CLICKING CLEAN:
WHO IS WINNING THE RACE TO BUILD A GREEN INTERNET?

2017

GREENPEACE

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The energy footprint of the IT sector is already estimated to consume approximately 7% of global electricity.

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EXECUTIVE SUMMARY

The internet will likely be the largest single thing we build as a species. Tasked with creating and then catering to the world's insatiable appetite for messages, photos, and streaming video, along with critical systems supporting our financial, transportation, and communication infrastructures, the internet serves as the central nervous system of the modern global economy.

Not surprisingly, it takes a tremendous amount of energy to manufacture and power our devices, data centers, and related infrastructural needs. The energy footprint of the IT sector is already estimated to consume approximately 7% of global electricity.[1] With an anticipated threefold increase in global internet traffic by 2020, [2] the internet's energy footprint is expected to rise further, fueled both by our individual consumption of data and by the spread of the digital age to more of the world's population, from 3 billion to over 4 billion globally. [3]

How we build and power our quickly growing global digital infrastructure is rapidly becoming central to

the question of whether we will be able to transition to renewable energy in time to avoid dangerous climate change. If data centers and other digital infrastructure are 100% renewably powered, our increasing reliance on the internet can actually accelerate our transition to a renewably powered economy. But, if our growing digital infrastructure is built in the opposite direction, locking us into a dramatic increase in the demand for electricity from coal and other dirty sources of energy that are changing our planet's climate, it will be far more costly and take an unnecessarily longer time to reach a renewably powered economy.

In light of the sector's pivotal role, Greenpeace began benchmarking the energy performance of the IT sector in 2009, challenging those companies who are the largest global architects and operators of the internet to commit to powering their rapid growth with 100% renewable energy. Ultimately, the largest players will be deciding whether our entire digital footprint is powered with renewable energy or antiquated fossil fuels.

Thankfully we actually are seeing a significant increase in the prioritization of renewables among some of the largest internet companies. The race to build a renewably powered internet started with digital platform leaders such as Facebook, Apple, and Google who first made 100% renewable commitments four years ago and have now been joined by nearly 20 internet companies,[4] including global cloud and colocation companies who had previously been lagging far behind. Companies entering the race to build a renewably powered internet are motivated by:

- Customers who have carbon or renewable energy goals demanding that their digital infrastructure is powered by clean sources of electricity;

- The rising cost competitiveness of renewable energy, with long-term contracts increasingly at cost parity or even beating fossil fuels in many markets, while also providing long-term price security.

- Competitiveness among IT companies and the linkage of brand identity with a renewable supply of energy, given the growing concern on climate change among employees and customers.

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IT companies who have made 100% renewable commitments are already seeing results in the deployment of a significant amount of renewable energy to power data centers and are modeling leadership for companies outside the IT sector to pursue their own 100% renewable energy goals. Direct purchase of renewable energy by corporations in the U.S. has increased dramatically since 2010, exceeding 3.2GW in 2015 alone, with over two-thirds of this volume attributed to renewable electricity deals by major internet companies. [5]

But while the number of companies committed to a 100% renewable future continues to grow, many of the 100% RE commitments are being pursued on a path that is much more status quo than transformational. These companies are erroneously seeking to receive similar recognition as did the more impactful leadership of Apple, Google, Facebook, and others in the marketplace for being green. Shortcuts threaten to undermine the high-impact efforts set by leaders within the sector, reducing pressure on utilities to shift their investment to bring new renewable energy onto the grid and creating a longer path toward a brighter and more sustainable future.

With this year's update, we have expanded our analysis to look at the performance of East Asian internet giants such as Tencent, Baidu, Alibaba, and Naver, who are now positioning to expand to the global level. But the lack of access to a renewable energy from monopoly utilities is a major obstacle toward creating a renewably powered internet in this region. Without key policy changes, the rapid growth of the internet in East Asia will likely be powered by coal and other dirty sources of electricity.

A fully renewably powered internet will not happen overnight, but for sector companies to adopt a 100% renewable commitment is an important first step. This commitment must be matched with deeds that also show true leadership, taking successive steps in the same direction. While important progress has been made in driving renewable energy investment in several markets, the dramatic increase in the number of data centers in markets such as Virginia, dominated by utilities that have little to no renewable energy, is driving a similarly dramatic increase in the consumption of coal and natural gas.

In these markets, a much greater focus on advocacy is needed to overcome the entrenched political power of the utilities and create a pathway for the rapid adoption of renewables. This is particularly true in the United States following the election of Donald Trump, who has promised to roll back climate policies and revive the use of coal. Sustained and vocal advocacy by corporations, who recognize the ecological and economic imperative for an aggressive transition to renewable sources of electricity, has never been more important in the United States.

Given the critical importance of corporate advocacy for climate and renewable energy policies, we have adjusted our evaluation criteria to give increased attention to the advocacy efforts of companies. We have witnessed leaders such as Google, Apple, Facebook, eBay, and now Switch using their influence to push vendors, utilities, and governments to create access to renewable energy where previously there was none.

A similar but far more limited effort has started among Korean internet companies Samsung SDS and Kakao, who have also begun to push for access to renewable energy. Building the bridge to a sustainable supply of renewable electricity must become a core priority for the rest of the sector. Renewable energy advocacy must be as important as or even more important than current company advocacy efforts around privacy, government surveillance, or reduction of tax burdens. [6]

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Key findings

- Apple retains its leadership spot for the third year in a row among platform operators. Both Apple and Google continue to lead the sector in matching their growth with an equivalent or larger supply of renewable energy, and both companies continue to use their influence to push governments as well as their utility and IT sector vendors to increase access to renewable energy for their operations.

- Switch, new to the Clicking Clean report this year, scored among the highest for any class of company and is the definitive leader among colocation operators for its efforts to transition its data center fleet to renewables as fast as possible through a combination of renewable energy procurement and aggressive advocacy.

- Major internet companies' leadership has been a catalyst in driving a broader set of corporations to adopt 100% renewable goals, contributing to a dramatic increase in renewable deals in the U.S. signed directly by corporations, totally 3.4GW of renewable deals signed in 2015, with over two-thirds of this power from renewable deals by IT companies.

- Cloud computing market leader Amazon Web Services (AWS) took some important steps in the past year, including promising leadership in supporting clean energy policy. But given AWS's continued lack of transparency and its rapid growth in Virginia and other markets largely served by dirty energy, it remains unclear whether the AWS cloud is actually on a path to becoming renewably powered.

- Video streaming is a tremendous driver of data demand, with 63% of global internet traffic in 2015, and is projected to reach 80% by 2020.[7] Netflix alone already accounts for over one-third of internet traffic in North America[8] and is in the midst of a worldwide expansion.

- The transition to the cloud could in fact increase the demand for coal and other fossil fuels despite significant gains in energy efficiency and adoption of a commitment to 100% renewable energy because of the dramatic growth in new data center construction by cloud and colocation companies such as AWS and Digital Realty in Virginia and other hot spots that have some of the lowest percentages of renewable electricity in the U.S.

- Faced with a lack of access to renewables in monopoly markets, there are increasing signs that some companies are resorting to status quo shortcuts to reach their claims of being renewably powered, increasing the demand for dirty energy and undermining the continued leadership and momentum of market leaders who are legitimately driving additional renewable investment. (see Shortcuts, page 39)

- The continued lack of transparency by many companies regarding their energy demand and the supply of electricity powering their data centers remains a significant threat to the sector's long-term sustainability. The least transparent companies such as AWS, Tencent, LG CNS, and Baidu are also among the most dominant in their respective markets, making their lack of movement toward more transparency even more egregious.

- Advocacy for renewable energy is still sorely needed in South Korea, where utility monopolies dominate the energy market, and almost all power comes from fossil fuels. However, progress is being made in Gangwon Province, where the provincial government recently decided to build the first 100% renewably powered data center complex in Chuncheon City, thanks to the growing demand for and public support of renewable energy from the major IT companies in Korea.[9]

Company Scorecard

	Final Grade	Clean Energy Index	Natural Gas	Coal	Nuclear	Energy Transparency	Renewable Energy Commitment & Siting Policy	Energy Efficiency & Mitigation	Renewable Procurement	Advocacy
Adobe	B	23%	37%	23%	11%	B	A	B	B	A
Alibaba.com	D	24%	3%	67%	3%	F	F	C	F	D
amazon.com web services	C	17%	24%	30%	26%	F	D	C	C	B
Apple	A	83%	4%	5%	5%	A	A	A	A	B
Baidu 百度	F	24%	3%	67%	3%	F	F	D	F	F
Facebook	A	67%	7%	15%	9%	A	A	A	A	B
Google	A	56%	14%	15%	10%	B	A	A	A	A
hp	C	50%	17%	27%	5%	D	B	C	B	C
IBM	C	29%	29%	27%	15%	C	B	C	C	F
Microsoft	B	32%	23%	31%	10%	B	B	C	B	B
NAVER	C	2%	19%	39%	31%	B	B	B	D	D
ORACLE	D	8%	26%	36%	25%	D	D	F	D	F
salesforce	B	43%	12%	16%	15%	B	A	C	B	B
SAMSUNG 삼성SDS	D	11%	19%	29%	31%	C	D	C	D	C
Tencent 腾讯	F	24%	3%	67%	3%	F	F	D	F	F

Please see Appendix I: Methodology (page 42), for explanation of scoring methodology and basis for calculation of Clean Energy Index and company energy mix.

Colocation & CDN Company Scorecard

Company	Final Grade	Clean Energy Index	Natural Gas	Coal	Nuclear	Energy Transparency	Renewable Energy Commitment & Siting Policy	Energy Efficiency & Mitigation	Renewable Procurement	Advocacy
acer	D	6%	35%	36%	16%	D	D	C	D	D
Akamai	B	16%	-	-	-	A	A	A	C	B
ASUS	D	6%	35%	36%	16%	C	D	C	F	D
中華電信 ChunghwaTelecom	D	6%	35%	36%	16%	C	D	D	D	D
DIGITAL REALTY Data Center Solutions	C	21%	33%	25%	19%	B	C	B	D	D
DFT DATA CENTERS	F	7%	32%	29%	31%	D	F	D	F	F
EQUINIX	B	20%	30%	29%	20%	B	B	B	C	B
FAREASTONE 遠傳	D	6%	35%	36%	16%	B	F	C	D	F
kt	F	2%	19%	39%	31%	D	F	D	F	F
LG CNS	F	2%	19%	39%	31%	F	F	F	F	F
LG U+	F	2%	19%	39%	31%	D	F	D	F	F
rackspace the open cloud company	C	29%	25%	26%	19%	C	B	B	C	C
SK 주식회사 C&C	F	2%	19%	39%	31%	D	F	D	F	F
SK telecom	F	2%	19%	39%	31%	D	F	D	D	F
switch	A	100%	0%	0%	0%	A	A	A	A	A
Taiwan Mobile	D	6%	35%	36%	16%	C	D	D	D	D

Internet Company Scorecard

Video Streaming

	Final Grade	Clean Energy Index	Natural Gas	Coal	Nuclear	Energy Transparency	Renewable Energy Commitment & Siting Policy	Energy Efficiency & Mitigation	Renewable Procurement	Advocacy
Afreeca.com	F	2%	19%	39%	31%	F	F	F	F	F
Amazon Prime	C	17%	24%	30%	26%	F	D	C	C	B
HBO	D	22%	20%	25%	25%	D	F	F	F	F
Hulu	F	20%	30%	29%	20%	F	F	F	F	F
Netflix	D	17%	24%	30%	26%	F	F	C	D	F
Pooq.co.kr	F	2%	19%	39%	31%	F	F	F	F	F
Vevo	F	27%	15%	32%	26%	F	F	F	F	F
Vimeo	D	47%	13%	20%	19%	D	F	F	C	F
YouTube	A	56%	15%	14%	10%	B	A	A	A	A

Music/Audio Streaming

	Final Grade	Clean Energy Index	Natural Gas	Coal	Nuclear	Energy Transparency	Renewable Energy Commitment & Siting Policy	Energy Efficiency & Mitigation	Renewable Procurement	Advocacy
iTunes	A	83%	4%	5%	5%	A	A	A	A	B
NPR	F	17%	24%	30%	26%	F	F	F	F	F
Pandora	F	13%	32%	20%	27%	F	F	F	F	F
SoundCloud	F	17%	24%	30%	26%	F	F	F	F	F
Spotify	D	56%	15%	14%	10%	F	F	F	C	F
Podbbang	F	2%	19%	39%	31%	F	F	F	F	F

Messaging

	Final Grade	Clean Energy Index	Natural Gas	Coal	Nuclear	Energy Transparency	Renewable Energy Commitment & Siting Policy	Energy Efficiency & Mitigation	Renewable Procurement	Advocacy
iMessage	A	83%	4%	5%	5%	A	A	A	A	B
Kakao Talk	C	2%	19%	39%	31%	C	D	D	F	C
QQ	F	24%	3%	67%	3%	F	F	D	F	F
Skype	B	32%	23%	31%	10%	B	B	C	B	B
WeChat	F	24%	3%	67%	3%	F	F	D	F	F
WhatsApp	A	67%	7%	15%	9%	A	A	A	A	B

Search

	Final Grade	Clean Energy Index	Natural Gas	Coal	Nuclear	Energy Transparency	Renewable Energy Commitment & Siting Policy	Energy Efficiency & Mitigation	Renewable Procurement	Advocacy
Baidu	F	24%	3%	67%	3%	F	F	D	F	F
Bing	B	32%	23%	31%	10%	B	B	C	B	B
Daum.net	C	2%	19%	39%	31%	C	D	D	F	C
Google.com	A	56%	15%	14%	10%	B	A	A	A	A
Nate	F	2%	19%	39%	31%	F	F	F	F	F
Naver	D	2%	19%	39%	31%	B	D	B	D	D
Yahoo	B	74%	5%	12%	6%	C	B	B	B	D
Zum	F	2%	19%	39%	31%	F	F	F	F	F

Social Media

	Final Grade	Clean Energy Index	Natural Gas	Coal	Nuclear	Energy Transparency	Renewable Energy Commitment & Siting Policy	Energy Efficiency & Mitigation	Renewable Procurement	Advocacy
82cook.com	F	2%	19%	39%	31%	F	F	F	F	F
Band.us	F	2%	19%	39%	31%	F	F	F	F	F
Clien.net	F	2%	19%	39%	31%	F	F	F	F	F
Coolenjoy.net	F	2%	19%	39%	31%	F	F	F	F	F
DCinside.com	F	2%	19%	39%	31%	F	F	F	F	F
Facebook.com	A	67%	7%	15%	9%	A	A	A	A	B
Gasengi.com	F	2%	19%	39%	31%	F	F	F	F	F
Ilbe.com	F	2%	19%	39%	31%	F	F	F	F	F
Instiz.net	F	2%	19%	39%	31%	F	F	F	F	F
Instagram	A	67%	7%	15%	9%	A	A	A	A	B
Inven.co.kr	F	2%	19%	39%	31%	F	F	F	F	F
JjangOu.com	F	2%	19%	39%	31%	F	F	F	F	F
Lezhin.com	D	56%	15%	14%	10%	F	F	F	C	F
LinkedIn.com	B	10%	31%	23%	20%	A	A	B	B	A
Nexon.com	F	2%	19%	39%	31%	F	F	F	F	F
Pinterest	F	17%	24%	30%	26%	F	F	F	F	F
Ppomppu	F	2%	19%	39%	31%	F	F	F	F	F
Reddit.com	F	17%	24%	30%	26%	F	F	F	F	F
Twitter	F	10%	43%	21%	14%	F	F	F	F	F

Blogs

	Final Grade	Clean Energy Index	Natural Gas	Coal	Nuclear	Energy Transparency	Renewable Energy Commitment & Siting Policy	Energy Efficiency & Mitigation	Renewable Procurement	Advocacy
Blog.me	C	2%	19%	39%	31%	B	B	B	D	D
Blogger.com	A	56%	15%	14%	10%	B	A	A	A	A
Egloos.com	F	2%	19%	39%	31%	F	F	F	F	F
Tistory.com	F	2%	19%	39%	31%	F	F	F	F	F
Tumblr	B	74%	5%	12%	6%	C	B	B	B	D
WordPress	D	13%	34%	29%	15%	B	F	F	F	F

E-Commerce

	Final Grade	Clean Energy Index	Natural Gas	Coal	Nuclear	Energy Transparency	Renewable Energy Commitment & Siting Policy	Energy Efficiency & Mitigation	Renewable Procurement	Advocacy
11st.co.kr	F	2%	19%	39%	31%	F	F	F	F	F
Aladin.co.kr	F	2%	19%	39%	31%	F	F	F	F	F
Amazon.com	C	17%	24%	30%	26%	F	D	C	C	B
Auction.co.kr	F	2%	19%	39%	31%	F	F	F	F	F
Bobaedream	F	2%	19%	39%	31%	D	F	F	F	F
Coupang.com	F	2%	19%	39%	31%	F	F	F	F	F
Danawa.com	F	2%	19%	39%	31%	F	F	F	F	F
eBay.com	B	38%	38%	13%	10%	B	D	C	C	A
Etsy.com	B	14%	19%	36%	31%	A	A	B	B	B
Gmarket.co.kr	F	2%	19%	39%	31%	F	F	F	F	F
Interpark	F	2%	19%	39%	31%	F	F	F	F	F
Wemakeprice	F	2%	19%	39%	31%	F	F	F	F	F
Yes24.com	F	2%	19%	39%	31%	F	F	F	F	F

"Across the tech sector we need to recognize that data centers will rank by the middle of the next decade among the large users of electrical power on the planet." Brad Smith, President–Microsoft

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POWERING OUR DIGITAL WORLD 01

The digital world—our digital devices and the internet that links them together—is becoming more central and a larger piece of modern society with each passing year. Ubiquitous, fast and cheap Internet access combined with a seemingly endless array of internet-enabled devices is rapidly redefining what we consider online and what is offline. This transformation to the digital age offers tremendous potential to help us be smarter about how we use energy, enabling us to better measure and manage our energy consumption, allowing us to rely more and more on renewable sources of energy.

This ability to catalyze transformative change in the consumption and production of energy is why IT companies have such a critical role in whether we will be able to transition to a much smarter and renewably powered economy and achieve the significant reduction

in greenhouse gases (GHGs) to avoid devastating impacts from climate change.

