have set targets which exceed the WEEE requirements.

A number of mobile telephony companies have launched initiatives to encourage consumers to increase handset recycling:

- Telenor has teamed up with the Red Cross to recycle mobile phones. For each user returning a mobile phone, the user will receive 50 free SMSs and the Red Cross will plant 25 trees in Asia. Of the phones collected, those damaged will be recycled and those that can be repaired will be sold in Asia with the proceeds going to the Red Cross.
- AT&T is working with a charity that recycles used mobile phones and purchases prepaid phone cards for troops overseas with the proceeds. AT&T's 2,200 stores collect handsets on behalf of the charity, making it simpler for consumers to recycle their old phones.
- Sprint's Wireless Recovery Program takes back all phones and accessories, regardless of make, and then refurbishes, resells or recycles the phones with the net proceeds going to charity.
- Vodafone has phone and accessory collection schemes in place across virtually all of its markets, collecting 1.8 million devices in 2008/09. Many of these schemes are linked to charitable donations, including a scheme in Italy where the proceeds from selling refurbishable phones funds installation of solar panels for schools.
- Nokia has launched a recycling initiative in Malaysia by placing kiosks in busy shopping malls. The kiosks both collect old phones to be recycled and act as a convenient, automated facility for customers to drop-in phones for service. Nokia plants a tree for every phone dropped and provides the consumer with a unique URL and instructions with which to view their tree through Google Earth.
- The Australian telecoms industry set up "MobileMuster" in 1999 to collect and recycle mobile phone handsets, batteries and accessories. Today it uses a network of over 3,500 mobile phone retailers, local councils, government agencies and business drop off points across Australia[32].
- The Korean Association of Information and Telecommunication (KAIT) stages periodical handset collection campaigns to recycle or refurbish used devices. KT and SK Telecom also operate a handset recycling program, collecting used handsets and loaning them to customers who have misplaced or lost phones or are getting their phones repaired.
- China Mobile co-sponsors with handset manufacturers a programme called "Green Boxes Environmental Protection Campaign" aimed at recycling mobile phones and accessories. By the end of 2007, 2.6 million phones and accessories had been recycled, and the goal of the initiative is to have Green Boxes in 80% of all retail sites by 2008, and full coverage by 2009.
- Telefonica O2 in Germany has a recycling programme that allows customers to send their old handsets and accessories, regardless of manufacturer, network or how well they work, to Greener Solutions, a company that specialises in recycling mobile phones. Pre-paid envelopes with instructions are available in all O2 Shops. Part of the proceeds from returned mobile phones are donated to the World Wide Fund for Nature, to support the large-scale nature conservation project "Central Elbe", aimed at water conservation, development of hardwood and softwood riverside forests and support for endangered animal and plant species in Germany. Around 46,000 mobile devices have been collected since 2006.

1.2 Perspectives on mobile industry progress and vision

"ICTs are part of the solution, not part of the problem, and there are enormous gains to be made through the smart use of ICTs in virtually every single sector. Forward-thinking leaders already recognize the powerful role ICTs play in helping address climate change issues across the board. The importance of ICTs now needs to be recognized globally - and the vital role of ICTs as we move forward in dealing with climate change issues be further promoted."

[31] The Waste Electrical and Electronic Equipment (WEEE) Directive is the European Community directive 2002/96/EC on waste electrical and electronic equipment which, together with the RoHS Directive 2002/95/EC, became European Law in February 2003, setting collection, recycling and recovery targets for all types of electrical goods.

[32] http://www.mobilemuster.com.au/quick_facts

Dr Hamadoun I. Touré , Secretary-General of ITU

"There is no doubt of the significant potential across the telecommunications sector to contribute to the reduction of global emissions, through the provision of broadband and mobile services that improve energy efficiency. There may be considerable potential for large scale reductions in travel to meetings. As demand for their products and services increases, telecommunications companies must stay attuned to the impacts of climate change legislation and continually focus on their own energy efficiency to keep their emissions and utility costs in check, as this report suggests they will. By doing this, they will become better prepared to compete in a carbon-constrained economy and capitalize on the opportunities that future presents".
Paul Dickinson, Chief Executive, Carbon Disclosure Project

From operators:

"Bharti Airtel is committed to being environmentally responsible in every aspect of its business. Initiatives such as the sharing of tower infrastructure and the use of 'green shelters' at cell sites enable us to make substantial reductions in our energy consumption and, in the process, reduce our carbon footprint. In connecting millions of customers to government entities and banks and by providing facilities like video conferencing and m-commerce, Airtel helps limit the use of paper and the need for travel."
Sunil Bharti Mittal is the Chairman & Managing Director of Bharti Airtel Ltd

"Green IT is the catalyst for protecting environment as it enables the mobile industry as well as other industries to significantly lower the CO2 emission. In this effort, KT is making significant investment in Green IT infrastructures as well as collaborating with global operators and manufacturers."
Pyo, Sam-Soo, President, Head of Technology Strategy Office of KT Corporation

"Mobilkom austria developed a smart application in cooperation with one of its vendors which makes it possible to automatically switch off the GSM carrier resources at low traffic times."
Hannes Ametsreiter, CEO mobilkom austria and Telekom Austria

"ICT is the most important social infrastructure today which can enhance efficiency and produces innovation overall in the economy. SK Telecom is keen to realize such potentials of ICT infrastructure. On top of solution services supporting convenient public transportation and efficient utility management, we have been involved with the Smart Grid and u-City projects in Korea. With an expertise gained from eco-friendly u-city development in Korea, we are seeking opportunities in emerging countries such as China. Mobile-in-Vehicle service enabling eco-driving will be commercialized later this year. Harnessing our world-leading ICT infrastructure, SK Telecom pledges to invest more than 2.5 billion USD for next five years in five core technologies to increase productivity for cities, industries, and individuals."
Man-Won Jung, President and CEO of SK Telecom

"Telecom Italia supports the environmental cause through innovative solutions for a wide range of applications including e-health, e-learning, telepresence and info-mobility, so contributing to the reduction of CO2 and fighting the climate change. This long-lasting commitment in support of the environment is testified by several international awards obtained throughout the years."
Franco Bernabè, CEO of Telecom Italia

"The mobile industry has a key role to play in building a more sustainable world. We have a responsibility for reducing energy consumption and CO2 emission of our activities - but also a significant opportunity to help our customers reduce their own emissions and energy costs through smart use of ICT solutions. Telenor will be fully engaged in GSMA's climate change goals toward 2020."
Jon Fredrik Baksaas, President and CEO of Telenor Group

"Telstra has a keen interest in sustainable network development and environmentally sound business processes. As a company we have well developed environmental sustainability strategies.
The Telstra Next G™ network is an intelligent, secure and reliable network that is helping business cut costs, reduce their carbon footprint, increasing productivity, enhancing education and improving health services."

David Thodey, CEO of Telstra

"Tackling climate change is a huge challenge for the world, and one where the mobile telecommunications industry can make a great contribution. Vodafone and other innovative businesses can play their parts but policymakers must make the carbon connections between ICT and climate change, and construct policy frameworks that incentivise the investment and actions necessary to create smart wireless communications and which encourage cross-industry collaboration. With the right approach, there is a win-win for business, society and the environment."
Vittorio Colao, CEO of Vodafone Group, in "Carbon Connections: Quantifying mobile's role in tackling climate change"

From manufacturers:

"There are 3 crises in the world today: a financial crisis, a crisis in confidence and climate change. Green is the way forward - which will help us find innovative ways of responding to the first 2 crisis while meeting the demands of our citizens and ultimately drive growth."
Ben Verwaayen, CEO of Alcatel-Lucent, speaking at the World Economic Forum's "Summer Davos" in Dalian, China

"Mobile enabled ICT and broadband can be powerful enablers to offset CO2 emissions, and also in stimulating the economy. Ericsson has worked extensively to document how our solutions can contribute to economic growth as well as environmental sustainability. We are pleased that GSMA will be championing this message on behalf of the industry. We believe the Green Manifesto is an important step to bring forth the cases and the facts that we have understood so well in our sector, to the global leaders and policy makers that will ultimately decide the fate of the planet."
Carl-Henric Svanberg, CEO of Ericsson

1.3 Achievements of mobile operators to date

Measuring the comparative GHG emissions associated with mobile networks is difficult because:

- Some operators are still building out their networks (especially in emerging countries)
- Operators offer different services (for example, data versus voice)
- Operators configure networks differently and use a range of frequency bands
- Parts of the network are sometimes outsourced (including the entire transmission and switching components in the case of virtual operators)
- Operators have different customer bases (business and governments versus consumers)
- Different countries have very different sources of energy powering the electricity grid or have limited or poor grid infrastructure

However, the European Commission, in a paper published in March 2009, quoted a comparison of commitments by telecom companies[33]:

Figure 6 - Voluntary telecom sector commitments to targets and deadlines for GHG emissions and energy efficiency / consumption

Company	Target Reduction %	Baseline	Target Date	Comment
Alcatel-Lucent	10	2007	2010	CO2 emissions of facilities
Bell Canada	15	Not given	2012	GHG emissions
British Telecommunications	80	1996	2020	CO2 emissions
Deutsche Telekom	20	2006	2020	CO2 emissions
Ericsson	15-20	2006	2008	Energy efficiency
France Telecom	20	2006	2020	CO2 emissions
Motorola	6	2000	2010	CO2 emissions
Nokia	18	2006	2010	CO2 emissions
Nokia Siemens Networks	20-49	2007	2009-2010	Energy consumption of products
Sony Ericsson	20	Not given	2015	CO2 emissions
Telecom Italia	30	2007	2008	Eco-efficiency indicator
Telenor	40	2008	2017	CO2 emission efficiency
Vodafone	50	2006/7	2020	CO2 emissions

Since then some of these companies have updated or refined their commitments. A summary of mobile operators' commitments sourced from a review of websites, interviews and company environmental reports in August 2009 follows.

China Mobile

[33] EU Commission press release, "Commission pushes ICT use for a greener Europe", 12 March 2009. Nokia entry adjusted to reflect CO2 emissions rather than energy consumption; Sony Ericsson entry added; Telenor entry added; Ericsson improved energy efficiency of radio base stations by 80% from 2001 to 2008; the baseline is the year against which the improvement target is set

"In our Green Action Plan, we have declared our own target: to reduce power consumption per telecommunication traffic unit by 40% by 2010 compared to 2005 levels."
– China Mobile CSR Report, 2008

KT
"KT will reduce the amount of CO2 emission by 20% by 2013 from the year 2005. As for the reduction efforts, it will entail all areas where KT conducts business directly and indirectly (Direct GHG emission, supply chain and end users using its products and services)"– KT information

Telefonica
"Telefonica is committed to reducing its consumption of network electricity by 30% per equivalent access and its office electricity consumption per employee by 10% by 2015" The baseline year is 2007.
– Telefonica 2008 Special Report on Corporate Responsibility

Telenor
*"The group executive management of Telenor has adopted an ambitious target for reducing Telenor's internal carbon intensity of its operations by 40% by **2017**, compared to the **2008** intensity level."*
– Telenor website

Vodafone
"We have set ourselves a tough challenge to halve our CO2e emissions by 2020, from the 2006/07 baseline... This Group reduction target applies to all of our local operating companies that were active for a full year in 2006/07; and to their CO2e emissions from all energy sources except business flights and other greenhouse gases."
– Vodafone CR Report, year ending 31 March 2009

Many equipment and handset vendors have also set targets:
Alcatel-Lucent
"Reduce our absolute carbon footprint (CO2 equivalent) by 50%, of 2008 baseline, by 2020. Improve the functional energy efficiency of key products by at least 20% by 2010 compared with 2008."(*New or recently developed products on an upward curve of their life cycle)*
- Alcatel-Lucent 2008 CSR Report

Ericsson
"In 2008, Ericsson set a new group-level target to reduce its life-cycle carbon footprint by 40% over the next five years, starting with a 10% reduction in 2009. The footprint will include total CO2e emissions from: in-house activities, such as production, transport, sites and business air travel, and the lifetime energy use of the products sold by Ericsson during the year (portfolio energy-efficiency improvement)."
- Ericsson 2008 Annual Report

Motorola
"Reduce normalised carbon footprint (includes direct greenhouse gas emissions and indirect emissions from electricity use) by 15% from 2005 levels and... As a founding member of the Chicago Climate Exchange (CCX), a voluntary emissions-reduction program, we also have committed to a 6% reduction in our absolute greenhouse gas emissions by 2010, compared with 2000."
- CDP response and corporate responsibility on Motorola website

Nokia
"Reduce CO2e emissions ... by a minimum of 10% in 2009 and by a minimum of 18% in 2010, compared to the base year 2006."
- Nokia environment strategy on Nokia website

Nokia Siemens Networks
"Nokia Siemens Networks is committed to: (1) Improve the energy efficiency of our GSM/EDGE and WCDMA/HSPA base station products by up to 40% by 2012, (2) Decrease the energy consumption of our buildings by 6% by 2012, and (3) Increase the use of renewable energy in company operations to 50% by the end of 2010"
- Nokia Siemens Networks environment strategy on NSN website

SonyEricsson
"SonyEricsson today unveiled goals for reducing CO2e emissions across the whole company by 20% by 2015 in absolute terms. At the same time, the company committed to reducing the total GHG emissions by 15% from the full life cycle of its products i.e. from the mining, production, through the use by consumers to the end of life management by 2015."
- SonyEricsson Press release, 4 June 2009

1.4 The mobile industry's goals

Whilst almost all mobile operators are taking initiatives to improve their sustainability and reduce GHG emissions, the complexity of measurement, variety of business models and sector growth have led to different approaches to GHG reduction targets and commitments. However, in the next 12 to 24 months, the mobile industry intends to build on the work being undertaken by ICT companies through GeSI[34] to develop and agree a standardized mechanism for measuring emissions, with a view to making a commitment to carbon neutral growth.

The mobile industry forecasts that it will reduce its total global CO2e emissions per connection[35] by 40% in 2020 as compared to 2009. This forecast covers all emissions from energy sources under the control of the mobile operators, including energy consumption from the radio network, buildings' energy consumption and emissions from transport[36].

Mobile operators plan to work with handset vendors to ensure that the energy consumed by a typical handset is reduced by 40% in standby and in use by 2020.

Mobile operators will also work with equipment vendors to ensure that the life cycle emissions of network equipment components are reduced by 40% in the same timeframe.

The GSMA will encourage operators to achieve these goals by:

- Working with other industry bodies to develop standard measuring methodologies.
- Assisting the measuring and monitoring and tracking of the total emissions of mobile operators and the reporting against targets.
- Facilitating sharing of good practice information in order to help all operators achieve substantial GHG emission reductions.

