# AT&T Research Report:

# ICT Sustainability Modeling

## August 2011

**AT&T is engaged in ongoing research to help better quantify the emission reductions that its products and services can provide with the goal of educating business customers and society on how they can use Information and Communications Technology (ICT) to be more efficient, productive and sustainable.**

## Introduction

AT&T is engaged in ongoing research to help better quantify the emission reductions that its products and services can provide with the goal of educating business customers and society on how they can use Information and Communications Technology (ICT) to be more efficient, productive and sustainable.

This research report details AT&T's development of greenhouse gas (GHG) emission measurement models that can be used by customers to estimate and document the positive outcomes that result from using AT&T solutions for "travel replacement," including video conferencing and telecommuting.

Research was conducted under the auspices of the AT&T Business Sustainability Advisory Council (ABSAC), a group sponsored by AT&T which is comprised of environmentally focused non-governmental organizations (NGOs), researchers from academic institutions, and select business partners and AT&T customers.

## Background

Since 2008, AT&T has been an active participant in the Global eSustainability Initiative (GeSI), a leading consortium of ICT providers focused on contributing to a more sustainable future. GeSI, along with The Climate Change Group, released the landmark SMART 2020 report and subsequent related studies detailing how ICT can help address environmental issues by enabling others to reduce their GHG emissions by as much as 15% by 2020.

While the GeSI studies raised considerable awareness of ICT's potential for reducing GHG emissions, the lack of commercially relevant assessments and tools for business was viewed as a major impediment to translating the benefits from ICT products and services into quantifiable business sustainability gains.

As part of its ongoing commitment to foster open cooperation and improve sustainability in AT&T's own industry, in late 2009 AT&T formed ABSAC with the purpose of further studying and building upon the GeSI recommendations in an effort to help business customers unlock the full sustainability potential of ICT products and services.

ABSAC is focused on four principal areas that address current gaps in relevant GHG assessment for business:

- Identify new opportunities for ICT to help reduce GHG emissions
- Lead efforts to analyze and quantify GHG emission reductions associated with AT&T's ICT solutions
- Develop common models to demonstrate environmental impacts
- Create tools that aid customers in easily calculating GHG emissions reductions, energy savings and productivity gains

## GHG Modeling Approach

There are currently a number of widely adopted and related environmental protocols and standards for measuring GHG emissions. Principal among these are the GHG Protocol developed by the World Resources Institute and World Business Council for Sustainable Development, the Voluntary Carbon Standard, the Clean Development Mechanism (CDM) from the Kyoto Protocol and the ISO 14064 standard from the International Organization for Standardization (ISO). These approaches represent the scientific and environmental communities "best practices" for measuring GHG emissions.

For the purposes of measuring the benefits of ICT-based GHG reduction, however, these approaches are simply too complex, costly and time consuming for the vast majority of business customers. Recognizing this obstacle, in the summer of 2010, GeSI created the ICT Enablement Methodology that aimed to simplify how to go about identifying and quantifying the GHG emission benefits of implementing ICT solutions. This was achieved by taking the best-in-class attributes of existing methodologies, including the ISO standard, to create a more flexible approach that limits calculations for a specific project goal and scope to all but the most primary enabling effects and life cycle processes that contribute to or eliminate emissions.

Meanwhile, an ABSAC sub-team was formed to focus the group's efforts on applying the GeSI ICT Enablement Methodology as the starting point for its travel replacement model development. However, recognizing that GHG reduction is often not the top priority driving ICT purchase or use consideration among business customers, the models were augmented to include other highly relevant bottom-line business "sustainability" benefits, including travel dollars saved and productivity enhancements achieved.

Mirroring the GeSI ICT Enablement Methodology, the ABSAC modeling exercise followed three primary steps, with particular emphasis on the final step of formulating conclusions:

- Step One: define the goal and scope of the study—this step involves considering all potential GHG effects related to the ICT solution area being modeled.

- Step Two: limit the assessment by defining a "business as usual" reference that excludes all but the most significant primary effects and life cycle processes based on a rough estimation of the drivers of emissions specific to the area under study.

- Step Three: assess and interpret net results through a rigorous assessment of significant life cycle processes based upon assumptions, limitations, uncertainty, data quality and conclusions.

## Data Acquisition

In defining the goal and scope of GHG modeling in this context, it is important to recognize that the emissions related to using telepresence and telecommuniting are generated by individuals. As a result, obtaining explicit data on actual and potential emissions savings achievable through ICT requires input from individuals related to their activities and based on actual individual experiences. Recognizing the challenges and timeframe that would be required to create an original baseline study, the ABSAC team determined to obtain readily available "evidence-based" data from AT&T's historical data and surveys regarding AT&T employee life cycle processes.

This streamlined approach provided the ability to quickly calibrate and validate predictive models for GHG emissions reductions based on an assessment of relevant effects from data already collected regarding AT&T's own use of AT&T Telepresence Solution® and ongoing tracking surveys of AT&T's approved telecommuting population equipped with AT&T Remote Access Services.



