A joint initiative of ETNO and WWF

SAVING THE CLIMATE @ THE SPEED OF LIGHT

First roadmap for reduced CO_2 emissions in the EU and beyond

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Preface

We live in exciting times. For the first time in the history of mankind we have the economic and technological capacity to allow everyone on the planet to live a life of dignity. Democracy is spreading and an increasing number of companies are looking for new ways to provide welfare to a wider constituency than their shareholders. The rapid growth in countries like China and India does not only result in reduced poverty, it can also trigger new and innovative urban solutions that are sustainable.

At the same time the challenges ahead of us, both in Europe and on a global level, are frightening. Environmental challenges such as global warming, loss of biodiversity and pollution forces us to question the direction of current development. Growing inequity and inability to provide citizens with fulfilment clearly encourage us to find new ways to organise society.

It is all too easy to withdraw into defensive positions - to use fear to build walls around the well known, or try to dream of old times. But to put our heads in the sand and pretend that only the positive trends exist is not going to solve any problems. The need for leadership is greater than it has been for a long time.

This report is inspiring on many levels. It shows how a changing world that can seem frightening also carries many new opportunities. It shows that old simplistic polarisations are no longer valid. It also shows that a new generation of entrepreneurs in Europe can provide more solutions than usually expected.

Only a few years ago this report would have been impossible, as neither of the two actors then had any concrete work linking ICT to Climate Change. WWF began its project with Information and Communication Technology in 2002, when the book «Sustainability at the Speed of Light» was released. In the same year ETNO launched a project about ICT's effect on climate change. This shows how fast the world we live in is changing. Actors that never talked with each other, until a few years ago, now work together in order to find ways to solve some of the biggest challenges of our time.

It is encouraging to see how these two very different organisations share a vision of a Europe where sustainable development is a driver of innovation. Today sustainable development is seen, all too often, as an obstacle for economic development. Here is a report that challenges this notion. Many have talked about the Information Society; many about sustainable development. But not only have these groups often ignored each other, few attempts have been made to combine these discussions in a concrete way.

This initiative is driven by the urge to find solutions, recognising the need for new targets and incentive structures. Let's ensure this initiative gets a fair chance, and encourage other actors to participate in both this and similar projects.

The challenges are huge but, as this report shows, the opportunities are even greater.

Margot Wallström,
Vice President
of the European Commission

Executive Summary

The world faces serious environmental challenges and problems. Solutions to these are usually seen as being opposed to economic development. However, new technologies and knowledge can ensure that sustainable resource use and economic development is not only possible but mutually supportive. By approaching the challenges from a new perspective, problems can turn into opportunities.

One of the world's most pressing challenges is climate change: the need to radically reduce greenhouse gas emissions, while continuing to enable economic development, both in the European Union and worldwide is a combination that requires innovative action.

The EU, as one of the richest and most technologically advanced regions of the world, is already a leader in the field of sustainable development both within its borders and beyond. So far the leadership has been more one of words than of concrete actions. But actions are needed if we are to reach the targets that have been discussed. The EU has affirmed that at least a 15-30% cut in greenhouse gas emissions by 2020 will be needed to keep the temperature increase under 2 °C, and a deeper reduction by 60-80% may be needed by 2050.

To achieve these reductions it will be necessary to go beyond incremental improvements in energy efficiency, current life-styles and business practices. Improved energy efficiency for existing lifestyles, cars and domestic appliances may be enough to reach the initial Kyoto targets in 2012, but they will not be enough for deeper reductions. To achieve dramatic reductions of CO_2 additional structural changes in infrastructure, lifestyles and business practice are necessary.

As demonstrated in this document, there is a potential to allow the ICT sector to provide leadership. This is a sector that is used to rapid changes and has many of the most innovative people in the business sector, and a unique service focus: it can become an important part of the solutions needed to combat climate change.

The strategic use of ICT can contribute significantly to energy efficiency, sustainable economic growth as well as job creation. ICT can reduce the need of travel and transportation of goods by bridging distance problems. It can increase efficiency and innovation by allowing people to work in more flexible ways. It can also ensure a shift from products to services and allow for dematerialisation of the economy.

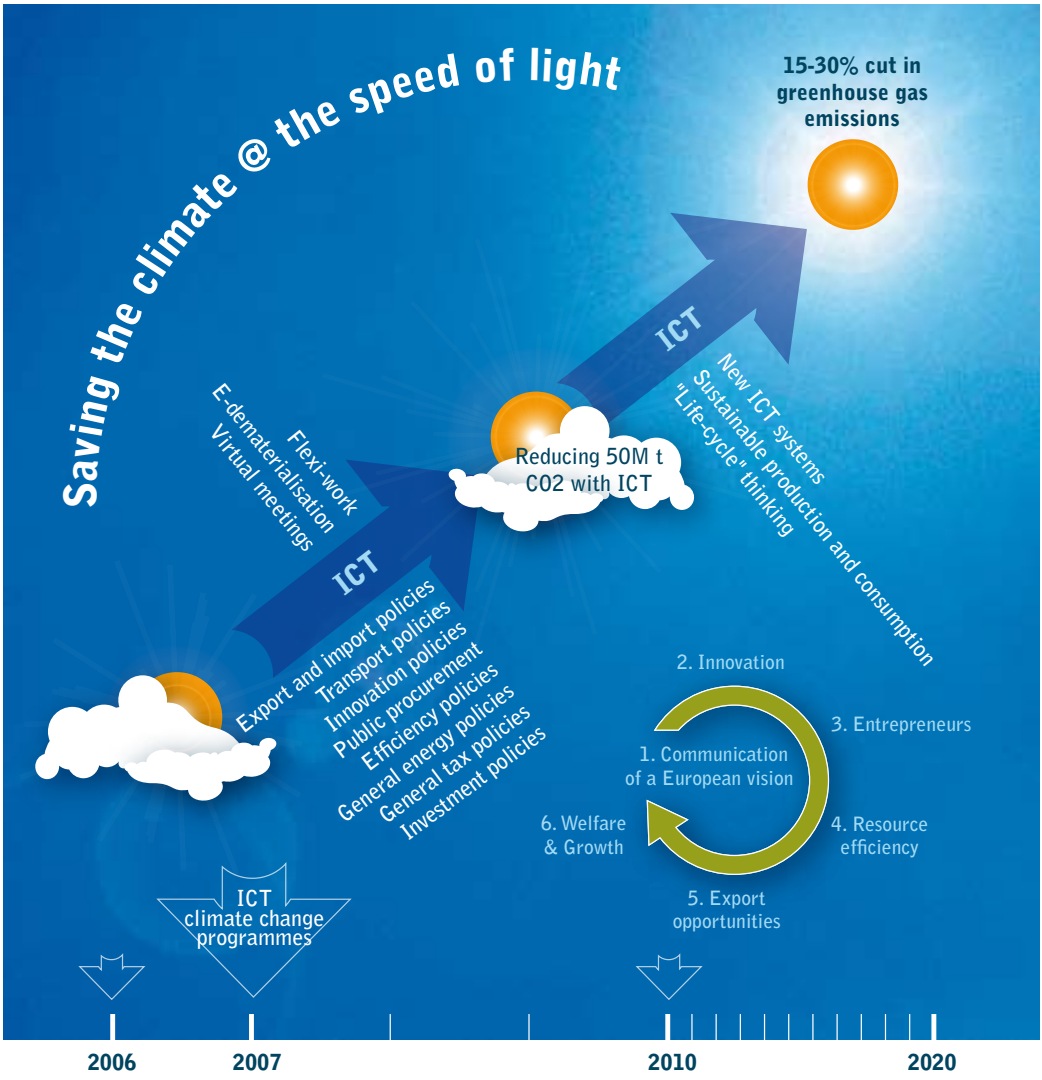
In line with the outcome of the World Summit on the Information Society, - "Government, civil society and the private sector are encouraged to initiate actions… for sustainable production and consumption" – ETNO and WWF embarked on a joint initiative, "Saving the climate @ the speed of light". This project rests on four assumptions: there is a need to act now, a strategy is necessary to ensure that ICT can combat to reduce CO_2, there is a need for a clear focus and scale up those existing applications which are to delivering good results.

Three goals were chosen for the strategy in order to ensure the development of policy in Europe that supported sustainable utilisation of ICT services. The goals are meant to provide guidance for the work and provide a framework for the discussions with relevant decision makers in the EU.

1. ICT is recognised as an important part of the solution for combating climate change in Europe
2. Key actors have a climate change strategy for ICT
3. Concrete "ICT-Climate change" programmes are initiated in Europe by 2007.

To be able to take the initial steps we prepared our first roadmap to support the major structural contributions where ICT can break the current emission trends. The concrete cases provided in this study are based on existing and implemented ICT solutions. They offer a new way for finding solutions, and show that: "telcos [Telecom operators]… can be part of the solution rather than part of the problem" (Ovum, 2005).

To allow the ICT sector an important role in reducing CO_2 and scale up existing solutions an e-strategy for CO_2 reductions is necessary. This strategy should include targets, based on already implemented ICT services, science and on the precautionary principle. Europe's international footprint and export opportunities should also be considered in the strategy.



The roadmap outlines two phases for actions:

- The first phase is a concrete (numerical) target for 2010 of 50 million tonnes CO_2 annually. This target is based on the implementation of several strategic ICT applications, e.g. virtual meetings, e-dematerialisation and flexi-work. This also includes some additional tasks like policy revision (e.g. energy, tax, transport, innovation, etc.) and supplementary, parallel actions.

- The second phase is a target for 2020. This target should be set before 2010 and should include more services and system solutions, where a number of services are combined, as well as a more ambitious target for CO_2 reduction. Possible focus areas for the second phase are sustainable consumption, production, city planning and community development.

This document is obviously not meant as a one-stop-shop to sustainable ICT use. The main purpose is to inspire action that can support the development of an ICT-strategy for combating climate change. A number of things are needed to make this happen. A high-level decision is necessary in the European Commission, there is a need for further dialogues that develop the details around the targets in this report, there is a need to involve ICT solutions in policies related to sustainable development. As we don't have much time there is an urgent need for a decision that clearly states the need for a ICT-strategy.

There will never be a time where all facts are on the table, but every day without an e-strategy is a day of lost opportunities. The time to act is now. This report hopefully provides a guide to what could be done in the short term, for a more competitive, innovative, resource-efficient and globally responsible Europe.

1. Introduction

The world faces a number of challenges. Economic globalisation, the depletion of natural resources, demographic changes and the rise of new large economies will profoundly affect many things we take for granted. The challenges that need to be addressed will be geopolitical, technical, environmental, economic, and they are interacting at a pace that is triggering different kinds of tensions. These tensions will present unique opportunities for proactive actors to show how they can provide welfare in a sustainable way.

The EU is one of the most affluent, technologically advanced regions of the world and as a leader in the field of sustainable development the EU has an important role to play both within its borders and beyond. The Lisbon agenda as well as the Sustainable Development Strategy could encourage a positive development if they are implemented in the right way, as they are meant to support innovation and a Europe that acts instead of just reacting.

