Low Carbon Telecommunication Solutions in China:

Current Reductions and Future Potential

- Abridged Version

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Based on the case study of China Mobile which helped society to reduce more than 55 million tons of CO_2 in 2009 with low carbon ICT services
- Abridged Version

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Preface

This report is the world's first study on the role of ICT sector in providing low carbon solutions in China. Low carbon ICT solutions such as e-books, teleworking, smart transport solutions, smart city lights, smart appliances, smart houses already have important roles to play in a modern low carbon society. As this report demonstrate, the contributions from low carbon ICT services provided by the Chinese telecom sector is already significant and the potential to reduce 1 billion tons of CO_2 in a few decades with smart ICT solutions can not be ignored.

Low carbon ICT services have so far not been at the centre of the discussions when low carbon solutions are discussed. This report is proof that this should change and future low carbon strategies should include the telecom sector as an important solution provider. Based on real-life cases, the results in this report can inspire action and increase understanding of low carbon ICT services that can deliver the needed transformative change.

It is time for companies with important solutions to be given a more central role when a low carbon economy is discussed. Companies like China Mobile will continue to work to reduce their own emissions, but the contributions through the services they provide are even more important.

The report has a number of specific suggestions, from targets for ICT solutions to methodologies to calculate the savings, that we hope can guide and inspire future work in this important field.

We believe that low carbon ICT services can provide innovations in carbon reduction to help build a harmonious and sustainable development society in China, as well as providing profits to companies and creating more jobs.

Wang Jianzhou
President,
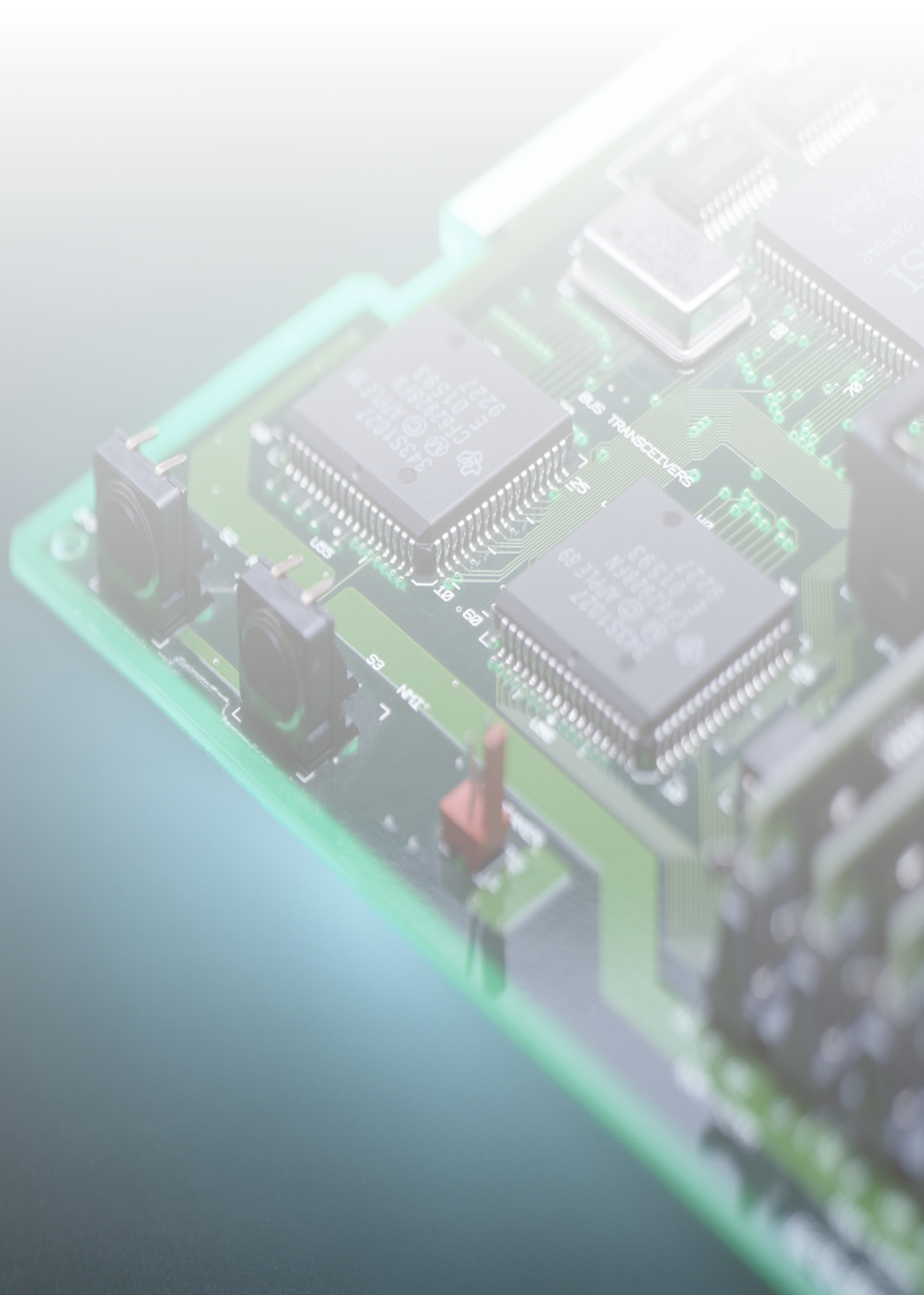China Mobile Communications Corporation