AT&T Telepresence® can be used as a "travel replacement" technology

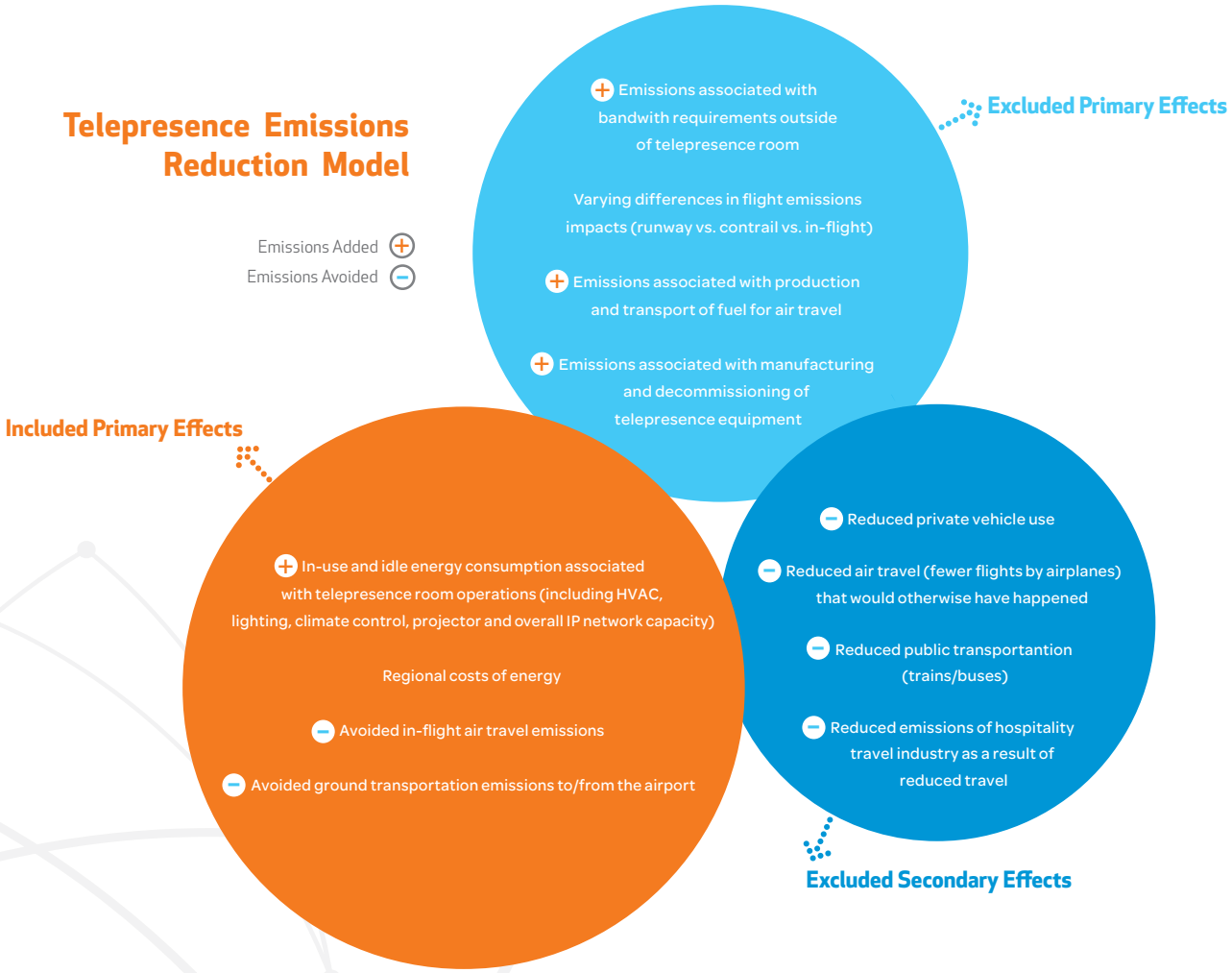
## Step One: Define Goal and Scope

The goal for this modeling study was to provide business customers with a recommended approach for measuring the sustainability benefits of using AT&T Telepresence Solution® as a travel substitute for conducting meetings involving attendees from multiple locations. Assessment decisions regarding what primary and secondary enabling effects to include or exclude were driven by extensive analysis of data documenting AT&T's own usage experience as well as additional studies regarding telepresence provided by the original equipment manufacturer, Cisco.

AT&T uses telepresence in its own business in more than 150 installed telepresence rooms to conduct meetings and to improve the ability of employees to communicate and collaborate. AT&T's telepresence usage has been tracked since January 2009, capturing data from Cisco Telepresence Manager meeting logs and AT&T Exchange Server calendar information used to determine meeting scheduling and participation. Meeting attendee locations are linked to GPS coordinates that allow for the calculation of potential travel savings and GHG emissions avoidance. The usage tracking also includes employee surveys conducted to collect qualitative feedback and validate assumptions.

