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# Innovating toward a low-carbon Canada:

Using technology to transform tomorrow

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# Foreword

Throughout the history of civilization, our ideas of what constitutes normal behaviour have changed significantly. We learn something new, we change our behaviour, and often under the new normal our lives improve. It doesn't always happen quickly, but change always happens.

Technology has been, and always will be, a major driver of change, and it has now taken industry and society to the verge of important economic and social developments. These developments offer major economic gains to businesses and governments, life-altering personal benefits to individuals, and a meaningful contribution to the health of the planet.

These technological developments can be realized today and only require a minor shift in behaviour. Advances in transportation technology and infrastructure, and the widespread use of the Internet and mobile technologies are already changing the way we live and work.

As technology enables us to convert more of our everyday activities to digital process, we are successfully decoupling economic growth and prosperity from growth in greenhouse gas emissions. As we increasingly digitize the economy, we move bits and bytes wherever possible instead of people and property.

Information and Communications Technology (ICT) is what makes it all possible.

For example, with technologies that exist now – and that will be continuously improved – ICT has the ability to help many of us free ourselves of the necessity to commute to work.

ICT has the ability to make our homes and workplaces much more efficient, to make all the transportation related to the world's commerce more efficient, and to eliminate a great deal of the need to move many physical things back and forth.

Even now, a smart ICT-enabled company will produce 200 times the profit per tonne of GHG emitted than an old-school company. The ICT sector is poised to not only help us greatly reduce our greenhouse gas emissions, but also to create profitable enterprises in the process.

This report describes the role ICT plays not only in reducing the environmental damage we do, but in working smarter – in finding more prosperous and profitable economic opportunities by overcoming the inertia of today's normal behaviour.

Unlike politicians, corporations have long lives. And everyday consumers 'vote' with their dollars. That is the new politics, which can move at incredible speed, and will save us from climate change. I call it Sustainability Product Marketing.

We are now at the dawn of a great change in the way we run our economies. Tomorrow's new normal will be better for all of us.

**Paul Dickinson**, CEO, Carbon Disclosure Project

# Introduction

## Saving the climate @ the speed of light

Businesses, government and Canadian citizens alike now recognize the need to act quickly to reduce greenhouse gas emissions (GHG) and stem the rising tide of climate change. Carbon abatement has become a fact of life, a cost of doing business and a requirement of living in the 21st century. The fact is, change is needed from literally every corner of society – policy change, economic change, regulatory change and behavioural change – to mitigate potential climate disasters and keep global warming below the dangerous threshold of 2 degrees Celsius.

Information and Communications Technology (ICT) is a major enabler of that change.

For the purposes of this report, ICT encompasses a wide range of technologies. These include, but are not limited to, computer and communications networks and software video conferencing, remote workplaces, distance learning and more.

In some cases, ICT directly reduces GHG emissions by controlling energy consumption and in others, is a catalyst or mechanism for reduction by allowing energy-consuming actions and transactions to happen with less energy overall. In keeping with the old saying that “you don’t manage what you don’t measure” ICT can provide compelling information that prompts or triggers changes in energy use.

Implementing existing ICT more aggressively (as outlined in the scenarios below) can enable GHG reductions of approximately 20 million tonnes a year in Canada in the near future. This is roughly the equivalent to taking 3.2 million cars off the roads or 7% of Canada’s annual Kyoto obligation.

More ambitious and aggressive application and development of such products and services can expand the opportunities to a stretch goal of approximately 36 million tonnes a year, certainly within a 2020 timeframe.

Because ICT-enabled reductions result from energy conservation, they generally produce economic as well as environmental benefits. Improved energy efficiency is consistently the fastest, cheapest, most widely applicable and permanent approach to GHG reduction. Bottom line savings throughout the economy from these measures are estimated at \$7- \$13 billion a year, but this will undoubtedly increase as fossil fuel-based energy prices escalate.

ICT applications also have benefits beyond tackling global warming. These include avoiding unnecessary travel, reduced strain on infrastructure, more responsive government and business services, more productive employees, access to a wider talent pool and more comfortable buildings.

While not specifically addressed and quantified in this report, development of other ICT products and services and deeper/wider adoption can have a transformative impact. ICT can play a key role in achieving the transition to a low-carbon economy needed to avoid dangerous climate change. Improvements to the access and use of information, services and energy and better transportation options will positively influence work and recreation patterns and help manage other aspects of our lives and economy.

Adoptions of ICT-enabled GHG reduction opportunities are already underway around the world, but further opportunities exist. In Canada, action by the business community and governments is of critical importance to achieving low-carbon benefits. Both government and industry are also key ICT users that have the greatest leverage and can initiate action quickly.

## Climate and economic benefits

Reducing corporate Canada's energy use and carbon footprint meets financial, environmental and work quality priorities. The ICT sector itself has a significant opportunity to develop new GHG abatement products and services, facilitating environmental and economic benefits, thereby improving its own bottom line and Canada's technological innovation profile.

For Canadian governments, support for ICT-enabled GHG-reduction initiatives can reduce the need for services like transportation infrastructure and makes delivery more effective through initiatives such as e-government offerings.

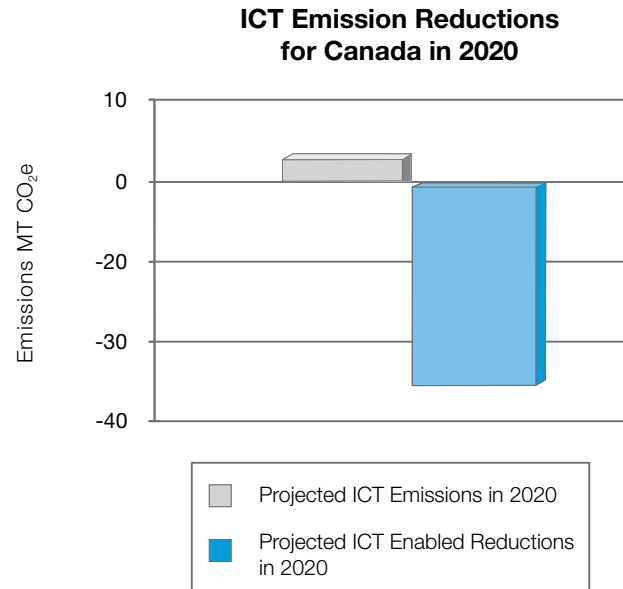
Beyond these direct economic and environmental benefits for government and business, ICT uptake has additional positive spin-offs. At the macro level, Canadian productivity would increase as a result of more efficient and competitive workers. This would result in increased investment in Canada, a stronger Canadian economy and a higher quality of life for Canadians. On an individual level, employees will enjoy lifestyle benefits such as reduced or eliminated business travel and commuting time, flexible work schedules and more efficient homes. Consumers will also have access to a broader range of products and services regardless of where they live, without having to travel.

## The ICT sector's role

At approximately one megatonne of GHG emissions, the ICT sector itself contributes less than 1% of Canada's total. This is consistent with findings in other jurisdictions. For instance, WWF's report entitled *From fossil to future* reveals that in the European Union, the ICT sector's emissions represent 2% of total emissions. To address climate change and combat projected growth trends associated with increasing use of ICT, the sector is deploying and developing tools and approaches to mitigate emissions.

Data centres, for example, can cut emissions through virtualization (reducing the number of computers needed by consolidating applications to fewer machines), reduced cooling requirements, and use of renewable energy. Other measures include cutting energy demand in commercial buildings (headquarters, branch offices and remote operations) and manufacturing facilities, and dramatically improving the energy performance of equipment the industry provides to customers (phones, chargers, set top boxes, modems).

Compared to the ICT sector's own emissions, the opportunities for ICT-enabled GHG reductions in the wider economy are an order of magnitude larger. These arise from reducing travel, replacing physical materials and processes with electronic solutions, enhancing the operating efficiency of buildings and transportation, and generally facilitating low-carbon behaviours and life styles.



