CLEAN ENERGY IS CALLING

2019

ASSESSING ENERGY USE &
ENVIRONMENTAL IMPACTS OF THE
TELECOMMUNICATIONS INDUSTRY

Green America®

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Authors: Michael Weingartner, Beth Porter, Green America
Editor: Todd Larsen, Green America
Green America
1612 K Street NW, Suite 600
Washington, DC 20006
GreenAmerica.org

Contact Beth Porter: bporter@greenamerica.org with questions.

EXECUTIVE SUMMARY

INTRODUCTION

Green America is a national nonprofit organization working to create a green economy through economic solutions to environmental and social justice problems. We urge industries to improve their supply chains and practices to promote sustainability and provide them assistance in doing so. We also provide resources for individuals looking to green their lives, their places of work, and their larger communities.
A major part of creating a truly green economy is shifting America's electricity generation to 100% clean power from wind and solar. In identifying sectors which lag in clean energy use, the telecommunications industry stands out as a large entity with significant influence on the climate with its use of over 30 million megawatt hours (MWh) of energy usage, mostly from fossil fuels.

In 2017, Green America launched a campaign titled "Hang Up on Fossil Fuels" that urges the two largest telecom companies in the U.S., AT&T and Verizon, to set a goal of reaching 100% renewable energy by 2025. This report was originally published in March 2018, and in the past year, there have been considerable updates and progress to include in this new version.

PROBLEM STATEMENT

Our planet has surpassed 410 parts per million[1] of carbon dioxide in the atmosphere, which reflects years of degradation and consumption that have been rising along with the sea levels. Given the lack of current political leadership in the United States on climate policy, organizations, individuals,

local and state governments, and companies must work to reduce our greenhouse gas emissions to 350 parts per million or less.

The telecom sector uses enormous amounts of energy each year. The sector is using enough electricity to power all the households in New York City. The four largest companies – AT&T, Verizon, Sprint and T-Mobile – collectively use more than 30 million MWh of electric power each year. AT&T and Verizon, the two leading US companies in the industry, have a combined electricity usage that could power 2.6 million homes for a year. Historically, the vast majority of this sector was powered on fossil fuel energy, but there have been steps taken to increase its use of clean energy in the past year. After Green America announced its "Hang Up on Fossil Fuels" campaign in 2017, tens of thousands of consumers reached out to AT&T and Verizon urging them to use clean energy.

In January 2018, T-Mobile moved into a leadership position on renewable energy commitments through its announcement to reach 100% renewable energy by 2021. In February 2018, following T-Mobile's announcement, AT&T announced that it will purchase 520 MW of power from two wind farms in Oklahoma and Texas, and then later in the year announced a deal with NextEra Energy Resources for an additional 300 MW from two new Texas wind farms. The two purchase agreements equal roughly 30 percent of AT&T's total energy use.[2] In November 2018, Verizon finally made moves to follow its competitors' lead by quietly announcing its goal of 50% clean energy by 2025.[3] Verizon recently issued a $1 billion green bond, and part of the money raised from that bond will go to clean energy purchases.

A large portion of this energy (90%) powers wireless access networks, towers, and other infrastructure allowing cell phone users to access data and connect nationwide.

The bulk of the energy used by telecoms goes to power wireless networks, towers, and other infrastructure. Data centers make up the remainder of the energy used and are a rapidly growing driver of climate emissions worldwide. Data centers are central locations of computing and networking equipment and have existed since computers became a part of our lives. The telecommunications industry relies heavily on these centers and access networks running 24/7 so we can access them at anytime, and stay connected to our friends and families. That connectivity comes at a high environmental cost since data centers and networks serving the telecom industry are powered by fossil fuels.

FINDINGS

A review of the four major telecom companies in the US conducted by Green America found the following.

1. Renewables:

Only one major telecom company, T-Mobile, has made a commitment to move to 100% renewable energy. AT&T has announced the purchase of 820 MWh of wind energy, which we estimate will take vits overall consumption of clean energy to approximately 30% of total energy used. Verizon and Sprint are both utilizing less than 2% renewable energy, although Verizon has committed to reaching 50% by 2025. Verizon's previous goal was to reach a mere 4% of clean energy over the next decade.

As of 2018, including all current contracts for renewable energy by the four major telecom companies, Green America estimates that the entire telecom industry will be using at most 15% renewable energy for all its energy needs.

2. Intensity and Usage:

AT&T, Verizon, and Sprint have all lowered their energy intensity (increased efficiency) over the past decade. As a result, AT&T and Verizon have kept their energy use and emissions constant. Sprint has significantly reduced its energy usage. T-Mobile is the only company to see an increase in energy usage over the past decade, although as of 2016 it has started to decrease. However, in comparing the four companies regarding their energy intensity in relation to revenues or customers, AT&T and Verizon use far more energy per revenue dollar or per customer than Sprint or T-Mobile.

3. Overall Greenhouse Gas (GHG) Emissions:

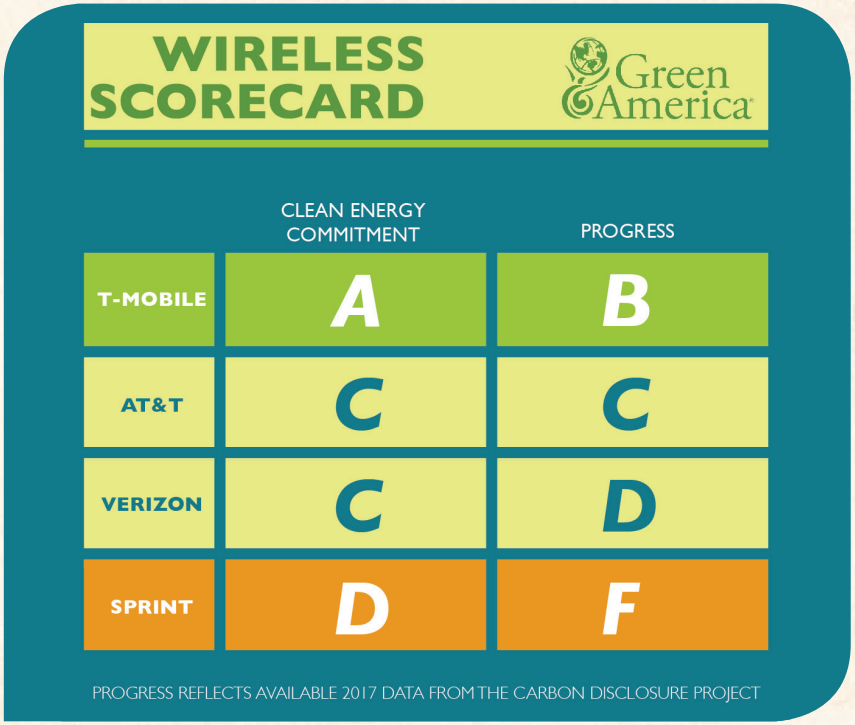
AT&T and Verizon have not set goals for reducing overall emissions. Sprint made a commitment to reduce overall emissions by 20% by 2017, and more than doubled that target with a reduction of 47%. T-Mobile has committed to reduce Scope 1 and 2 emissions 95% from a 2016 baseline year by 2025. In this report we track both Scope 1 emissions (from sources that are owned or controlled by the organization) and Scope 2 emissions (from the consumption of purchased energy). In the telecom sector, Scope 2 emissions are much greater per company than Scope 1 since most of the energy used is purchased electricity, which is why the rapid transition to renewables is so important.

4. Renewable Energy is a sound business decision:

The availability of wind and solar energy in the United States is growing dramatically and the cost is going down. Wind power is increasingly the least expensive form of energy generation available in several areas of the country. In announcing its commitment to reaching 100% renewable power by 2021, T-Mobile highlighted the fact that the company expected to save approximately $100 million in the next 15 years. By this estimation, a company the size of Verizon could potentially reach $500 million in savings by moving to 100% clean energy.[4]

GREEN AMERICA'S WIRELESS SCORECARD

Based on publicly available data and information provided directly to Green America by companies, we graded each of the companies on core metrics related to efficiency, clean energy, and greenhouse gas emissions reductions.