[34] GeSI EE IOCG Standardisation Branch

[35] Connections do not include M2M SIMs

[36] Share of emission savings from operators will come from de-carbonation of network, which is not within the control of mobile operators unlike their energy efficiency measures, but will contribute to meeting the industry's commitment

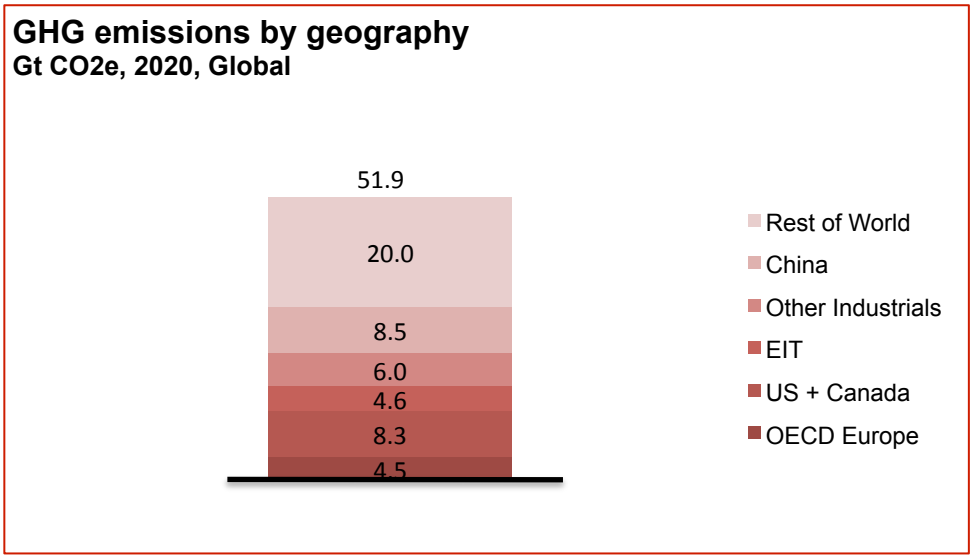
Chapter 2

Enabling impact

How the mobile industry is reducing GHG emissions in other sectors

A "business-as-usual" scenario would see global emissions associated with human activities rise from 40 GtCO2e emitted in 2002 to nearly 52 GtCO2e in 2020, according to the IEA, These emissions emanate from six major sources: transportation, power, buildings, industry, agriculture, and forestry and land use.

Figure 7 - GHG emissions by geography[37]



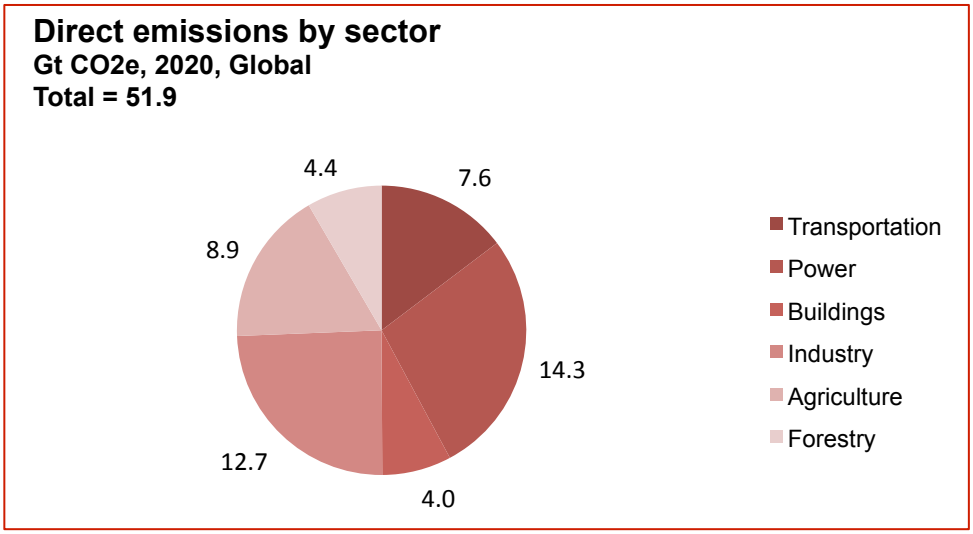
[37] IEA, "World Energy Outlook", 2007

Note: Other Industrialised countries: Australia, New Zealand, Japan, Singapore, South Korea, Taiwan, UAE, Saudi Arabia, Qatar, Oman, Kuwait, Israel, Bahrain, Mexico

Economies In Transition: Eastern Europe and Russia

Rest of the World: Africa, South and Central America excl. Mexico, Asia excl. China and countries included in "Other industrialized"

Figure 8 - Direct emissions by sector[38]



2.1 Mobile telecoms is enabling significant GHG emission reductions in other sectors, but could do much more

The mobile industry is enabling significant reductions in GHG emissions and costs across a range of sectors of the economy, using M2M (Machine-to-Machine) and other communications to deliver so-called smart solutions.

A 2009 analysis, published by Vodafone and Accenture in the "Carbon Connections" report[39], assessed 13 specific initiatives related to dematerialisation, smart grids, smart logistics, smart transportation (smart cities) and smart manufacturing, in which existing mobile technologies are abating GHG emissions in Europe (EU25[40]).

The report details how such existing technologies can be put to use to reduce GHG emissions in multiple sectors of the economy and estimates that 113 Mt CO2e can be saved by 2020 through this set of initiatives.

The report "SMART2020: Enabling the Low Carbon Economy in the Information Age"[41], published by GeSI and The Climate Group in 2008, assesses the direct and enabling impact of the ICT sector as a whole on global GHG emissions from 2002 to 2020.

The report details how a large set of ICT-enabled initiatives leading to GHG emissions reductions in the buildings, transportation, power, and industry sectors can lead to 7.8 GtCO2e reductions in 2020, from a total 2020 GHG emissions of 51.9 Gt CO2e on a "business-as-usual" trajectory.

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[38] IEA, "World Energy Outlook", 2007

Note: Other Industrialised countries: Australia, New Zealand, Japan, Singapore, South Korea, Taiwan, UAE, Saudi Arabia, Qatar, Oman, Kuwait, Israel, Bahrain, Mexico

Economies In Transition: Eastern Europe and Russia

Rest of the World: Africa, South and Central America excl. Mexico, Asia excl. China and countries included in "Other industrialized"

[39] Vodafone, "Carbon Connections: Quantifying mobile's role in tackling climate change", July 2009

[40] EU 25 is composed of the following countries: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom

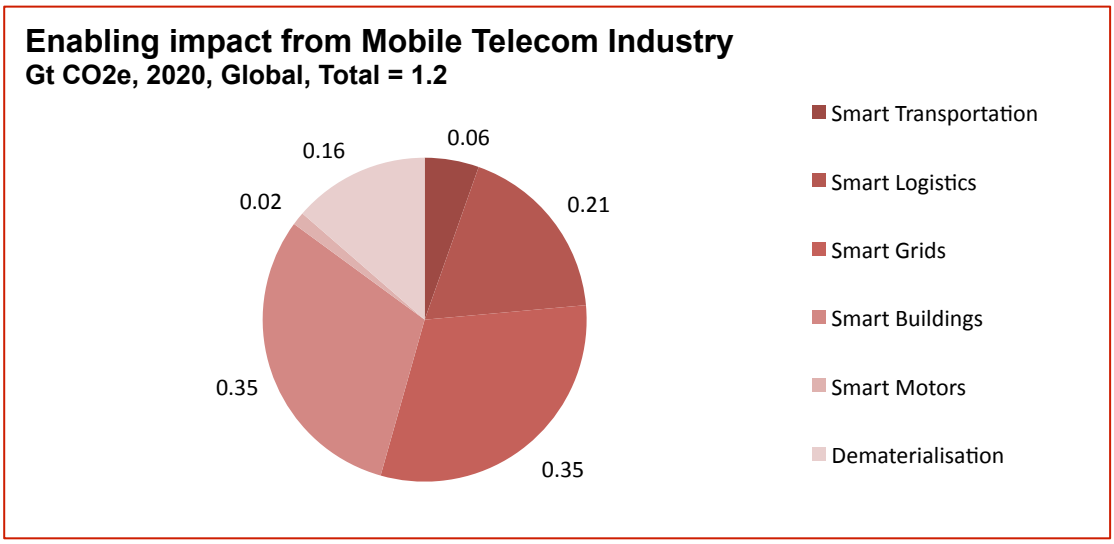
[41] Vodafone, "Carbon Connections: Quantifying mobile's role in tackling climate change", July 2009

An extrapolation of results from the "Carbon Connections" and "SMART2020"[42] reports shows that the mobile industry can enable GHG savings of at least 1,150 Mt CO2e in 2020, or 2.2% of the global 2020 GHG emissions, in the "business-as-usual" scenario, provided the initiatives are rolled out worldwide.
Examples of the initiatives required to reduce GHG emissions include:

- Smart transportation and logistics
  - Smart logistics solutions, including fleet tracking systems and load optimisation
  - Smart transportation solutions, including synchronised traffic and notification systems, onboard telematics to encourage eco-driving, congestion management, routing and journey management optimisation, and road pricing
- Smart grids and smart meters solutions, including electricity network monitoring, and electricity and gas metering
- Smart buildings, which use mobile and other ICT technologies to deliver highly energy-efficient, low-emissions buildings both for new and existing building stock
- Dematerialisation, that is, the substitution of high carbon products and activities with low carbon alternatives, for example, substituting face-to-face meetings with video-conferencing, or home-working

The mobile industry also has a role to play in monitoring and broadcasting weather and other environmental impacts, a crucial element for successful adaptation to the changing climate. Mobile technology can facilitate climate change adaptation by providing mobile-enabled weather monitoring systems, adverse weather early warning systems, and water level and soil water monitoring systems.

Figure 9 - Enabling impact from mobile industry[43]



A number of abatement technologies have already been developed across the sectors mentioned, and the markets and business models relating to these technologies have achieved varying levels of maturity. Common to all, however, is the need for cooperation between stakeholders in the development, marketing and implementation of solutions in order to secure their viability.

For example, smart buildings solutions require the cooperation of stakeholders including property developers, property owners, architects, building technology manufacturers, e.g., heating, ventilation

[42] SMART2020, The Climate Group and GeSI, "Enabling the low carbon economy in the information age", 2008

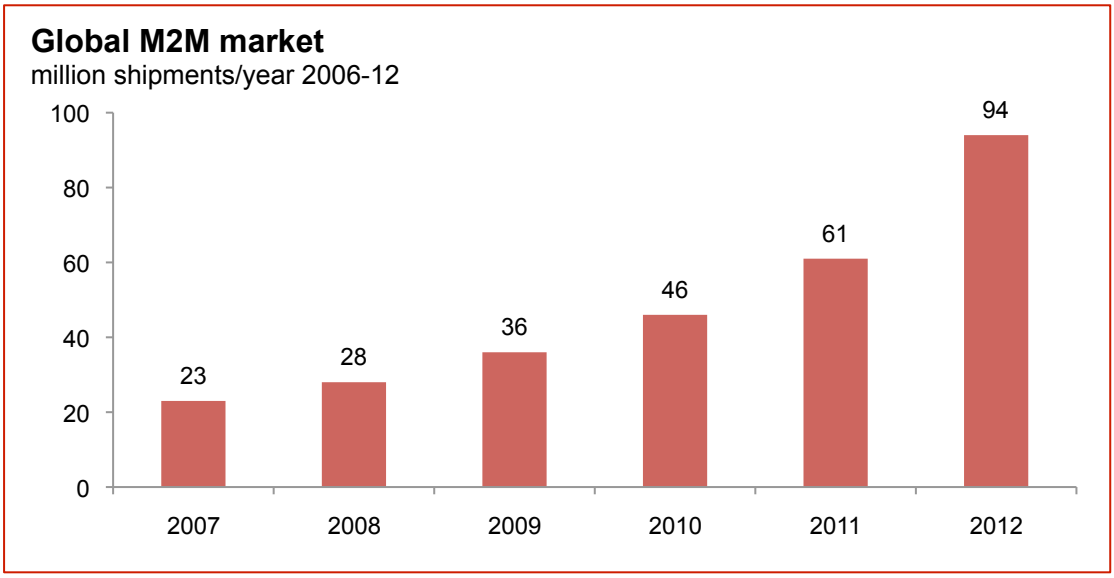
[43] Irbaris Analysis; SMART2020, The Climate Group and GeSI, "Enabling the low carbon economy in the information age", 2008; Vodafone "Carbon Connections: Quantifying mobile's role in tackling climate change", July 2009

and air conditioning (HVAC), lighting and automation technologies, contractors, and specialist companies such as telecom businesses. A large number of these solutions also require wireless components in their implementation.

For example, M2M communications can be used for the automatic measurement and transmission of data from remote sources. M2M has applications across a range of sectors including transportation, buildings, power and security services and can have a direct impact on the efficient use of energy in society and hence on GHG emissions. For example, embedded mobile solutions in cars can help drivers make more educated choices as to their routing and schedules, hence reducing delays and congestion, as well as supporting preventative maintenance.

The M2M market is set to surpass 180 million connections in 2012, according to a study by the GSMA, with unit shipments rising to approximately 100 million per year by 2012. See Figure 10.

Figure 10 - Shipments of M2M units, actual and forecast, 2006-2012E[44]



In addition to these M2M components, new energy-efficient solutions can also be delivered using conventional mobile handsets and smart phones. For example, there are applications that enable consumers to use their handsets to check their energy consumption and facilities managers to monitor the energy use of their buildings. Such tools can lead to changes in behaviour and energy efficiency gains ranging from 3.5% to 7% according to Energywatch[45].

Smart transportation and logistics

Transport-related GHG emissions are a major contributor to overall global emissions and are forecast to continue growing rapidly. The sector accounted for 14% of global GHG emissions in 2002[46] and GHG emissions from transport are expected to grow 42% over the period from 2002 to 2020 to reach 7.6 Gt CO2e or 15% of global GHG emissions in 2020[47].

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[44] GSMA, "Embedded Mobile, M2M solutions and beyond", 2009; Berg Insight Cellular M2M Shipments, 2008

[45] Energywatch, "Smart meters – cost and consumer benefits", 2007; other sources indicate savings of 10%, such as in Sarah Darby, "The effectiveness of feedback on Energy consumption", 2006

[46] World Resources Institute 2000

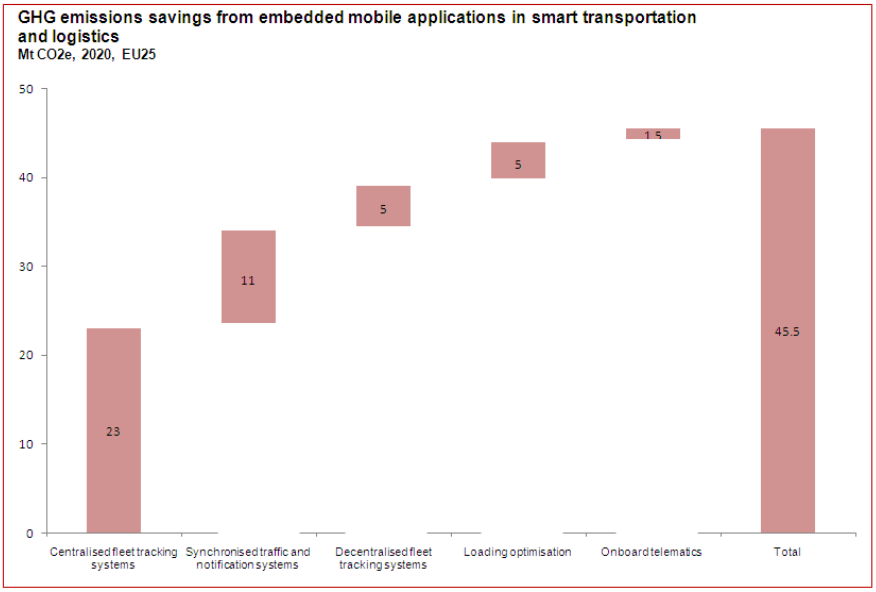
[47] IEA, "World Energy Outlook", 2007

The "Carbon Connections" report[48] estimates that 45 Mt CO2e can be saved in 2020 in this sector alone by applying a number of mobile-enabled solutions in the EU25[49] (see Figure 11). Extrapolating these figures worldwide suggests that these mobile-enabled initiatives could reduce GHG emissions by 270 Mt CO2e in 2020 or 3.5% of 2020 global transportation and logistics GHG emissions in the "business-as-usual" case.

