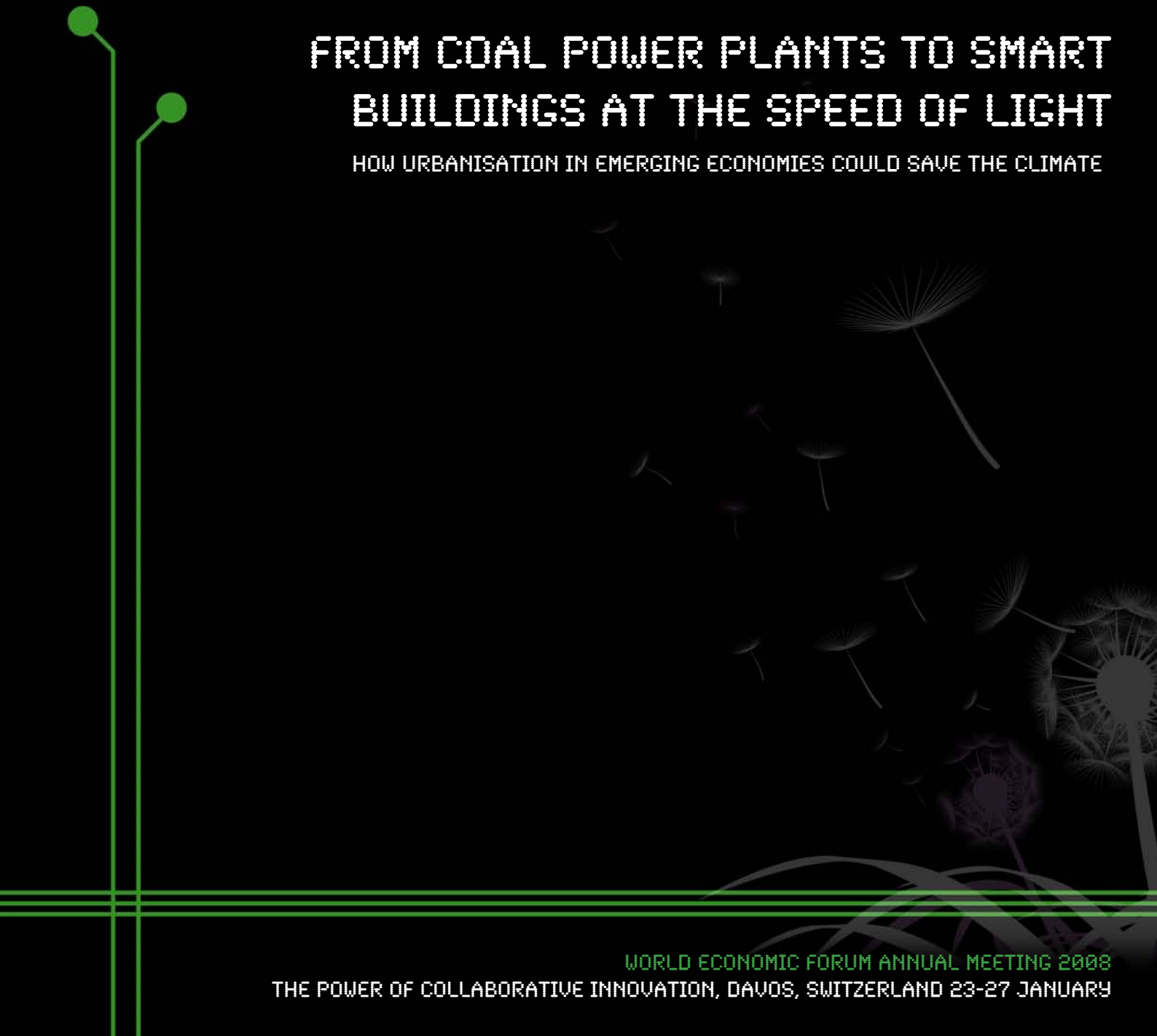
WWF

for a living planet®

FROM COAL POWER PLANTS TO SMART BUILDINGS AT THE SPEED OF LIGHT

HOW URBANISATION IN EMERGING ECONOMIES COULD SAVE THE CLIMATE



WORLD ECONOMIC FORUM ANNUAL MEETING 2008

THE POWER OF COLLABORATIVE INNOVATION, DAVOS, SWITZERLAND 23-27 JANUARY

21ST CENTURY OPPORTUNITIES

CONVERGING CHALLENGES AND THE NEED FOR LEADERSHIP

"India has 10 of the 30 fastest-growing urban areas in the world and, based on current trends, analysts estimate that 700 million people – roughly equivalent to the entire current population of Europe – will move to cities in India by 2050."

