2020 10x Progress Update

Progress summary – On track at the halfway point

AT&T has long understood that connectivity and our other services can enable our customers to reduce greenhouse gas (GHG) emissions to mitigate climate change and in 2015, established our 10x Carbon Reduction goal to enable customer carbon savings 10 times the footprint of our operations by 2025. This goal was intentionally set as a ratio, to create an incentive to both reduce AT&T's own operational emissions, and quantify and increase the emissions reductions that AT&T enables. Here is our progress from 2018, the year we first calculated the emissions reduction enabled by AT&T, through to 2020:

	2018		2019		2020	
	million metric tons	10x progress	million metric tons	10x progress	million metric tons	10x progress
Enabled Emissions Reduction	17.1	2.2	24[1]	3.5	31.3	5.4
AT&T Scope 1 & 2	7.7		6.8		5.8	

The good news is that our 10x goal worked. Due to efforts to increase energy efficiency and engage in more renewable energy, AT&T's 2020 operational footprint shrunk to 5.8 million metric tons of CO_2e. At the end of 2020, AT&T calculated that we enabled emissions reductions of 31.3 million metric tons of CO_2e, achieving an enablement impact 5.4 times the footprint of our own operations at the halfway point of the 10x Goal.

In 2020, AT&T announced our goal to be carbon neutral by 2035. With this new goal, we have committed to significantly reduce our own emissions over the coming years, resulting in a dramatically lower 10x ratio target for customer emissions reductions. This has prompted the need for a new ambitious enablement goal, separate from our own operational footprint. So, in 2021 AT&T decided to go even bigger with its commitment and announced the AT&T Gigaton Goal: to develop connectivity solutions that enable customers to reduce a gigaton (1 billion metric tons) of greenhouse gas emissions by 2035. One gigaton of emissions is roughly equivalent to more than 1.6 million cross country flights.

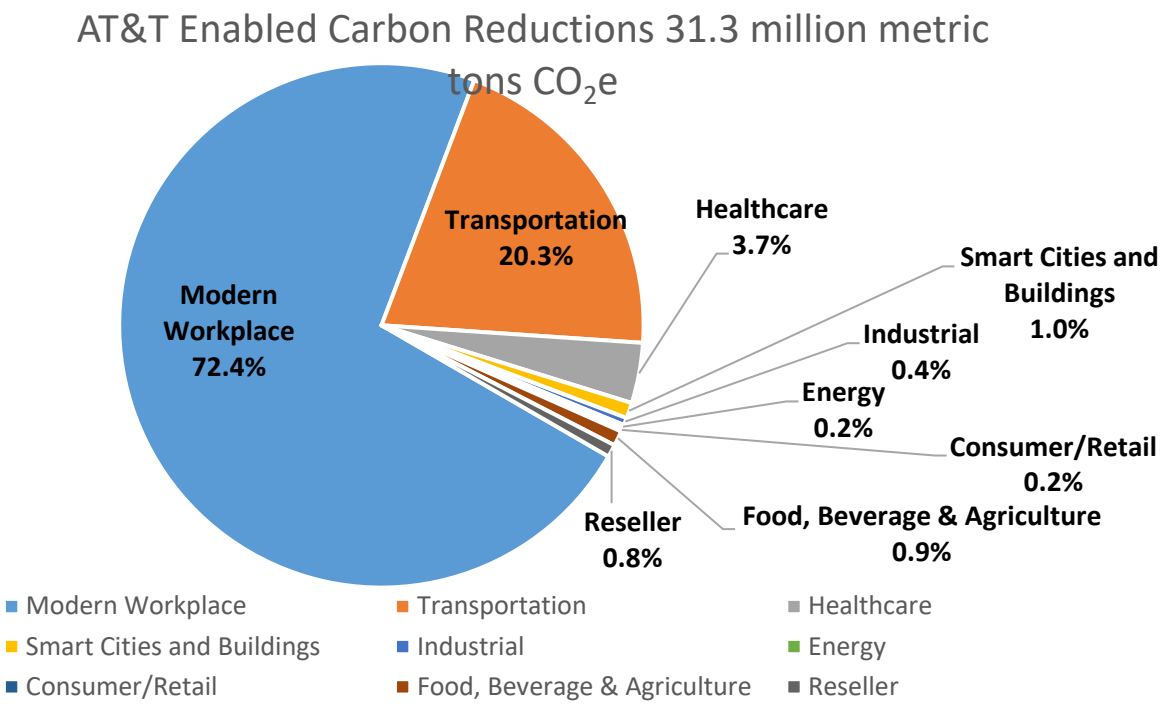
This goal will calculate the cumulative impact of emissions reduction from 2018, when we first calculated our emissions reduction enablement, until 2035. Progress against this goal will be reported annually. At the end of 2020, we calculated cumulative emissions reductions of 31.3 million metric tons of CO_2e, so we are at the beginning of our journey, achieving 3.1% of our goal in our first three years.

[1] Note: Per our 10x Methodology, we calculate avoided emissions every 2 years, so we took the average of 2018 and 2020 for 2019 avoided emissions.

By the numbers – High-level summary of impact areas

We have identified nine key Impact Areas where AT&T connectivity can play a fundamental role in reducing emissions. Here is a summary of their relative impact in 2020:

Impact Area	Carbon avoided (tCO_2e) (rounded)	Percentage of total
Modern Workplace	22,700,000	72.4%
Transportation	6,400,000	20.3%
Healthcare	1,200,000	3.7%
Smart Cities and Buildings	300,000	1.0%
Industrial	100,000	0.4%
Energy	70,000	0.2%
Consumer/Retail	60,000	0.2%
Food, Beverage & Agriculture	300,000	0.9%
Reseller[2]	200,000	0.8%
Total	**31,300,000**	**100%**



[2] Eight impact areas were originally identified in the 2018 Progress Report. Since then, the impact area 'Reseller' has been added to the list.

Overview of abatement factors by impact area

We've identified a collection of activities for each impact area and worked with Carbon Trust to develop an abatement factor that represents the average emissions reduction that can be possible when using an AT&T-enabled solution. Below is a summary of those activities, their abatement factors and the relative impact of each activity.