A great deal of creativity and willingness to think of completely new approaches to solve these challenges will be crucial. We must ensure that we mainstream sustainability responses into the private and public sectors' core strategic planning, rather than continuing with 'business as usual' or creating limited 'end-of-pipe' solutions.

One of the most pressing challenges is climate change and the need to provide energy in a sustainable way to meet the continuously increasing demand due to growth in the world population and rapid industrialisation in developing countries in particular.

The scenarios developed by the Intergovernmental Panel on Climate Change project an increase in global mean surface temperature of 2.0–6.4 degrees Celsius above pre-industrial levels by 2100, increased incidence of floods and droughts, and a rise in sea level of up to 88 centimetres between 1990 and 2100.[1]

Not only are the potential impacts of climate change under business as usual scenarios frightening, the use of fossil fuel is also related to a number of other challenges that are of key importance for the future. Reducing carbon emissions is linked to higher resource efficiency that often results in a general reduction of resource use and thereby giving a broader contribution to other environmental goals. A solution to climate change will also address a chain of other important issues such as oil spills, oil/coal exploration in sensitive areas, international conflicts to secure energy demands, and even terrorism. As senior officials in the EU have stressed, "smart development" is more important than "smart bombs" for sustainable development.[2]

The EU has been one of the first to acknowledge the need to act. It concluded that at least a 15-30% cut in greenhouse gas emissions should be considered for rich countries by 2020 and reductions by 60-80 percent until 2050 have been discussed[3]. An unprecedented joint statement from the world's main national scientific academies (France, Russia, Germany, United States, Japan, Italy, Canada, Brazil, China, and India) in June 2005 urged the leaders of the G8 summit to commit to taking prompt action to reduce emissions of green-house gases, based on the principles of the UNFCCC (United Nations Framework Convention on Climate Change)[4]. To reach these reductions it is necessary to move beyond marginal improvements.

So far most of the focus has been on the supply side and energy efficiency in existing appliances. While this is enough to reach the Kyoto target it is not enough to reach the reductions necessary for keeping the temperature increase below 2 degrees Celsius in a situation where emerging economies like China and India will become leading global economies. To provide global welfare with dramatic reductions of CO_2 there is a need to look beyond marginal reductions. The inability to reach the necessary long-term reductions with the current focus in the EU is something that many experts have highlighted.[5]

The possibility to move beyond marginal changes is greatly enhanced by the increased use of Information and Communication Technology (ICT) in society. The move beyond marginal changes could however result in a move in both directions as ICT to a large extent can be viewed as a catalyst. ICT can contribute to the acceleration of the current trends, through everything from increased exploration of fossil fuel and more wasteful consumption through new marketing to more transportation due to ICT driven just-in-time-systems. The increased use of ICT solutions in the financial sector has shortened the decision making process, meaning that long-term issues may not always receive enough consideration.

A more strategic focus on ICT could however give a significant and sustainable contribution to the broader economic challenges that the EU is facing. The "Kok Report", of the High Level Group on the Lisbon strategy, highlighted that the possibilities for wider economic structures which can create a network economy and society and a fundamental re-engineering of business processes can be opened up by ICT. Opportunities exist for new business-to-business or business-to-consumer relationships; companies can become more networked, customer focused and agile. In a service-based society more value generation lies in research, innovation, distribution, financing, marketing and service rather than manufacturing the physical product. Knowledge and the potential of ICT penetration can enable this economic shift.

The Kok Report also concluded that neither Europe's knowledge society in general, nor the ICT sector, are as strong as they should be in order to achieve the Lisbon Strategy's vision. In patent applications, numbers of scientific researchers, universities' standing in international rankings, numbers of Nobel Prize winners or references in scientific papers, Europe trails the US.

> *"The European IT sector represents 6 % of European GDP compared with 7.3 % in the US[6], while European investment in IT capital goods has consistently lagged behind the US by around 1.6 % of GDP in the recent past[7]"*
>
> *Kok Report, 2004, p. 19*

So far the ICT sector and all the innovative people working in it have been almost totally excluded from the discussions about resource savings and CO_2 reductions. There is a huge opportunity to engage a sector that is used to rapid changes and employs many creative people. Given the right incentive structure this sector could become an important part in combating climate change. This is something that consultants in the sector have begun to realise.

The EU could support this as a unique opportunity to combine innovation, competitiveness and climate action.

> *Telcos are punching below their weight in the climate change arena - they can be part of the solution rather than part of the problem. Telcos will find it hard to avoid being victims of climate change, but they can reduce their role as villains; and they might even turn out to be heroes.[8]*

To encourage technology development and increased innovation in Europe the strategy for CO_2 reduction should not ignore one of the most rapidly changing sectors. A serious EU strategy must put technological development at the heart of any policy formulation; not only in traditional areas, but also in new areas where investment in research is among the highest.

This roadmap will not focus on the problems with a "business as usual" scenario; it will focus on what is needed to support the really interesting contributions where ICT can enable a break of current trends. Replacement of significant amounts of transportation, increased efficiency, dematerialisation, better understanding of different choices etc. are all important parts in a resource-efficient knowledge society. The roadmap is an outline and is meant as inspiration for further discussions where all relevant stakeholders obviously will be involved.

What role ICT will play depends on the choices we make. Today no strategy to support the use of ICT to reduce CO_2 emissions exists on the EU-level, or anywhere else for that matter[9]. This roadmap will make the case that such a strategy is necessary and hopefully inspire the creation and implementation of such a policy. The concrete cases described in this roadmap are based on already existing ICT solutions[10]. These cases clearly show that it is time to the ICT begin to act in order to realise this potential.

2. The project: "Saving the climate @ the speed of light"

"The private sector and civil society, in dialogue with governments, have an important consultative role to play in devising national e-strategies… Government, civil society and the private sector are encouraged to initiate actions and implement projects and programmes for sustainable production and consumption…"

World Summit on the Information Society, WSIS

2.1. Background

The project "Saving the climate @ the speed of light" is a joint ETNO-WWF initiative. It began in Budapest after the First European Conference on Telecommunications and Sustainability on 25-26 November 2004. During the conference it became obvious there existed many overlaps and interesting synergies between ETNO's and WWF's agendas for the sustainable use of ICT.

Encouraged by the support for joint initiatives that governments have shown in processes like the World Summit on the Information Society, a project for sustainable use of ICT was developed with a focus on reducing CO_2 emissions.

As many studies about ICT and sustainable development have been written and a number of actors talked about the potential, the project first did an overview of the progress so far. It soon became obvious that there was a significant gap between the academic studies and the policymaking. The studies generally discuss theoretical potentials and use unclear timescales. At the same time the policy makers need a clear focus, concrete examples and specific information a what needs to be done. This roadmap is to a large extent an attempt to overcome this gap.

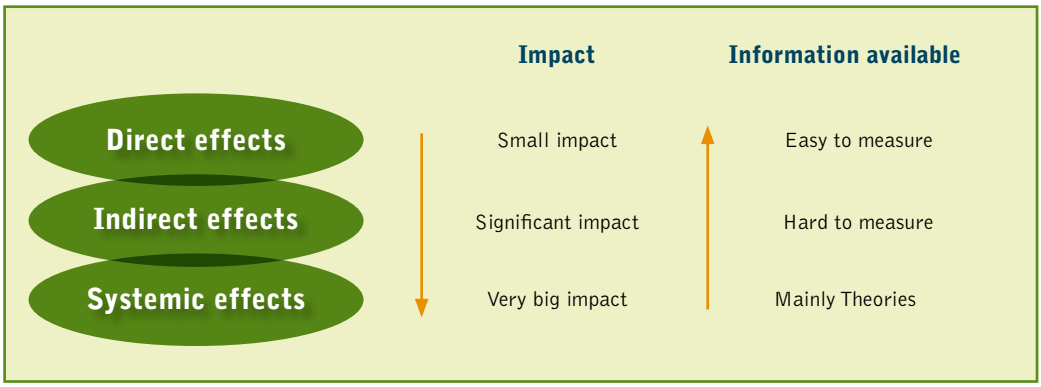
Direct-, Indirect- and Sytemic Effects

The fact that ICT can significantly reduce CO_2 emissions in many different ways is something that has created confusion. To understand the different ways ICT can contribute to reduced CO_2 emissions, and sustainable development, is important. The fact is that the biggest savings and most important contribution of ICT exist in areas where the least information is available. Using the GRI[11] language for the telecom sectors the effects of ICT can be divided into three different groups: direct, indirect and systemic (see Figure 1).[12]

Direct effects refer to those caused by ICT infrastructure and equipment, e.g. the resource consumption (including materials and energy) when producing ICT equipment, the energy consumption when using ICT, and the effects of the resulting electronic waste. In order to have a credible strategy resulting in increased use of ICT, the direct effects must be addressed[13].

Indirect effects derive from the existing use and habits that are fulfilled through communication-based applications. These can be both positive and negative. For example, the reduced need for transportation as a result of teleconferencing, or the increase transportation in just-in-time deliveries due to B2B applications, are examples of secondary effects.

FIG.1



Systemic effects link performance at the micro-level (e.g. organisational level) with economic, environmental, or social conditions at the macro-level (e.g. regional, national, or global level). They stem from new habits, social structures and consumption patterns that arise through the use of communication products, applications and services when they are used in society, such as the change in commuting distances and times due to potential mobile communication, access to information and the speed of technological development.

The problem indicated by Figure 1 is that two forces are pulling in different directions. The first force relate to the future and the search for the most important ICT contributions. This search for solutions, that can give significant contributions, has led actors to look for services with positive indirect effects that can contribute to significant systemic effects. The second force concerns to the unwillingness and inability to deal with complex issues among many actors. The current research structure has for example resulted in a lot of reports and projects that look into the direct effects, but very few dealing with the systemic effects.

To make things even more complicated, current vested interest, e.g. those responsible for transportation policy both public and private, have often tried to downplay the potential for ICT. It contributed to a situation where most of the discussion is circulating around the direct effects.[14]

Unfortunately these two forces have created a situation where most discussions and initiatives have gravitated toward the simple end of the spectra. Existing research methodology is easy to apply and media can understand and communicate these issues easily. As a result sophisticated approaches get very little attention.

This is especially serious as it seems to have contributed to a situation where many ICT actors are reactive instead of proactive when it comes to environmental issues. It has also resulted in a strong focus on the products instead of the services. Instead of providing solutions through services and considering environmental challenges as an opportunity, ICT's effect on the environment has been seen as a risk related to the products that must be managed.

As ICT can also contribute to sustainable development in different ways the picture becomes even more complex. While the direct impact is simple, the indirect and systemic effects will result from the implementation of very many different applications.