Some key mobile-enabled initiatives related to smart transportation and logistics are:

- Centralised fleet tracking systems, which allow large logistics and transport companies to optimise routing, reduce delays and reroute shipments in real time. These systems use an M2M device fitted on each vehicle to communicate their position, speed and direction to a central tracking system via a cellular connection and are suited to large logistics fleets.
- Synchronised traffic and notification systems in urban areas can help to reduce emissions by improving urban traffic management, and by networking traffic lights, notification boards and auxiliary systems to enable dynamic rerouting of traffic, reducing congestion.
- Decentralised fleet tracking systems, in which an onboard tracking system enables communications between vehicles in a fleet without the need for a central hub. This system suits smaller logistics companies: drivers adjust their routes to optimise delivery planning based on the location, speed and destination relative to the other vehicles of the fleet, which are communicated via M2M cellular connections. These systems are more suited to smaller logistics fleets.
- Load optimisation systems, in which an onboard device remotely monitors the load's weight or volume and is connected via an M2M connection to a centralised fleet management system. The vehicle's speed or route can then be adjusted to make use of spare capacity.
- Onboard telematics systems, which enable data, such as fuel consumption, temperature or status of engine components, to be collected onboard and communicated wirelessly via an M2M device. Central fleet management systems can then monitor the status, efficiency and safety of vehicles remotely, allowing fleet managers to schedule predictive maintenance.
- Embedded mobile communications are also being used to facilitate road pricing systems, in which vehicles are charged per kilometre driven, reducing unnecessary journeys.

Figure 11 - Potential GHG savings in 2020 by embedded mobile applications in transportation and logistics, EU25 [50]



[48] Vodafone, "Carbon Connections: Quantifying mobile's role in tackling climate change", July 2009

[49] Initiatives referred to are categorized in the Carbon Connections" report as smart logistics (35Mt CO2e) and smart cities (10 Mt CO2e)

[50] Vodafone, "Carbon Connections: Quantifying mobile's role in tackling climate change", July 2009

CASE STUDY 5 - REAL TIME TRAFFIC INFORMATION WITH TOMTOM, VODAFONE, NETHERLANDS[51]

In 2007, Vodafone and the Dutch navigation systems company TomTom launched a service in the Netherlands that uses mobile phone signals sent from vehicles in traffic jams to enable a real-time travel information service.

Mobile phones continuously beam signals to their nearest base stations, which gives the network provider the approximate location of the phone. TomTom uses this location information to establish congestion levels on particular roads, the likely delay and then to suggest alternative routes.

The service provides a more accurate, faster and more detailed picture of actual travel times than solutions that use roadside equipment, for lower total investment. Similar systems are being launched by TomTom and Vodafone in other countries.

CASE STUDY 6 - TRAFFIC INFORMATION ON MOBILE PHONE, OPTUS, AUSTRALIA[52]

Australian mobile network operator Optus has started to monitor road traffic conditions by analysing location data collected anonymously from mobile phones. Covering over 70,000 km of roads, the Optus Traffic View system has been commercially available since July 2009 following trials since late 2006.

Using ITIS TrafficScience Cellular Floating Vehicle Data (CFVD) technology to sample the location of a mobile phone over a period of time, Optus can determine the route and velocity at which the phone is travelling. While an individual record of a mobile phone's position is typically less accurate than that of a corresponding GPS record, this is compensated for by the large number of mobile phones on any road, knowledge of the underlying road network and the application of statistical techniques.

An independent quality report produced by the Australian Road Research Board (ARRB) has shown that the system is producing extremely high quality traffic information.

CASE STUDY 7 - GPRS-ENABLED FLEET MANAGEMENT SOLUTION, WYLESS, EUROPE[53]

Serving the commercial vehicle and construction plant markets, Enigma Vehicle Systems provides a vehicle and asset tracking and telematics service across Europe at a fixed cost. Enigma uses an embedded mobile solution, developed by Wyless that provides cost-effective, fixed-price roaming with a management platform for SIM card control and connectivity across the networks of over 200 GPRS operators.

CASE STUDY 8 - FLEET MANAGEMENT LOGISTICS WITH TRIMBLE, TELSTRA, AUSTRALIA[54]

Trimble and Telstra have developed a solution that integrates in-vehicle hardware, GPS, Internet and wireless network technologies to provide fleet tracking and real-time connectivity between mobile assets and an application server that can be accessed by the customer via any web-connected computer.

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[51] Reuters, Press release

[52] Itis website, press release, July 2009

[53] GSMA, "Open platform for a connected world", 2009

[54] Telstra website, "Trimble GeoManager" brochure, 2008

The system can automatically capture data from the field to improve operational efficiency:

- By nominating the closest field worker for each assignment, managing unauthorised vehicle use and indirect travel routes
- By increasing the effectiveness and accountability of the workforce and by quickly identifying exact locations of fleet vehicles from the customer service desk, which can dispatch vehicles efficiently and improve customer satisfaction and loyalty.

Telstra estimates that an organisation with a field workforce of 500 employees could avoid approximately 600 tonnes of CO2e per annum by adopting Trimble mobile field force management application on a wireless device. The initial investment could be paid off through reduced energy expenditure in around six months, providing annual savings of about 10%.[55]

Telstra says it has deployed the solution across it own operational fleet and has achieved productivity savings of about 20% and reduced fuel costs by more than 6%.

CASE STUDY 9 - SMART LOGISTICS AND FLEET MANAGEMENT, ISOTRAK, UK[56]

Isotrak's fleet management system is designed to help UK businesses cut fuel costs and CO2e emissions, reduce fleet size and save staff time. Isotrak's fleet management system combines satellite tracking and onboard telematics data sent over the Vodafone mobile network using standard SIM cards. This enables businesses to monitor their fleets remotely and plan more efficient logistics based on where vehicles travel, what they carry and how they are driven. Isotrak estimates that by changing driving styles, for example, fuel efficiency can be improved by up to 15%.

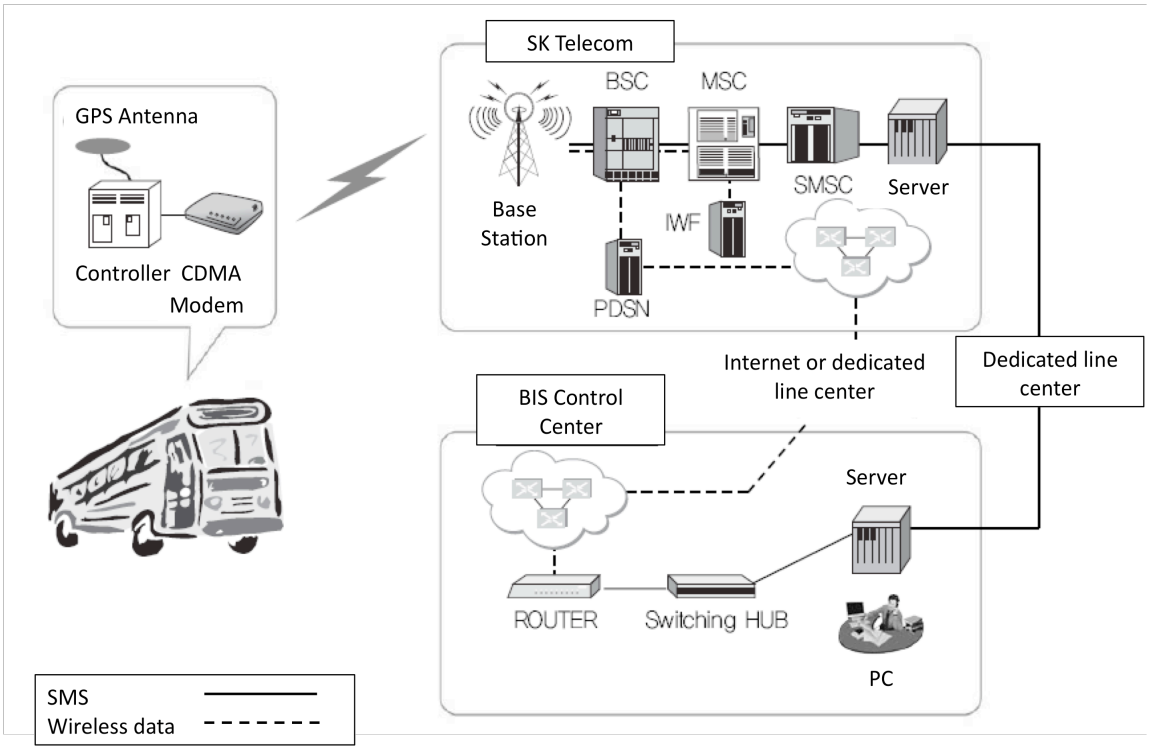
UK supermarket chain Asda's fleet saved 29 million road kilometres, or 28 Kt CO2e, and cut fuel costs by 23% over three years. Asda drivers have changed their behaviour to improve fuel efficiency by 6.6% and the system is also enabling Asda to backhaul more waste and recyclable materials between stores and distribution centres, minimising the number of trucks running without full loads.

CASE STUDY 10 - BUS INFORMATION SYSTEM, SK TELECOM, SOUTH KOREA

In 2006, SK Telecom started providing bus traffic information in Gyeonggi-do, the most populous province in Korea. Since May 2007, SK Telecom's CDMA network has connected 9,000 buses, enabling the supply of traffic information at bus stops, via the Web and mobile phones. The service was accessed 2.3 million times per month in 2008.

[55] Telstra's Sustainability White Paper: http://www.telstraenterprise.com/researchinsights/Pages/Sustainability.aspx

[56] Vodafone, "Carbon Connections: Quantifying mobile's role in tackling climate change", July 2009



In the system, bus fleets are equipped with a GPS controller and CDMA module to feed real-time traffic data to a control centre, which then uses this information to advise bus drivers on how to maintain regular intervals between buses. Passengers can be informed of bus availability, estimated arrival times and other traffic information at each bus stop.
The accessibility and reliability of the information encourages citizens to use public transportation more frequently. The service was accessed 2.3 million times per month in 2008. The Bus Information System, together with a new pricing scheme for buses connecting Gyeonggi-do with Seoul, has significantly contributed to passenger growth from 3.4 million to 4.5 million per day.

Smart grids and smart meters

Power-related GHG emissions are a major contributor to overall global emissions, accounting for 24% of global GHG emissions in 2002, with a forecast 51% growth from 2002 to 2020 to reach an expected 14.3 Gt CO2e or 27% of global GHG emissions in 2020.[57]

The "Carbon Connections" report estimates that 43 Mt CO2e can be saved in the power sector in 2020 by applying mobile enabled solutions in the EU25. Again, extrapolating worldwide suggests that GHG emissions could be reduced by 350 Mt CO2e in 2020 or 2.5% of 2020 global power-related CO2e emissions by using mobile-enabled solutions in a "business-as-usual" scenario.

Traditional electricity transmission and distribution networks tend to lack flexibility and monitoring capabilities, making it difficult to optimise loads across the day, adapt to new capabilities such as distributed electricity generation, and monitor and manage distribution losses across the grid. Transmission losses in Europe are equivalent to 8% of total production, according to Eurostat[58]. The figure is much greater in emerging countries such as India, where almost 25% of all energy produced is reported to be lost or used illegally.

By contrast, a smart grid delivers electricity from suppliers to consumers using digital technology to save energy, reduce cost and increase reliability, transparency and flexibility of the network. It has been

[57] IEA, "World Energy Outlook", 2007

[58] Eurostat data, 2007

estimated that 80% of the GHG emissions reduction enabled by the smart grid in 2020 come from integrating renewable power and reducing transmission and distribution losses by optimising the electricity grid in both the high voltage transmission and the low voltage distribution networks. The remaining approximately 20% of emission abatement are achieved through demand management - to reduce peak load - and behavioural change driven by user information. To do this, smart meters need to be installed at the point of energy consumption, allowing the remote monitoring of customer electricity and gas usage, and the integration of decentralised electricity generation, such as small-scale wind or solar electricity generation into the network. Decentralised generation reduces the losses associated with transmitting centrally generated electricity over long distances and allows for an increase in renewable and lower carbon energy supply.

Smart meters also enable consumers to use Web-based programs or mobile phone applications that give a real-time view of how much energy a home is using. The advent of home networks with mobile applications and /or web based programs would provide consumers with the capability to identify which appliances consume the most energy, essentially allowing consumers to control their energy consumption. With the right incentives in place, this would drive consumers to change their behaviour. For example, to take advantage of lower off-peak rates consumers might run washing machines and charge their plug-in electric vehicle in the middle of the night, effectively reducing peak electricity consumption.

A number of companies are developing both smart grid hardware and software components and complete solutions and services. AT&T, Qwest and Microsoft are developing a solution to serve the needs of utilities. To be rolled out in late 2009, Google's PowerMeter solution is designed to receive information from utility smart meters and energy management devices and provides customers with access to their home electricity consumption on their personal iGoogle mobile homepage.[59]

CASE STUDY 11 – SMART METERING FOR CSG, HUAWEI AND CHINA MOBILE, CHINA[60]

One of the biggest business problems faced by China Southern Power Grid (CSG), which provides southern China with electricity, is how to collect electricity usage information from all the meters across its vast infrastructure. Relying on employees to manually read meters proved time-consuming, often inaccurate and expensive.

To improve its efficiency, CSG has installed an automated solution from Huawei, Hongdian and China Mobile, which uses an automated meter reading system and embedded mobile modules to remotely collect data from across its meter and power grid. With the system, which uses one million remote monitoring devices, CSG can now track end-users' electricity usage in real-time, which allows it to both prepare accurate bills and estimate ongoing demand.

In locations such as apartment blocks, multiple sites can be connected to a single data collection and communications terminal which aggregates the output of all meters and relays the aggregated data. The SIM information is embedded directly into the communication module's software to prevent end-users from removing the SIM card and taking the meter out of service. CSG can detect faults on the meter and control it remotely. The solution also provides over-the air updates for the communications module so that its software is kept up-to-date.

CSG is also using M2M technology to monitor other key parts of its electricity network, such as substations, power lines and primary nodes. By connecting the communications module to additional equipment, such as cameras or monitoring equipment, CSG can obtain real-time information to help it with remote troubleshooting and maintenance.

The automated meter reading and monitoring solution has provided CSG with a number of benefits, including:

- Lower costs: labour costs, maintenance and troubleshooting costs kept to a minimum. Communications costs are kept low by using the public wireless network.

