



Connect to Planet

Consider a future where connected cars produce more efficient traffic patterns on crowded city streets. Connected buildings are smart enough to reduce their own energy use. Learn how our technology is turning potential into reality. Smart businesses and smart cities are here.



Energy Management

Materiality Assessment Topics: Company energy use

Issue Summary

Globalization, population growth and other factors have led to the exponential adoption and use of smart technologies. Networks carry the voice, data and video that connects us, helping to spread information and spur innovation. Delivering this content requires energy.

Our Position

Effective energy management has a direct impact on a company’s bottom line, is an important environmental consideration and is critical to the competitiveness of our business and the reliability of our service to customers. We’re working toward a 2020 goal of reducing the electricity consumption of our company relative to data traffic on our network by 60% as compared to our 2013 baseline.

Data Highlights

2017 Key Performance Indicators

Electricity	2013	2014	2015	2016	2017
Energy intensity (MWh electricity/petabytes network traffic)	233	186	145	139	128



Energy intensity (MWh electricity/\$ billion revenue) ¹	114,686	113,863	101,163	94,313	91,122
Alternative energy (solar and fuel cell) capacity (MW)	19.8	22.5	25.9	39.9	50.8
Alternative energy (solar and fuel cell) production (kWh)	134.6M	154.3M	187.8M	298M	391M
Energy projects implemented (approx.)	4,500	3,900	15,000	25,000	18,000
Annualized energy savings from energy projects	\$40M	\$84M	\$119M	\$101M	\$148M
Total electricity use (MWh) (global direct billed and leased electricity)	15.0M	15.1M	15.1M	15.4M	15.4M

- **2020 Goal:** We will continue to drive reductions in emissions and increases in resource efficiency and alternative energy deployment. We will enable AT&T customers to lead more sustainable lives



by expanding access to technology, further integrating sustainability solutions into products and measuring the impacts.

- **2025 Goal:** AT&T will enable carbon savings 10 times the footprint of our operations by enhancing the efficiency of our network and delivering sustainable customer solutions.

Learn more about our [2020/2025 Goals](#).

Targets to our 2020/2025 Goals



In Progress

2020 Target: Reduce the electricity consumption of our company relative to data traffic on our network by 60% by 2020 (baseline of 2013).

- **PROGRESS:** Relative to our 2020 target for energy intensity (93 MWh electricity/petabyte of network traffic), AT&T has achieved a 45% reduction compared to the 2013 baseline of 233 MWh/PB. Our electricity consumption (in MWh) per PB of data carried on our network (the AT&T energy intensity metric) for 2017 is 128 MWh/PB.¹

2017 Target: Expand our on-site alternative energy capacity to at least 45 MW—more than double our 2014 capacity—by the end of 2017 and intensify our pursuit of off-site renewables with competitive financials.

- **PROGRESS:** In 2017, AT&T expanded our fleet of Bloom natural gas fuel cells by 12 MW, with 27 sites commissioned in California, New York and New Jersey. This growth brings our total on-site alternative energy capacity to 50.8 MW, exceeding the 2017 target established. The estimated combined energy production from these new facilities is almost 100 million kWh annually, and the estimated energy production of the entire renewable energy portfolio is more than 398 million kWh annually.
- AT&T announced one of the largest Corporate Renewable Energy purchases in U.S. history. AT&T will purchase 820 MW of wind power through 3 agreements with subsidiaries of NextEra Energy Resources, the world's largest operator of renewable energy projects. The Large Scale Renewable Energy (LSRE) generation is expected to start producing near the end of 2018.

2025 Target: Enhance network efficiency to enable the achievement of a net positive ratio.

- **PROGRESS:** As we pursue our 10x goal, which represents a net positive ratio between our operational footprint and the carbon reductions our technology makes possible for customers using our services, we are working to enhance our network efficiency through energy management and the integration of renewable energy. Please see our [Addressing Climate Change](#) and [Greenhouse Gas Emissions](#) issue briefs for more information.