Modern Workplace

Activity	Item units	Abatement factor (kg CO_2e/unit/year)
Telecommuting - Remote working	Residential internet connections	1,152.65
Video conferencing - Desk-based	Video conferencing seats	3,800.00
Video conferencing - Telepresence Rooms	TP rooms	95,000.00
Cloud Connectivity	Virtual network circuits to Cloud Service providers	15,270.96
Flexware	Number of connections	565.72
Video Optimizer	Number of users	0.01

Transportation

Activity	Item units	Abatement factor (kg CO_2e/unit/year)
Fleet Management	Connected vehicles	571.26
EV Charging	Connected charging stations	3,858.00
Smart Pallets	Number of composite pallets	71.60
Carsharing	Number of cars	34,667.89

Healthcare

Activity	Item units	Abatement factor (kg CO_2e/unit/year)
Remote Patient Monitoring	Connected remote monitoring devices	866.25

Smart Cities and Buildings

Activity	Item units	Abatement factor (kg CO_2e/unit/year)
Efficient Building Equipment Funding	Number of sites	167,475.22
Energy Building Management System - EBMS	Connected building management systems	12,130.35
Smart parking	Parking service connections	270.01

Street lighting	Street lights	53.50
Advanced Water Metering Infrastructure	Number of houses	0.52
Efficient cooling towers	Number of Trasar units	1,553.85

Industrial

Activity	Item units	Abatement factor (kg CO_2e/unit/year)
Cold Storage Energy Efficiency	Number of cold storage facilities	1,768,627.77

Consumer/Retail

Activity	Item units	Abatement factor (kg CO_2e/unit/year)
Smart Landscape Irrigation	Number of sites	901.84

Food, Beverage and Agriculture

Activity	Item units	Abatement factor (kg CO_2e/unit/year)
Food Waste to Energy	Number of sites	84,408.30
Smart Farm Irrigation	Number of connections	16,910.10
Durable Ag Sensors	Number of connections	11,534.59

Energy

Activity	Item units	Abatement factor (kg CO_2e/unit/year)
Residential Smart Meters	Connected residential smart meters	158.36
Oil and Gas Pipeline Monitoring	Number of rectifiers	95.69
Solar PV Optimization	Number of systems	4.42

Reseller

Activity	Item units	Abatement factor (kg CO_2e/unit/year)
Reseller	Number of connections	711.99

Methodology summary

In this section, we will define the type of data collected and the research used to calculate the carbon abatement factor for each activity.

Emission factors from the following sources are used throughout the calculations to develop the carbon abatement factors:

- eGrid 2019
- BEIS 2020
- EPA
- IEA 2019

Detailed in the table below are the references and assumptions used specifically for each activity.

Modern Workplace

Activity	References and assumptions
Telecommuting - Remote working	Percentage of people sometimes working remotely: Bureau of Labor Statistics – American Time use Survey and Gallup – COVID-19 and Remote Work: An Update Total employed in the US: Labour Statistics 2020 Distance commuted: Bureau of Transportation, Omnistats Forms of commuting and vehicle occupancy: Bureau of Transportation Statistics, Principal Means of Transportation to Work 2019
Video conferencing - Desk-based	Internal case study: an annual figure of 'typical equivalent travel distance to physical meetings if these had taken place instead of video calls' was calculated from data collected by a provider of video conferencing, and based the use of a managed video conferencing service over the period of a year. The case study considered the number of people involved in the video conferences, and their locations. It also assumed that 4% of the travel distance was by car, and 96% was by air. Meeting avoidance factor of 32%: Cisco research quoted by BT DEFRA 2020 emission factors for long-haul air travel and car travel

Video conferencing - Telepresence Rooms	The Telepresense Revolution: CDP, and Verdantix – avoided travel miles per telepresence suite per year DEFRA 2020 emission factors for long-haul air travel and car travel Assume 4% of the travel distance was undertaken by car, and 96% was by air (based on internal case study mentioned above in VC – Desk Based)
Cloud Connectivity	Greenpeace Clicking Clean report — energy mix for electricity used by cloud providers The following assumptions were used: 160 Mbps bandwidth per customer, 250 users per customer, typical equivalent configuration would have 8 physical servers (4 physical servers hosting email, groupware, and file storage, with 4 additional servers for backup / cache / test)
FlexWare	AT&T case study: AT&T FlexWareSM puts common network functions on one device, reducing space, electricity usage, and emissions
Video Optimizer	AT&T case study: AT&T Video Optimizer helps developers improve viewers' mobile app and video experience while lowering energy usage and emissions

Transportation

Activity	References and assumptions
Fleet Management	Energy Savings Trust: A Guide to Telematics – typical fuel savings of between 5% and 15%. A figure of 10% fuel saving was used in the calculations. EPA: Greenhouse Gases Equivalencies Calculator – emission factor for gasoline Bureau of Travel Statistics: Light Duty Vehicle, fuel consumption and travel – average fuel consumed per vehicle per year
EV Charging	AT&T case study: ChargePoint uses AT&T connectivity to help businesses scale access to electric vehicle (EV) charging stations and reduce greenhouse gas emissions
Smart Pallets	AT&T case study: Unlocking the Potential of Connected, Reusable Pallets
Carsharing	Greenhouse Gas Emission Impacts of Carsharing in North America – tCO_2e saved per year per household Calculations assume one household is equivalent to one member of a carsharing platform, and an average of 60 members per car.

Healthcare

Activity	References and assumptions
Remote Patient Monitoring	Average of 1.5 of hospital admissions per year – Focus on: Hospital admissions from care homes Average of 5.5 days per hospital stay – OECD: Length of Hospital Stay Average 105 $kgCO_2e$ per day per hospital stay – NHS Sustainable Development Unit: NHS England Breakdown of Goods and Services Carbon Footprint by Organisation Type, Full Report The savings calculated derive from reduction in hospital emissions due to reduced hospital stays. There are also savings due to reduced travel, however these have not been included, and are expected to be small compared to the reduction in hospital emissions.

Smart Cities and Buildings

Activity	References and assumptions
Efficient Building Equipment Funding	AT&T case study: Efficiency-as-a-Service" Enables AT&T to Reduce Lighting Bills and Emissions
Energy Building Management System – EBMS	AT&T case study: Using the Internet of Things to reduce facility costs and emissions
Smart parking	SFMTA Study: Pilot Project Evaluation - pilot project assessing how effectively a smart parking solution delivered expected benefits, by comparing pilot and control areas. Data on reduced CO_2e and reduced vehicle miles travelled used for calculations.
Smart street lighting	Average yearly consumption: TFL Report 2011 Assumed carbon reduction: Telensa: Lighting and Intel: Smart Street Lights for Brighter Savings and Opportunities
Advanced Water Metering Infrastructure	Internal case study: a pilot project with 502 houses, assessing impact of advanced metering infrastructure (AMI) with AT&T connectivity. The internal case study found that by allowing for increased visibility of the performance of water utilities, improving water safety, reducing water leakages, this AMI reduced water-related waste, emissions and costs.
Efficient cooling towers	Emissions savings per trasar unit: Calculated from EcoLab: Partners for Greater Purpose, Sustainability Report 2019