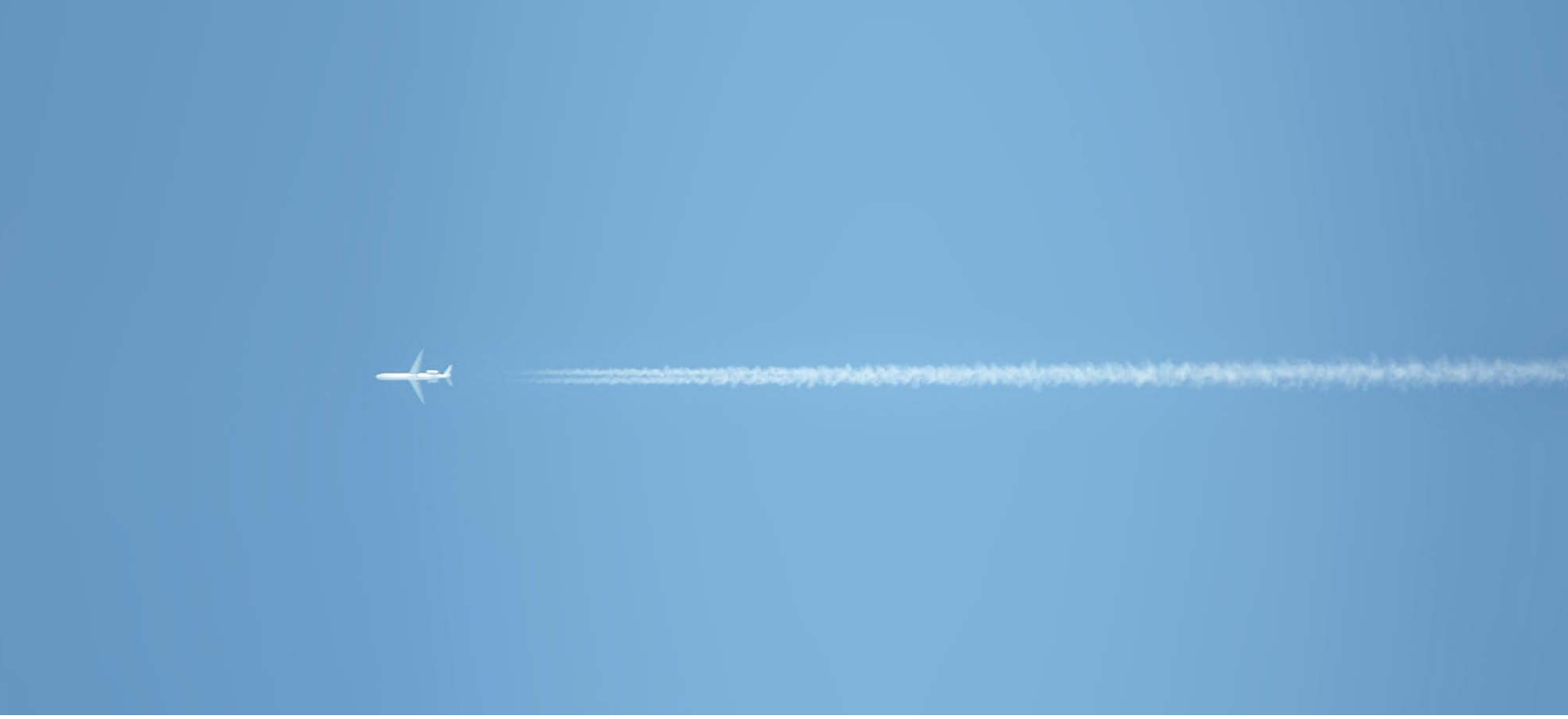
In addition to realizing productivity gains through the use of telepresence, AT&T conservatively estimates that telepresence usage over the most recent 12-month period (ending April 2011) saved in excess of $6.4 million in travel dollars and avoided more than 3,800 metric tons of $CO_2$-equivalent emissions—an amount roughly equal to the emissions generated by 745 passenger vehicles for a

year (based on figures obtained using the EPA's Greenhouse Gas Equivalencies Calculator). Note that AT&T elected to represent GHG measurements in terms of $CO_2$-equivalents, called $CO_2$-e, which represents all GHG emissions using $CO_2$ as the common unit of measure.




## Step Two: Limit Assessment

The primary enabling effect of telepresence in reducing GHG emissions stems from meeting attendee travel avoidance, including in-flight travel and ground transportation to and from the airport. In order to get a full view of associated emissions savings and incremental emissions generation, the model includes in-use and idle energy consumption associated with telepresence room operations (including HVAC, lighting, climate control, projector and overall IP network capacity) as a primary enabling effect.



Excluded primary effects included emissions associated with bandwidth requirements outside of that required for the telepresence room and emissions associated with manufacturing and decommissioning of telepresence equipment, since their impact was assessed as negligible. Having telepresence rooms does consume energy, however, it only represents 1.5% of the air travel emissions avoided according to data collected by Cisco. Also excluded were varying differences in flight emissions impacts (runway vs. contrail vs. in-flight) and emissions associated with production and transport of fuel for air travel.

The model also excludes other secondary effects that eliminate emissions that occur when conducting meetings via telepresence. These include private vehicle use, air travel that would otherwise have happened (fewer flights by airlines), public transportation (trains/buses) and emissions of the hospitality/travel industry.