Travel replacement, De-materialisation and New Combined Services

The most obvious way ICT can reduce CO_2 emissions is the potential to reduce the need to travel and the transportation of goods. The use of video- and teleconferencing can dramatically decrease the need for flying and travel by car. E-commerce can reduce the need for transportation, if it combined with a sustainable logistic system, especially with a system that allows instructions/information to be sent to high-technology decentralised facilities where the goods are produced locally instead of transporting them all over the world, etc.[15]

Then it becomes more challenging as a large group of potential savings are more complex. We can talk about different ways to dematerialise the economy and focus on the service instead of the product. "Bits instead of Atoms" was coined by Negroponte in the mid 90's but never got much beyond academia. Sustainable consumption where we get increased welfare but with reduced material consumption is still a concept that is neither integrated into business strategies nor policymaking.[16]

We can also see how ICT can allow us to build our societies in more sustainable ways. Flexible work, decentralised production of goods and videoconferencing are just three applications that could help us build sustainable cities.[17] Sustainable cities, that are not just marginally, area a high global priority will, given that two billion people move into cities until 2030 and that for the first time in history more people will live in urban than rural areas. [18-19]

Both production and consumption patterns as well as urban solutions require us to think beyond

single solutions. We must start to think how different solutions interact. Without a clear vision, such as targets for reduced material consumption and CO_2 emissions, it is hard to see how this will ever happen.

On an even larger and more complicated scale ICT will interact with other technologies and enable new solutions that only exist in laboratories in the world, or even in someone's head somewhere on the planet, maybe in Europe or maybe in China or India.[20]

We must find options that are concrete we should enough to deliver direct results. At the same time open up new solutions and synergies with other initiatives that lead to further reduction by enabling new ICT services that can contribute to more substantial reductions both through indirect and systemic effects.

Climate change[21] is one of the most serious environmental challenges and action is needed now in order to avoid dangerous consequences. Until now almost all the measures to reduce CO_2 have focused on incremental improvements in existing systems. To make things worse these measures have often been perceived as a problem for economic development and not as the investments they actually are.

The introduction of ICT as a part of the solution challenges many of the old objections against climate action. Not only can these measures reduce CO_2, they can do so almost as a side-effect while increasing innovation, welfare, equity and competitiveness. But only if a strategy exists.

2.2. The assumptions for the project

The project rests on four assumptions: there is a need to act now, a strategy is necessary to ensure that ICT will help to reduce CO_2, we must have a clear focus and we need to scale up those existing applications which are already delivering good results.

The need to act

There is a growing consensus that temperature increases due to global warming must stay below 2°C. This implies a reduction of greenhouse gas emissions for the group of developed countries in the order of 15-30% by 2020 and 60-80% by 2050.

It should be noted that the 2°C level is a compromise reflecting a lack of leadership in politics and business. If we look at new research, including findings about thresholds, we might even need deeper cuts to avoid dangerous climate change. Regardless of the conditions for these targets, the fact is that most current emission trends are still increasing. If these targets are to be met, the time to act is now.

The need for a strategy

Without an effective strategy we will not only risk our climate, but also waste time and money. If the developed world is serious about its targets, it must create a structured opportunity for ICT to contribute to CO_2 emission reduction. In the European Union this means that a concrete strategy should be devised with goals, responsibility and budgets.

The need for a clear focus

We cannot continue promoting different ICT solutions for reduced CO_2 emissions randomly. Furthermore, certain infrastructures and services need to be in place before truly substantial emission reductions can be realised. Instead of hoping this will happen, parties must focus on strategies to ensure these infrastructures, services and applications become reality. Then it would be possible to reach a sustainable critical mass and get the multiplication effects needed.

The need to scale up

Small demonstration projects are important, but it is time to multiply resulting best practice on a European scale. These ICT applications that are multiplied should be chosen strategically. Such services should result not only in reduced CO_2 emissions; they should lead to further reductions by enabling other ICT solutions that can contribute to more substantial reductions.

2.3. The goals of the project

Three goals were chosen for the strategy in order to ensure the development of policy in Europe that supported sustainable utilisation of ICT services. The goals are meant to provide guidance for the work and provide a framework for the discussions with relevant decision makers in the EU.

Goal 1: ICT is recognised as an important part of the solution for combating climate change in Europe
Goal 2: Key actors have a climate change strategy for ICT
Goal 3: Concrete "ICT-Climate change" programmes are initiated in Europe by 2007

To provide further guidance the following preliminary indicators for these goals were chosen as a basis for discussion with decision makers. These might change by 2007, but then the project will explain why that happened and why the new indicator is better.

Indicator 1

There exists a written strategy for ICT and climate change on the EU level. This could be either an overall strategy, or individual strategies linked to key areas, such as energy, transportation, infrastructure and processes, such as the Lisbon and the Sustainable Development Strategy.

Indicator 2

Different relevant Directorate Generals (DGs) in the European Commission will have developed a joint paper, including an action plan that supports the use of ICT through key applications as a way of reducing CO_2. This joint paper would ensure that the cross-cutting nature of ICT is captured and that the more significant contributions that cannot be achieved within existing structures are not lost. It is also important to ensure that the work with sustainable ICT solutions do not fall between different areas of responsibility. Co-ordinated actions will be needed in areas such as industrial development, trade, transportation, energy and environment.

Indicator 3

Incentives (e.g. tax incentives, grants, loans with favourable interest rates, procurement strategies, R&D support) for a limited number of strategic applications will have been explored, and implemented by appropriate bodies. Effective incentive structures will often require a dialogue with member countries as many of the regulations are national or local.

Indicator 4

Relevant EU bodies will have set measurable targets for CO_2 reducing ICT applications. These targets could be both in relative terms, e.g. of a 30% reduction for 2010 (compared with 1990 emissions) a number of specified ICT solutions will contribute to 5%, or it could be in relation to the current situation, e.g. that videoconferencing will replace 20% of internal EU business travels by 2010. Linked to this could also be more technical targets, e.g. the most travelled destinations inside the EU could all have an ICT infrastructure that allows high quality videoconferencing to take place. Obviously the different EU bodies should report their use of ICT and how they have used it to increase efficiency and reduce environmental pressure. The important thing is to set a clear target for sustainable ICT applications on a European level. Experience shows that clear targets trigger innovation and we have seen that even discussions about a target have triggered interesting responses with concrete suggestions such as the possibility for the European Investment Bank (EIB) to provide credit lines for ICT applications that reduce CO_2 emissions.

In this document a number of targets are suggested. As reducing CO_2 emission with ICT is a new area these targets might be either too low or too high. They are however based on measures on savings in already existing and implemented solutions, so the savings potential should be in the right order of magnitude. Even if the targets would be off base, their assessment would make it possible to set more adequate targets based on deeper understanding of the role of ICT. The EU can no longer afford to ignore the important role that ICT will have, either positive or negative.

3. The opportunity of ICT services to reduce CO_2 emissions

To grasp the opportunities that ICT services offer, we must start to think in new ways. We must focus on the service we want, not the product we use right now to provide this service. We are often stuck in traditional thinking and if cars contribute to CO_2 emissions we usually spend most of our resources on how we can make the engines more efficient, maybe we are also looking into new fuels. But we need to ask why people use the car? Is there a better way to reach the same goal with a different service? Would a a working public transport system that is flexible and well working due to ICT be better. Sometimes getting to the office or to a business meeting is just a habit, but for doing the job it may be unnecessary if the person has access to a connected computer.

Below are concrete examples of services that are available today and that have been implemented on a small scale. Each of the examples is briefly described and for each we have graphically shown what could happen regarding CO_2 emissions if we scaled up the use of these applications.

It should be stressed that these applications are actual services that were implemented in reality and therefore in non-optimal situations. Obviously it is never possible to reach the theoretical potentials but the reduction could be bigger given more favourable flanking measures, such as better information and economic incentives.

These reductions should be seen only as the beginning. If we start to scale up these applications, the it could lead the way to new and more significant reductions as urban planning starts to as integrate them from the beginning and as companies start to integrate sustainable ICT use in order to provide sustainable welfare.

As many of these solutions depend on individual choices it is important to introduce them in a way where there is a dialogue, so people and companies are not forced to do things they don't like. Instead they should be informed about the potentials. To ensure this, resources must be provided for awareness raising. Furthermore, studies on what incentive schemes that people see as the best will play an important role.

We have sorted the different solutions in three categories.

First those services which are usually be discussed. These solutions usually make work more efficient, reducing costs as well as travel and CO_2 emissions.

The second are solutions where people get a similar service, but dematerialised and usually with improved quality. So instead of something physical the service depends on the existing digital network.

Finally third category offers solutions which are more complex and have many different positive implications. These solutions not only replace an old service by a more efficient one; they create new kinds of systems that in turn create new and added value. When we moved from oxen to a mechanic agricultural system, we obviously got much more than a reduction of oxen. The increased capacity in the agricultural society was part of a change that brought us the industrial society. No one would talk about «de-oxification» today, but for people who saw the ox as the reference this might have been a way to describe the situation. Even if we are used to the industrial society today, we must look beyond what ICT can replace and see what new opportunities, but also challenges, a more resource efficient society will bring.

The case studies included in this roadmap were selected because they are real-world examples, not simple ideas about what kind of technologies and solutions might be available in the future, and as such they can be implemented immediately. All cases have also been through third party verification. They were selected because of their simplicity in that they can be easily integrated straight into existing systems without additional supporting structures (neither technical nor administrative). Additionally, many people can already associate with them intuitively, recognising that these solutions can save resources. Finally, despite being simple, they are able to 'open the door' to other more sophisticated solutions. The fact is that if ICT applications are more closely aligned to CO_2 reductions, customers or society, business and industry and politics will look for more, thus opening up the market for more applications – such as intelligent heating, production on demand, etc.

3.1 A new and more efficient meeting culture: Travel replacement[22]

The first two applications relate to reduced travel. This potential is probably the most obvious way that ICT can contribute to environmental gains, including CO_2 reductions. Often the service required is not to move someone from one place to another, but to enable people to meet for a specific reason. Of course people need to meet in person from time to time, but often, especially in case of routine meetings, physical meetings can be substituted by virtual meetings. In other words no one argues for the substitution of all existing meetings with virtual meetings, but for a system where the actual need, improved efficiency and better quality are achieved. In such a system the number of physical trips can be reduced significantly.

While the dematerialisation of goods and promotion of local production differs between sectors and the services they provide, meetings between people are quite similar in different sectors. This can be seen on the broad, but still small use of virtual meetings that now happens. The use has not been primarily driven by environmental concerns, and will likely never be. The reason companies use virtual meetings today is often because because it can help them saving money, increasing efficiency and reducing many risks associated with travel.

The fact that reduced resource use is not the prime driver makes it important for government agencies to take on a special responsibility. As most market actors are under economic pressure to deliver short term profit to shareholders and not potential long term gain, they tend to discount future costs. Many market actors, ICT companies, financial companies and others are unable to orientate their business towards a situation in the future whereby we have natural resource constraints. It is therefore important that governments and/or not-for-profit actors invest in infrastructures that ensure the delivery of services that society needs, i.e. providing welfare with greatly reduced resource consumption. It is obvious that countries like China and India can not follow the development path of Europe.

Instead we must work together to support a new industrial development in the emerging economies at the same time as the EU makes a transition to a sustainable knowledge society. In this process Europe must ensure that it decreases its ecological footprint and increases its competitiveness at the same time.

To enable a new communication network to play an important role it must reach a critical mass. The incentive to use it, also follows a logic different from that of the traditional industrial economy. The more people use video conferencing, the better for everyone since it increases the usefulness of the service. This can be contrasted with road transport where the increased use and number of cars result in congestion and reduced welfare.