2025 Target: Deliver customer solutions to achieve a net positive ratio.

- **PROGRESS:** As we pursue our 10x goal, which represents a net positive ratio between our operational footprint and the carbon reductions our technology makes possible for customers using our services, we are engaging customers to understand, measure and promote the benefits they're achieving. In 2017, we began a collection of 10x case studies that demonstrate and quantify the emissions impacts of 2 interesting technology use cases—the connected shipping pallet and smart rice farming. These case studies can be found on our [10x website](#).



Our Approach and Supporting Actions

Energy management is constantly evolving, and we continuously work to explore new strategies and creative ways to make progress on our energy goals and more efficiently manage the energy we use. As discussed below, visibility and accountability, innovation and collaboration, and technology are the building blocks of our approach.

Visibility and Accountability

At AT&T, we recognize the value and importance of making energy use and efficiency fully visible, particularly to those best positioned to make changes and improvements. To this end, we have tailored policies, organizational structures, processes and tools to help make sure our workforce is engaged in the energy management effort.

Some examples of the ways we demonstrate visibility and accountability with regard to our energy use include:

Energy Policy

Information about energy use and efficiency projects is provided to the Corporate Social Responsibility Governance Council, which is comprised of senior executives and officers with responsibility for the business areas most linked to current CSR priorities. This council is led by our Chief Sustainability Officer, who works with the Public Policy and Corporate Reputation Committee of the AT&T Board of Directors to achieve a wide range of specific, sustainable business objectives. The [AT&T Energy Policy](#) states that, “as a global communications leader, effective energy management is critical to the competitiveness of our business and the reliability of our service to customers.” It also outlines our commitment to “developing, in our offices and labs, new technologies and approaches to energy use” and calls for a comprehensive energy strategy with clear goals, metrics and management systems.

Energy Team & Champions

Dedicated full-time to energy management, the AT&T Assistant Vice President of Energy and Property Management Center of Excellence, John Schinter, oversees AT&T’s company-wide efforts across business units. He develops and implements our energy transformation strategy and leads a 17-member energy team, which also works full-time to oversee thousands of energy projects, analyze and collect data, and track progress and goals. 10 regional energy leads and 229 Energy Champions work with the energy team. These champions are largely real estate managers and network operators on the ground, implementing energy management



projects. As part of our efforts to encourage accountability, the managers and operators working on these projects have part of their compensation directly tied to performance on energy management.

Tracking Energy Management

The foundation of our energy management program begins with our utility invoices. Each month, roughly 300,000 invoices are scanned to extract key information and to pay the bills. The data and invoices are then made available in a web platform to internal network operators, real estate managers and all other AT&T employees who have a need to view and manage energy use for a given set of facilities or functions. This extracted information—including the bill images themselves—is archived for use in all manners of energy reporting and analysis, project planning, energy commodity purchases, etc. The availability and accessibility of energy-use information such as this helps to drive energy accountability. The energy team uses this data for many critical purposes, such as to benchmark energy performance, set expectations and budgets, and assess use trends over time. Billing and rate reviews are conducted on all facilities at least once every 18 months. The top 800 energy-consuming buildings are reviewed more frequently, due to the nature of their energy usage and billing patterns. Using data from our energy consumption database, we have entered more than 1,300 unique properties—including the vast majority of our top 800 facilities—in the ENERGY STAR® Portfolio Manager.

Energy Scorecard

Central to our energy management program is the energy scorecard. Developed in 2008, the energy scorecard gives much needed visibility to facility energy consumption and project activity. Fed by a centralized database, this scorecard generates easy-to-understand grades at our top 1,800 energy-consuming facilities and retail locations. The grades are based on energy consumption and activity, including initiatives related to energy-efficiency projects. The energy scorecards are available to facility managers, making energy consumption performance available across the team. We have found that this increased visibility is helping to set goals and promote innovation through shared learning.