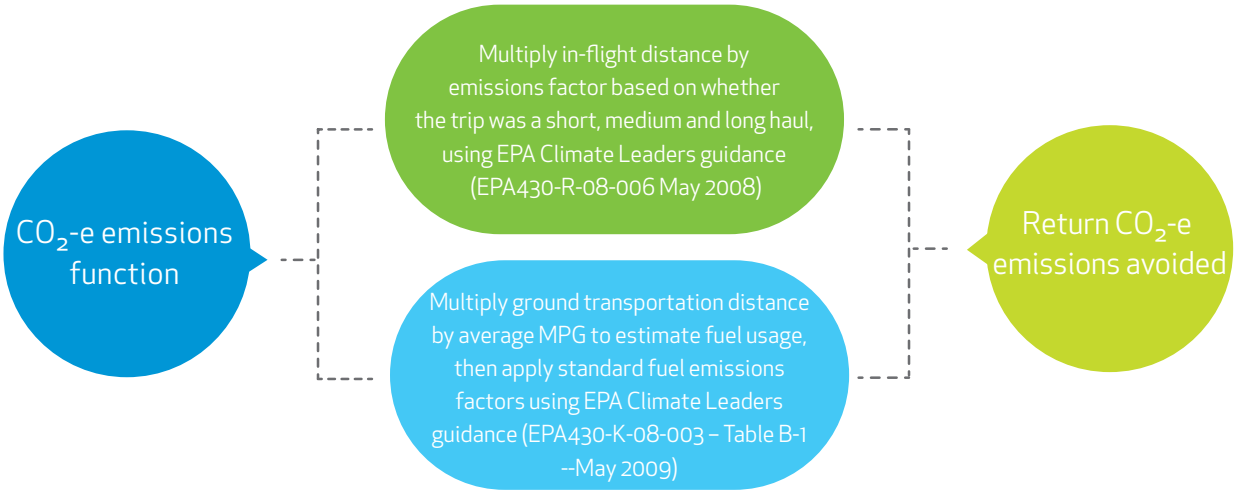
## Step Three: Assess and Interpret Net Results

In conducting the final step of the telepresence modeling process, the ABSAC team departed from the ICT Enablement Methodology to broaden the overall assessment and interpretation of net results to include not only GHG emissions avoided, but also travel cost savings and productivity gains.

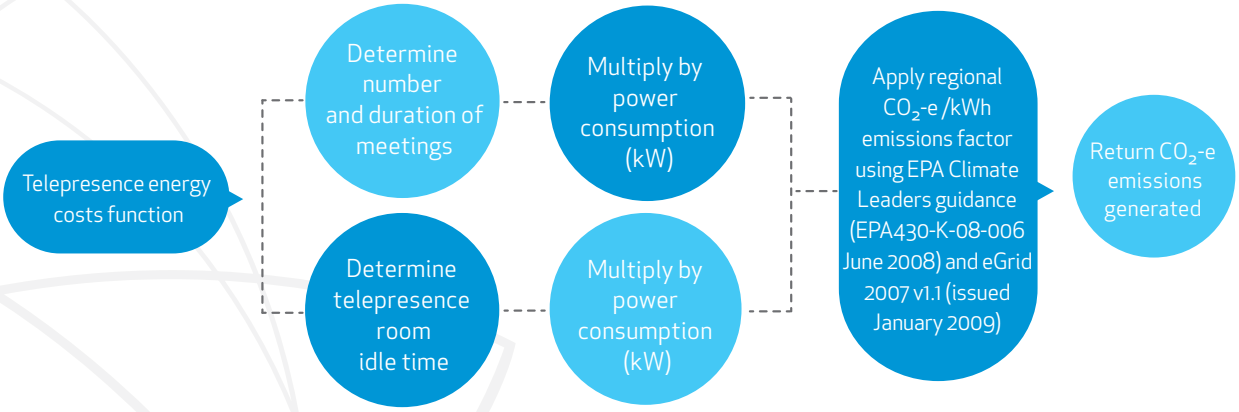
- Net Result 1: GHG Emissions Avoided (Offset by Telepresence Energy Impacts)

The first net result is a calculation of total GHG emissions avoided, in terms of $CO_2$ -equivalents. This is ascertained by tabulating the emissions related to air travel and travel to and from the airport by meeting attendees who would have traveled to the meeting if telepresence were not an option, and offsetting that amount by the emissions generated by conducting the meeting via telepresence.