Reducing travel will imply changes in the business culture. Companies should be encouraged to limit business travel those cases that are essential for corporate needs and not use it as an incentive or bonus.

There are also other issues that need to be addressed in order to enable a significant shift from physical to virtual meetings. Many people today are used and educated to deal with physical meetings, their negotiation skills and presentations are based on a physical meeting. A new generation should be encouraged to develop similar skills using virtual meetings during their education and within the companies. Finally the issue of security and quality needs to be addressed. People must be able to have meetings without other people being able to listen to conversations and it must be quick and simple to get a high quality, if possible large scale, projection that creates a feeling of joint participation in the meeting.[23]

Videoconference

"Videoconferencing is an interactive tool that incorporates audio, video, and computing, and communications technologies to allow people in different locations to electronically collaborate face-to-face, in real time, and share all types of information including data, documents, sound and picture. In essence videoconferencing removes the barrier of distance that separates us."[24]

For years and even decades the potential for videoconferencing has been discussed. Today however the bandwidth is available, technology to ensure secure transmissions exists and prices make a commercial break through possible.[25]

An important trend that could enable a shift towards virtual meetings is the increasing number of companies having meeting departments instead of travel departments in order to ensure that the most efficient way of meeting is ensured within the company.

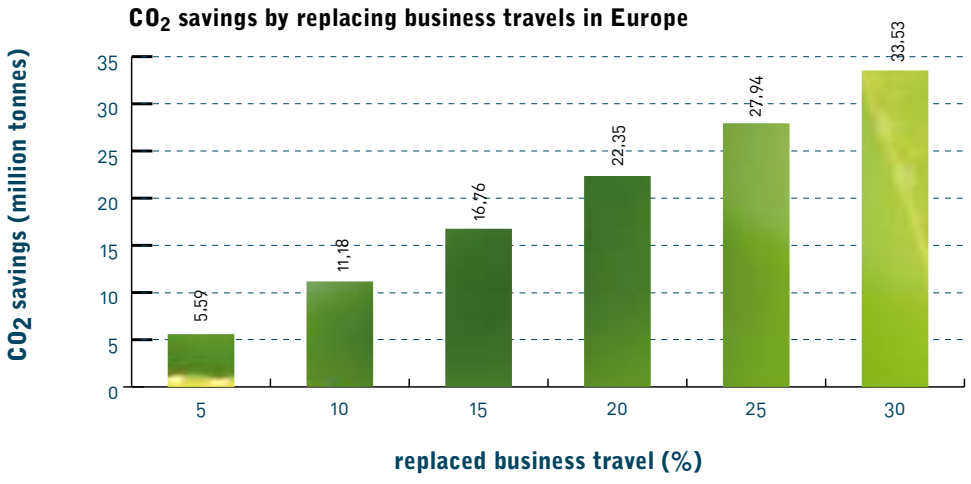
As environmental aspects of videoconferencing are almost never key to the decision to use it today, it is important to ensure that the factors guiding the decisions to use videoconferencing are supported[26]. This implies that information about potential economic savings, increased efficiency, the standard of a new generation of equipment, etc. are communicated and best practices spread.

> *The environmental impact of an international conference [...] is clearly dominated by the travel activities of the participants. Among travel activities, the long-range flights are the dominant element. Minimising air travel is thus the only way to attain a significant reduction in environmental impact.*[27]

Today, many actors are offering different options to reduce climate change. However, there should be a focus on solutions which allow a real change in travel practices for example, rather than options, such as forest plantations that are useful but may not represent a long term solution.

Until today no one has made the direct link to investments in videoconferencing, even if that would address the core problem instead of only postpone the need of a change in the travel patterns of today.

Existing videoconference solutions indicate that if 5 – 30% of business travels in Europe was substituted by videoconferencing, more than 5.59 – 33.53 million tonnes of CO_2 emission a would be saved.[28] Based on the German experiences, a 20% reduction of business travel in the EU through video-conferencing could save 22 million tonnes of CO_2, that also could be a possible annual target for 2010 if the right measures where to be put in place.



It is time to stop opposing virtual meetings to physical meetings, both have a role to play. What we should do instead is to look at the efficiency, cost, environmental improvements that new business models as well as solutions can provide. One interesting option is the use of decentralized conferences, which take place at several locations and which are connected to one another live by suitable telecommunication facilities and supported by groupware that would make a face-to-face meeting more efficient. This could result is significantly reduced air travel.

Audio-conference

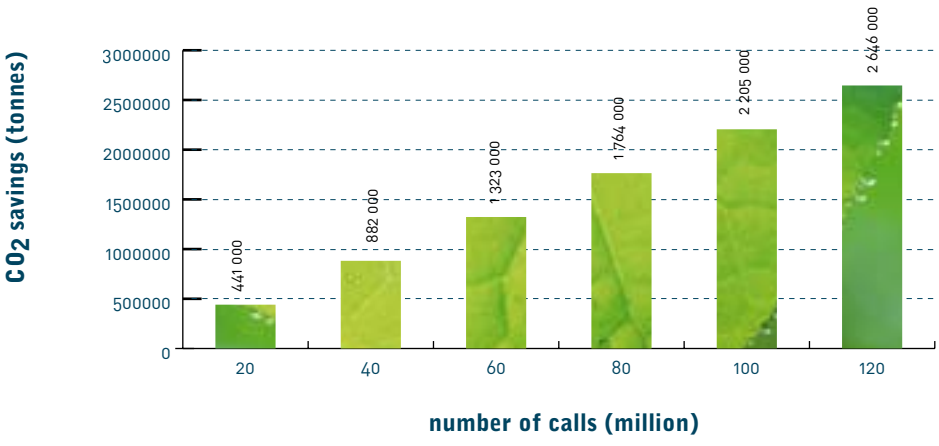
A conference call is a call in which three or more parties interact simultaneously. In the main, it is a very cost effective way to reduce travel expenses, and the emission related to it.[29]

Even if videoconferencing is what most people think about when it comes to ICT's potential to save travel, we should not forget audio-conferencing. In many situations a simple and working audio-conference system can save travel. The border between audio and videoconferencing is also increasingly blurred. By using new applications all participants in an "audio-conference" connected via the web can look at the same document on their screens simultaneously, for example.

Based on existing and on used audio-conference solutions, where the amount of travel replaced by audio conferences has been calculated, we can see that if 30 million audio conference calls were made it could save 661 500 tonnes of CO_2 and if 130 million calls were made it could save 2 866 500 tonnes.[30]

Based on the UK's experience, a target for the number of audio-conference calls made to replace a physical meeting could be set at 96.5 million by 2010. This would be the equivalent of having one (1) physical meeting per year replaced for 50% of today's employees in the EU-25 countries. This would result in savings of approximately 2.1 million tonnes CO_2 per year.

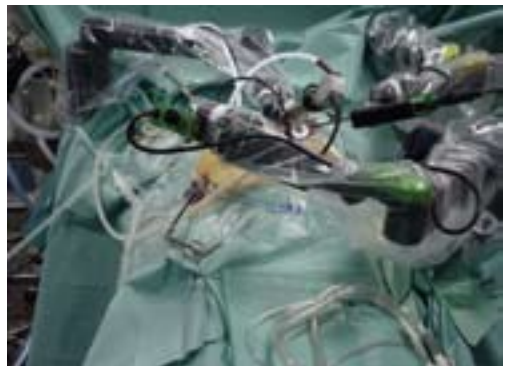
CO_2 savings according to the audioconference calls



Other areas

By setting targets and promoting video and audio conferencing opportunities, other gains could also become possible. By motivating a shift in thinking, from the traditional ways of providing meetings to new services that enable increased efficiency and effectiveness, plus reduced costs and environmental impact, companies will start to look at other solutions that are able to replace the traditional forms of transportation. Future targets for the use of ICT could then include incentives that encourage companies to use for example telemonitoring.

Tele-education is also an area that could grow rapidly, not as a substitute for traditional education, but as a complement to it. It could improve the quality of learning especially in more specialised and advanced subjects. Lectures in these fields could be provided to those who, due to existing infrastructure, are physically isolated today. Postgraduate studies in parallel with a career could provide people with life-long learning without having to travel.



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For equity as well as innovation, solutions could be provided that allow children living in rural areas to have the same quality of education as children in urban areas. Simple things like language lessons could be more easily solved, especially if schools in different countries would be contacted in this type of cheap solution regularly. Though less the opportunities in tele-education are high and not utilised, the topic of urbanisation is already on the table.

One important area in an aging Europe is the use of different kinds of tele-medicine, tele-care/remote assistance services. Safety and health will always be the first priority in health care but by providing new ICT based working infrastructures, once people get used to the new technology, new solutions will be possible. The reduced need to travel, plus overcoming the reluctance to go to the doctor that many people have today when they have to take time off could open up doors to preventive care that could reduce unnecessary suffering and waste of resources. This could also help to reduced inequity between urban and rural areas.

3.2 Sustainable consumption: De-materialisation[31]

If we move one step away from the most obvious savings in travel and examine how ICT can provide higher welfare with a smaller ecological footprint, we come to sustainable consumption. Much of what we, in the industrialised world, need and enjoy has a large ecological footprint. If the world over the next decades increases its population by around 50% from its current six billion to nine billion, and if we succeed in lifting people out of poverty, we need to think about new ways to provide welfare using natural resources.

Below are three concrete examples where equal or better services are provided with dramatically reduced environmental impact. The last two are relevant to the ongoing transformation to e-governance, something that so far has hardly been discussed from an environmental perspective. Each of them will obviously not provide any significant contribution to the CO_2 reductions. Instead they should be seen as indicators of the ability to promote a broader development where dematerialisation is encouraged. Incentives that encourage such development should be a cornerstone in any policy for a sustainable competitiveness that allows companies in Europe to develop worldwide solutions. In this way, Europe can become more competitive, move into new emerging business areas, reduce its own footprint and build an export industry that contributes to sustainable development in other countries instead of undermining it.[32]

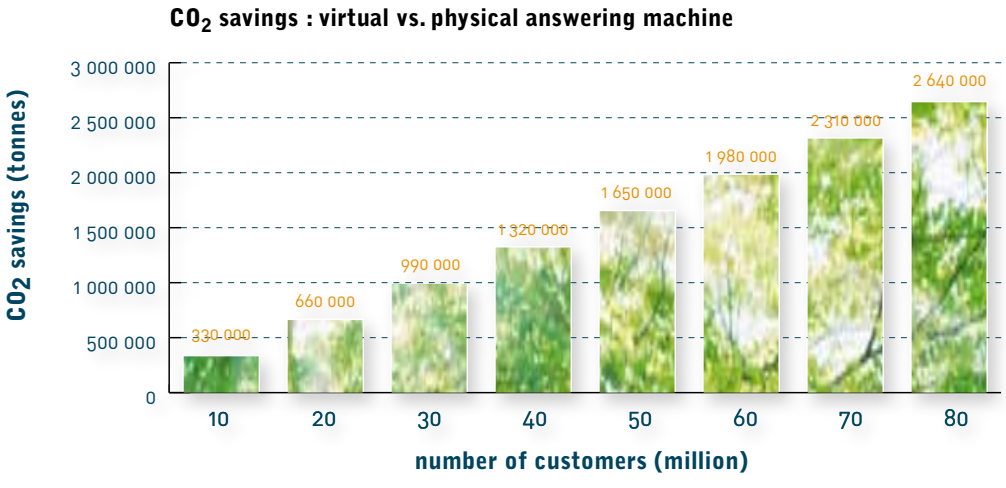
Virtual answering machine

Virtual answering machines provide the opportunity for the customer to receive messages when not available, but the messages are not recorded by physical additional equipment, but by the operator. Usually it is also able for fax services.

