CLEAN ENERGY IS CALLING 2020

ASSESSING ENERGY USE & ENVIRONMENTAL IMPACTS OF THE TELECOMMUNICATIONS INDUSTRY

Green America®

TABLE OF CONTENTS

EXECUTIVE SUMMARY

INTRODUCTION

Green America is 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 an equitable shift of America's electricity generation to 100 percent 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, which has historically come from fossil fuels.

In 2017, Green America launched our Hang Up on Fossil Fuels campaign to urge major U.S. telecom companies to set a goal of reaching 100 percent renewable energy by 2025. Since the campaign launch, we've seen significant progress in the sector, but there is still more work to be done. Fortunately, opportunities continue to grow rapidly in clean energy to ensure this urgent transition away from fossil fuels.

PROBLEM STATEMENT

Our planet has surpassed 410 parts per million[1] of carbon dioxide in the atmosphere, a devastating number which reflects years of degradation and consumption that have been rising along with the sea levels. The United Nations Intergovernmental Panel on Climate Change advises that, in order to stay below 1.5 degree Celsius of warming, we must cut greenhouse gas emissions in half by 2030 and eliminate them entirely by 2050. This means widespread, systemic change in all sectors to prevent the harshest and most deadly impacts of the climate crisis. A major component of reducing emissions is a rapid transition to renewable energy sources. Given the lack of current political leadership in the United States on climate policy, organizations, individuals, local and state governments, and companies must work aggressively to cut greenhouse gas emissions.

The telecom sector uses enormous amounts of energy each year - 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.

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

Historically, this sector was powered by polluting fossil fuel energy, but there has been progress towards increasing renewables in recent years. Since Green America announced its "Hang Up on Fossil Fuels" campaign in 2017, thousands of consumers called for the industry to clean up wireless. We mobilized people to contact AT&T and Verizon through petitions, social media posts, and direct calls. And now, we're finally seeing changes throughout the sector.

SECTOR PROGRESS

In January 2018, T-Mobile moved into a leadership position on renewable energy commitments through its announcement to reach 100 percent 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. Additional purchase agreements signed on Climate Week 2019, brought AT&T's renewable energy contracts to 1.5 Gigawatts, equal to roughly 25-30 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 percent clean energy by 2025[3]. In 2019, Verizon issued a $1 billion green bond to, in part, fund new clean energy projects. In 2020, we've finally seen Verizon announce its first clean energy purchase from the bond. It has allocated $133 million to a purchase agreement for up to 130 megawatts of wind energy from a new facility in the Mid-Atlantic set to begin operation this year.

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 at any time, so we can stay connected. That connectivity comes at a high environmental cost since data centers and networks serving the telecom industry are powered by fossil fuels.

REPORT FINDINGS

Green America reviewed the four major US telecoms' energy use and emissions based on newest available data from the Carbon Disclosure Project (from 2018) and company responses to our *Clean Energy Calling* survey. Based on the data collected we found the following:

Renewables:

T-Mobile's commitment to reach 100 percent renewable energy by 2021 remains the most ambitious goal in the sector. In 2020, T-Mobile reached 95 percent renewables and completed its merger with Sprint. T-Mobile is preparing an updated timeline for its newly expanded network to reach 100 percent renewables. AT&T has purchased more than 1.5 gigawatts of clean energy since 2018, which we estimate equals approximately 25-30 percent of its total energy. In 2019, prior to merging with T-Mobile, Sprint announced its first

clean energy project which the company stated would provide roughly 30 percent of its energy use. In November of 2019, Sprint announced a commitment to 100 percent renewable energy by 2025. Verizon recently announced a purchase agreement for 130 MW of capacity as the first move to meet its goal for 50 percent renewables by 2025, but it remains far from meeting this target.

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 relatively constant, however, in 2018 AT&T reduced its total energy use and reduced its emissions. T-Mobile is the only company to see an increase in energy usage over the past decade. 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 customer than Sprint or T-Mobile.

Overall Greenhouse Gas (GHG) Emissions:

T-Mobile has committed to reduce Scope 1 and 2 emissions 95percent from a 2016 baseline year by 2025. In 2019, Sprint set a goal of 100 percent carbon neutrality by 2025. AT&T continues to see progress on its goals to reduce its Scope 1 emissions by 20 percent and has exceeded its goal to reduce Scope 2 emissions by 60 percent. Verizon has committed to reduce its Scope 1 and 2 emissions 100 percent by 2035 from a 2018 baseline year. 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.

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 and both wind and solar are often less expensive than fossil fuels nationwide. In announcing its commitment to reaching 100 percent 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 percent 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 clean energy commitments and actual progress.

The telecommunications industry made strides in reducing fossil fuel use, but there is much more work to be done. To reduce our climate emissions at the speed and scale necessary to address the climate crisis, all companies should commit to shift to 100 percent renewable energy and fully reduce greenhouse gas emissions by 2025. 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 percent clean energy, telecom companies can, as well.