## $CO_2$-e Emissions Avoided

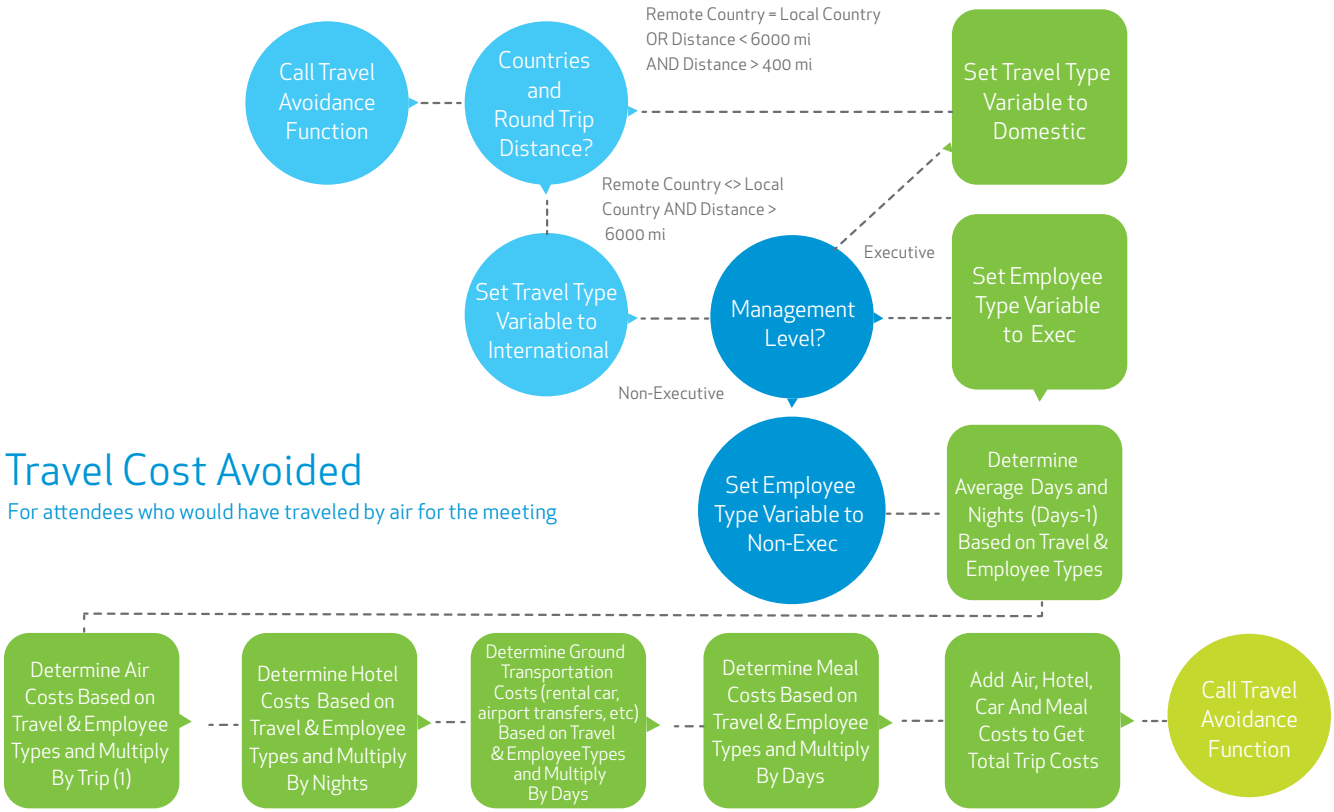



## $CO_2$-e Emissions From Telepresence




The calculation for GHG emissions generated by the use of telepresence includes power consumption during actual meetings as well as idle time when the dedicated telepresence room is not in use. The number and duration of meetings are multiplied by energy consumption per hour and then regional $CO_2$-e/kWh figures are applied to estimate $CO_2$-e emissions utilizing EPA Climate Leaders guidance and eGrid emission factors.

- Net Result 2: Travel Cost Avoided




## Travel Cost Avoided

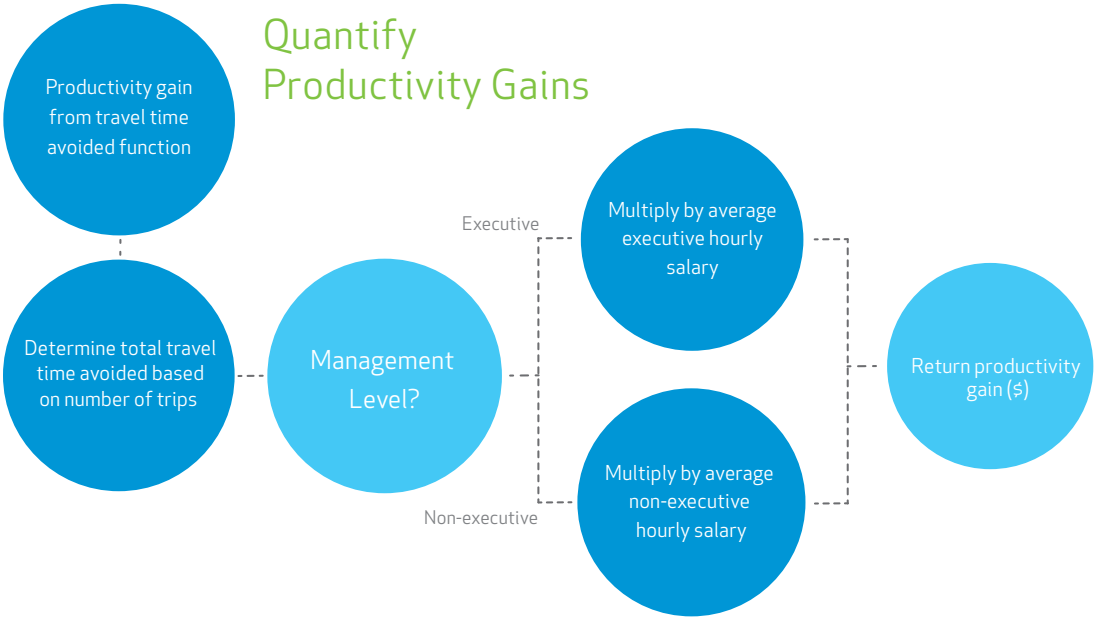
For attendees who would have traveled by air for the meeting

| | | | | |
|---|---|---|---|---|
| Air : | Average Ticket Cost | x Trip | = | Total Air Cost |
| Hotel : | Average Nightly Cost | x Nights | = + | Total Hotel Cost |
| Car : | Average Daily Cost | x Days | = + | Total Car Cost |
| Meals : | Average Daily Cost | x Days | = + | Total Meal Cost |
| | | | | Total Trip Cost |

When determining what travel costs have been avoided, the calculation includes what remote attendees would have spent to achieve the same meeting experience (face-to-face, real-time) if telepresence were not an option. Roundtrips of greater than 400 miles are considered to be meetings that would have resulted in travel. Meeting attendance figures indicate approximately 10-12% of total attendees actually avoided travel by using telepresence. While travel avoidance is only one of the benefits of using telepresence, as documented here, it offers significant opportunities for further investigation.