An example of dematerialisation is the virtual answering machine. In large parts of the world people will never see an answering machine. The mobile revolution has helped people to move straight to dematerialisation and increased resource efficiency in many ways.

Existing and implemented virtual answering machines indicate that if 10 million customers shifted from traditional to virtual answering machines, then 330 000 tonnes of CO_2 could be saved, 90 million customers could achieve 2 640 000 tonnes CO_2 emission reductions.[33]

Based on the success with virtual answering machines a target could be set that 20% of households in EU-15 countries (31 million) should have one physical product replaced by a virtual solution (in case of virtual answering machine this would mean more than 1 million tonnes of CO_2 reduction). This target would include industries that sell customer goods and encourage them to dematerialise. The target should also be accompanied by a campaign showing how to protect the planet through new solutions that increase the welfare if we have an intelligent development of our technology.



Online phone billing

Online billing is a service when the customer receives the bill electronically over the web instead of printed on paper and dispatched by ordinary mail service. This enables people pay their bills over the net.

Online billing is increasingly popular. It is a good example of the positive effects dematerialisation can have. Not only does it make companies more cost efficient, there are also many savings for the environment. Less paper, less transportation, less energy use, and less physical infrastructure are needed to deal with the distribution of the bills.

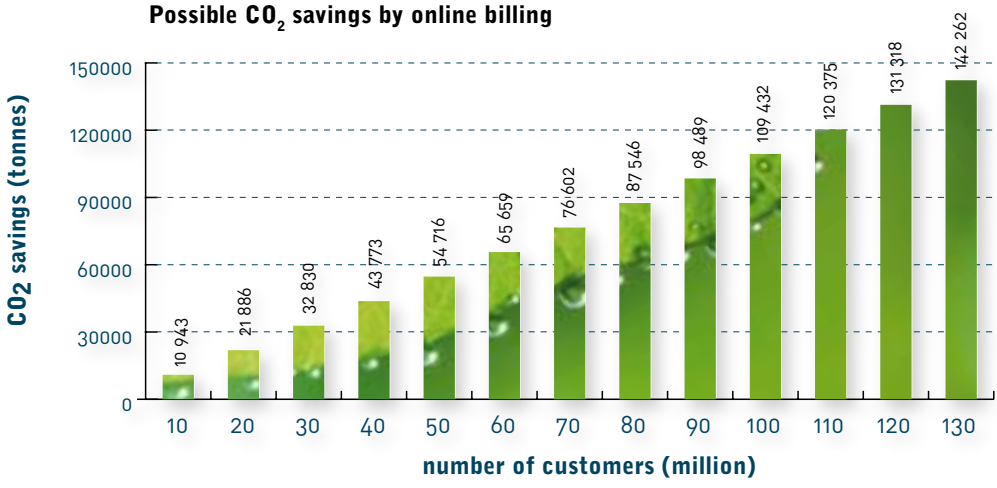
Existing and implemented online phone bill services indicate that 10 million customers could save 10 943 tonnes CO_2 and 90 million customers could save almost 100 000 tonnes.[34]

These calculations take into consideration only the phone bills, but people also have electricity bills, water bills, subscriptions, etc. Most of these could be moved to online billing.

Supported with the right incentives, a shift towards online billing could be a part of a more general development towards a more resource efficient society. Not only does online billing save transportation of the bills to your home, but it also allows companies to reduce cost related to storage of the bills. When bills are moved to the web, people can manage them from any place.

To contribute to a more resource-efficient society, a dematerialisation target should be set. One concrete target could be that 20 % of companies that send out bills to more than 100 000 customers should offer these customers the option to pay their bills over the web or through their mobile phones. The companies should also be encouraged to find new ways of dematerialising their services.

At least 500 000 tonnes of CO_2 should be saved through these ICT measures.



Web-taxation

Web-taxation is a system where citizens are given the opportunity to report on their tax affairs via the web.

Web-taxation is another example on how paper, transportation, office as well as storage space cost can be reduced. Many countries set the same deadline to hand in the tax declaration, which can contribute heavily to congestion.

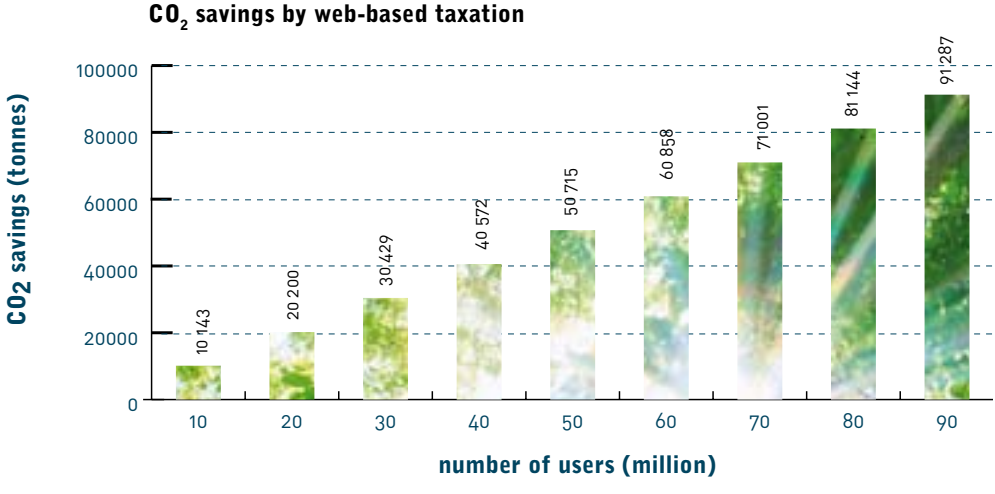
Web-taxation is interesting as it can be seen as a way of introducing environmental resource efficiency onto the e-governance discussions. A lot of papers that are currently mailed could be moved to the web. People should also be able to get help over the phone or through the internet. The responsibility of governments to build resource-efficient solutions and contribute to reduction of CO_2 emissions have so far been almost totally ignored. Information, clear targets as well as incentives are necessary to drive this change.

Existing and implemented use of web-taxation indicates that if 10 million customers shifted from traditional taxation to web-taxation once a year, then 10 143 tonnes CO_2 emission could be saved; 90 million customers could achieve 91 287 tonnes CO_2 emission reductions.[35]

To encourage more environmentally friendly development of e-governance and support authorities and governments to contribute to reduced CO_2 emissions in their e-governance, a target should be set that 100 million citizens in Europe are given the opportunity to take advantage of e-governance in a way that improves the service and saves CO_2 at the same time. At least 500 000 tonnes of CO_2 could be saved through these measures. This requires more measures than web-taxation, but with the increased commercial use of ICT to deal with payments, reporting and transactions this goal can be easily reached.

Other areas

By setting targets for dematerialisation the incentives to move the focus from products to services, from such easy solutions like video on demand (online downloadable films) instead of VCR-s and DVDs, or music on demand services (online downloadable music, albums) would increase. While these measures could help us to reach a reduction of 500 000 tonnes of CO_2, significant reductions are around the corner with existing technologies such as electronic paper.[36] The European initiative, Illiad, is interesting and the potential to save significant amount of resources should be explored[37]. With the experience of the failure of the paperless office, increased pressure on the world's forests and the growing understanding that innovative solutions are needed to allow China and India grow to high income countries, better supporting measures should be implemented to ensure dematerialisation.



3.3 Sustainable Community/City planning: Combined measures[38]

While environmental gains related to transportation and dematerialisation are relatively easy to understand and envisage, the more significant reductions will come from solutions that combine different kinds of saving. The case of flexi-work is one that, in a quite simple way, indicates the kind of multidimensional savings that future ICT services can bring.

Flexi-work

Flexi-work (also called telecommuting or telework) is the ability to do work at a location other than the work office.

The obvious saving due to flexi-work is through reduced travel. However, the savings from flexi-work are not only related to the reduced work-related travel. Most studies actually indicate that reduced need for office space will yield the biggest savings.[39]

Looking at long term consequences we can see that this can lead to the development of new urban solutions based on reduced need for physical transport and significantly less office space. In Europe this will take time as much of the old infrastructure already exists, but for rapidly growing economies such as China and India this could lead to dramatic savings compared to traditional industrialisation, especially if these measures are combined with highly efficient buildings or even buildings that are net energy producers.

If we look at Europe, the employment ratio in urban and rural areas, the overcrowded traffic and infrastructural problems in the cities, flexi-work should be considered. There are many good reasons to rethink current forms of employment, and question model of building cities that focuses on the construction on roads, parking spots and other infrastructure related to car transport.

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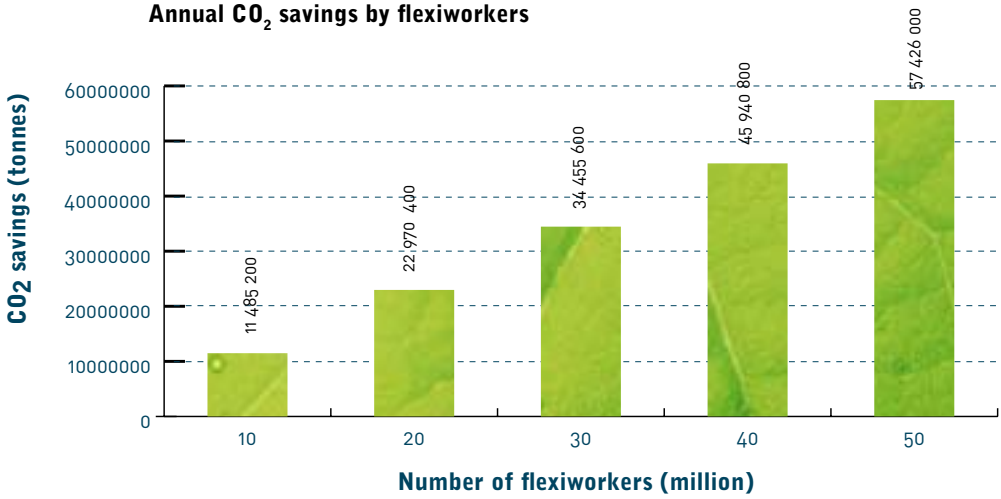
If we had the possibility to work from home 1 or 2 days per week in cities, or just start working at different times, we could definitely decrease the rush hours which result in unnecessary emissions in most major cities around the world.