### The imperative: innovation @ the speed of light

Canadian businesses and governments must encourage and accelerate the development and adoption of GHG-reducing ICT through policies, investments, inducements, and by aggressively educating Canadians about the environmental, economic and social benefits. This report intends to educate, challenge, inspire, and stimulate such action to reap the multiple benefits.

Two targets for ICT-enabled reductions are outlined in this analysis. The first short term goal is relatively easy to achieve and is based on a modest push and uptake of existing ICT solutions. A more ambitious target, the stretch goal, is achievable with a more aggressive effort to require and embrace existing and emerging technologies. Although un-quantified here, a transformative scenario imagines development and implementation of breakthrough technologies that transform services and behaviours in a way that dramatically reduces GHG emissions.

## Canadian ICT-enabled GHG emissions reduction opportunities

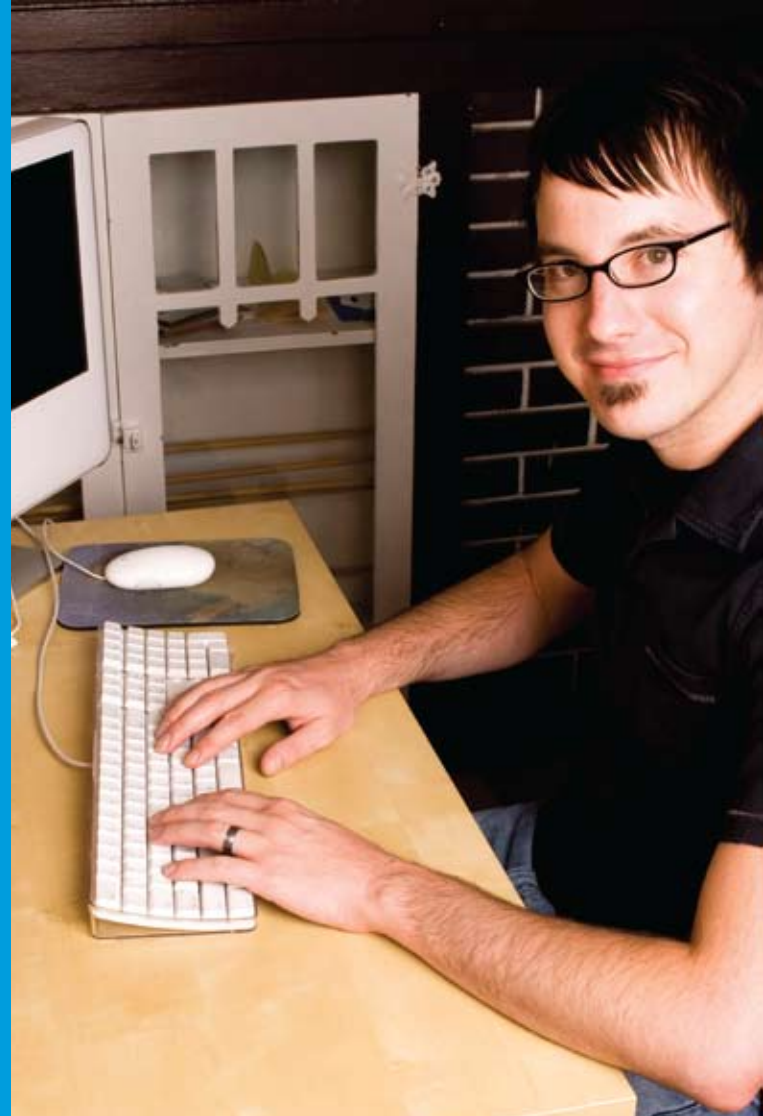
Recommendations and Reduction Targets	Short Term Goal (MT of CO <sub>2</sub> e)	Stretch Goal (MT of CO <sub>2</sub> e)
<b>Build a tele-working culture</b>		
Increase tele-workers from 2.7% to 5% of Canadian workforce	1.3	
Increase to 10%		2.6
<b>Share the road, share the ride</b>		
Increase car pooling from 10% to 12%	1.5	
Increase to 20%		2.5
Increase car share (rental) membership from 35,000 to 90,000 members	0.1	
Increase to 150,000 members		0.2
<b>Optimize the burn - drive smarter</b>		
Reduce Class 8 fleet idling time from 48% to 22%	3.2	
Reduce from 48% to 12%		3.9
Adoption of route optimization tools by 10% of fleet	1	
Adoption by 20% of fleet		2
<b>Collaborate eco-nomically - conduct more virtual meetings</b>		
Eliminate 20% of business travel	1.1	
Eliminate 30%		1.6
<b>Let's get digital - with e-products and e-transactions</b>		
Replace 40% of physical bills with electronic payment	0.02	
Replace 80%		0.03
<b>Building efficiencies - from bungalow to skyscraper</b>		
Reduce energy consumption with energy monitoring devices by 6% (based on 86% uptake)	4.3	
Reduce by 15%		10.9
Equip buildings with automatic controls:		
50% of commercial and 20% of residential	6.6	
80% of commercial and 50% of residential		12.2
<b>Total carbon reduction opportunity</b>	<b>19.1</b>	<b>36</b>
<b>Estimated financial benefit / saving (\$ billion)</b>	<b>7.5</b>	<b>12.9</b>
<b>Comparison to Canada's annual Kyoto obligation (%)</b>	<b>7</b>	<b>13.3</b>

All the areas identified as potential GHG savings in the above table are described in greater detail under each recommendation section. Each recommendation includes corporate benefits, case studies, specific data on the goal and stretch goal savings and a roadmap towards achieving these goals.

The GHG reduction opportunities identified here are based on realistic assumptions of wider and deeper use of existing Information & Communications Technologies (ICT). The estimated impact is calculated based on carbon dioxide equivalent (CO<sub>2</sub>e) reduced per unit of activity, multiplied by the frequency of that activity. While the report focuses on GHG reductions, where possible it also identifies financial savings and other business and social benefits from the recommended actions. A description of the methodology used to determine the GHG reductions and financial savings described herein can be found at [www.ca/hitech\\_lowcarbon](http://www.ca/hitech_lowcarbon).

## Recommendation 1:

Build a tele-work culture –  
work is an activity, not a place.



Transportation – conveying people and goods – contributes more than 25% of Canada's total GHG emissions. ICT solutions that enable tele-commuting or tele-work significantly reduce the fuel used to commute to and from work, as well as the building, heating and cooling of office space. In fact, with longer commutes due to urban sprawl and sky-rocketing fuel prices, tele-work is an increasingly attractive option for many employers and employees.



In an era of increased competition for qualified employees, tele-work can also be a competitive advantage. Tele-working employees notice an improvement in productivity and work-life balance. It reduces absenteeism due to sickness, traffic or inclement weather, and results in more focused, happier employees who face fewer distractions away from a shared office space. The tele-work option allows employers to expand their recruitment pool and for some individuals, tele-work may even make the difference between being able to work or not.

Employers benefit from the reduced office space with savings falling straight to the bottom line. Tele-work is also an effective risk abatement measure, enabling business continuity through various disruptions (e.g: pandemic, extreme weather or power failures).

As the largest employers in Canada, governments enjoy these tele-work benefits, while also reducing strain on public transportation infrastructures like public roads, bridges, public transit systems and highway policing.

### The goal and the stretch goal

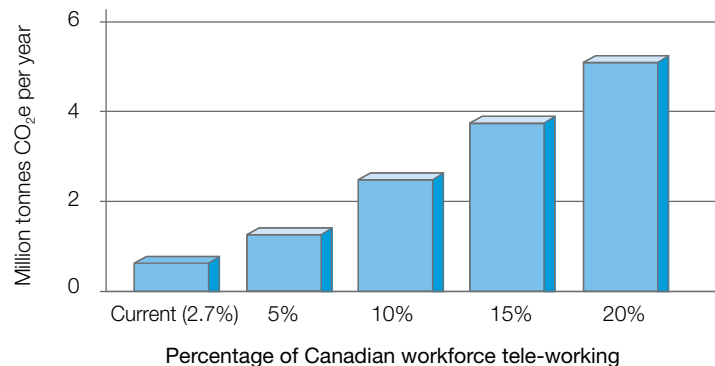
Approximately 500,000 Canadians, or about 2.7% of the workforce, are now tele-workers. On average, substituting one Canadian's daily commute eliminates 1.4 tonnes of GHG a year. Increasing the number of tele-workers to just 5% would result in a reduction of 1.29 million tonnes of GHG emissions per year through the elimination of car commutes to offices.