Industrial

Activity	References and assumptions
Cold Storage Energy Efficiency	AT&T case study: Energy Efficient Frozen Food - Lineage Logistics uses ndustrial.io and AT&T Internet of Things (IoT) to reduce energy use in cold food storage facilities

Consumer/Retail

Activity	References and assumptions
Smart Landscape Irrigation	AT&T case study: Lowe's Uses HydroPoint and AT&T to Reduce Water Consumption and Carbon Footprint

Food, Beverage and Agriculture

Activity	References and assumptions
Food Waste to Energy	AT&T case study: Emerson's Grind2Energy integrates AT&T IoT to turn food waste into clean energy
Smart Farm Irrigation	AT&T case study: Rice Farmers Use Internet of Things to Enable Water and Emissions Reductions
Durable Ag Sensors	AT&T case study: Soiltech uses AT&T Internet of Things connectivity to optimize food from soil to storage, helping increase yield, reduce waste and lower emissions

Energy

Activity	References and assumptions
Residential Smart Meters	Ofgem study: GB-wide smart meter roll out for the domestic sector – electricity savings per meter EIA: average electricity consumption per US household
Oil and Gas Pipeline Monitoring	AT&T case study: OmniMetrix uses AT&T IoT connectivity to help customers monitor oil and gas pipelines, helping reduce inspection time, costs, fuel usage, and emissions
Solar PV Optimization	Internal case study: Solar PV with AT&T's IoT connectivity enabled users to monitor, troubleshoot, and improve the performance of installed solar systems. This visibility was found to decrease emissions by reducing the need for a technician to visit site (reducing travel emissions) and increasing uptime in electricity generation (generating additonal renewable electicity that can be introduced into the grid).

Reseller

Activity	References and assumptions
Reseller	Average abatement of AT&T IoT enabled solutions used as a proxy. Average includes abatement from: fleet management, EV charging, Smart Pallets, Remote Patient Monitoring, Efficient Building Equipment Funding, Energy Building Management System, Smart Parking, Smart Street Lighting, Residential Smart Meters, Smart Farm Irrigation, Durable Ag Sensors, Oil and Gas Pipeline Monitoring, Advanced Water Metering Infrastructure, Solar PV Optimisation, Efficient Cooling Towers, Carsharing

Progress to 2025 — 10x Goal Update

May 2019

Contents

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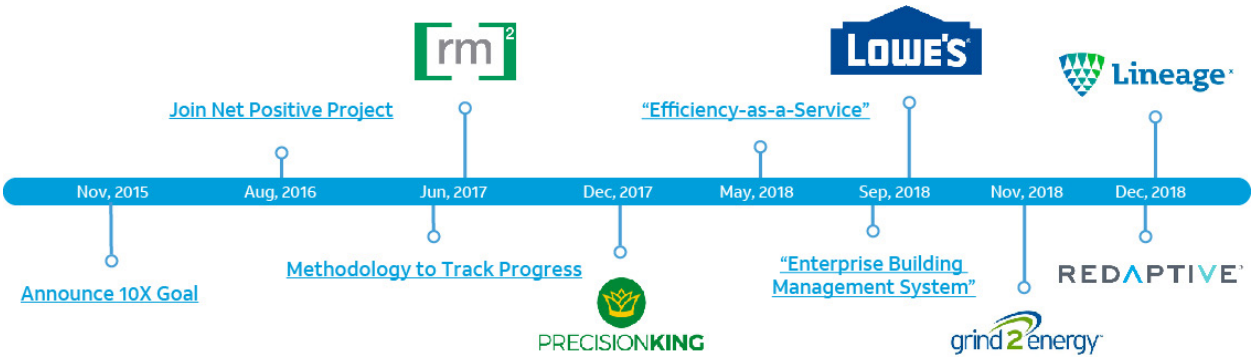
Climate change is one of the world's most pressing challenges. At AT&T, we believe that our technology solutions can play an important role in addressing the problem. That's why we set our 10x carbon reduction goal, demonstrating our ambition to reduce our own greenhouse gas (GHG) emissions footprint while using the power of our technology to enable GHG emissions reductions that are 10 times greater than our own by 2025.

Overview

Since setting our net positive goal in late 2015, we have established a methodology to define the scope of the goal and measure our impact. We are working with our customers and Carbon Trust, a leading climate change non-government organization, to quantify how AT&T technology is enabling GHG emissions reductions, and we are documenting and sharing these customer success stories in our 10x Case Study Series.

This document provides a summary of our progress and examples of the overall net positive impact that our technology is enabling. We will provide additional updates with more real-world examples and data-driven results every 2 years.

Progress timeline, 2015–2018



Progress toward goal

At the end of 2018, we calculate that we enabled GHG savings approximately **2 times the GHG footprint** of our operations. We are using this estimate to understand the current state and progress against our larger goal.

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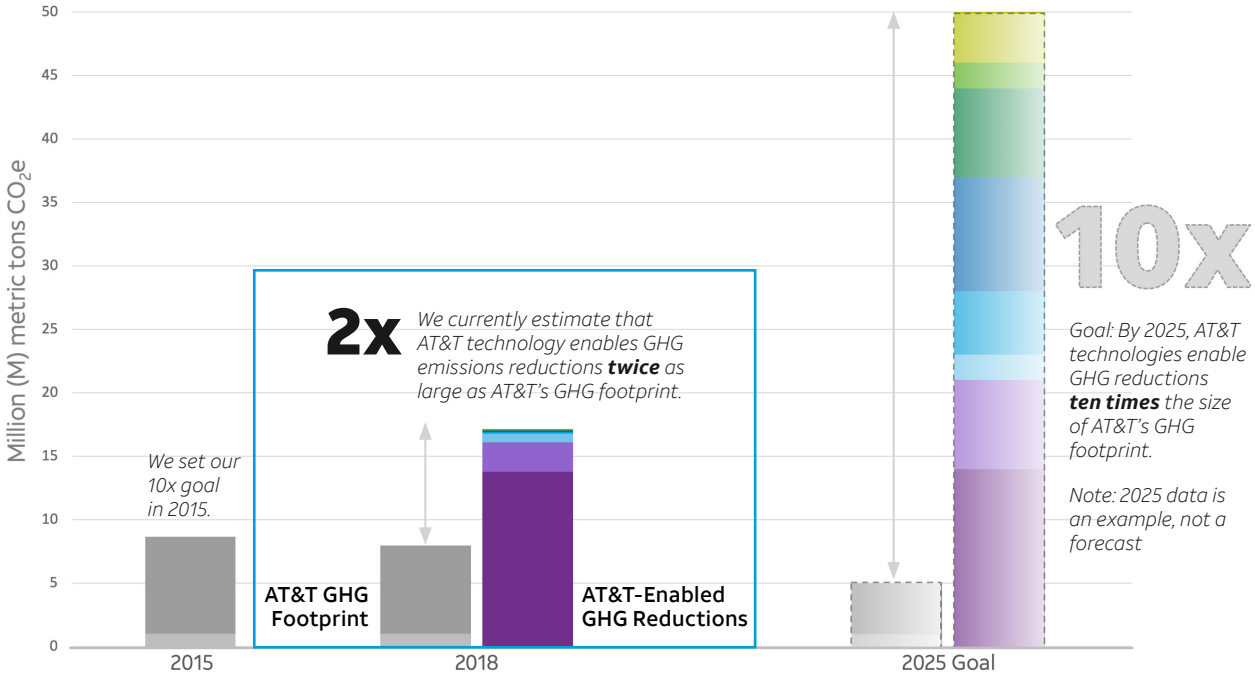
We measured our impact by examining how AT&T technology solutions can enable lower GHG emissions in 8 impact areas and compared those emissions to our own footprint.[1] At the close of 2018, we calculate that our technology solutions enabled GHG reductions of 17.1 million metric tons of CO_2e, which is equivalent to over 1.9 billion gallons of gasoline. In 2018, our GHG carbon footprint was approximately 7.7 million metric tons of CO_2e, putting our current 10x factor[2] at approximately 2.2x.[3]