Existing and implemented use of flexi-work indicate that 10 million flexi-workers could result in savings of more than 11 million tonnes CO_2 emission, while with 30 million flexi-workers it is possible to achieve more than 34 million tonnes of CO_2 savings.[40]



To encourage more flexi-workers a target could be set that 10% (19.3 million) of EU-25 countries' employees became flexi-workers by 2010. This would result in approximately 22 million tonnes of CO_2 reductions. This is a very ambitious target, but a move towards a knowledge society with improved life quality should make this possible. Many people in sectors that do not traditionally see themselves as suitable for flexi-work are in a transition period and need further education. This education could take place at home or close to the home in order to reduce the travelling, especially at peak hours.

Other areas

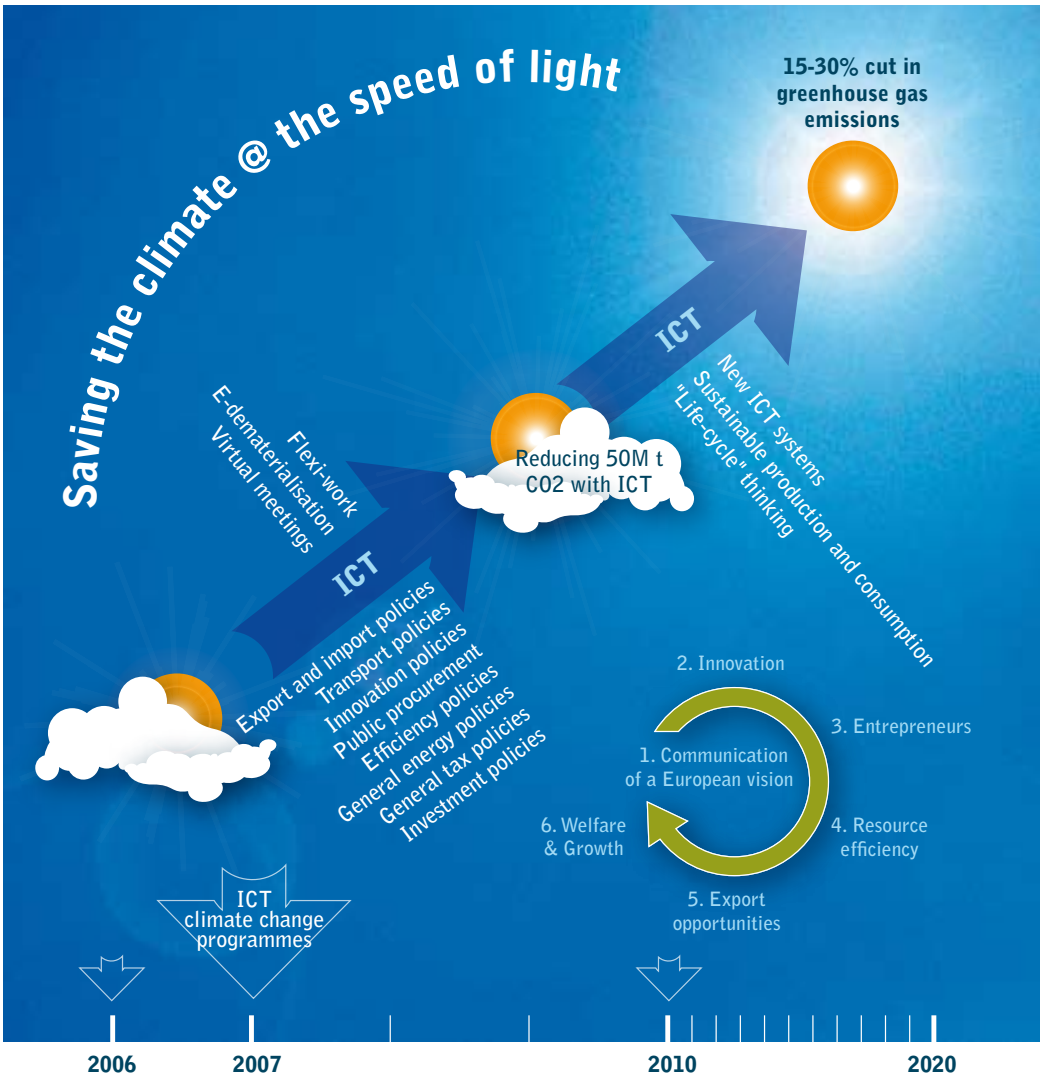
In this area the opportunities are almost unlimited and many times it gets easier and easier to add savings and new solutions to each other as people get used to "living intelligent" and as infrastructure is in place. The new solutions span over many different areas that will open up new business opportunities: flexible car ownership, e-commerce, intelligent heating of buildings, e-business are only a few fields that have great potential and that will be explored in the second roadmap of ETNO - WWF joint initiative. These opportunities will play an important role in increasing welfare while at the same time contributing to significant CO_2 reductions and increased competitiveness in the business sector.

Much of the savings will also be related to things that most people will never need to think much about. Intelligent houses where the architects have planned windows and local trees to make sure that they contribute to an optimal temperature all year around. Then the actual heating/cooling system is connected to the weather forecast system and is working together in order to reduce the need of cooling and heating. Not only the energy consumption can be reduced, peak demand can also be reduced. It is also possible to combine this with a system whereby ICT can be used to balance locally produced energy outputs (wind, solar, bio and fuel cells) that are fed into national grids. The mobile phone can provide recipes that are based on what is available at home and recommend those groceries that are fresh and are locally produced in order to minimize transportation by checking barcodes or RFID tags on them.

Innovation will play a key role in achieving an equitable and environmentally sustainable development in Europe and globally. Without ICT it is very hard to see how this will happen, because it implies a dramatically reduced material demand. With ICT the work for sustainable development can be as exciting and inspiring as it has the potential to be. Sustainable development has been seen as something that is separate from business development and innovation for too long. The role ICT can play in combating climate change shows how outdated such a perspective is. In order to make this happen leadership is however necessary to ensure that current structures are able to grasp the opportunity.

4. An e-strategy for CO_2 reductions in Europe

An e-strategy for CO_2 reductions in Europe should be based on agreed targets, science and the precautionary principle. Europe's international footprint should also be considered in the strategy. This implies the need to reduce CO_2 emissions in the EU by about 30 percent by 2020 and by 80 percent by 2050. Innovation and technological development that result in goods and services that can be exported and help other parts of the world to increase their welfare should be encouraged.



The strategy should be developed in 2 steps.

- The first step is a concrete target for 2010 with a specific number of tonnes CO_2 based on the implementation of a few strategic ICT applications. A number of supporting targets should also be set, all of which should be measurable.

- The second step will include more services and system solutions, where a number of services are combined and a more ambitious target is set.

The fist target would not give a very large contribution, even if it is significant compared to other CO_2 reduction measures in the EU, but it would be crucial to pave the way for the second target where more significant reductions can be realised.

4.1. First steps for 2010

50 million tonnes CO_2 reduction per year with ICT by 2010

Tools:

- **Virtual meetings – reducing around 24 million tonnes CO_2 / year**

  Examples:
  audio- and video-conference applications
  In Practice:
  – Audio-conference: half of EU-25 countries' employees replace one meeting with one audio-conference call per year: 2.128 million CO_2
  – Video-conference: replacing 20% of business travels in EU-25 countries 22.35 million tonnes CO_2

- **e-dematerialisation – reducing around 4 million tonnes CO_2 / year**

  Examples:
  online-billing, virtual answering machine, web-based taxation, e-governance
  In Practice:
  To reach the target an EU-wide e-dematerialisation campaign is necessary by encouraging the measurements, establishing labelling process for goods from product to service.

- **Combined measures / Flexi-work – reducing around 22 million tonnes CO_2 / year**

  In Practice:
  10% of EU-25 countries' employees become flexi-workers 22.17 million tonnes CO_2

This reduction of 50 million tonnes CO_2 is small compared with the potential for ICT solutions, but it is still more than the CO_2 emissions from the transport sector in Austria and Finland combined (The two countries holding the EU Presidency in 2006).[41] The significant contribution will however come in the second step where a more comprehensive approach is developed.

Policy revisions for the target

For each of the following areas the policies should be explored to see how they could promote sustainable ICT use:

1. general energy policies
2. general tax policies
3. public procurement
4. transport policies
5. efficiency policies
6. investment policies
7. innovation policies
8. export and import policies

Supplementary, parallel actions

In order to ensure optimal delivery and maximum synergies with other policy goals it is important that the ICT strategy is developed within a broader context of sustainable development. Even if the goal relates to CO_2 reduction, the positive side effects and the necessary supporting measures must be included. After discussions with different stakeholders in the EU we believe that the project has the potential to contribute in the following areas:

These six areas are all linked to the goals of CO_2 reductions and can in a simplified way be described through a development circle (see below).

Possible targets for supplementary, parallel actions.

For each of the supplementary/parallel actions targets could be set. Below are suggestions based on discussions with key stakeholders in the EU.

1. Communication of a European vision

Many people are unsure about the direction taken today and react with fear to the changes we are going through. We believe that the ICT-project could be part of a positive communication package that inspires people and shows how challenge can be turned into opportunities.

1.1 In order to engage the ICT sector a targeted public campaign that highlights its potential to contribute to key social challenges would be appropriate. Companies and individuals should be encouraged to come up with new solutions to these challenges. This could be linked to a competition where the best suggestions are not only given a prize, but also become implemented. In particular, young entrepreneurs who have never been engaged in sustainability work should be targeted.

1.2 As the challenges that EU face are not unique innovative ways of dealing with them, such as an ICT-project, should be communicated in countries outside the EU as well. For this to work it is important that the EU institutions take the lead in using ICT services that reduce CO_2 emissions.

2. Innovation

The project builds on innovation. The ICT sector is one of the most research-intensive sectors, where new solutions are presented to the market. Sustainable innovation will be key if the challenges of today are to be solved.

2.1. In order to encourage innovation (and entrepreneurship) a website could be opened where services that can help to meet the target are welcomed. This website could be in the form of a "sustainable developers' zone", i.e. a place where ideas are not only presented, but also developed. This could be linked to business actors who are interested in developing these solutions. Joint initiatives with business actors will also be crucial. It will be important to link SMEs to the initiative in order to ensure that not only large players are involved.

2.2 A number of technological breakthroughs are around the corner. The EU should be prepared for the positive and negative effects these might bring. This includes everything from high quality digital paper to fuel cell batteries that could allow many small applications to be disconnected from the power grid forever.

3. Entrepreneurs

Sustainable Europe needs entrepreneurs. Many ICT companies are small but growing rapidly. New business models make it possible to build companies in innovative ways and take advantage of networks and open source schemes that can provide solutions also to global public goods.

3.1 The global dimension is key in the climate change work and initiatives that contribute to sustainable export should be encouraged. Existing export promotion initiatives should be involved in the e-strategy development.

3.2 The current education and employment system is often built on an industrial logic that is not always able to develop the kind of solutions needed. Areas that could be explored include sustainable design, urban planning, 'from product to service' perspective, software development and construction.

4. Resource efficiency

Many ICT solutions are implemented as they save resources. Even if the primary incentive is economic, the links to natural resources are often easy to make.