http://business.guardian.co.uk/story/0,,2002796,00.html

China imported a record 163m tonnes of crude oil in 2007 and the Chinese car fleet is projected to expand.

http://www.chinadaily.com.cn/bizchina/2008-01/12/content_6389410.htm

In India the number of 'million plus' cities increased from 5 in 1951 to 23 in 1991 and to 35 in 2001. About 37% of the total urban population live in these million plus cities.

Urbanisation in India, Pranati Datta, Population studies Unit, June, 2006

2,000,000,000 m^2 of new building space is added every year in China.

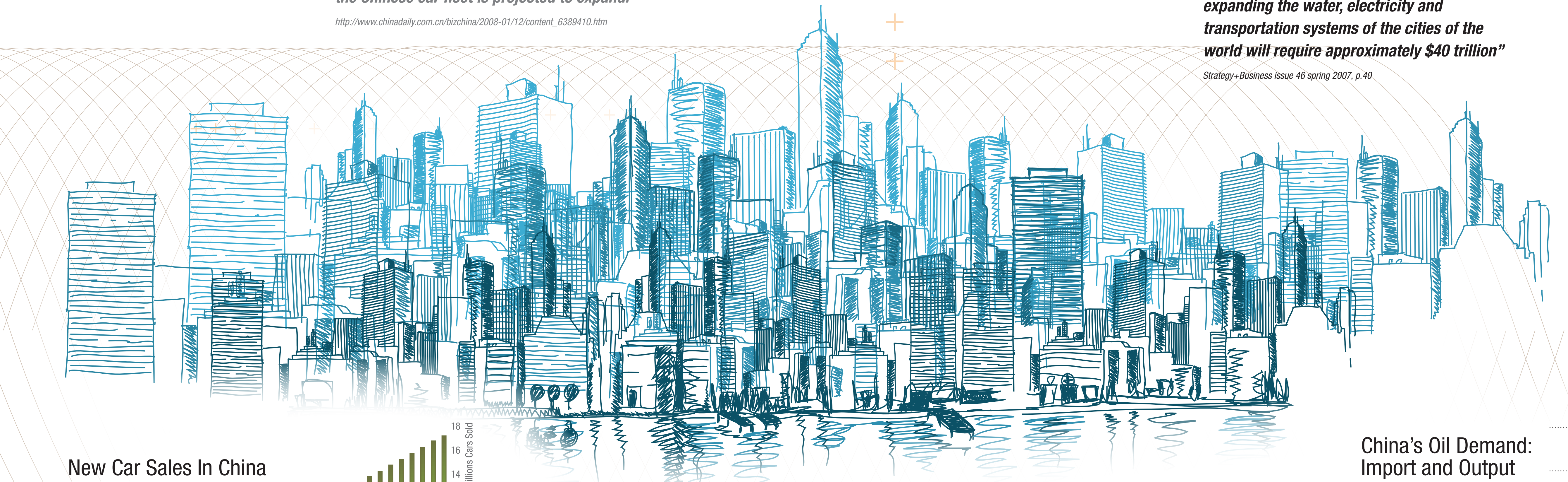
WEO 2007, p.283

"As we swell toward nine billion in the next half a century, humanity will undergo historic changes in the balance between young and old, rich and poor, urban and rural. Our choices now and in the years ahead will determine how well we cope with our coming of age"

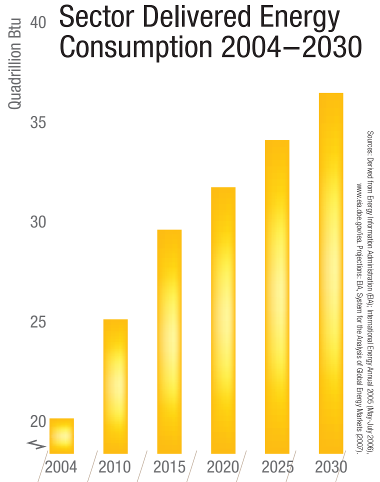
http://www.sciam.com/article.cfm?id=human-population-grows-up

"Over the next 25 years, modernizing and expanding the water, electricity and transportation systems of the cities of the world will require approximately $40 trillion"