SOLUTION

The telecommunications industry can make great strides in reducing fossil fuel use, which requires the major companies achieving clean energy goals in a responsible timeline. To reduce our climate emissions at the speed and scale necessary to address the climate crisis, all companies should commit to shift to 100% renewable energy and reduce their GHG emissions. T-Mobile has made the strongest commitment to renewable energy to date, with a goal of 100% energy from wind by 2021, and by joining RE100, a global initiative uniting companies that are all committed to 100% renewable energy. AT&T, Verizon, and Sprint should adopt a goal of 100% clean energy before 2025, along with overall carbon emission reduction goals and deadlines for each step. Clean energy means solar and wind power, with a complete phase

out of coal, nuclear, and natural gas. Clean energy options are increasing every year, in large part to satisfy the demands set by major corporations, states, municipalities, and other institutional purchasers. If major IT companies like Apple and Google can achieve 100% clean energy, telecom companies can too.

ENERGY USE IN TELECOMMUNICATIONS INDUSTRY

The sector which facilitates and supports the flow of digital information worldwide is collectively known as the information and communications technology (ICT) sector. It is made up of the manufacturing and service industries responsible for products that store, retrieve, manipulate, transmit, and/or receive digital information, and the networks that connect them.

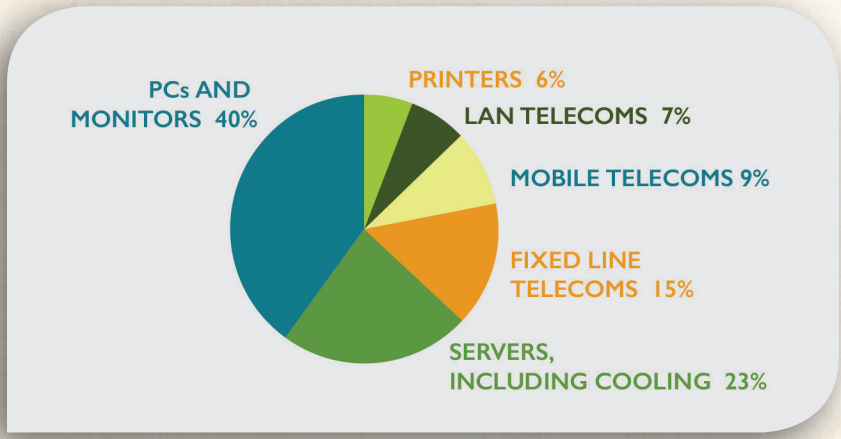


Figure 1: Energy Usage in the Telecom Sector

The ICT sector consumes approximately 4%[5] of the world's total electricity and is responsible for 2% of global greenhouse gas emissions; about 830 million tons of CO2e annually[6] – more than the entire aviation industry. While the ICT sector uses less energy and is responsible for fewer emissions than some sectors like construction, transportation, and agriculture, its impact is by no means minor. ICT is a rapidly growing sector, and more rapid growth is expected in the near term.

As a result, the ICT sector is expected to double its current proportion of global GHG emissions to 4% of the global total by 2020.[7] As technology companies, known for their innovation and drive to produce lasting change, businesses in ICT are well-positioned to be leaders in addressing the sustainability and climate related problems in their sector.

PROJECTED INDUSTRY GROWTH: 5G EXPANSION

Global internet traffic is predicted to nearly triple between 2016 and 2021. Broadband speeds are expected to double, and demand will nearly triple as monthly per capita internet traffic is predicted to rise from 13 GB to 35 GB per person over the same period.[8] The number of connected devices is expected to rise from 17.1 billion to 27.1 billion devices. About half of those devices will be smartphones, tablets, and PCs, with the remainder being part of the Internet of Things (IoT) network.[9]

These connected objects can be everyday items like headphones, refrigerators, and wearable fitness devices; to motorized vehicles; to the components of larger equipment like a jet engine or oil rig drill.
The network connectivity of these objects allows users to remotely monitor, sense, and control their functions in real time. Applications for IoT are endless, including urban transport, environmental sensing, medical devices, and home appliances. Some estimates put the number of connected devices, including PCs, mobile devices, and objects part of the IoT, at over 100 billion by 2025.[10]

In 2018, Verizon announced its launch of the world's first commercial 5G (fifth generation) network in four US cities, with plans to expand nationally. This network promises faster speeds, longer battery life, larger data, reliable connectivity, and has been hailed as an industrial revolution by some telecom experts. It will also increase the number of IoT devices that can be connected from 1,000 devices per square kilometer to one million devices per square kilometer.[11] The amount of infrastructure and energy needed to support such a large and fast network could be staggering. Some industry experts estimate that 5G could consume up to 1,000 times as much energy as current networks, while others believe this problem can be managed with greater energy efficiency over time.[12] Navigating this challenge will also require expanded use of hardware and base stations for the network. The increase in smaller cells for 5G will lead to greater total energy consumption, but the energy consumption per cell is smaller than present networks. The Small Cell Forum estimates 5G cell deployments will overtake 4G by 2024, and the total installed base of 5G small cells in 2025 is predicted to be 13.1m, over one-third of the total in use.[13]

A beneficial aspect of 5G is its potential to increase efficiency, which could result in less energy being wasted. Verizon has claimed that 5G will help cities save 70% of their energy usage, but this is based on a number of assumptions that may be difficult to verify in application. As the 5G network progresses, it will be important to push for monitoring of its concrete environmental impacts, both positive and negative.

This report is focused on telecommunications companies which provide mobile services, so it is especially important to note that the predicted rise in internet traffic and demand for network services is tracked by a notable shift in the way that people access their data and the internet. Smartphone traffic is expected to exceed PC traffic by 2021, growing from 13 to 33% from 2016 to 2021, with PC traffic dropping from 46 to 25%. Smartphone use is growing especially fast, with the average user expected to increase mobile data use to 8.9 GB of mobile data per month by 2021, up from about 1.4 GB in 2016.[14] By 2021, mobile data traffic, which includes mobile phones, wireless-enabled laptops, smartphones, and tablets, is predicted to increase by a factor of seven and mobile and wireless traffic will account for 63% of total internet traffic by 2021.[15]

As telecommunications become an integral part and a major driver of economic development, and more people access information through mobile devices, the social and environmental impact of mobile service providers will grow. With more users and increased demand for bandwidth, there is a need for more network infrastructure, data centers, and energy inputs. Additionally, the costs to service providers for running these networks will increase, driven primarily by rising energy demand.

Integrating sustainability into the expansion and growth of these networks will be easier, cheaper, and more environmentally sound than later retrofitting a system not designed to be sustainable. Green power production in the form of wind and solar is an important piece of an interconnected world; projected growth is not sustainable using current levels of fossil fuels. At their cores,

telecommunication companies have always been innovators. They now have the opportunity to use that innovative spirit to find ways to reduce energy use and emissions, and to deploy and scale alternatives to fossil fuel energy.