Dermot O'Gorman
Country Representative,
World Wide Fund for Nature Beijing Office

Contents

Introduction

This is the first report with calculations based on empirical cases for carbon emission reductions delivered by information and communication technologies (ICT or IT) services in China. The report includes assessment of the current reductions as well as the future potential. This English version is an abridged version of the full Chinese version that has detailed calculations and methodology discussions[6] .

The report is a result of a joint project between China Mobile[7] and WWF[8] with the objective to promote increased understanding of the potential for low carbon ICT services in China and throughout the world. The research was carried out by Service Management Science Research Institute - Beijing University of Posts and Telecommunications[9].

The focus of this study is the reduction potential from current and future solutions delivered by the telecom industry in China (greening with IT). The emissions from the telecom industry itself are also discussed (greening of IT), but they are not the focus. China Mobile is an important company as it is the leading mobile services provider in China; the Group controls the world's largest mobile network and the world's largest mobile subscriber base, with more than half a billion subscribers[10].

The ICT solutions provided by telecom operators are divided into four areas: smart logistics, dematerialization, smart work and smart appliances. The reduction potential by ICT service solutions in these four arenas are analyzed respectively, combining quantitative analysis with qualitative analysis. The quantification of the CO_2 reduction of ICT service solutions, provided by China Mobile, was done using a well established LCA methodology.

By identifying the current reductions and future potential from ICT service solutions the report demonstrates that the most important contribution to CO_2 reductions from the telecom sector is though low carbon ICT services, not through reduction of ICT's own emissions. The four arenas presented in the report could be used to guide incentives that will affect the development of the telecom industry in order to ensure that low carbon solutions are supported.

As the empirical material 14 low carbon ICT services from Chongqing Mobile, a subsidiary company to China Mobile, where selected from the four areas (smart logistics, dematerialization, smart work and smart appliances). The reduction from each service was quantified on an annual basis. Based on the verified reductions of these 14 services in

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6. The full Chinese version is available at http://www.wwfchina.org/aboutwwf/whatwedo/climate/publication.shtm or http://www.lowcarbonbiz.org
7   http://www.chinamobileltd.com/
8   http://www.wwfchina.org/english/
9. http://www.bupt.edu.cn/enver/
10. As of 30 November 2009 the number of subscribers were 518 million, http://www.chinamobileltd.com/

Chongqing, the total reduction from such services was calculated for China Mobile and the telecom sectors as a whole in China.

The first part of the report describes the relation between the different stakeholders that are relevant for the development, support and use of ICT service solutions in order to understand the opportunity for low carbon solutions in the future. The stakeholders include the provider and operator of ICT products, the user of the solutions and the policy maker. The choices of the three stakeholders will determine the future of low-carbon ICT solutions.

The second part provides and overview of the impact that ICT solutions have and can have on the environment, and analyzes the relationship between ICT solutions and carbon emission reduction.

The third part describes the methodology of emission reduction. For example, methods introduced in the GHG Protocol are adopted appropriately in this study according to the availability of data.

The forth part is the quantitative analysis of the amount of greenhouse gas reduction caused by China Mobile. By calculating the reductions from the use of 14 ICT solutions from Chongqing Mobile an estimate of emission reduction brought by China Mobile and the whole Chinese telecom industry is made.

The fifth part focuses on the future potentials for ICT solutions in the four key areas (smart logistics, dematerialization, smart work and smart appliances).

Approach to estimation of CO_2 reductions from low carbon ICT services

In order to estimate the CO_2 reductions in China from low carbon ICT services a four-step approach was used (see illustration below). In the first step, detailed CO_2 savings from 14 strategic low carbon solutions were calculated. This step provided an understanding of the situation for low carbon ICT services in reality and provided specific data relevant for China Mobile in Chongqing. In the second step, less detailed CO_2 savings from a larger group of low carbon ICT services was calculated.