A more aggressive approach involving policies that promote tele-work would easily expand the Canadian tele-workforce to 10% (1,797,070 individuals), which would reduce GHG emissions by 2.58 million tonnes.

Each tele-worker who avoids commuting 5 days per week saves \$3,377 per year. This equates to savings of approximately \$1.24 billion if 5% of the workforce tele-works. The stretch goal would save approximately \$2.47 billion. Shrinking physical workplace requirements could save employers in the order of \$844 million to \$1.69 billion. Even shaving 1% off the annual highway budget would save provincial and municipal governments \$1.5 billion.

For the methodology used to calculate these savings, please go to [wwf.ca/hitech\\_lowcarbon](http://wwf.ca/hitech_lowcarbon)

### GHG reduction potential from increasing tele-work



## The tele-workplace today

Today's technologies enable people to work from remote locations at least as effectively as in an office and often more. Using Canada's broadband networks, companies can provide 'virtual private networks' that offer workers a secure, networked environment indistinguishable from that at a traditional office.

Broad availability of high-speed networks with secure Virtual Private Networks built into them will provide the backbone. Sophisticated collaboration and communication tools enable people engaged in a common task to achieve their goals. Electronic collaboration among multiple parties is seen as a breakthrough strategic innovation in the 21st century. This has spawned a deluge of collaboration tools which can enable tele-workers to collaborate remotely as well as or better than co-located colleagues. Shared calendars allow workers to book either physical or electronic meetings and have them appear in all workers' agendas, whether in the office or at a remote site. Project management systems can span both local and remote workers, and keep all informed and on track in a shared project.

Phoning tele-workers in a home office can be indistinguishable from calling them at work. With Voice Over Internet Protocol (VOIP), telephone numbers are no longer linked to a particular location but are portable to wherever there's an Internet connection. Workers are connected to the corporate voice mail system, able to receive, store, and forward messages as if they were connected at the office.

Likewise, email and instant messaging are accessed anywhere there is Internet access. Even informal social office relationships can be reproduced through use of social networks. Knowledge management systems allow collection, organization, management and sharing of common knowledge in a variety of systems, from any location.

These technologies level the playing field between workers at the office and tele-workers and ensure that tele-workers are at least as effective as workers in a traditional office setting.

### **CASE STUDY: Tele-workers cut 20,000 tonnes of GHG emissions**

As a communications-rich company, almost half of Bell Canada's 43,000 employees are equipped to tele-work. Surveying them revealed that 6% do tele-work. Some only do so occasionally with an average of 4.8 days per month, and regular tele-workers at 13.45 days per month (measured over 18 workable days including holidays, sickness, etc).

The commuting time saved by tele-working is significant. For 20% of tele-workers it eliminates a 60-90-minute trip each way, and 60 % make their trips in cars – the most carbon-intensive commuting mode (excluding air travel).

Tele-workers are very enthusiastic about the huge improvement in their life style, and even reluctant managers have been won over, as evidenced by this comment from a Bell manager:

“The fact is some tele-workers can be more efficient than office workers through elimination of commuting, and reduced disruptions associated with normal offices environment. Phone calls are more focused and shorter. Use of Instant Messaging has grown to replace email and phone calls for obtaining info and permits more multitasking.”

The net result of Bell's tele-working policy and practice has been an annual reduction of 20,000 tonnes of GHG emissions.

## The tele-workplace of tomorrow

A good worker in the office is a good tele-worker and, in many cases, a better, more productive worker because of fewer distractions. Attitude is the greatest impediment to the significant environmental and economic benefits of tele-work. Companies that successfully use tele-workers have educated managers and developed tele-working policies and guidelines.

Many workplace managers cling to an outdated notion that for employees to be effective they must be in the line of sight of a manager, while employees worry about isolation. Increasing the number of tele-workers in Canada requires a concerted effort by business and the public sector to change the attitudes of workplace managers and to deploy remote working tools and discourage vehicle use.

## Innovating @ the speed of light

### Government should drive uptake by:

- instituting toll zones for vehicles or for cars with only one passenger, increasing parking fees, and/or other fees/taxes to dis-incent commuting in cars;
- providing tax incentives to offset start-up hardware/software costs for tele-work environments;
- instituting programs like Transport Canada's ecoMobility program, which offers grants to municipalities and other organizations to test innovative ideas for reducing transportation emissions;
- being a role model by adopting and promoting tele-work;

### Business should drive uptake by:

- providing education to change management attitudes and break down resistance by countering myths about tele-work;
- actively promoting tele-work, providing training and sharing guidelines;
- developing a certification program for proficiency in tele-work and creating an award program for excellence in tele-work;
- supporting education, especially for MBAs – the future business decision makers – on how to integrate tele-working in their strategies.

### The ICT sector should drive uptake by:

- developing products and services to cost-effectively implement tele-work;
- prioritizing sales of tele-work products and services;
- providing easy-to-use security tools to remove risks of tele-work.

## Recommendation 2:

Share the road, share the ride –  
it's the social way to go.



Transportation-related GHG emissions can be reduced through ride-sharing (car pooling), which ICT facilitates through social networking tools, such as ride matching web sites. Sophisticated online reservation systems also enable people to share cars – allowing access to a vehicle without having to own one.

Every ride shared is a car trip avoided which cuts GHG emissions and lessens the burden on infrastructure. Fewer cars also means less traffic, which reduces idling and the risk of traffic accidents. Commuters get to work faster and save money on gas and maintenance.

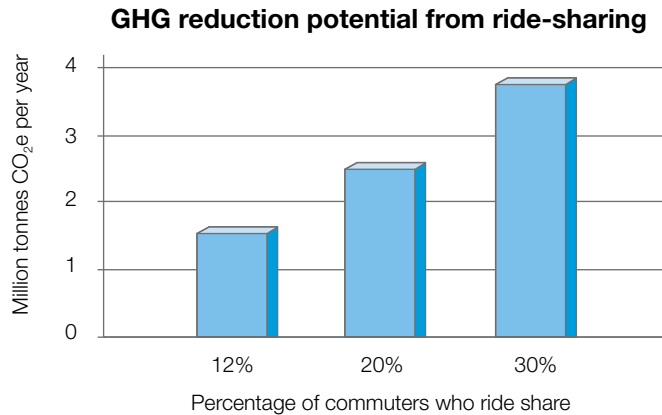
Car-sharing also reduces the manufacturing impact of cars and stimulates behavioural changes. Car sharers drive fewer kilometres per year.

### The goal and the stretch goal

With 10% of Canadian commuters already ride-sharing, grown to 12% would yield 1.51 million tonnes in GHG emission reduction. A stretch target to reach 20% of commuters ride-sharing would result in GHG reductions of 2.52 million tonnes. With the average cost of driving to work at \$3,485 per year in gas, wear and tear and parking, that's \$742 million saved when an additional 2% start ride-sharing, and \$3.71 billion if 20% of Canadians ride-share.

Currently, there are close to 35,000 members of car-sharing organizations in Canada and this industry is only in its infancy. Achieving a total of 90,000 sharers would eliminate 0.13 million tonnes of GHG emissions. Stretching the target to 150,000 car sharers would eliminate 0.22 million tonnes of GHG emissions. Car-sharing individuals save \$500 or more per month compared to the average cost of owning and operating a car in a city.