HOW A NETWORK CONSUMES ELECTRICITY

Mobile networks can be grouped into four main components that consume energy (Figure 2):[16]

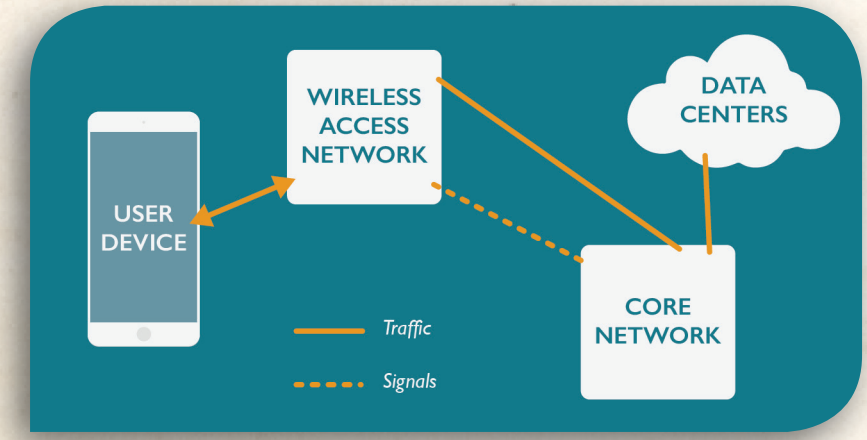


Figure 2: Network Components

The **user device** includes smartphones, tablets, and laptops and a **wireless access network** connects directly with user equipment and the core network. The **core network** delivers data to other subnetworks like the internet, and **data centers** (i.e. the "cloud") contain servers where user data is stored.

The network used to access the internet and other services via mobile devices is made up of four major components (see Figure 2). Each of these components is made up of technologies that use energy in some way. The component with the greatest energy demand is the wireless access network, specifically base stations and their individual elements, which connect directly with user equipment, followed by data centers and their need for constant cooling and backup power. According to a recent CEET report, access networks are responsible for approximately 90% of the energy used to access data wirelessly (including Wi-Fi networks), with most of that energy powering mobile networks. **About 9% is used to power data centers, less than 1% powering the core network, and a negligible amount required to power user equipment.** Breaking down the numbers shows that mobile networks are responsible for 59% of network energy consumption, with public and local Wi-Fi networks accounting for the other 31%.[17] Real-world data agrees with modeled levels of electricity use. Telefonica, a Spain-based mobile service provider reported in 2016 that 44% of their electricity consumption was from base stations[18] and Sprint reported in 2017 that data centers contribute just 4% of the company's electricity use and GHG emissions.[19]

EXISTING ENERGY- AND EMISSIONS-RELATED GOALS AND PROGRESS

For companies who run networks, there are three key ways to reduce emissions (this is covered in more detail in the Road to 100% section):

1. *network redesign for more efficient power usage;*
2. *increased use of energy-efficient equipment;*
3. *increased sourcing of renewable energy - predominantly wind and solar*[20]

This report is primarily concerned with the state of green power deployment in the telecommunications sector, with a focus on the four largest US mobile service providers and each company's commitments, goals, and progress towards 100% clean, renewable energy. AT&T, Verizon and Sprint made progress on options 1 and 2 above. T-Mobile is now the leader in option 3, with its recent commitment to 100% renewable energy by 2021. AT&T is making progress on option 3 with its new acquisition of 820 MW of power from two wind farms,[21] but the company has not yet committed to 100% renewable power with a deadline. Verizon was the long-standing industry laggard on clean energy commitments but has now set a goal of 50% clean energy by 2025. In Green America's view, option number three from the list above -- increasing the sourcing of green power to 100% by 2025 -- is the most important next step for the industry overall as it will help to scale up renewable energy nationwide and reduce emissions while meeting the increasing energy demands by these companies to power networks (including new 5G Networks) and data centers.

Telecom companies **Verizon Communications, AT&T Inc., T-Mobile US,** and **Sprint Corporation** are the four largest wireless service providers in the United States, with Verizon and AT&T outpacing T-Mobile and Sprint in terms of both wireless subscribers and consolidated revenue (see Table 1). They also outpace the smaller companies in terms of GHG emissions and energy use (see Figures 3, 4).

This report is concerned with three types of commitment related to energy and emissions. These include: 1) commitments to green power procurement; 2) reductions in intensity; and 3) reductions in absolute greenhouse gas emissions.

The goals set by AT&T, Verizon, Sprint, and T-Mobile US regarding carbon emissions and green power vary distinctly between the four companies, but only T-Mobile has made a commitment to sourcing 100% clean energy. Tables 2-5 list the most current goals and progress made by AT&T, Verizon, Sprint, and T-Mobile US.

COMPANY	WIRELESS SUBSCRIBERS (MILLIONS)[22]	2017 REVENUE (US$ BILLIONS)	TOTAL 2018 ENERGY REPORT BASED ON 2017 DATA (MWH)[23]	RENEWABLE ENERGY GOALS
AT&T[24]	141.5	$160.5	20,233,165	No set goal - announced purchases of 820 MW of wind energy (approx. 30% of total energy)
SPRINT[25]	53.6	$33.5	2,289,243 (from 2016)	Goal of 10% by 217, but less than 1% currently sourced from renewables.
VERIZON[26]	150.4	$126	12,655,300	Goal of 50% by 2025
T-MOBILE US[27 28]	72.5	$40.6	2,839,773	Goal of 100% by 2021

Table 1: Top four wireless service providers in the US by number of Q2 2017 wirleless subscribers, and by 2017 consolidated revenue.

Note: Total Energy Used includes both fuel and electricity expressed in MWh. For AT&T, Verizon, and Sprint, these Total Energy Used is derived from data reported to the Carbon Disclosure Project by each company. For T-Mobile, Total Energy Used is available on their website.

In 2015 AT&T committed to double its green power capacity to 45 MW by the end of 2017. In 2016, AT&T's green power portfolio still represented less than 2% of its total electricity consumption. However, in February 2018, the company announced plans to purchase 520 MW of wind energy from two windfarms, with 220 MW coming from the Minco V Wind Farm in Caddo County, Oklahoma and 300 MW from Webb and Duval counties in Texas. AT&T estimates this will result in savings equivalent to providing electricity for a quarter million homes a year.[37]

Later in 2018, AT&T announced an additional purchase of 300 MW through a deal with NextEra Energy Resources.[38] Green America estimates the total purchases will increase the company's overall renewable use from 1.26% of its operations to approximately 30%. Its new commitment does not meet our goal of 100% clean energy by 2025, but it is an important step for AT&T and the industry. AT&T has set a goal to reduce only direct emissions from sources owned by the company such as fleet emissions and on-site boilers, known as Scope 1 emissions.

According to AT&T's reporting, Scope 1 emissions account for 13% of the company's total greenhouse gas emissions. The clear majority are in the Scope 2 category, which are indirect emissions from the purchase of electricity, heat, or steam power. The company has made no commitments to reducing Scope 2 emissions. AT&T began using the energy intensity metric in 2013 and committed to a 60% reduction by 2020.[39] Currently, it has achieved a reduction of 45%, while continuing to grow its network in terms of users, traffic, and infrastructure.[40]

AT&T	
GOAL[29]	PROGRESS[30]
Reduce Scope 1 emissions by 20% by 2020 relative to a 2008 baseline.	Scope 1 emissions were down by 22% in 2017 from the 2008 baseline. (Note: Scope 1 emissions are approximately 13% of AT&T's total emissions)
Reduce energy intensity (MWh/Petabyte* traffic) by 60% by 2020 relative to 2013 baseline.	Energy intensity was down by 45% in 2017 relative to 2013.
Expand on-site alternative energy capacity to at least 45 MW (double 2014 capacity) by end of 2017.	In 2018 announced the purchase of 820 MW of wind energy. Four wind energy projects in TX and OK are in process.