4.1. For larger investments in urban infrastructures ICT solutions for increased resource efficiency should be included.

4.2. To strengthen the EU's knowledge base is crucial. The need to explore new opportunities as well as possible rebound effects is important.

4.3. To promote a broader use of sustainable ICT-solutions, there is a need to develop standards for calculating the gains. A way of communicating the positive effects of dematerialisation should also be explored.
Even if creating a label would take time, there are a number of products that can be dematerialised where both private customers and business would like to know how much CO_2 they saved.

5. Export possibilities

It is important that the EU finds areas where competitive advantages exist. In ICT the EU is leading in a number of areas and these could often be strengthened through a sustainability perspective.

5.1 In countries like Japan, US, South Korea, China and India a lot of work in the fields of ICT and resource efficiency is taking place. R&D initiatives, student exchanges or joint ventures should be encouraged.

5.2 One of the areas in the 2010 strategy that are successfully accomplished should be communicated to the world as an example of how technological innovation can help reduce CO_2 emissions.

6. Welfare/Growth

Where new jobs will be created is a key issue and something that must be included in all major projects.

6.1 During the process it is important to see how more and better jobs can be created. An evaluation should be conducted to see if the development of an e-strategy resulted in increased employment, especially in new companies or growing SMEs.

6.2 ICT also provide opportunities to measure welfare in a better way where qualitative aspects can be captured in a better what that through aggregated measures like GDP.

4.2. Second step for 2010: ICT-Climate change target for 2020

The target for 2020 should be set before 2010. It will include new services and system solutions, where a number of services are combined.

- ***Solution target.***

  During the first phase a strong focus should be on collecting suggestions for new services and possible targets for the 2020 target.

- ***Possible focus areas:***

- **Sustainable consumption**
  - Further dematerialisation
    E.g.: e-paper, music on demand, video on demand, Internet TV, etc.
  - Indirect effect on sustainable consumption by information
    E.g. intelligent products that can inform users about optimal use and give feed-back about the environmental impacts of different choices.

- **Sustainable production**
  - Decentralised production
  - Production on demand e.g. printing books on demand
  - Converging technologies e.g. nanotechnology, biotechnology, robotics

- **Sustainable community / city planning including travel replacement**
  E.g.: intelligent buildings, smart public transport systems, tele-monitoring, tele-education, tele-medicine, tele-care services, flexible car ownership, e-commerce, e-business, etc.

4.3. Creating a robust strategy

ICT as a tool for sustainability is still something new. It is therefore important to think carefully when ICT projects are implemented. Many people will be sceptical and it is important that responsible actors listen carefully to their concerns. Below are some of the areas which should be avoided and should be taken into consideration.[42]

Avoid exaggeration

When encouraging the development of a sustainable ICT society, it is tempting to give examples of perfect solutions to today's ecological and environmental problems. Unfortunately, many of these solutions only work under ideal conditions, and their performance under other circumstances can prove counterproductive.

There are two main reasons for the exaggeration of ICT's performance. Firstly, many of those working with ICT are used to talking about efficiency gains of hundreds to thousands of times, and about entirely new ways of solving problems, and understandably want to push the limits. Regrettably, unforeseen, events may be overlooked when the focus is on the highest possible number in a best-case scenario.

Secondly, in order to attract investors and customers, those involved in the development and construction of new ICT-enabled products must be heard loudly and clearly in the market. The easiest way to attract attention is to communicate the simplest and most positive numbers – even if these are only valid under certain assumptions.

To strengthen the robustness of the ICT system, three factors should be included in all discussions about new ICT systems and products: possible technological and human errors, feedback mechanisms, and a "cradle to grave" perspective. If all three factors are included, there will be an improved chance of obtaining solutions that resemble dynamic living systems. ICT systems would then be able to handle a vast range of disruptions – however, everything has limits, and when those are reached, the system breaks down.

1. Technological and human errors

One good example of where ICT's potential to solve important problems must be dealt with in a responsible manner is product tagging, i.e. providing products with their own identification card. This technology will probably revolutionise the way our economies work, as well as improving environmental protection, making a significant contribution to production efficiency and inventory. At the same time, the introduction of new technologies should not be used as an excuse to delay or halt the phase-out of toxic substances. Keeping this precautionary principle in mind, even a robust ICT system controlling toxic chemicals should not include chemicals harmful to the environment.

Often the parts of a larger system may function effectively, but when errors are encountered, problems such as the "Nimbus-7- blindness" might occur. This name refers to a satellite that was measuring the ozone layer effectively and correctly, but the low values that it was reporting had been covered up by a computer-program designed to discard sudden, large drops in ozone concentrations as "errors".[43]

It is easy to design a system that works well in a perfect world, but it is hard to design a system that works well in the context of technological and human error. In every important system, such as systems responsible for energy supply, or toxic measurements, there should therefore be fully redundant back-up systems, as well as alternative ways of solving the problem, including non-ICT solutions. Instead of aiming for perfection, in most cases it is better to have a system that is slightly less efficient, but that is robust and which can deal with a wide range of errors.

2. Feedback mechanisms

A robust system must be built so as not to encourage a strengthening of positive feedback mechanisms.[44] Furthermore, it must be able to handle unforeseen inputs and treat them in a systematic way. As sudden changes in both ecological systems as well as in society over the coming years can be anticipated, there must be room for unexpected events in all large ICT systems.

3. "Cradle to grave"

All systems and products must be designed with a "cradle to grave" or "life cycle" perspective, whilst clearly disclosing what parameters are used and under what conditions they are supposed to work. In the ICT world, the speed of change is sometimes so rapid that many people forget that many structures will exist for a long time.

5. Possible next steps

The next steps will depend on if actors in the EU are willing to go from word to action, using this report as inspiration to develop an actual strategy that can be implemented. ETNO and WWF will set up meetings with key stakeholders to see who are willing to take on the challenge to ensure that the EU develops and implements a sustainable e-strategy and that reduction of CO_2 is ensured by 2007.

We will aim to achieve our previously mentioned three goals, as follows:

- ICT will be recognised as an important part of the solution for combating climate change in Europe
- Key actors will have a climate change strategy for ICT
- Concrete "ICT-Climate change" programmes will be initiated in Europe by 2007

During this process ETNO and WWF will arrange seminars for interested key actors and explore possible ways forward. The challenge is to identify a strategy place within the Commission that can oversee an e-strategy.

We look forward to working with other actors who want to help ensure that the EU gets an e-strategy for CO_2 reductions in Europe. We are pleased that a number of actors already have indicated that they are willing to support these goals.

We also look forward to working with different actors to formulate more specific targets and strategies to help us achieve the goals.

We will also start to work in parallel with the 2020 targets for an e-strategy. In this process we will broaden the scope and include other third-party verified solutions and create a more comprehensive roadmap that can provide inspiration and guidance as well as serve as a benchmark for best practice. But most of all it will send a stronger signal to all relevant decision makers that the time for action is now. If the policy framework is right, ICT can become one of the major contributors to reduction of CO_2 and a more resourceful and equitable society.

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- James Goodman of Forum for the Future who also provided input to the roadmap.

Notes

1/ Millennium Ecosystem Assessment Synthesis Report, p. 2a9

2/ http://www.guardian.co.uk/afghanistan/story/0,1284,647516,00.html http://www.europaworld.org/issue71/awakeupcall1302.htm

3/ http://ue.eu.int/ueDocs/cms_Data/docs/pressData/en/ec/84335.pdf, http://ue.eu.int/ueDocs/cms_Data/docs/pressData/en/envir/84322.pdf

4/ http://www.the-scientist.com/news/20050607/01

5/ http://reports.eea.eu.int/eea_report_2004_5/en http://www.oxfordenergy.org/comment.php?0502

6/ The economic future of Europe', Olivier Blanchard, Working Paper 04-04, MIT.

7/ Between 1995 and 2001, investment in IT capital goods ran at 1.6 % of GDP less than the US. Francesco Daveri, Why is there a productivity problem in the EU?, Centre for European Policy Studies.

8/ Stephen Young, Ovum, 7 September 2005

9/ A number of initiatives exists in EU, both private and public, that can contribute to the formulation and later implementation of a strategy.

10/ K. Szomolányi, C. Wade, R. Lemke, D. Riva, ed. K. Szomolányi (2005): "Greenhouse Gas Effect of Information and Communication Technologies", ETNO

11/ The Global Reporting Initiative (GRI) is a multi-stakeholder process and independent institution whose mission is to develop and disseminate globally applicable Sustainability Reporting Guidelines.

12/ See www.globalreporting.org/ guidelines/sectors/TelecommPilot.pdf

13/ Issues that are important according to actors like Wuppertal Institute include: E-waste, take-back and proper disposal as serious concerns persist on polluting e-waste recycling in developing countries. Toxicity, especially in the disposal phase, due to the highly complex composition of many ICT devices. Supply chain impacts, especially during sourcing of raw materials for ICT devices and infrastructure production.

14/ To some extent the traditional responsibility of companies, combined with a tendency of focus on reduction of pollution as a problem, have probably also played a part in this as well. New reporting initiatives are however trying to move more towards a more comprehensive direction, but so far they focus more on the problem and the direct effects. The focus of most discussions is where to draw the line for responsibility for different direct emissions. For one of the better systems see: http://www.ghgprotocol.org/

15/ http://www.itu.int/osg/spu/wsis-themes/ict_stories/Themes/e-Commerce.html http://www.1000ventures.com/environment/susdev_main.html http://mitpress.mit.edu/catalog/item/default.asp?sid=A135E192-F653-4463-B932-217B94D94CAC&ttype=5&tid=1250

16/ Negroponte, Nicholas: Being Digital, MIT Press, Cambridge 1995

17/ http://www.neskey.com/What%20is%20Neskey/What_Is_Neskey.htm#sustainable http://www.euricur.nl/themes/ict.htm http://www.sustainit.org/telework-mobility/index.php http://mitpress.mit.edu/catalog/item/default.asp?ttype=5&tid=1704

18/ http://www.un.org/esa/population/publications/wup2003/WUP2003.htm

19/ http://stdev.unctad.org/themes/ict/docs.html The shrinking world is also challenging us to think about the "digital divide" that is not about providing the same hardware to everyone, but truly make the development of the new digital infrastructure and context something that do not exclude those who already are excluded in many ways, both in rich and poor countries

20/ http://www.wilsoncenter.org/docs/staff/Rejeski_stratempo.pdf http://www.nano.gov/html/interviews/MRoco.htm

21/ See for example: Avoiding Dangerous Climate Change, ed. Hans Joachim Schellnhuber, Wolfgang Cramer, Nebojsa Nakicenovic, Tom Wigley and Gary Yohe.

22/ For more information about travel replacement see for example: Patricia L. Mokhtarian, Telecommunication and travel, Journal of Industrial Ecology volume 6, Number 2, MIT Press; Peter Arnfalk, Virtual Mobility and Pollution Prevention - The Emerging Role of ICT Based Communication in Organisations and its Impact on Travel, Faculty of Technology, Lund University, Sweden; Markus Robért, Company Incentives and Individual Preferences - Towards sustainable travel alternatives, Department of Infrastructure, Royal Institute of Technology, Stockholm Sweden.