2018 estimated impact:

GHG emissions reduction: equivalent to 1.9 billion of gasoline avoided[4]

AT&T 10x: Our current progress and path forward



2018 values (in metric tons of CO_2e)

AT&T-enabled GHG reductions

- Modern Workplace ***13.78M***
- Healthcare ***697K***
- Industrial ***112K***
- Consumer/Retail ***12.6K***
- Transportation ***2.31M***
- Smart Cities & Building ***129K***
- Energy ***61.1K***
- Food, Beverage & Agriculture ***5.6K***

AT&T GHG footprint

- Scope 1 ***1M***
- Scope 2 ***6.7M***

1 Per the 10x Methodology, we define our 10x footprint as Scope 1 and 2 emissions as defined by the Greenhouse Gas (GHG) Protocol Corporate Standard.

2 The ratio comparing the AT&T GHG footprint to AT&T technology-enabled GHG reductions.

3 AT&T Technology-enabled carbon reduction (17.1) divided by AT&T Scope 1 and 2 (7.7) = 2.2.

4 All equivalencies in this document are estimated using the methodology outlined by the U.S. Environmental Protection Agency, Greenhouse Gas Equivalency Calculator. (Note, the average eGRID electricity factors have been used rather than the marginal AVERT electricity factors, this being a more conservative estimate of the savings).

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Goal outlook

AT&T remains committed to addressing climate change, and we are confident that we can meet our 10x goal by our target year of 2025. We are pleased with the current progress and encouraged by the actions we are taking to reduce our footprint and increase carbon-reducing technology solutions. We see these specific trends playing a key role in our progress towards 10x:

Managing AT&T's GHG footprint

Electricity efficiency is critical:

- We will continue to focus on energy efficiency efforts in our buildings and network.
- We will leverage AT&T technology to identify improvement opportunities.

Recent renewable energy commitments:

- In 2018, we committed to delivering up to 820 megawatts of clean wind energy to the American power grid.
- We expect these systems to come online in 2019, reducing our footprint.
- We expect to pursue more large scale renewable energy projects in the future.

Fleet efficiency:

- Our mobile fleet of vehicles is our largest Scope 1 emission source.
- We will continue investing in fuel-efficient vehicles and technology solutions to reduce emissions.

Enabling GHG reduction

Established technologies currently have largest impact:

- Modern Workplace technologies are currently the largest reduction source because they are mature and have a relatively high adoption rate.
- We expect this usage to continue, but we anticipate other areas will grow at a much faster rate.

Current IoT solutions taking hold in the marketplace:

- We have identified existing real-world Internet of Things solutions that enable GHG reductions, but we recognize that these are nascent and adoption is still growing.
- We will continue to evaluate marketplace solutions and quantify their carbon impact.

New technology advancements show promise in emissions-intensive industries:

- We expect technology advancements in areas such as 5G and IoT to have game-changing impacts for customers.
- We believe these technologies can drive GHG reductions in high-emissions industries such as energy, industrial/manufacturing, and transportation.

How 10x is influencing our business

The 10x goal is providing us with insight that can influence how we run our operations and engage our customers. For instance, our 10x goal provides motivation for us to reduce our own emissions, and that has played a role in our commitments to the large-scale wind purchases that we announced in 2018.

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For our customers, the development of our 10x case studies has shed light on the wide array of applications that that can be used to reduce costs and emissions. We are using these real-world stories to engage our customers in new conversations about ways we can work together to improve their business while reducing their environmental impact. The 10x goal and case studies turn the abstract idea of technology-enabled GHG reduction into a practical discussion about new technology solutions, and that's good for our customers, AT&T and the environment.

I. Climate change and the 10x goal

AT&T recognizes that GHG emissions are accelerating climate change, presenting significant threats to the global community. We understand the need to avoid the worst impacts of climate change by limiting carbon emissions to keep global temperature increases below 1.5 degrees Celsius, as articulated in the Paris Climate Agreement and supported by research published recently by the IPCC[5] and the U.S. federal government.[6]

The urgency of this crisis demands immediate action, and AT&T has developed a holistic climate change strategy that includes adaptation as well as mitigation. We are reducing our GHG emissions through extensive energy efficiency efforts and large-scale renewable energy purchases, and we are preparing for climate impacts through our Climate Change Resiliency Project. In addition, we are a founding member of the Climate Leadership Council, an international policy institute founded in collaboration with business, opinion and environmental leaders to promote a carbon dividends framework as the most cost-effective, equitable and politically-viable climate solution.

By 2025, AT&T will enable carbon savings 10x the GHG footprint of our operations by enhancing the efficiency of our network and delivering sustainable customer solutions.

A key component of our climate change strategy is an initiative focused not just on our own company but also on the customers we serve. That initiative is our 10x goal, our commitment to use the power of our technology to generate customer emissions reductions 10x greater than our own carbon footprint by 2025.

We will provide updates every 2 years to show our progress toward this goal. This document — as part of our 2018 Corporate Responsibility Report — is intended to show the progress we have made since setting the goal in November 2015. Our next update will accompany the 2020 Corporate Responsibility Report.

II. GHG impact methodology

When we set the 10x goal in 2015, there was no standard methodology to measure how technology solutions could help reduce GHG emissions. We worked with Carbon Trust and BSR, 2 leading non-government organizations with extensive experience in this area, to build a guidebook for measuring

5 IPCC, 2018: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, ipcc.ch/sr15/.

6 SGCRP, 2018: Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II, nca2018.globalchange.gov/.

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progress against our 10x goal. Released in June 2017, the methodology document is available on the 10x website.