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.
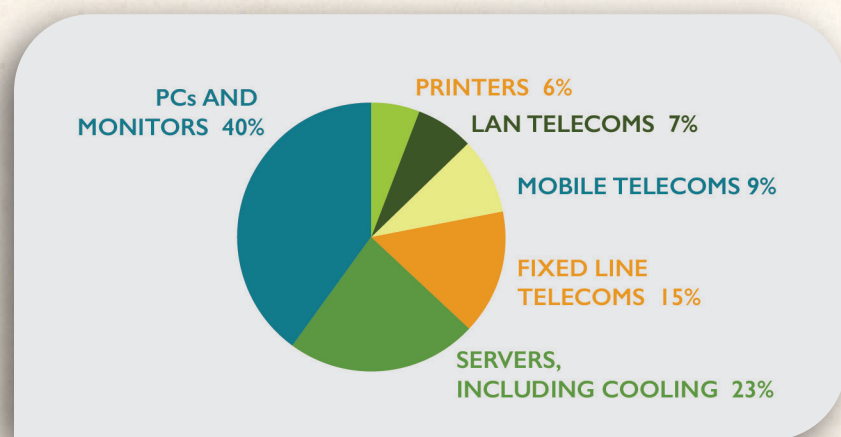

Figure 1: Energy Usage in the Telecom Sector

PCs AND MONITORS 40%
PRINTERS 6%
LAN TELECOMS 7%
MOBILE TELECOMS 9%
FIXED LINE TELECOMS 15%
SERVERS, INCLUDING COOLING 23%

The ICT sector consumes approximately 4 percent[5] of the world's total electricity and is responsible for 2 percent 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 significant. ICT is a rapidly growing sector, and more rapid growth is expected. The ICT sector is expected to double its current proportion of global GHG emissions to 4 percent of the global total by

this year[7]. However, in February 2020, the International Telecommunication Union (ITU) announced a new standard requiring the ICT industry to reduce greenhouse gas emissions by 45 percent from 2020 to 2030. The ITU stated this target is in compliance with the Paris Agreement and has been approved by the Science Based Target Initiative[8]. This promising announcement signals the global ICT sector is building on its history of innovation to address its impacts on the climate crisis.

CHANGES IN THE INDUSTRY

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[9]. 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[10].

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[11].

Over the past two years, all four major telecoms have launched 5G (fifth generation) networks. They promise faster speeds, longer battery life, larger data, reliable connectivity, and have been hailed by some industry experts as an industrial revolution. 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[12]. The amount of infrastructure and energy needed to support such a large and fast network could be staggering. Based on the reported experiences on[13] 5G in China, estimates show the networks require three times as much energy compared to 4G networks. 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[14].

To meet the expanded overall energy needs of 5G without increasing carbon emissions, telecom companies will need to increase their use of renewable energy while further improving energy intensity measures.

A beneficial aspect of 5G is its potential to increase efficiency by end users, which could result in less energy being wasted. Verizon has claimed that 5G will help cities save 70 percent 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, monitoring of its concrete environmental impacts (whether positive or negative) will be essential.

COVID-19 CRISIS & CLEAN ENERGY PROGRESS

As communities take the necessary precautions to avoid spreading COVID-19, in 2020 we've relied more than ever on networks to stay connected while physically distancing. Telecom companies are providing a vital service by working hard to support network capacity.

Our online infrastructure is used to peaks of activity at certain times – but now traffic is escalating across the board as schools, many workplaces, and community events have moved online. Many of our workplaces and schools use a higher, "enterprise" grade of internet broadband service, different from our homes. It's been described as going from carrying internet traffic in a large pipe verses the garden hose service for most homes[15].

AT&T has reported a 26 percent increase throughout its core network (business, home broadband, and wireless data)[16]. Voice calling has been up between 50-90 percent since regions began stay-at-home orders. The use of Wi-Fi calling minutes has been up more than 100 percent since March 22. T-Mobile and Sprint both report significant increases in usage as well.

This increased traffic is likely to result in an uptick in energy consumption. As the growth in data traffic is observed to outweigh gains of energy efficiency, and as many workers in the US will continue to work from home after the COVID-19 crisis is over, it is all the more crucial that this sector builds on

recent progress and commits to reach 100 percent renewable energy. It's estimated that the significant societal changes from COVID-19 will result in a 5.5 percent reduction of global greenhouse gas emissions in 2020[17]. However, to stay below a warming of 1.5 degrees Celsius and prevent the most devastating impacts of climate change, we need to be cutting 7.6 percent each year[18]. While transportation has significantly gone down and we're seeing lower air pollution, we still haven't hit the needed emission reduction because of our electricity use, agriculture, and other sources. It's even likely that this reduction in air pollution will increase overall warming, as these polluting particles act as a kind of barrier and reflect the sun's rays[19].

This further underscores the need to address our energy sources and rapidly shift from fossil fuels to clean energy sources for electricity. And the International Renewable Energy Agency has found that accelerating renewable energy investment could provide substantial economic benefits[20]. It projects that these investments would deliver global GDP gains of $98 trillion by 2050 and quadruple jobs in the sector to 42 million over the next 30 years. The same report found that replacing fossil fuels with renewables could curb the energy industry's CO2 emissions by 70 percent by 2050.

SUSTAINABILITY & SOCIAL JUSTICE IN TELECOMS

This report is focused on telecommunications companies which provide mobile services, so it is especially important to note the predicted rise in internet traffic and demand for network services, even before the COVID-19 crisis. Smartphone traffic is expected to exceed PC traffic by 2021, growing from 13 to 33 percent from 2016 to 2021, with PC traffic dropping from

46 to 25 percent. 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[21]. 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 percent of total internet traffic by 2021[22].

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. Clean power production in the form of wind and solar is an important piece of an interconnected world since projected growth is not sustainable using current levels of fossil fuels.