23/ Still a crucial technical challenge is to make eye contact possible in virtual group meetings, setting up a working connection, ensure that sound picture are synchronised and ensure an environment that create a feeling of participation.

Further reading

More information about the concrete examples can be found in:

Szomolányi, K. Wade, C. Lemke, R. Riva, D. ed. Szomolányi K., 2005. Greenhouse Gas Effect of Information and Communication Technologies: ETNO

More information about the role of ICT for sustainability, the different ways ICT can contribute and the need for a strategy can be found in:

Pamlin, D., et al., 2002. Sustainability at the Speed of Light : WWF
Pamlin, D. Thorslund E., 2005. An outline for a sustainable e-strategy: Stockholm, Swedish Governmental Forum for ICT and the environment, Ministry of Environment

Other material that might be of interest include:

- *Tuppen, C., 1992. Energy and Telecommunications - An Environmental Impact Analysis*
- *Negroponte, N., 1995. Being Digital*
- *The Commission's High Level Group of Experts on the Social and Societal Aspects of the Information Society., 1997. Building the European Information Society for Us All, Final Report*
- *Romm, J., 1999. The Internet and Global Warming - A Scenario of the Impact of E-commerce on Energy and the Environment*
- *Digital Europe, 2001 - 2004 .18 reports about ICT and sustainable development*
- *Wilsdon, J., et al., 2003 A Sustainable e-Europe: Can ICT Create Economic, Social and Environmental Value?*
- *Goodman, J., et.al., 2003 Making the net work - Sustainable development in a digital society"*
- *IZT, EMPA, FFF & IIIEE., 2004 The future impact of ICT on environmental sustainability*

24/ http://picturephone.com/products/learn_what_is_vc.htm
25/ New actors such as Huawei from China is moving rapidly in to this area and collaboration and support for these kind of initiatives should be encouraged in EU. http://www.huawei.com/mmweb/en/solutions/view.do?id=93
26/ Again it looks like if US might move ahead of EU and drive innovation and new solutions. Unless somthing happens soon EU might lose the competative edge that now exists. See for example: http://www.hp.com/halo/index.html?jumpid=re_r138/051 212xa/Halo http://www.economist.com/business/PrinterFriendly.cfm?story_id=5309284
27/ Hischier, R.; Hilty, L. M.: Environmental impacts of an international conference. Environmental Impact Assessment Review. Vol. 22, Issue 5, 2002, pp. 543-557
28/ The boundaries of the basic analysis: the numbers are based on German business travels' trend, prepared by Potsdam Institute on Climate Impact Research for Deutsche Telekom. The basis of the research was the trends in travels between 1976 and 2000. The research did not take the video-conference's equipments own impact on GHG emission, as it is negligible.
29/ http://www.tech-encyclopedia.com/term/conference_call
30/ The boundaries of the basic analysis: the original study was prepared by SustainIT for British Telecom during the financial year 2003. In the study BT employees were surveyed about their use of conferencing. The numbers are taking into consideration only those replacements which definitely replaced business travels.
31/ http://www.pre.nl/download/QuantifyingDematerialisation.pdf http://international.vrom.nl/docs/internationaal/7612-ResourceProductivity.pdf http://europa.eu.int/comm/environment/pubs/pdf/sustdev.pdf
32/ http://www.developments.org.uk/data/Issue23/it-problem-or-solution.htm
33/ The boundaries of the basic analysis: the research has been prepared by the German Oeko Institute for Deutsche Telekom, and based on the primary energy consumption of virtual and physical answering machines.
34/ Boundaries of the basic analysis: the basic study has been prepared by German Oeko Institute for Deutsche Telekom. In the final results only recycled paper production and paper-waste landfill were taken into consideration.
35/ Boundaries of the basic analysis: developed by University Veszprém (Hungary) for Magyar Telekom. The results are based on life cycle assessment (LCA) where existing web-based taxation and paper-based posted taxations are compared. In this transportation, production, energy consumption all were taken into consideration.
36/ http://www.fujitsu.com/global/news/pr/archives/month/2005/20050713-01.html
37/ http://www.irextechnologies.com/home.htm
38/ http://topics.developmentgateway.org/ict/rc/BrowseContent.do~source=RCContentUser~folderId=3123?source=RCContentUser&folderId=3123
39/ http://www.flexibility.co.uk/issues/sustainability/sustainability.htm http://www.edinburgh.gov.uk/CEC/Corporate_Services/Strategic_Support_Services/Smart_City/deliversmartcity/delivering_smart_city_report_introv2.html http://www.cityoflondon.gov.uk/NR/rdonlyres/64189EF2-12F2-41FD-8E11-7E8EC8BC5E04/0/BC_RS_ictinfra_0108_ES.pdf http://www.iges.or.jp/kitakyushu/Meetings/Thematic%20Seminar/ICT/Presentations/Cebu%20City_Statement%20(Dec.%2013-14,'04).doc
Gaining the air quality and climate benefit for telework, WRI: http://pdf.wri.org/teleworkguide.pdf
40/ Boundaries of the analysis: the original study was prepared by Sustel project for British Telecom. The research is based on a survey among BT flexi-workers about their travel-savings per week.
41/ EEA Technical report: Annual European Community greenhouse gas inventory 1990–2003 and inventory report 2005, Submission to the UNFCCC Secretariat, page 86 http://reports.eea.eu.int/technical_report_2005_4/en/EC_GHG_Inventory_report_2005.pdf
42/ For further reading on how to create a robust ICT strategy see: Pamlin Dennis. (2002): "Sustainability at the Speed of Light", WWF, page 171-181
43/ www.nas.nasa.gov/About/Education/Ozone/history.html.
44/ "Positive" feedback does not mean "good", it refers to a situation where the feedback reinforces or amplifies the initial change. Negative feedback is the opposite, and maintains stability by counteracting the initial change.

Summary of existing services' potentials

To summarise the three categories of services: These should not be seen as attempt to make a 100% accurate estimation of the claim. There are many unknown factors, such as the number of customers and the CO_2 replacing potential for different levels of consumption. The numbers are meant to give an overview of the opportunities that exist for economic growth whilst combating climate change in the same time.

Flexi-work

If 10% (19.3024 million) of EU-25 countries' employees became flexi-workers, then 22.17 million tonnes of CO_2 can be saved per year.

Audio-conference

If 50% (96.512 million) of EU-25 countries' employees replaced one meeting with one audio-conference call per year, then 2.128 million tonnes of CO_2 can be saved per year.

Business travel replacement (video-conference)

If 20% of business travel in EU-25 Countries is replaced by a non-travel solution (e.g. video-conference), around 22.35 million tonnes of CO_2 can be saved per year.

Online phone-bills

If all households, with Internet access, in EU-15 countries, and all mobile customers in EU-25 countries would get an online phone-bill, then 491.57 thousand tonnes of CO_2 can be saved per year.

Virtual answering machine

If 20% of households in EU-15 countries (31 million) use virtual answering machines instead of physical answering machines, then 1.03 million tonnes of CO_2 can be saved per year.

Web-based tax return

If all employees in EU-25 countries (193 million) deliver their tax return via the Internet, then 195.78 thousand tonnes of CO_2 can be saved per year.

Together this would mean saving approximately 50 million tonnes of CO_2 emissions per year.

The energy use of ICT products themselves

While this roadmap focuses on areas where ICT can contribute to sustainable development, e.g. the applications, we should not of course ignore the direct impacts. The energy used by products during their whole life cycle is not negligible, but it is the use, utilisation of different services that is the most important.

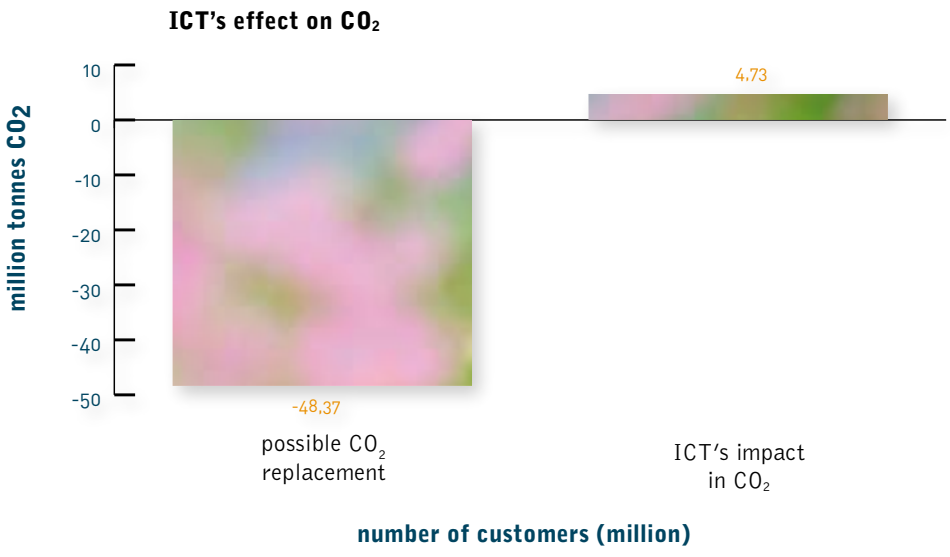
As the direct energy use of the ICT products are not negligible, it is necessary to ensure that incentives for reduced energy consumption are put in place. Progressive initiatives in business should be encouraged and tough standards should be implemented to ensure that laggards are not given a free ride and unfair economic advantage. It must be profitable to be a leader in sustainability. It is not enough to count on companies' good intentions. The economic incentives must deliver the same signals as the political vision.

ETNO members are participating in the drafting of the «Code of Conduct on Energy Consumption of Broad Band Equipment», promoted by the Joint Research Centre (European Commission). It aims to minimize energy consumption of BB communication equipment without hampering fast technological developments and services provided.

The 16 ETNO member companies that provided input to the study, have implemented a number of measures that reduce direct energy consumption and CO_2 emissions. Together, these companies represent 53% of Europe's telecommunications market in 2003 (according to estimates by EITO).

Comparing direct and indirect effects shows that the environmental impact of these 16 European telecommunications companies is around 10 times less than the potential reduction of carbon dioxide emissions on European level that can be achieved if only the applications in this roadmap are implemented. Measures to reduce CO_2 have also been implemented by many of the telecommunication companies. While the total energy consumption increased by almost 4%, the total CO_2 emissions were reduced by more than 11% between 2000 and 2003.

For more details see: Szomolányi, Wade, Lemke, Riva: Greenhouse Gas Effect of Information and Communication Technologies, ETNO



The strategic use of ICT can contribute significantly to energy efficiency, sustainable economic growth as well as job creation. ICT can reduce the need of travel and transportation of goods by bridging distance problems. It can increase efficiency and innovation by allowing people to work in more flexible ways. It can also ensure a shift from products to services and allow for dematerialisation of the economy.

To allow the ICT sector an important role in reducing CO2 and scale up existing solutions an e-strategy for CO2 reductions is necessary. This strategy should include targets, based on already implemented ICT services, science and on the precautionary principle. Europe's international footprint and export opportunities should also be considered in the strategy.

In this report a concrete way forward is outlined.

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