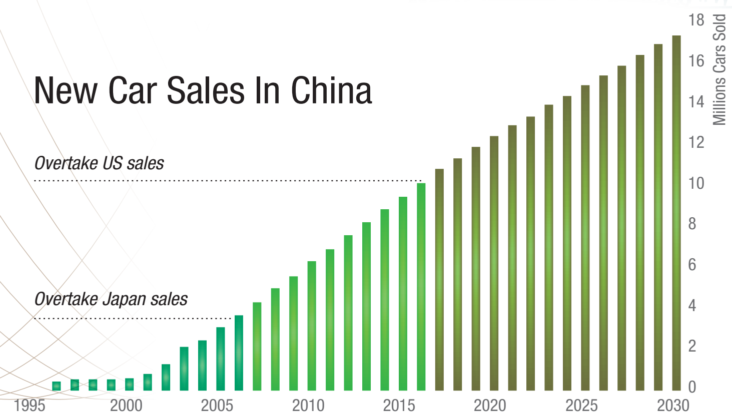
Strategy+Business issue 46 spring 2007, p.40



Non-OECD Residential Sector Delivered Energy Consumption 2004–2030



New Car Sales In China



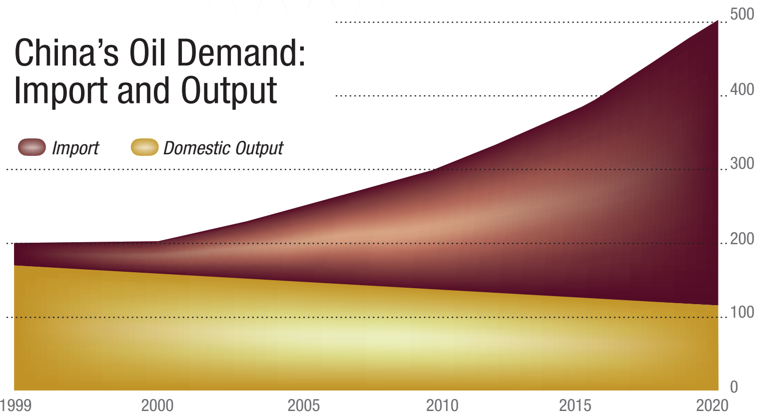
In China alone, cities and towns are expected to absorb about 300 million people from rural areas in 20 years. This is equivalent to the entire US population or more than twice the population of Japan.

http://www.chinadaily.com.cn/china/2006-03/21/content_547967.htm

"The old energy economy is well-organized, well financed, and politically influential. The new energy economy is entrepreneurial and decentralized, undercapitalized, and lacks substantial political power. Yet its economic potential is enormous. How do we tap it?"

Clinton Global Initiative, September 15-17, 2005

China's Oil Demand: Import and Output



The possibility of providing new and better services with the help of Internet and Communication Technology (ICT or IT) is well known. Less well known is the significance of these new services in reducing carbon emissions. This deficit in understanding that exists almost everywhere, from politics to business and the media as well as NGOs has resulted in a situation where focus has been on the IT sectors' internal emissions and the energy efficiency of equipment. While these two areas are important, their contributions to global emissions are not the most significant.

On the other hand, solutions provided by IT can and must play an important role as we move towards a low carbon economy if we are to reach the targets set by scientists and policy makers. Earlier studies have shown that the EU could, for example, increase productivity, living standards and save 50 million tonnes of CO_2 by implementing six quite simple IT solutions.[1] Such data, along with similar studies, was developed at a time when the full magnitude of the climate challenge was not known and many of the studies are based on old IT solutions.

It is now time to take the next step.

Converging trends at a historic moment

2008 will be a historic year. The history books will mark 2008 as the first year in human history when more people lived in cities than rural areas. Over the coming decades, virtually all of the population growth in the world, two billion people, will take place in urban environments. In two decades, the urban population will have increased by more than one third of today's entire global population.[2]

In conjunction, global energy and natural resource use is increasing rapidly, with energy demand expected to increase by more than 50 per cent during this time if current trends continue.[3] Significant is also the fact that emerging economies are still only modest users of natural resources per capita.

At the same time, the world needs a dramatic reduction of CO_2 emissions. According to scientists we must reverse a more than 150 year-old trend of almost exponential growth in global CO_2 emissions to avoid a climate catastrophe. The window of opportunity is less than a decade.