But along with the significant solutions potential, delivering the digital age requires a tremendous amount of energy. Despite significant improvements in energy efficiency in both our devices and in the operation of data centers, our IT-related energy appetite marches rapidly upward. When accounting for the energy needed to both manufacture our devices and power the internet and the rest of the digital infrastructure needed to run our connected world, the IT sector was estimated to already consume over 7% of global electricity demand in 2012, with projections this could exceed 12% by 2017, and continue to grow at least 7% annually through 2030, double the average rate of electricity growth globally.[10]

Main components of electricity consumption for the IT sector

2012

47% Devices
20% Networks
15% Data Centers
18% Manufacturing

2017

34% Devices
29% Networks
21% Data Centers
16% Manufacturing
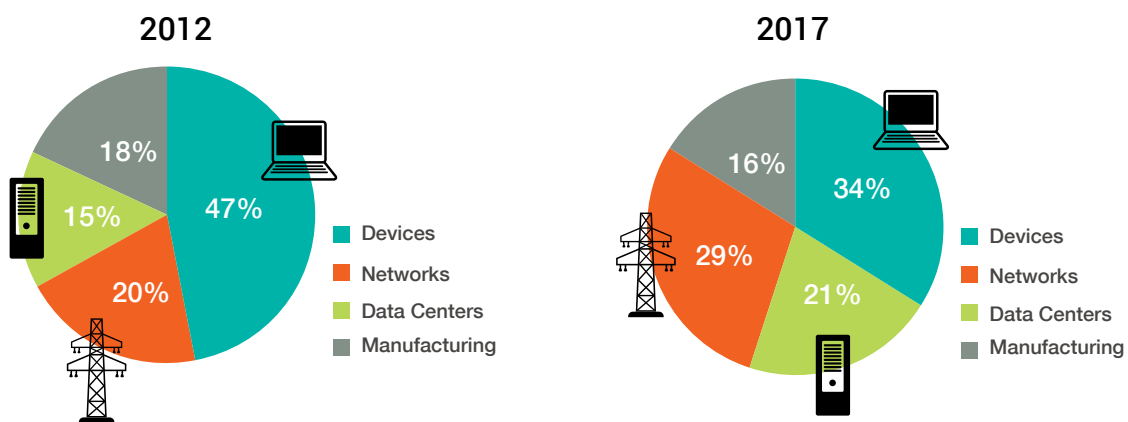
Main components of electricity consumption for the IT sector, 2012. From "Emerging Trends in Electricity Consumption for Consumer ICT"

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The internet system creates four major areas of energy demand: data centers, communication networks, end-user devices, and energy required to manufacture the equipment for all three.[11]

The energy needed to power our devices has historically been the dominant portion of the IT sector's electricity consumption. This is rapidly shifting as our personal computers and personal electronic devices have become smaller and more energy efficient to last throughout the day, while broadband and internet-based computing platforms that replace and augment computing and storage from individual devices have spread. In addition, the rapid growth in the total number of devices is driving the sector's energy and greenhouse gas footprint in the manufacturing in China and other parts of Asia, which remains heavily dependent on coal. Including manufacturing, the global IT sector electricity demand ranks behind only two countries in the world.[12]

2012 Electricity Consumption; Countries Compared to IT Sector in billion kWh
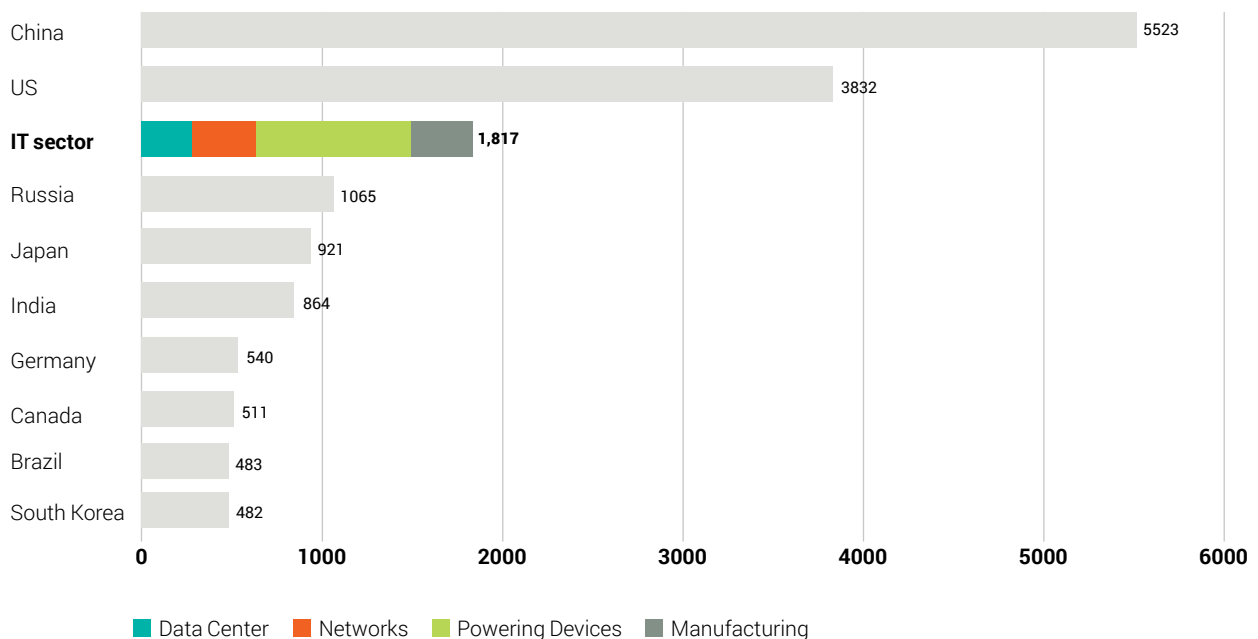
Source: Emerging Trends in Electricity Consumption for Consumer ICT, Peter Corcoran and Andres Andrae (2013) and CIA World Factbook. China/Russia/Canada figures are from 2014.

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Data Centers: The Factories of the Digital Age

With each new aspect of our daily lives and business models that depend on an internet connection, we are creating, sharing, and accumulating a tremendous amount of data at an ever increasing rate. Up to 2003, as a global community we had accumulated 5 exabytes (1 exabyte = 1 billion gigabites) of digital content, an amount that is now consumed every couple of days, as we reached 4,423 exabytes yearly in 2015. As digitization accelerates and more of the world's population joins the digital age, global data traffic is expected to more than double, reaching 10,457 exabytes by 2019 annually.[13]

This explosive growth in our digital consumption is driving massive new investments in digital infrastructure, particularly power hungry data centers that serve as the factories of the digital economy. Data centers, home to thousands of servers that store and deliver our messages, photos, and videos to our tablets and phones, vary greatly in size, with the larger cloud computing and colocation facilities capable of consuming as much power as a medium size city.

Despite some improvements in transparency by a number of internet companies, data on the electricity demand of the internet remains poor. Global estimates of the electricity demand of the network and data centers that deliver the internet vary widely in their methodology and scope. Many of the existing studies are based on country samples, annual surveys, or industry predictions that are difficult to compare due to variant methods.

A recent global analysis placed data center electricity consumption at just under 300 TWh/year in 2012, just under 2% of global electricity demand. Several countries and states have much higher percentages, with projected growth rates between 7 and 20% annually.[14] Recent studies in the United States indicate growth rates more toward the lower end of this range, indicating much bigger improvements in energy efficiency than previously estimated, led by rapid growth among cloud and colocation data center operators highlighted in this report.[15] Looking forward, global estimates of data center demand in 2030 anticipate an increase of three to 10 times current levels, with high end estimates of projected data center electricity demand alone reaching 13% of global electricity consumption.[16]

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Energy Efficiency + Renewable Energy

As our reliance on the IT sector and infrastructure will continue to grow, it is very important to make sure this growing infrastructure is built in the way that allows us to transition to renewable energy at the same speed we are moving to the cloud. Instead of celebrating the more efficient use of coal and other fossil fuels, the IT sector needs to set more ambitious goals. These goals must combine the sector's ability to rapidly deploy innovative technology with a scale of renewables investment and advocacy that will deliver a renewable energy powered internet that will help us finally move away from fossil fuels.

The recent study[17] of U.S. data center energy demand by the U.S. Department of Energy provides an important window on the future of the sector's energy appetite and the direction of its growth. This study indicated that data center energy demand is growing at a slower rate than previously projected, linked in part to a significant shift in server sales in the U.S. market to the "hyperscale" production and cloud computing data centers run by companies featured in this report. Such facilities are typically operating far more efficiently than most independently operated data centers due largely to much higher server utilization rates and better data center design, requiring a much smaller percentage of energy spent on cooling and other non-computing power demands. While the slowing of the growth curve of data center electricity demand in the U.S. is certainly welcome news, the trends highlighted by this report have been misinterpreted by some as evidence of a misplaced emphasis on the energy performance of large scale data center operators. This would be a mistake, as the ongoing shift to larger and more energy efficient data centers should actually underscore the importance of decisions that such global data center operators make now on where their critical infrastructure is located, and what source of energy will power them.

As highlighted in Section 3 of this report, the increasing concentration of large-scale data centers in electricity markets with utility monopolies that provide trace amounts of renewable power is increasing the sector's reliance on dirty sources of energy. These moves are potentially locking our digital infrastructure into long-term dependence on coal and natural gas at a time when the rapid transition to renewables is necessary.

There is also increasing evidence[18] that the net effect of the gains in efficiency may actually be playing a major role in increasing both our consumption of data and the overall data center electricity demand. As illustrated previously in other contexts, improvements in energy efficiency can actually result in greater consumption of resources overall as lower costs enable more demand (more supply at a lower cost). This is known as the Jevons Paradox. With the marginal cost of memory, CPU and bandwidth are tending toward zero, with the resulting proliferation of so many "free" and "unlimited" online services like YouTube and Netflix, the impressive efficiency gains achieved in delivering cloud-based computing services would appear to already be serving to significantly increase overall data center power consumption.

The IT sector is presented with a major decision about whether it will move beyond energy efficiency and commit to putting the growth of the internet on the path toward being fully renewably powered---providing a core infrastructure that we can heavily rely on as we seek to transition away from fossil fuels as rapidly as possible to avoid climate change.

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Major Drivers of Data Demand: Streaming Video & Social Media

One of the biggest drivers of the consumer data consumption is streaming of video. Various end-user electronic devices allow more people to watch TV shows, movies, and other on-demand content regardless of time and space limits. In 2020, the traffic due to video streaming will occupy more than 80.0%[19] of the total traffic generated among the all consumer-generated traffic. Every second, nearly a million minutes of video content will cross the network by 2020.[20] Also, social platforms such as Facebook and Twitter will start providing real-time video streaming services, meaning data will grow even more in the near future in this sector.

The rapid data growth caused by video streaming is rapidly becoming a global phenomenon across the regions. In North and South America, real-time entertainment continues to keep its first place in terms of network growth. It is responsible for over 71.0% of downstream bytes during the peak period. The biggest video content provider, Netflix continues to be the leader in peak period traffic, accounting for 35.2% of downstream traffic[22].

In Europe, real-time entertainment is the top traffic category, responsible for 45.6% of peak downstream traffic[23]. Last fall, Netflix expanded to six new European countries, which is the reason for its increase from the previously observed 3.44% of peak downstream traffic. Netflix accounts for over 20.0% of network traffic in the U.K. and Ireland, while in countries where it has recently launched such as Austria and France it already accounts for approximately 10.0% of peak downstream traffic less than a year after launch.[24]

Like Europe, consumption in Asia-Pacific is driven by the use of real-time entertainment, which accounts for 47.2% of the total downstream traffic during peak period.[25]

Mobile Data Traffic by Application Type (monthly Exabytes)[21]

2020
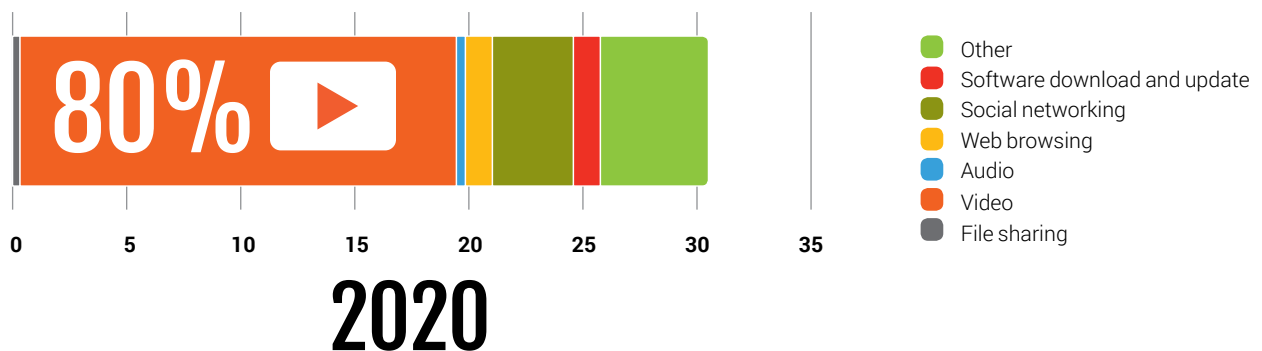
Source: Figures compiled from Cisco Network Traffic Forecast 2016 and Ericcson Mobility Report 2015.

This leadership by major internet companies has been an important catalyst among a much broader sector range of corporations to adopt 100% renewable goals.

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THE RACE TO BUILDING A RENEWABLY POWERED INTERNET

02

100% Renewable Commitments Rapidly Spread

When Greenpeace first began benchmarking major data center operators in March 2010, improvements in energy efficiency were the primary metric by which the sector measured its environmental performance.   Little, if any, attention was at the time given by companies to securing a renewable source of electricity to power data centers. Google started to break trail soon after with the signing of its first wind energy power purchase agreement (PPA).[26] However, the adoption of a meaningful goal to be 100% renewably powered was not being seriously considered by any company.

That changed in 2011 when Facebook, after hearing from nearly a million of its own users through Greenpeace's Unfriend Coal campaign, became the first IT company to make a meaningful long-term commitment to be 100% renewably powered. Both Apple and Google followed soon after in 2012. The past year has seen a significant jump as fifteen data center operators and major internet companies have embraced the importance of powering their rapidly growing operations with renewable energy.[27]

This leadership by major internet companies has been an important catalyst among a much broader sector range of corporations to adopt 100% renewable goals. Their actions send an important market signal to utilities and policy makers: leading businesses today want and expect access to renewable sources of electricity. These commitments have driven a dramatic increase in renewable deals in the U.S. signed directly by corporations, with over 3.4GW of renewable deals signed in 2015, over two-thirds of this power from deals by IT companies.

IT Sector Renewable Contracts 2010-16 (MW)
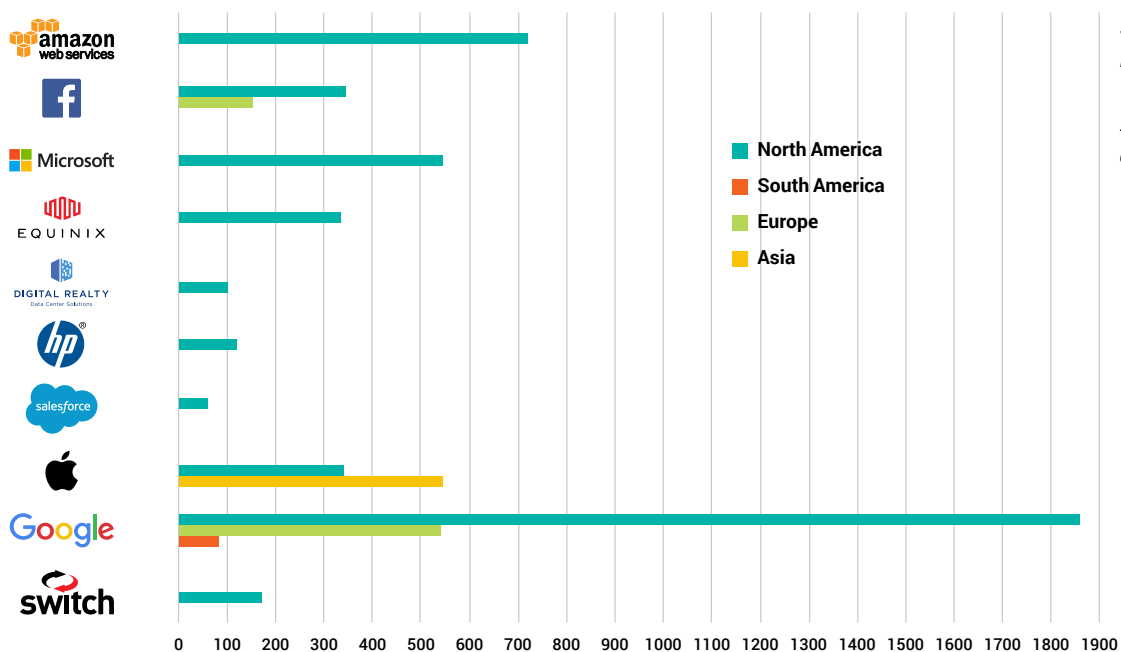
Source: Click Clean Renewable Energy Tracker (January 2017) www. clickclean.org

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100% Renewable Energy Commitments

2011 **2012** **2013** **2014**

December **May** **September** **February** **March** **November** **October**

Facebook / Apple / Google / rackspace the open cloud company / salesforce · box / amazon web services / Microsoft

2015 **2016**

March **May** **June** **November** **December** **March** **April** **September**

EQUINIX / DIGITAL REALTY Data Center Solutions / NAVER / switch / Adobe / hp / Etsy / Hewlett Packard Enterprise

Key global drivers behind IT sector renewable leadership:

- **Competitiveness of Renewable energy:** The rapidly declining cost of Renewable Energy is a significant factor in recent corporate renewables deals, along with the additional benefit of providing security against rising electricity rates from future increases in fossil fuel prices.

- **Brand Reputation:** Brand loyalty is important as global brands fight to capture and keep consumers within their online ecosystem as much as possible. Recent global surveys indicate that over 90% of consumers expect companies to act responsibly regarding social and environmental issues, with two-thirds indicating they will only pay attention to efforts that go above and beyond what other companies are doing.[28]

- **Business Customers:** More and more businesses are focusing on their environmental footprint, with over 60% of the U.S. Fortune 100 and 43% of the U.S. Fortune 500 having adopted a greenhouse gas reduction goal, a renewable energy target, or both. Responsible companies are not looking to just offshore their digital footprint to the cloud, but are looking for cloud and colocation vendors who will provide them the data they need on their energy footprints, and are growing in a way that will help them meet their own goals. Similarly, national, state, and local governments are setting aggressive climate and energy goals of their own, and setting procurement standards to favor companies with strong transparency and commitment to reduce their energy footprint.

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6.0 GW of Renewable Energy

Capacity (MW)

3000

2000

1000

0

2010 — 114
- Google (Iowa)

2011 — 101
- Google (Oklahoma)

2012 — 68
- Google (Oklahoma)
- Apple (North Carolina)

2013 — 494
- Apple(North Carolina)
- Google (Sweden)
- Apple (Nevada)
- Google(Texas)
- Microsoft (Texas)

2014 — 870
- Facebook(Iowa)
- Google (Iowa)
- Microsoft(Illinois)
- Google(Sweden)
- Yahoo (Kansas)
- Google (Holland)

2015 — 2701
- Apple (Nevada)
- Google (California)
- Facebook(Texas)
- Google(Oklahoma)
- Equinix(California)
- Apple (Oregon)
- Google(Texas)
- Apple(California)
- Google(North Carolina)
- Apple (China)
- Google (Chile)
- Apple (Singapore)
- Switch(Nevada)
- Google (Sweden)
- Equinix (Oklahoma)
- AWS(Virginia)
- Google(Texas)
- HP(Texas)
- Equinix (Texas)
- AWS (Indiana)
- Apple(North Carolina)
- AWS (Ohio)
- Salesforce (West Virginia)
- AWS(North Carolina)
- Google (Texas)

2016 — 1553
- Apple (China)
- AWS (Virginia)
- Microsoft (Kansas)
- Digital Realty(Texas)
- Apple (Arizona)
- Switch(Nevada)
- Google(Norway)
- Apple(China)
- Google(Kansas)
- Salesforce(Texas)
- Google(Sweden)
- Facebook (Ireland)

Source: Click Clean Renewable Energy Tracker (January 2017) http://www.clickclean.org

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High Impact Strategies for Driving Renewable Energy

Transaction Type	Potential Pros & Cons	Questions to Ask
Onsite Renewables Apple (NC & NV)	▶ Direct impact with clear story for company ▶ Concentration of data center power demand and land restrictions may not align to allow for significant supply	- Were RECs and other environmental attributes from the project retired/retained?
Power Purchase Agreement (PPA) Google AWS Microsoft Facebook HPE Equinix	▶ Enables specific new renewable project ▶ Provides hedge to control energy costs ▶ Regulatory complexity in some markets ▶ Virtual PPAs may have limited impact on local utility portfolio ▶ Financial risk if energy prices drop below strike price	- Does the company have data center/operations in the same electricity market as the PPA? - Has the company retained and retired the RECs and any other environmental attributes from the project?
Green Tariff (w/Sleeved PPAs) Google (NC) Apple (NC & NV) Switch (NV) IO (AZ)	▶ Utility manages energy contract and load balancing ▶ Often have built-in price premium, regardless of contracted price of renewables ▶ Lack of flexibility in some markets	- Does corporate buyer receive the benefit of lower RE price? - Is electricity price fixed, or only the premium? - Are RECs from the project passed to customer, or replaced with unbundled RECs?
Community Choice Aggregation	▶ Typically lower rate than existing utility ▶ Supply/price risk born by CCA entity ▶ Enable local control over supply ▶ long process for establishing, often made longer due to strong opposition from existing utility	- Will CCA contract create new renewable capacity?
Community Solar/Wind	▶ Support distributed RE investment ▶ RE output delivered as bill credit ▶ Eliminates siting limitations of onsite ▶ RECs typically kept by project sponsor	- How are RECs from project handled?
Direct Access Apple (CA & OR)	▶ Ensures a local supply of renewables ▶ No fixed price premium ▶ May not be new or additional project ▶ Access may be limited or significant exit fees	- Is project new/additional?