*Petabyte is a million gigabytes (unit of memory size)

Table 2: **AT&T** goals and progress

verizon

Verizon's previous commitment to clean energy was to double its capacity from 24 MW in 2016 to 48 MW in 2025. Like AT&T, the company was using less than 2% clean energy. Verizon had no public goals for reducing absolute emissions within any Scope. In November 2018, Verizon added a commitment to reach 50% clean energy by 2025 to its website but did not include details. In February 2019, Verizon issued a $1 billion green bond, which will go towards boosting its solar and hydrogen fuel cell electricity production at its properties and investing in solar and wind farms in nearby areas.[41]

Both Verizon and AT&T fail to adequately address emissions by not including clear commitments to reductions in Scope 2 or total emissions, which could be achieved by sourcing a significant proportion of their electricity from low-carbon sources. Verizon set its goal for carbon intensity reduction at 50% between 2009 and 2020. In 2016, it surpassed that goal and has reduced carbon intensity by 54% while continuing to grow.[42]

VERIZON

GOAL[31]	PROGRESS
Reduce carbon intensity by 50% by 2020, relative to a 2009 baseline.	In 2017, carbon intensity was down by 54% relative to the 2009 baseline. Verizon has now set a new goal to cut carbon intensity 50% from 2016 baseline by 2025.
Add 24 MW alternative energy capacity by 2025 (double its 2016 capacity for a total of 48 MW).	On-site renewable energy capacity is currently 24 MW. Set goal to reach 50% clean energy by 2025.

Table 3: **Verizon** goals and progress

T-Mobile

T-Mobile has committed to reaching 100% renewable energy by 2021, which puts it in a leadership position in the industry for renewables. Early in 2017 T-Mobile signed a contract with the Red Dirt Wind project for 160 MW of wind power, which made them one of the largest corporate buyers of green power in 2017.[45] In 2018, T-Mobile finalized a contract for 160 MWs from Infinity Renewables' Solomon Forks Wind Project in Kansas, with power generation slated to begin in early 2019. Combined, the two projects will generate 320 MWs for T-Mobile, enough to meet an estimated 60% of T-Mobile's total energy needs nationwide.[46] In 2018, T-Mobile added a new goal to reduce combined scope 1 and 2 emissions 95% from a 2016 baseline year by 2025. The company does not have publicly-facing commitments regarding reductions in energy intensity.

An evolving issue is the proposed merger of T-Mobile and Sprint, but there is no public information on what this will mean for T-Mobile's clean energy goals, since Sprint is not committed to a clean energy target.

T-MOBILE	
GOAL [34]	PROGRESS [35]
In January 2018, T-Mobile announced a commitment to 100% clean energy by 2021.	In 2017, signed Power Purchase Agreements (PPAs) with Red Dirt Wind project in Oklahoma. In 2018, signed contract with Infinity Renewables' Solomon Forks Wind Project in Kansas. Each project generates 160 MW for a total of 320 MW (60% of T-Mobile's energy use)
T-Mobile commits to reducing combined scope 1 and 2 emissions 95% by 2025 from a 2016 baseline year.[36]	As of 2017, Scope 1 and 2 emissions were 1,145,000 CO_2e. The baseline 2016 emissions were 1,038,413 CO_2e.

Table 4: **T-Mobile US** goals and progress

Sprint

Sprint set a goal in 2008 to source 10% clean energy by 2017, which it has failed to achieve; in 2016, it sourced 3 MWh from a single on-site solar project at one of its facilities, accounting for less than 1% of its total energy use (see Table 5). The solar project no longer produces energy, and it is unclear how Sprint plans to achieve its goal of 10%. Sprint has not yet announced new plans for significant investment.

Sprint has the most advanced intensity goal of the four companies in terms of total reduction and timeframe; committing to reduce carbon intensity by 75% over a 10-year period. It has achieved a reduction in carbon intensity of 92% between 2007 and 2017.[43] For absolute emissions reduction, prior to T-Mobile's announced commitment to 100% renewable energy by 2021, Sprint led the pack with a commitment to reduce Scope 1 and 2 emissions by 20% by 2017. It has achieved a reduction of 47%, more than twice the goal, and is the only company of the four to see consistently falling greenhouse gas emissions every year since 2009.[44]

SPRINT	
GOAL [32]	PROGRESS [33]
Reduce Scope 1 and 2 emissions by 20% by 2017 relative to a 2007 baseline.	Scope 1 and 2 emissions are down by 47% as of 2016 relative to 2007.
Reduce carbon intensity by 75% by 2017 relative to 2007 baseline.	Carbon intensity has been reduced by 92% as of 2016.
Secure 10% of electrical energy from renewable sources by 2017.	Sourced <1% of electrical energy from renewables as of 2016.

Table 5: **Sprint** goals and progress

LONG-TERM PROGRESS

Of the four companies discussed in this report, T-Mobile is the only company to make a commitment to 100% renewable energy. Sprint is the only one to achieve significant reductions in both energy use and emissions since 2009. Relative to rapid growth in cellular data demands over the past several years, both AT&T and Verizon have kept energy use and emissions constant; neither has significantly reduced energy use or emissions over the 2009 to 2017 period. T-Mobile is the only company which has seen increases in energy and emissions since 2011, the year for which data becomes available, which highlights the importance of its new commitment to 100% clean energy (see Figures 3 and 4).

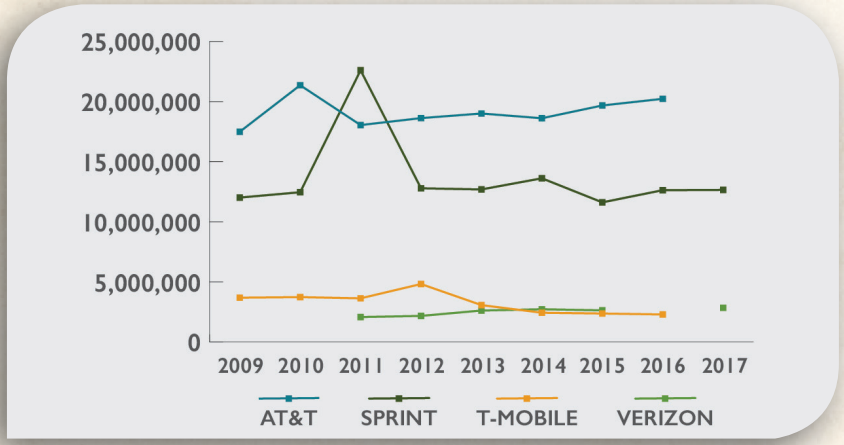


Figure 3: Total energy consumption by T-Mobile, Verizon, AT&T, and Sprint. Gaps represent lack of data disclosed by company. Data is shown for the years in which data is publicly available or was provided directly by the company. (CDP submissions: AT, VZ SP; DTK Corp Resp)

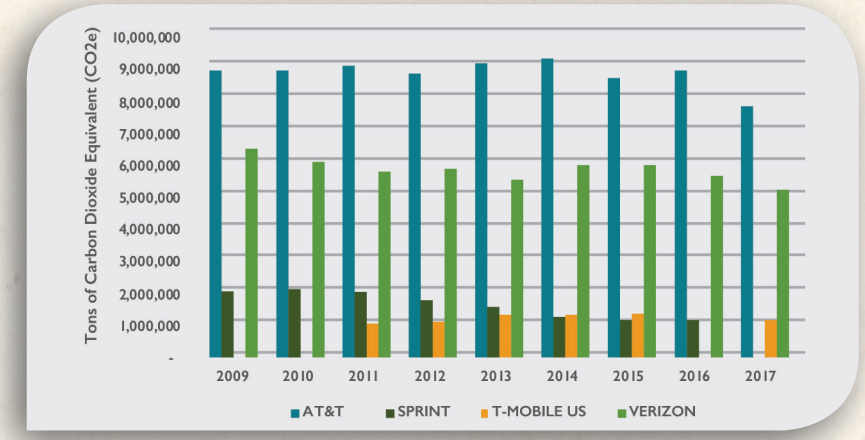


Figure 4: Total CO2e emissions by T-Mobile, Verizon, AT&T, and Sprint. Gaps represent lack of data disclosed by company. Data is shown for the years in which data is publicly available or was provided directly by the company. (source - CDP submissions: AT, VZ SP; DTK Corp Resp)

Both AT&T and Verizon have plans to install or purchase more clean energy but neither have goals specific to reducing their total overall carbon emissions, nor have they adopted a goal of 100% renewable energy for their electricity. While Sprint did set a goal for clean energy procurement (see Table 5), it has failed to meet or even come close on those goals. In 2016, it sourced 3 MWh from an on-site solar project.