Make money and save the planet

Never before has such a transformation of global infrastructure taken place in so short a period of time as what is currently needed. Immense pressure on the planet demands a dramatic increase in urban solutions that can improve quality of life without consuming excessive natural resources.

There is money to be made in this transition. Seen from a traditional perspective, future energy infrastructure investment decisions are expected to exceed US$20 trillion between 2005 and 2030.[5] If we change perspective, and think about low-carbon solutions where construction and transportation infrastructure is also included, this number must be multiplied many times over.[6] Looking at potential financial resources for this transition, the traditional financial markets in the OECD must play an important role, but other sources should not be ignored.

China's trade surplus has surged to reach a record US$262.2 billion in 2007 and an important factor that should not be forgotten is that "the era of cheap raw materials" is said to be over.[7,8] This creates increased revenue streams that can be turned into investments for a low-carbon economy. Between 2004 and 2008, the cumulative additional export revenue (relative to the 2001-02 level) from oil and gas for the Middle East and Central Asian oil-exporting countries will amount to almost US$2 trillion.[9] Already on the second day of 2008, oil hit US$100 a barrel.[10]

Leadership in a low-carbon economy

Urbanisation, including the construction of new buildings, will be of key importance in driving future technology development and institutional innovation, and the way that China and India adopt new urban solutions will drive this development, not only in the two countries, but also on a global scale.

While the world was home to 14 megacities in 1995 (a city with more than ten million inhabitants), 20 years later in 2015 there will be 7 more – totalling 21.[11] In parallel to this urban explosion, the energy consumption of buildings has been identified as an urgent megatrend in need of transformation. Today, buildings use about one third of global energy and with population growth and urbanisation that number will rise. By 2025, following current unsustainable trends, buildings will be the main users of energy. And, if the trend continues, buildings are likely to use as much as industry and transport combined by 2050.[12]

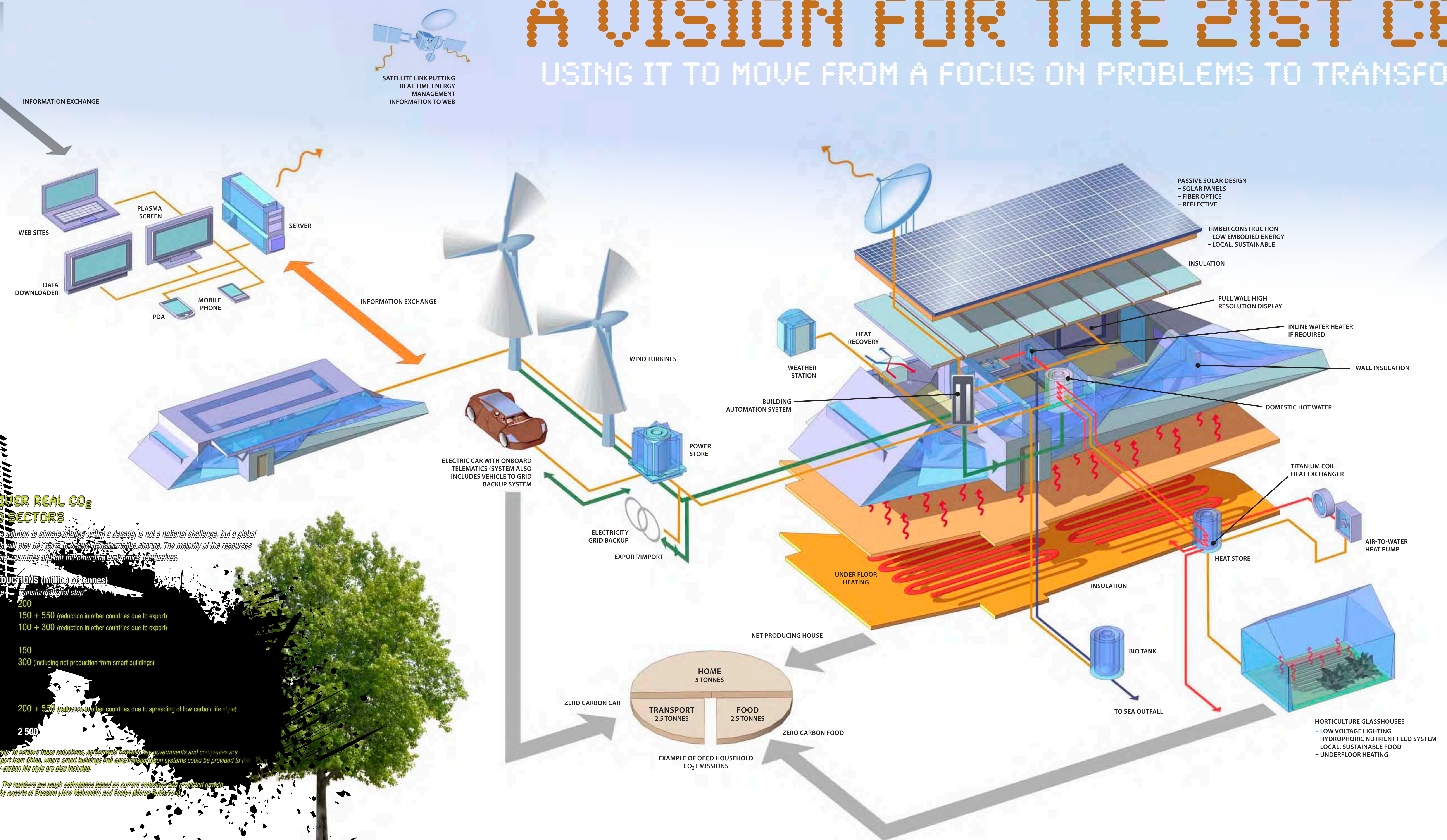
Already existing technology can turn these buildings into resource-efficient net producers of electricity. This would turn one of the major challenges in our century into an opportunity. Urban development in emerging economies must be viewed from this perspective. Besides entering the history books as the historic threshold for urbanisation, 2008 could also be written in as the first year in a transition towards a global low-carbon economy. 2008 holds open the prospect of the global community witnessing the very first, concrete steps in such a low carbon transition.