EMPOWER

In 2017, one of our network organizations created a program to help provide awareness around our energy challenges. This concept has been so well received that plans are being made to expand across our enterprise. Energy Management, Providing Our Workforce Extra Resources (EMPOWER) will give our employees insights on current energy-related projects and initiatives. It will provide them with additional resources to show how they can help reduce energy consumption and move toward more sustainable energy. Included in this initiative are



a series of short videos that showcase some of our current projects and training courses that will provide them with educational opportunities. EMPOWER will give employees the tools they need to help spark ideas that will help us drive energy consumption down in the future as well as an avenue for submitting their own ideas for consideration and implementation.

Tracking and Communicating Our Progress

Making energy data accessible and clear to energy managers across the company is essential to keeping on top of its management. Our energy team uses a centralized, user-centered energy project management platform. This energy project management platform captures worldwide energy project data and provides routine and customized reports, enabling energy project management. Past, present and potential energy projects are captured and archived to facilitate the coordination of funding, approval, progress and all manner of reports, which are vital in securing future funding.

We routinely share information on energy performance across our entire real estate operations through newsletters, email campaigns, meetings and video conferencing. Also, through our energy website, energy managers and corporate real estate users can access facility-level energy data and utilize our state-of-the-art energy management tools.

Innovation and Collaboration

Our long and storied history of innovation and collaboration continues today with respect to our approach to energy management. We work with internal and external organizations—large and small—to identify better ways to source energy, purchase and deploy energy efficiency, and be more efficient and responsive with how we manage our infrastructure and the energy it consumes.

Some examples of our innovative and collaborative efforts include:

Saved Power Purchase Agreements (SPPA)

Energy efficiency projects with inherently compelling financials are relatively easy to execute. However, funding and implementing efficiency projects becomes more challenging when the financial returns are less compelling. Recognizing this, we developed the Saved Power Purchase Agreement (SPPA), an Efficiency as a Service (EaaS) mechanism to fund efficiency upgrades without the need of upfront capital. Using the SPPA model, we authorize a third-party vendor to install energy efficient equipment at our facilities, then pay that vendor at a rate (less than the prevailing utility rate) for every unit of electricity they are able to vaporize (eliminate). These savings are metered and validated using our AT&T wireless network for



data harvesting. We have found this to be a successful model for hedging electricity rates and reducing electricity use (and in many cases other costs) with no upfront capital costs.

By way of example, through 2017 AT&T has deployed smart lighting systems at 647 AT&T facilities, including administrative buildings, data centers, retail stores, work centers and telecommunications equipment buildings. The reduced energy consumption in these facilities resulted in almost \$20 million of annual avoided electricity utility payments and reduced electricity usage by 183 million kilowatt hours (kWh). The nature of the SPPA arrangement allows AT&T to additionally enjoy non-energy financial benefits. For example, the SPPA funding model is helping AT&T to attain its 10x goal for carbon savings—10 times the footprint of our own operations by 2025—by reducing our electricity emissions. The sustainability savings attained on these 647 facilities is equivalent to more than 97,500 metric tons (mtons) of carbon dioxide equivalent (CO₂e) emissions. The new equipment also typically has lower maintenance requirements, thus reducing material costs, labor costs and fuel use from truck trips. We expect this program to continue to expand in the coming years as we look at ways to use this model for different applications and in more facilities. We are also working with technology and business collaborators to develop programs that leverage AT&T technology to enable similar benefits for customers who are having trouble funding energy efficiency projects in their own facilities, leveraging our AT&T communications backbone for metering and validation of savings. For 2018, we are already utilizing the SPPA financial model to fund the installation of new lighting systems at more than 200 retail and 46 non-retail AT&T facilities, with more expected in the coming months.