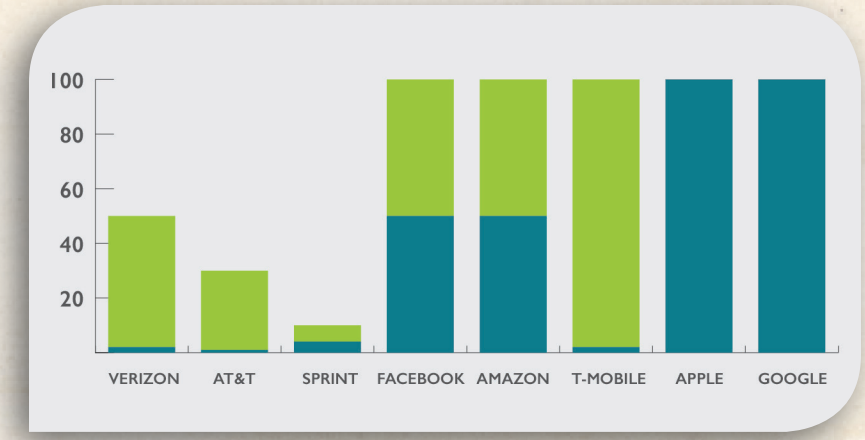
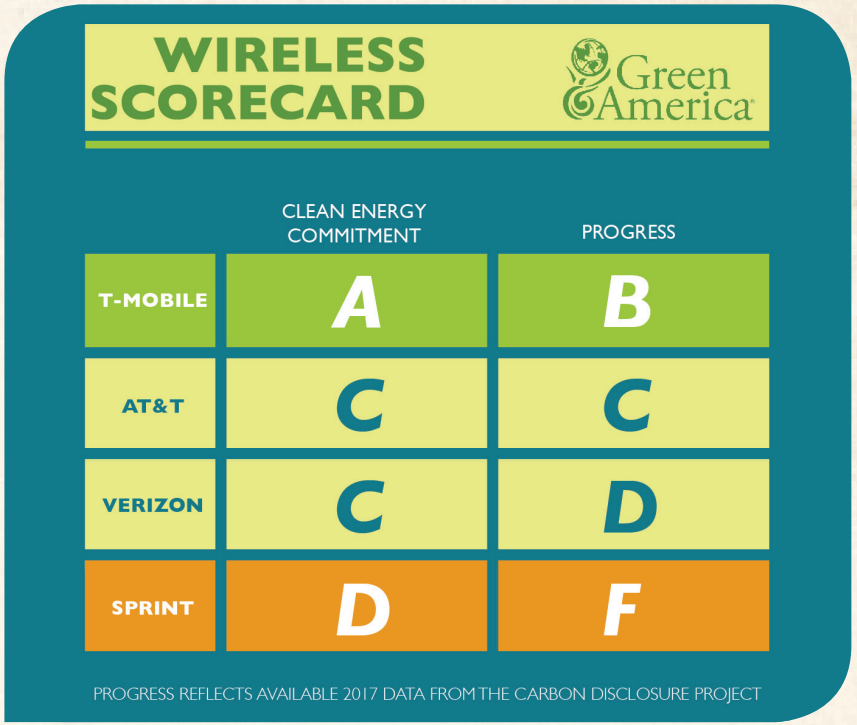


Figure 5: Current renewable energy (blue) as a proportion of total energy use (green) for Google, Apple, T-Mobile, Amazon, Facebook, Sprint, AT&T, and Verizon (telecom progress is 2016-17 CDP data and does not represent energy from new 2018 purchases and commitments).

GREEN AMERICA'S WIRELESS SCORECARD

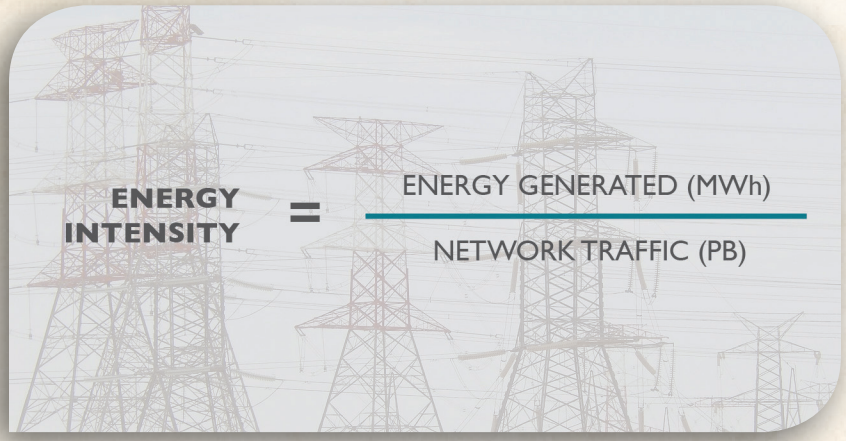
Based on publicly available data and information provided directly to Green America by companies, we graded each of the companies on core metrics related to efficiency, clean energy and greenhouse gas emissions reductions.



INTENSITY METRICS EXPLAINED

All four companies discussed in this report use an intensity metric for measuring improvement. For telecommunication companies, it makes sense to measure intensity as a function of network traffic, but it is often measured as a function of revenue for some companies, or GDP for countries. Other entities may have their own intensity metrics based on the products or services they provide. Intensity scores can be measured and compared year to year, and can be especially helpful for measuring improvement in a company that is changing in size.

AT&T uses what it calls energy intensity (EI), a function of electricity use and network traffic, which is defined as:



Verizon and Sprint use a very similar method, but instead of using electricity use, they measure intensity as a function of greenhouse gas emissions and network traffic. They define carbon intensity (CI) as:

While both energy intensity and carbon intensity are ways of measuring efficiency, the pathways for achieving reductions in each metric are different. Energy efficiency projects that reduce a company's total energy use reduce both EI and CI; EI is affected directly by reductions in electricity generated, and CI is affected indirectly as lowering energy requirements results in fewer emissions. Alternatively, replacing fossil fuels with low-carbon energy sources generally has no effect on EI, as there is no change in the total electricity generated, but reductions in greenhouse gas emissions leads to direct reductions in CI.

These two metrics, energy intensity and carbon intensity, are related to each other mostly through the combustion of fossil fuels to generate electricity. Reaching 100% green power is the only way for a company to continue to use large amounts of electricity to power their networks and data centers, and to decouple their growth from greenhouse gas emissions.

Each company uses different units to calculate efficiency, some use energy intensity (MWh/petabyte) some use emissions intensity (tons co2e/petabyte). These units cannot be directly compared to form conclusions on who is the most efficient. But, when we look at efficiency in terms of electricity use emissions per dollars revenue, this offers a more balanced snapshot of each company. We find that T-Mobile and Sprint are far more efficient when it comes to using energy and emitting carbon, despite AT&T and Verizon having the advantage of scale:

COMPANY	2017 MWh	2017 REVENUE (BILLIONS)	2017 CO_2 (TONS)	SUBSCRIBERS (MILLIONS)	MWh USED PER SUBSCRIBER	CO_{2e} TONS USED PER SUBSCRIBER
SPRINT*	2,289,243*	33.5	1,139,488	53.6	4.27	2.13
AT&T	20,233,165	160.5	7,801,564	141.5	14.29	5.51
VERIZON	12,655,300	126	5,174,020	150.4	8.41	3.44
T-MOBILE	2,839,773	40.6	1,145,000	72.5	3.92	1.58

Table 6: Energy and Emissions in Relation to Revenues and Subscribers. *Data for Sprint is for 2016 (Sprint did not submit 2017 data to CDP).