This low carbon leadership could be provided by the IT sector.

[1] http://www.panda.org/ict, the 50 million tonnes was more than 10 times more than the emissions from the 16 telecom network operators that participated in the study.
[2] http://www.un.org/esa/population/publications/wpp2004/wpp2004_volume3.htm
[3] http://www.iea.org/textbase/nppdf/free/2006/key2006.pdf
[4] http://environment.guardian.co.uk/climatechange/story/0,,2073006,00.htm
[5] IPCC, fourth assessment report, climate change 2007: synthesis report, p. 18
[6] http://www.strategy-business.com/resiliencereport/resilience/rr00045?pg=0
[7] http://www.chinadaily.com.cn/china/2008-01/11/content_6387775.htm
[8] 'More of everything: does the world have enough resources to meet the growing needs of the emerging economies?', a survey of the world economy, The Economist, 16 september 2006.
[9] http://www.imf.org/external/pubs/ft/survey/so/2007/car1030a.htm
[10] http://www.forbes.com/markets/feeds/reuters/2008/01/02/2008-01-02t215601z_01_n02599328_rtridst_0_markets-commodities.html
[11] www.foreignpolicy.com/story/cms.php?story_id=3504
[12] http://www.wbcsd.org/plugins/docsearch/details.asp?doctypeid=251&objectid=mjyyodg

A VISION FOR THE 21ST CENTURY

USING IT TO MOVE FROM A FOCUS ON PROBLEMS TO TRANSFORMATIVE CHANGE



A VISION THAT CAN DELIVER REAL CO_2 REDUCTIONS IN THE OLD SECTORS

Ensuring a shift for buildings to become part of the solution to climate change within a decade, is not a national challenge, but a global opportunity. Urbanisation and emerging economies will play key parts to ensure transformative change. The majority of the resources for the investments needed must come from the rich countries and not the emerging economies themselves.

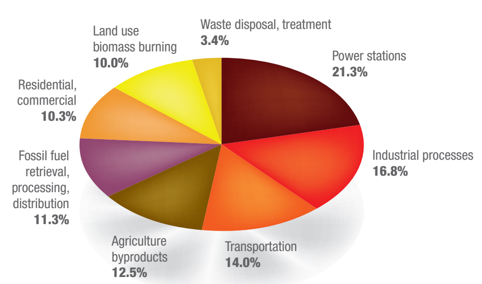
SECTOR	CO_2 REDUCTIONS (million of tonnes) First step	Transformational step*
Power station	60	200
Industrial processes	40	150 + 550 (reduction in other countries due to export)
Transportation	40	100 + 300 (reduction in other countries due to export)
Fossil fuel retrieval, processing and distribution	10	150
Residential, commercial	100	300 (including net production from smart buildings)
LOW CARBON LIFE STYLE (e.g low carbon food, smart clothing and experiential consumerism)	-	200 + 550 (reduction in other countries due to spreading of low carbon life style)
TOTAL	**250**	**2 500**