Shifting from fossil fuels to renewables is a key component to advancing environmental justice. Fossil fuel extraction, combustion, and waste disproportionally impact communities of color. Impacts from fossil fuel plants are suspected contributing factors to higher mortality rates in these communities as they are more exposed to pollution and witness significant health impacts and lower life expectancies. According to the National Association for the Advancement of Colored People (NAACP) report, 68 percent of African

Americans live near a coal-fired power plant. Latinos are also disproportionately exposed to these toxic chemicals. A 2016 report from the Clean Air Task Force states that "the air in many Latino communities violates air quality standards intended to protect human health" and Latino children are more likely to die from an asthma attack than white children.

As we transition from fossil fuels to renewables, it is also essential to ensure that jobs in wind and solar benefit impacted and under-served communities. And when solar and wind facilities are built in or near vulnerable communities, those communities must have key roles in the process and obtain benefits from the installations.

At their cores, telecommunication companies have always been innovators. They have the opportunity to use that innovative spirit to continue reducing energy use and emissions, and deploying alternatives to fossil fuel energy while supporting diverse populations and communities. Green America advocates for solutions that support both people and the planet. Transitioning away from fossil fuels in a sustainable way means ensuring renewable energy firms have responsible labor practices, support all communities, and are advancing diversity, equity, and inclusion throughout their companies.

The 2020 US Energy and Employment Report finds that women make up to 32 percent of the US electric power generation workforce, compared to 47 percent in the overall US workforce[23]. This sector reports being more racially diverse than the national workforce, however 69 percent of the sector's employees are white, as is 78 percent of the national workforce.

DEMOGRAPHIC	EMPLOYEES	PERCENT OF SECTOR	NATIONAL WORKFORCE AVERAGES
MALE	100,058	68%	53%
FEMALE	15,000	32%	47%
HISPANIC OR LATINO	9,200	18%	18%
NOT HISPANIC OR LATINO	3,804,035	82%	82%
AMERICAN INDIAN OR ALASKA NATIVE	3,344,727	1%	>1%
ASIAN	1,173,353	10%	6%
BLACK OR AFRICAN AMERICAN	1,109,491	9%	12%
NATIVE HAWAIIAN OR OTHER PACIFIC ISLANDER	66,191	1%	>1%
WHITE	63,941	69%	78%
TWO OR MORE RACES	55,589	10%	2%
VETERANS	24,000	9%	6%
55 AND OVER	20,270	14%	23%
UNION	14,420	7%	6%

Figure 2: Electric Power Generation Sector Employee Demographics, Q4 2019 (Source: 2020 US Energy & Employment Report and Bureau of Labor)

Solar employs the most people of any electric power generation sector with 248,034 employees, despite most electricity still coming from natural gas, coal, and nuclear power. This demonstrates the incredible potential for job creation as we continue to shift from fossil fuels to clean energy. However, unionization in the electric power generating sector is just 7 percent and only 4-6 percent in the solar and wind sectors. Within solar power, women make up less of the solar workforce versus the overall workforce average. People identifying as Latino and Asian are more represented in solar power workforce than in the larger workforce, but African Americans are underrepresented.

Women and African Americans are also underrepresented in wind power. And people identifying as Latino and Asian are better represented in wind power than in the broader workforce. It is clear that more work needs to be done to diversify the fast-growing renewable energy sector.

In Green America's *Clean Energy Calling* survey, we asked companies what role they are playing to benefit communities and increase diversification and unionization in the renewable energy sector. In response, Sprint states that supporting local communities and economies is at its top of mind when exploring partners for clean energy. For example, its largest VPPA project with Duke Energy Renewables is the Maryneal Windpower project in Nolan County, Texas which is committed to source labor locally. The project will provide $9.4 million to the local school district over the next two decades. It expects to spend 21 percent of project development dollars with minority and women-owned businesses.

Duke Energy Renewables is a subsidiary of Duke Energy, which reports that its workforce is workforce is comprised of 18.1 percent collective bargaining unit members as of December 2018. Regarding diversity in its workforce, Duke Energy Renewables reports that 23.3 percent of its workforce are female and 18.8 percent identify as minorities. It reports that women comprise 18.8 percent of management roles (including its CEO) and minorities make up 11.9 percent of management roles.

The major telecom companies all state commitments to working with diverse firms, including those that are minority owned, women owned, LGBT owned, veteran owned, disability owned, and SBA-defined small and disadvantaged businesses. However, the companies do not indicate a preference for unionized labor or for women and minority employees in their contracts for renewable energy[24].

T-Mobile reports that it engages with its Scope 3 suppliers who have made public commitments to renewables education and help to improve energy option for local communities and low-income or underserved communities. AT&T repots spending $15 billion or 26.8 percent of total spend (excluding Content and Programming spend) on diverse suppliers in 2018[25][26]. Verizon similarly indicates that it is looking for diverse suppliers and spent $5.8 billion for their services in 2019[27].