It's not enough for these companies to simply stop increasing their greenhouse gas emissions; they must actively work to reduce total emissions and to decouple emissions from energy use, in addition to network growth.

The only way this is possible is through the sourcing of green, low-carbon power sources like wind, solar, and small hydropower.

THE ROAD TO 100% RENEWABLES

Green America calls out companies for poor environmental and social impacts, and promotes solutions (congratulating companies that make advances). We research industries and lead a call to change companies lagging on sustainable practices, while providing consumers alternatives from socially and environmentally responsible businesses in that sector. We have done this for companies in the chocolate, clothing, finance, and even online shopping sectors. Based on current commitments within the wireless telecom sector, T-Mobile is the preferred option for its commitment to 100% renewable energy by 2021.

T-Mobile is the first telecom company to meet commitments that are increasingly frequent in the ICT sector. There are around a dozen major US companies in the ICT industry that have reached or surpassed 100% green power (see Table 7). Some, like Netflix, purchase more green power than they use in their own operations. Netflix does this to offset the emissions of cloud services provided by other companies. The companies in Table 7 include software developers, manufacturers, and cloud service providers with large arrays of facilities and data centers.

Telecom companies like AT&T, Verizon, Sprint, and T-Mobile also have facilities and data centers, but as discussed in the Networks explained section, most of their greenhouse gas emissions come from the operation of sprawling networks, with a smaller, but by no means insignificant proportion from data centers and facilities.

COMPANY	ANNUAL TOTAL ELECTRICITY USE (MWh)	% RENEWABLES
NETFLIX	100,058	298%
ACER AMERICA	15,000	104%
ADVANTEST AMERICA	9,200	100%
INTEL	3,804,035	100%
MICROSOFT	3,344,727	100%
APPLE	1,173,353	100%
CISCO SYSTEMS	1,109,491	100%
IBM BLUEMIX INFRASTRUCTURE	66,191	100%
SAP AMERICA	63,941	100%
WORKDAY	55,589	100%
1&1 INTERNET	24,000	100%
GREEN HOUSE DATA	20,270	100%
AUTODESK	14,420	100%

Table 7. US ICT companies that have reached or surpassed sourcing 100% of their energy from renewable sources.

This presents a unique challenge to telecom companies with high-traffic networks to manage, but none, until T-Mobile and AT&T, have made any significant progress or commitments to green power in the United States.

It is not surprising that T-Mobile is making the first significant commitment to renewable energy in the telecom sector. Deutsche Telekom — T-Mobile's parent company — is near or at 100% renewable energy in Greece, Albania, Hungary, Austria, and the Netherlands.[48] Two smaller European telecom companies; Proximus from Belgium, and KPN from the Netherlands,[49] currently operate mobile and landline networks powered by 100% renewable energy.[50]

Telefonica, the eighth largest telecom company in the world, which operates throughout Europe and Latin America, has committed to reaching 100% renewable energy in all countries by 2030.[51] Telefonica, like the US telecom companies, has also set an intensity goal - reducing energy intensity by 50% by 2020. Unlike most US companies, they have also set goals for short- and long-term absolute emissions reductions - 30% by 2020 and 50% by 2030.[52] Proximus[53] and KPN[54], having reached 100% green power, are both working towards being carbon neutral.

Telefonica, Proximus, and KPN have all set science-based energy and emissions targets in line with the Paris Agreement, which the United States officially pulled out of in 2017.[55] Telefonica is already at 100% renewables in Germany and the UK, and 79% in Spain. The company more than doubled its use of renewables from 21 to 44% in 2016 alone with a massive purchase of electricity from electricity marketing company ACCIONA Green Energy Developments.[56] This is an impressive rate of transition off of fossil fuels, and large investments in green power can help companies transition rapidly. For example, in 2015, tech giant Google was operating with 44% green power; since 2017 the company has been operating with 100% green power worldwide.

Companies like Proximus, KPN, and Telefonica operate in many countries which already use a higher rate of renewable energy than the United States, but the fact that they also operate sprawling networks means they can provide a helpful model for American companies in the push to reach 100% green power.

For companies running networks, there are three key ways to reduce emissions:

1. *More efficient power usage at facilities;*
2. *Increased use of energy-efficient equipment;*
3. *Increased sourcing of clean energy - predominantly wind and solar.*[57]

This report is primarily concerned with the state of clean energy deployment in the telecommunications sector, with a focus on the four largest US mobile service providers and each company's commitments, goals, and progress towards 100% clean, renewable energy. In Green America's view, option number three from the list above, increasing the sourcing of clean energy to 100%, is the next step for telecom companies. This includes buying more renewable energy from solar and wind to run their facilities and data centers.

The energy requirements of base stations and the fact that they are often located in remote areas is an opportunity for these companies to increase the stability and coverage of their networks and invest in on-site clean energy to generate clean electricity in areas with limited grid access. This is the pathway that T-Mobile is following with its recent commitment to 100% renewable energy by 2020.

GREEN POWER PROCUREMENT

Increasingly, companies are seeing buying green power as a smart business choice. 71 of Fortune 100 and about half of Fortune 500 companies have adopted goals related to sustainability and renewable energy.[58] With the cost of wind and solar energy declining rapidly, switching to renewable energy can actually save companies money. T-Mobile estimates that its commitment to go 100% renewable by 2021 will reduce energy costs by $100 million over 15 years.[59] Forward-thinking companies are seeing that buying green power does more than just help individual organizations save money, increase efficiency, and improve brand reputation; at a higher level, it also helps to strengthen competitiveness of US markets; create jobs and expand markets, and reduce long-term business risks by strengthening action against climate change.

Electricity is a large proportion of costs for tech companies, and many now see controlling a portion of their energy production as critical, especially with the continuous growth exhibited by companies in the ICT sector. Purchasing green power in some form is becoming more and more attractive as the cost of electricity generated by wind and solar continues to fall. In many US regions, utility-scale wind and solar electricity is cost-competitive with coal and natural gas, and wind and solar are projected to be among the cheapest sources of new generation by 2022.[60]

Some companies, like Google, Microsoft, and Amazon have invested heavily in wind and solar in a variety of forms. Since 2013, Green America has conducted a campaign to urge Amazon.com to adopt renewable energy, with tens of thousands of consumers encouraging the company to switch to 100% renewable energy by 2025. Currently, Amazon is sourcing over 50% of its electricity for its data centers from renewables.[61]

When it comes to the act of purchasing or generating green power, telecom companies can take several major avenues to diversify their energy portfolios and eventually reach 100% green power:

- *Asset purchasing or leasing*
- *Power purchase agreements (PPAs)*
- *Green tariffs*
- *Renewable energy certificates (RECs)*

ASSET PURCHASING OR LEASING

In many areas and for certain facilities, electricity generation can be done on-site using wind, solar, or power storage units leased or owned by the company itself. While upfront capital costs can be high with this strategy, owning the systems outright allows for a long lifecycle of low-cost electricity, as these units typically produce electricity for longer than most contracts, and are cheap to operate and maintain. This strategy also allows companies to take advantage of tax

benefits such as investment tax credits (ITC) for green power installments, and in some states, engage in net metering as a source of revenue, which is when excess electricity is sold to the utility and fed back into the grid.[62]

In addition to large capital costs, the inherent variability and intermittency of power sources like wind and solar can present a problem for on-site generation, especially during hours of peak demand. Variability and intermittency issues associated with wind and solar are usually solved by having facilities use energy from the grid combining wind and solar units with battery storage, which has historically been cost prohibitive for most companies. Recently, battery storage technologies have rapidly dropped in price.[63] [64]

Between 2010 and 2016, the price of lithium-ion batteries dropped by 73%, and battery production costs are projected to fall by more than half of current costs by 2030, mostly due to design improvements and economies of scale.[65] Despite high capital costs of batteries, power producers in some states like Hawaii, California, and Minnesota have deployed massive battery banks to supplement wind and solar projects, citing lower costs than building and operating new natural gas facilities.[66] [67] In many areas, battery storage is becoming more and more suitable for individual, residential, and commercial use, and large-scale utility systems, and the feasibility of distributed green power supplemented by battery storage for base stations is increasing as battery prices continue to drop. For telecoms, battery systems for small distributed wind and solar at base stations is a viable option in many areas.