For the methodology used to calculate these savings, please go to [wwf.ca/hitech\\_lowcarbon](http://wwf.ca/hitech_lowcarbon)



### Ride and car-sharing today

Statistics Canada data shows that only 10% of those commuting to work today are passengers. There is a tremendous opportunity for ICT to facilitate and expand ride-sharing in an organized manner.

While some organized programs (such as SmartCommute in Toronto and Allego in Montréal) and some ride-sharing sites are available, adoption is slow. A simple Google search reveals hundreds of requests for ride-sharing in the Toronto area alone. Promoting these initiatives as a form of public transit would help drive adoption. Compared to the usual costs of public transit initiatives, the investment required by government would be low.

Car-sharing programs can also be facilitated by ICT. The key is a sophisticated reservation system that allows members to reserve a vehicle online or via a mobile device using a smartcard or chip-enabled key to unlock any door in a fleet. Notwithstanding extremely low awareness among Canadians, the largest car-sharing organizations in Canada (Communauto, Autosshare, ZipCar and Co-operative Auto Network) together boast over 35,000 members across Canada. This indicates huge room for growth.

### **CASE STUDY: Car sharing reduces cars, costs and climate impact**

Communauto, a very successful car-sharing operation in Montréal, Québec City and Sherbrooke has 14,000 members. About 20% say they use car-sharing instead of having a car, and even more (61% in Québec and 81% in Montréal) state it has allowed them to avoid the purchase of a second car. Studies in Québec and Europe have shown that 33-50% of the members of a car-sharing service eventually give up a car. In addition, members reduce the mileage they drive in cars by up to 57%.

## **Sharing tomorrow**

The greatest impediment to ride-sharing is the difficulty and inconvenience of finding someone with whom to share a ride. There are also concerns about personal safety and insurance coverage.

Online social networks have proven remarkably successful in connecting millions of people with similar interests and should contribute to the success of ride-sharing. Ride-sharing should produce similar results. Every individual added to a social network increases the probability that a hopeful ride-sharer and ride provider can find a match. The rapid expansion of wireless capabilities also means that adjustments can be made at the last minute.

Car-sharing is similarly subject to a virtuous circle of adoption – the more members, the larger the fleet that can be supported, and the more likely each member is to find a conveniently located car when needed. Car-sharing is likely to become progressively more popular with greater adoption.

## **Innovating @ the speed of light**

### **Governments should drive uptake by:**

- increasing the number of High Occupancy Vehicle (HOV) lanes as an incentive to sharers;
- instituting financial dis-incentives to commuting alone, as outlined for tele-working;
- providing ride-matching service through appropriate government and transit web sites;
- treating ride-sharing as a form of public transit while providing financial and administrative support.

### **Business should drive uptake by:**

- naming a ‘champion’ to promote ride-sharing internally;
- providing ride-matching tools e.g. on Intranets;
- developing recognition programs for ride-sharers;
- conveying the environmental and social benefits of ride-sharing versus driving alone;
- profiling and praising uptake.

### **The ICT sector should drive uptake by:**

- developing turnkey implementation approaches that can be easily implemented by employers or municipalities.

## Recommendation 3:

Optimize the burn – drive smarter.



Commercial vehicles consume vast amounts of ever scarcer GHG intensive fuels. Route optimization aims to decrease travel distance, which in turn significantly reduces fuel consumption and costs. Combining cheap data transfer with remote modern devices offers huge opportunities to improve the efficiency of commercial vehicle operations.

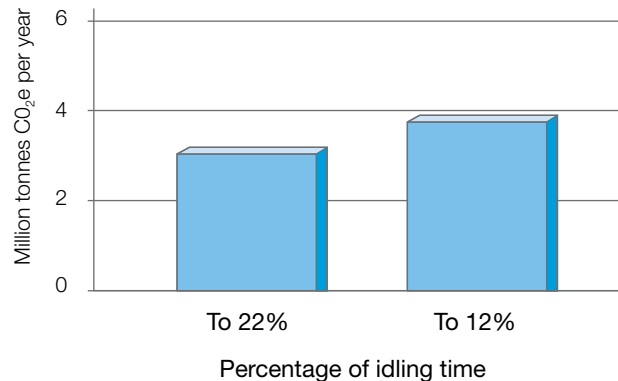
### The goal and the stretch goal

By reducing idling to 22% of total operating time from an average of approximately 48% in Class 8 (large) trucks, 3.19 million tonnes of GHG emissions can be avoided. A more aggressive deployment of ICT tools can help reduce idling time to 12%, thereby reducing emissions by 3.91 million tonnes. Similar results can be achieved in service vehicles. Most large trucks can reduce their fuel bills by 10-15% just by limiting idling, saving approximately \$1.17 – \$1.43 billion a year with the cost of the equipment paid back in the first 6 months.

Basic route optimization tools are already deployed in the transportation sector. Even the most rudimentary of these can chop at least 10% off a service vehicle's mileage. If just 10% (250,000 vehicles) of Canada's fleet adopted ICT, the savings would amount to at least \$25 million in fuel, reducing carbon emissions by at least one megatonne.

For the methodology used to calculate these savings, please go to [wwf.ca/hitech\\_lowcarbon](http://wwf.ca/hitech_lowcarbon).

### GHG reduction potential by reducing idling



## Transport optimization today

Commercial vehicles spend a shocking proportion of their time idling and pumping out GHG emissions.

ICT provides data to understand and modify driver behaviour: engines with on-board computers record and provide feedback on idling, speeding and hard-braking. Some larger trucks can provide sophisticated reports either passively, when a vehicle arrives in a yard, or actively through mobile and satellite communications systems.

ICT also has a central role in facilitating intelligent dispatch and route optimization, helping reduce vehicles' total mileage and travel time. United Parcel Services famously plans its routes to avoid left turns. This greatly reduces time spent idling with surprisingly large reductions in fuel costs and GHG emissions.

The use of intelligent dispatch systems can improve the efficiency of both intra-city fleets and long-distance transportation and trucking. The availability of affordable GPS systems is accelerating the development of software to maximize efficiency in these areas.



**CASE STUDY: Telematics to the rescue**

Bell uses telematic technology to achieve higher customer service with less fuel and lower emissions. This equipment provides round-the-clock vehicle positioning, remote maintenance diagnostics, and wireless in/out transmission of a range of data useful in modifying driving patterns and expediting orders.

The ability to optimize dispatch results in a 10% reduction in the total distance driven, reducing unproductive time and improving by 3% the time vehicles are in use. While turning service vehicles into fully-equipped mobile offices could have the rebound effect of increased idling, feedback and automatic control mechanisms are programmed to reduce it on average by 30%. With these efficiency parameters, rollout to a first group of the company's Québec and Ontario fleet of 1,300 vehicles, which process 164,000 orders annually, will yield 1,787 tonnes of GHG reduction (minus 30.3 tonnes 'spent' to run the equipment).

Adoption rates of these technologies remain low despite the significant cost savings. Several factors that inhibit more extensive roll-out must be addressed, including concerns from employees about such real-time reporting and continuous oversight and the cost of communicating data via existing wireless networks. For some, it is simply inertia and sometimes the low visibility of fleet operations as a source of cost savings and environmental benefits.

## Optimized transport tomorrow

While much attention has been given to using alternative fuels to reduce GHG emissions in the transportation sector, the opportunities are limited and complex and not without controversy and cost. Using ICT to help reduce transport-related emissions is a faster, less expensive way to make a difference. Besides the wider adoption of today's technologies, there are other approaches that could achieve even further reductions. More sophisticated ICT approaches can eliminate routine trips to/from central offices and compounds both during the course of a day and the commuting trips at either end.

Real-time information about traffic management is increasingly available to travelers, either in highway signs or in GPS-based individual information devices. More cars are equipped with transponders to interact with toll stations. Tire manufacturers are considering embedding chips in all tires. The vast majority of individuals have cell phones. In this environment, ICT can facilitate a system in which all private vehicles are connected to an intelligent transportation grid that dynamically routes and redirects them to optimize flow of traffic. Improved efficiency, reduced mileage and avoidance of idling would result in reduced GHG emissions.