The Greenlining Institute's "2019 Supplier Diversity Report Card: Incremental Progress in a Swiftly Changing Landscape" finds that Verizon and Sprint were the leaders in supplier diversity overall (A grades) and that AT&T and T-Mobile were mediocre (C grades)[28]. In regard to sourcing from African

American owned businesses, Sprint was the clear leader (A grade), followed by Verizon (B), AT&T (C) and T-Mobile (F). *(AT&T and Verizon did not provide responses to the Clean Energy Calling survey. Green America will update this report with any future responses we may receive.)*
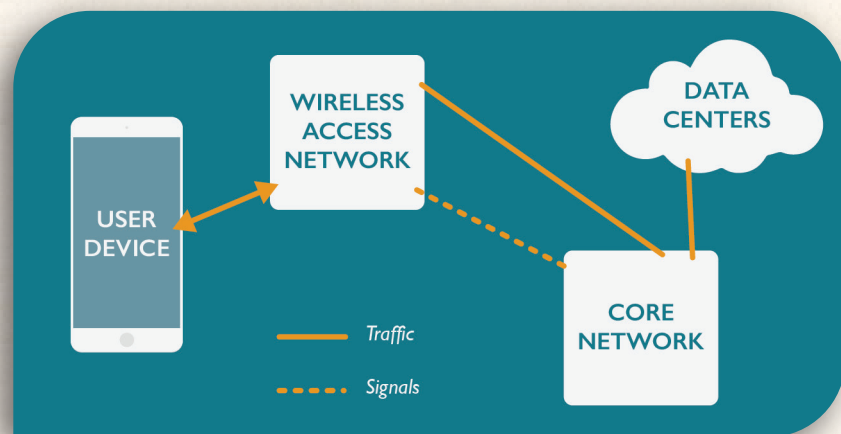
HOW A NETWORK CONSUMES ELECTRICITY

Figure 3: Network Components[29]

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

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 percent of the energy used to access data wirelessly (including Wi-Fi networks), with most of that energy powering mobile networks. About 9 percent is used to power data centers, less than 1 percent 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 percent of network energy consumption, with public and local Wi-Fi networks accounting for the other 31 percent[30]. Real-world data agrees with modeled levels of electricity use. Telefonica, a Spain-based mobile service provider reported in 2016 that 44 percent of their electricity consumption was from base stations and Sprint reported in 2017 that data centers contribute just 4 percent of the company's electricity use and GHG emissions[31].

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 percent 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*

This report is primarily concerned with the state of clean 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 percent clean, renewable energy. As of 2020, all major telecom companies made progress on the above action items, although at very different rates. T-Mobile continues to be the leader in option 3, as it has approached its goal of 100 percent renewable energy and will release an adjusted timeline due to its expanded network from the merger with Sprint (Sprint announced a goal of 100 percent renewable energy by 2025). AT&T is making progress on option 3 in its purchases of over 1.5 gigawatts of clean energy, which Green America estimates will provide roughly 25-30 percent of its total energy use[32]. But the company has not yet committed to 100 percent renewable power with a deadline. Verizon is the long-standing industry laggard on clean energy commitments but set a goal of 50 percent clean energy by 2025. It announced its first clean energy purchase to begin the work to meet this goal, a new wind energy facility that will provide over 133 megawatts of energy once it is fully operational later this year. Green America estimates this will provide less than 5 percent of its total energy usage, showing how much further the company must go to reach its goal.

Green America urges telecom companies to aim for 100 percent renewable energy by 2025. This 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** have been the four largest wireless service providers in the United States. As of 2020, T-Mobile and Sprint merged, however, the merger is not yet reflected in the companies' reports. This report covers 2018 data released in 2019 to Carbon Disclosure Project. Verizon remains the company with the highest number of subscribers, followed by AT&T.

All four companies use an intensity metric for measuring improvement. This includes energy intensity, which is a function of electricity use and network traffic and is measured by electricity generated (MWh) divided by network traffic (PB). Another metric is carbon intensity, which is a function of greenhouse gas emissions and network traffic and is measured by tons of carbon dioxide (CO_2) divided by network traffic (PB).

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.

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 percent clean energy 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.

COMPANY	WIRELESS SUBSCRIBERS (MILLIONS)[33]	2018 REVENUE (US$ BILLIONS)	TOTAL 2018 ENERGY REPORT BASED ON 2018 DATA (MWh)[34]	RENEWABLE ENERGY GOALS	PROGRESS
AT&T[35]	150.25	170.8	17,774,664	NO SET GOAL – ANNOUNCED PURCHASES OF 1.5 GW OF WIND ENERGY	APPROX. 25-30 PERCENT OF TOTAL ENERGY
SPRINT[36]	53.51	33.5	2,289,243 (from 2016)	SPRINT SET A GOAL OF 100 PERCENT BY 2025	CONTRACTS IN PLACE FOR 173 MW OF WIND EQUAL 30 PERCENT OF TOTAL.
T-MOBILE[37][38]	77.25	43.3	3,206,000	GOAL OF 100 PERCENT BY 2021	T-MOBILE HAS ANNOUNCED REACHING 95 PERCENT OF ITS GOAL. SINCE MERGING WITH SPRINT, T-MOBILE REMAINS COMMITTED TO 100 PERCENT AND WILL ANNOUNCE AN ADJUSTED TIMELINE TO REFLECT NEW NETWORK GROWTH
VERIZON[39]	153.97	130.86	11,993,479	GOAL OF 50 PERCENT BY 2025	A CONTRACT FOR 130 MW OF WIND (APPROX. 3-5 PERCENT OF TOTAL ENERGY)

Table 1: Top four wireless service providers in the US by number of Q2 2019 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.