Distributed power generation using wind and solar is an opportunity for telecom companies to power base stations with limited grid access, and to save money on electricity bills. Mobile service providers around the world are deploying base stations with on-site green power. Telefonica currently operates more than 4,200 remote base stations using wind and solar, and mobile service providers in many developing countries are installing wind, solar, and battery storage units at new base stations and to replace older diesel-powered stations as a solution to pollution problems, high operation and maintenance costs of diesel generators, and unpredictable fuel prices.[68]

Base stations with on-site green power generation are attractive in these areas, as grid access and refueling diesel generators can be difficult due to lack of infrastructure. As a result, many developing countries are not only favoring distributed power generation over traditional utilities, they are also skipping the construction of infrastructure for landline and wired communications; instead opting for mobile networks. This is fueling growing demand for distributed generation in the form of wind, solar, and battery storage, and technology companies are quickly developing a variety of cost-competitive, sustainable base stations to supply this fast-growing market.

POWER PURCHASE AGREEMENTS (PPAS)

For companies using large amounts of energy, locking in electricity costs at a low price can be critical. For green power, this can be accomplished with power purchase agreements (PPAs). When large companies enter into wind or solar PPAs, they usually partner with a developer, who builds, operates, and maintains the wind or solar units, with an agreement to sell a large amount of power to the partner company. For example, in 2016, Amazon entered into a contract with Lincoln Clean Energy to build, own, and operate a 253-megawatt wind farm in Scurry County, Texas. PPAs allow companies to purchase green power at a locked-in price for long periods of time, usually at lower than market prices.

While wind and solar have no fuel costs, in the fossil fuel world, costs can fluctuate unexpectedly (see Figure 6) based on economic and social circumstances, political instability, and natural disasters. Avoiding major price fluctuations is a positive for companies who get their electricity through PPAs, as they lock in prices for 10-30 years, allowing buyers to better manage budgets and long-term expense planning. For companies with large energy requirements, wind and solar PPAs can be one of the cheapest ways to buy green power, as the price per kilowatt-hour is generally lower for these long-term contracts than other purchases of wind or solar power, and there are no up-front capital costs to the buyer.

Some areas are less suited to the development of large-scale wind and solar operations than others based on climate factors, proximity to mountains or large buildings, and availability of land. When a company's facilities are in such an area, it doesn't make sense to develop new green power in the vicinity.

A solution that many large buyers have found is virtual power purchase agreements (vPPAs). A virtual PPA is different from a normal PPA in that the company entering into the contract doesn't use the electricity produced directly. Instead, the green power project sells electricity into the grid at a wholesale price.

A common structure for vPPAs is for green projects to pay buyers when the market price for electricity is higher than the price agreed-upon in the contract, and the buyers to pay the project when the market price falls below the agreed-upon price. vPPAs are one way that companies can bring large purchases of additional green power to the grid, while not having to worry that the locations of their facilities may not be optimal for wind and solar installations. For telecom companies with base stations spread across a variety of climates and geographic locations, vPPAs can be an important method for reaching 100% green power.

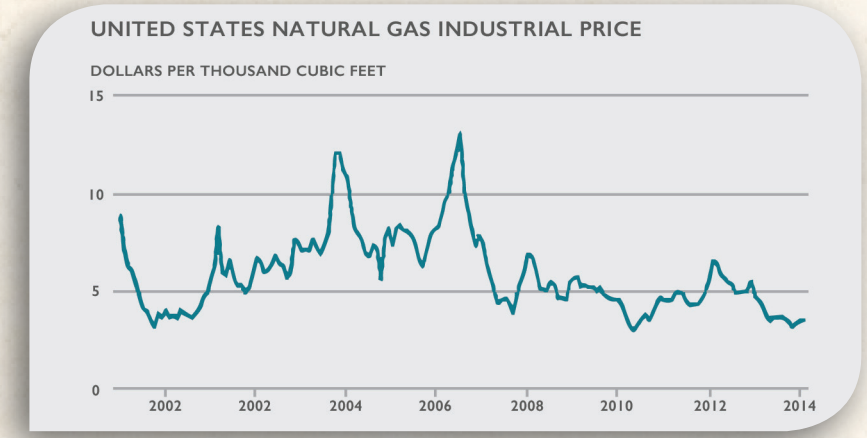


Figure 6: U.S. Natural Gas Industrial Price Fluctuations from 2000 to 2016.

GREEN TARIFFS

In response to demand for green power, especially from large institutional and corporate buyers, utility companies in states with regulated electricity markets have begun offering large scale purchasing programs that allow customers to purchase green power at a fixed price. In unregulated markets, buyers can purchase electricity directly from electricity producers, but in regulated markets, vertically integrated utility companies both produce and transmit electricity to customers. The green "tariff" is a solution; it is only charged to participants, so the cost and risk are minimized for nonparticipants. The electricity is sold bundled with RECs, and prices are fixed in long-term contracts, which directly reflect the generation and delivery cost of wind and solar power. While a PPA is a partnership between buyers and an electricity producer, a green tariff contract is a partnership between buyers and a utility company, who will either develop or procure new green power on its own.

Green tariffs are a relatively new product, and corporate buyers have the potential to advocate with their local utility companies, who want to meet their customers' demands for green power. For example, the first green tariff contract was negotiated in 2013 between Apple and utility company NV Energy, which built a 20 MW solar array to supply green power to Apple's Nevada facilities. Since then, a handful of other green tariff programs have emerged, driven entirely by ICT companies demand for wind and solar, including Apple, Google, Facebook, Switch, and Amazon Web Services. In 2017 alone, Facebook invested in 230 MW of wind and solar through green tariffs in New Mexico and Nebraska, and another 465 MW of green power is currently under negotiation through green tariff programs in multiple states.[69]

RENEWABLE ENERGY CERTIFICATES (RECS)

Once electricity has entered the grid, it is impossible to tell the source of that electricity. Renewable energy certificates (RECs) were created as a contractual mechanism to track the generation of renewable energy. Each REC certifies 1 MWh of renewable energy can be used as a trade commodity certified to represent a certain amount of renewable energy that has been produced and fed into the grid. For example, RECs are bundled with the electricity sold in a PPA. The buyer can keep those RECs and claim the renewable energy use as their own, or they can unbundle them and sell them as a separate commodity.

Unbundled RECs are cheaper in markets where renewable energy is abundant. They are a cheap, easy way for companies buy green power, even if they are in areas without direct access to existing wind and solar installations. The downside to unbundled RECs is that their purchase doesn't guarantee additionality; it does not directly cause the creation of the electricity they represent. On their own, RECs often don't provide developers enough financing for the construction of new wind and solar projects. Long-term contracts like PPAs can provide financing to cover the high capital costs, reduce risk for developers, and reduce electricity costs for buyers, while investing in new development of wind and solar projects in the locations where buyers operate.

Some companies, like Google and Microsoft don't use unbundled RECs as part of their energy strategies for this reason exactly, and choose instead to use buy RECs bundled with electricity generation via PPAs, vPPAs, green tariffs, asset purchasing or leasing for on-site generation, and other mechanisms that invest directly in the development of green power. Unbundled RECs should be a last resort choice for companies interested in developing their green power portfolios.