This allowed for an understanding of the total reductions from low carbon ICT solutions by China Mobile in Chongqing. In the third step the savings from China Mobile in Chongqing was scaled up based on macroeconomic data to provide an assessment of the total savings in China by China Mobile. In the fourth and last step, the savings from China's telecom sector as a whole was calculated based on the market share of China Mobile.

STEP 1:
Approach: Detailed calculations
Scope:14 low carbon solutions
Area: Chongqing
Delivered by: Chongqing Mobile

STEP 2:
Approach: Less detailed calculations
Scope: ALL low carbon solutions
Area: Chongqing
Delivered by: Chongqing Mobile

STEP 3:
Approach: Scaling Up
Scope: ALL low carbon solutins
Area :China
Delivered by: China Mobile

STEP 4:
Approach: Estimation
Scope: ALL low carbon solutions
Area : China
Delivered by: China;s telecom sector

Key findings

- In 2008, China Mobile helped to reduce more than 48.5 million tons of CO_2 emissions in China with the help of low carbon ICT services[11]. This demonstrates that ICT service solutions already today deliver significant emission reductions in China.

- In 2008 the CO_2 reductions from the services China Mobile delivered (48.5 million tons) was more than six (6) times bigger than the carbon emissions from China Mobile's own emissions (7.94 million tons[12]).

Reductions and emissions from China Mobile 2008
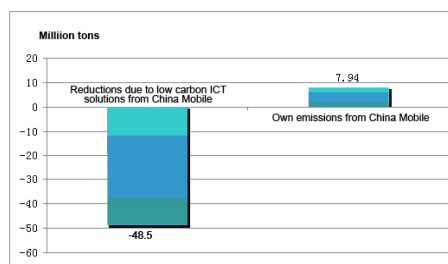
- The use of low carbon services from China Mobile studied in this report increased with approximately 20% between 2008 and 2009. It is therefore reasonable to assume that the savings from low carbon ICT solutions provided by China Mobile in 2009 was 58.2 million tons. The savings from China Mobile in 2009 was almost six and a half (6.45) times bigger than the carbon emissions from China Mobile's own emissions in 2009 (9.02 million tons[13]). So China Mobile increased their

own emissions with 1 million ton and increased the reductions with 9.7 million tons from 2008 to 2009.

- Based on the result for China Mobile, and with conservative estimates, it is reasonable to assume that China's telecom industry as a whole contributed to at least 70 million tons of carbon emission reductions in 2008[14] , without regard to fixed-line telecom carriers[15] . This amount is equivalent to the total CO_2 emissions from countries like Sweden, Finland and Norway.

Comparing the savings from China's telecom sector with three Nordic countries
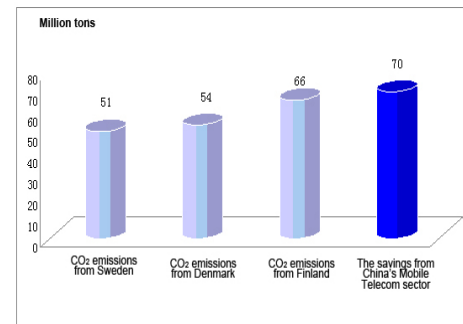
- Based on the approximate 20% growth from 2008 to 2009 the CO_2 reductions from low carbon ICT solutions from the China's telecom industry, without regard to fixed-line telecom carriers, are estimated to be at least 84 million tons in 2009.

- The reductions from the selected 14 low carbon ICT services of Chongqing Mobile, a subsidiary company to China Mobile, were 0.109 million tons in 2008.

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11 For practical reasons the report used metric tons, but called them "tons" instead of "metric tons" or "tonnes" that is the correct way.
12 Page 37, Corporate social responsibility Report 2009, China Mobile Limited, http://www.chinamobileltd.com/images/pdf/2010/csr/2010_csr_e.pdf
13. Page 37, Corporate social responsibility Report 2009, China Mobile Limited, http://www.chinamobileltd.com/images/pdf/2010/csr/2010_csr_e.pdf
14. China Mobile's subscriber base represented approximately 70 percent of the total market for China's mobile telecom sector as of 2008 and 2009..
15. In this research fixed network operators are not included. Therefore, the actual amount of CO_2 emission reductions made by China's telecom industry including fixed and mobile network operators as a whole is much more than 70 million tons in 2008.