Applying these technologies to the public transportation system would make mass transit more effective and attractive. These include enabling Radio-Frequency-Identification (RFID) smart cards as common currency across buses, trains, light-rail lines, ferries, taxis and commuter/carpool parking lots.

## Innovating @ the speed of light

### **Government should drive uptake by:**

- standardizing vehicle monitors and mandating their use;
- mandating vehicle monitors in government and Crown Corporation fleets with pro-active policies to reduce emissions;
- implementing intelligent traffic management systems to reduce fuel (and give preference to private vehicles carrying more than one person);
- introducing rebates/surcharges to encourage uptake of transport optimization tools until requirements kick in.

### **Business should drive uptake by:**

- highlighting opportunities, leadership efforts and ecological benefits of reducing mileage and increasing fuel efficiency;
- educating fleet managers on the benefits of driving more fuel-efficiently by using information from vehicle monitors;
- educating driver members about benefits of exploiting vehicle monitoring to drive more fuel-efficiently;
- discontinuing resistance to installation of vehicle monitors and highlighting their value.

### **The ICT sector should drive uptake by:**

- developing low-cost services to support low-volume, low-bandwidth communications to facilitate data stream;
- prioritizing the marketing and sale of these products and highlighting the cost saving benefits.

## Recommendation 4:

Collaborate economically –  
conduct more virtual meetings.



**Skilful collaboration is a must in today's business environment. This collaboration extends beyond the individual work group to include collaboration across work groups and business units, suppliers and customers. In an era of globalization, those collaborating can be anywhere in the world.**

**Paralleling the rise of global teams, air travel has become increasingly unpleasant with long wait times, longer flights, intrusive security practices, rising prices and falling service levels. The stage is well set for ICT-enabled collaboration.**

Electronic conferencing has been a staple of workplace collaboration for decades. The telephone enables voice communication without physical presence. Teleconferencing enables groups of people to meet without physical presence. A new array of ICT tools is available and constantly evolving to assist with electronic meetings and collaboration. These include video conferencing, data conferencing, document sharing, webinars and remote training technologies.

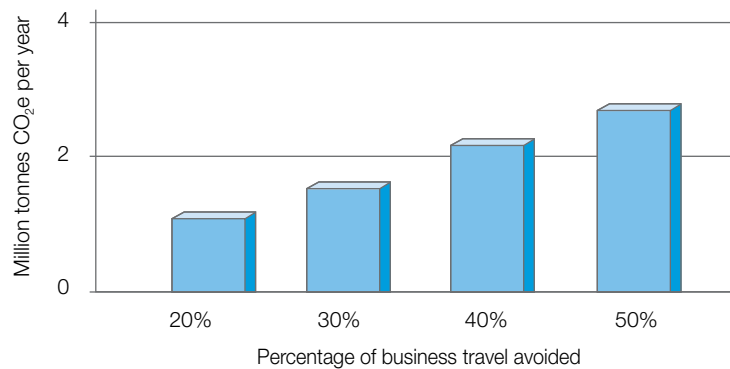
### The goal and the stretch goal

Relatively conservative actions to promote and enable the expanded use of electronic conferencing, electronic collaboration and electronic training can eliminate 20% of business travel and would reduce greenhouse gas emissions by 1.08 million tonnes a year. Substituting 30% of business travel would result in reductions of 1.62 million tonnes of GHG. With rising fuel prices, the stretch goal is not inconceivable.

Assuming a proportional mix of domestic and international travel is avoided, savings of \$5.6 – \$8.4 billion are possible, requiring well under 100 trips to pay back a sophisticated electronic collaboration system.

For the methodology used to calculate these savings, please go to [wwf.ca/hitech\\_lowcarbon](http://wwf.ca/hitech_lowcarbon)

### GHG reduction potential from electronic conferencing



## Collaboration today

Statistics Canada reports that Canadian business travel accounts for a whopping 5.4 million tonnes of GHG emissions.

Driven primarily by cost considerations, an increasing number of companies are making a great effort to reduce their travel to meetings. Webinars are becoming commonplace for people to get a live mini-tutorial or training in particular topics. In the financial world, teleconference calls or full webcasts are regularly used for annual general meetings and analyst calls.

Training in particular is being revolutionized by the availability of new and more flexible tools for remote meetings. Whether it's a corporate training program, a distance-based post-secondary program, medical training, or any number of other training initiatives, training departments are stretching budgets and scarce training resources by using distance education.

With the ubiquity of the Internet, new tools such as document sharing and mark-up, enables distributed teams to work in ways they haven't before. The benefits of electronic conferencing include: greater productivity; faster

decision-making and improved time to market; improved responsiveness; better document tracking and project management records, and improved communication and collaboration with co-workers, partners and customers. Nevertheless, there has been resistance to distance conferencing for certain types of sensitive meetings where past technology has not captured the full range and nuance of voice and body language. In addition, the complexity of simply establishing the connection has often resulted in low usage of existing facilities, but things are changing quickly in this field.

### **CASE STUDY: Video conferencing drives carbon footprint reduction**

The first priority for Hewlett-Packard (HP) is reduction in air travel accomplished through the use of its Halo video conferencing technology. According to Dreamworks founder Jeffrey Katzenberg, this technology is designed to be “as though you were there”.

When employees request travel arrangements to and from any of the 34 destinations (in 14 countries) with Halo Studios, HP’s travel system prompts them to book a Halo Studio instead. HP calculates that each studio avoids an average of one flight per day. With the number of studios quadrupling by 2009, the company expects to significantly reduce staff travel time and costs, and avoid at least 32,000 tonnes of GHG emissions per year.

## **Collaboration tomorrow**

Breakthroughs in technology are changing the nature of the electronic conferencing experience, providing real-time, life-like definition – even holographic images. These new technologies offer the promise that teleconferencing can achieve the intimacy and interaction quality of face-to-face meetings. In Europe, the emergence of high quality video phones has dramatically reduced intra- and inter-city travel.

Cost is the impediment to early adoption of this cutting edge technology. However – as proven by most technologies – as the marketplace expands the price tends to come down, often quickly and dramatically.

## **Innovating @ the speed of light**

### **Governments should drive uptake by:**

- providing financial incentives for purchase of conferencing equipment and collaborative software, such as faster capital write-off schedules;
- eliminating aviation fuel tax exemption and other subsidies to air travel;

### **Business should drive uptake by:**

- setting and implementing carbon-reduction policies including carbon calculators and budgets (what is not measured is not managed);
- transforming “travel” departments into “meeting” departments;
- acting as a role model by adopting electronic conferencing;
- establishing organizational ‘travel-free’ times;

### **The ICT sector should drive uptake by:**

- providing training in effective conferencing techniques;
- demonstrating how to calculate the multiple benefits of electronic conferencing.

## Recommendation 5:

Let's get digital, with e-products and e-transactions.



In a digital age, many products that were once composed of atoms are now composed of bits: digital newspapers, online directories, music downloads, video downloads, digital books, electronic conferences, webinars, email and instant messages.

In addition, more of our transactions for physical products are executed online – banking, bill paying, tax filing, government services, and more. ICT offers the opportunity to convert much of what is done in the physical world (with its GHG-producing consequences) into activities done electronically, with a much smaller environmental impact and with significant cost savings.