[59] Google website, powermeter/howitworks, 2009

[60] GSMA, "Remote monitoring opens revenue stream and cuts costs", February 2009

- More accurate information: Automating data collection eliminates the inevitable human error that occurs with manual collection.
- Simple deployment: M2M modules can be easily integrated into meters through a standard serial interface and configured over the air
- More reliable power network: any breakdown in the network is quickly detected and remedied.
- Carbon reduction: CSG has greatly reduced the carbon footprint of its meter readers and engineers who no longer need to travel to every incident or reading

Smart buildings

Buildings worldwide are a major source of carbon emissions and energy consumption. In 2002, energy use in residential and commercial buildings worldwide accounted for 21% of GHG emissions and is forecast to grow by 41% over the period from 2002 to 2020 to reach an expected 11.7 Gt CO2e or 23% of global GHG emissions[61].

Accounting for only the M2M and mobile-enabled buildings related initiatives in the "SMART2020" report, the GHG emissions reduction opportunities from optimised Building Management Systems, HVAC and lighting conservatively represent 350 Mt CO2e in 2020 or 3% of 2020 global buildings-related CO2e emissions in the "business-as-usual" case[62].

The buildings sector has the largest potential for energy efficiency gains, according to the IEA and the UN Intergovernmental Panel on Climate Change. Whilst traditional efficiency techniques such as insulation are often more economically attractive, especially in new-builds, smart M2M-enabled building technologies will likely play an increasingly important role in delivering energy efficiency gains, cutting GHG emissions and reducing costs.

At the core of smart buildings solutions lies the ability for building occupiers and facility managers to control building heating, ventilating and air-conditioning (HVAC), lighting and other appliances remotely, using mobile devices. M2M devices can be embedded in HVAC, lighting and other appliances across the building. Central monitoring and management of HVAC, lighting and appliances and overall energy consumption is supported by a Building Management System (BMS) that can be accessed by a Facilities Manager in commercial buildings or the occupier in residential buildings.

CASE STUDY 12 - ALERTME.COM HOME ENERGY MANAGEMENT TECHNOLOGY, UK[63]

AlertMe.com is a new breed of online consumer energy service and uses broadband, wired or wireless network to operate. It keeps householders in touch with their homes, using all the displays and devices that we already engage with daily, such as mobile, web and TV, showing where energy is being consumed in the home, suggesting changes which would provide the biggest savings, and automating energy saving. Householders can also view other relevant information, such as tracking temperatures in different areas of the house and comparing historical usage.
For example, a householder away from home, is able to adjust heating controls, turn off appliances and plan usage for non-peak times via text or email and override heating profiles if the weather suddenly changes or if he comes home early. The service automatically optimises consumption depending upon the householder's activities, such as turning off the heating when the house is empty or turning off appliances left on standby.
The company has struck deals with several operators in Europe, and British Gas has announced a relationship in the UK.

Dematerialisation

Besides making transportation and buildings more energy efficient, mobile technologies and services further help reduce carbon emissions by means of dematerialisation, that is, the substitution of high

[61] IEA, "World Energy Outlook", 2007

[62] Global GHG emissions from buildings after allocation of power generation to final demand from industry (45%) and buildings (55%)

[63] AlertMe 2009 website

carbon products and activities by low carbon alternatives. Replacing physical meetings with virtual meetings or allowing employees to work from home are examples of such initiatives.

Another example is digital downloads, which can reduce significantly the greenhouse gases associated with delivering music to customers via physical CDs.[64] Obviously, fixed-line technologies, as well as mobile technologies, play a key role in dematerialisation.

The "Carbon Connections" report estimates that 22 Mt CO2e in 2020 can be saved from applying a small number of dematerialisation solutions in EU25. Extrapolating this worldwide suggests that the GHG emissions can be reduced by 160 Mt CO2e in 2020 or 0.3% of 2020 global CO2e emissions by applying mobile-enabled solutions in the "business-as-usual" scenario.

With the increased availability and decreasing costs of wireless and wireline data networks, workers are set to make more use of fixed and mobile video conferencing from computers, smart phones and other devices. Going forward, mobile technology can lead to further use of teleconferencing technologies, with participants accessing conferences remotely using mobile devices with high bandwidth 3G or next generation access networks.

CASE STUDY 13 - DEMATERIALISATION SERVICES FROM MOBILE BROADBAND NETWORK, TELSTRA, AUSTRALIA[65]

With a peak speed of 21Mbps, Telstra's Next G mobile broadband network reaches more than 99% of the Australian population, building upon more than 6,700 base stations deployed across more than two million square kilometres in Australia.

It has numerous applications in the dematerialisation space. For example:

- E-health: A high quality x-ray image can be downloaded by a doctor in as little as 15 seconds, potentially leading to major cost and time savings across the health care industry
- Online media: a consumer can access and download an mp3 song, or even a YouTube video, in seconds, rather than minutes.
- Teleworking: Telstra says some of its business customers are seeing productivity improvements of up to 30% in parts of their workforce as the Next G™ network enables them to cut travel costs and save time. A lifecycle analysis by Telstra demonstrated how an organisation with 1,800 employees could reduce GHG emissions by approximately 500 tonnes of CO2e per annum by encouraging 200 staff to work remotely from home three days a week. The study, which followed the international standard for life cycle analysis, estimated savings of 1.6 tonnes of CO_2 per year for each of these home-office based workers.

Passenger transport, real estate, construction, finance, trade, education and health, in particular, benefit from high-speed mobile broadband, according to a recent report by Concept Economics.[66] For example, across the Vodafone group of companies, the implementation of over 650 videoconferencing facilities has helped the business reduce flights by approximately 30%.

Environmental Information Systems

Some developing countries are likely to be hard hit by climate change in the medium term. For example, a recent Global Humanitarian Forum – Geneva report[67] estimated that climate change will cause agricultural yields in some areas of Sub-Saharan Africa to fall by 50% as early as 2020.

Many of these developing countries do not have adequate weather monitoring capabilities to help them to adapt to the changing climate.

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[64] http://download.intel.com/pressroom/pdf/CDsvsdownloadsrelease.pdf

[65] Telstra, "Government Customer Newsletter, Second edition", June 2009

[66] Concept Economics, "Next G Productivity Impacts Study", June 2009

[67] Global Humanitarian Forum www.ghf-ge.org

But now mobile-enabled Environmental Information Systems (EIS) are starting to play an important role in weather monitoring, broadcasting systems warning of adverse weather and water management:

- M2M-enabled water management devices are used to monitor soil water content and optimise crop growing conditions. Such systems assess and control irrigation on a just-in-time basis, using weather information and water evaporation, plant transpiration and sub-soil leakage data.
- The existing mobile telecom infrastructure, together with antenna masts, security and provision of a source of power, could be used to set up weather monitoring stations wherever there are mobile base stations.
- Adverse weather early warning systems can also be developed on the back of existing mobile infrastructures. Such systems involve the broadcasting of warning messages by SMS to mobile phones to forewarn the population of an imminent adverse weather event. In 2007, India launched such as system, the National Tsunami Early Warning System which uses SMS messages as one of the ways to alert the public[68].
- MTN Uganda is offering Google SMS, an application that provides internet-like access to information through a mobile phone via SMS. The topics include farming tips (management of pests and disease, along with daily local weather and seasonal reports to guide agriculture activities) and a new marketplace application that helps buyers and sellers of crops connect to each other[69].
- In 2007 the Joint Research Centre of the European Commission launched mobGAS a mobile phone application available in 21 European languages that allows users to see how their daily choices are impacting on climate change by compiling information inputted by the user on, for example, how they regulated their heating, what means of transport they took or the household appliances they used[70].

Whilst quite promising, such applications are still in their infancy and the mobile industry can likely do more to help the world's population adapt to the effects of climate change.

CASE STUDY 14 - GROUNDWATER MONITORING SOLUTION, SK TELECOM, SOUTH KOREA

Together with local authorities, the South Korean government operates groundwater monitoring wells at over 930 sites nationwide.

Each well measures groundwater level, temperature and conductivity daily with groundwater quality measurements taken twice a year. Data collected at wells is transmitted to a remotely located server through a wired or wireless network, with monitoring wells located in remote and mountainous regions usually connected via SK Telecom's CDMA mobile network. Collected data is used to identify areas with vulnerable groundwater levels and quality. Similar solutions are being used for remote management of Korea's reservoirs and groundwater tanks.

CASE STUDY 15 - WEATHER STATIONS, ERICSSON, GHF, WMO AND ZAIN, AFRICA

In sub-Saharan Africa, plans are in place to roll out weather monitoring stations on 5,000 radio base stations provided by Ericsson and operated by Zain and other mobile network operators over the coming years. Utilising the mobile networks means that African weather services will not need to build a parallel tower infrastructure.

The project is being backed by Ericsson, the Global Humanitarian Forum (GHF) headed by Kofi Annan, and the World Meteorological Organisation (WMO), amongst others. Mobile operators, starting with Zain, will provide the necessary connectivity, power and security to sustain the weather equipment.

The project began with the installation of 19 stations in East Africa's Lake Victoria region and is intended to cover Kenya, Tanzania, Uganda, Burundi and Rwanda by 2012. The long-range goal is to install 5,000 automatic weather stations on towers across Africa.

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[68] Indian Government http://www.igovernment.in/site/indian-tsunami-warning-system-goes-live/

[69] http://www.mtn.co.ug/MTN-Products/Google-SMS/Google-SMS.aspx

[70] http://mobgas.jrc.ec.europa.eu/mobgas/app/MainPage.po

Given the lack of monitoring capability in the region at present, this new equipment is likely to dramatically improve weather forecasting.

CASE STUDY 16 - EIS FLOOD/CYCLONE ALERT, GRAMEENPHONE AND TELETALK, BANGLADESH [71]

When a cyclone is about to hit the shores of Bangladesh, locals in the area get an early warning of what is to come by the 42,000 volunteers of the Bangladesh Red Crescent Society who move around with bicycles and megaphones with advice on whether to evacuate homes.

But some of the more remote disaster-prone areas are not covered by volunteers and often villagers have no idea that their homes are likely to be flooded or that a severe cyclone is heading their way.

In a bid to minimise loss of life and damage to property, Bangladeshi authorities have now signed an agreement with two mobile operators in the country to provide disaster early warning alerts to the population, 95% of which have mobile coverage.

When needed, Grameenphone and state-owned Teletalk will send text messages showing up as alerts to all their subscribers in two of the most vulnerable areas: flood-prone north-central Shirajganj district and cyclone-prone Cox's Bazar district on the coast.

CASE STUDY 17 - DIESEL PARTICULATE FILTER REMOTE MONITORING, KT, SOUTH KOREA[72]

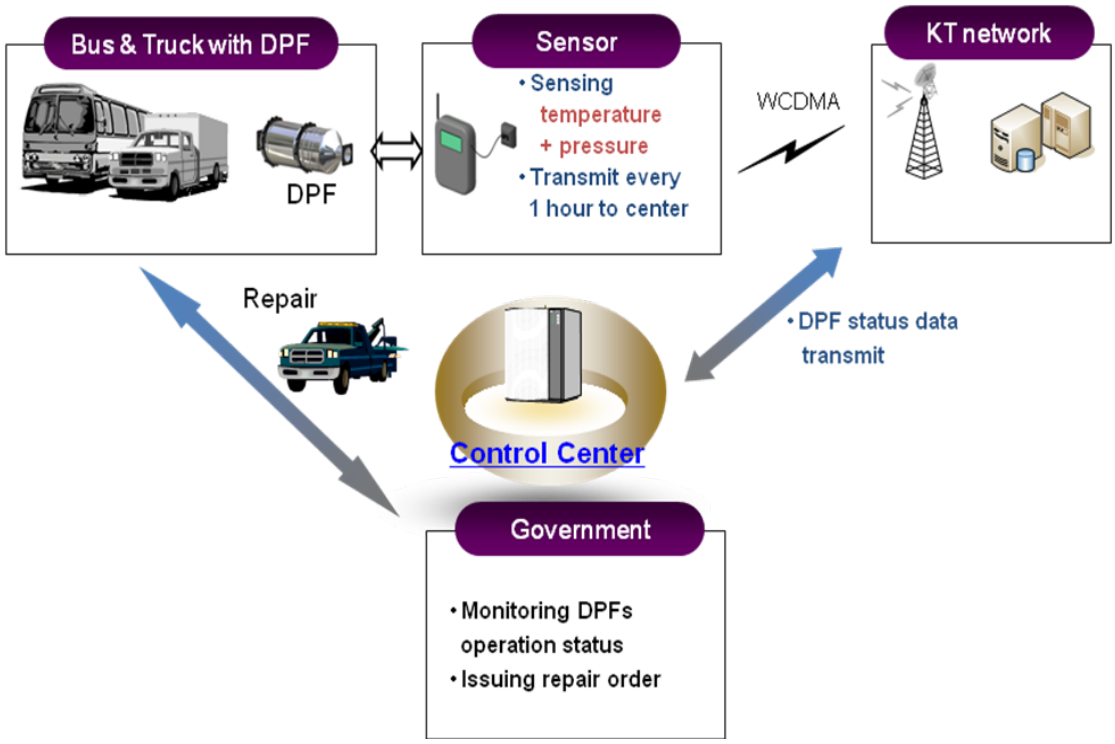
KT provides a Diesel Particulate Filter remote monitoring service in conjunction with Seoul City Authority to use the mobile network to effectively monitor and control the pollutants released by the buses and trucks network.

In this service, sensors installed on buses and trucks measure and report particulate levels to the government control centre on an hourly basis. The sensors have embedded WCDMA modules transmitting information via KT's mobile network. If the measurements exceed a certain level, the control centre issues a repair order to the relevant vehicle.

In 2008, about 2,000 vehicles were equipped with these sensors and there are plans in place to expand the system to 100,000 vehicles by 2012.