** A transformational step would require significant leadership. To achieve these reductions, agreements between key governments and companies are required. This step also includes figures for sustainable export from China, where smart buildings and cars/transportation systems could be provided to the rest of the world. Additional figures for the spread of a low-carbon life style are also included.*

The above table should be seen as inspiration for a vision. The numbers are rough estimations based on current emissions and projected growth. All figures are estimations by WWF based on calculations by experts at Ericsson (Jens Malmodin) and Ecofys (Marco Buttazzoni).

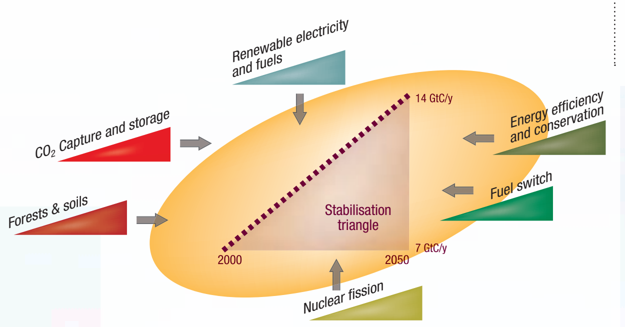
Categorising CO_2 emissions from a problem perspective

The way we usually look at reducing CO_2 emissions today is that we first identify the culprits and then sort them into different sectors. This is very helpful in many cases, but not necessarily in finding solutions beyond incremental improvments within these sectors.



Source: Stern Report October 2006, SAM Group

Aiming to "fix the problem", the next logical step following such a division is to develop large-scale change on the supply side, with some incremental changes on the demand side. This has, for example, resulted in approaches where the solutions are presented like "wedges" or simple climate maps that build on linear and incremental thinking.



These approaches have played an important role so far, enabling "big" emission numbers to be broken down into smaller parts. The major contribution is probably the physycological value added in doing so since "smaller wedges" make it more demonstrable that it is, in fact, possible to avoid dangerous climate change. As mentioned above it has, however, mainly triggered discussions about supply side actions, and it might not be a surprise that these perspectives are often supported by conservative-minded energy utilities.

When we understand where the emissions come from and that it is possible to solve the climate challenge, we can now leave a problem-focused, and over-simplified, perspective behind and introduce an opportunity- and innovation-based approach, focused on meeting needs in society. If we take the need for housing as an example, we can move around the pie chart and challenge today's divisions into sectors while delivering transformative change. To achieve the necessary reductions of CO_2 emissions and combat climate change, this shift in perspective is fundamental to a sustainable Vision for the 21st Century.

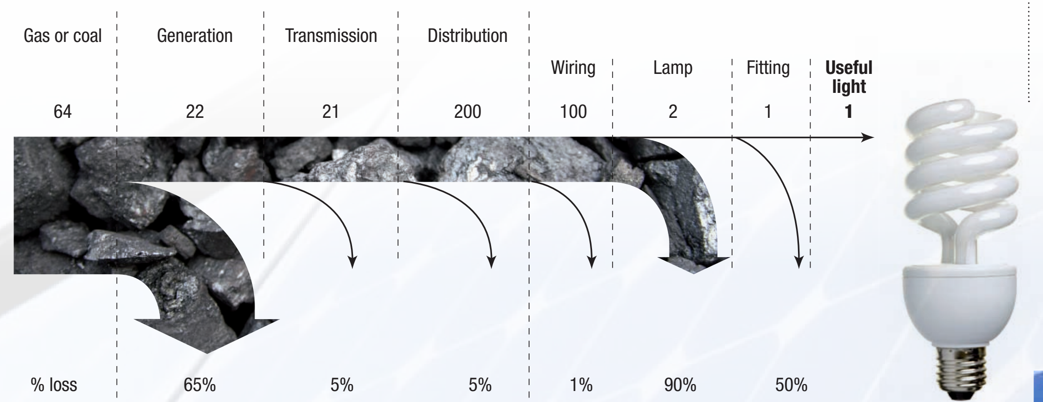
1 Opportunity 1:
Eliminate unecessary drivers of CO_2 emissions
Building smart buildings that do not need external electricity

Approximately 45% of final consumer energy is used for low-temperature heat (cooking, water and space heating, drying), 10% for high-temperature industrial process heat, 15% for electric motors, lighting and electronics and 30% for transport. The CO_2 emissions from meeting this energy demand using mainly fossil fuels account for around 80% of total global emissions.[1]

As buildings are major users of electricity, smart buildings could contribute to reduced demand for power stations and even become net producers of electricity.