Travel cost avoidance is calculated using AT&T executive and non-executive employee domestic and international average travel costs. International travel is only assumed if the local and remote countries are not the same and round trip travel distance is greater than 6000 miles, which represents the approximate distance for the longest possible continental trip in the U.S.

- Net Result 3: Quantify Productivity Gains




Productivity gains are estimated by multiplying the average executive and non-executive hourly salary by the associated total travel time avoided.

This model takes a conservative view of productivity gains realized, as it only accounts for primary gains achieved through travel time avoided. As such, approximately five hours of travel downtime are avoided per trip, according to data from Cisco. Secondary gains, including enhanced decision making and communication, reduced time to market, more effective crisis management, and improved access to executives and specialists are more difficult to quantify and therefore not included in the model. Note that productive use of travel downtime (work done on the plane) is also excluded in this model.

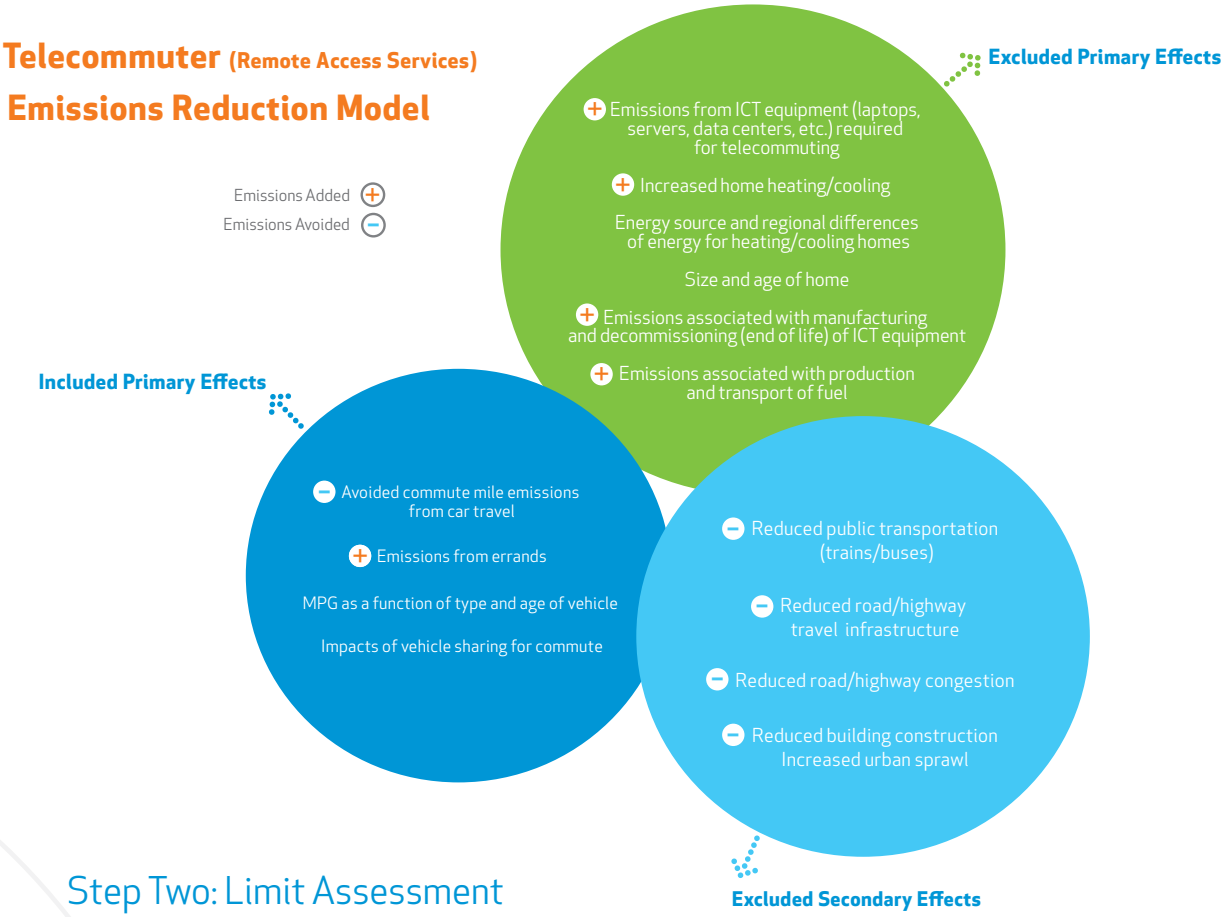
## Step One: Define Goal and Scope

The goal for this modeling study was to provide business customers with a recommended approach for measuring the sustainability benefits of implementing a formal telecommuting program. While a robust ICT infrastructure is a pre-requisite for most successful telecommuting environments, unlike the telepresence model, all ICT effects in telecommuting fall under the category of "business as usual." In other words, there are little to no substantial additional ICT costs (specialized equipment or rooms) or emissions associated with telecommuting vs. what is required in today's traditional office environment.