[71] Reuters news

[72] KT information, October 2009

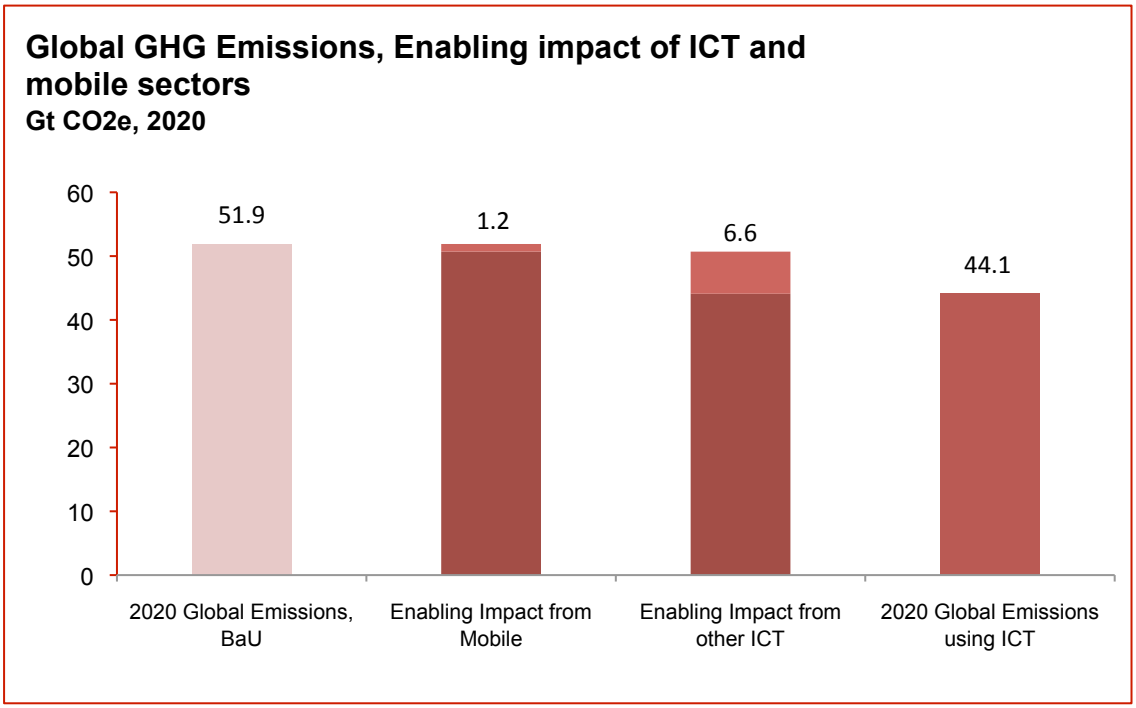

Bus & Truck with DPF
DPF
Sensor
• Sensing temperature + pressure
• Transmit every 1 hour to center
WCDMA
KT network
Repair
• DPF status data transmit
Control Center
Government
• Monitoring DPFs operation status
• Issuing repair order

2.2 ICT and the wider context for mobile carbon efficiency initiatives

The mobile industry is part of the ICT sector, which as a whole has a major role to play in tackling climate change by enabling other sectors, such as transport, buildings, power and industry to become more efficient.

As mentioned earlier, the "SMART2020" report found that the ICT sector could reduce global GHG emissions by 7.8 Gt CO2e in 2020, from a total 2020 GHG emissions of 51.9 Gt CO2e on a "business-as-usual" trajectory. This amounts to roughly five times the carbon footprint of the ICT sector itself in 2020, estimated as 1.4 Gt CO2e per annum in the "business-as-usual" case in the "SMART2020" report.

Figure 12 - Enabling impact of ICT and mobile sectors[73] on global GHG emissions

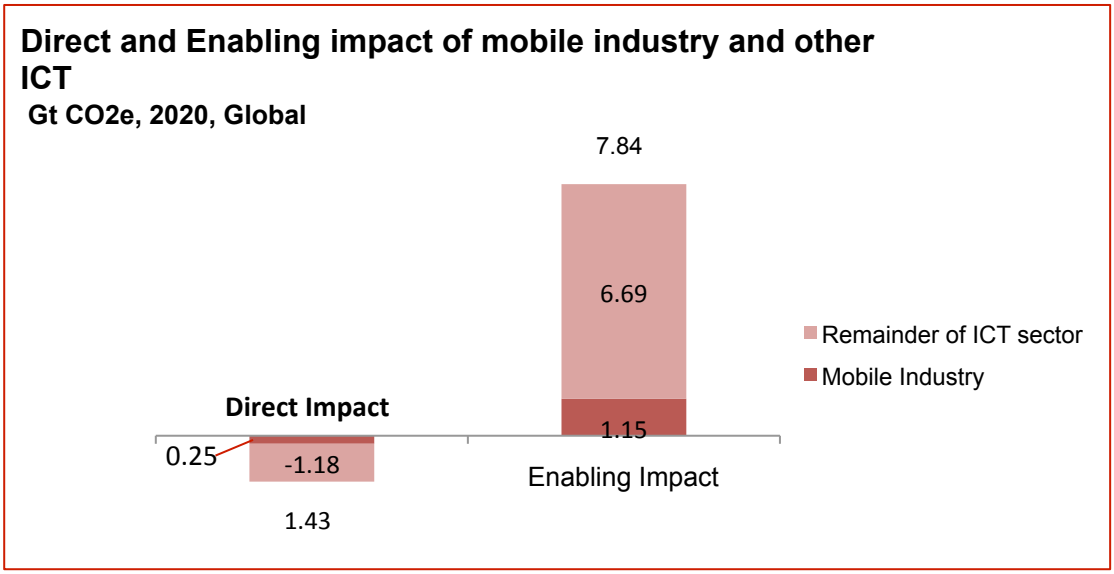


This report estimates that mobile technologies could reduce global GHG emissions in other sectors by 1,150 Mt CO2e by 2020, whilst the total estimated carbon footprint of the mobile industry in 2020 is estimated at 245 Mt CO2e in the "business-as-usual" case.[74] Therefore the mobile industry has the potential to reduce GHG emissions reduction by four to five times its own footprint.

[73] SMART 2020, The Climate Group and GeSI, "Enabling the low carbon economy in the information age", 2008

[74] See Chapter 1 - Direct impact

Figure 13 - Direct and enabling impact of mobile industry[75] and other ICT



Increased energy efficiency is critical in global efforts to mitigate GHG emissions. A recent McKinsey report[76] on opportunities for greater energy efficiency in the non-transportation sectors of the US economy found that "energy efficiency offers a vast, low-cost energy resource for the US economy". The U.S. and other countries need to find ways to unlock this potential and overcome the many barriers associated with achieving greater energy efficiency.

In this section, an overview of ICT initiatives in each of the sectors is provided.

Smart transportation and logistics

Earlier in this report, mobile-enabled initiatives driving a reduction in GHG emissions were highlighted: fleet tracking systems, load optimisation, onboard telematics, and synchronised traffic and notification systems. The ICT sector offers a number of other, non mobile-specific solutions to further reduce global GHG emissions from logistics, such as improving the design of transport networks, running centralised distribution networks or running home delivery service management systems.

ICT-driven initiatives that can further reduce GHG emissions in the transportation area include software applications and monitoring equipment, which enable optimal choices and transfer between different modes of transport of goods, i.e. intermodal shift, which support eco-driving and provide the means for truck route optimisation and inventory management.

Smart grids and smart meters

In addition to the embedded mobile communication solutions involved in smart meters, the ICT sector provides the additional hardware and software components required for integrated smart grids.

Many utilities have pledged to roll out fully-fledged smart grid solutions. In the US, Pacific Gas & Electric Company is planning to roll out 10 million smart meters by 2012. Other utilities nationwide are following suit: Duke Energy has announced a partnership with Cisco to roll out a smart grid serving 1.5 million households in Ohio and Indiana, and Florida Power & Light Company has started the deployment of smart meters for its residential and small-business customers in Florida.

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[75] Irbaris analysis; SMART 2020, The Climate Group and GeSI, "Enabling the low carbon economy in the information age", 2008

[76] McKinsey, "Unlocking energy efficiency in the US economy", 2009

Utilities in Europe are also launching their own solutions: in the UK, National Grid is developing a smart network with the support of Cable & Wireless. In Italy, Milan-based municipal utility A2A has asked Siemens to help with the installations of 1 million smart meters at a rate of 60,000 a month.

These companies are using several different communications technologies. Smart meters can communicate with the outside world by means of wireline and wireless technologies, including Wi-Fi, GPRS, HSPA, Bluetooth and dedicated protocols such as Zigbee.

Smart buildings

The ICT sector is playing a major role in managing the lifecycle of buildings. In addition to the embedded mobile communication solutions involved in the rollout of Building Management Systems, remote monitoring and management of HVAC and lighting systems, the broader ICT sector is also helping to reduce GHG emissions in buildings by:

- Facilitating low GHG emissions building design, for example, by using design and simulation hardware and software
- Improving building commissioning, for example, by using Building Management Systems hardware and software and sensing systems to feed back on actual building performance versus designed performance

Dematerialisation

ICT technologies can enable a number of dematerialisation initiatives, such as teleworking, teleconferencing and web contact centres, which generate significant environmental, economic, and social benefits by reducing the need for physical goods and travel[77].

Globally, studies on teleworking have found that both workers and employers report substantial productivity gains associated with home access to ICT. The move towards teleworking also has the potential to deliver substantial environmental benefits by reducing the need for travel. Organisations implementing teleworking also realise savings on property-related costs, notably reducing office space requirements and electricity expenditure.

Teleconferencing incorporates audio, video and computing, and allows people in different locations to interact face-to-face, in real time – a viable alternative to business air travel. Substituting video conferencing for some business travel and avoiding its associated expenses can help cut an organisation's operating costs and GHG emissions, and generate strong returns within a relatively short time, often within 12 months.

Web Contact Centres are virtual call centres hosted by a telecommunications provider, which rely on personal computers, phone lines and Internet access to enable employees to work remotely and flexibly. Web Contact Centres can help reduce GHG emissions from travelling to and from large call centres, since employees can work from home or from smaller "cottage offices".

E-services, including broad initiatives such as e-commerce, e-health, e-government or e-billing, reduce the need for travel, printing, in person meetings, office and commercial space. All these initiatives are enabled by ICT technologies in one or more ways.

Online media cuts energy usage by replacing traditional CDs and DVDs with electronic downloads on to mobile devices and other ICT hardware.

In spite of its considerable scope, dematerialisation has had a more limited impact on GHG emissions reduction than would be expected, principally due to low teleworking and teleconferencing adoption rates and the limited GHG emissions reduction potential of e-services and on-line media. For example in the UK in 2008, 7% of workers worked from home at least once a week, 78% said that they were not able to work from home and the proportion of workers who usually work from home does not appear to

[77] Telstra, "Using ICT to Drive your Sustainability Strategy", Extract, April 2009

have increased over the last 10 years. However, there is evidence that more of those workers who can sometimes work from home are doing so more often[78] and that it improves their quality of life. [79]

Researchers are divided on how to measure the exact savings achieved by teleconferencing initiatives. Clearly, if a US-based employee has a teleconference with a colleague in China, they avoid travelling for that very conversation. However, it is not clear whether they would have had this conversation, if no means had been available to them in the first place, or whether they might eventually travel to meet, as an outcome of successful teleconferences. Research in this field is complex, but tends to indicate that 35% of teleconferencing does substitute travel[80] and reduces office space needs[81].

The "SMART2020" report estimates that in 2020, dematerialisation could yield annual GHG savings of 0.5 Gt CO2e, or 1% of global GHG emissions in "business-as-usual" scenario. However, there is a high degree of uncertainty in this sector as much of the reductions will be driven by behavioural changes that are difficult to forecast.

Environmental Information Systems

Satellite imagery and weather pattern analysis, and climate change modelling all require powerful super computers. The potential for future growth in this sector is likely to be high, given the increasing need for a better understanding of the climate.

[78] UK Department for Transport 2009, http://www.dft.gov.uk/pgr/statistics/ datatablespublications/trsnstatsatt/ homeworkinginternet

[79] Australian Mobile Telecommunications Association, "Australians say mobile phones help balance work and family", June 2007

[80] Research from IDC and Brockmann

[81] Telstra, "Teleworking: demonstrating the environmental impacts and benefits", 2008

Chapter 3

Public Policy

How policymakers can help the mobile industry reduce GHG emissions

Most policies and programmes sponsored by governments focus on the direct effect of the mobile industry, rather than using mobile communications as an enabler of change. To assist the mobile industry to enable emissions reductions of 1,150 Mt CO2e in 2020 in other sectors, it is vital that policymakers consider the following:

- Including mobile and broader ICT in government policies and programmes with respect to smart grids, smart buildings and smart transportation
- Supporting broadband infrastructure deployment that has become as important today as roads, railways and ports were in the 20th century, by ensuring the mobile industry has access to newly available harmonised spectrum and by supporting the roll out of energy efficient networks through the streamlining of planning approval and the provision of investment incentives.
- Encouraging cross-sector collaboration between the mobile and other ICT sectors and the transport, buildings and power sectors, especially with respect to the development of open standards to ensure interoperability and drive scale efficiencies.
- Demonstrating leadership by greening operations in the public service, e.g., by procuring embedded mobile-enabled smart building technologies in schools and government departments, and promoting increased teleworking amongst public sector employees.
- Building awareness of mobile and other ICT technologies, through education of users, and helping to facilitate the behavioural changes that will create transformative reductions in greenhouse gas emissions.
- Facilitating a common framework to measure the mobile industry's energy and environmental performance, and that of other sectors, for example by aligning national and regional methodologies with those being developed by ETSI and ITU in conjunction with the mobile industry and other private sector players.
- Supporting the development and piloting of new technologies by incentivising the increased deployment of embedded mobile solutions with respect to smart grids, buildings and transport.

This section contains a high-level summary of the major policies currently relating to climate change, and the ICT and mobile industries. More detail is then provided on the policies impacting the sectors mentioned earlier in this report, focusing on the impact of existing policies relative to enabling the full potential of mobile and ICT GHG emissions reduction initiatives.
Finally, a number of policies and programmes to help the mobile industry in its direct actions to reduce GHG emissions and in its enabling actions to reduce emissions in other sectors are detailed.[82]

3.1 Perspectives on current policies

Over the past few years, a large number of policies and programmes on ICT and the environment have been sponsored by governments and business organisations. An analysis of these policies and programmes[83] shows that:

- Most policies and programmes focus on the direct effect of the ICT sector; less on using ICT as an enabler of change. Few business associations have strategies to deploy ICTs to reduce emissions outside the ICT sector, although there are notable exceptions such as the Global e-Sustainability Initiative (GeSI)[84] and the Digital Energy Solutions Campaign (DESC)[85].

[82] See also for example "A five-step plan for a low carbon urban development", WWF and Ericsson, 2009

[83] OECD Working Paper, December 2008 OECD meeting in Helsingor

[84] GeSI, Global e-Sustainability Initiative, www.gesi.org

- Policies focus on addressing issues at the consumption stage of the ICT service life-cycle, rarely addressing the complete ICT emissions life-cycle.
- Many policies recognise, but do not account for the challenge that increased take-up of emission-reducing ICT products and services requires behavioural changes from end-users. However, voluntary initiatives such as the Energy Star standard for office equipment have started changing end-user behaviour by providing better information to consumers at the time of purchase. The EC-sponsored Code of Conduct on Energy Efficiency is also driving further reduction of standby consumption in ICT equipment.

Smart transportation and logistics

There is abundant policy work aimed at supporting the reduction of GHG emissions in the transportation and logistics sector. In many countries, policies include, for example, targeting vehicle CO2e emissions per kilometre, taxing transport fuels, imposing differentiated tax levels based on car emissions and subsidising eco-car purchases.

Transport is currently excluded from the EU Emissions Trading System, but the aviation sector will be phased in to the scheme from 2012[86]. In addition, the EU has investigated the potential for including shipping in the scheme. The planned New Zealand Emissions Trading System, due to start in 2010, will include transport emissions from 2011, including petrol and diesel fuel consumption[87].

However, few policy initiatives directly promote increased adoption of embedded mobile communications to reduce GHG emissions in the transportation and logistics sector.

In Europe, one such initiative is the German motorway toll system that uses mobile communications to charge haulage vehicles on a per kilometre basis depending on their emission levels and number of axles [88]. Similarly, the Netherlands intends to introduce a price per kilometre charge, first for freight transport vehicles, and eventually for passenger cars. That system may also use mobile communications[89].