	ICT solutions	Reduction in2008(ton)	Assumption of calculation (for the year 2008)
1	Mobile Newspaper (individual subscriber)	457	The number of customers were 0.9 million; The replacement of mobile newspaper to traditional newspaper was 4.3%.
2	Mobile Newspaper (internal journal)	22	The number of customers were 20 thousand; The replacement of the traditional internal newspaper by m-paper was 100%, i.e. the paper journals was totally replaced by mobile ones.
3	DM Promotion Pamphlet	109	Chongqing Mobile sent 12 million e-pamphlet; The replacement of the traditional pamphlet by a e-promotional pamphlet was 100%.
4	Subscriber Self Service	3322	Energy reduction of an online business hall was equals to that consumed by 287 physical halls, assuming that a concrete hall has 5 customer service seats
5	Electronic Invoice	327	The number of electronic invoices in Chongqing Mobile were 60 million, one electronic invoice equals to one paper invoice.
6	Mobile Music Download	26	The number of download in Chongqing Mobile were 0.8 million, which equals to 5000 CDs of the same profit revenue.
7	MMS Card	22	The number of MMS cards sent by Chongqing Mobile was 4.8 million, which equals 1 million paper cards.
8	Logistic Information Network	101804	The number of registered vehicles were 30 thousand; Empty load decreased by 10% after applying this service.
9	Grid Metering System	44	Chongqing Mobile applied this service to 500 grids.
10	Downtown E-government	34	This service was used in two administrative districts in Chongqing.This includes remote sensors that reduce transport needs, saving materials and fuel. (remote control system for streetlamps is not included in this service)
11	Rural E-government	1941	This service was used in 262 towns. This includes video conferencing systems and transmission of documents, storage of data, supplying service in the electronic form, reducing paper needs, transport needs etc.
12	Remote Control System for Street Lamps	1016	The number of controlled streetlamps was 2000; The smart lamps helped to achieve centralized management and remote control of streetlamps, cutting down the consumption of electricity.
13	Card Integration	0.2	An integration of multi cards into a small SIM card, reduced the number of cards.In the year 2008, Chongqing Mobile used 10000 SIM cards in a trial.
14	Mobile E-payment	0.08	By the end of 2008, Chongqing Mobile had cooperation with more than 2400 stores.Subscribers use this service can pay their bills via mobile.
	Total	109 000	

The reduction from the 14 low carbon ICT services of Chongqing Mobile

- The selected 14 ICT solutions account for 9.4% of Chongqing Mobile's total business, and providing these solutions uses 9.4% of the electricity consumed by Chongqing Mobile (totally 185 million Kwh in 2008), which is equal to produce 0.015 million tons of CO_2. This means, for the selected 14 ICT solutions, emitting 0.015 million tons itself will help the society reduce 0.109 million tons (more than 7 times).

■ Besides the 0.109 million tons that was calculated in detail from 14 low carbon ICT solutions of Chongqing Mobile, a range of additional low carbon ICT services was also estimated: Intelligent control of Central Air-conditioning system, Intelligent control of elevator that reduce unnecessary power consumption, information service of traffic inquiry, taxi dispatch service, mobile navigation that reduce unnecessary fuel consumption, mobile payment, MMS card, SMS bill, e-book, digital wallet that save the consumption of paper and transportation, etc.

■ Based on measures of selected solutions, and based on existing knowledge, the carbon reduction of the low carbon ICT solutions that was not included in the detailed calculations are on average of 5 times[16] of their own emissions adding up to 0.726 million tons. The result is that the total savings from the low carbon ICT solutions from Chongqing Mobile are 0.109 million from the 14 solutions plus 0.726 million from the other low carbon solutions adding up to a total of 0.835 million tons.

■ The business of Chongqing Mobile accounts for 1.72% of China Mobile's total business scale. Based on the verified reductions of solutions and services in Chongqing the total reduction from these services delivered by China Mobile is estimated to 48.5 million tons in 2008.

■ Accelerating the uptake of low carbon ICT service solutions in China could result in significant cost reductions and increase the uptake of such solutions not just in China, but also globally as it would ensure economy of scale and increased innovation in the field of low carbon ICT solutions.