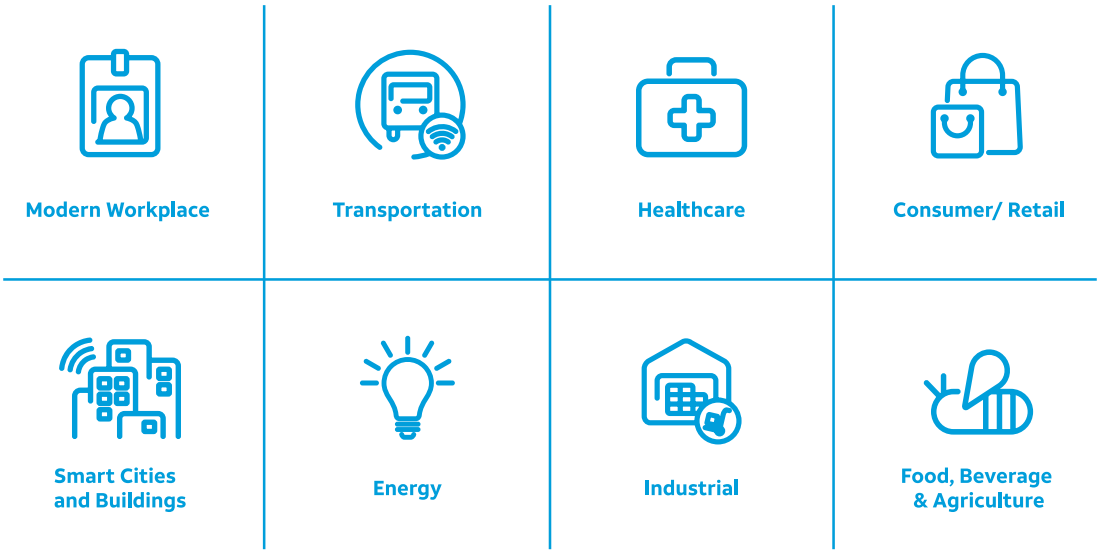
We are also a founding member of the Net Positive Project, a collaborative effort looking to spur "net positive" efforts like our 10x goal that put back more into society, the environment and the global economy than they take out. Together with this group, we are working to create credible, common approaches to measuring "net positive" and to encourage other companies to pursue a net positive impact.

III. Identifying GHG abatement impact areas

We have aligned our work with industries and technology solutions that offer the greatest potential to reduce GHG emissions. Again, we engaged BSR and Carbon Trust to help identify areas that have high potential for AT&T technology-enabled GHG emissions reductions and evaluated these existing frameworks to help prioritize our efforts:

- GeSI Mobile Carbon Impact Study
- GeSI SMARTer2030
- The 3% Solution (WWF/CDP)
- Sustainable Development Goals
- GRI & CDP, as mapped by SDG Global Compass
- Science Based Targets initiative
- AT&T Customer Focus Areas

Using these resources as a guide, we have focused our work on key impact areas that we believe can help achieve the most carbon and cost reductions for our customers. Some of the technologies used in these areas are just starting to gain market traction and have relatively small GHG impacts at this time, while other established technology solutions such as remote working platforms have already gained a foothold and are already reducing GHG emissions at scale. While we recognize that these areas may evolve over time as new technologies develop, our 8 impact areas are:



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IV. Impact area summaries

In each of these impact areas, we are working to identify and quantify how AT&T technology solutions enable GHG emission reductions. The sections below provide a summary of each impact area, including:

- An overview of the impact area
- Our perspective on the current state and future potential of each impact area
- A highlighted solution that is enabled by AT&T and its estimated annual GHG reduction impact in terms of gallons of gasoline. Note that these examples do not represent all the solutions we have evaluated to estimate our impact. A full list is available in Appendix 1.

Modern workplace

Overview	AT&T's role and perspective	Highlight and impact
• The way we work has changed radically over the last few decades, fueled by the power of computers and mobile connectivity. • This transition has made it possible for employees to work remotely, reducing fuel usage. It has also enabled employers to reduce the electricity need for office space lighting, heating and cooling.	• AT&T has long been a leading provider of mobile work tools and virtual collaboration technology. • We implement flexible work programs for our own employees and we provide these services for many of our customers. • Wireless and wired connectivity can allow for access to information, more efficient use of time, and a lower environmental footprint by reducing fuel needed for travel and lower electricity usage in the workplace. • Because this technology is so well established, this represents our largest source of technology-enabled carbon reduction in 2018.	Desk-based video conferencing utilizes AT&T voice and data connectivity to avoid traveling for a meeting. Whether across town or around the globe, this technology helps accelerate business while reducing travel. 

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Transportation

Overview	AT&T's role and perspective	Highlight and impact
• In 2016, 28% of U.S. GHG emissions came from transportation,[7] making it one of the largest sources of GHG emissions. • Alternative fuel and electric vehicles reduce tailpipe emissions, but traditional fuel vehicles still are most vehicles on the road.[8] • Asset tracking, route optimization, idling reduction, and fuel-efficient driving behavior are critical to emissions reduction.	• AT&T-enabled wireless fleet management technology can allow fleet managers to use data to more efficiently deploy and route vehicles to help reduce delivery and idle time, improve mileage and reduce fuel costs. • Asset management technologies can help maintain visibility and control of assets while avoiding transportation trips and loss. • This helps reduce fuel usage and associated GHG emissions by optimizing how we move people and things from point A to B.	RM2 shipping pallets are lighter and more durable than traditional wooden pallets, reducing fuel use and emissions. Integrating AT&T connectivity enables customers to track location and condition of the shipment and reduce the risk of loss, lowering the per-trip cost. 

7 Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016, U.S. Environmental Protection Agency, 12 Apr. 2018, epa.gov/sites/production/files/2018-01/documents/2018_complete_report.pdf.

8 Annual Energy Outlook 2019, U.S. Energy Information Administration, 24 Jan. 2019, eia.gov/outlooks/aeo/.

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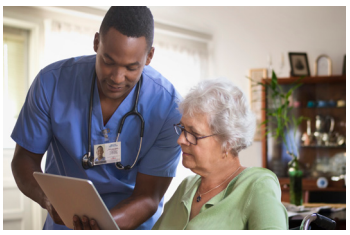
Healthcare

Overview	AT&T's role and perspective	Highlight and impact
• If the U.S. healthcare system were a separate country, its $3.3 trillion GDP would make it the fifth-largest economy in the world. It is also the world's seventh-largest producer of carbon dioxide.[9] • The U.S. healthcare system emitted 655 million metric tons of carbon dioxide in 2011, which accounted for around 10% of all the CO_2 generated in the United States that year.[10]	• Connected technology solutions can help create expanded access to medical and health services, offer insight into medical conditions, and help people with disabilities overcome accessibility challenges. • Using solutions such as remote patient monitoring, patients can reduce the number of trips to see a medical provider, saving time and reducing fuel usage. • Smart building technologies can help hospitals and other medical facilities reduce the electricity needed to provide their services.	Remote patient monitoring allows health providers to gather patient health information without a patient having to travel, reducing travel-related emissions. 