Alternative and Renewable Energy Collaboration

Beyond financial innovations, we collaborate with other external organizations to help us further our energy management goals through alternative and renewable energy solutions. By the end of 2017, our alternative and renewable energy portfolio included 4.6 MW of solar installations, 46.2 MW of on-site fuel cell power from Bloom Energy servers and 0.82 MW of wind capacity for a total alternative energy capacity of 51.6 MW. These sources of power will produce 398 million kWh annually, which is equivalent to the electricity use of more than 44,000 homes for a year.²

In 2017, we continued to build out alternative energy capacity and worked with Bloom Energy Corporation to install Bloom Energy servers at 27 Bloom Fuel Cell installations in California, New York and New Jersey. The fuel cell technology can range from moderately favorable to generally carbon neutral compared to conventional grid power sources and depending on the composition of the grid energy that is being displaced. Fuel cells virtually eliminate sulfur oxides (SO_x), nitrogen oxides (NO_x), and other harmful smog-forming particulate emissions while helping AT&T to hedge against conventional power rate uncertainty. Future applications will leverage the always-on reliability of fuel cells as we build them in mission-critical roles. A



mission-critical fuel cell is one that is the primary source of electric power for a facility, with the electric grid serving as back-up power. In this application, we are able to take advantage of a number of synergies, such as the elimination of on-site generators and Uninterruptable Power Source (UPS).

But the story does not end with what we've done in the past. In 2018, AT&T announced [one of the largest corporate renewable energy purchases in U.S. history](#). AT&T will purchase 820 MW of wind power through 3 agreements with subsidiaries of NextEra Energy Resources, the world's largest operator of renewable energy projects. The large-scale renewable energy (LSRE) purchase is 1 part of our larger commitment to the environment and the transition to a low-carbon economy. The projects are expected to reduce greenhouse gas emissions equivalent to taking more than 530,000 cars off the road or providing electricity for more than 372,000 homes per year.² The LSRE generation is expected to start producing near the end of 2018.

AT&T has developed an Alternative Energy Dashboard and made it available to all AT&T employees via our company intranet. The Alternative Energy Dashboard provides real-time alternative energy production and associated environmental offsets. It gives the viewer visibility of daily, weekly, monthly and annual alternative energy production and associated environmental offsets of all solar and fuel cells deployed by AT&T—providing both a current view and an overview of the total production since the system's inception. The dashboard further provides pictures of each system and its location on a map. On one screen, the viewer can now see the immense volume of electricity produced by our onsite alternative energy production installations and understand the impact of these systems on our business and the environment.

Technology

Day-to-day use of advanced technology and big-data analytics in the routine management of business functions has grown so fast that present-day business processes simply don't resemble what they were 10, 15 or 20 years ago. At AT&T, we are always looking for ways to embrace—and even advance—such technologies. Nowhere is this more evident than in our use of technology to support our energy efficiency goals and objectives. Some examples include:

Modernizing Our Network

The modernization of our networks to meet the demands of the 21st century presents enormous opportunities. This starts with our transition from a copper-based network to one that is fiber-based and operates via Internet Protocol (IP), which will allow us to deploy network equipment that is greatly improved in terms of energy efficiency and traffic capacity.



We're also shifting control from hardware to software to make our network faster, simpler and more scalable.

- Software-Defined Networking (SDN) shifts control of the network from hardware to software, giving customers more control over their network services. This creates an intelligent network that is more flexible, efficient and aware of applications. We've already converted 55% of our network functionality to SDN and are on our way to 75% by 2020. Millions of customers are already using our virtualized and software-controlled network.
- Network Function Virtualization (NFV) moves network functions from hardware-based appliances into software platforms running on commodity hardware. This means we can update network functions from almost anywhere and do it quickly without having to redeploy new hardware. We can dynamically reroute traffic, add capacity and introduce new features through programmable, policy-based controllers.

Altogether, this software-defined and virtualized, all-IP, fiber-based network will allow us to make great advances in minimizing unused capacity, unnecessary energy expense and real estate square footage.