■ The potential savings from smart logistics, dematerialization, smart work (including smart meeting and smart commuting) as a whole in 2010 is 399 million tons, 615 million tons in 2020 and 1298 tons in 2030. This would be a significant contribution to the global GHG reductions and an important contribution to China's target to reduce the carbon intensity by 40-45% by the year 2020.
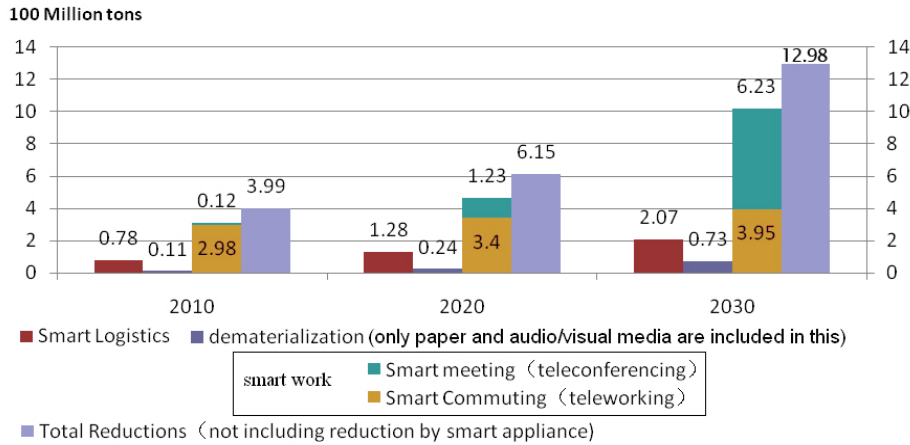
■ The four areas where future savings have been assessed are smart logistics, dematerialization, smart work and smart appliances. Generally speaking, the emission reductions by smart logistics, smart work and smart appliances are larger than that brought by the areas of dematerialization studied in this report.

Ⅰ. Smart logistics delivered by the Chinese telecom industry could reduce CO_2 emissions by 78 million tons in 2010, 128 million tons in 2020 and 207 million tons in 2030. These savings assume that current average no-load ratio of trucks in China would drop from 30% to 15% in 2010, 2020 and 2030 on account of the great effort of policy makers, ICT providers and users. Additional savings due to shorter transport routes, less production of trucks, smaller garages are not included in the savings.

Ⅱ. Dematerializaton, which here only refers to online media and the replacement of paper by e-paper, delivered by the Chinese telecom industry could reduce CO_2 emissions by 11 million tons in 2010, 24 million tons in 2020 and 73 million tons in 2030. These savings assume that 25% of paper and all the CDs/VCDs/DVDs

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16. We have used a conservative estimate and assumed 5 times savings on average compared to the own emissions from the low carbon solutions. The actual savings range between 2 to more than 100 times compared with the own emissions from the ICT solutions.

Potential CO$_2$ savings from low carbon ICT services in China

100 Million tons

Legend:
- Smart Logistics
- dematerialization (only paper and audio/visual media are included in this)
- smart work
  - Smart meeting（teleconferencing）
  - Smart Commuting（teleworking）
- Total Reductions（not including reduction by smart appliance）

compared with a business as usual scenario, would be replaced by e-paper or online media in 2010, 2020 and 2030. Additional savings due to reduced or eliminated need for transport of paper, storage of paper, land-use change, maintenance of underlying infrastructure and production of machines are not included.

Ⅲ . Smart work, which here refers to smart commuting (Teleworking) and smart meeting (Teleconference). Smart commuting services delivered by the Chinese telecom industry could reduce CO$_2$ emissions by 298 million tons in 2010, 340 million tons in 2020 and 395 million tons in 2030. Smart meeting (Teleconference) services delivered by the Chinese telecom industry could reduce CO$_2$ emissions by 12 million tons in 2010, 123 million tons in 2020 and 623 million tons in 2030[17]. These savings assume that mileages on the way to and back from work would drop by 80% and that virtual meetings would replace 4%, 15% and 37% of commercial aviation respectively for

2010, 2020 and 2030. Additional savings due to reduced need for underlying high-carbon infrastructure such as roads, parking spaces, fuelling stations, exploration of oil, manufacturing of cars and spare parts are not included. These additional savings are often between 30-100% of the direct savings. [18]

Ⅳ . Smart appliances, here refer only to three special services (remote control system for street lamps, grid metering system, and remote monitoring system for diesel generators). Because of the great varieties of smart appliances, it is hard to estimate their reduction potential in China as a whole. Savings from smart appliances have not been included in the above graph due to significant uncertainties, but we believe smart appliances will play a very important role in the future. For example, already in 2010 it would be possible to save 3.57 million tons of CO$_2$ if remote street lamp control systems are used for 50% of the lamps in China.