9 "U.S. Health System Will Need to Adapt to Climate Change." U.S. Health System Will Need to Adapt to Climate Change, The Commonwealth Fund, 18 Apr. 2018, commonwealthfund.org/blog/2018/be-high-performing-us-health-system-will-need-adapt-climate-change.

10 Rappleye, Emily. "US Healthcare Is World's 7th Largest Producer of CO_2." Becker's Hospital Review, 20 Apr. 2018, beckershospitalreview.com/population-health/us-healthcare-is-world-s-7th-largest-producer-of-co2.html

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Consumer/Retail

Overview	AT&T's role and perspective	Highlight and impact
• Brick and mortar retail stores and warehouses represent 87% of retail sales, and with it, a substantial environmental impact due to electricity and water use.[11] • Online shopping has more than doubled its share of retail sales from 2007–2017.[12] • Online shopping brings the potential benefit of lower energy usage at stores and reduced emissions from consumers travelling to stores, but also introduces potential GHG emissions increases from delivery and data center operations.	• AT&T has teamed up with a wide range of retail companies to cultivate a connected, efficient retail experience, keeping stores running efficiently and reducing energy and water usage. • We are also working with retail and logistics experts to integrate technology solutions with the potential to optimize the delivery process for online purchases. • Connected coolers with smart analytics can help optimize inventory and replenishment, reducing trips and preventing waste in retail and grocery stores.	HydroPoint® smart irrigation controllers use AT&T Internet of Things (IoT) to optimize landscape irrigation and reduce water usage. Because water treatment and pumping use so much energy, saving water also effectively reduces community GHG emissions. 

11 Fareeha, Ali. "A decade in review: Ecommerce sales vs. retail sales 2007-2018." Digital Commerce 360, 20 Feb. 2019, digitalcommerce360.com/article/e-commerce-sales-retail-sales-ten-year-review/.

12 Ibid

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Smart Cities and Buildings

Overview	AT&T's role and perspective	Highlight and impact
• Cities consume approximately 75% of global energy.[13] Buildings account for up to 70% of energy use in major cities — and 30% of greenhouse gas emissions globally.[14] • The United Nations estimates that 68% of the world population will live in urban areas by 2050.[15] • Rethinking how we build and maintain our cities and buildings can impact our success in dealing with GHG emissions and climate change.	AT&T is providing the next-generation wireless networks and services to help cities realize many potential environmental benefits of smart cities, including: • Increased energy efficiency • Improved water conservation from reducing pipe leaks and water waste • Reduced carbon emissions and improved air quality • Tools to increase the visibility of building equipment to help reduce energy and carbon footprint.	By integrating AT&T Internet of Things connectivity, Redaptive can implement energy-efficient building equipment upgrades that can reduce energy costs and GHG emissions for its customers with no upfront capital investment and immediate financial returns. 

13 Energy. UN Habitat, unhabitat.org/urban-themes/energy/

14 "Smart Buildings: Forming The Foundation Of Smart Cities." Forbes, 24 Oct. 2018, forbes.com/sites/insights-inteliot/2018/10/24/smart-buildings-forming-the-foundation-of-smart-cities/#6cdf07c2585e.

15 "68% of the world population projected to live in urban areas by 2050, says UN." United Nations Department of Economic and Social Affairs, 16 May 2018, un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html.

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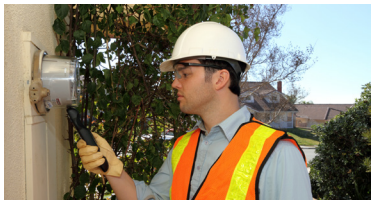
Energy

Overview	AT&T's role and perspective	Highlight and impact
• In 2017, the U.S. Energy Information Administration estimated that emissions of carbon dioxide (CO_2) by the U.S. electric power sector were about 34% of the total U.S. energy-related CO_2 emissions.[16] • The burning of coal, natural gas and oil for electricity and heat is the largest single source of global greenhouse gas emissions.[17]	• AT&T works closely with our utility and oil & gas customers to help them operate more efficiently and safely. • Technology is giving utilities greater autonomy and more choices in the way they source, use and store electricity. Smart storage systems also help speed up the transition to renewables. • The electric power system is evolving from a unilateral system to an integrated networked ecosystem and we believe that AT&T's expertise in highly secure connectivity will be an important enabler for the energy of the future.	Connected residential electricity meters can help reduce electricity usage and the associated GHG emissions because they provide timely information to consumers about their usage, empowering them to adjust lighting and heating/cooling to reduce that usage. Connected meters also collect usage data remotely, reducing the need for truck dispatches and associated travel-related emissions. 

16 "How much of U.S. carbon dioxide emissions are associated with electricity generation?" U.S. Energy Information Administration, 2017, eia.gov/tools/faqs/faq.php?id=77&t=11.

17 Global Greenhouse Gas Emissions Data. U.S. Environmental Protection Agency, epa.gov/ghgemissions/global-greenhouse-gas-emissions-data.

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Industrial

Overview	AT&T's role and perspective	Highlight and impact
• 22% of U.S. GHG emissions came from industrial sources such as manufacturing, food processing, mining and construction in 2016.[18] • The economic impact of the Industrial Internet of Things (IIoT) was estimated at $145 billion in 2017 and could reach $232 billion by 2023.[19]	• AT&T-enabled IIoT allows businesses and cities to harness data to predict, learn and make near real-time decisions to optimize their operations. • These solutions can make best use of assets, enable preventative maintenance, reduce electricity use, save fuel by avoiding unnecessary trips, and reduce associated GHG emissions. • AT&T believes IIoT will grow to be a major contributor to energy efficiency-related carbon reductions.	Lineage Logistics®, a leading food cold storage operator, engaged a software and engineering company focused on reducing waste called ndustrial.io to optimize energy at its warehouses. AT&T IoT connectivity enables Lineage to create heat maps, alerts and reports that empower it to actively manage its cooling operations and reduce energy cost and GHG emissions. 

18 Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016. U.S. Environmental Protection Agency, 12 Apr. 2018, epa.gov/sites/production/files/2018-01/documents/2018_complete_report.pdf.