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WHO'S NEXT TO GO GREEN?
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"Climate change is an urgent global priority. We believe the private sector, in partnership with policy leaders, must take bold steps."

– Urs Hölzle, SVP, Google

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How Green Is It?

Nuclear

Nuclear power plants create unacceptable risk to the environment and human health and are an expensive diversion from the deployment of renewable energy and energy efficiency required to stave off the worst impacts of global warming. Efforts to revive the nuclear industry in the US have largely failed due to the impossibly high costs of building and maintaining nuclear power plants – that money is best spent on renewable sources of power.

Hydropower

Hydropower is the most established baseload clean energy source. Sourcing energy for a data center from existing hydropower reduces carbon emissions and is more environmentally friendly than powering from a predominantly coal, gas, or nuclear powered grid. However, using existing hydropower does not lead to investment in new renewable energy capacity, and large hydropower projects can have detrimental effects on local environments. In many parts of the US, existing hydropower is fully subscribed, which means that increasing demand in hydropower-heavy grids could ultimately lead to new fossil fuel investment if companies do not demand renewable energy.

Well-planned and managed small-scale or microhydro power projects have much less impact on river ecosystems and have the potential to provide a scalable baseload power source for data centers.

Geothermal

Geothermal energy is a consistent and renewable source of power in areas of the world where it can be found. It provides significant and growing electric generation in countries including the US, Iceland, and Indonesia. In 2014, 620MW of new geothermal power were added globally, with Kenya and the Philippines among developing countries leading the way.

Biogas

Biogas can come from many sources; methane from landfill sites and anaerobic digestion of farm waste or sewage sludge are the most common. The environmental benefits of biogas vary widely depending on the source.

Biomass

Large-scale biomass used for electricity generation can create significant environmental problems, as the source of biomass is likely to come from unsustainable sources. Wood pellets from the southeast U.S. are currently being shipped to the U.K. and other parts of the EU, simultaneously driving deforestation and undermining climate protection goals in both countries.

Fuel cells

A small but increasing number of data center companies are deploying natural gas-powered fuel cells on site as both primary and backup power supplies. Fuel cells can be a good mitigation strategy when used as a primary power source to unplug a data center from a coal-fired grid. Nonetheless, natural gas is not a renewable energy source, even when used in fuel cells.

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On-site Deployment

On-site or near-site deployments of renewable energy are the most straightforward to assess for their impact, since on-site renewable energy investments are inherently additional and local. However, given the energy density of data centers, on-site renewable installations such as solar may only provide a small percentage of the total facility power demand. On-site renewable developments send a strong signal to utilities by indicating a reduction in demand for their own generation portfolio.

Power Purchase Agreement (PPAs)

PPAs have been the largest means by which corporate buyers have purchased renewable energy to date. By providing a guaranteed buyer of both the underlying electricity and the renewable electricity credits, the PPA allows the energy developer to secure financing, driving additional renewable development. For the data center operator, PPAs can deliver a guaranteed price for electricity, providing protection against future increases in the price of traditional grid power. In the United States in 2015, more wind energy PPAs were signed by corporate customers than by utilities for the first time, driven in part by the anticipated expiration of federal tax incentives.

Most PPAs are "Virtual" or "Synthetic" PPAs, which does not require the actual delivery of electricity to the buyer. The electricity is instead resold to the open market, with the buyer keeping any underlying RECs, which can then be retired. If a company executes a virtual PPA in the same electricity market in which it operates a data center, then a virtual PPA can still be a credible way to add renewable energy and displace demand for dirty energy on the same grid.

Utility Green Tariff

In response to growing demand from data center operators and other companies who want greater access to a renewable electricity supply in regulated markets like North Carolina and Nevada, U.S. utilities have begun to respond by offering new renewable or green tariff products to large customers, allowing them to procure a large amount of renewable energy via the utility.[29] Many of these new tariff programs have been designed as sleeved or back-to-back PPAs, with one PPA between the utility and the identified renewable developer, and another one between the utility and the corporate customer. Duke Energy in North Carolina created the Green Source Rider tariff in response to pressure from Google, Apple,

and Facebook,[30] with Google and Apple signing the first two contracts under the new program. Apple played an instrumental role in helping establish a new Green Tariff program in Nevada, which has also been utilized by Switch in signing a contract to secure a renewable supply from utility-scale solar projects in the state.[31]

Community Solar

In states that allow virtual net-metering, allowing corporations to credit off-site solar electricity generation to their utility bill if the solar array is in the same service territory as their meter(s), community solar has strong potential for corporate buyers, particularly those who find PPA models not suitable due to minimum size and term requirement and greater risk considerations. Community solar could be particularly well suited for companies who have a small amount of load in any one location, such as customers within a colocation facility.[32]

Community Choice Aggregation (CCA)

The CCA model is a promising option for driving renewable investment and deployment, involving the local municipality or group of local governments serving as an aggregator of electricity demand, purchasing renewable energy in bulk for customers in its territory. A CCA allows for communities to buy electricity that has much higher renewable electricity than available from the local utility, as it negotiates on behalf of its residents and businesses with independent power producers under a long-term PPA.[33] Several IT companies are supporting local communities in California where they operate data centers to launch CCAs that would provide a renewable energy supply.

Direct Access

In the U.S., Direct Access (DA) programs exist where the market is not fully deregulated at the retail level, but DA allows a customer to purchase electricity from an electricity supplier other than the local utility, potentially creating stronger options for securing a renewable electricity supply. Direct Access is not available in every jurisdiction, and is often restricted to a small number of customers (California) or has a limited number of eligible providers (Oregon).

Facebook and Apple have been leading the sector in operational transparency, providing regular and easy-to-access reporting of their data center energy footprint.

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BARRIERS TO 100% RENEWABLY POWERED INTERNET

03

1) Lack of Transparency

When Greenpeace began evaluating data center operators in 2010, most companies in the sector were very reluctant to discuss electricity use in any level of detail, as if IT companies had adopted a collective code of silence. Fortunately, we have since seen a meaningful shift toward more transparency among global data center operators over the past three years. Business and government customers increasingly want to know key data points on the environmental performance of facilities to which they have off-shored their computing capacity, with the expectation that their colocation or cloud provider will help them achieve their carbon reduction and renewable energy goals.

Publishing the data for consumers demonstrates that a company is willing to hold itself accountable. Acquiring and publishing this data is the first thing a company that wants to contribute to a green internet should do. Not all companies are in the position to make renewable energy investments, due to their size, budget or operating market, but any company can publish its energy data to show that it is taking the issue seriously.

Online platform data center operators like Facebook and Apple have been leading the sector in operational transparency, providing regular and easy-to-access reporting of their data center energy footprint, including facility level detail on both consumption and changes to electricity supply. Cloud computing companies have lagged behind platform specific leaders like Apple and Facebook in their energy transparency, frequently citing competitiveness concerns in revealing details on the scale of their operations. Global CDN (content delivery network) operator Akamai continues to be an important exception to this general trend, both reporting and aggregating its energy performance data and providing it to its customers upon request.

Among emerging Asian data center operators, a similar code of silence is gradually being replaced with greater transparency, most clearly among the Korean IT companies thus far. Naver and Samsung SDS have begun publicly disclosing their electricity use while also adopting greenhouse gas targets.

Among emerging Chinese internet giants such as Baidu, Tencent, and Alibaba, the silence on energy performance still remains. Neither the public nor customers are able to obtain any information about their electricity use and CO_2 target.[34] In sharp contrast, Taiwan's FarEastTone has begun to publish critical details on its data center footprint and performance of its digital operations.[35]

To evaluate a company's progress toward becoming 100% renewably powered, two levels of detail are essential: (a) baseline data on annual energy consumption, energy mix, and greenhouse gas emissions, including location-specific information for all significant facilities, and (b) details on the nature of any on-site generation or market purchases of renewable electricity made directly or on the company's behalf.

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Hot Spots of US Data Center Investment:

Location (Utility)	RE+ Hydro	Existing Data Center Capacity[36]	Under Development[37]
Northern Virginia (Dominion)	3%	774MW	+435MW
Chicago (ComEd)	3%	502MW	+101MW
Northern California (PG&E)	30%	424MW	+78MW
Dallas (ERCOT)	12%	403MW	+143MW
New Jersey (PSEG)	1-3%	327MW	+148MW

One of the single biggest obstacles to sector transparency is Amazon Web Services (AWS). The world's biggest cloud computer company remains almost completely non-transparent about the energy footprint of its massive operations. Among the global cloud providers, only AWS still refuses to make public basic details on the energy performance and environmental impact associated with its operations. Many data center customers need reliable data to evaluate the environmental performance and carbon footprint of their IT vendors and suppliers. In some cases, companies that would like to be more transparent about their energy footprint have been hampered by their cloud providers' refusal to provide them with data. For customers of AWS and many other data center operators, it remains difficult if not impossible for the companies to benchmark the footprint of their online operations because their vendors do not disclose critical energy data, or what is provided is done so only under a non-disclosure agreement, significantly limiting usefulness.

2) Lack of Access to Renewable Energy Supply

North America:

Driven by significant new capital investment by cloud computing companies and colocation operators, new data center capacity is rapidly being added across a number of U.S. metropolitan markets. This includes markets such as Virginia and Chicago that are served by utilities with extremely low amounts of renewable energy powering their respective generation mix.

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Virginia: Where the Cloud Touches the Ground

1%

1%	■	RE
2%	■	Hydro
31%	■	Coal
33%	■	Nuclear
32%	■	Natural Gas
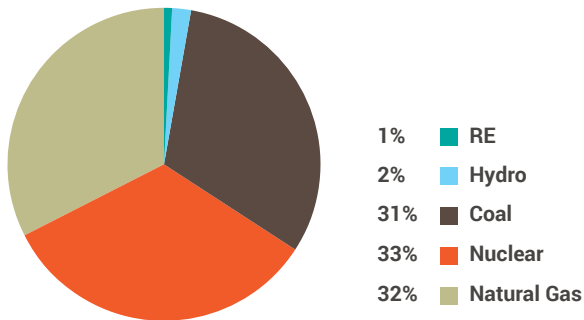
Northern Virginia, just across the Potomac River from Washington, DC, is home to the greatest concentration of data centers in the world.[38] Loudoun Country alone boasts that in its "Data Center Alley" up to 70% of global internet traffic passes through its borders on a daily basis, and the county is aggressively recruiting even more data centers to be built.[39] That amount of internet traffic requires massive amounts of electricity; the majority of it is provided by Dominion Resources, a utility that continues to rely almost exclusively on dirty sources of generation, with only 1% of electricity generated from renewable sources.[40] While predictions of US electricity consumption will remain effectively flat for the foreseeable future,[41] Dominion reports to investors that data centers are the primary driver of its electricity demand, anticipating an annual increase of 11% out to at least 2020.[42]

Despite the lack of access to renewables, companies who have made commitments to be 100% renewably powered made dramatic expansions in Virginia in the past year. AWS, who already had 500MW of data center capacity across 23 facilities, dramatically expanded its Virginia footprint. Analysis of backup generator permits recently approved for AWS facilities in Virginia indicates the company is planning to nearly double the size of its operations in the state, with an additional 560MW in capacity added across existing and seven new data centers since our last report.[43]

Some breakthroughs were made in the past year to bring renewable energy into this, using two different paths:

● To get around the monopoly of Dominion Resources, AWS signed two PPAs for renewable projects in the same electricity grid as their data centers, one wind[44] and one solar.[45] Both projects represented important firsts in the region for utility-scale deployment of wind and solar.

● Microsoft entered into three-way partnership with the local utility and the State of Virginia, helping to finance a 20MW solar project in the state, with the state taking the actual electricity and Microsoft taking the RECs and other environmental attributes associated with the energy production of the project, ensuring others will not count the solar produced toward any regulatory obligations or goals.[46]

While both companies are to be commended for taking steps toward displacing coal and other dirty sources of electricity generation from the same grid, they are also dramatically increasing demand. These efforts further underscore the need for both better options for customers to buy renewable energy and a greater willingness on behalf of the companies to ensure such deals are designed to have a greater impact.

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- While AWS signed a sizeable contract to enable these projects to move forward, it currently appears that AWS did not retain the underlying renewable energy credits (RECs) with either project, given their significant value due to renewable energy compliance obligations of utilities in the region.[47] AWS and the developer appear to have instead sold the RECs, and bought replacement RECs from a national pool, taking away the ability to claim the amount of renewable energy added was actually additional from what would already have been required. [see shortcuts, replacement RECs p 39]

- Microsoft's participation in the partnership was limited to the purchase of both the RECs and other environmental attributes associated with the electricity generated by the solar facility, including carbon credits that would come into play once the US EPA's Clean Power Plan takes effect. The underlying "null" electricity was sold to the State of Virginia. The three-way partnership was created to salvage a project that was put together by Dominion and previously rejected by regulators as being too expensive,[48] with the recommendation that third parties could develop the

project at a lower cost than Dominion was wanting to charge ratepayers. Microsoft's agreement to purchase the RECs in this deal allowed Dominion to maintain control of the project, and maintain the profit margin it was seeking by charging it to ratepayers.

In response to the PPA deal by AWS, Dominion recently filed and received approval to offer a new "Special Rate Contract," that would provide a unified rate, linking the wholesale transactions occurring as a result of the renewable PPAs to the rate AWS is paying for its electricity consumption in Dominion territory, providing a more stable net rate.[49] Dominion is planning to extend this special rate contract to other data center operators, though only up to 200MW of demand.[50] While this new rate offering is an improvement, what is really needed in Virginia is an opening of the market to allow PPAs for developers offering a 100% renewable product. This is currently allowed under Virginia statute, but has been aggressively fought by Dominion and other utilities in the state thus far. However, a recent administrative decision on another utility renewable tariff may pave the way to allow renewable PPAs in the state.[51]

Significant New Growth in Virginia Continues

Company	Previous Estimate of Data Center Capacity[52]	New Capacity or Expansion Since Clicking Clean '15	New Renewable Energy Projects Deployed in Virginia or Adjoining States
amazon web services	500MW	+560 MW[53]	Seven renewable projects for total of 137MW of delivered capacity (468MW nameplate)[54]
DIGITAL REALTY Data Center Solutions	145MW	Purchased 130 acres for new data center campus (+150MW)[55]	None
DFT DuPONT FABROS TECHNOLOGY	217MW	+32 MW with ACC9 Expansion[56]	None
EQUINIX	121MW	Announced plans to add new campus with 5 new data centers, bringing total to 15[57]	None
Microsoft	115MW	+35 MW in new Virginia colocation leases[58]	Signed deal for solar project with 5MW of delivered capacity (20MW nameplate)[59]

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Asia: China, Taiwan, and Korea

The Asia-Pacific region is becoming one of the fastest growing markets for the IT sector. However, unlike the leading IT corporations such as Google, Facebook, and Apple, the Asia-Pacific region is still lagging behind when it comes to building the renewable energy powered Internet. North and Southeast Asian region (China, Japan, Korea, Philippines, and Indonesia etc.) is the world's biggest CO_2 emitter.

China

5%	■ RE
20%	■ Hydro
67%	■ Coal
3.2%	■ Nuclear
2.9%	■ Natural Gas
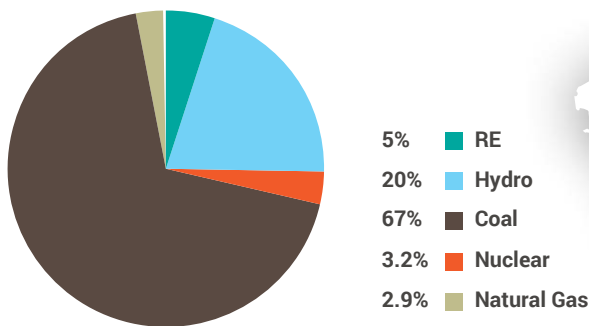
China has seen a accelerated growth of wind and solar installation in the past decade and now is aiming for 210 GW[60] of wind and 110 GW[61] of solar installation by the year 2020. The electricity generated from the renewable energy amounts to 24.5%; however the largest proportion comes from hydropower and only 5% from solar and wind by 2015.[62] The power sector of China is highly centralized, monopolized, and lacking in transparency, with five big state-owned utility companies and two grids covering the integration, transmission and trading functions nationwide.

Year 2016 saw the kick off to a slow and steady reforming process, allowing diversified generators to be integrated into the grid, while also allowing private companies to register as electricity distribution businesses. This process will be further consolidated with rounds of pilots and trials, aiming for a more RE-friendly power sector in the coming decades. There is currently no market mechanism to meet a company's or individual's requests for renewable energy, other than installing solar panels or wind turbines onsite or nearby in its own facilities. Investment in renewable energy plants, such as those recently made by Apple in China is a workable but less direct option.[63]

5%

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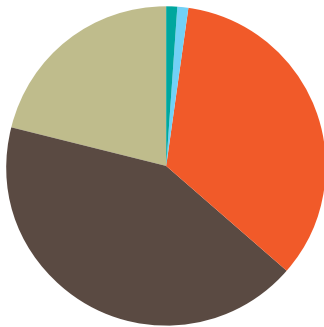
South Korea

1.1%	■	RE
1.1%	■	Hydro
38.7%	■	Coal
31%	■	Nuclear
19.1%	■	Natural Gas[64]

1%

South Korea has been widely recognized for its IT manufacturing sector and is now seeing a rapidly growing IT service segment with cloud computing, mobile business, and big data gaining in importance. South Korea has also become a key location in the region for global cloud players. This past year saw an influx of new data center investment by global IT corporates such a Microsoft Azure and Amazon Web Services. IBM Softlayer also expanded its business and plans to launch data centers in this fast-growing cloud service market.