17. From Workplace to Anyplace, Marco Buttazzoni, Andrea Rossi, Dennis Pamlin, Suzanne Pahlman,
    http://www.worldwildlife.org/who/media/press/2009/WWFBinaryitem11939.pdf
18. http://www.sustainable-transportation.com/

Recommendations

For policy makers

1 Low carbon ICT solutions should be included as a key part in China's 12th five year plan as it can help China become more resource efficient as well as support innovation. Meanwhile, in the national climate strategy specific attention should be given to transformative solutions like the ones from ICT that could help reduce emissions by 80 percent or more compared with high carbon ways to provide services (e.g. virtual meetings instead of flying, teleworking instead of car commuting, e-books instead of paper books, etc). In this way China would promote the kind of solutions that are truly sustainable and not just slightly less unsustainable.

2 Targets for China's telecom industry's contribution to reduced emissions through low carbon services should be formulated. Minimum 600 million tons of CO_2 reductions from ICT solutions in four areas by 2020 and 1000 million tons by 2030 are two possible targets.

3 The government should stipulate emission limits for certain services to support innovation and heighten the sense of industrial discipline in order to increase the incentive to use low carbon ICT solutions. For example, government can formulate a maximum limit on annual emissions and energy consumptions for different sectors, and then impose a luxury tax on emissions over this limit.

4 Low carbon ICT solutions in sectors with high emissions, such as building and logistics, should be promoted. Some real estate developers,China Vanke for example, have already taken green building into account in the design of new buildings[19] . These enterprises are deserved to pay more attentions. They set an example for other enterprises in the same sector. Meanwhile, the government could encourage a competition among sectors with high carbon emissions, and give awards to those applying low carbon ICT solutions. It will encourage ICT operators to provide more efficient low carbon ICT solutions for sectors with high emissions.

5 The government should take ICT solutions into account in urban planning, provide incentives for city planning that include more teleworking and virtual meetings as well as smart public transport, and provide infrastructure to smart solutions in future.

6 The government should make control and management for the energy consumption in buildings by encouraging the cooperation of ICT suppliers and architecture developers to develop specific ICT solutions and realize the comprehensive functions of data collection, monitoring and management. A scientific monitoring of carbon emissions is the basis of realizing reductions.

7 The government should lower the investment barriers and provide more supports to resource saving measures in order to support telecom operators to develop low carbon information solutions. For example, enterprises can enjoy tax deduction by submitting a report of their carbon reduction. For small enterprises cooperating with telecom operators, loans could be provided when providing low carbon ICT solutions.

19   Vanke is the largest residential real estate developer in China. http://www.vanke.com/main/defaultEnglish.aspx

For telecom players, users of telecom solutions and academia:

8 Targets for positive contributions from low carbon telecom solutions should be formulated by all important telecom operators.

9 For key low carbon telecom solutions more detailed studies are needed to refine and verify the contributions to reduced emissions.

10 Since ICT solutions are applied in different industries and based on different set of functions, the ways that ICT solutions deliver CO_2 reductions are very different. Therefore, when promoting low carbon ICT solutions it is important to take into account both the kind of reduction that the ICT solution is delivering (e.g. direct or indirect and incremental or transformative) as well as the industrial context where the solutions are taking place, in order to ensure the maximum CO_2 reductions.

11 It is important to create guidance and best practice to ensure that the rebound effects from low carbon telecom solutions generate increased emissions, instead the rebound effects should be directed so that they generate further reductions (i.e. low carbon feedback)

12 Best practice of the use of low carbon ICT solutions in different industries should be collected and promoted.

13 Telecom service providers and telecom operators should cooperate, jointly develop and address the technological bottlenecks, in order to ensure accelerated uptake of low carbon ICT solutions. Initiatives to discuss the creation of industry standards and propel the virtuous cycle of low-carbon economy should be supported. For instance, video conference has encountered some technological problems such as delay, bandwidth, picture definition and stability,

together with some economic problems such as high cost and so on. These problems need a joint effort of both operators and manufacturers to solve. public and urge the public to invest more time and energy to pay attention to carbon emission reduction undertaking.

14 Telecom service providers and telecom operators should enhance the sense of social responsibility and realize the value of low carbon economy and its commercial potential. For example telecom operators should strengthen broadband infrastructure construction in order to provide necessary conditions for the development of ICT products. They should also regard the emission reduction effect as an important attribute during the product developing stage and accelerate the coming of future low-carbon smart society.

15 China's telecom industry, together with policy makers and other stakeholders, should support the development of an internationally agreed standard to calculate savings from low carbon ICT service solutions.