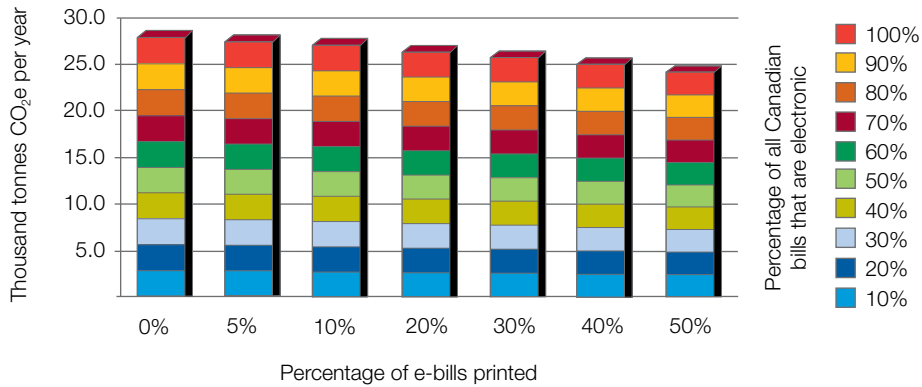
### The goal and stretch goal

If Canadians replace 40% of their physical bills with electronic ones and print 20% of these, GHG emissions would be reduced by 10,500 tonnes per year. If they replace 80% of their physical bills with electronic ones and only print 5% of these, the reduction opportunity increases to 22,000 tonnes. Electronically replacing one-third of music CDs sold annually yields an additional emission reduction of 11,100 tonnes.

Meeting this goal can save Canadian businesses \$1.1 billion, and the savings can be stretched to \$2.2 billion by doubling implementation.

For the methodology used to calculate these savings, please go to [wwf.ca/hitech\\_lowcarbon](http://wwf.ca/hitech_lowcarbon).

**GHG reduction potential from e-billing**  
(based on percentages of letter mail displaced)



The business case for e-transactions is extremely compelling – it saves money for the company. The financial investment has a quick payback, it eliminates nuisance paper for the consumer, and satisfies both the company’s and consumer’s desire to reduce their carbon footprint. All that’s needed to improve adoption is commitment.

## Converting physical to electronic today

An increasing number of businesses are asking customers to conduct their business electronically. The main motivation is cost savings, with some companies even offering customers a discount to accept e-billing on the grounds that they are passing along some of their savings. More recently, e-transactions have also been recognized both by businesses and customers as an environmentally responsible and preferable way of doing business.

Carbon reduction benefits of e-billing arise predominantly from avoiding the energy involved in paper production: harvesting, transporting and processing the fibre into a finished product. Trees are important storehouses of carbon and can sequester or release varying amounts of carbon depending on the nature of the forest and the forestry practice. WWF is presently involved in assessing the lifecycle carbon balance from woodland to mill to product to waste.

### **CASE STUDY: e-solutions enable low-carbon banking and commerce**

The Royal Bank of Canada is committed to offering its clients a low-carbon banking system. Banking online eliminates trips to the bank, the most GHG-intensive part of banking for customers.

To promote an e-statement option, the bank offers to donate \$5 to the Nature Conservancy for every customer who switches. Since March 2006, clients have been able to get their banking statements electronically. More than two million customers are using this option with another 50,000 going electronic every week. The result is a cumulative reduction of 1,300 tonnes of GHG emissions plus savings of 10,500 trees and 36 million litres of water.

The bank has now begun offering VISA e-statements, as well as e-statements for credit lines and home lines of credit. RBC's 78,000 employees have been receiving electronic pay stubs for three years. The bank also requires electronic bills from its suppliers.

## **e-transactions tomorrow**

The next generation of Canadians is growing up digital and will live in a digital world. Our information and entertainment industries are being steadily digitized and all signs point to this trend accelerating in the future. Print advertising has shifted online; even the venerable Canadian Tire catalogue will be digitized. For reference information from local directories to stock process, online is the go-to location. Readership of printed newspapers and magazines is declining as readers turn to electronic options for their information. For the music industry, the transformation is basically complete. Video has been moving quickly online, books will likely provide the next breakthrough. The financial benefits of digital rather than paper transactions will continue to drive transactions online.

## **Innovating @ the speed of light**

### **Governments should drive uptake by:**

- setting targets for and reporting on e-transactions and the associated GHG reductions;
- acting as role models in adopting e-transactions;
- promoting the environmental benefits, ease, security and legality of e-transactions while debunking perceived barriers.

### **Business should drive uptake by:**

- highlighting the ecological benefits both for the company and its customers;
- highlighting the long-term financial savings and 'easy win' quick payback;
- making e-billing and e-transactions a corporate priority and promoting its benefits.

### **The ICT sector should drive uptake by:**

- developing shared services for e-transactions for smaller businesses that might struggle to implement their own systems.





## Recommendation 6:

Build Canadian efficiencies –  
from bungalows to skyscrapers.

Heating, cooling and lighting buildings is very energy-intensive and a substantial source of GHG emissions. This is largely the result of a lack of energy-efficient building stock, relatively low-cost energy and Canada's cold winters and warm summers.

While cars, SUVs and airplanes are the archetypical culprits of climate change and the focus of much attention, consumers have little awareness of the energy inefficiency of buildings. And ultimately, the built environment offers the greatest opportunity for reduction of GHG emissions.

Heating, cooling and plug-load in buildings account for 29% of Canada's GHG emissions. ICT offers significant opportunities to help Canadians better manage and control their energy consumption, with the attendant environmental and financial benefits.

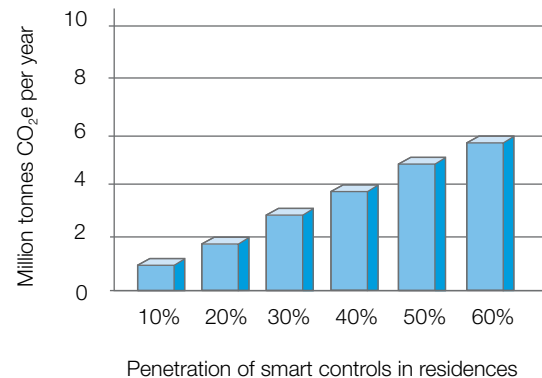
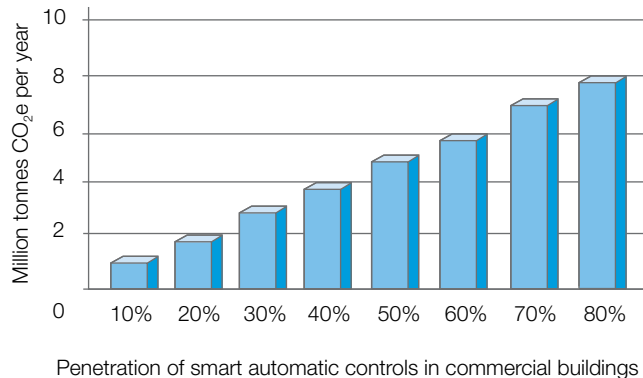
### The goal and the stretch goal

Modest changes in behaviour can result in a per-home reduction in energy use. The goal of a 6% reduction has been reached in homes with energy monitors. Extrapolated to national uptake at 86%, this could achieve 4.34 million tonnes of GHG emission savings. Education, promotion, and effective time-of-use billing will allow consumers to achieve a 15% reduction in energy use, translating into a stretch target of a 10.85 million-tonnes reduction of GHG emissions. At average electricity costs, consumers would save \$206 – \$515 million per year. Utilities experience immediate payback on meters through operational savings.

Deployment of automatic controls for space heating/cooling, hot water and lighting can save even more. Equipping 50% of commercial buildings and 20% of residences can result in a saving of 6.6 million tonnes GHG emissions. A stretch target could be achieved with appropriate promotion, education and incentives and save 12.2 million tonnes. Bottom line savings would be in the order of \$1-2 billion, depending on commercial energy rates.

For the methodology used to calculate these savings, please go to [wwf.ca/hitech\\_lowcarbon](http://wwf.ca/hitech_lowcarbon).

### GHG reduction potential from automatic controls



## Building efficiency today

ICT can help make buildings more energy efficient by reducing the total energy consumption as well as smoothing out peaks and troughs of energy use. Reducing peak consumption does not actually reduce energy use. However, it can eliminate the need for new power plants and reduce the use of carbon-intensive energy sources in provinces where fossil fuels are used for electricity and heat.