Smart grids and smart meters

Smart grids are being promoted and funded by many governments as a way of addressing energy independence, GHG emissions and economic and emergency resilience issues. In Europe, the smart grids European Technology Platform for Electricity Networks of the Future began its work in 2005. Its aim is to formulate and promote a vision for the development of European electricity networks looking towards 2020 and beyond[90].

In North America, the American Recovery and Reinvestment Act in 2009 has allocated $4.5 billion to improve the grid and make it smarter, including the deployment of 40 million smart meters in US homes.[91]

In Asia, the South Korean government recently announced that it will invest heavily in smart grids. As part of its current 5-year plan, China is building a Wide Area Monitoring System and plans to install sensors at all its largest generators and substations.[92]

Industry consortia for smart grids are also forming, such as the GridWise Alliance in the US, which signed a partnership agreement with South Korea in 2009 on sharing smart grid technology[93]. The

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[85] DESC, Digital Energy Solutions Campaign, http://www.behindthegreen.org/about/desc/

[86] EU Press release, http://europa.eu/rapid/pressReleasesAction.do?reference=IP/08/1114

[87] New Zealand Government, http://www.climatechange.govt.nz/emissions-trading-scheme/implementing/index.html

[88] German Federal Ministry of Transport, Building and Urban Affairs, Q&A http://www.bmvbs.de/en/Transport/

[89] Dutch Ministry of Transport, Public Works and Water Management http://www.verkeerenwaterstaat.nl/english/ topics/mobility_and_accessibility/ roadpricing/030_questions_and_answers/index.aspx#v2

90 Smartgrids.eu website

91 US Government http://www.whitehouse.gov/issues/ energy_and_environment/ http://www.oe.energy.gov/ information_center/1225.htm

[92] Qixun Yang, Beijing Sifang Automation and Bi Tianshu, North China Electric Power University "WAMS Implementation in China and the Challenges for Bulk Power System Protection, Infrastructures in China, IEEE 2007

[93] Grid Alliance http://www.gridwise.org/news_newspress.asp

GridWise initiative, a public-private partnership between the Department of Energy and Pacific Northwest National Labs along with a range of companies, has developed pilot projects in demand management and real-time billing. The Electricity Networks Strategy Group in the UK has recently set up a Smart Grids Working Group.

Although development of smart grid solutions is currently hindered by the lack of standards, this issue is being addressed: IEEE and NIST, via their Smart Grid Interoperability Panel, are working on developing standards and the Embedded Mobile initiative from the GSMA is developing guidelines for upcoming M2M and smart grid applications, and the integration of GSM modules into metering solutions.

Smart buildings

Governmental and inter-governmental policies promoting greener, smarter buildings have increased markedly in recent years.

The EU has taken a policy lead on greener buildings with the Energy Performance of Buildings Directive which mandates EU member states to establish a methodology for calculating the energy performance of all buildings, establish minimum performance standards, and label buildings according to their energy efficiency and carbon performance.

Correspondingly, many countries have developed their own voluntary standards for green or energy efficient buildings. France developed the High Quality Environmental standard (HQE), based on the principles of sustainable development first set out at the 1992 Earth Summit. In Germany, voluntary standards are being set by the Deutsche Gesellschaft für Nachhaltiges Bauen (DGNB). In the UK, the BRE Environmental Assessment Method standard (BREEAM) was developed as a voluntary measurement rating for green buildings.

In the US, the voluntary Leadership in Energy and Environmental Design (LEED) green building rating system was developed by the US Green Building Council and provides a suite of standards for environmentally sustainable construction.

In Asia, various voluntary standards are also in operation, such as Green Star in Australia, GBAS in China, and GRIHA, a variant of LEED, in India.

Some regions are collaborating on buildings emissions reductions projects. For example, the Buildings and Appliances Task Force, an Asia-Pacific Partnership on Clean Development & Climate, aims to promote best practice, demonstrate technologies and building design principles to increase energy efficiency in buildings, and support the integration of appropriate mechanisms to increase the uptake of energy-efficient buildings and appliances.

Dematerialisation

To encourage the dematerialisation of products and services, governments have deployed policies such as:

- Providing information to employers and employees about the environmental and other benefits of dematerialisation activities, such as teleworking
- Leading by example, e.g., by promoting teleworking in governmental institutions
- Encouraging dematerialisation, e.g., with company policies that enforce travel restrictions while providing alternatives such as telepresence, which lead to both significant cost savings and GHG reductions
-

In the UK, the Flexible Working Regulations came into force in 2003. They allow employees to request flexible working arrangements such as teleworking and flexible hours, and require employers either to permit such arrangements or explain why they are denied.

Environmental Information Systems

Weather-related EIS have historically been set-up and developed by national weather forecasting institutions. New EIS rolled out in developing countries are typically funded by national governments, often with the support of international aid programmes and NGOs, and private stakeholders such as mobile telecom operators or other private sector organisations.

Such international participation led to the funding of a tsunami early warning system in Indonesia, in which Germany, Japan, China, France, the USA and the UNESCO[94] are participating.

3.2 What can governments do to help the mobile sector reduce emissions?

3.2.1 Supporting direct actions by the mobile industry to reduce its emissions

The initiatives of the mobile industry to reduce its direct emissions rely on the development of an enabling regulatory framework and the creation of tax or other economic incentives to support the business case. Necessary policy support measures include:

- Facilitating the development of a common framework to measure the mobile industry's energy and environmental performance, and that of other sectors, for example by aligning national and regional methodologies with those being developed by ETSI and ITU in conjunction with the mobile industry and other private sector players. With such measurement standards in place, encourage further innovation among suppliers of mobile communications network equipment towards energy efficiency.
- Fostering innovation in low GHG footprint handset manufacturing, e.g., by reducing tax or providing tax incentives on handsets with low GHG footprints or with a high share of recyclable materials.
- Supporting investment in GHG emission-reducing technologies and processes by mobile operators, including antennas with reduced manufacturing GHG footprint and more energy efficient radio equipment for base-stations. This can be achieved, for example, by enabling some form of carbon credit, tax incentive or low interest financing to help incentivise capital investment in energy efficient and low GHG equipment.
- Supporting the current efforts of the mobile industry to reduce its emissions by sharing infrastructure. Active sharing of site electronics, which will reduce the number of sites required by each company, is currently not possible in many countries given competition rules.
- Ensuring spectrum availability, especially making harmonised low-frequency spectrum available to reduce the need for densely-constructed mobile networks. For example, it takes three times as many base stations to build a 3G network using the 2100 MHz spectrum band as it does using 850 MHz.
- Supporting broadband infrastructure deployment by supporting the roll out of energy efficient networks through streamlining planning approval and providing investment incentives.
- Protecting the intellectual property rights of technology owners, in order to sustain and broaden investments in clean technology innovation and efficiency improvements.
- Supporting pilots of renewables-powered base stations in geographies where it makes sense by offering operators power utility status to allow for local small scale power generation in communities where such activity is beneficial, and consider using development funds to reach project viability as needed. Development of local skills in green technologies could provide significant local and national benefits in countries where such initiatives are launched.

94 German government http://www.jakarta.diplo.de/ Vertretung/jakarta/en/ _C3_9Cbergabe__Early __Warning__System.html

3.2.2 Helping the mobile industry reduce emissions in other sectors – overall perspective

Market-based mechanisms

Governments clearly need to sign a successor to the Kyoto Protocol, which expires in 2012, in Copenhagen in December, establishing binding global long-term targets for the reduction of GHG emissions.

Against the backdrop of a new treaty, emissions reduction policies must be implemented or continued at a country, state and/or regional level. GHG cap and trade schemes should deliver a stable and effective long-term price for carbon; incentivise large energy intensive businesses to cut GHG emissions.

Governments should also consider allowing large, energy non-intensive businesses and public sector organizations to participate in "Clean Development Mechanism" type trading schemes when they have products and services that could be considered carbon offsets or credits.

Regulatory and fiscal policies

It is the GSMA's view that the mobile industry will be able to support market development of the opportunities highlighted in this report, as long as the policy approaches highlighted in this report are broadly developed. The GSMA will work to support governments and other appropriate industry bodies as they work toward the common policy objectives outlined here.

Developed countries need a regulatory framework supporting the deployment of the mobile broadband infrastructure necessary to make connected, smart energy efficient solutions available to all consumers whilst mobile. Governments should ensure that they allocate some of the spectrum freed-up by the switchover from analogue to digital television to mobile broadband. Governments need to support the development of open standards for M2M communication.

The GSMA supports expanding the World Trade Organisation Information Technology Agreement (WTO ITA) to include more signatories from developing countries with the goal of reducing import duties on mobile equipment and lowering costs for end-users.

In some instances, a key barrier to growth is the lack of a viable business case to implement specific embedded mobile solutions. To help overcome this barrier, governments should provide fiscal incentives to make the business case for embedded mobile solutions more attractive.

Given that mobile technologies will be used to reduce GHG emissions across many different sectors, developed countries should ensure that mobile devices, including smart phones, and embedded mobile technologies, remain free of customs tariffs to maximise uptake of these technologies. The EU recently agreed to classify smart phones, with features such as GPS, as mobile phones and therefore they enter the EU market tariff-free.[95] Smart phones are currently tariff-free entering the US. [96] However many emerging countries impose customs tariffs on mobile phones, including smart phones, and they should reduce these tariffs to encourage greater mobile device uptake, as well as enabling GHG emission reductions.
The GSMA believes governments should lead these initiatives, working with the GSMA and other appropriate industry bodies.

Grants and loans

To support new technology development through (R&D and commercialisation) pilots, governments should use grants, soft loans and other incentives to encourage the increased deployment of embedded

[95] EU Explanatory Notes on Mobile Phones, http://eur-lex.europa.eu/LexUriServ/ LexUriServ.do? url= OJ:C:2009:185:0001:0002:EN:PDF

[96] United States International Trade Commission USITC http://hts.usitc.gov/ tariff code 8517.12.00

mobile solutions, working with the GSMA to identify the sectors and technologies in need of support. If government stimulus funds are made available, it is important that they should not finance the establishment of duplicate private wireless networks by utilities, for example, but that existing public mobile networks should be used instead.

Information

Mobile devices can help promote increased awareness of climate change, for example through software applications that enable users to calculate their personal GHG emissions, including their home energy usage, and information campaigns which give suggestions for reducing personal GHG emission footprints. Governments in developed and emerging countries should work with the GSMA to realise this potential.

Improvements in energy efficiency are highlighted by the International Energy Agency (IEA) as a key component of GHG emission reductions in all future scenarios. Providing consumers with information on their own energy usage is the basis for encouraging behavioural change to increase energy efficiency in residential buildings.

Policy-makers and the mobile industry should work together to increase awareness of embedded mobile-enabled solutions, for example by showcasing success stories.

Role of local authorities

Local authorities play a key role at sector level in the development and usage of new services, broadband coverage and bandwidth expansion. Local communities are in the best position to aggregate public services (e-education, e-health, etc) and ensure their availability to citizens through the internet. Local authorities also have a direct interest in broadband coverage to attract enterprises and particularly small manufacturing enterprises. Existence of public initiative networks enables local operators to offer business services and challenge national operators. Fibre-based backhaul networks are crucial to enable such offers.

Fibre-based backhaul networks also play an important role in achieving broadband coverage and prepare the migration from high to very-high speed fixed and mobile services – fibre-based backhaul networks are necessary independent of access technology.

Local authorities can also lower market entry barriers for the roll out of next generation access networks by adopting master plans (e.g., duct installation in waiting mode, dark fibre roll-out) and mapping available infrastructures to support the deployment of next generation access networks (creating a “digital registry”).

3.2.3 Helping the mobile industry reduce emissions in other sectors – sector by sector perspective

In addition to high-level government-led initiatives, specific policy support at the sector level is necessary to increase usage of emissions-reducing mobile applications.

Smart transportation and logistics

The tremendous potential of embedded mobile-enabled fleet management solutions must be harnessed by both developed and developing countries, and can be encouraged by setting up or reinforcing holistic fuel efficiency and energy efficiency standards.

The issue of traffic congestion requires system-wide solutions rather than incremental solutions. Governments should seek to encourage transport infrastructure upgrades that make use of ICT and mobile telecom technologies, while ensuring road equipment is integrated with existing communications infrastructures. For example, the US federal government could expand the requirements for integrating ICT solutions into the Department of Transportation's Urban Partnerships funding[97] so that more road and public transportation infrastructure can capture, analyse, utilise and communicate real-time information.

Increased availability and reliability of information on public transport will help promote integrated transport solutions and encourage modal shift to lower GHG emission transport modes, e.g., from car to bus. Public sector organisations should use embedded mobile solutions to help deliver this, e.g., making real-time tracking of buses available on the Internet and smart phones, so that transport users can make informed choices on which modes of transport they use.

Smart grids and smart meters

The transformation of traditional power grids to smart grids will need considerable government support and leadership.

As mentioned earlier in this report, 80% of the GHG emissions reduction that could be achieved by smart grids in 2020 arises from integrating renewable power and reducing transmission and distribution losses, whilst the remaining 20% emission reductions are achieved through demand management and behavioural change driven by user information.

Therefore, the focus should not be only on 'smart metering', but also on improvements to the core infrastructure of the grid and innovations on the demand-side, such as electric vehicles or smart, energy producing homes.

Many countries and companies are beginning to see the benefits of smart grid deployment from societal and commercial perspectives, but regulatory and technical challenges stand in the way of rollout. Utilities are rarely provided with incentives to reduce overall demand for power. And communications standards that span high voltage transmission networks through to the distribution network and homes have not been developed.

As traditional electricity networks evolve and fixed and mobile telecommunications become more integrated into an "energy internet", the regulators of both the power and telecommunications industries should co-operate to ensure that technical standards are developed to ambitious roadmaps, while avoiding the duplication of infrastructure. For utilities, the transition from an one-to-many distribution system to one that enables interconnection will also require modifications to billing and rate-based regulation. For telecommunication service providers, the likely impact on spectrum allocation should be explored.

Government support of existing industry standards processes through the IEEE, NIST and the GSMA will be the most efficient way to establish the necessary common standards, e.g., making use of SIM-based identity and security.

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[97] US Government http://www.upa.dot.gov/index.htm

Governments in developed and developing countries are already choosing to regulate or incentivise the introduction of smart meters based on open standards for energy consumers. These regulations and incentives need to be future-proofed to comply with open standards to enable a range of new services that are not yet possible.

Stimulus funds should not be used to build new private communication networks for services that can be provided by readily-available mobile networks with sufficient bandwidth, quality of service and security.

Smart buildings

The vision of efficient buildings depends on whole building energy management and early intervention in new building design processes to ensure that buildings are part of a zero-carbon infrastructure, while also generating their own energy from renewable sources.

Government can support this vision by creating open codes and standards for new and existing buildings, mandating labels for all buildings that state their energy and carbon emissions, both for designed and in-use emissions. And finally, those standards should support IP-enablement and fixed broadband and mobile access throughout buildings, ensuring that connected, smart, energy-efficient solutions are available to all users whether in-building or whilst mobile.

In addition, specific policies that target increased investment in embedded mobile-enabled smart building technologies could include financial incentives, tax breaks and requirements for retrofit and re-commissioning.

Governments can show leadership by procuring embedded mobile-enabled smart building technologies, e.g., in schools and in government departments.