This report is concerned with three types of commitment related to energy and emissions. These include: 1) commitments to clean 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 renewables vary distinctly between the four companies, but only T-Mobile and Sprint have made commitments to source 100 percent clean energy. Tables 2-5 list the most current goals and progress made by AT&T, Sprint, T-Mobile US, and Verizon:

In 2016, AT&T's renewables portfolio still represented less than 2 percent of its total electricity consumption. However, in 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 estimated this will result in savings equivalent to providing electricity for a quarter million homes a year[40]. In late 2018, the company announced an additional purchase of 300 MW through a deal with NextEra Energy Resources[41].

In 2019, AT&T built on this progress by announcing two new renewable energy deals with Invergy and Duke, bringing the

company to over 1.5 gigawatts of clean energy. Green America estimates the total purchases will increase the company's overall renewable use from 1.26 percent of its operations to approximately 25-30 percent. Its new commitment does not meet our goal of 100 percent clean energy by 2025, but it is an important step for AT&T and the industry. AT&T's purchases of renewable energy are amongst the highest corporate purchases of renewables each year.

AT&T has set goals to reduce both Scope 1 and Scope 2 emissions. According to AT&T's reporting, Scope 1 emissions account for 13 percent 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. AT&T began using the energy intensity metric in 2013 and committed to a 60 percent reduction by 2020[42]. As of its 2018 report, it has achieved a reduction of 78 percent, while continuing to grow its network in terms of users, traffic, and infrastructure[43].

AT&T GOAL[44]	PROGRESS[45]
Reduce Scope 1 emissions by 20 percent by 2020 relative to a 2008 baseline. Reduce Scope 2 emissions 60 percent by 2020 relative to a 2013 baseline.	In 2018 announced the purchase of 820 MW of wind energy. In 2019, AT&T announced two more projects bringing the company to 1.5 gigawatts of clean energy. The energy from these projects is not yet reflected in AT&T's Carbon Disclosure Project reports.
Reduce energy intensity (MWh/Petabyte *traffic) by 60 percent by 2020 relative to 2013 baseline.	Energy intensity was down by 78 percent in 2018 relative to 2013.
Expand on-site alternative energy capacity to at least 45 MW (double 2014 capacity) by end of 2017. AT&T is the only telecom to not set a new goal.	In 2018 announced the purchase of 820 MW of wind energy. In 2019, AT&T announced two more projects bringing the company to 1.5 gigawatts of clean energy. The energy from these projects is not yet reflected in AT&T's Carbon Disclosure Project reports.

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

Sprint [32]

Sprint set a goal in 2008 to source 10 percent clean energy by 2017, which it 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 1percent of its total energy use. **However, in late 2019, Sprint announced a commitment to source 100 percent renewable electricity across all operations (retail stores, offices, call centers, and network sites) by 2025**[46]. It signed virtual power purchase agreements (VPPAs) for two wind energy projects set to come online in 2020 and 2021. Sprint has also formed a partnership with Direct Energy Renewable Services and reports that Sprint is now powering its 800+ locations in Virginia with 100 percent renewable energy[47].

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 percent over a 10-year period. It achieved a reduction in carbon intensity of 92 percent between 2007 and 2017.[48] Sprint reported a 27.8 percent year-over-year reduction in energy intensity from 2018 to 2019. However, its overall energy use had a slight 1.5 percent increase in 2018 due to its 5G network buildout. Sprint has achieved a greenhouse gas emission reduction of 47 percent and is the only company of the four to see consistently falling emissions every year since 2009[49].

Sprint reports it was on the path to reach 100 percent carbon neutrality for its Scope 1 and 2 emissions by 2025 (including the use of carbon offsets starting in 2024). In April 2020, T-Mobile and Sprint announced the finalization of their merger. This report reflects 2018 data from reports issued by the companies in 2019 and as such, the merger is not within its scope. We anticipate having updates on T-Mobile's expanded network and new timeline to reach its goal of 100 percent clean energy in the 2021 version of *Clean Energy Calling.*

SPRINT

GOAL [50]	PROGRESS [51]
Sprint's initial goal was to reduce Scope 1 and 2 emissions by 20 percent by 2017 relative to a 2007 baseline. In 2019, Sprint announced a new goal of becoming 100 percent carbon neutral for business operations (Scope 1 and 2) by 2025	Scope 1 and 2 emissions are down by 47 percent as of 2016 relative to 2007.
Reduce carbon intensity by 75 percent by 2017 relative to 2007 baseline.	Carbon intensity is reduced by 92 percent as of 2016. Sprint also reduced its energy intensity and reported a 27.8 percent year-over-year reduction in 2019 compared to 2018.
Sprint's initial goal was to secure 10 percent of electrical energy from renewable sources by 2017. In 2019 the company announced a new goal of 100 percent renewable energy by 2025.	In 2019, Sprint announced a clean energy purchase agreement to provide roughly 30 percent of its energy use.

Table 3: **Sprint** goals and progress

T··Mobile·

T-Mobile committed to reaching 100 percent renewable energy by 2021, putting it in a leadership position in the industry for renewables. It reports that in 2020, it has reached 95 percent of this goal.

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 clean energy in 2017[52]. 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. In April 2020, T-Mobile announced that a partnership with Illinois-based Otter Creek Wind Farm fully achieved commercial operation to generate over 504,100 MWh of clean energy a year[53].