“Smart” meters provides detailed information about energy consumption to both the user and the seller in real time. Combined with time-of-use billing (where peak times cost more), customers can see the value of changing their consumption patterns. BC is installing meters for all 1.7 million customers. Ontario is installing smart meters in all residences and small businesses. This is increasingly attractive to utilities whose mandates include both energy provision and conservation. It helps guide system planning and investment, and completely eliminates the need for on-site meter reading – saving money and emissions.

### **CASE STUDY: Local electricity and communications service providers help local customers save**

A seven-month pilot test involving 375 Ottawa Hydro customers assessed how real-time data combined with time-sensitive pricing structures would affect electricity consumption during the summer: participants with a visible meter and time-of-use pricing reduced overall consumption by 6% and peak consumption by 5.7%.

A project in Milton, Ontario is providing a glimpse of the future, starting with 250 homes. Bell’s Home Energy Conservation solution is an easy-to-use system that provides residences with real-time and historical consumption information accessible both on the Internet and through mobile devices. The local utility can control energy demand according to pre-set criteria and programs, and receives real-time feedback from participating homes and communities needed for energy planning and grid control.

While information from such monitors can be acted upon or disregarded, a ‘demand-response switch’ controls use in response to specific conditions. Households and industries who agree to install a switch on their air conditioners, hot water tank and/or other equipment, also agree to allow their utility to control their unit or turn off the power for short periods in response to peaks in demand. Such a system is mainly designed to cope with impending crisis situations that would lead to brown-outs. But the technology could be a powerful tool to reduce overall electricity consumption beyond emergency prevention.

These devices allow them to be effectively controlled in order to minimize electrical utilization and GHG emissions.

## Buildings for tomorrow

The power delivery system of the future could look very different as ICT is thoroughly integrated. Today we have two distinct infrastructures: the electrical grid and the communications grid, which exist as two solitudes. The symbiosis is beginning as intelligence – ICT-enabled feedback and control opportunities – becomes embedded in the electrical grid. In such an integrated system, consumers could be equipped with a ‘natural resources dashboard’, including a GHG meter, cost and alternate options, and utilities would have the capacity to optimize individual customers’ usage.

Presence-based power activation is another ICT application with promise for eliminating energy waste. Systems that automatically activate lighting and heating/cooling, initiated by a specialized RFID card or by a cell phone, go beyond simple motion sensors for lighting, as they are securely associated with designated persons who can turn things on/off.

So-called “intelligent” buildings with sophisticated ICT can continuously monitor internal and external conditions, shifting consumptions patterns in real-time by choosing the cheapest and most carbon efficient method of providing heating and cooling. While becoming the norm in new buildings, retrofitting older buildings with such technology can payback in as little as one and a half years.

## Innovating @ the speed of light

### **Governments should drive uptake by:**

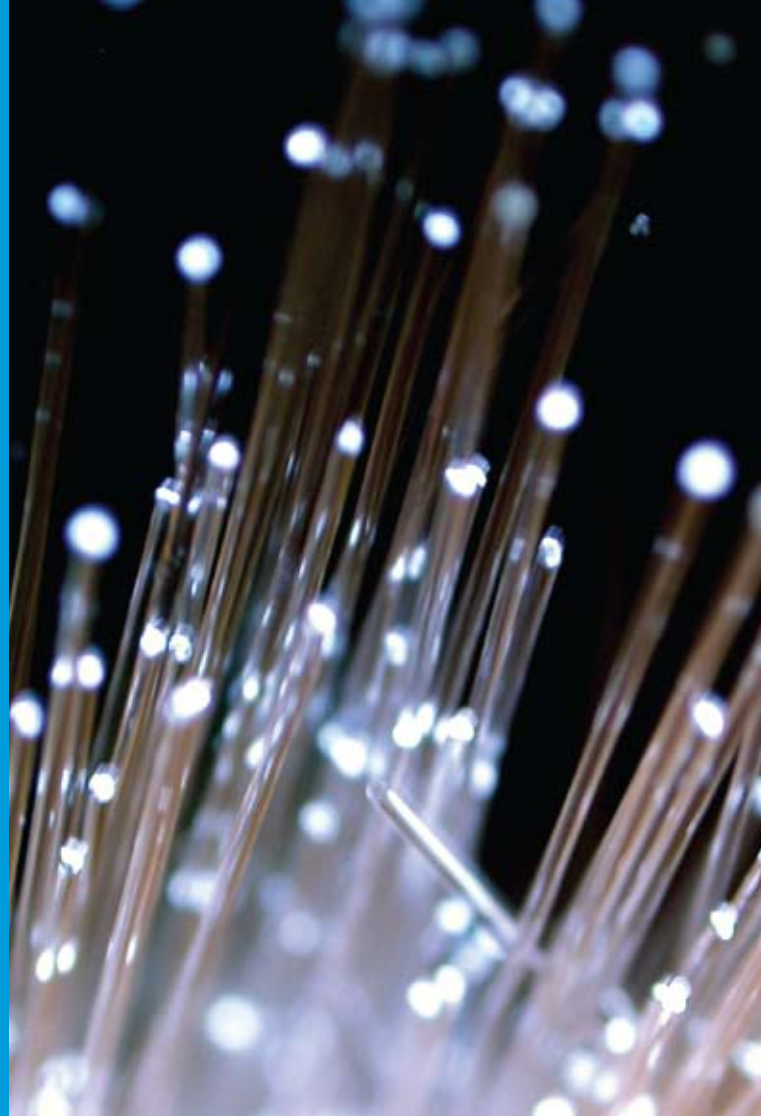
- setting efficiency targets and policies;
- mandating time-of-use billing, demand-response programs and energy conservation targets for all utilities;
- requiring all major appliances to be ‘smart-meter-ready’ and ensure meters are consumer-friendly;
- creating price signals and financial incentives to accelerate installation of ‘intelligent’ controls in new and older buildings;
- educating the public about how significant their home energy consumption is while promoting the value of reducing consumption in mitigating climate change.

### **Business should drive uptake by:**

- highlighting the financial and ecological benefits of having greater control and the ability to track and forecast energy use;
- installing “smart” metres in company buildings.

### **The ICT Sector should drive uptake by:**

- developing network services to move small volumes of data cost-effectively.



## Conclusion:

Broadband solutions to climate change in Canada.

As Paul Dickinson points out in his eloquent forward we humans have a wonderful ability to change when change is in our better interest. We know our interests are under threat from climate change. This document is meant to draw attention to that fact – together, we know that we must halve our greenhouse gas emissions or our future is imperiled. But these pages also serve as a reminder that change is part of human nature. Throughout our history, we’ve succeeded time and again in teaching ourselves to alter our ways. We will this time, too. It’s one of the things we’re good at.

Technology, we remind ourselves, has always been the fulcrum of our evolution. Today, Information and Communications Technologies are at the vanguard of a series of transformations that will not only help us cut GHG emissions, but also enhance the way we live our lives. It's an entirely human response: increase productivity (both social and economic) by decreasing harmful waste – while at the same time enhancing our material well-being.