Dematerialisation

Governments need to ensure the widespread availability of high-speed, high-bandwidth mobile broadband to increase mobile teleconferencing (including telepresence) and mobile-enabled teleworking. Unlike current trends in South Korea and Japan, current infrastructure development does not allow most European and North American households to receive high-quality digital services. Some developing countries are leapfrogging earlier communications networks and installing high-speed broadband as standard. [98]

Governments could lead by example and promote increased teleworking amongst public sector employees.

Environmental Information Systems

Developed and emerging countries will increasingly need to adapt to the impacts of climate change and they will need particular help in this regard.

The GSMA calls for the Climate Change Conference in Copenhagen to help resolve the funding of emerging countries' adaptation to climate change, now and in the future. Funding should be made available for the deployment of mobile-enabled EIS, such as weather monitoring, adverse weather warning systems and water monitoring, as they play an important role in any adaptation strategy.

* * *

[98] SMART 2020, The Climate Group and GeSI, "Enabling the low carbon economy in the information age", 2008

Endnote

The views expressed in this document represent a collation of various viewpoints emerging from the discussions of the participants to this process. They do not necessarily reflect the individual institutional viewpoints of the GSMA or any of the particular companies or other institutions whose representatives have taken part in this process.

Frequently asked questions

How was the manifesto developed?
The manifesto was developed by the GSMA with the support of Irbaris, an advisory firm specialised in the carbon and cleantech sectors. Irbaris capitalized on a number of existing analyses and resources to develop sections of the manifesto and complemented these inputs with its own analyses. Qualitative information, perspectives and case studies were developed together with mobile operators, telecom equipment and handset vendors and with the GSMA itself.

Who is the intended audience of this manifesto?
The manifesto is primarily intended for policymakers ahead of the United Nations Climate Change Conference, including the 15th Conference of the Parties (COP 15), in Copenhagen in December. The report aims to provide them with the perspective and policy recommendations of the mobile industry. Other audiences may also benefit from reading the manifesto, whether mobile industry staff and executives, investors, consumers or other stakeholders.

What is the objective pursued in publishing this manifesto?
The objective of the paper is to present the perspectives of the mobile industry ahead of the COP15 meeting in Copenhagen. It intended to:

- Be a major step towards a public commitment to increasing the industry's energy efficiency
- Demonstrate why mobile solutions, along with other ICT solutions, should be a priority area for COP15 in terms of promoting lower carbon solutions
- Define what guidance COP15 should provide so that the adoption of smart mobile solutions is accelerated in other sectors
-

What methodology and sources have been used in computing the direct impact or GHG emissions of the mobile industry in this manifesto?
Emissions from the mobile industry have been calculated by referring to a number of reports and analyses already published, including "SMART2020" from GeSI and The Climate Group, "Lifecycle assessments of ICT" from Ericsson and "Lifecycle Environmental Issues of Mobile Phones" from Nokia. The assumptions used are:

	Unit	*Y2002*	*Y2009*	*Y2020*	*Source*
Device embedded, per phone	kg CO2e	22	18	11	Nokia 2001 LCA data used for 2002 figure; Ericsson data used for 2009 figure; 40% handset manufacturers commitment for 2020
Device Consumption, per sub, per annum	kg CO2e	7	3	1.8	Nokia 2001 LCA data used for 2002 figure; Ericsson data used for 2009 figure; 40% handset manufacturers commitment for 2020 figure
Phone replacement interval	Years	2	2	2	Estimate
Network embedded, per sub, per annum	kg CO2e	9	9	5	McKinsey and Ericsson data for 2002 (embedded = 15% of network emissions pa in 2002); team estimate for 2009; 40% equipment manufacturers commitment for 2020 figure
Network consumption, per sub, per annum	kg CO2e	51	51	31	McKinsey and Ericsson data for 2002; team estimate for 2009; 40% operators commitment for 2020 figure

Total emissions, per sub, per annum	kg CO2e	78	72	43	Calculation
Subscribers	#mn	1150	3400	5700	Wireless Intelligence
Global emissions, per annum	Mt CO2e	90	245	245	Calculation
Total emissions, per connection, per annum	kg CO2e	78	53	31	Calculation
Connections	# mn	1150	4600	8000	Wireless Intelligence

Subscriber figures are based on connections data from Wireless Intelligence, using a connection/subscriber ratio of 1.0 in 2002 and 1.4 in 2009 and 2020 globally.

The total emissions per subscriber of the mobile industry are the sum of the device embedded emissions per subscriber (on an annual basis, and assuming a phone replacement rate of 2 years), the device consumption, the network embedded emissions per subscriber, and the network consumption per subscriber.

The total global emissions of the mobile industry are the product of total emissions per subscriber multiplied by total number of subscribers.

What methodology and sources have been used in computing the emission reductions in this manifesto?
Emissions reductions have been calculated by extrapolating two sets of estimates of emission reductions previously published:

- For smart transportation and logistics[99], smart grids, smart motors and dematerialisation: the figures in "Carbon Connections: Quantifying mobile's role in tackling climate change"[100] were used; Vodafone identified 113 Mt CO2e emission reductions for Europe in 2020
- For smart buildings: the SMART2020[101] emission reductions identified for Europe were used as a basis; 3 percentage points out of 10 were attributable to mobile-enabled smart buildings initiatives and thus accounted for an extra 53 Mt CO2e in Europe in 2020

The emission reductions were estimated by extrapolating these European figures in proportion with the GHG emissions of each sector (transportation, industry, power and buildings) at a global level.[102]

[99] Smart Transportation is referred to as Smart Cities in the Vodafone report

[100] Vodafone, "Carbon Connections: Quantifying mobile's role in tackling climate change", July 2009

[101] SMART2020, The Climate Group and GeSI, "Enabling the low carbon economy in the information age", 2008

[102] By 2020 in the Business as Usual case, Europe GHG emissions reach 4.5Gt CO2e and Global emissions reach 52 Gt CO2e

Appendix – other mobile industry case studies

Direct impact

CASE STUDY 18 – RENEWABLE-ENERGY POWERED BASE STATIONS, CHINA MOBILE, CHINA

China Mobile has one of the world's largest deployments of green technologies to power its base stations. Utilizing solar, wind, and bio-fuels as alternative energy sources, China Mobile had 2,135 base stations powered by alternative energy in 2008 across 25 of its provincial subsidiaries. Of these, 1,615 are powered by solar energy, 515 are powered by solar and wind energy and 5 are power by alternative sources, including hydrogen. China Mobile reports that, in Jiangsu (on Cheniushan Island in the Yellow Sea), a base station powered by solar and wind energy generates enough energy to even provide power for some of the island's residents.

CASE STUDY 19 – RENEWABLE-ENERGY POWERED BASE STATIONS, DIALOG TELEKOM, SRI LANKA

In Sri Lanka, Dialog Telekom is piloting green power in collaboration with the GSMA Development Fund with 10 hybrid renewable energy-powered base stations across the country. The multi-vendor trial is enabling Dialog and the GSMA to evaluate the effectiveness of the different technologies.

CASE STUDY 20 – RENEWABLE-ENERGY POWERED BASE STATIONS, DIGICEL, VANUATU

In Vanuatu, an island nation located in the South Pacific Ocean east of northern Australia, Digicel is working with the GSMA Development Fund to assess and develop commercial scale roll outs of green power technology. There are currently 24 live sites in the Digicel Vanuatu network running on green power, including eight mission-critical backbone sites carrying up to 60% of Digicel's traffic. The findings of the initial assessment show that commercial scale implementation of green power solutions is viable for replacement of diesel generators.

Enabling impact – Smart transportation and logistics

CASE STUDY 21 - OPTIMIZING VEHICLE FLEET MANAGEMENT, ORANGE, GLOBAL[103]

GEFCO, a logistics provider to industry, wished to acquire a simple, customizable on-board telematics solution for its 21 subsidiaries worldwide, with three objectives:(1) to track its deliveries Europe-wide, with precision; (2) to optimize truck routes; and (3) to provide security for its freight and staff.

The integrated solution devised by Orange includes equipment, communications at a flat-rate tariff in each European nation and the use of the information transmitted by the trucks. An on-board box contains a GPS and a modem running on the GPRS network. Every 15 minutes, it sends location information to the Orange Business Services server, allowing shippers and GEFCO clients to see in near-real time the data on their deliveries: departure time, position, route, etc.

CASE STUDY 22 – VEHICLE ENERGY EFFICIENCY "SHOW HYUNDAI-MOTOR MOBILE SERVICE", KT, SOUTH KOREA

KT and Hyundai Motor Company jointly developed and are offering an on-board automobile diagnostic device communicating via the mobile network. The service monitors the vehicle condition and provides car maintenance information such as engine or transmission breakdown status, and general car alerts, with details of what needs replacement. It also provides information on how drivers can be more energy efficient and drive more safely and real time traffic information adapted to the specifics of the trip and driving patterns of the driver.

The features of the service benefit customers and help reduce CO2 emissions and other pollutants by supporting eco-driving and allowing preventive maintenance.

[103] France Telecom information, September 2009

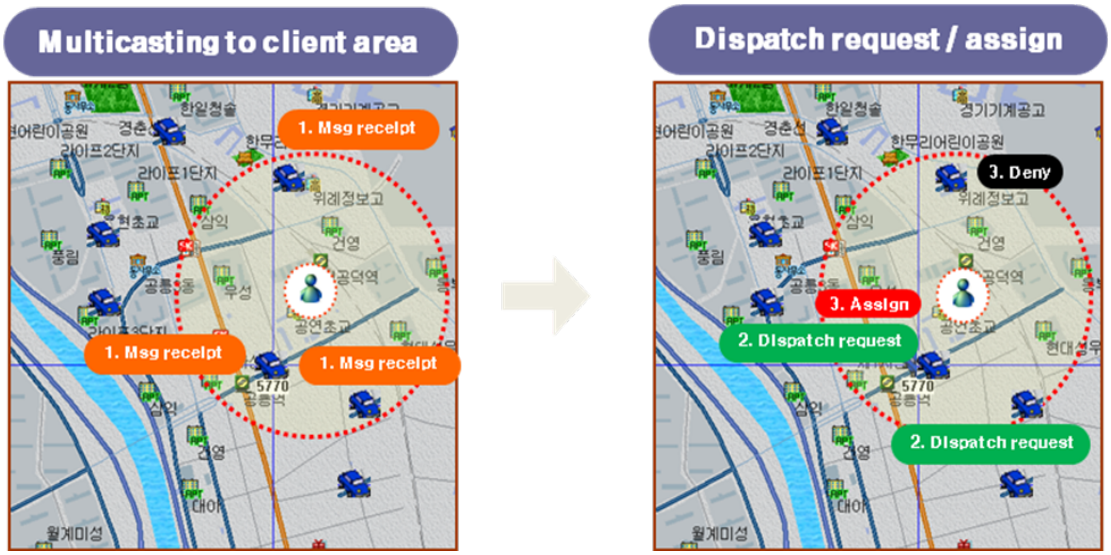
Vehicle connected with diagnostic device

Vehicle diagnostic centre

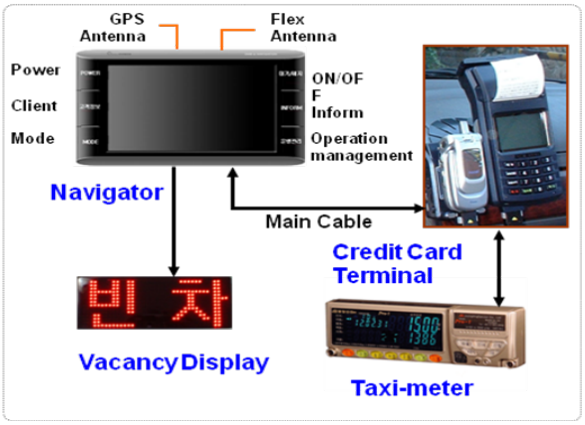
CASE STUDY 23 - TAXI DISPATCH SYSTEM, KT AND SK TELECOM, SOUTH KOREA[104]

In conjunction with Seoul, Busan, Daegu and Incheon City authorities (four of the largest cities in Korea) and taxi companies, KT and SK Telecom have developed a Taxi Call Service which allows for the nearest taxis to be dispatched to customers using WCDMA and GPS technology.

When a customer calls the taxi company, its call is multicast to all taxis within a 1.5km radius zone, with the assignation of the job to the first taxi to respond in the zone.



In this system, taxis are equipped with a navigator (GPS, I/O terminal, navigation), a CDMA/WCDMA cellular modem, a credit card terminal, a taximeter and a vacancy display as depicted in the figure below.



[104] KT information, October 2009

This solution saves energy consumption by optimizing taxi dispatching. About 55,000 taxis use the system at present.

Enabling impact – Smart grids and smart meters

CASE STUDY 24 - REMOTE GAS METER READING, ORANGE, GLOBAL[105]

Primagaz is a subsidiary of SHV and the largest LPG distributor in world, with over 2 million customers and 20,000 points of sale. It needed a remote metering solution meeting three objectives: (1) avoid customer gas supply cut-offs; (2) reduce CO2 emissions by reducing travel and (3) develop "sustainable energy" advice and solutions to customers.

Orange offered an integrated solution involving a M2M remote measurement solution for individuals and companies, with SIM card-based identification of devices, hosting of data and service platform and global system integration.

The system is being rolled out progressively to 11,500 Primagaz customers on 3,380 sites and has already met a number of targets: customer comfort and satisfaction have improved through elimination of meter readings and billing based on actual consumption and continuity of gas supply, and travel of monitoring and maintenance teams has been avoided leading to an estimated reduction of 80,000 km driven in 2009, reducing GHG emissions by 48t CO2e.

CASE STUDY 25 – LEADING THE WAY TO SMART POWER FOR ACEA, ERICSSON, ITALY[106]

Acea's main areas of business are water and electricity. Based in Rome, it operates in the production, transmission, sales and distribution of power, public lighting, decorative and architectural lighting and integrated water services management.

Since 2006, Acea's smart metering service has used Ericsson's technology and service centre to monitor electricity usage behaviour, save costs and allow customers to manage their electricity consumption. By better communicating power consumption, smart meters raise energy awareness among end-users, helping to encourage behaviour that will reduce GHG emissions. They also deliver better financial control, ensuring electricity customers are charged only for their real electricity use.

Ericsson's service centre supplies Acea with a web-enabled interface to facilitate travel-free meter management and reading, reducing costs and environmental emissions. All electricity service provisioning procedures are handled through the service centre, where end-user consumption patterns can be modelled and even fraud detected. In future, this modular remote management solution is set to be extended to other utilities, such as gas and water suppliers.

CASE STUDY 26– EFFICIENT ENERGY AND WATER CONSUMPTION MEASUREMENTS, ALCATEL-LUCENT AND DIEHL ENERGY SOLUTIONS, GERMANY

Alcatel-Lucent, in collaboration with DIEHL Energy Solutions, has developed a comprehensive solution that enables energy supply and combination utilities to provide timely, detailed consumption information to their customers.