T-Mobile added a new goal to reduce combined scope 1 and 2 emissions 95 percent from a 2016 baseline year by 2025. The company does not have publicly facing commitments regarding reductions in energy intensity.

Also, in April 2020, T-Mobile and Sprint announced the finalization of their merger. This report reflects 2018 data from reports issued by the companies in 2019 and as such, the merger is not within its scope. We anticipate having updates on T-Mobile's expanded network and new timeline to reach its goal of 100 percent clean energy in the 2021 version of *Clean Energy Calling.*

T-MOBILE

GOAL[54]	PROGRESS[55]
In January 2018, T-Mobile announced a commitment to 100 percent clean energy by 2021. The company aims to power all network locations with 50 percent renewable energy by 2020.	T-Mobile reports that it has achieved 100 percent renewable energy for its data centers, commercial and retail locations. For its goal to power all network locations with 50 percent renewables by 2020, it reports reaching 19 percent in 2018.
T-Mobile commits to reducing combined scope 1 and 2 emissions 95 percent by 2025 from a 2016 baseline year.[56]	T-Mobile reports 20 percent reductions have been achieved as of 2018. It reports this target is approved by the Science-Based Targets Initiative. The baseline 2016 emissions were 1,116,991 metric tons of CO2e.

Table 4: **T-Mobile US** 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 percent clean energy. In November 2018, Verizon added a commitment to reach 50 percent 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[57].

Finally, in February 2020, Verizon announced that $133 million of the green bond has been allocated to a purchase agreement for up to 130 megawatts of capacity from a new wind energy facility. The facility is set to begin operation at the end of 2020 and creates new renewable capacity in the Mid-Atlantic region. This is a step in the right direction, but Verizon has a long way to go to reach its goal.

Verizon has committed to reduce its Scope 1 and 2 emissions 100 percent by 2035, relative to a 2018 baseline. It reports not currently having science-based targets but anticipates that will be secured by 2021 (or as it states, two years from its 2019 report).

VERIZON

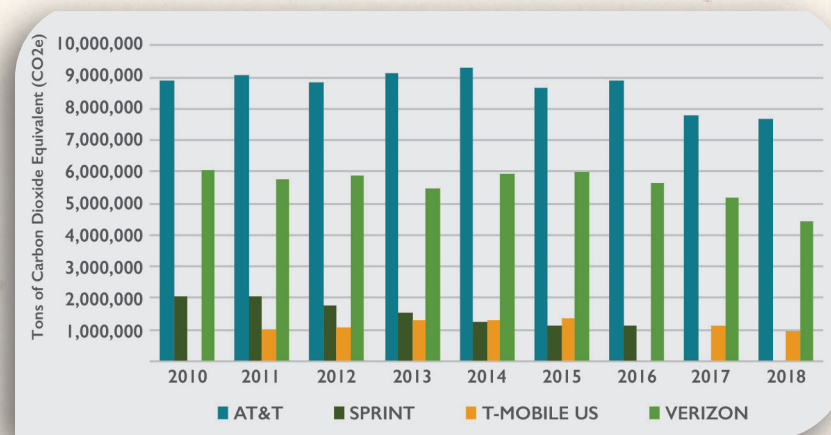| GOAL	PROGRESS
Verizon commits to reduce its scope 1 and 2 emissions 100 percent by 2035, relative to a 2018 baseline.	Verizon does not currently have science-based targets, but it anticipates setting one in the next two years (by 2021).
Reduce carbon intensity by 50 percent by 2025, relative to a 2016 baseline.	In 2018, carbon intensity was down by 46 percent relative to the 2016 baseline. Verizon reports it is on track to reach its goal.
Reach 50 percent clean energy by 2025 relative to a 2018 baseline.	On-site renewable energy capacity is currently 24 MW. Its new contract for s 130 MW wind project announced in 2020 is not yet reflected in its Carbon Disclosure Project report.

Table 5: **Verizon** goals and progress

LONG-TERM PROGRESS

Of the four companies discussed in this report, T-Mobile (including Sprint) is the only company to make a commitment to 100 percent renewable energy. Relative to rapid growth in cellular data demands over the past several years, both AT&T and Verizon have kept energy use and emissions relatively constant; however AT&T reports energy reduction between 2017 and 2018, the same timeline in which Verizon reports a reduction in emissions. 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 efforts to reach 100 percent clean energy (*see Figures 3 and 4*).

Figure 5: 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)

Figure 4: 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. (Source – CDP submissions: AT, VZ SP; DTK Corp Resp)

Each company uses different units to calculate efficiency, some use energy intensity (MWh/petabyte) some use emissions intensity (tons co^2e/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	2018 MWh	2018 REVENUE (BILLIONS)	2018 CO_2 (TONS)	SUBSCRIBERS (MILLIONS)	MWh USED PER SUBSCRIBER	CO_{2e} TONS USED PER SUBSCRIBER
AT&T	20,233,165	160.5	7,681,860	150.25	0.12	0.05
SPRINT*	2,289,243	33.5	1,139,488	53.51	0.04	0.02
T-MOBILE	2,839,773	40.6	951,127	77.25	0.04	0.01
VERIZON	12,655,300	126	4,418,820	153.97	0.08	0.03

Table 6: Energy and Emissions in Relation to Revenues and Subscribers. *Data for Sprint is for 2016 (Sprint's 2018 CDP data was not available).