Currently, Korea Electric Power Corporation (KEPCO), the monopoly electricity provider in South Korea has a generation mix with only 1.1% renewable electricity, with fossil fuel and nuclear power representing over 90% of its generation mix. The South Korean government has set a target of providing 13.4% of overall electricity through renewable energy by 2035, however, this is an insufficient target in comparison to the EU's 20% target by 2020.[65]

Naver is the first Asian company to commit to 100% renewable energy, but due to the monopoly utility, it is not possible to purchase renewable energy using the market mechanism. Without greater policy support for renewables, the only current options are building on-site RE facilities or finding RE projects in the vicinity.

There is one bright spot—recently the provincial government of Gangwon announced a plan to build a renewably powered data center complex in Chuncheon City using, 200MW from a floating solar farm and a hydrothermal cooling system with water from Soyang Dam. This will be the first renewably powered data center in East Asia.
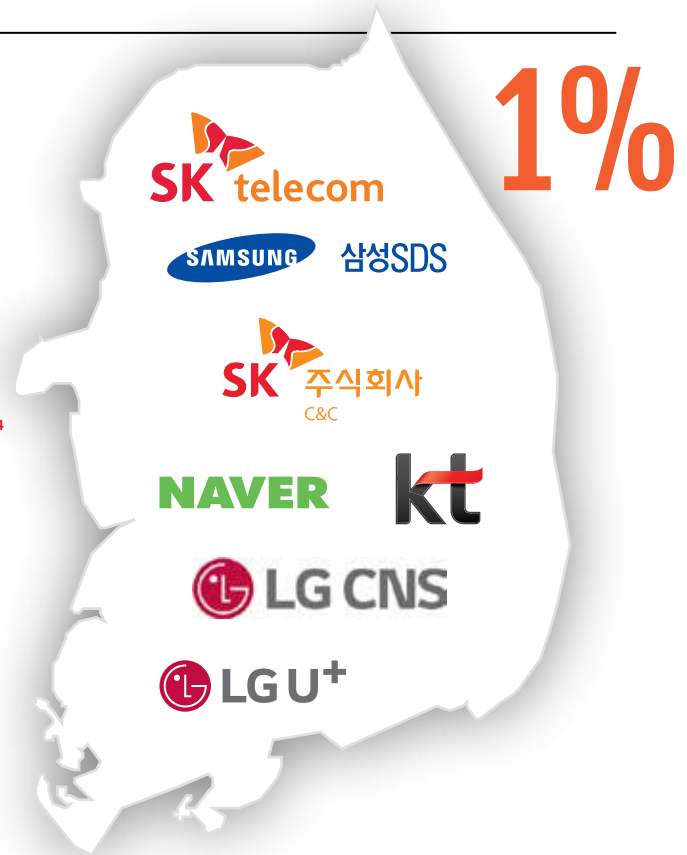
> "'Green' brand positioning is giving competitive advantages to many IT companies, opening a door for new opportunities"
> –Naver

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Taiwan

4.2%   ■ RE
1.4%   ■ Hydro
35.7%   ■ Coal
16%   ■ Nuclear
35.1%   ■ Natural Gas

4.2%
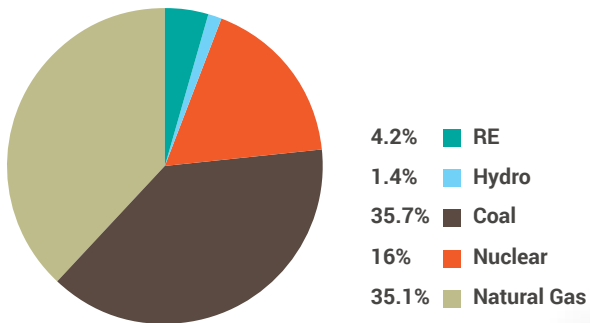
Taiwan is headquarters to some of the most influential technology companies in the world and it has carved out a distinctive niche as a high-tech hardware manufacturing hub. The country has combined competitive IT services of cloud computing, software services, and big data technologies to build its IT infrastructure. Google has recently expanded its data center in Taiwan, and several other global brands are reportedly considering Taiwan for data center investments.

However, Google and other data center operators who have committed to powering their data centers with renewable energy face a monopoly market run by Taipower, the state-owned utility. Taipower relies heavily on imported energy for power generation with dependency on energy imports as high as 97.6%, with most of the generation mix heavily dependent on fossil fuels. To facilitate the creation of a voluntary renewable market in Asia, Google has provided seed funding to support a renewable energy tracking system, with an initial focus on Taiwan.[66]

The leaders—Apple, Google, Facebook, and now Switch—have shown a commitment and ability to remain focused on longer term plays to open monopoly markets to renewables.

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Section 04
**Evaluating 100%
Renewable Claims**
Impact vs Shortcuts

EVALUATING 100% RENEWABLE CLAIMS: IMPACT VS. SHORTCUTS 04

The rapid increase in the number and volume of corporate renewable energy contracts is already causing a significant shift in the marketplace, creating pressure on utilities to increase the amount of renewable energy in their portfolio. Evaluating whether these deals are actually shifting a company's supply of electricity from dirty to renewable sources is far from straightforward especially given the inherent invisibility of the electricity flows and the lack of transparency and weak reporting standards for corporate renewable purchases. Without a deeper investigation, it is increasingly difficult to tell the difference between the renewable claims of a company who is actually pursuing a high impact strategy that is changing the energy mix on the grid from a similar sounding claim to be renewably powered, but is green in name only, as the electricity being consumed remains unchanged.

A company whose strategy focuses on maximizing impact and changing the grid over the long-term can serve as a powerful catalyst in driving investment in renewable generation, as well as moving both utilities and policymakers to prioritize bringing more renewable energy on the grid. The leaders—Apple, Google, Facebook, and now Switch—have shown a commitment and ability to remain focused on longer term plays to open monopoly markets to renewables.

Conversely, a company primarily motivated by securing the right to claim a renewable energy supply, but not in actually changing the mix of the electricity on the grid that is powering its operations is more likely to result in reducing the pressure on utilities to shift to renewables, and increase the demand for fossil fuel and other forms of dirty electricity in its supply. Without stronger standards of reporting and commitment to additionality of supply (see below), there is a real danger that the growing number of shortcuts being used by some companies to advance toward their 100% renewable goal will weaken the resolve of current corporate renewable leaders to pursue high impact strategies.

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Decoding Green Energy Commitments

100% Renewable

Long-term commitment to become 100% renewably powered. For data center and internet companies, the focus of this commitment is on renewable electricity.

Clean Energy

Often used to refer inclusively to renewables along with existing large hydroelectric. Care often needed to ensure no misinterpretation to include nuclear[67] or natural gas[68] as suggested by certain energy companies.

Carbon Neutral/Zero Net Carbon

No agreed upon definition on means of achieving, but broadly a commitment to have measured and somehow eliminated or "offset" all carbon dioxide emissions from company activity (at least Scope 1 and 2) within a given year. A company's "offset" projects may fall outside the energy sector or involve other greenhouse gases, such as methane. Does not require a change in energy source or a reduction in pollution from energy consumption, as carbon-neutral claims are often met through the purchase of unbundled RECs or carbon offsets, which focus only on carbon-related pollution.

In addition to 100% renewable commitment in 2014, AWS offers to customers the option of being hosting by four "Carbon Neutral" regions.[69] No definition of carbon neutral or details of how it has achieved its definition are provided.

On top of 100% renewable commitment adopted in 2012, Google has maintained a commitment to be a "Carbon Neutral" company since 2007. Google does not buy unbundled RECs toward achieving its Carbon Neutral goals, only those purchased via long-term contract. In 2011, Google published a white paper[70] on the standards it uses in selecting offset projects, but no longer publishes details on the projects it has secured offsets from, only the total amount as measured against the balance of its carbon footprint.[71]

Prior to making 100% renewable commitment in 2014, Microsoft had also adopted a company-wide commitment to be "Carbon Neutral" in 2012, while also adopting an internal carbon tax, publishing a white paper outlining its approach.[72] Microsoft has provided regular updates on investments made from revenue from carbon tax, and has begun to transition away from unbundled RECs and carbon offsets to more impactful contracts for renewable energy.[73]

Last year announced a commitment or intention to "fully offset" its carbon footprint from its operations. Pointing to its greater reliance on AWS's "carbon neutral" regions, Netflix indicated it relied on RECs and Guarantees of Origin to cover any remaining gap of its footprint not already "neutral" according to AWS's standards. Though wind (North America) and hydroelectric (Europe) were identified, given that no specific projects were mentioned, presumably Netflix relied on unbundled certificated[74] (see shortcuts, page 39)

Evaluating 100% Renewable Strategies

Companies should outline clear principles for how they intend to pursue their 100% renewable energy goals in order to establish a clear standard and build momentum toward higher impact strategies. Companies pursuing a high impact strategy to reach their renewable goals should adopt the following elements:

- Local: Renewable energy supply located on the same grid as the company's demand

- Driving New Investment: Renewables energy credits are bundled with underlying electricity, displacing demand for existing dirty electricity generation.

- Additional: Renewable energy is new and "additional" from what would have occurred

- Renewables Advocate: Advocate for change with utilities, regulators or with elected officials for policies to increase the supply of renewable energy on the grid in locations where the company has operations.

Most Common Shortcuts to 100% Renewable Claims

Reliance on Unbundled RECs

Reliance on the purchase of unbundled Renewable Energy Credits (RECs) to achieve renewable claims, which currently does little to increase renewable energy investment (see principle #1/#2 on page 40)

Overreaching Claims

Over-claiming change to electricity supply by counting single large renewable deals in one region toward the energy footprint in another despite the absence of a shared electricity grid (see principle #3 on page 40)

Lack of Transparency in Transactions

Poor transparency in reporting the nature of a deal for renewable electricity, often masking whether the renewable deal is additional or helping to displace electricity demand from dirty sources of electricity.
(see principle #3 on page 40)

Redefining Renewable

While there is universal agreement on a range of renewable energy technologies,[75] some utilities are pushing to expand or distort the boundaries for what counts as renewable at the state level or country level. Examples of these efforts to redefine renewables to include industrial scale biomass, large-scale hydroelectric, fuel cells, IGCC(integrated gasification combined cycle), COG (Coke Oven Gas), BFG (Blast Furnace Gas), LDG (Linz-Donawitz Converter Gas)[76] or municipal waste (see box-page p25 for overview of energy technologies)

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1) Local: Renewable energy supply connected to demand

A central principle to pursuing an impactful strategy to be 100% renewably powered is purchasing renewable energy from local sources or otherwise from sources that are connected to the same grid where the company has significant electricity demand. Attempts to claim to be renewably powered in one location through the purchase of renewables in another country or state that is not connected to the same electricity grid as the facility does not have the same credibility. The company has done nothing to change the electricity supply powering the facility or to reduce local air pollution from the displacement of dirty electricity generation.

While local RE may be more difficult in some monopoly markets where customers do not have the option to choose their source of electricity, other mechanisms like virtual PPAs may provide an interim step toward opening the market and offsetting electricity demand with electricity from renewable sources. Ultimately policy changes to unlock the market to companies to buy renewable energy will be needed to green the grid for everyone. Purchasing of local unbundled renewable credits, while preferable to relying on national ones, should not take the place of advocating for increasing market access to renewables and increasing utility renewable investments.

2) Driving New Investment — Not reselling existing projects

Renewable Energy Credits (RECs)—or their European equivalents, guarantees of origin (GOOs)—are property rights created when renewable energy is generated, used to confer the environmental attributes of the renewable energy to the REC owner, and could be sold separately from the electricity generated. Originally designed for the compliance market to give utilities flexibility, RECs play a critical role in ensuring more than one party does not count the same electrons of renewable energy.

However, RECs and GOOs have flooded the market in both the U.S. and the EU, as renewables increasingly beat coal and other dirty sources of energy on an economic basis. This added supply of RECs continues to exceed regulatory obligation in many markets, which is driving the price of renewable credits not needed for compliance purposes to record lows. In these oversupply markets like Texas, REC prices fell to as low as $0.38/MWh in 2015.[77] The minimal additional revenue generated from the sale

of RECs alone does little to drive additional renewable generation capacity, or displace demand for dirty sources of electricity.

RECs continue to represent more than half of voluntary green power market sales sold in the U.S.[78] The voluntary unbundled REC market stopped growing for the first time in 2014, and recovered only modestly in 2015, indicating corporate customers may be moving away from these low-impact products as higher-impact renewable options (see table page 40) with greater upside become cheaper each year. Though there remain notable exceptions such as Intel, most IT companies have already shifted away from pursuing unbundled REC products as a central strategy due to the lack of impact in displacing fossil fuel generated electricity from the grid and the lack of any economic benefit in the form of a hedge against rising electricity prices to the buyer. Microsoft, who had previously relied heavily on unbundled RECs as a means of achieving its "carbon neutral" claim, has been gradually shifting to higher impact purchasing strategies such as PPAs, where the electricity and the RECs are sold together, providing sufficient guaranteed revenue to drive new renewable energy deployment.

3) Transparency on Renewable Deals: Additionality

Companies pursuing 100% renewable energy goals should include a focus on bringing new and additional renewable electricity onto their local grid, helping to displace existing dirty energy supply instead of simply buying up existing renewable energy capacity. A key consideration in measuring additionality is making sure that any additional renewable energy is not counted by the utility to meet its existing renewable or carbon regulatory obligations.

With the number of companies wanting to purchase renewables from local sources rapidly increasing, a growing challenge is how to meet this demand in electricity markets that do not provide a scalable pathway to directly purchase renewable electricity via the utility. Alongside the rise of "Virtual PPAs," the practice of "REC swapping" and "replacement RECs" has recently emerged to reduce the cost of these deals to the buyer. These types of arrangements have arisen in markets where the local REC price is much higher due to market demand driven by regulatory obligations for local renewable development. Renewable energy developers offer a PPA or Virtual PPAs from a nearby renewable project, but unbundle and retain the RECs actually generated by the project, and agree to

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provide the corporate purchaser with "replacement RECs" typically from surplus markets in Texas or Oklahoma where the RECs may be one-tenth the cost or less. The developer would in turn sell the local RECs to a utility that needs them to meet their regulatory obligations. While these deals have more impact than just buying national RECs, and may be helping to displace demand for dirty energy sources within the regional grid, the additional nature of the deal is called into question, as the utility would have otherwise been required to fulfill its regulatory obligation to provide a certain amount of renewable electricity in its generation mix.

In addition to better company reporting of its footprint on a facility or regional level, much greater transparency is needed in how companies are contracting for and counting RECs delivered via their renewables PPAs. Questions should be answered with each renewable deal announcement:

- Disclosure of current or expected electricity demand of facility that will be powered from the purchase of renewable energy.

- Basic details on source(s) and expected amount of renewable electricity to be produced, and means by which it was purchased (PPA, Green Tariff, Direct Access, etc.)

- Publicly acknowledging whether they are retaining and retiring the RECs generated from the project or if they are sold in whole or in part

- Retention of a environmental attributes: An additional element that will likely become important in the US market under the Clean Power Plan is whether the company signing the renewable energy PPA retains "all environmental attributes" that come from the renewable energy, or if the carbon benefits are retained to sell to the utility for purposes of meeting its carbon performance obligations.

4) Advocacy: Increasing Renewables on the Grid

Despite the significant leadership by IT companies in many markets to deploy renewable energy at record breaking levels, much more needs to be done to change the regulatory and policy framework to enable a transition to renewables at the scale and speed necessary to tackle the threat of climate change. Corporate renewable deals only in those places like Texas, where it is cheapest and easiest to buy, is not an impactful strategy for companies with 100% renewable commitments and have data centers in markets like Virginia, South Korea and others that remain heavily dependent on fossil fuels and lack

options to purchase renewable energy. Opening market access to renewable deals through renewable tariffs can be an important catalytic first step, but support for bigger and more transformative policy changes needed to drive investment toward renewables as rapidly as possible.

Given the critical need to shift energy policy to accelerate renewable investment, particularly in monopoly markets in Asia and the US Southeast, we have added a separate evaluation for company advocacy in this year's report. Even in more liberalized markets, stronger corporate advocacy is needed for policies that will green the broader grid, narrowing the gap that they need to cover to be able to achieve and maintain a 100% renewable supply.

Collaborative Policy Advocacy

- Supporting US Clean Power Plan (US EPA): Amazon, Apple, Google, and Microsoft filed a joint amicus curie brief with the DC Circuit Appellate Court in support of the US EPA's Clean Power Plan that will place carbon emission standards on power plants, citing their experience that renewable energy is good for the environment and good for their business (March 2016).[79]

- Shifting Investment to Renewable Energy (Virginia): Adobe, Facebook, Equinix, LinkedIn, and Microsoft joined several other corporations with sizable operations in Virginia and sent a letter to Virginia utility regulators supporting increased and diversified renewable energy supply in VA as part of Dominion Power's Integrated Resource Plan submission for 2015.[80]

- Blocking Rollback of Renewable Energy Standard (North Carolina): Apple, Google, and Facebook, who all operate large data centers in the state, sent a letter to the leaders of the state assembly, asking that any proposal to freeze the state's renewable portfolio standard be rejected.[81]

Customer Related Advocacy

Lacking any information on the source and amount of energy linked to the use of the AWS cloud, 19 AWS customers, including Hootsuite, Tumblr, Change.org and The Huffington Post, sent a letter to AWS encouraging it to "commit to transparency on energy and environmental performance, including publishing information describing AWS' energy and carbon footprints and progress toward renewable energy goals." [82]

Overall, Google, Apple and Switch have demonstrated the strongest leadership on clean energy advocacy in the past year, each using different avenues of influence to push for policies that will increase renewable energy access and deepen investment in deployment of renewable solutions.

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Appendix I:
Methodology

Appendix I: Methodology

To evaluate performance, Greenpeace uses information provided directly as well as publicly available information from each company, including corporate communications, public submissions to stakeholders, reporting bodies, media coverage, or published reports to analyze performance.

Overall Grade (Column 1)

Overall grades are weighted as follows: Transparency (20%); Renewable Energy Commitment & Siting Policy(20%); Energy Efficiency & GHG Mitigation (10%); Renewable Energy Procurement, including current energy mix (30%); Advocacy (20%

Clean Energy Index methodology (Column 2)

Greenpeace has established the Clean Energy Index as a response to the lack of useful metrics and publicly available data to evaluate and compare the energy footprints of major cloud providers and their respective data centers.

This lack of data is not due to the fact that data does not exist. However, many companies remain unwilling to provide basic information about both the amount and source of their growing electricity consumption. Despite a proliferation of metrics created by the industry (such as PUE) that attempt to quantify how green a data center is as measured by energy efficiency, very few companies report under newer metrics (such as Green Energy Coefficient, GEC) that could shed any light on the basic question: how much dirty energy is being used, and which companies are choosing clean energy to power the cloud?

The Clean Energy Index attempts to provide a basic answer to this question, based on what is provided by companies or gleaned from the limited information available, and focusing on recent data center investments of select brands and the current clean energy supply associated with each investment.

Starting with an initial set of some of the largest cloud providers, Greenpeace has attempted to identify two main inputs from a representative sample of their most recent (five years or less) infrastructure investments.

Those inputs are:

(1) Estimated size of electricity demand of each facility (in megawatts);

(2) Amount of renewable electricity being used to power it (by percentage).

This information is then used to approximate, initially on a facility level, the number of megawatts of clean energy the facility will consume. Having calculated a facility-level Clean Energy Index for at least a representative sample of data centers, Greenpeace derives a company average of clean energy percentage across its facilities.