Much of today's energy system was built during a time when oversupply was the only way to ensure that enough power was available. Years of traditional investment supporting a large scale energy system have resulted in an aged, inefficient, and environmentally wasteful system. For example, most of the existing infrastructure (wires, transformers, substations and switches) that makes up the US electric grid has been in use for 25 years or more.[2] The result is a very inefficient electricity generation and distribution system that converts only one third of the total energy it consumes into useful electricity.[3] That equates to approximately 1.5 billion tonnes of CO_2 emissions wasted during the production and delivery of electricity in the US every year.[4] On top of this, we have to add the subsequent waste and inefficiency in how we consume electricity in our homes, offices, schools and factories.

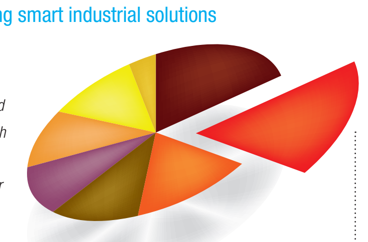
Fortunately, today's technologies allow for new "smart buildings". A smart building would include built-in IT solutions in the core structure and allow, not only a zero energy need (see for example the very interesting WBCSD initiaitve The "Zero Net Energy" Challenge), but also for a building to become a net producer of electricity/energy.[5] IT can ensure that a built-in decentralized energy system can work and be energy-efficient through intelligent control systems. IT can also ensure that the different net-electricity producing buildings can be connected and brought together in what can be described as an intelligent "virtual power plant". A virtual power plant would basically consist of server space and software to ensure that power in a grid of connected buildings is redirected where needed.



Source: Based on Cleland, 2005, as presented in IPCC's Fourth Assessment Report, Working Group III report "Mitigation of Climate Change", p. 258

2 Opportunity 2:
Ensure smart solutions in houses
Achieving smart industrial solutions

Smart buildings would include features which allow for services to replace the "need" for carbon-intensive industrial processes.



By creating an integrated energy system for buildings a number of opportunities arise to reduce the need for traditional linear and carbon-intensive industrial processes. A smart building will make it much easier to track the material flows going in and out of the house and ensure reuse and recycling when possible. Through smart construction it is easer also to analyse the life-cycle impacts of products.

One exemple of an intelligent building solution that could impact the industrial sector is fiber opticts to provide light. Using fiber optics to bring in light does not require the infrastructure required for light bulbs, an infrastructure needed even for energy-efficient ones. The graph below illustrates not only the energy loss from source to service (and it is clear that a lot of coal is required to supply us with the service needed: light), it also indicates the huge amount of supporting infrastructure in terms of powerplants, transmission infrastructure, etc that is needed. Thus, eliminating the use of electricity for the purpose of lighting would make much of the supporting infrastructure redundant.

A smart building can also make it easier for companies that provide services instead of products to supply residents with what they really need as the building can communicate directly with companies providing for residents' needs and ensure optimal use of their services. There will be no need to buy a washing machine, instead it would be possible to pay for clean clothes, it will not be necessary to buy a fridge but instead rent a service for fresh food and so on. This transition from selling products to providing services will probably first take place in commercial buildings as companies move towards sustainability.

So, by constructing smart buildnings on a large scale we could see ripple effects through large parts of the industrial system that would encourage a shift from product to service.

3 Opportunity 3:
Benefit from synergies with other societal needs
Providing smart transportation systems

The structure of a smart building allows additional needs to be met, apart from those traditionally directly associated with housing, allowing for embedded IT solutions to reduce the CO_2 impact from transportation.

A smart house will focus on the services needed for those living in it. With a service perspective, we are not limited to replacing unsustainable products from a traditional problem perspective, but can meet real converging needs such as those for transportation and communication services. Two major contributions can be foreseen in the area of transport/communication.