16 Two different kinds of reductions are important to separate. First, solutions that deliver reductions by improving the energy efficiency of traditional industries, e.g. smart control of engines. These solutions improve efficiency in existing systems by improving products. Second, solutions reducing energy consumption by providing new ways to deliver a service, e.g. mobile newspaper (allowing people to gain access to news and information through e-readers instead of newspapers). The reduction caused by the first category is easier to calculate than those caused by the latter as it is often

incremental solutions in existing systems where the system is left without any major changes. The reductions in the second category may be more significant, but also more difficult to calculate as the underlying infrastructure are different.

17 Introduce e-readers/multifunctional devices at universities as this would both encourage development of innovative solutions among students and reduce the demand for energy and paper. [20]

18 Support the use of video conferencing during international negotiations to allow broader participation and less pollution.

19 Encourage State Owned Enterprises and other companies to increase the use ofteleworking, including education for middle management that want to learn how to create good working conditions with low carbon teleworking.

20 Information campaigns that highlight the positive aspects of low carbon ICT should be launched in order to make people aware of the telecom sector as an important solution provider. China's telecom industry should publicize the emission reduction effect and potential of ICT products so as to improve the acceptability of the ICT products, enhance the sense of environmental protection among the public and urge the public to invest more time and energy to pay attention to carbon emission reduction undertaking. |

Methodology

There are many ways to quantify CO_2 emission reduction. Commonly used methodologies include different LCA's and input output analysis. The ways to use these methodologies are described in ISO 14065 and other documents, including PAS 2050, the GHG Protocol for Project Accounting and The GHG Protocol for Corporate Accounting. [21]

LCA is short for life cycle assessment and is the methodology used in the calculation of reductions in this report. The essence of LCA is to take account of every segment of a product, including its material collection, producing, sales, usage and recycling. Carbon emission involved in each segment should be considered. GHG protocol is published by World Business Council for Sustainable Development and World Resources Institute. It is a general method of calculating the emission of greenhouse gas, which elaborates on specific steps of the calculations. [22]

For ICT solutions provided by telecom industry, most LCA methodologies include the emissions during the lifecycle and not the impact from the use phase. The emissions from video conference solutions will only include

20. Globally e-readers are growing fast. About four million e-readers were sold in 2009, according to US-based research firm iSuppli, which predicts sales will reach 12 million in 2012. It's expected that 3 million e-readers will be sold in China in 2010, up from 800,000 last year, according to a report from the research company DisplaySearch, giving China a 20% share of total devices sold worldwide http://www.cibmagazine.com.cn/Features/Business.asp?id=1222&hanwang_s_global_ambitions.html
21. http://www.iso.org/iso/catalogue_detail?csnumber=40685
http://www.bsigroup.com/en/Standards-and-Publications/How-we-can-help-you/Professional-Standards-Service/PAS-2050/
http://www.ghgprotocol.org/
http://randd.defra.gov.uk/Document.aspx?Document=EV02074_7070_EXE.pdf
22. http://www.ghgprotocol.org/files/technical-topics.pdf

the emissions from the production, distribution, use and end-use of the product. It will not include the savings from the use of the video conference solution due to reduced ravelling, even though that this is in most cases the most important impact on emissions from a video conference solution.

To calculate the savings from ICT solutions it is necessary to first calculate the direct emissions from the old system, like cars, inefficient buildings, flying etc. But it is also important to calculate the emissions from the underlying infrastructure that the old system depends on, like roads, parking spots, extraction and distribution of oil. Often the later emissions, related to the underlying infrastructure, are forgotten. But when people for example start using more virtual meeting, the savings are not just from reduced emissions from less flying it also reduces the need for construction of airplanes, airports, hotels, etc. Many studies that have been done using LCA methods clearly indicate that providing services with the help of ICT results in significant CO_2 emission reductions, compared with high carbon ways of providing the same service. ICT can be 100 or even 1000 times less carbon intensive. [23]

In this study, 14 ICT solutions that China Mobile provides are analyzed, the appropriate method to calculate the solutions' CO_2 emission reduction was selected according to the availability of actual data. The method established in this study is widely used in calculating the CO_2 emission reduction brought by CMCC, and was also used to estimate the reduction contributed by China's telecom industry as a whole.