In compiling the information included in this report, Greenpeace contacted all companies featured here and asked for information regarding their data center facilities, and for information on their energy commitment and infrastructure siting, energy efficiency and mitigation efforts, renewable energy procurement and renewable energy advocacy. Where clear and consistent information is not provided by the company, Greenpeace made estimates of data center power demand available to companies for comment in advance of publication, and issues raised by the companies are highlighted in footnotes on the scorecard.

The above inputs are taken from the following sources:

- Submissions by companies directly to Greenpeace

- Public submissions by companies to reporting entities or stakeholder publications

- As defined by company when announcing investments

- As reported by the media (in stories on the investments or construction of facilities, etc.)

- Electricity demand is derived by taking the announced size of investment and deriving total number of MW, using industry average cost per IT load multiplied by publicly available PUE for facility or, if not available, 1.5 for new facilities.

- When relying upon backup generator permits to calculate the estimated electricity demand of a facility, Greenpeace made conservative assumptions regarding the total power the generators are needed to cover, as well as the number of generators deployed for redundancy.

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If not reported by the company, the generation mix of the electricity is taken from one of the following sources, as available, in declining order of preference:

- The most recent published generation mix of the local utility or state regulatory agency.

- In the U.S., the 2012 eGrid State level generation mix as reported by U.S. EPA, or if not applicable, reported subregional egrid generation mix.

- Outside the U.S., national data or regional (e.g.European Commission) data, and then International Energy Agency 2013 statistics.

Important Note: This analysis does not attempt to represent itself as a comprehensive snapshot of how much clean energy is being consumed on a company-wide level. Only the companies can properly provide that.

Greenpeace would welcome the opportunity to incorporate more detailed data to inform our analysis, as that would likely provide a more complete and refined picture of cloud providers' energy use. As companies provide better data, Greenpeace will incorporate this into our evaluation and encourage other companies to follow.

For those companies who have adopted 100% renewable energy targets and provide facility level energy details, Greenpeace will use current consumption and renewable procurement data provided by the company instead of designed facility capacity.

Coal, Nuclear and Gas Intensity (Columns 3–5)

A company's coal intensity is a simple calculation of the approximate total percentage of coal-generated electricity powering the company's data centers. A company's nuclear and gas intensities are similar: simple calculations of the approximate total percentages of nuclear- and gas-generated electricity powering the company's data centers. This is calculated initially on a facility level, based on the estimated maximum power demand of the facility and the percentage of coal and nuclear-generated electricity supplied by the contracting utility or the local grid.

The company-level intensity of coal, nuclear and gas energy is rendered by adding the total MW of estimated maximum power from coal, nuclear and gas generation across the sample data center fleet, divided by the total estimated MW maximum power demand of the same sample data centers.

Energy transparency methodology (Column 6)

Companies are evaluated on the scope and level of detail made publicly available on energy consumption of IT infrastructure that allow stakeholders and customers to evaluate the energy-related environmental performance and impact at corporate, product, and facility level. Public information includes information from a company's website, annual reports, submissions to regulatory agencies or information clearinghouses such as the CDP.

- For corporate and facility-level reporting, key elements of information include: location and size of facilities; size of electricity demand; generation mix and associated carbon content (including power purchase agreements specific to the facility), and carbon intensity of data delivery and storage. Reporting should include both owned and rented facilities.

- For customer level reporting, companies should provide regular energy and carbon footprint information (pre-offset) associated with the customers' consumption, reported in a manner consistent with established reporting protocols.

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Renewable Energy Commitment & Infrastructure Siting methodology (Column 7)

Companies are assessed on the strength of their commitment to powering their data centers with renewable energy, including infrastructure siting criteria and investment decisions that enable the development of the company's IT infrastructure to maximize the use of clean sources of energy, and avoid an increase in demand for coal or nuclear power to meet the growing demand for electricity from their operations. High-scoring companies demonstrate:

- Adoption of a 100% renewable energy commitment

- Renewable energy procurement guidelines that prioritize high impact methods of powering with renewable energy that demonstrate additionality, proximity to demand, and sustainability, as opposed to purchase of unbundled renewable energy credits or carbon offsets.

- A clean energy siting policy to prioritize IT infrastructure investments or procurements that rely primarily upon renewable energy as a source of electricity and discriminate against coal and nuclear power to meet infrastructure electricity demand.

- Consistent patterns of major infrastructure investment decisions that increase or shift electricity demand to renewable sources of electricity.

- Commitment to eliminate coal, nuclear and gas energy from powering company infrastructure.

Energy Efficiency & GHG Mitigation Strategy methodology (Column 8)

Companies are evaluated on the strength of their strategies and measurable progress to mitigate the demand for dirty energy generated by their IT infrastructure. The effectiveness and strength of a company's mitigation strategy is measured along the following guidelines:

- Companies with absolute emission reduction goals will be rated higher than those companies who adopt an intensity-based target.

- Investments in clean energy supply and local energy efficiency mechanisms. Greenpeace ranks those investments higher than the purchase of offsets and renewable energy credits to reach established environmental goals.

- Companies are credited for participating in open-source sharing of energy efficient design and equipment specification to enable further learning and improvement within the sector.

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Renewable Energy Procurement methodology (Column 9)

Companies are assessed on the strength of their measurable progress and commitment to renewable energy investments. In reporting their renewable procurement, companies should follow the guidance established in the recently adopted Scope 2 Guidance of the Greenhouse Gas Protocol, which established clear reporting requirements for reporting market-based purchasing of renewable electricity. High scoring companies also demonstrate:

- Efforts to meet electricity demand with the direct installation of renewable energy, and reduce emissions through higher efficiency will receive the highest marks.

- Efforts to meet their electricity demand with the long-term PPAs or from local or community renewable energy developer or utility.

- Companies are credited in selecting renewable energy option for their cloud services or colocation facilities.

Advocacy methodology (Column 10)

Companies are evaluated on actions taken to advocate for ambitious policies at all levels of government that encourage wide-scale renewable energy generation and use. High-scoring companies also demonstrate:

- Top level advocacy with the national/regional policymakers for policies that result in greater access to renewable energy or greater amounts of renewable energy connects to the grid.

- Proactive advocacy with utilities for more access or for grid-wide investment in renewable energy.

- Proactive advocacy with existing cloud services, colocation or CDN vendors for a renewably powered product.

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Appendix II:
Company Scores
Explained

Appendix II: Company Scores Explained

To evaluate performance, Greenpeace uses information provided directly as well as publicly available information from each company, including corporate communications, public submissions to stakeholders, reporting bodies, media coverage, or published reports to analyze performance. Please see Appendix I: Methodology (page 42), for fully explanation of scoring methodology and basis for calculation of Clean Energy Index and company energy mix.

Adobe

B | **23%** | **23%** | **37%** | **11%**

Adobe is a global software company, whose products are among the most widely used in the creation and viewing of digital images and documents. Adobe delivers its products from its own data center in Oregon, several colocation facilities, and uses AWS to host aspects of its "Creative Cloud.

B Energy Transparency: Adobe provides annual updates on its energy and environmental footprint through its website, and detailed submissions to CDP, including data center electricity consumption. Adobe has also provided Greenpeace with more detailed estimates of consumption across individual data center facilities.

A Renewable Energy Commitment: Adobe significantly increased its commitment to renewable energy since our last report, committing the company to be 100% renewably powered by 2035,[83] and has articulated its strategy for pursing this goal to prioritize in the following order: Energy efficiency; Onsite renewables where feasible; Advocacy to increase renewable energy on grid; Renewable power purchase agreements for new projects in locations they have operations.[84]

B Efficiency and GHG mitigation: Adobe has implemented a range of energy efficiency measures across its operations, and has an annual energy reduction target of 3.5% per year, but this goal does not apply to its own data center.[85] Adobe reports a maximum PUE of 1.4 across its thirteen data centers, putting it below the industry average.[86]

B RE procurement: Adobe recently shifted a significant portion of its data center operations away from a high carbon colocation operation to its Oregon data center that has a much cleaner supply of electricity, following its engagement with colocation vendors to provide renewable energy.[87] Adobe purchased unbundled RECs toward the achievement of its 2015 carbon neutral goal, but expressly did not count them, stating "[W]e believe unbundled RECs in the volume needed for carbon neutrality claims for Adobe do nothing to move the market in renewable energy."[88]

A Advocacy: Adobe significantly stepped up its clean energy advocacy among both government and its vendors, emerging as one of the leaders in the sector. Adobe was one of nineteen customers of AWS who publicly wrote to urge the company to adopt greater energy transparency and to increase its supply of renewable energy.[89] Adobe was also one of several IT leaders who pushed regulators in Virginia to increase investment in renewable energy placed on the grid by the local utility Dominion Energy.[90] Adobe also signed American Business Act on Climate[91] and the Corporate Renewable Buyer's Principles.[92]

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Alibaba.com™

D | 24% | 67% | 3% | 3%

Alibaba is the world's largest retail platform.[93] Alibaba runs dozens of cloud computing and colocation data centers in China. They are also rapidly expanding data centers operations overseas, such as Singapore and the US. Alibaba did not respond to our request for company's energy data.

F **Energy Transparency:** Alibaba has no publicly available information on energy or greenhouse gas.

F **Renewable Energy Commitment:** Alibaba has no publicly available evidence.

C **Efficiency and GHG mitigation:** Alibaba's Qiandaohu Data Center utilized natural lake water in their cooling system. It is claimed to obtain PUE as low as 1.3. Alibaba's new data center in Zhangbei county is experimenting to use wind tower to cool down the servers, as to save power from traditional air-conditioning.

F **RE procurement:** Alibaba's new data center in Zhangbei has been sited for abundant supply of wind power. Zhangbei is part of the designated "renewable energy zone" in northern China.[94] Although Alibaba has built its own solar power facilities, the total capacity, 200kW, is too little to make meaningful contribution to the company's total power consumption.

D **Advocacy:** Although Alibaba's chairman, Jack Ma, has been advocative on climate issues at public events, there is no accessible evidence showing the corporate has made official efforts in promoting renewable energy.

amazon.com™
web services

C | 17% | 30% | 24% | 26%

Despite being home to some of the best known properties on the internet, the world's largest cloud company continues to remain among the least transparent in revealing the energy footprint of its rapidly expanding global infrastructure. Though it has taken additional public steps toward making its cloud renewably powered, including the signing of three renewable energy projects in the past year, our analysis of recent investments indicate AWS' overall Clean Energy Index % fell sharply since our last report, as the company's near doubling of data center capacity in Virginia far outstripped the addition of renewable energy supply.[95] An important bright spot is the significant increase in renewable energy advocacy by AWS, where it has begun to emerge as one of the leaders within the sector in using its influence to push for renewable energy policy. But without greater transparency and evidence of a real commitment to link its growth with renewable electricity as Google, Facebook, and Apple have, customers of AWS should remain concerned the company's rapid expansion will continue to increase the demand for electricity from coal and other polluting sources.

F **Transparency:** AWS' greatest barrier to earning the confidence of its customers in its 100% renewable energy goal continues to be its lack of transparency. Major customers of AWS remain unable to get energy data of their use of the AWS Cloud that they can use for reporting and measuring their own impact.[96] AWS did finally make public at least a broad range of its current annual power demand (500-650MW),[97] however the continued lack of detailed data from AWS on its energy consumption also make it impossible to place its recent renewable energy purchases in context, preventing customers from making informed decisions about whether to use AWS, or in which part of the AWS infrastructure to host. AWS claims five regions that are "Carbon Neutral",[98] but it provides no definition of what this means, or how it is able to deliver this claim. Is AWS' Ireland region greener than its Frankfurt region? Will U.S. Central (Ohio) be greener when it comes online than U.S.-East (Virginia)? Unfortunately it is impossible for AWS customers or the broader public to answer these questions accurately without greater transparency by AWS.

D **RE Commitment & Siting Policy:** AWS took a big step forward with its November 2014 long-term commitment to be powered by 100% renewable energy, and has since built upon this goal with a more specific target of 40% by the end of 2016. However, just in the past year since the adoption of its 100% renewable commitment, AWS has made dramatic investments in new data center facilities in Ohio and Virginia,[99] both of which are predominantly coal-powered, as well as in India, the U.K.,[100] and South Korea,[101] and has similarly not indicated its plans for procuring renewable energy to match its demand in those locations.[102] By contrast, Facebook, Google and Apple, which have renewable siting policies in place that prioritize access to renewable energy, have increasingly used their leverage in choosing new data centers regions to secure 100% renewable sources of energy. Examples include Denmark,[103] Ireland,[104] Sweden, and United States (Alabama,[106] Arizona,[107] Iowa,[108] New Mexico and Texas[109]). AWS needs to do more to ensure that its renewable energy pledge is actually guiding its growth by similarly prioritizing access to renewable energy in its siting policy when choosing new data center locations.

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C **Energy Efficiency & Pollution Mitigation:** AWS has regularly touted high utilization rates and energy efficiency in making the case that cloud computing creates fewer carbon emissions than in-house data hosting. Unfortunately, AWS does not release actual data of its own to help customers substantiate the potential benefits, pointing primarily to studies that use "average" data points.[110] Greenpeace has little doubt that AWS runs a highly efficient cloud operation with utilization rates much higher than the average in-house data center, but customers cannot quantify those gains, or compare Amazon to competitors, without actual data.[111] Google, by contrast, reports robust data on its efficiency efforts and publishes actual PUE data. AWS' partnership with Tesla to do a significant test deployment of utility scale storage at one of its data centers is promising, potentially allowing them to increase their reliance on renewable sources of electricity if successful.[112] We look forward to learning from AWS with this important pilot.

C **RE Procurement:** In 2015 AWS showed important leadership in scaling its renewable energy commitments. The company executed three breakthrough deals in the states in which their data centers reside. However, while AWS signed sizeable PPA's, financially enabling these projects to move forward, and even securing the naming rights for each, it appears as if AWS did not actually retain the underlying RECs for their projects. Instead it appears that unbundled replacement RECS were purchased for AWS from a national pool, effectively undermining its own claims of added renewable energy.(see page 39) Google, Apple, and other leaders have announced clear principles for their 100% renewable energy goals, both noting the importance that renewable electricity purchases should add additional energy to the grid, and that all environmental attributes associated with such projects would be retired. AWS must provide greater transparency on the nature of its renewable contracts and carbon neutral claims.

B **Renewable Energy Advocacy:** Amazon significantly stepped up its clean energy and climate advocacy over the past year, both through its utility relationships and with policymakers.[113] At the U.S. national level, in addition to joining the Clean Power Plan Amicus Brief (see page 41), Amazon supported the extension of the important tax credits for renewable energy. In Ohio, Amazon pushed for the a repeal of laws restricting wind development,[114] and in Virginia, AWS was successful in negotiating an innovative energy management deal with Dominion Virginia Power, with Dominion agreeing to manage the energy from AWS's PPA, integrate the energy produced from various Amazon wind and solar farm projects onto the grid that serves AWS data centers, providing a single blended rate to AWS for its electricity demand in Dominion territory.

A **83%** **5%** **4%** **5%**
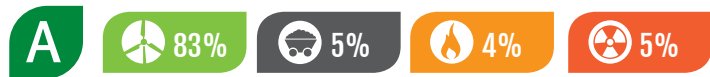
Apple has remained among the most aggressive in the sector in its efforts to power its online platform with renewable energy. Apple continues to play an important role in opening access to renewable energy new markets where it has located its data centers, such as the company's most recent data center in Arizona. Apple has also played a catalytic role within its IT supply chain, pushing other IT data center and cloud operators who help deliver pieces of Apple's corner of the internet to follow their lead in powering their operations with renewable energy, though with slower success than its own data centers thus far.

A **Transparency:** Apple provides the clearest and most detailed reporting of the major data center operators on the energy performance of its own data centers, including detailed consumption and details on how its renewable contracts or investments have changed the grid mix for each data centers. While Apple's reporting on its collective colocation footprint has improved this year, Apple should take the next step forward by making public those companies who are working to help Apple achieve its goal to have a 100% renewably powered corner of the internet.

A **Renewable Energy Commitment & Siting Policy**: Since adopting its 100% renewable commitment in 2012, Apple has maintained a strong siting policy, requiring any new data center location to have the ability to secure 100% renewable energy. Also to its credit, Apple has also maintained strong principles guiding its pursuit of its renewable electricity supply, with the requirement that any new load Apple is creating is also met with the equivalent new renewable supply, regardless of underlying grid mix. Apple's most recent data center expansion in Ireland, Denmark, and Arizona all have been developed from the beginning with plans for a renewable electricity supply.

A **Energy Efficiency & GHG Mitigation:** In addition to its efforts to increase its supply of renewable energy, Apple reports its efforts to reduce energy consumption and greenhouse gas footprint associated with its data centers through a variety of measures, and like a number of other companies, has deployed data center designs in northern latitudes to take advantage of open air cooling opportunities. For its new data center in Denmark, it will be designed to directly inject waste heat into the local heating district, reducing fossil fuel demand elsewhere.

A **RE Procurement:** Apple continues to match the expansion of its own data centers with an equivalent local supply of renewable energy to match this growth. Although details on the renewable energy supply for its most recent data centers in Denmark and Ireland have not yet been announced, Apple recently confirmed a significant new solar project that will provide renewable energy to its new data center "Control Center" in Mesa, Arizona, with the local utility agreeing to a long-term PPA for the output of the 50MW project owned by Apple. Apple has also been busy keeping up with its rapidly growing data center in North Carolina, bringing its third solar project online, and become the second customer to publicly announce a deal under Duke Energy's Green Rider renewable tariff program.

B **Advocacy:** Apple has continued to evolve as an even stronger corporate advocate for climate and clean energy policies. Along with Google, Microsoft, and Amazon, Apple filed a brief in support of the US EPA's Clean Power Plan. (see page 41) Apple has also been very active at the state level in the U.S. In North Carolina, where it operates its largest data center, Apple joined Facebook and Google to defend existing renewable policies from attack(see page 41). While Apple had some success in getting its colocation suppliers to provide a renewable hosting service, its recent decision to significantly expand its reliance on Dupont Fabros Technology infrastructure in both Chicago and Virginia seem to be a step in the wrong direction.

Bai du 百度

F **24%** **67%** **3%** **3%**

Baidu is the most used internet search provider in China. Approximately 92% of Chinese internet users used Baidu as their internet search engine. Baidu uses colocation and owns self-built data centers. Baidu did not respond to our request for company's energy data.

F **Transparency:** Baidu has no publicly available information on energy or greenhouse gas.

F **Renewable Energy Commitment & Siting Policy**: Baidu has no publicly available evidence.

D **Energy Efficiency & GHG Mitigation:** Baidu's Yangquan Data Center and the M1 Data Center have applied innovative technology to increase energy efficiency and reduce greenhouse gas.

F **RE Procurement:** A very small solar power facility has been installed in the Yangquan Data Center. The total capacity of renewable energy generated by Baidu is 66.79 kW. No further information has ever been provided by Baidu.

F **Advocacy:** No publicly available evidence.

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Appendix II:
Company Scores
Explained

| A | ⚡ 67% | 🔋 15% | 🔥 7% | ☢ 9% |

Home to the three largest social networks (Facebook, Messenger, and WhatsApp) in the world,[115] Facebook's decisions on how to power its data centers have a large bearing on how quickly we can build a renewably powered internet. Facebook was the first major internet company to commit to be 100% renewably powered and continues to play a leadership role within the sector. Showing strong transparency and a track record of its five latest data centers sighted in locations that allowed them to be renewably powered.