First, and maybe most self-evidently, a smart buildning will also be able to provide energy (hydrogen or electricity) to the vehicles used by the people in the buildning. Second, it will allow us to challenge the concept of space – the space where we live will be inevitably connected to the space where we work, and vice versa, challenging the basic notions of office and residence. We shall, for example, be able to conduct virtual meetings, through means such as full wall high-resolution screens, which will make some physical meetings of today unnecessary. Such an infrastructure would enable meetings and communications less dependant on physical transportation. For some products, decentralised production can become an option in a not too distant future thereby reducing the need for unnecessary travel further and leaving more scope for essential travel.

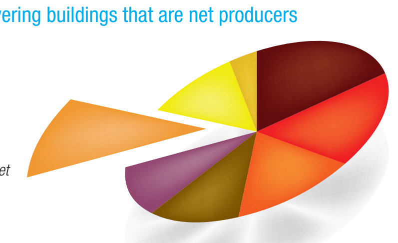
4 Opportunity 4:
Hidden gains
Reducing the need for extraction of fossil fuels

By eliminating the use of fossil fuels through smart buildings that support a new infrastructure, the emissions related to a fossil-fuel infrastructure would not take place.

Combined, smart buildings, positive contributions through more efficient infrastructure, new industrial development and smart transportation will reduce the need for fossil fuel extraction. This might be obvious, but many times when savings due to IT solutions are calculated the reduced need for extraction is forgotten. Not only would a major shift towards smart buildings reduce the need for extraction of fossil fuel, it would also have many other positive effects (less political tension around oil resources, less destruction of bio diversity, etc).

5 Opportunity 5:
Achieving transformative change
Delivering buildings that are net producers

Buildings have the potential to move away from being net users of energy to becoming net producers.



Making our way through the pie chart circle, we finally arrive at the actual "slice" for buildings. By introducing an IT-driven service perspective and eliminating the need for external electricity by constructing a smart and net-energy producing building, we have already addressed the direct consumption of fossil fuels for heat supply that is the largest direct carbon footprint for many buildings. In doing so we have transformed buildings, one of the biggest contributors to climate change, and turned them into what could become the most important part of a global solution.

Nothing new really exists in going full circle around the pie chart, it is only a matter of changing perspective from problem to opportunity. Smart buildings are simply a reflection of how society has developed and how this development provides us with new opportunities. What has happened is that the connectivity in society has increased. Prices of sustainable solutions, including IT solutions, have fallen over recent years and new ways of structuring businesses alongside innovative lending policies now exist. We are now in a position to to achieve transformative change.

What is still needed is the leadership that can bring together the parts needed to fulfill a 21st Century vision and benefit from the opportunities at hand. The IT sector is perfectly placed to take on this leadership role – ensure a transition where climate change becomes a driver for innovation and profit – and become a winner in a low carbon economy.

[1] IPCC Fourth Assessment Report Working Group III report "Mitigation of Climate Change", p.256
[2] National Electric Delivery Technologies Roadmap, US Dept. of Energy, Office of Electric Transmission & Distribution, Jan 2004, Page 5.
[3] Energy Information Administration, US Dept. of Energy, Annual Energy Review, 2006, Page 221 (Page 2 of Section 8) "41 quadrillion BTU's of raw energy are consumed to generate 13 quadrillion BTU's of usable electricity" http://www.eia.doe.gov/emeu/aer/pdf/pages/sec8.pdf
[4] Environmental Protection Agency, Inventory of US Greenhouse Gas Emissions & Sinks, 1990 to 2005, Page 45. "in 2005, the electricity generation in US resulted in 2,381 Tg of CO2 equivalent" (a Tg = teragram = 1012) http://www.epa.gov/climatechange/emissions/downloads06/07CR.pdf
[5] http://www.wbcsd.org/templates/TemplateWBCSD5/layout.asp?type=p&MenuId=MTA5NA&doOpen=1&ClickMenu=LeftMenu

ICT for sustainable urban solutions

www.panda.org/ict

This paper is based on WWF's work with IT/ICT, especially the joint initiative with HP where the key objective is to identify the first billion tonnes of CO_2 reductions through the use of IT. The text is written by Dennis Pamlin, Global Policy Advisor, WWF and Suzanne Pahlman, Strategy and Innovation Consultant (www.spahlman.com).

WWF is the world's largest and most experienced independent conservation organisation, with almost 5 million supporters and a global network active in more than 90 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by:
- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- promoting the reduction of pollution and wasteful consumption.

WWF

for a living planet®

For further information about WWF's work please contact:

Dennis Pamlin,
Global Policy Advisor,
dennis.pamlin@wwf.se