AT&T's approved telecommuter population, which totals approximately 14,000 employees, has provided data via surveys since 2009. AT&T defines telecommuting as a formal work arrangement in which people work from home at least one day each week.

Survey data collected from AT&T's telecommuter population allows for the calculation of avoided GHG emissions based on transportation method (personal vehicle, shared ride, public transportation, bike, etc.), commute miles, number of telecommuting days/week, vehicle type and year and number of errand miles. By using data from the most recent 2010 survey and applying guidelines from the US Department of Energy and EPA, AT&T estimates its telecommuters avoided 175 million total commute miles and 76,000 metric tons of $CO_2$-e emissions—the equivalent of removing 14,788 passenger vehicles from the road for a year.

Reducing GHG emissions associated with unnecessary workplace travel, whether telecommuting, working from home, while traveling or as extended members of corporate work groups, is aided by remote access solutions that extend the boundaries of fixed workplace environments. To achieve location independence, workers need secure broadband access. AT&T Remote Access Services provide users the flexibility to access corporate information applications on the fly, providing an experience and performance similar to what they would achieve directly on the corporate network.




## Step Two: Limit Assessment

The primary enabling effect of telecommuting is reducing GHG emissions associated with travel to and from an office location. There are several variables that have an impact on this calculation, including the type and age of vehicle, the length of commute, whether or not vehicle sharing was involved, and the extent to which the vehicle is used for running errands while telecommuting.

Because of the complexity and variability of collecting other data points that could have an impact on the measurements, several inputs were not included in the model. These include emissions from ICT equipment (laptops, servers, data centers, etc.) required for telecommuting, increased home heating/cooling, size and age of home, emissions associated with manufacturing and decommissioning (end of life) ICT equipment and emissions associated with production and transport of fuel.

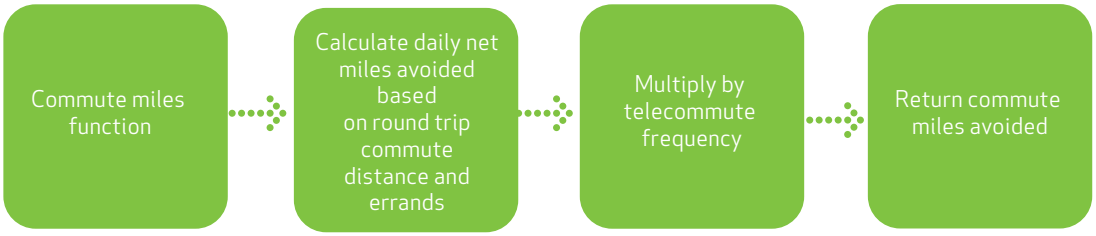
The model also excludes other secondary effects that decrease GHG emissions associated with commuting, including reduced public transportation (trains/buses), road/highway travel infrastructure and congestion, as well as building construction and urban sprawl.

## Step Three: Assess and Interpret Net Results

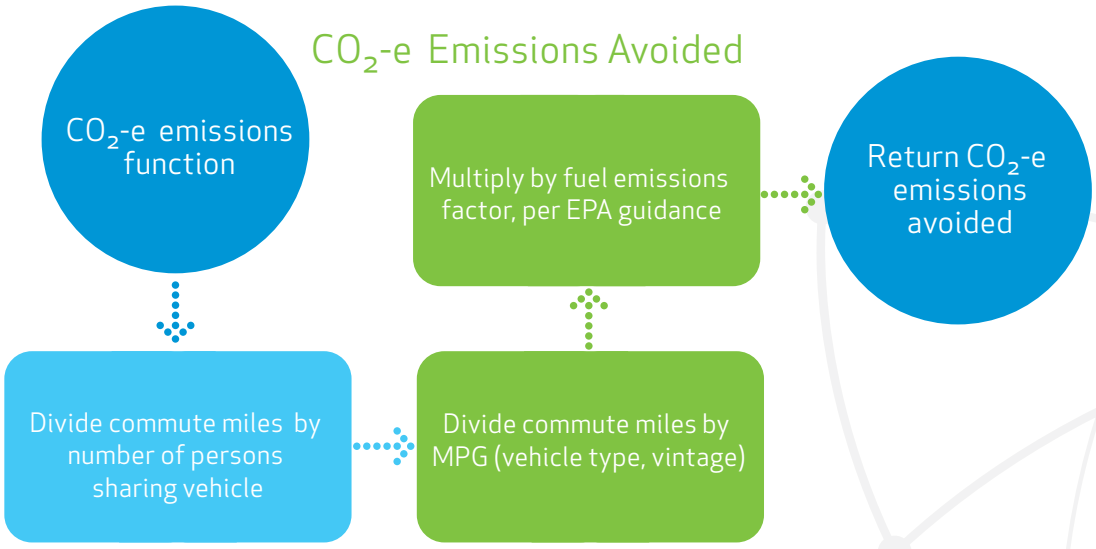
Similar to the approach taken for the telepresence model, in assessing net results for telecommuting, the ABSAC team sought to ascertain productivity gains as well as GHG reduction benefits.