In order to ensure conservative estimations only the direct emission reductions were included (e.g emissions from a car) not the indirect savings (e.g. from production of the car

and extraction of the oil), and not the systemic savings related to reduced use of the underlying infrastructure such as roads, parking spots, etc. Including these emissions would increase the savings from low carbon ICT solutions, and in transport areas these indirect and systemic emissions often result in 30% higher emissions compared with a "tail-pipe" approach. [24]

Method and steps in estimating CO_2 emission reduction contributed by China's telecom industry
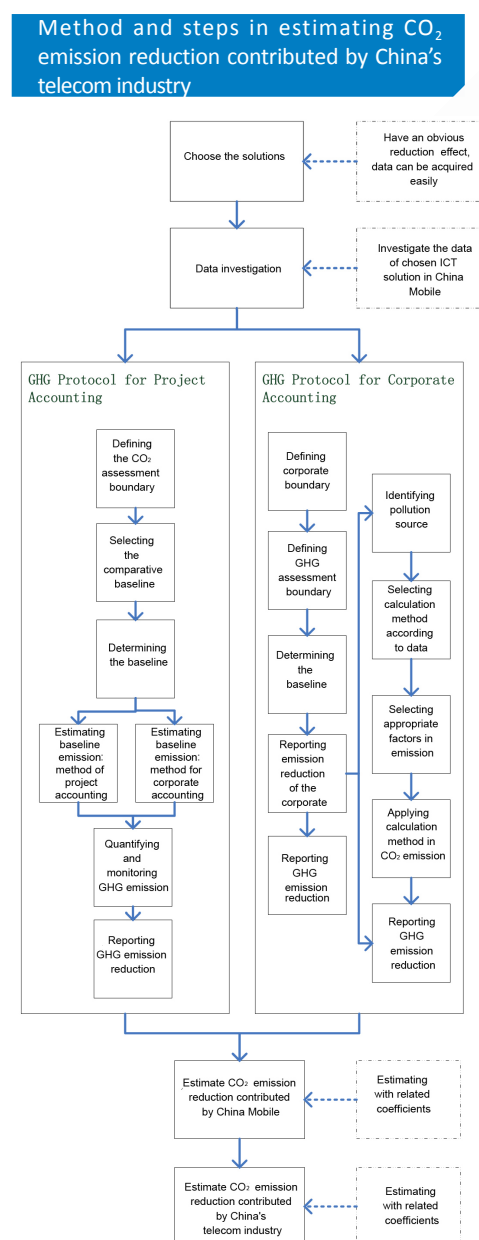
23. http://pamlin.net/blog/Ericsson_Climate_Positive.pdf
     http://assets.panda.org/downloads/global_strategy_for_the_1st__billion_tonnes_with_ict__by_wwf.pdf
     http://assets.panda.org/downloads/fossil2future_wwf_ict.pdf
24. See for example: Chester, M et al., 2009. Environmental Assessment of Passenger Transportation Should Include Infrastructure and Supply Chains. Environmental Research Letters, 4. Available online at http://dx.doi.org/10.1088/1748-9326/4/2/024008.

1. Choose the solutions:

Different ICT solutions bring about different CO_2 emission reductions, so ICT solutions with obvious reduction effects should be chosen. For the convenience of calculating, solutions in which data is more easily obtained should be prioritized.

2. Data investigation:

Investigate the chosen ICT solutions, including goal of the service, technological method, application time and zone of the service, together with the mechanism of the reduction, effect of that, and the carbon footprint of life cycle.

3. Choose method:

According to the availability of data, it is determined whether the accounting for project or for corporate should be chosen. The accounting for project should be chosen when data of the primary and secondary effect of the reduction activities is acquirable and easy to calculate.

4. alculate CO_2 emission reduction:

Calculate CO_2 emission reduction of chosen ICT solutions. The GHG Protocol for Project Accounting and GHG Protocol for Corporate Accounting can be used as guidance together with PAS 2050. Two steps are needed: First, selecting the comparative baseline, quantifying and reporting the emission reduction. There are two methods to select the baseline. First is to set the emission of the system before applying the solutions as baseline; the second is to suppose the emission without applying the solutions. Second, after determining the baseline, calculate the gross emission brought by the chosen ICT solutions and get emission reduction by subtracting emissions from the ICT solutions from the old solution.

5. Estimate CO_2 emission reduction of low-carbon ICT solution contributed by China Mobile:

Through the calculation in the previous step, contribution of the chosen solutions on CO_2 emission reduction is determined. According to the proportion of the chosen ICT services' volume of business to that of China Mobile, CO_2 emission reduction contributed by China Mobile across China can be estimated.

6. Estimate a total contribution and the potential of CO_2 emission reduction brought by China's telecom industry:

According to the proportion of China Mobile's market scale in China's telecom industry, a total contribution and the potential of CO_2 emission reductions by China's telecom industry can be estimated.

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WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature by:

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- Ensuring that the use of renewable natural resources is sustainable;
- Promoting the reduction of pollution and wasteful consumption.

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