A Transparency: Facebook's reporting of the operational footprint of its data centers remains among the clearest and most accessible among major data center operators, particularly tracking its year over year progress.[116] Facebook provides not only aggregate data on its progress, but also shows facility level detail on both energy and carbon footprint for each of its data centers, and any adjustments that should be made as a result of any purchases of renewable energy.[117]

A Renewable Energy Commitment & Siting Policy: Since adopting a commitment to become 100% renewably powered, Facebook also adopted an interim goal of 25% renewable by 2015, which given their reporting of 35% renewably powered at the end of 2015, is easily achievable. Facebook has since adopted a new interim target of 50% by 2018.[118] Facebook's expansion of its own data centers in Texas,[119] Ireland,[120] and most recently in New Mexico[121] provide compelling evidence that Facebook is making access to renewable energy a core requirement for its growth strategy. The exception to this excellent track record is Facebook's recent decision to expand the amount of data center space it is leasing from Dupont Fabros Technology in Northern Virginia,[122] which is dependent on a dirty energy supply from Dominion Energy(see page 31).

A Energy Efficiency & GHG Mitigation: Facebook has remained a critical driver of the Open Compute Project(OCP), which it launched in 2011 to share best practice in designing and operating energy efficient data centers. OCP continues to grow as more major data center operators join, including most recently Google. While Facebook has directed much of its growth to its own renewably powered data centers, Facebook still continues to rely fairly heavily on leased data center space from Dupont Fabros Technology in Virginia, who lags at the bottom of our rankings of US colocation operators. Shifting load from these facilities to its own facilities or to colocation operators who are willing to shift to a renewable supply of electricity would help keep it on its pathway to be 50% renewable by 2018.

A RE Procurement: Since adoption of its 100% renewable commitment, the location of Facebook new data centers in Iowa, Ireland, Texas, and in New Mexico have all been conditional on Facebook's ability to secure renewable energy. Facebook has aggressively negotiated for and subsequently signed major contracts for renewable energy at each of these locations, bringing a total of 550 MW of new renewable capacity online. With the announcement of its latest data center in Las Lunas, New Mexico, Facebook was able to secure a special rate tariff and commitment by the local utility to sign three solar PPAs to meet the initial power demands of the Facebook facility, with Facebook able to purchase this power effectively at cost.[123] Facebook's largest data center by energy demand is in North Carolina.[124] While both Apple[125] and Google[126] have moved forward to sign contracts under Duke Energy's new Green Source Rider renewable electricity tariff for their data centers in North Carolina, Facebook has not to date. This is a gap in their RE commitment as Facebook's operation continues to increase its demand from Duke Energy's electricity mix that contains less than 2% renewables.

B Advocacy: Facebook has been active in pushing for better access to renewable energy in the states it has operations. Facebook joined Apple and Google in defending North Carolina's renewable energy law. (see page 41) Facebook also a signed letter to Dominion Energy in support of a stronger renewable energy investment plan in Virginia. (see page 41) While Facebook has also been active with a number of several business collaboratives that support better options for corporations to buy renewable energy. However, Facebook has not been vocal in its support of key policies at the federal level, most notably the Clean Power Plan. Given its recent decision to increase its reliance on Dupont Fabros Technology data centers, it would seem to indicate Facebook is not using its leverage as its second largest customer[127] in the same way it has with utilities for its own data centers.

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Google

A   ⚙ 56%   ⛏ 15%   🔥 14%   ☢ 10%

Google took several significant steps forward since our last report toward a renewably powered Google Cloud, building on its strength of advocacy and renewable procurement, but also improving its renewable energy deployment in new markets to keep pace with its rapid growth. Google still has significant room to improve in regards to transparency, however, lagging behind Apple, Facebook and Switch in providing facility level energy demand data.

B **Transparency:** Google's energy transparency has improved slightly over the past year, good enough to again beat cloud computer peers like Microsoft and Amazon, but still far behind its platform competitors such as Apple and Facebook. Google now reports location specific PUE data as well as very basic data on its colocation footprint, along with a breakout of its energy footprint on a regional basis. However, unlike Facebook and Apple, Google still does not provide energy demand or energy mix at a facility or even for regional locations of its cloud platform(Google Computer Platform, GCP), making it difficult for customers to make informed decisions on whether to choose GCP and in which location.

A **Renewable Energy Commitment & Siting Policy**: Google strengthened its commitment to becoming 100% renewably powered in a number of important ways over the past year, including a clear articulation of the principles and criteria it follows to increase its supply of renewable energy, including a strong additionality component.[128] Google has improved on synchronizing its plans for expansion with the ability to make progress on its renewable energy goals. This is evidenced by recent expansions in the United States (Alabama[129] and Oklahoma[130]), South America (Chile[131]), and the EU (Netherlands[132]), all of which have been matched with a strategy to deliver enough renewable energy to match their electricity demand. It is important for Google to maintain this integrated approach as the company has announced its intention to rapidly expand GCP to 10 additional regions in the coming year.[133]

A **Energy Efficiency & GHG Mitigation:** Google announced a near term goal of tripling the amount of renewable energy it purchases by 2025, growing from its already significant 1.1GW to over 3GW.[134] Google in the past year has increased its transparency for driving improvements in energy efficiency in its data centers,[135] [136] including the use of machine learning to optimize data center operations and drive significant gains in energy efficiency.[137] Google also became a contributing member of the Open Compute Project.[138]

A **RE Procurement:** Google has been extremely active in the past year purchasing renewable energy for its operations, with nine additional renewable energy contracts[139] executed since our last report. Totaling over 1.3GW of new renewable energy for the company's data centers. These new contracts now bring the total global renewables purchased to 2.5 GW.[140] Additionally, Google was the first customer to announce a renewable contract under Duke Energy's Green Source Rider for its existing North Carolina data center.[141] This contract seals years of advocacy leadership by Google that initially drove the launch of this program with Duke Energy.[142]

A **Advocacy:** Google continues to set the bar for clean energy advocacy within the sector, actively engaging in important policy debates across the jurisdictions of its rapidly growing infrastructure. Google has been particularly active in its support of the US EPA's Clean Power Plan, providing comments encouraging the EPA to increase its support of renewable in the implementation of the plan. [143] [144] Google also joined Amazon, Apple, and Microsoft in filing a brief in support of the plan. (see page 41) Google has also been very active at the state level in the U.S., particularly in the Southeast, where it has played an important role both in defending existing renewable policies from attack (see page 41), as well as expanding utility investment and access to renewables in monopoly utility markets like Georgia.[145] Google has also been active in supporting the strengthening of renewable energy markets in the EU,[146] [147] and has provided seed funding to support the establishment of renewable energy tracking programs in Taiwan and other parts of Asia.[148]

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Explained

hp®

C   🌀 **50%**   ⛏ **27%**   🔥 **17%**   ☢ **5%**

Along with eBay, HP has recently undergone a major restructuring and separation of business operations, with HP Enterprise(HPE) emerging to operate its data center business for enterprise customers. HPE has since embraced its own 100% renewable energy commitment, and signed its first major renewable energy deal.

D **Transparency:** HP Enterprise (HPE) provides an annual disclosure of its electricity use and carbon footprint only at the corporate level through its Living Progress report. HPE still does not provide any breakout on its data center specific energy information at either the fleet wide or facility level, putting it well out of step with sector leaders.[149]

B **Renewable Energy Commitment & Siting Policy**: HPE took an important step forward with its adoption of a long-term commitment to 100% renewable energy in mid 2016, along with an interim target of 50% by 2025.[150]

C **Energy Efficiency & GHG Mitigation:** HPE recently adopted a new GHG reduction target for its own operations of 25% by 2025, measuring from a 2015 baseline, and has also set an aggressive energy efficiency performance target for its data center products of 30X improvement by 2025, using a 2015 baseline. HP Project Moonshot high-efficiency server products do have significant potential to reduce server energy demand, but there is limited data available on their levels of adoption to date.

B **RE Procurement:** HPE's recent decision to sign a long-term contract for 112MW of new wind energy, enough to power its Texas data centers with 100% renewable energy, was an important step forward on its 100% renewable energy commitment.[151]

C **Advocacy:** HPE's predecessor had been a consistent supporter of climate and renewable energy policies. HPE has been less vocal on these issues since becoming a separate company. HPE did sign the Low Carbon USA ad in the Wall Street Journal,[152] and has rejoined many of the sector collaborations around renewable energy that it was part of under HP, but HPE has been much quieter on the advocacy front than HP Inc since the separation.

IBM

C   🌀 **29%**   ⛏ **27%**   🔥 **29%**   ☢ **15%**

IBM continues to seek a position in the top tier of global cloud companies, focusing on its strengths among enterprise clients and its growing analytics offerings. IBM's historic strength in energy transparency has not yet carried over to IBM's data center operations. Recent commitments to increase the amount of renewable energy powering its operations to 20% by 2020 remain an indication IBM thinks that renewable energy and climate protection remain important, but IBM remains steadfastly on the sidelines compared to other IT sector leaders in advocating the renewable energy and climate change policies that are needed to deliver a "Smarter Planet"™.

C **Transparency:** IBM provides detailed energy usage and GHG footprint at the company level in its environment report, including its renewable energy procurement, but does not provide a specific breakout of its data center energy related consumption.[153] Softlayer, IBM's cloud computing subsidiary does provide a detailed listing of its data centers and server capacity, but does not provide energy performance data.

B **Renewable Energy Commitment & Siting Policy**: In 2015 IBM established a goal to procure electricity from renewable sources for 20% of its total electricity consumption by 2020, which it appears on target to easily achieve.[154] IBM has also renewable adopted procurement principles that guide it to work directly with its electricity suppliers to purchase renewable energy, rather then rely on renewable energy credits as an offset mechanism. IBM should leverage its influence as a customer and adopt longer term transformative goals for its supply of renewable energy.

C **Energy Efficiency & GHG Mitigation:** IBM has a well-established track record in driving energy efficiency goals to reduce its GHG operational footprint, and recently adopted third generation CO_2 reduction goal in 2015 to reduce reduced 28.7% from its 2005 base line.[155] However, IBM does not provide sufficient detail on how its energy efficiency efforts are reducing its data center energy footprint.

C **RE Procurement:** IBM has purchased 679,000 MWh of renewable energy company wide in 2015. Highlighting its five Texas based data center, IBM indicates these facilities are 100% renewably powered.[156] However, due to the lack of transparency on data center energy demand, it remains difficult properly assess how its renewable electricity supply maps against its rapidly growing data center fleet.

F **Advocacy:** Despite its own renewable energy procurement experience, IBM has remained steadfastly on the sidelines of the renewable energy and climate policy debate at both the federal and state level in the United States. Even where renewable policies have come under threat in states where IBM has major operations (North Carolina), IBM has remained on the sidelines while other IT leaders have stepped forward to defend these policies as important to their continued growth.[157]

Microsoft

| B | ⚙ 32% | ⛏ 31% | 🔥 23% | ☢ 10% |
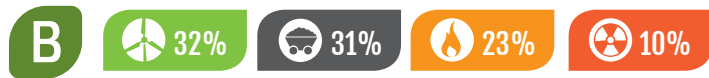
Microsoft is one of the world's largest and fastest growing cloud computing companies, and has been aggressively increasing its investments in new data centers over the past year.[158] For our last two Click Clean evaluations, Microsoft has been a solid C student at best, due largely to the company's reliance on unbundled RECs and offsets as the primary basis for laying claim to both its Carbon Neutral and 100% renewable goals. However, a new policy and commitments recently announced by Microsoft President Brad Smith have apparently marked an important shift in strategy, pointing Microsoft away from its claim of its data centers are already 100% renewable.[159] President Smith pointed to a new goal of Microsoft data centers that directly rely on renewable sources of electricity, currently at 44%, and established a near term goal of 50% renewable by 2018.[160] While this shift in focus in Microsoft's policy is welcome, a much greater sense of urgency on the implementation side is needed given the rapid expansion of Microsoft's cloud infrastructure currently underway.

B Transparency: With its new transparency commitment Microsoft has begun to lift the veil on its actual performance toward its 100% renewable commitment and is now tracking a near term goal of being 50% powered from sources that directly rely on renewable energy by 2018. Microsoft has also begun to provide regional reporting of its data center energy demand and respective energy mix without its reliance on unbundled RECs, though Microsoft still lags far behind sector leaders Apple and Facebook who provide detail facility and regional reporting information on their data centers.

B Renewable Energy Commitment & Siting Policy: Microsoft's shift to measuring the amount of renewable energy directly powering its data centers and the corresponding establishment of a near term target of 50% by 2018 is a significant upgrade from its previous claims of already being "100% renewable." Microsoft's new commitment has also strengthened its renewable procurement standards, particularly the retirement of all project related RECs and other environmental attributes from its PPAs. Microsoft should complete its transition, and abandon its historical practice of buying unbundled RECs to meet its "carbon neutral" goals, as Google has already done, and focus its resources on actions that will actually impact the amount of renewable energy powering its data centers.

C Energy Efficiency & GHG Mitigation: While innovative R&D projects using underwater data centers have earned Microsoft some acclaim,[162] the centerpiece of Microsoft's greenhouse gas mitigation strategy is an internal carbon fee it adopted in 2012 to help inform decision-making across the company's global operations as part of its "carbon neutral" commitment. Microsoft has begun to provide reporting on how this revenue is being reinvested.[163] While a portion of the revenue from this carbon fee is clearly driving investments in energy efficiency projects tied to Microsoft's own operations and is saving the company money, much of this revenue still appears directed to unbundled REC and offset projects that do little to adjust Microsoft's trajectory toward becoming a greener company, reflective of Microsoft's previous strategy. With the new focus and commitment articulated by President Brad Smith,[164] hopefully the carbon fee status update will reflect a greater impact on Microsoft's own energy footprint.

B RE Procurement: Microsoft has sought to maximize impact with the two renewable contracts it has signed thus far. Some companies who have signed PPAs in US Midwest and Mid-Atlantic regions and elected to swap the RECs for cheaper replacement RECs from outside the region(see page 40-41). Microsoft instead has chosen to retire the project RECs to maximize impact. While Microsoft signed two significant renewable PPAs in 2013 and 2014, its direct purchase of renewable energy has since come to an apparent standstill, with over 26 months passing since the last PPA,[165] despite 2015 being a record year for corporate renewable contracts.[166] During this same period, the number of Azure regions has at least doubled, growing from seventeen in March of 2015 to thirty four today.[167] While renewable energy projects take time to reach maturity, hopefully the company's new commitment to direct purchasing of renewable energy and its recent decision to significantly expand its data centers in wind rich states of Wyoming and Iowa will soon bring an end to the current drought.

B Advocacy: Microsoft has finally begun to use its sizeable political influence toward achieving its renewable energy goals in a more public way this past year. On the broader policy side, Microsoft joined Amazon, Apple, and Google in filing a brief to support the US Clean Power Plan. (see page 40) Microsoft also joined several other IT companies who have significant data center operations in Virginia in a letter to the head of Dominion Power in support of a stronger renewable energy investment plan in Virginia (see page 41). While Apple and other internet companies with 100% renewable energy commitments have been putting pressure on their colocation providers to work to secure a renewable energy supply, Microsoft's increased reliance on Dupont Fabros Technology data centers would seem to indicate it is not using its leverage as its largest customer in the same way it has with prospective utilities for its own data centers.[168]

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Appendix II:
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NAVER

C | 2% | 31% | 39% | 19%
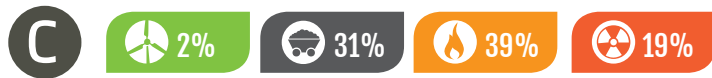
Naver Corporation is an internet service company, operating South Korea's top search portal.

B **Transparency:** Naver publishes the total electricity consumption of its operations as well as GHG in the website[169] in three language, Korean, Japanese, and English, however its plan how to reduce GHG and meet its 100% renewable energy commitment is not sufficiently shared or stated.

B **Renewable Energy Commitment & Siting Policy:** Naver publicly committed to 100% renewable energy and now set up a taskforce team to build a roadmap to 100% renewable energy.[170]

B **Energy Efficiency & GHG Mitigation:** Naver has shown leadership by prioritizing investment in highly energy efficient facilities and equipment by using the natural wind.[171] It also published a book to share its innovative technology to encourage other companies to enhance their energy efficiency.

D **RE Procurement:** Naver has set up on-site solar at one of its facilities, however the amount is insignificant and there is no further movement to procure renewable energy after their 100% commitment.

D **Advocacy:** After Naver became the first Asian company to publicly commit to 100% renewable energy in 2015, it has lacked follow through to push for necessary changes in government energy policy. As we all witness how Google and Apple changes their utility suppliers and key policymakers to create renewable energy friendly environment, publicly supporting and advocating of renewable energy is also needed from Naver.

ORACLE®

D | 8% | 36% | 26% | 25%

Oracle is seeking to expand its enterprise database business model into one that is much more cloud focused. Oracle has performed consistently near the bottom of our evaluations of US data center operator since 2012, with little signs of improvement this year. Oracle's renewed focus to become more of cloud focused company to compete with AWS[172] has led to rapid expansion in Virginia[173] and Chicago[174] that rely almost exclusively on dirty sources of electricity.

D **Transparency:** Through both its website[175] and CDP, Oracle provide basic reporting of its energy consumption, greenhouse gas emissions, and energy intensity performance across its entire corporate footprint. Oracle lags far behind leading US data center operators, as it does not provide any meaningful detail on its data center energy performance or source of electricity that powers them.

D **Renewable Energy Commitment & Siting Policy:** Oracle recently adopted a corporate wide goal to be 33% renewably powered by 2020, up from its current reported level of 24%.[176] Neither Oracle's website nor its most recent CDP submission provide details on how it able to achieve its current reported level, and what is reported appears to be primarily through the purchase of unbundled RECs.[177] Oracle's recent rapid expansion of its data center footprint in Virginia indicates the lack of a meaningful siting policy to advance its renewable energy goals.[178]

F **Energy Efficiency & GHG Mitigation:** Oracle only provides select information on the energy performance of its data centers, and explicitly excludes data centers from its company wide energy reduction goals.[179]

D **RE Procurement:** Oracle reports the purchase of a small amount (<1MW) of Renewable Energy Credits for its Austin Data center, and the purchase of "zero carbon electricity" for several of its U.K. facilities.[180]

F **Advocacy:** No evidence of Oracle support of renewable energy or climate protection policies has been submitted or discovered.

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salesforce

B | 43% | 16% | 12% | 15%
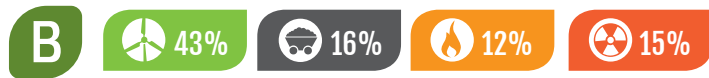
Salesforce continues to experience tremendous growth in its data center electricity demand, accelerating from 40% growth in FY 2015 to nearly 90% in FY 2016.[181] Much of this latest growth has occurred in areas with higher carbon energy sources of electricity as GHG emissions from its data centers like coal, as data center GHG emissions have increase 111% in the same period.

B Transparency: Salesforce provides high quality energy use and GHG emissions for its overall data center energy demand through annual reporting on its website,[182] but provides limited site specific energy data via CDP. Salesforce provides carbon footprint information to customers who request it, however Salesforce has not provided sufficient details on where its rapidly expanding data center energy demand is occurring, and how this expansion is being powered by local renewable energy associated with its recent virtual PPAs in West Virginia and Texas.