Project iCON

Project iCON (intelligent connection of facility networks) uses our network to acquire valuable performance data from facility equipment across the country. We manage the data from a centralized point that allows us to create performance baselines, monitor equipment status and identify required maintenance actions in real time. This allows for significant savings on maintenance costs, in addition to reductions in unnecessary energy use. The implementation of Project iCON is helping to revolutionize the way we manage and, ultimately, reduce our energy usage.

Facility and Network Initiatives

In 2017, we invested nearly \$20 million to implement 17,489 projects that total to a gross annualized savings of \$148.5 million. Since 2010, we have implemented more than 83,000 energy-efficiency projects, resulting in annualized savings of \$575 million. Examples of major programs include:

- **Real Estate Reduction:** By using space more wisely, we are able to reduce the amount of energy used to power it. During 2017, we closed, vacated or downsized our space in 127 owned or leased facilities—reducing building occupancy by more than 4.1 million square feet and consolidating our operations to facilities that are more energy efficient. This portfolio reduction will help us conserve 43 million kWh of electricity each year, which is equivalent to the electricity use of more than 4,800 households.²



- **Facility-Based and Large-Scale Energy Efficiency Projects:** These include such projects as the upgrade of air-handler efficiency and controls in our buildings, lighting retrofits and variable frequency drive (VFD) installations. These projects provide an annualized savings of more than 141 million kWh and \$8.5 million. From a payback perspective, these improvements in energy savings will be realized in approximately 2.3 years. They will save an amount of electricity equivalent to what would be required to provide electricity to nearly 16,000 homes for a year.²
- **Training Employees:** Equipping our energy managers with proper tools and knowledge is critical to driving progress. Nearly 100% of our Energy Champions are ENERGY STAR®-certified through an internal ENERGY STAR® online training course that is available to them at any time.

Cell Sites

As part of our commitment to sustainability, we are creating industry leading innovations to reduce energy consumption in the AT&T wireless network. With a 4G LTE network covering more than 400 million people in North America, the cell sites that support our coverage are significant contributors to the AT&T energy footprint.

We are leveraging our [ONAP-based](#) network automation platform—together with industry-leading, patented machine learning-based analytics—to make intelligent decisions that safely allow a subset of a cell site's capacity to temporarily go into a sleep mode. Our intelligence will determine the timing and duration of the sleep mode, enabling us to reduce our energy footprint while maintaining a premium customer experience. We are in the process of deploying our technology across the AT&T nationwide LTE network, and we expect to expand our intelligence to 5G as it rolls out as well.

AT&T has also designed, implemented and evolved to new and more energy-efficient models of air conditioning systems (HVAC) for sheltered cell sites. The newest designed sites are factory-equipped with direct-air cooling systems. When outside temperature and humidity are within acceptable ranges, the systems circulate outside air to cool the shelter equipment space instead of using the HVAC compressors. As older and less power-efficient technologies are removed from our sites, we will become less dependent on mechanical cooling. This will create opportunities for higher operating temperatures and greater use of the free cooling systems.

Network Transformation

In 2017, the AT&T Network organizations continued to execute on the AT&T Network's decommissioning program, designed to improve overall asset utilization through the systematic decommissioning and removal of excess network capacity and hardware. These efforts are a



key support pillar in the transformation of our Network to the AT&T Software Defined Network. Teams across the country completed more than 15,000 projects—many of which are groups of hundreds of sub-projects—involving the elimination of equipment formerly supporting legacy systems across all network layers. This includes the end-of-life turn down and decommissioning of the Mobility GSM network (Global System for Mobile communication). These efforts have eliminated more than 1.6 billion kWh on an annualized basis from our energy footprint, or roughly 857,000 mtons of CO₂e from our environmental emissions footprint.