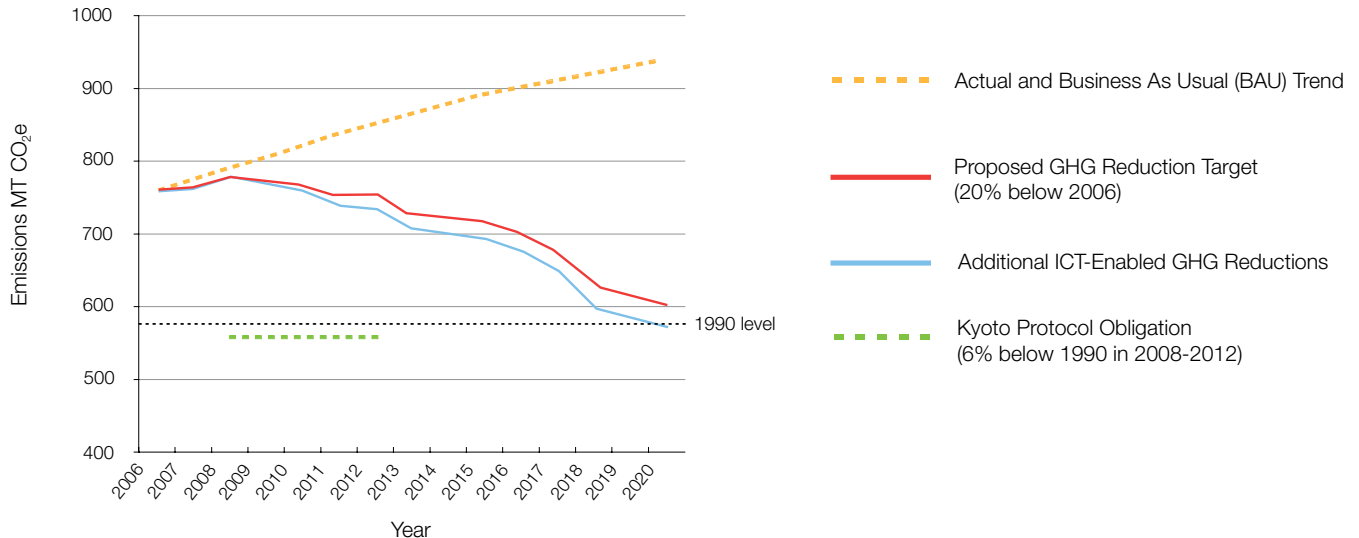
In the near-term, a variety of ICT products and services will enable us to reduce car and air travel, increase the efficiency of buildings, commercial transportation, and digitization of materials, while also reducing greenhouse gas emissions by approximately 20 million tonnes per year. That amounts to roughly 7% of Canada's annual average Kyoto obligation. This goal can be achieved with fairly straight-forward changes in behavior.

In this report, we have presented a roadmap toward a series of strategic investments combined with a plea for the removal of financial and regulatory disincentives presently in the way of getting Canadians where we need to go.

A more ambitious (but eminently achievable) goal would drive deployment of ICT applications to enable cutting GHG emissions by 36 million tonnes a year, certainly within a 2020 timeframe. Against a backdrop of consistently rising emissions, and at a time when the trend should be at least 25% below 1990 levels, this would be a welcome outcome.

Because most of the ICT-enabled reductions we have discussed will come from energy conservation, they will reap great financial savings. The estimated \$7 billion annual savings from reaching the near-term goal, and the potential \$13 billion from stretching deployment of ICT tools, go right to the bottom line for all of us – business, government, as well as each of us individuals. This is without even taking into account the significant avoided costs of energy production and distribution or, for that matter, the increasingly internalized cost of carbon.

### ICT Enabled Reductions In Canada



Canada's proposed climate plan does not foresee meeting Kyoto obligations or the level of emission reduction scientists deem necessary to avoid dangerous climate change. Implementation the ICT-enabled reductions outlined in this report could help improve the outlook.

ICT applications create economic opportunity for Canada as a provider of these innovative goods and services to the global marketplace. Strategically-minded energy service companies are poised to access, package, and deliver billions of dollars in financial savings. Compared with the imperative of lowering Canada's carbon output, this may be of secondary benefit. But it comes as a pleasant bonus.

**Furthermore, ICT-enabled solutions will address other pressing needs: work-life balance; reduced strain on infrastructure; promoting more responsive government and business services; encouraging more productive employees and providing access to a wider talent pool.**

Analyses by WWF and others of ICT-enabled GHG reduction efforts in Europe and Australia – and a new global study of industry-specific applications – all come to the same overall conclusion: As ICT becomes integrated into a given society, deeper more transformative opportunities for low-carbon work, travel, learning, and culture combine to offer order-of-magnitude greater reductions.

To date, ICT's deployment in helping Canada do its part to avoid dangerous climate change has been notably lacking in government and business policy. The gap must be filled. Deploying GHG-busting ICT requires more than just the technologies and services described in this analysis (although even these remain under-subscribed). The key is for businesses, governments, and the technology sector to share a vision of ICT as part of the solution to climate change – above and beyond the products and services they sell or use.

Opportunities for creating a low-carbon Canada are simply too important to be left to chance. There is no substitute for establishing short, medium and long-term targets for GHG reduction. These targets must be combined together in an over-arching strategy to deliver on the recommendations to create a roadmap for ICT-enabled solutions to climate change.

## Recommendations:

- 1:** We must build a tele-work culture. Electronic collaboration among multiple parties will be the breakthrough innovation of the 21st century. Using broadband network, companies can provide “virtual private networks”, allowing Canadians to decrease commuting time and energy by working from home.
- 2:** We should enhance car- and ride-sharing. Every ride shared is a car trip avoided. Car-sharing programs can be facilitated by ICT. Online social networks connect ride-shares and ride-providers in a virtuous circle of adoption.
- 3:** We need to optimize the carbon-burn by driving smarter. Commercial vehicles spend a shocking percentage of their time idling, pumping out GHG emissions. ICT monitoring devices coupled with data transfer offer huge opportunity to improve efficiency. Even the most basic route optimizing tools can reduce a service vehicle’s consumption by 10%.
- 4:** We must encourage more electronic meetings. Bringing people together electronically rather than face-to-face saves enormous transportation costs. Eliminating just 30% of business travel would reduce GHG by 1.6 million tonnes.
- 5:** We must facilitate more e-products and e-transactions. ICT offers the opportunity to convert much of the GHG producing activities in the physical world to an electronic one, while also eliminating the nuisance of paper.
- 6:** We need to use ICT to make our buildings more efficient. Heating, cooling and plug-in loads account for 29% of Canada’s GHG emissions. “Intelligent buildings” with sophisticated ICT monitoring can shift consumption patterns by choosing the most carbon-efficient methods.

The ground-breaking *Stern Review on the Economics of Climate Change* warns that climate change could produce disruption in our economy and culture similar to that of the world wars and the economic depression of the first half of the 20th century. Faced with those crises, Canadians were able to – sometimes forced to – adapt their behaviour for the greater good. We’ve done it before; we can do it again. It’s time for business and government leadership to overcome inertia and eliminate counter-productive policies. Current barriers will not be overcome without changes in our basic understanding. With planetary well-being at stake and viable solutions at hand, it’s a prize that’s worth aiming for.

**In the face of looming climate crisis,  
it’s a goal we need to achieve.**



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This Canadian project has been inspired and informed by the work of WWF colleagues and partners who have developed analyses for how ICT can enable GHG reductions in Europe and Australia and leadership commitments by key ICT sector players to reduce GHG emissions.

## **Feedback @ the speed of light:**

Comments and ideas, success stories and challenges, and expressions of interest in collaboration are welcome and needed to further advance the adoption of ICT solutions to climate change, and can be emailed to [ca-panda@wwfcanada.org](mailto:ca-panda@wwfcanada.org).

## **For more e-information:**

In keeping with the objective herein – reducing resource use and global warming emissions – only 1,200 copies of this document have been printed. The report, a two-page summary, the detailed methodologies used for calculating ICT-enabled GHG reductions and financial savings, additional case studies and other reports related to ICT solutions to climate change (by WWF and others) will be available electronically, in easy-to-read format, at [wwf.ca/hitech\\_lowcarbon](http://wwf.ca/hitech_lowcarbon)

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WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature. WWF works to conserve the world's biodiversity, ensure that the use of renewable natural resources is sustainable, and advance reduction of pollution and wasteful consumption.

Nature simply cannot survive runaway climate change, nor can societies that depend on functioning ecosystems. WWF's Climate Solutions 2050 analysis indicates that it is possible to avoid dangerous climate change while humanity develops, but only if growth and prosperity are de-coupled from fossil fuel emissions and the world's forests are safeguarded.

WWF works with change-ready Canadians – individuals, business and government – towards a low-carbon Canada. WWF partners with leadership companies under the Climate Savers banner, helps people start living *The Good Life*, and advances practical and policy measures to stop energy waste and dramatically reduce greenhouse gas emissions.



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