19 "Industrial Internet of Things (IIoT) Market Revenue To Surge To US$ 232.15 Billion by 2023." Zion Market Research, 22 Jan. 2019, globenewswire.com/news-release/2019/01/22/1703106/0/en/Industrial-Internet-of-Things-IIoT-Market-Revenue-To-Surge-To-US-232-15-Billion-by-2023-Zion-Market-Research.html.

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Food, Beverage & Agriculture

Overview	AT&T's role and perspective	Highlight and impact
Agriculture accounted for 9% of total U.S. GHG emissions in 2016, per the EPA.[20] Management of agricultural soils accounts for over half of the emissions from the agriculture economic sector.[21] The GHG implications from growing, transporting, storing and disposing of food are substantial and present an opportunity for resource efficiency and emissions reductions.	By working with farmers to improve how they grow food through efficient fertilizer usage, fuel usage and irrigation practices, AT&T believes that IoT can be a key enabler to reducing the environmental impact of feeding our population. By integrating sensors and connectivity into the water distribution and irrigation systems, technology can help identify and reduce wasted water and the carbon emissions related to the treatment and pumping of water. AT&T Asset Management solutions can be integrated with food distribution and waste systems to reduce inefficiencies.	Grind2Energy™ has created an industrial food grinder that turns food waste into a nutrient-rich slurry that anaerobic digesters can turn into biogas and fertilizer. They turned to AT&T to integrate IoT connectivity and robust reporting, helping to increase scalability and increase the market competitiveness of the system. 

V. Raising awareness

One of the main objectives of the 10x goal is to raise awareness of existing and developing technology solutions that have the potential to reduce GHG emissions. To make meaningful progress toward a low-carbon economy, we need scale across all impact areas. To that end, we have made a concerted effort to join with our customers to raise the visibility of these solutions. Through our 10x Case Study series, we hope to stimulate more awareness and interest in solutions with the aim of increasing adoption and, as a result, reducing GHG emissions at greater scale.

20 Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016. U.S. Environmental Protection Agency, 12 Apr. 2018, epa.gov/sites/production/files/2018-01/documents/2018_complete_report.pdf.

21 Sources of Greenhouse Gas Emissions. U.S. Environmental Protection Agency, epa.gov/ghgemissions/sources-greenhouse-gas-emissions.

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Appendix

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Appendix 1: Summary of AT&T-enabled technology solutions and emissions abatement factors

This table summarizes the types of AT&T-enabled solutions that have been included in this year's 10x impact estimate. The table is grouped by impact area and identifies the solutions that have been included in the analysis, the estimated GHG abatement factor for each solution, and the source for each abatement factor. Where available, we have used the AT&T 10x case study to estimate the potential to reduce emissions in each impact area. For those solutions where we do not have a 10x case study, we have calculated the GHG abatement factor using research from credible sources and publicly available data. We intend to continue this series of case studies as new technology solutions are developed.

This list represents the existing research that we have used to date and is not intended to show the complete impact.

Impact area	Solution	Abatement factor (kg CO_2e/unit/time)	Source/References
Consumer /Retail	Smart Landscape Irrigation	800 kg CO_2e /site using smart irrigation/year	AT&T 10x case study: Lowe's Uses HydroPoint and AT&T to Reduce Water Consumption and Carbon Footprint
Energy	Residential Smart Meters	142 kg CO_2e /connected residential smart meter/year	Ofgem study: GB-wide smart meter roll out for the domestic sector EIA: average electricity consumption per US household
Food, Beverage & Agriculture	Food Waste to Energy	84,000 kg CO_2e /site using Grind2Energy/year	AT&T 10x case study: Emerson's Grind2Energy integrates AT&T IoT to turn food waste into clean energy
Healthcare	Remote Patient Monitoring	871 kg CO_2e /connected remote monitoring device /year	See Appendix 2 below.
Industrial	Cold Storage Energy Efficiency	1,400,000 kg CO_2e /cold storage facility /year	AT&T 10x case study: Lineage Logistics & ndustrial.io: Energy Efficient Frozen Food

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Impact area	Solution	Abatement factor (kg CO_2e/unit/time)	Source/References
Modern Workplace	Video Conferencing - TelePresence Rooms	101,000 kg CO_2e /TelePresence room /year	Case study in SMARTER2020 report. The Telepresence Revolution, CDP and Verdantix.
	Video Conferencing - Desk Based	4,300 kg CO_2e /video conference seat/year	See Appendix 2 below.
	Cloud Connectivity	13,683 kg CO_2e /highly secure connection to cloud service providers/year	Average server power. PUE factors — various sources. Greenpeace Clicking Clean report — energy mix for electricity used by cloud providers
	Telecommuting/ Remote Working	637 kg CO_2e /residential internet connection/year	See Appendix 2 below.
Smart Cities and Buildings	Efficient Building Equipment Funding	154,000 kg CO_2e /site using Efficiency-as-a-Service/year	AT&T 10x case study: AT&T and Redaptive® Help Overcome Obstacles to Energy Efficiency in Buildings
	Buildings	13,600 kg CO_2e /connected building management system/year	AT&T 10x case study : Using the Internet of Things to reduce facility costs and emissions
	Smart Parking	271 kg CO_2e /parking service connection /year	SFMTA study: SFpark Pilot Project Evaluation
	Smart Street Lighting	49 kg CO_2e /LED street light connection/year	Intel: Smart Street Lights for Brighter Savings and Opportunities

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Impact area	Solution	Abatement factor (kg CO_2e/unit/time)	Source/References
Transportation	Connected Shipping Pallet	71.6 kg CO_2e /composite pallet /pallet lifetime	AT&T 10x case study: Unlocking the Potential of Connected, Reusable Pallets
	Electric Vehicle Charging	1,630 kg CO_2e /connected charging stations/year	Number of charging points and number of electric vehicles. Electric car energy use.
	Fleet Management	612 kg CO_2e /connected vehicle /year	See Appendix 2 below.

Appendix 2: Avoided emissions calculations for AT&T 10x top 4 categories

Carbon Trust has calculated the avoided emissions enabled by AT&T that are included in this summary report. These calculations represent the estimated GHG emissions that have been avoided by AT&T customers using AT&T's products and services. Carbon Trust used the research referenced in this document and the details in the 10x case studies (att.com/10x) to make these calculations.

These include avoided emissions, which have been calculated for the case studies published on AT&T's website (att.com/10x), and for a range of cases enabled by AT&T products and services.

The list of cases that have been considered are listed in Appendix 1. Of these, 4 categories make up more than 95% of the total avoided emissions: telecommuting; video conferencing (desk-based); fleet management; and remote patient monitoring. The assumptions, data and calculations for these 4 cases are described in this appendix.

The overall methodology that was used is described in the methodology document published on our website (att.com/10x).