Data Centers

Improving the energy use of data centers represents a constant challenge and opportunity for our business. We are committed to pursuing energy efficiency at these facilities to provide a productive and efficient space for our equipment. Common projects include replacement of older major air conditioning equipment (chillers and compressors) with newer, more efficient equipment. Other projects include retrofitting of existing equipment with variable frequency drives (VFDs) and other similar enhancements to use existing equipment more efficiently. Additionally, AT&T considers sustainability as one of the variables in the design and construction process of any new data center. We consider sustainable design and LEED-qualifying solutions that affect water, energy and waste — for example, economization, reducing the use of impervious surfaces and installing natural low-maintenance landscaping.

ENERGY STAR®

AT&T participates in the ENERGY STAR® program for set-top boxes for both its DIRECTV and U-verse products. This voluntary program sets and periodically updates best-in-class efficiency standards, encouraging participants to continually increase the efficiency of equipment.

- In 2017, AT&T received the ENERGY STAR® Partner of the Year award for investing in efficient designs for pay TV hardware and services, bringing this equipment into homes and educating technicians and customers about energy savings associated with their ENERGY STAR® certified receivers. This accomplishment acknowledges our continued support of ENERGY STAR® efforts.
- At year end of 2017, 96% of all AT&T receivers in the U.S. were ENERGY STAR® qualified. AT&T has been able to reduce set top boxes total annual energy consumed by its U.S. receivers by more than 2 billion kWh compared to its 2012 baseline, which equates to an annual carbon emissions reduction of more than 800,000 metric tons CO₂e. AT&T accomplished this overall electricity reduction in customers' homes even while increasing the total number of receivers in circulation by more than 5 million units.

Learn more about our [2017 ENERGY STAR® Partner of the Year award](#).



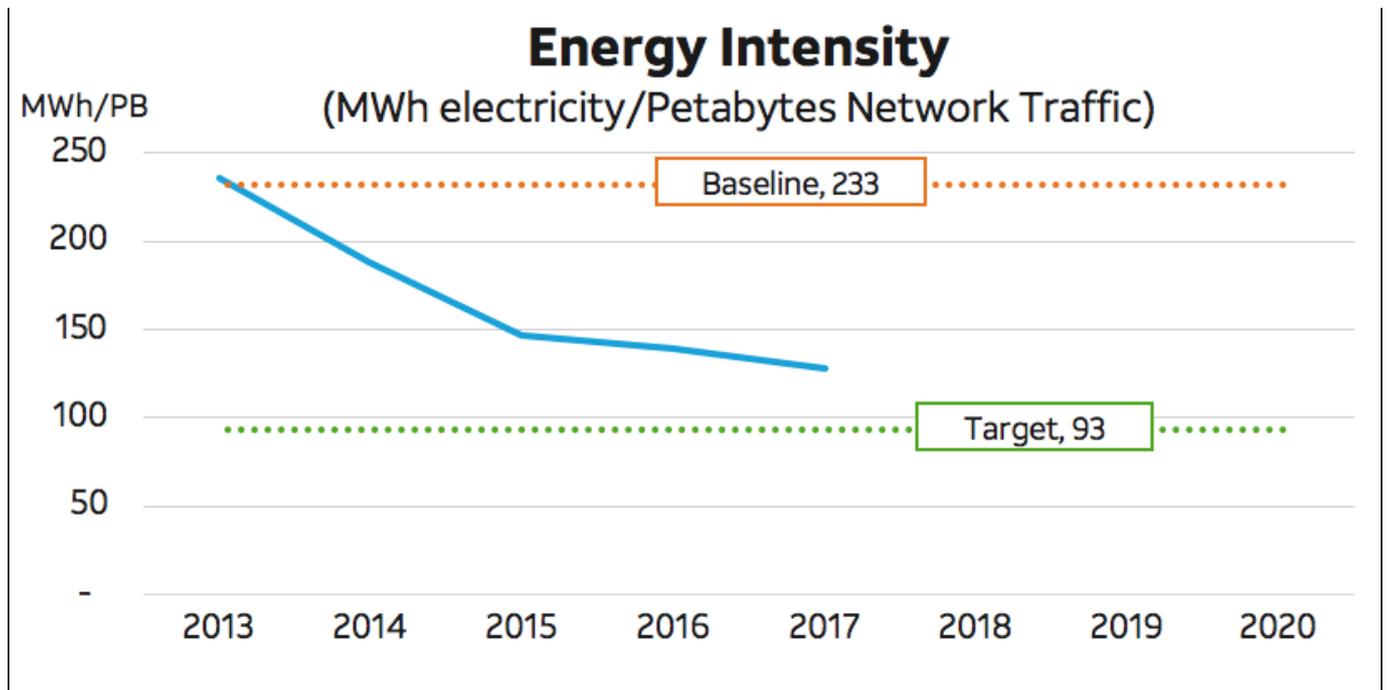
How We Track & Measure Energy Efficiency