A Renewable Energy Commitment & Siting Policy: Salesforce has strengthened its commitment to become 100% renewably powered with the adoption of procurement standards, including the requirement for local sources of renewable energy supply to power its fast growing operations.[183]

C Energy Efficiency & GHG Mitigation: While Salesforce has adopted a goal to be net zero carbon by 2050 to compliment its 100% renewable energy goal, Salesforce lacks any concrete near and medium term goals to improve its energy efficiency performance, or curb its rapidly rising GHG emissions.[184]

B RE Procurement: Salesforce has taken some significant steps in 2016 to reduce its energy footprint by signing two major purchase contracts for renewable energy in the US in Texas and West Virginia,[185] building on its renewable energy supply for its U.K. data center. Salesforce has significant data center operations on the same grid as both of these projects, although it is only clear that Salesforce retained and retired the renewable energy credits associated with the Texas project.[186]

B Advocacy: Salesforce has stepped up its advocacy in the past year, signing American Business Act on Climate[187] to support stronger climate policy, and also joined with Adobe, Facebook, Microsoft, and other major energy customers to push for greater investment in renewable significant electricity by Virginia's Dominion Energy, in letter to the state's utility regulators.[188]

SAMSUNG 삼성SDS

D | 11% | 29% | 19% | 31%

Samsung SDS is an affiliated company of Samsung Group providing IT services to other companies within the Samsung group.

C Transparency: Samsung SDS reported total electricity use and GHG in CDP[189] as well as the public website named Repository of Korea's Corporate Filings[190] at the fleet level. However, it is not easily accessible to the public.

D Renewable Energy Commitment & Siting Policy: Samsung SDS has adopted a new siting policy to purchase the renewable energy when the market mechanism is created, there is still no public commitment to 100% renewable energy[191]. SDS should not wait until the market mechanism is created but put more effort to show how its innovative design and technology can renewably power its new data center in Gangwon Province.

C Energy Efficiency & GHG Mitigation: Samsung SDS has adopted a GHG reduction target and reports on its energy performance at the facility level.

D RE Procurement: For its data center in Sangam, Samsung SDS has deployed on-site renewables equivalent to 6 % of its total electricity demand.[192]

C Advocacy: Samsung SDS has demonstrated some proactive efforts to support the renewable energy law revision that would allow to trade the renewable energy,[193] but should be more vocal to ensure meaningful options for purchasing renewable electricity will be created.

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TENCENT 腾讯

F | 24% | 67% | 3% | 3%

Tencent is one of the largest internet companies in the world. Tencent's instant messaging platform QQ has become the largest online social network in China. Tencent is also a dominant player in China's online game industry. The company also provides multi-facets entertainment and media services. The company is running more than 58 data centers in mainland China. Tencent has also invested in data centers in Hong Kong, Toronto, and Europe. Tencent did not respond to our request for company's energy data.

F **Transparency:** Tencent has no publicly available information on energy or greenhouse gas.

F **Renewable Energy Commitment & Siting Policy**: Tencent has no publicly available evidence.

D **Energy Efficiency & GHG Mitigation:** Tencent does not provide meaningful detail on the energy performance of its data centers, offering only limited PUE data for selected facilities. Tencent invests in innovation to increase energy efficiency of data centers. At Tencent West Lab, they are developing the "T-block" which is designed to operate with PUE as low as 1.1, however, this is yet to be put into practice.[194]

F **RE Procurement:** The total capacity of renewable energy generated by Tencent is limited to 300kW.

F **Advocacy:** No publicly available evidence

Colocation & CDN

acer

D | 6% | 36% | 35% | 16%

International technology firm whose major products are personal computers, LCD displays, and smartphones as well as cloud-based platform and service.

D **Transparency:** Report its corporate-wide energy consumption[195] and greenhouse gas footprint with its CSR report, but not includes data center energy consumption.

D **Renewable Energy Commitment & Siting Policy**: Committed to 100% renewable energy in the US,[196] but purchases only unbundled RECs, which do little to drive additional renewable energy deployment. Acer should show a more ambitious effort and commitment in Taiwan as well.

C **Energy Efficiency & GHG Mitigation:** Set a long-term carbon reduction goal in 2020 and with various ways to save energy in 2015.

D **RE Procurement:** Acer relied heavily on RECs to substantiate its claim of 30% renewable energy in 2014 and achieve 40% in 2015, which do little to drive additional renewable energy investment.

D **Advocacy:** Promote supplier chain to use renewable energy as long-term goal[197] and also involved as a core member of The Business Council for Sustainable Development of Taiwan and present energy white paper to the government in 2015. The paper includes energy policy, energy efficiency, water management and environmental education with short and long-term goal.

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Akamai

B | 16% | – % | – % | – %

Akamai operates on of the world's largest Content Distribution Networks(CDN), with its operations distributed globally across a range of colocation data center operators. Akamai's recent commitment to be 50% renewably powered by 2020 is an important step forward for the company, and important signal to others in the sector who have their energy demand widely distributed.

A **Transparency:** Akamai continues to provide regular updates on its energy performance through both its own website[198] and detailed submissions to CDP, including reporting its network's use of electricity by region of operation. Akamai will also provide to its customers upon request a monthly carbon footprint associated with content delivery through the Akamai network servers. Akamai provides the results of its annual sustainability survey back to its vendor network, providing a benchmark to assist data center colocation operators to understand how well they are performing in relationship both to their customers' expectations, and to the competition.[199]

A **Renewable Energy Commitment & Siting Policy**: Because of its distributed nature as a CDN, securing a renewable electricity supply for its operations across a broad range of colocation operators represents a different challenge than those who operate their own data centers, but also a high impact opportunity. Akamai stepped up to this challenge in the past year, adopting a commitment to be 50% renewably powered by 2020,[200] stipulating principles that its efforts to achieve this goal shall be focused on investments that bring new renewable energy onto the same grid that its operations draw electricity from.[201]

A **Energy Efficiency & GHG Mitigation:** Alongside the adoption of its commitment to be 50% renewably powered by 2020, Akamai also committed to an absolute reduction in greenhouse gas emissions by 2020. Akamai has maintained an annual target to reduce the carbon and energy intensity of traffic on its network by 30% each year since 2009, and with the exception of a few quarters, has hit or exceeded this target,[202] This has been driven in part by more efficient hardware and by shifting to more efficient and lower carbon colocation data centers.[203]

C **RE Procurement:** Akamai's recent adoption of an aggressive renewable energy target will hopefully deliver new renewable electricity to power its network in the coming year. Akamai has recently shifted a significant piece of its digital network from a much dirtier energy grid in Texas to one that is largely hydroelectric powered in the Pacific Northwest, but this move does not bring additional renewables to the grid.

B **Advocacy:** Akamai has stepped up its advocacy efforts on clean energy and climate protection in the past eighteen months. In addition to joining President Obama's American Business Act on Climate Pledge[204] and the Low Carbon USA advertisement[205] along with several other IT companies, Akamai also supported the US EPA's Clean Power Plan[206] and the extension of US federal tax incentives for renewable energy deployment.[207] Akamai should continue to be proactive in taking opportunities to engage other internet companies on opportunities to increase their supply of renewable energy through their colocation providers

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D · 6% · 36% · 35% · 16%
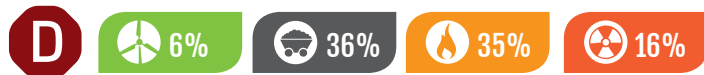
Asus provides a range of IT products and services including optical drives, PCs, smartphones, and global private cloud computing service.

C **Transparency:** Asus discloses only basic energy consumption and greenhouse gas footprint at the corporate-level, and provide data center energy consumption worldwide but not on individual data center operations.[208]

D **Renewable Energy Commitment & Siting Policy**: Set a new siting policy to purchase renewable energy when the market mechanism is created.

C **Energy Efficiency & GHG Mitigation:** Asus has established an absolute green house gas reduction goal of 50% below 2008 levels by 2025.[209]

F **RE Procurement:** No renewable energy procurement.

D **Advocacy:** Showed limited effort to advocate the renewable energy expansion at the political platform. Joined as a core member of The Business Council for Sustainable Development of Taiwan and present energy white paper to the government in 2015. The paper includes energy policy, energy efficiency, water management and environmental education with short and long-term goal.

D · 6% · 36% · 35% · 16%

Chunghwa telecom is the largest integrated telecom carrier in Taiwan providing fixed, mobile, and data communication services.

C **Transparency:** Chunghwa telecom reported its corporate-wide energy consumption and greenhouse gas footprint on its CSR and CDP report.[210]

D **Renewable Energy Commitment & Siting Policy**: No public commitment to 100% renewable energy, but set up the new siting policy to purchase renewable energy when the market is created.

D **Energy Efficiency & GHG Mitigation:** Set a goal of saving 1% energy as objective between 2015 and 2019. It needs more ambitious target to enhance the energy efficiency and have a target limiting annual carbon emission increase from service growth within 2% range (base year of 2012)

D **RE Procurement:** On site solar power facility has been installed, with the total capacity of renewable energy generated remains small, totaling 213.8kW and wind is 26.6 kW.

D **Advocacy:** It joined the core of The Business Council for Sustainable Development of Taiwan (BCSD-Taiwan) and present energy white paper to government in 2015. The paper includes energy policy, energy efficiency, water management, and environmental education with short-term and long-term goal.

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DIGITAL REALTY
Data Center Solutions

C   🌀 21%   ⚙ 25%   🔥 33%   ☢ 19%

Digital Realty is one of the largest digital landlords in the world, with 156 data centers worldwide. Digital Realty operates primarily on the wholesale end of the colocation market, providing entire data center properties to major internet and cloud companies. Many of Digitals largest customers have adopted commitment to be 100% renewably powered, including Facebook, Rackspace, Salesforce, Google, Equinix and Amazon Web Services. Digital Realty has slowly begun to respond, adopting a commitment to be 100% renewably powered in April 2015, recently signed its first major purchase of renewables in Texas in 2016.[211] However, Digital Realty lags far behind colocation leader Switch in transitioning its customers to a renewably powered data center, as its continued expansion in dirty energy markets like Virginia continues to increase the demand for dirty sources of energy.

B **Transparency:** Digital Realty continues to improve its energy transparency, providing clear snapshots of its energy mix, total electricity consumption, and greenhouse gas footprint, although unlike Equinix it does provide a regional breakdown nor report its progress on year over year basis to CDP, but does clearly highlight the year over year change in its electricity supply.[212]

C **Renewable Energy Commitment & Siting Policy**: Digital Realty adopted a long-term commitment to power its operations with 100% renewable energy with new and additional sources of electricity, though unlike Switch or Equinix, has not established policies to put a priority on access to renewable electricity supply into its future growth, or set near term goals to chart its progress toward 100% renewably powered operations.[213]

B **Energy Efficiency & GHG Mitigation:** Digital Realty has adopted a goal to make its U.S. buildings 20% more energy efficient by 2020, currently at 17%. More specific performance targets, including renewable energy or carbon goals such as those adopted Equinix are needed to better define the renewable energy transition Digital Realty wants to pursue and how it plans to get there. Digital should be recognized for the deployment of Green Bonds to fund significant energy efficiency projects across a number of its facilities.

D **RE Procurement:** With the recent signing of a large contract for wind energy in Texas,[214] Digital Realty has at least made a first real step toward driving renewable energy deployment, moving beyond the unbundled REC purchase approach in the initially offering of its Clean Start program. But given the size of Digital Realty's data center portfolio and the number of major customers that have already made 100% renewable commitments, much more impactful efforts must soon follow.

D **Advocacy:** Digital Realty has engaged in collaborative efforts among companies in support of greater access to renewable electricity such as the Renewable Energy Buyers Alliance and the Corporate Renewable Energy Buyer's Principles. Despite its significant purchasing power, Digital has remained silent at critical junctures to push for greater renewable investments by its utilities. Despite having a significant operations in Virginia, Digital did join not Equinix, Salesforce or others major customers in demanding state regulators to support greater investment in renewable energy than was currently being planning by Dominion Virginia Power.[215]

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DFT DATA CENTERS

F   7%   29%   32%   31%

DuPont Fabros Technology (DFT) is one of the largest wholesale data center colocation providers in the US, providing large blocks of data center capacity in several major markets. DFT's largest market by far is Northern Virginia, with upwards of 200 MW in data center capacity, making it one of the state's largest customers of electricity. Despite 100% renewable commitments by Facebook and Microsoft, its two largest customers who represent over half of its annual rent,[216] DFT has done nothing to secure supply of renewable electricity to help support these goals.

D **Transparency:** DuPont Fabros Technology does report on its website the power capacity and energy performance of its cloud computing service at the facility level. However, DuPont Fabros Technology does not participate in the Carbon Disclosure Project or otherwise report its total energy or carbon footprint. DuPont Fabros Technology states that it will provide the carbon and energy footprint data upon request by its customers.

F **Renewable Energy Commitment & Siting Policy**: DuPont Fabros Technology does not state a public preference for renewable energy supply when it sites its data centers, nor has it set a renewable energy target for future investments. The majority of its data centers in Northern Virginia, powered by the local utility, Dominion Energy, whose electricity mix is only 3% renewably powered, with no plans to significantly increase this minuscule amount well into the future. Despite this long-term lack of access to renewable power, DFT announced plans to expand its Ashburn, Virginia campus by four new data centers (ACC 8, 9 10 & ACC 11),[217] as part of its plans to grow its footprint 45% by 2020.

D **Energy Efficiency & GHG Mitigation:** As a wholesale colocation provider, DuPont Fabros Technology's primary opportunity for driving efficiency across its data centers is in the design and management of the facility, as demonstrated with the highly efficient ACC-7 facility. However, DuPont Fabros Technology's competitor Digital Realty Trust has recently established fleet-wide performance targets for its US facilities, something that would benefit both DuPont Fabros Technology's customers and its own bottom line.

F **RE Procurement:** DuPont Fabros Technology does not have a stated goal or vision to power its data center infrastructure with renewable energy. The company's only renewable installation was attached to a New Jersey Data center that it recently sold.

F **Advocacy:** DFT has not demonstrated any support for climate or renewable policies.

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EQUINIX

B   20%   29%   30%   20%

Equinix's has moved aggressively in the past two years to become one of the world's largest data center operators. Following the merger with EU based Telecity, acquisition of Tokyo based Bit-Ise, and most recently the purchase of 29 data centers in the US and Latin America from Verizon, Equinix now operates over 175 data centers globally.[218] Equinix was the first colocation data center operator to make a commitment to be 100% renewably powered in 2015, and has taken initial steps toward this goal by signing sizeable renewable contracts in California, Oklahoma and Texas. However, Equinix's renewable strategy is lagging behind its rapid expansion, particularly in markets like Virginia that rely almost exclusively on dirty sources of electricity.

B **Transparency:** Equinix updates its website to provide a snapshot of its energy demand, energy mix, and related greenhouse gas footprint at both a global and regional level, and has recently begun to report its energy footprint to CDP. Equinix should take the next step beyond the regional level in its reporting, detailing how its renewable energy procurement is being delivered to match its demand in major metropolitan markets. Equinix's recent claims that the large renewable deals in Texas and Oklahoma will allow it to claim all of its North American operations are 100% renewable are a step in the wrong direction.[219]

B **Renewable Energy Commitment & Siting Policy**: Equinix was the first major colocation provider to adopt a commitment to become 100% renewably powered, with an interim goal to be 50% renewable by the end of 2017, and adopted principles that place priority on markets that provide access to local sources of renewable energy. Equinix should strengthen its procurement standards to increase its focus on additional new sources of renewable power, as Switch, Google, Apple and others have done.

B **Energy Efficiency & GHG Mitigation:** Equinix has adopted energy efficiency design targets for all new data centers, with regionally differentiated PUE targets: Americas 1.30-1.40, Asia Pacific (including Oceania) 1.33-1.43, EMEA 1.29-1.42, based on annual average Power Usage Effectiveness (PUE).

C **RE Procurement:** Equinix currently claims to have reached 43% renewable energy supply for its global level operations at the end of 2015, most of which is currently associated with the purchase of Renewable Energy Credits (RECs) and Guarantees of Origin, many of these credits are unbundled from the underlying electricity. Given the guiding principles articulated with Equinix's 100% renewable commitment, Equinix should be expected to pursue much more impactful strategies to bring new renewable energy onto the same grid as it facilities, either directly or in collaboration with key customers, Recent claims that its entire North American operations will be 100% renewably powered when the wind projects in Texas and Oklahoma come online are a significant step backwards, and far below best practice demonstrated by Switch, Apple, and other sector leaders who have deployed renewable electricity at a local or regional level for each facility.

B **Advocacy:** Equinix has become more active in supporting renewable energy and climate change policy, joining with President Obama's American Business Act on Climate Change Pledge in advance of the Paris Climate Change conference.[220] Equinix's has also begun to use its influence as a major utility customer to push for greater investment in renewable significant electricity by Virginia's Dominion Energy, joining Microsoft, Facebook, Salesforce, and other data center operators in letter to the state's utility regulators.[221]

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FarEastTone

D | ⚡ 6% | ⛏ 36% | 🔥 35% | ☢ 16%
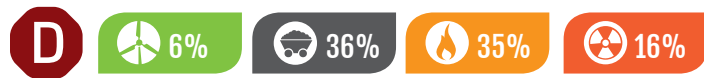
FarEastTone(FET): a leading company in Taiwan and its major service is telecommunications and digital application.

B Transparency: FET provides a good breakdown of data center electricity demand, GHG , including year over year change, and report PUE performance with its CSR report.[222]

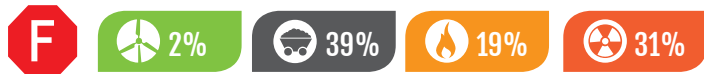**F Renewable Energy Commitment & Siting Policy:** No public announcement in terms of 100% renewable energy commitment.

C Energy Efficiency & GHG Mitigation: Set three year energy efficiency improvement plan. Includes reducing 5% Power Usage Effectiveness (PUE)[223] as objective, and energy saving projects to reduce 10% energy usage in every base station. The average PUE of FET data centers is well above industry best practice, and FET has recently adopted annual energy efficiency target of 5%/year, and provides detailed breakdown of ongoing energy efficiency efforts.[224]

D RE Procurement: Set a goal of increasing 10 times onsite renewable energy installation capacity by 2017 and 200 MWh green tariff in 2 years.

F Advocacy: No evidence of advocacy work within either CSR report of release to Greenpeace.

kt

F | ⚡ 2% | ⛏ 39% | 🔥 19% | ☢ 31%

KT (Korea Telecom) is an one of the three major telecommunication service companies in Korea.

D Transparency: KT reports its total electricity consumption and GHG[225] in its 2016 sustainability report but there is no specific information at the facility level.

F Renewable Energy Commitment & Siting Policy: No public commitment towards renewable energy. KT is proactively promoting and advertising smart energy use with its technology however KT is still heavily dependent on fossil fuels. Given that KT is an official sponsor of the "carbon neutral" 2018 Winter Olympics, KT should aim to power its technology with 100% renewable energy.

D Energy Efficiency & GHG Mitigation: KT has set a long-term GHG reduction goal and showed some efforts to enhance energy efficiency[226] such as reducing electricity use by master cooling system and saving power through high-efficiency temperature chambers, and LEDs

F RE Procurement: KT Showed some evidences under the chapter called Strategy for Energy diversification in 2016 sustainability report such as expanding solar powers, 623.8 MWh[227] including the geothermal energy for its 3 office buildings. However, it is difficult to fairly evaluate KT's effort in terms of lacking information related to its data centers.