IMPORTANCE OF REACHING 100% BY 2025

The consequences of pouring greenhouse gas emissions into our atmosphere are dire, and there are immediate environmental and health impacts, which often afflict the poorest people worldwide. Island nations are experiencing the effects of sea level rise and some may disappear this century, while coastal communities around the world are grappling with devastation in the wake of intensified hurricanes and tropical storms. The contrasting occurrences of stale draughts and heavier rains are wreaking havoc on farmers, making it difficult to harvest enough crops to meet their financial needs but also causing glimpses of food staple shortages for communities.

The UN Intergovernmental Panel on Climate Change issued a report in 2018 stating that we only have 12 years to take meaningful action on climate change. A United Nations organization has calculated that global climate change is already the cause of 400,000 premature deaths every single year.[70] Furthermore, recent reports show that pollution kills three times as many people as AIDs, tuberculosis, and malaria combined.[71] When surveyed, Europeans overwhelmingly acknowledge their countries are already feeling the effects of climate change, and between this public outcry and 97% scientific consensus on the issue, the continent's leaders have taken political action to tackle climate change from various angles – including increases in clean energy sources.[72]

Unfortunately, the United States is facing a lack of leadership in the White House, inertia on Capitol Hill in moving environmental policies forward, and deregulation of even the most basic rules to protect our air and water. The Trump administration is actively working to privilege inefficient and outdated fossil fuel companies, many of whom will continue to decline for market reasons. Coal energy, for example, makes up a mere 30% of all U.S. energy and demand for it is steadily dropping in the face of cheaper energy options like natural gas and renewables (which are increasingly the least expensive energy source).[73]

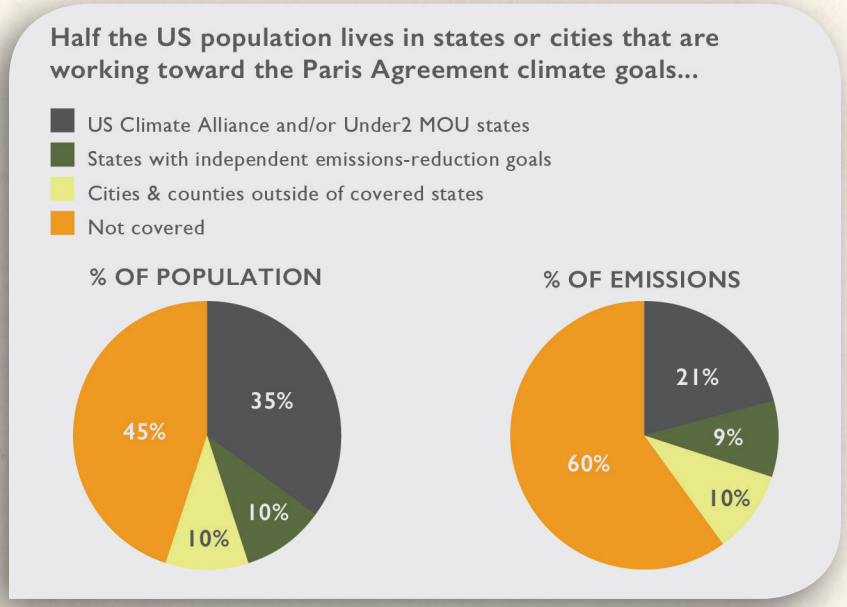


Figure 7: Percentage of U.S. Population Living in States or Cities Working Towards Paris Agreement Goals Despite U.S. Government Withdrawal.

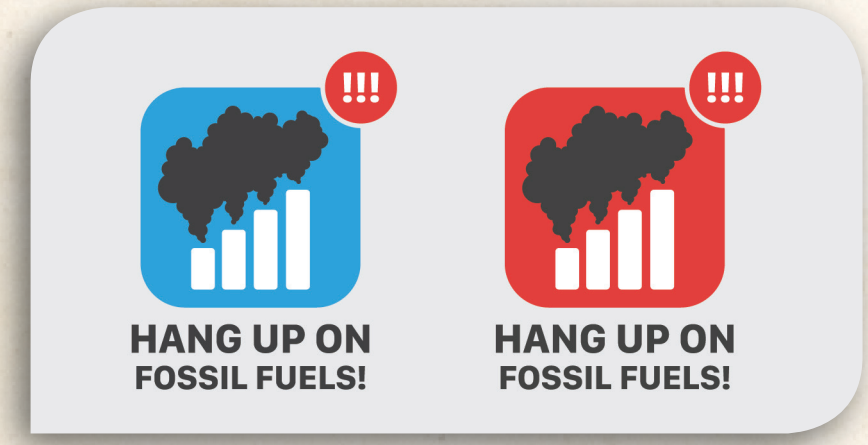
However, after the announcement of the White House's decision to withdraw from the 195 countries committed to the Paris Climate Agreement, a phenomenal display of true leadership echoed throughout the country. Governors, Mayors, and over 100 businesses released statements assuring the public they would uphold the specific goals outlined in the Paris Agreement. This swift response was inspiring and some companies had already embarked on self-imposed sustainability goals. Climate Interactive reports half the country's population lives in states or cities that are working toward the Paris Agreement standards, and provides a detailed map which identifies where these leaders are making change.[74]

As we have seen hurricanes and natural storms intensifying, the devastating impacts which still burden citizens from Puerto Rico to Houston, it is made clearer each time we turn on the news that climate change is not a distant worry for future generations to grapple with – it is happening now and action to address it must happen in accordance. This movement of entities stepping up to ensure we reach our climate goals has expressed the possibility that it may even surpass the original goal of reducing U.S. emissions 26% by 2025 from the levels measured in 2005 (the country is currently almost halfway to the goal).[75]

We can achieve this target through more efficient, cleaner transportation options in cities and incentivizing the purchase of recycled materials to curb the significantly higher emissions from new material extraction and production. And of course, a key area is shifting from fossil fuels to sustainable, clean energy. For this, we look to companies which use substantial amounts of energy to produce their goods and services. The telecommunications industry relies on its energy sources to power the busy servers all hours of the day for networks to stay active. We need companies which require this scale of energy to enlist true renewables (solar and wind) to keep their operations running while doing their part to help our country achieve the necessary emission reductions to tackle climate change.

HOW GREEN AMERICA AND CONSUMERS ARE TAKING ACTION

Millions of consumers use AT&T and or Verizon as their wireless provider. They can join us in urging leading companies like AT&T and Verizon to set the bar higher on renewable energy for the telecommunications industry. Green America's campaign, Hang Up on Fossil Fuels, calls on AT&T and Verizon to reduce their emissions, increase their use of clean energy and reduce their dependence on fossil fuels to power their networks.



Specifically, we ask that they:

•Publicly set greenhouse gas emissions reduction goals with a timeline to get there.
•Make a commitment to increase the amount of renewable energy powering their networks, with a goal of 100% clean energy by 2025, largely coming from solar and wind sources.

If you wish to see this industry set a new standard for clean energy, please add your name to this letter to AT&T and Verizon's CEOs (greenamerica.org/cleanupwireless). As a potential or existing customer of these companies, your voice speaks volumes to them and it's important that they hear demands for sustainability loud and clear. If you'd like to take further action, you can call the CEOs' offices at these numbers using the script below.

AT&T: CEO Randall Stephenson's office at (210) 821-4015

Verizon: CEO Lowell McAdam's office at (212) 395-1000

"As a customer of [AT&T or Verizon] I expect your company to do its part to reduce climate emissions. I want to see your company adopt a goal of 100% renewable energy, from wind and solar, by 2025. Several large tech companies are already at 100% renewable power. Your company needs to be a leader in telecommunications. I appreciate that you have reduced energy intensity of your operations and taken initial steps to purchase renewable energy. Now, please move to 100% renewable power. Thank you."

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