Green America analyzes practices within sectors and leads a call to change companies lagging on sustainable practices. We also aim to provide consumers with 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 percent renewable energy by 2021.**

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 percent clean, renewable energy.

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.

Increasingly, companies are seeing buying renewables 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[59]. Forward-thinking companies are seeing that buying clean energy 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.

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

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 clean energy 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[60].

Power purchase agreements (PPAs):

For companies using large amounts of energy, locking in electricity costs at a low price can be critical. For clean energy, this can be accomplished with power purchase agreements (PPAs). When large companies enter 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.

Green tariffs:

In response to demand for renewables, 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 clean energy 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 clean energy on its own.

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.

IMPORTANCE OF REACHING 100 PERCENT 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. These heavily impacted communities are also least responsible for the climate crisis as they release less emissions than developed nations. 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.

A United Nations organization has calculated that global climate change is already the cause of 400,000 premature deaths every single year[61]. Furthermore, recent reports show that pollution kills three times as many people as AIDs, tuberculosis, and malaria combined[62]. When surveyed, Europeans overwhelmingly acknowledge their countries are already feeling the effects of climate change, and between this public outcry and 97 percent 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[635].

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 20 percent 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)[64].

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[65].**
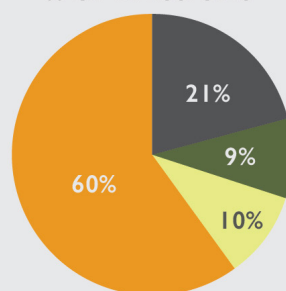
Half the US population lives in states or cities that are working toward the Paris Agreement climate goals...

- ■ US Climate Alliance and/or Under2 MOU states
- ■ States with independent emissions-reduction goals
- ■ Cities & counties outside of covered states
- ■ Not covered

% OF POPULATION

- 35%
- 45%
- 10%
- 10%

% OF EMISSIONS

- 21%
- 9%
- 60%
- 10%
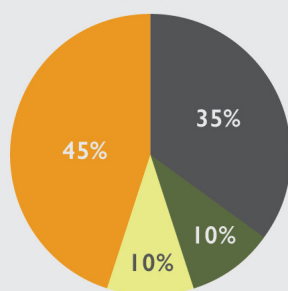
Figure 6: Percentage of U.S. Population Living in States or Cities Working Towards Paris Agreement Goals Despite U.S. Government Withdrawal (Source: Climate Interactive)

goals is a fundamental shift from fossil fuels to renewable, clean energy. For this, we urge leadership from 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.

As hurricanes and natural storms are intensifying, it is made clearer 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 percent by 2025 from the levels measured in 2005 (the country is currently almost halfway to the goal)[66].

We can achieve this target by scaling up the range of existing solutions throughout sectors such as transportation, agriculture, and industrial production. Critical to achieving our climate

HOW GREEN AMERICA AND CONSUMERS ARE TAKING ACTION

Millions of consumers 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 *Hang Up on Fossil Fuels* campaign calls on telecom companies to:

- *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 percent 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 join our online actions:

- *Add your name to our petition*
- *Contact companies directly via social media or a phone call*

REFERENCES

1   https://www.scientificamerican.com/article/we-just-breached-the-410-ppm-threshold-for-co2/

2   http://about.att.com/story/att_expands_renewable_energy_program_with_nextera_energy_resources.html

3   https://www.verizon.com/about/responsibility/sustainability

4   https://greenamerica.org/blog/why-verizon-passing-500-million

5   https://ieeexplore.ieee.org/document/4729106/?part=1

6   http://pubs.acs.org/doi/abs/10.1021/es303384y

7   http://pubs.acs.org/doi/abs/10.1021/es303384ypercent40proofing

8   https://www.itu.int/en/mediacentre/Pages/PR04-2020-ICT-industry-to-reduce-greenhouse-gas-emissions-by-45-percent-by-2030.aspx

9   https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/vni-hyperconnectivity-wp.html#_Toc484556817

10 https://www.ericsson.com/assets/local/mobility-report/documents/2016/Ericsson-mobility-report-june-2016.pdf

11 https://www.researchandmarkets.com/research/bvgxvl/global_sensors_in

12 https://www.wsj.com/articles/verizons-5g-game-plan-1536673535

13 https://www.lightreading.com/asia-pacific/operators-starting-to-face-up-to-5g-power-cost-/d/d-id/755255

14 https://www.smallcellforum.org/press-releases/market-status-apac-north-america-lead-network-densification-2021/

15 https://www.nytimes.com/2020/03/16/technology/coronavirus-working-from-home-internet.html

16 https://www.pcmag.com/news/att-reveals-covid-19-impact-on-networks-traffic-is-way-up

17 https://www.carbonbrief.org/analysis-coronavirus-set-to-cause-largest-ever-annual-fall-in-co2-emissions

18 https://www.unenvironment.org/interactive/emissions-gap-report/2019/

19 https://grist.org/climate/the-world-is-on-lockdown-so-where-are-all-the-carbon-emissions-coming-from/

20 https://www.theguardian.com/environment/2020/apr/20/green-energy-could-drive-covid-19-recovery-international-renewable-energy-agency

21 https://www.ericsson.com/assets/local/mobility-report/documents/2016/Ericsson-mobility-report-june-2016.pdf

22 https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/vni-hyperconnectivity-wp.html#_Toc484556817

23 https://www.usenergyjobs.org/

24 https://www.t-mobile.com/our-story/working-together/suppliers/supplier-diversity