Telecommuting

Solution and mechanism for avoided emissions

Telecommuting is when people work from home, rather than travelling to a place of work (office). The avoided emissions are directly related to the reduction in travelling. The premise is that people are able

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to work from home by having a broadband connection without which it would not be practical to work from home.

Assumptions and calculation method

The calculation uses an average commuting distance, a number of days per week worked from home for telecommuters, and number of working weeks per year to calculate total miles per year saved by an average telecommuter. It is assumed that the commuting would have been by car, thus the mileage figure can be converted into CO_2e savings per telecommuter by applying appropriate miles/gallon and tCO_2e/gallon factors. Then this is expressed as CO_2e saving per broadband connection by multiplying by the number of telecommuters and dividing by the total US broadband connections.

Data and data sources

Data item	Data value	Units	Source/References
Average commuting distance	29.8	miles per day	Calculated from: Source: US Department of Transportation, Bureau of Transportation Statistics, Omnibus Household Survey. bts.gov/archive/publications/omnistats/volume_03_issue_04/index Figure two
# of days / week worked from home (for US telecommuters)	2.81	days	news.gallup.com/reports/199961/7.aspx
Working weeks per year	47	weeks	Assumption
Avg. miles per gallon	17.9	miles / gallon	bts.gov/content/motor-vehicle-fuel-consumption-and-travel
Emission factor for gasoline	0.008887	metric tons CO_2 /gallon of gasoline	epa.gov/cleanenergy/energy-resources/refs.html

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Data item	Data value	Units	Source/References
Number of U.S. telecommuters	36,448,796	telecommuters	Bureau of Labor Statistics, American Time Use Survey, 2017. bls.gov/charts/american-time-use/work-by-ftpt-job-edu-p.htm
Total U.S. Fixed Broadband Connections	112,000,000	connections	ustelecom.org/research/ustelecom-industry-metrics-and-trends-2018/
# of AT&T Fixed Broadband Connections	15,719,000	connections	AT&T 2017 Annual report

Results

- Avoided emissions factors calculated are:
  - Avoided emissions per telecommuter = 1.96 tCO_2e per telecommuter per year
  - Avoided emissions per broadband connection = 0.637 tCO_2e per connection per year

Video conferencing (desk based)

Solution and mechanism for avoided emissions

Desk-based video conferencing allows remote collaboration, avoiding the need for physical travel to meetings. Thus, this avoids the emissions associated with the travel. AT&T provides the video conferencing capability.

Assumptions and calculation method

The calculations were based on an annual figure of typical equivalent travel distance to physical meetings if these had taken place instead of video calls. This figure was calculated from data collected by a provider of video conferencing, based on analysis of use of a managed video conferencing service over the period of a year. These calculations are based on data from an internal study - hereafter called the "video conferencing study" - that considered the number of people involved in the video conferences, and their locations. A "meeting avoidance factor" was applied to the travel distance figure. This factor represents the percentage of video conferences that would have been replaced by a physical meeting. The factor used was 32%, thus approximately 1 in 3 video conferences would have had a physical meeting.

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The resulting avoided travel distance was converted to avoided carbon emissions, by applying appropriate emission factors. It was assumed that 4% of the travel distance was by car, and 96% was by air. (The percentage figures come from the video conferencing study).

Data and data sources

Data item	Data value	Units	Source/References
Annual equivalent travel distance per managed video endpoint	73,860	Video-Miles / device / year	From video conferencing study
Meeting Avoidance Factor	32%	percentage	Cisco research
EF longhaul economy air travel per mile	0.1697	kg CO_2e / mile	Defra 2014 without RF + WTT
EF car (upper medium, petrol) per mile	0.43441	kg CO_2e / mile	Defra 2014
Ratio of car travel to air travel	4.0%	percentage	From video conferencing study

Note (for comparison): the calculations give a figure of 23,635 travel miles saved per year, which is equivalent to 4.6 return trips by air between New York and San Francisco.

Results

- Avoided emissions per video conferencing device = 4.3 tCO_2e per VC device per year

Fleet management

Solution and mechanism for avoided emissions

Fleet management and telematics covers a range of applications including satellite navigation, fleet tracking and dispatch, road tax collection, driver behavior monitoring and fuel management, among others. Mechanisms that cause abatement include targeted behavior improvement to improve fuel efficiency, satellite navigation to reduce journey distance and avoid congestion, and optimized route planning.

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AT&T provides the connectivity to the vehicles enabling the real time collection of telematics data, which can be used to reduce fuel consumption.

Assumptions and calculation method

The key assumption is that fleet management enables fuel savings through a variety of mechanisms. There are numerous studies that demonstrate typical fuel savings of between 5% and 15%. A figure of 10% fuel saving was used.

To calculate the avoided emissions the average annual fuel consumption per customer vehicle was multiplied by the emission factor for gasoline to give the total average annual vehicle emissions. The avoided emissions are then calculated by applying the 10% saving factor.

Data and data sources

Data item	Data value	Units	Source/References
Average fuel consumed per vehicle per year	689.2	gallons	bts.gov/content/other-2-axle-4-tire-vehicle-fuel-consumption-and-travel
Emission Factor for gasoline	0.008887	metric tons CO_2 /gallon of gasoline	epa.gov/cleanenergy/energy-resources/refs.html
Fuel Savings % for Fleet Management System	10%	percentage	energysavingtrust.org.uk/sites/default/files/Telematics.pdfenergysavingtrust.org.uk/sites/default/files/Telematics.pdf

Results

- Avoided emissions per connected vehicle = 0.612 tCO_2e per vehicle per year

Remote patient monitoring

Solution and mechanism for avoided emissions

Remote patient monitoring allows health monitoring for patients at home. This can result in reduced visits to health centers and hospitals, resulting in reduced emissions for travel and for hospital stays.

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AT&T provides the connectivity for the monitoring devices enabling the remote collection and monitoring of the data.

Assumptions and calculation method

The carbon savings are calculated assuming a reduced number of hospital stays. The number of hospital days avoided is calculated based on studies of hospital admissions and average number of day stays in hospital. This is then multiplied by an emission factor for hospital days.

There are also savings due to reduced travel, however these have not been included, and are expected to be small compared to the reduction in hospital emissions.

Data and data sources

Data item	Data value	Units	Source/References
Hospital admissions per year	1.5	admissions per year	health.org.uk/sites/default/files/QualityWatch_FocusOnHospitalAdmissionsFromCareHomes.pdf (p.24)
Average days stay in hospital	5.5	days per hospital stay	data.oecd.org/healthcare/length-of-hospital-stay.htm
Hospital emissions	106	kg CO_2e per day stay	sduhealth.org.uk/documents/publications/Bed_Days.pdf

Results

- Avoided emissions per connected remote monitoring device = 0.871 tCO_2e per device per year

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