We use our energy intensity metric to track and evaluate the energy-efficiency progress resulting from our actions as discussed above.

Energy Intensity Metric

The pure scope and scale of our global business and network operations presents challenges with measuring and tracking energy efficiency. We have established an energy intensity metric to measure our electricity usage compared to our network data traffic, allowing us to see the progress in our efficiency efforts at a time when increasing network demands directly impact electricity use.¹ Our baseline for this metric is our 2013 energy intensity value of 233 MWh/PB. Our 2020 target is 93 MWh/PB, which represents a 60% reduction from the 2013 baseline. Intensity Metric

Base Year (2013)	2015	2016	2017	Target Year (2020)
MWh/PB				
233	145	139	128	93





Though AT&T has set an aggressive goal for reduction of electricity consumption in MWh/PB of carried network data traffic, the combined efforts across all business units to manage our energy footprint and to transform our business have moved us toward our energy intensity goal even faster than anticipated. The 2020 goal set in 2013 allotted us 7 years to produce a 60% reduction in our energy intensity. By the end of 2017, with 4 years behind us, we have achieved 75% of our reduction goal, and this is despite the growth in our operational footprint in Mexico and Latin America.

How Do We Calculate Our Metric?

The calculation methodology for our intensity metric was developed to allow long-term efficiency tracking. Because different companies' networks are configured and carry traffic in different ways, it is exceedingly difficult to compare one network to another. We believe that the critical measure is relative performance of a network over time, using a consistent methodology. There are 2 components to the intensity metric: electricity consumption and network traffic.

We calculate electricity consumption by aggregating all directly billed electricity consumption together with estimates of electricity consumption for leased facilities globally where electricity usage is part of the rent.

We calculate network traffic by gathering data (or using estimations when actual measurements are not available) from all network layers and carried over the copper or fiber of our network. This includes our global backbone, U-verse television distribution network, and Mobility network.

AT&T total network traffic includes:

- Traffic carried on all AT&T global networks, either measured or estimated.
- All packet data traffic (Ethernet, frame, ATM and IP, including both 141.6 million in the U.S. and 15.1 million wireless subscribers in Mexico).
- Voice network traffic (TDM, IP, wireless—both the U.S. and Mexico).
- Consumer broadband distribution network serving 15.7 million broadband subscribers.
- Video connections to: 25.2 million subscribers (U.S.), 8.2 million subscribers (Pan Americana), 5.3 million subscribers (Brazil).

AT&T total network traffic does not include data traffic carried over the air, as with the satellite uplink and downlink traffic of DIRECTV, even though this method of traffic delivery allows AT&T to move vastly more data with less of an energy footprint and is a clear competitive advantage for AT&T. Learn more in our [Investor Briefing](#).

Our network traffic calculation is a comprehensive measurement. In developing this measurement, we took extreme care to ensure traffic was only counted once to prevent



inaccuracies in traffic volume. Where actual traffic measurements were not available, AT&T took a disciplined approach in estimating such traffic, ensuring it was not counted elsewhere.

¹ Electricity use is the numerator and is a proxy for total energy use. Network data traffic volume is the denominator and is a proxy for our production.

² Equivalency calculated using the [EPA Greenhouse Gas Equivalencies Calculator](#).