25 https://suppliers.att.com/sd/certification.aspx

26 https://about.att.com/story/2019/supplier_diversity_program.html

27 https://www.verizon.com/about/our-company/supplier-diversity

28 https://greenlining.org/wp-content/uploads/2020/01/FINAL_2019-Supplier-Diversity-Report-Card_Single.pdf

29 http://www.ceet.unimelb.edu.au/publications/ceet-white-paper-wireless-cloud.pdf

30 https://www.telefonica.com/en/web/responsible-business/environment/energy-and-climate-change-2

31 http://goodworks.sprint.com/

32 https://about.att.com/story/2019/climate_week_2019.html

33 https://www.fiercewireless.com/wireless/how-verizon-at-t-t-mobile-sprint-and-more-stacked-up-q3-2018-top-7-carriers

34 https://www.cdp.net/en/info/about-us

35 https://investors.att.com/~/media/Files/A/ATT-IR/financial-reports/annual-reports/2016/att-ar2016-completeannualreport.pdf

36 https://tmo-assets-1524598101.netdna-ssl.com/explore/annual-report-2016/annualreport2016.pdf?icid=WMM_TM_Q217ANNUAL_Y9JREP47QS8430

37   https://www.t-mobile.com/resources/renewable-energy

38   http://www.verizon.com/about/sites/default/files/annual_reports/2016/downloads/Verizon-AnnualReport2016.pdf

39   http://www.about.att.com/content/csr/home/issue-brief-builder/environment/greenhouse-gas-emissions.html

40   http://about.att.com/story/att_corporate_renewable_energy_purchase.html

41   http://about.att.com/story/att_expands_renewable_energy_program_with_nextera_energy_resources.html

42   http://www.about.att.com/content/csr/home/issue-brief-builder/environment/greenhouse-gas-emissions.html

43   https://www.cdp.net/en/formatted_responses/responses?campaign_id=62255737&discloser_id=366&locale=en&organization_name=ATpercent26T+Inc.&organization_number=1113&program=Investor&project_year=2018&redirect=httpspercent3Apercent2Fpercent2Fcdp.credit360.compercent2Fsurveyspercent2Fft9rgfbwpercent2F11723&survey_id=58150509

44   http://www.about.att.com/content/csr/home/issue-brief-builder/environment/greenhouse-gas-emissions.html

45   https://www.cdp.net/en/users/sign_in?ReturnUrl=percent2fsitespercent2f2017percent2f13percent2f1113percent2fClimate+Change+2017percent2f_layoutspercent2fAuthenticate.aspxpercent3fSourcepercent3dpercent252Fsitespercent252F2017percent252F13percent252F1113percent252FClimatepercent2520Changepercent25202017percent252FPagespercent252FDisclosureViewpercent252Easpx&Source=percent2Fsitespercent2F2017percent2F13percent2F1113percent2FClimatepercent20Changepercent202017percent2FPagespercent2FDisclosureViewpercent2Easpx

46   https://newsroom.sprint.com/sprint-goes-carbon-neutral-and-announces-new-environmental-goals.htm

47   https://newsroom.sprint.com/direct-energy-works-with-sprint-for-100-renewable-energy-in-virginia-operations.html

48   http://goodworks.sprint.com/planet

49   http://goodworks.sprint.com/planet/climate-change/greenhouse-gas-emissions-and-energy/

50   http://goodworks.sprint.com/planet

51   http://goodworks.sprint.com/planet/climate-change/greenhouse-gas-emissions-and-energy/

52   https://newsroom.t-mobile.com/news-and-blogs/earth-day-2017.htm

53   https://www.t-mobile.com/news/earth-day-2020

54   https://www.telekom.com/en/corporate-responsibility/climate-and-environment/is-01-climate-and-environment-context/reducing-co2-355308

55   https://newsroom.t-mobile.com/news-and-blogs/tmobile-commits-renewable-energy.htm

56   https://www.cdp.net/en/formatted_responses/responses?campaign_id=62255737&discloser_id=5723&locale=en&organization_name=T+Mobile+USA+inc&organization_number=22331&program=Investor&project_year=2018&redirect=httpspercent3Apercent2Fpercent2Fcdp.credit360.compercent2Fsurveyspercent2Fft9rgfbwpercent2F29350&survey_id=58150509

57   http://fortune.com/2019/02/06/verizon-green-bond-telecom-environment/

58   http://www.verizon.com/about/responsibility/sustainability

59   https://www.aee.net/articles/corporate-buyer-demand-driving-renewable-markets-that-states-can-capture

60   https://energy.gov/savings/business-energy-investment-tax-credit-itc

61   http://daraint.org/wp-content/uploads/2012/09/CVM2ndEd-FrontMatter.pdf

62   http://www.npr.org/sections/goatsandsoda/2017/10/19/558821792/report-pollution-kills-3-times-more-than-aids-tb-and-malaria-combined

63   https://www.theguardian.com/environment/2017/mar/08/climate-change-impacts-already-hitting-us-say-europeans

64   https://www.huffingtonpost.com/entry/coal-is-going-down-even-without-the-clean-power-plan_us_59dea14ce4b075f45223a3d6

65   https://www.climateinteractive.org/programs/us-subnational-climate-action/

66   https://www.nytimes.com/2017/06/01/climate/american-cities-climate-standards.html?_r=0