The smart metering solution offers automatic and accurate monitoring of electricity, gas, heating and water consumption. The solution encompasses measurement devices, through measurement data collection and management systems, as well as components for wide area network communication systems, to a comprehensive service offering for suppliers and measurement service providers.[107]

In October 2009, Alcatel-Lucent signed an agreement with the German municipal utility Stadtwerke Pasewalk GmbH to implement smart meter operation services. The solution will help the municipal utility address the multiple challenges that are imposed on utilities throughout Europe to respond to economic pressure from stakeholders and regulators for greater asset efficiency as well as reducing their environmental impact.

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[105] France Telecom information, September 2009

[106] Ericsson information, October 2009

[107] Alcatel-Lucent Press Release: February 18, 2009.

Alcatel-Lucent's end-to-end approach is designed to ensure that Stadtwerke Pasewalk is in compliance with upcoming European Union regulations and can provide its customers with an instrument with which they can monitor their own energy consumption in real time and optimize accordingly.

Alcatel-Lucent's service package benefits from the know-how of its partners: Vodafone Germany, DIEHL Energy Solutions and SIV AG, with its 100% subsidiary UTIPS GmbH, a provider of integrated solutions and services for the energy sector. Alcatel-Lucent will operate the central meter data management system to monitor and control the smart meters and integrate the individual systems. Vodafone Germany will provide machine-to-machine communication solutions and DIEHL Energy Solutions will deliver the smart meter and systems solutions plus attached services. SIV AG is providing their ERP system kVASy®, used for billing by the Stadtwerke Pasewalk as well as for services of UTIPS GmbH, which will be linked to the Alcatel-Lucent components. [108]

Enabling impact – Smart buildings

CASE STUDY 27 – HAMPSHIRE HOTELS BECOME A DYNAMIC HOSPITALITY ENTERPRISE, ALCATEL-LUCENT, USA

Alcatel-Lucent provided a solution to Hampshire Hotels and Resorts to implement a dynamic IP network consisting of both wireless and wireline connectivity that enables guest to reduce their energy usage and carbon footprint. For example, when a guest checks into a hotel, the room lights and temperature controls are turned on. Once in the room, they may adjust the temperature and lighting to their preferred settings. Upon leaving the room, a sensor will trigger the system to switch the lights and air conditioning to stand-by mode. The same sensor will recognize when the guest returns and switch to active mode, with lights and temperature returning to the guest's preferred settings. The guest's preferences can be stored and used on the guest's return visit to any of Hampshire's properties. The overall estimated system savings for Hampshire Hotels is about 5,700 Metric tons of CO2e emissions per year.[109]

Enabling impact – Dematerialisation

CASE STUDY 28 – UNITED COMMUNICATIONS, TELENOR, NORWAY[110]

Telenor has launched its Unified Communications solution, which is already used by 30,000 Telenor employees, on to the Norwegian market, enabling users to share information easily, travel less and reduce their GHG emissions.

Telenor's Unified Communications solution is a customer-tailored service where speech, data, text, video and conferencing solutions are linked up both from a functional and a technical point of view, giving users much more flexibility to perform their duties irrespective of time and location.

Unified Communications is designed to enable people within an organisation to collaborate better, while making it easier to develop skills and gather best practice information. Telenor has found that information sharing increases and that means that the efficiency of working processes increases, too. Less travelling means less time pressure for employees, while also having benefits in terms of climate change and cost savings.

CASE STUDY 29 – HEALTH NETWORK INFORMATION SYSTEM BY GPRS, ERICSSON, CROATIA[111]

The Ericsson eHealth system that has been installed to support the primary health care in Croatia is forecast to lead to significant CO2e emission reductions by reducing patient travel and paper consumption. Ericsson estimates emission reductions related to e-referrals and e-prescriptions services, based on life cycle assessment studies, amount to 15 Mt CO2e per annum.

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[108] Alcatel-Lucent Press Release: October 7, 2009.

[109] Alcatel-Lucent *Enriching Communications* Publication: Volume 3, Issue 1, 2009 (case study available at: http://www.alcatel-lucent.com/enrich/v3i12009/article_c2a2.html?l=en)

[110] Telenor information, October 2009

[111] Ericsson information, October 2009

Enabling impact – Environmental Information Systems

CASE STUDY 30 – E-MONITORING CLIMATE CONDITIONS IN ECUADOR, EARLY WARNING SYSTEM[112]

In 2008, floods in the Ecuadorian coastal region killed 60 people and resulted in 63,000 million hectares of non-productive land with economic losses of approximately 85 million Euros.

To develop an early warning system to reduce the impact of potential natural disasters, Telefonica Movistar Ecuador has signed an alliance with two institutions involved in monitoring of the impact of El Niño in Ecuador: the National Research Centre of El Niño Phenomena[113] and the Hydrology and Meteorology National Institute[114]

The alliance has resulted in the development of a Mobile Information System of Climate Alerts warning inhabitants of the Ecuadorian coastal region of climate disasters using messages sent to their mobile phones. The mobile subscribers can then disseminate the information in their communities.

[112] Telefonica information, October 2009

[113] Centro Internacional para la Investigación del Fenómeno de "El Niño"

[114] Instituto Nacional de Meteorología e Hidrología

Glossary

ARRB: Australian Road Research Board

Bandwidth: Rate of data transfer, measured in bits per second.

Base Transceiver Station: wireless communications station installed at a fixed location and used to communicate as part of either a push-to-talk two-way radio system or a wireless telephone system.
BAU: Business as usual.

BMS: Building management system: Used in smart buildings to automatically control and adjust heating, cooling, lighting and energy use.
BREEAM: Building Research Establishment Environmental Assessment Method.

Broadband: Wide band of frequencies used to transmit telecommunications information.

Carbon footprint: Impact of human activities on the environment measured in terms of GHG produced, measured in CO2e.
CDMA: Code division multiple access.

CO2: Carbon dioxide.

CO2e: Carbon dioxide equivalent.

Demand response: Reduction of customer energy usage at times of peak usage in order to help improve system reliability, reflect market conditions and pricing and support infrastructure optimisation or deferral.
Dematerialisation: The substitution of high carbon activities or products with low carbon alternatives.

DESC: Digital Energy Solutions Campaign, a consortium of IT & telecom companies, trade associations and environmental NGOs who will be working alongside members of Congress, the incoming Obama Administration and others who help shape climate and energy policy in Washington and beyond.
DGNB: Deutsches Gesellschaft für Nachhaltiges Bauen.

Direct footprint: In this report refers to the CO2e impact of the ICT sector.

Distributed generation: Generation of electricity from small energy sources.

EDGE: Enhanced Data rates for GSM Evolution is a backward-compatible digital mobile phone technology that allows improved data transmission rates, as an extension on top of standard GSM. EDGE was deployed on GSM networks beginning in 2003
EIS: Environmental Information Systems
EiT: Economies in transition.

Embedded carbon: Total CO2e required to get a product to its position and state. Includes product manufacture, transport and disposal.
Emerging markets: Business and market activity in industrialising or emerging regions of the world.

Enabling effect: Term coined in this report to describe the ability of ICT solutions to facilitate emissions reductions by means of: improved visibility; management and optimisation of processes; and behavioural change as a result of better information provision.
ETP: European Technology Platform, a European network bringing together researchers, industry and other relevant stakeholders in a particular technological field in order to foster European research and development in the concerned area.
ETSI: European Telecommunications Standards Institute

EU ETS: European Union Emission Trading System, the largest multi-national emissions trading scheme in the world. The ETS currently covers more than 10,000 installations in the energy and industrial sectors which are collectively responsible for close to half of the EU's emissions of CO2 and 40% of its total greenhouse gas emissions
EU25: the European community of 25 countries as it was known in 2004, composed of the following countries: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom
GDP: Gross domestic product.

GeSI: Global e-Sustainability Initiative, an international strategic partnership of ICT companies and industry associations committed to creating and promoting technologies and practices that foster economic, environmental and social sustainability and drive economic growth and productivity. Formed in 2001, GeSI fosters global and open cooperation, informs the public of its members' voluntary actions to improve their sustainability performance and promotes technologies that foster sustainable development. It partners with the UNEP and the ITU.

GHG: Greenhouse gas.

GPRS: General packet radio service is a packet oriented mobile data service available to users of the 2G cellular communication systems global system for mobile communications (GSM), as well as in the 3G systems.
GPS: Global positioning system: The only fully functional global navigation satellite system. Utilising a satellite constellation of at least 24 medium earth orbit satellites that transmit precise microwave signals, the system enables a GPS receiver to determine its location, speed, direction and time.
GRIHA: Green Rating for Integrated Habitat Assessment, the National Rating System for green buildings in India, conceived by TERI, and developed jointly with the Ministry of New and Renewable Energy.
GSM: Global system for mobile communications.

Gt: Gigatonne: One billion tonnes.

HSPA: High-Speed Downlink Packet Access is an enhanced mobile telephony communications protocol also coined 3.5G, 3G+ or turbo 3G, which allows networks based on Universal Mobile Telecommunications System (UMTS) to have higher data transfer speeds and capacity.
HQE: High Quality Environmental standard, a standard for green building in France, based on the principles of sustainable development first set out at the 1992 Earth Summit.
HVAC: Heating, ventilation and air conditioning.

ICT: Information and communications technology: Combination of devices and services that capture, transmit and display data and information electronically.
IEA: International Energy Agency.

IEEE: an international non-profit, professional organization for the advancement of technology related to electricity, with more than 365,000 members in around 150 countries.
IPCC: Intergovernmental Panel on Climate Change: Scientific intergovernmental body set up to assess the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation.
ITU: International Telecommunications Union

kWh: Kilowatt hour.

Kyoto Protocol: Legally binding agreement of the UNFCCC in which industrialised country signatories will reduce their collective GHG emissions by 5.2% on 1990 levels. Negotiated in December 1997 in Kyoto, Japan, and came into force in February 2005.
LCA: Life-cycle analysis, also known as life-cycle assessment.

LEED: Leadership in Energy and Environmental Design: Green building rating system established by the US Green Building Council.
LTE: Long Term Evolution is the last step toward the 4th generation of radio technologies designed to increase the capacity and speed of mobile telephone networks. Many mobile carriers have announced plans to convert their networks to LTE beginning in 2009.
M2M: Machine-to-Machine, data communications between machines referring to telemetry or telematics that is accomplished using networks, especially public wireless networks.
MOU: memorandum of understanding

Mt: Megatonne (1 million tonnes).

NGO: Non-governmental organisation.

NIST: National Institute of Standards and Technology, a measurement standards laboratory which is a non-regulatory agency of the United States Department of Commerce aimed at promoting U.S. innovation and industrial competitiveness by advancing measurement science, standards and technology in ways that enhance economic security and improve quality of life.
OECD: Organisation for Economic Co-operation and Development.

OMTP: Open Mobile Terminal Platform, an operator-sponsored forum that serves the needs of each and every link in the mobile phone value chain by gathering and driving mobile terminal requirements. With 32 participants from all parts of the industry ranging from operators to chipset manufacturers and from OEMs to Internet companies.
RoW: Rest of the world.

SIM: Subscriber Identity Module, typically on a removable SIM card that securely stores the service-subscriber key used to identify a subscriber on mobile telephony devices (such as computers and mobile phones)
Smart buildings: Group of embodied ICT systems that maximise energy efficiency in buildings.

Smart charger: Device (primarily mobile phone) battery charger that turns off when the device is fully charged or if plugged in without device attached.

Smart grid: Integration of ICT applications throughout the grid, from generator to user, to enable efficiency and optimisation solutions.
Smart logistics: Variety of ICT applications that enable reductions in fuel and energy use by enabling better journey and load planning.
Smart meters: Advanced meters that identify consumption in more detail than conventional meters and communicate via a network back to the utility for monitoring and billing purposes.
Smart motors: ICT technologies that reduce energy consumption at the level of the motor, the factory or across the business.
SMS: Short message service**:** Communications protocol allowing the interchange of short text messages between mobile telephone devices.
Teleconferencing: Service that allows multiple participants in one phone call, replacing or complementing face-to-face meetings.
Teleworking: Working remotely via the use of ICT solutions. Includes telecommuting and tele- and videoconferencing.
UCS: Universal Charging Solution is a cross-industry standard for a Universal Charging Solution for new mobile phones that will enable the mobile industry to adopt a common format for mobile phone charger connections and energy-efficient chargers, resulting in an estimated 50 per cent reduction in standby energy consumption, the potential elimination of up to 51,000 tonnes of duplicate chargers1 and the enhancement and simplification of the end-user experience by removing the myriad models and connections involved in charging a mobile device.
UMTS: Universal Mobile Telecommunications System is a third-generation mobile telecommunications technologies, closely related to GSM/EDGE as it borrows and builds upon concepts from GSM.
UNFCCC: United Nations Framework Convention on Climate Change: Adopted in May 1992, signed by more than 150 countries at the Earth Summit in Rio de Janeiro. Its ultimate objective is the "stabilisation of GHG concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." Came into force in March 1994 and is ratified by 192 countries.
Videoconferencing: The audio and video transmission of meeting activities.

Virtualisation: Software allows computation users to reduce hardware assets, or use them more efficiently, by running multiple virtual machines side by side on the same hardware, emulating different components of their IT systems.
W: Watt

WEEE Directive: European Community directive 2002/96/EC on waste electrical and electronic equipment. Together with the RoHS Directive 2002/95/EC, it became European Law in February 2003 and sets collection, recycling and recovery targets for all types of electrical goods.

Case studies in this manifesto

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Acknowledgements

The manifesto was developed by the GSMA with the support of Irbaris and The Climate Group. Particular thanks to the members of the Steering Committee and the editorial team, who helped develop and sustain the project. The analysis contained in this report would not have been possible without contributions from the **Steering Committee**:

Alcatel-Lucent, Mark Benowitz : **AT&T**, Charlene Lake, Beth Shiroishi, Mike Pfau : **Deutsche Telekom**, Luis Neves, Chair of GeSI : **Ericsson**, Elaine Weidman, Karin Svingby : **GSMA**, Belinda Exelby, Jack Rowley, Gabriel Solomon, David Taverner : **KT**, Byungki OH : **Mobilkom**, Oliver Kaliski : **Nokia Siemens Networks**, Anne Larilahti : **Orange**, Philippe Tuzzolino : **SKT**, Jeehye Park : **Telecom Italia**, Paulo Nazzaro, Lucy Lombardi : **Telefonica**, Alberto Andreu Pinillos : **Telenor**, Eric Ekern : **Telstra**, Turlough Guerin : **The Climate Group**, Molly Webb : **Vodafone**, Chris Burgess : **Zain**, Lynne Dorward, Khalid Pervez

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The GSMA represents the interests of the worldwide mobile communications industry. Spanning 219 countries, the GSMA unites nearly 800 of the world's mobile operators, as well as more than 200 companies in the broader mobile ecosystem www.gsmworld.com.

It also produces the premier industry events including the Mobile World Congress in Barcelona www.mobileworldcongress.com and the Mobile Asia Congress www.mobileasiacongress.com.

The Climate Group (www.theclimategroup.org) is an independent, not-for-profit organisation working internationally with government and business leaders to advance smart policies and technologies to cut global emissions and accelerate a low carbon economy. Its global coalition of companies, states, regions and cities around the world recognise the economic and environmental imperatives of taking decisive action now. The Climate Group was founded in 2004 and has operations in Australia, China, Europe, India and North America.

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