- Net Result 1: Commute Miles and GHG Emissions Avoided

### Step 1: Calculate Commute Miles Avoided



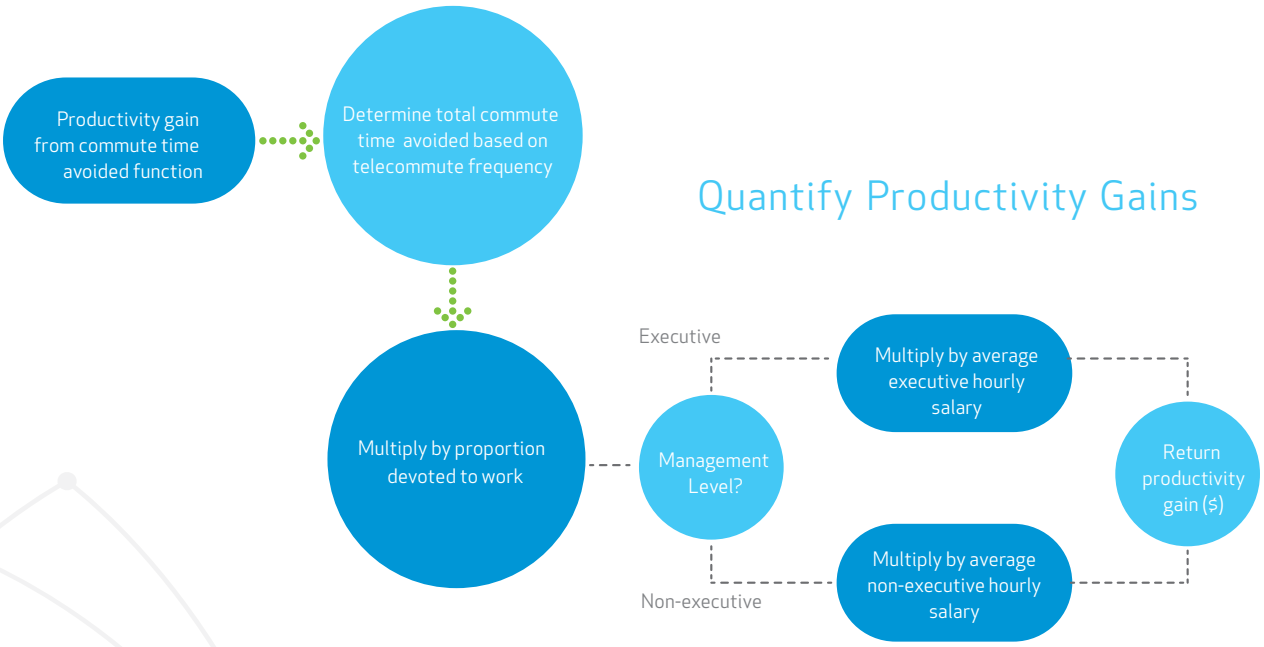

Determining the number of commute miles avoided is accomplished by calculating the round trip commute distances, adjusting for any change in errands due to telecommuting (i.e. additional errands to take kids to school), and multiplying that daily total by the telecommute frequency.




Calculating emissions avoided is then accomplished by dividing the number of commute miles by the vehicle occupancy (in the case of shared vehicles) and then dividing commute miles by the vehicle's mileage per gallon (MPG).

MPG is a function of the type and age of vehicle, and AT&T used the resources provided by the US Department of Energy to estimate fuel usage for the vehicles in the study. Once fuel usage was known, AT&T applied the guidance from the EPA Climate Leaders (EPA430-K-08-004, Table B-1) to estimate $CO_2$-e emissions.

- Net Result 2: Quantify Productivity Gains




Telecommuter productivity gains are calculated on the basis of commute time avoided and whether time is applied to workplace activity. The proportion of saved commute time devoted to work is then multiplied by the average executive and non-executive salaries to measure the value of return productivity gain. In analyzing productivity gains, the 2010 AT&T Employee Telecommuting survey estimated that 71% of employees' saved commute time was used for work activities.

## Conclusion

It is sometimes difficult and confusing to quantify the impacts of business change. In the case of implementing ICT technology, AT&T's objective in supporting this research is to share the knowledge and insight gained from the real-world implementation of two ICT technologies that can create real environmental and bottom-line business benefits.

The ABSAC sub-team created two comprehensive models for assessing the sustainability impacts of telepresence video conferencing and telecommuting (Remote Access Services), demonstrating how to capture and quantify net results for emissions reduction, cost savings and productivity enhancements.

The process of constructing and validating these models and their component calculations required accessing data from various sources within AT&T, equipment manufacturers, travel providers, and third-party emissions standards and protocols. The modeling exercise benefited greatly from the availability of two years of AT&T baseline data and user surveys which supported "evidence-based" assessment decisions regarding inclusion and exclusion of primary and secondary effects. In evaluating the impacts for telepresence and remote access services these assessments could not have been achieved with the same degree of confidence in the absence of such extensive knowledge.

Given the complexity and resources required to complete this modeling exercise, it is unrealistic to expect that a significant number of business customers would consider following a similar approach to calculate their own efficiency gains. However, to support customers in their efforts to quantify the benefits associated with an investment in ICT services such as Telepresence or Remote Access, AT&T has developed the AT&T Carbon Impact Assessment Tool, which can provide customers with an approachable way to estimate these savings using the methodologies discussed in this paper.