F Advocacy: No evidence of advocacy for renewable energy or climate change.

LG CNS

F | ⚡ 2% | ⛏ 39% | 🔥 19% | ☢ 31%

LG CNS is an affiliated company of LG Group, providing IT services to corporations.

F Transparency: No data release in terms of the total electricity use and GHG emission. LG CNS promotes its data center in Busan as one of the most efficient and environment friendly one but it is very difficult to evaluate its state due to extremely poor transparency.

F Renewable Energy Commitment & Siting Policy: LG CNS has not made a public commitment to power its operations with renewable energy.

F Energy Efficiency & GHG Mitigation: No long term GHG reduction target or performance target has been adopted.

F RE Procurement: No evidence was found that LG CNS has sought to power its operations with renewable electricity supply.

F Advocacy: No evidence of advocacy for renewable energy or climate change.
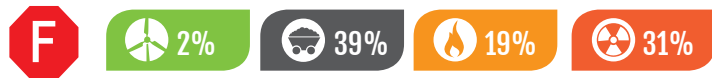
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LG U⁺

F | ☮ 2% | ⚒ 39% | 🔥 19% | ☢ 31%

LG U plus is an one of the three major telecommunication service companies in Korea and an affiliated company of LG Group.

D **Transparency:** LG U+ publishes its total electricity consumption and GHG emission in its 2014 sustainability report[228] as well as CDP, but this report is not recently updated and CDP is not an easily accessible for stakeholders in Korea.

F **Renewable Energy Commitment & Siting Policy**: No commitment toward renewable energy by LG U+.

D **Energy Efficiency & GHG Mitigation:** No long term GHG reduction target or performance target has been adopted,[229] but there is limited evidence of prioritizing energy efficiency, but the detail on this information is not easily accessible. LG U+ promotes its new data center in Pyeongchon[230] as an environment friendly and one of the most energy efficient center however its renewable energy use is less than 1% from the geothermal and other information is extremely lacking related to data center.

F **RE Procurement:** No evidence of advocacy for renewable energy or climate change

F **Advocacy:** No evidence of advocacy for renewable energy or climate change.

rackspace
the open cloud company

C | ☮ 29% | ⚒ 26% | 🔥 25% | ☢ 19%

Rackspace was one of the first cloud companies to embrace a 100% renewable energy commitment in 2012, and has since established a goal to reach 100% by 2026. After an initial reliance on unbundled RECs, Rackspace claims to be gradually phasing out its reliance on RECs for more impactful options for purchasing renewable energy. But having just been taken private, it is unclear whether the company's new owners will stay the course for Rackspace to become 100% renewable by 2026.

C **Transparency:** Rackspace has recently begun reporting its energy consumption data to CDP, providing a more standardized reporting format for tracking its progress. Prior to being taken private, Rackspace continued to provide updates on the total amount of power it currently has under contract across its data centers each quarter, as well as the full capacity under reserve.[231] These updates have not continued since the company has gone private in November 2016.[232]

B **Renewable Energy Commitment & Siting Policy**: Rackspace's newest data center in London has a design PUE of 1.15, and Rackspace has adopted short-term energy performance targets for both its offices and data centers. Rackspace' sustainability program is currently self funding, with 25% of the cost savings or avoidance achieved by sustainability efforts produced back into programs or investments that will further emissions reductions.[235]

B **Energy Efficiency & GHG Mitigation:** While Rackspace has thus far relied heavily on RECs to achieve its renewable energy goals, the company has recently contracted with its Dallas colocation vendor to buy renewable power directly to power its operations there. The company has also pledged to make additional direct purchases of renewable energy in 2017 and 2018.

C **RE Procurement:** While Rackspace has thus far relied heavily on RECs to achieve its renewable energy goals,[236] the company has recently contracted with its Dallas colocation vendor to buy renewable power directly to power its operations there.[237] The company has also pledged to make additional direct purchases of renewable energy in 2017 and 2018.

C **Advocacy:** While Rackspace specifically identifies advocacy as a core tenant of its Global Energy Policy,[238] much of Rackspace's advocacy to date has been focused on specific data center vendor relationships. While Rackspace may not have the name recognition of some brands, the company has unique opportunities to push for better options for renewable energy with its vendors, customers, and government officials.

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F | 2% | 39% | 19% | 31%

SK Holdings (C&C) is an IT service company and affiliated company of SK Group.

D **Transparency:** Full disclosure on the total electricity consumption and GHG[239] in its 2016 sustainability report but there is no specific data for its data centers.

F **Renewable Energy Commitment & Siting Policy:** No public commitment towards renewable energy.

D **Energy Efficiency & GHG Mitigation:** No long-term GHG reduction target or performance target but SK C&C shows some recent evidence of efforts to invest and prioritize in energy efficiency.[240]

F **RE Procurement:** SK C&C reports to have invested on new and renewable energy[241] but doesn't disclose the exact energy source as well as its capacity

F **Advocacy:** No evidence of advocacy for renewable energy or climate change.

F | 2% | 39% | 19% | 31%

SK Telecom is an one of the three major telecommunication service companies in Korea and an affiliated company of SK Group.

D **Transparency:** SK Telecom disclosed electricity consumption and GHG in its 2015 sustainability report but no specific energy data for its data centers.[242]

F **Renewable Energy Commitment & Siting Policy:** No public commitment towards renewable energy.

D **Energy Efficiency & GHG Mitigation:** SK Telecom set a long-term but unambitious GHG reduction goal, of 2%, and has made some investments in smart grid and new energy business with the monopoly utility, KEPCO, but the detail on this information remains very limited.[243]

D **RE Procurement:** SK Telcom reports it has deployed 2,729 MWh of new and renewable energy [244] facility but the exact source has not been published.

F **Advocacy:** No evidence of advocacy for renewable energy or climate change.

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switch

| A | 100% | 0% | 0% | 0% |
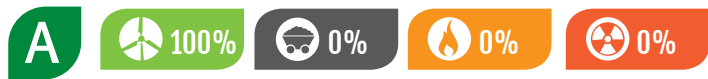
Switch has emerged as the leader among colocation operators, and ranks near the very top of the sector overall. Though with a much smaller fleet of data centers than many other colocation operators, Switch hosts significant pieces of digital real estate for several well-known online brands. Switch has been engaged in a multi-year fight to secure access to renewable energy for its Nevada facilities, which include some of the largest data centers in the world, and has recently secured a renewable supply of electricity supply for its new data center in Michigan.

[A] Transparency: Switch provides detailed information on a facility level, including GHG, for its existing data centers in Las Vegas and Reno, Nevada.[245] Switch makes an energy dashboard available to its customers that provide data on the energy footprint of its servers in the Switch facility for their own monitoring and reporting.

[A] Renewable Energy Commitment & Siting Policy: Switch has adopted a long-term commitment to power its data centers with 100% renewably electricity, including a commitment to achieve this goal through the direct purchase of new and additional sources of renewable energy that are attached to the same grid as its data center facilities.[246] Switch has also adopted a siting policy that requires that any new data centers under the company's control be located in jurisdictions that will allow it to purchase enough electricity to power with 100% renewable energy.[247]

[A] Energy Efficiency & GHG Mitigation: Switch data center design allows for very high-density rack configuration, and has thus far produced a very low PUE, approximately 1.23 average over the preceding 12 months for its Nevada data centers.[248] Switch has had these performance levels confirmed by a third party auditor, and represent a surprisingly efficient benchmark for a retail colocation facility, despite not having the advantage being in a location that lends itself to open-air cooling throughout the day.

[A] RE Procurement: Switch fought the monopoly utility(NV Energy) and state regulators in Nevada for the right to exit the utility to secure a renewable supply of electricity directly. Switch ultimately signed deals for utility scale solar projects in both the northern and southern half of the state, to provide adequate supply to both its massive Las Vegas and Reno data center campuses. Switch's recent announcement to open a new data center in Michigan was contingent on its ability to secure a commitment with local utilities and regulators that they will be able to contract for enough renewable electricity to also make their Michigan campus 100% renewably powered.[249]

[A] Advocacy: Switch has emerged as one of the most aggressive data center operators in pushing for the policy changes needed to transition to a renewably powered economy, both from an economic and ecological perspective. Switch engaged in a multi-year legal battle in Nevada to secure the right to opt-out of NV Energy's service, to allow them to secure a renewable supply of electricity that would allow them to achieve their renewable energy goals and lower their operating costs, a battle it ultimately won.[250] Switch has also joined with Tesla and other major electricity customers to support a successful ballot initiative in 2016 that would eliminate NV Energy's monopoly and allow customers to choose their electricity provider.[251] Switch also joined American Business Act on Climate Pledge.[252]

Taiwan Mobile

| D | 6% | 36% | 35% | 16% |

Taiwan Mobile is a leading telecommunication company in Taiwan.

[C] Transparency: Taiwan Mobile report its corporate-wide[253] and greenhouse gas footprint through CSR report, but not fleet-level data energy consumption on data center publicly.

[D] Renewable Energy Commitment & Siting Policy: No public announcement in terms of 100% renewable energy use, but has set a long-term goal in 2020 to increase renewable energy installation.[254]

[D] Energy Efficiency & GHG Mitigation: Established an 8MWh as energy saving objective in 2016.

[D] RE Procurement: Installed onsite solar and small wind turbine energy on its building[255] and base stations.

[D] Advocacy: Taiwan Mobile joined the core of the Business Council for Sustainable Development of Taiwan and present energy white paper to the government in 2015. The paper includes energy policy, energy efficiency, water management and environmental education with short and long-term goal.

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Video Streaming

Afreeca.com

F | 2.2% | 38.7% | 19% | 31%
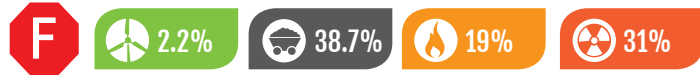
Afreeca.com, a peer to peer video streaming service in Korea, appears to be hosted by SK Broadband.[257] Afreeca. com did not provide Greenpeace with information about its energy use.

F Energy Transparency: Afreeca.com does not provide any information about its energy footprint or greenhouse gas emissions.

F Renewable Energy Commitment: Afreeca.com has not set any energy goals.

F Efficiency and GHG mitigation: Afreeca.com did not provide evidence of the energy efficiency of its operations.

F RE procurement: Afreeca.com has not offered evidence of renewable energy procurement.

F Advocacy: Afreeca.com did not provide evidence of renewable energy advocacy.

Amazon Prime Video

C | 17% | 30% | 24% | 26%

Amazon Prime Video, an on-demand streaming service for Amazon Prime members, is hosted by Amazon.com subsidiary, Amazon Web Services (AWS), which operates a global fleet of data centers. See page 47 for a detailed assessment of AWS.

HBOGo.com & HBONow.com

D | 22% | 25% | 20% | 25%

HBO delivers movies and its popular original programming through its HBO GO and HBO Now services, which are handled by Major League Baseball Advanced Media (MLBAM).[258] MLBAM operates data centers in San Francisco, Omaha, and New York City, and also uses AWS.[259] [260]

D Energy Transparency: HBO received credit for basic CSR reporting by its parent company, Time Warner Inc., including disclosure of Time Warner's overall electricity consumption and carbon footprint to the CDP.[261] It's unclear whether Time Warner's submission accounts for HBO's energy footprint from its streaming via MLBAM.

F Renewable Energy Commitment: HBO has not adopted a commitment to renewable energy.

F Efficiency and GHG mitigation: HBO did not provide any details on its energy performance or efforts to increase data center energy efficiency.

F RE procurement: HBO has not offered any evidence of taking steps to secure a renewable supply of electricity.

F Advocacy: HBO has not provided any evidence of renewable energy advocacy.

Hulu.com

F | 20% | 29% | 30% | 20%

Hulu, an online video service, appears to be hosted by Equinix.[262] Hulu did not respond to requests from Greenpeace for information about its energy use.

F Energy Transparency: Hulu does not provide any information about its energy footprint.

F Renewable Energy Commitment: Hulu has not set any energy goals.

F Efficiency and GHG mitigation: Hulu has not provided any evidence about increased energy efficiency.

F RE procurement: Hulu has not offered evidence of renewable energy championship.

F Advocacy: Hulu has not provided any evidence of renewable energy advocacy.
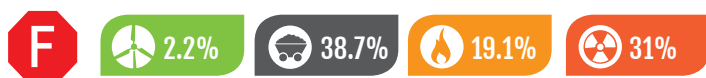
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Netflix.com

D | 17% | 30% | 24% | 26%

Netflix is one of the largest and fastest growing video streaming platforms in the world, and already accounts for over one-third of peak download traffic in North America.[263] Netflix is seeking to rapidly expand its service internationally, particularly in the Asian-Pacific region. Netflix heavily relies on Amazon Web Services for delivering its content to its customers, along with OpenConnect, the Netflix content delivery network.

F **Energy Transparency:** Unlike other major video streaming platforms such as Apple, Facebook, or Google, Netflix does not regularly provide energy consumption data, greenhouse gas emissions, or the actual energy mix of its global operations. Without this data, or details on how it is able to claim offsets (28%[264]) from renewable energy, we have assigned Netflix the same energy mix as AWS, which it now fully relies upon for its data center operations.[265] While other IT companies seek to make their footprint appear small at the customer level, Netflix's misleading attempt to equate human emissions of CO_2 from breathing as somehow equivalent to its energy intensive operations is not reflective of innovative IT company, and has more in common with previous attempts by the fossil fuel industry to shift responsibility for climate change.[266] The reality is that Netflix's rapid growth is increasing demand for coal and other dirty sources of energy that are a threat to human health and the climate. Hopefully Netflix will soon take greater responsibility and apply itself, as other sector leaders have, to drive more renewable energy onto the grid to power its operations.

F **Renewable Energy Commitment:** Netflix has not adopted any public commitment to renewable energy, though claims it is important that its data center providers "commit to be 100% green power through RECS", without apparent concern for whether their providers are actually securing a renewable supply of electricity.

C **Efficiency and GHG mitigation:** Netflix claims to have achieved significant improvements (100x) in its energy efficiency performance in the past four years through the widespread use of flash storage. Unfortunately, without more data on its energy performance year over year, it is very difficult to assess the company's performance. A third party analysis of Netflix traffic also appears to recognize recent efficiency improvements through data compression.[267]

D **RE procurement:** Netflix's 2015 energy footprint publication indicated that it purchased Renewable Energy Credits in the same location as its cloud footprint, but did not provide any detail on how this achieved. As demonstrated by many of its peers, Netflix should move beyond its reliance on unbundled RECs and focus on ensuring its growth is matched and powered by new sources of renewable electricity.

F **Advocacy:** Netflix has stated that "It's important that our data center providers commit to 100% green power through RECs and that they continue to find new and innovative ways to become carbon neutral." [268] Unfortunately, such a low bar is unlikely to push AWS or other data center operators to take the action necessary to transition to a renewable supply of electricity.

Pooq.co.kr

F | 2.2% | 38.7% | 19.1% | 31%

Pooq.co.kr, a video streaming website in Korea, appears to be hosted by KT(Korea Telecom).[269] Pooq.co.kr did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Pooq.co.kr does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Pooq.co.kr has not set any energy goals.

F **Efficiency and GHG mitigation:** Pooq.co.kr did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** Pooq.co.kr has not offered evidence of renewable energy procurement.

F **Advocacy:** Pooq.co.kr did not provide evidence of renewable energy advocacy

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Appendix II:
Company Scores
Explained

Vevo.com

F | 🌀 27% | ⛏ 32% | 🔥 15% | ☢ 26%
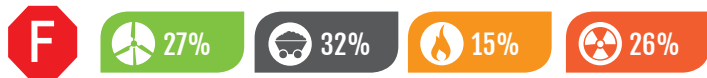
Vevo.com, a music video streaming service, appears to use both Rackspace and Amazon Web Services to host its content. [270] [271]

F Energy Transparency: Vevo does not provide any information about its energy footprint.

F Renewable Energy Commitment: Vevo has not set any renewable energy goals or adopted a long-term commitment to be renewably powered.

F Efficiency and GHG mitigation: Vevo has not provided any evidence about increased energy efficiency.

F RE procurement: Vevo has not offered evidence of renewable energy procurement.

F Advocacy: Vevo has not provided any evidence of renewable energy advocacy.

Vimeo.com

D | 🌀 47% | ⛏ 20% | 🔥 13% | ☢ 19%

Vimeo.com, the online video sharing website owned by IAC, appears to be hosted by Amazon Web Services. Vimeo did not provide Greenpeace with information about its energy use.

D Energy Transparency: Vimeo provided basic information on its data center infrastructure, but does not make public any information about its energy footprint.

F Renewable Energy Commitment: Vimeo has not set any renewable energy goals or adopted a long-term commitment to be renewably powered.

F Efficiency and GHG mitigation: Vimeo has not provided any evidence about increased energy efficiency.

C RE procurement: Vimeo has benefited from its decision to host a significant portion of its data center operations with Google and Switch, who both have a high percentage of renewable electricity .

F Advocacy: Vimeo has not provided any evidence of renewable energy advocacy.

YouTube.com

A | 🌀 56% | ⛏ 15% | 🔥 14% | ☢ 10%
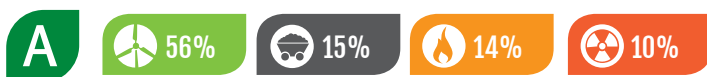
YouTube.com, the video streaming site, is owned and hosted by Google, which operates a fleet of global data centers. Please see page 51 for a detailed evaluation of Google's performance.

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Music/Audio Streaming

iTunes.com

A | 83% | 5% | 4% | 5%

iTunes offers music for download as well as streaming in a rapidly growing number of markets. Owned and operated by Apple, iTunes relies primarily on Apple data centers for its delivery of content, supported by colocation and cloud vendors. Please see page 69 for a detailed evaluation of Apple's performance.

NPR.org

F | 17% | 30% | 24% | 26%

NPR is the public radio network in the United States, and streams its original radio broadcasts, syndicated programs and podcasts online. NPR appears to rely heavily on AWS to support its online program delivery.[272]

F **Energy Transparency:** NPR does not provide any information on its energy footprint.

F **Renewable Energy Commitment:** NPR has not adopted a commitment to renewable energy or goals to increase its supply.

F **Efficiency and GHG mitigation:** NPR has not provided any evidence about increased energy efficiency.

F **RE procurement:** NPR has not offered any evidence of renewable energy leadership or made investments to increase the amount of renewable energy it uses.

F **Advocacy:** NPR has not provided any evidence of renewable energy advocacy.

Pandora.com

F | 13% | 20% | 32% | 27%

Pandora is one of the largest online music streaming platforms, operating in North America, Australia and New Zealand. Pandora's data centers are located in colocation facilities operated by Equinix in San Jose, CA and Ashburn, VA as well as by Digital Realty Trust in Chicago, IL and Oakland, CA.[273]

F **Energy Transparency:** Pandora does not provide any information on its energy footprint.

F **Renewable Energy Commitment:** Pandora has not announced any commitment to renewable energy or goals to increase it supply.

F **Efficiency and GHG mitigation:** Pandora has not provided any evidence about increased energy efficiency.

F **RE procurement:** Pandora has not exhibited any renewable energy leadership or made investments to increase the amount of renewable energy it uses.

F **Advocacy:** Pandora has not provided any evidence of renewable energy advocacy.

SoundCloud.com

F | 17% | 30% | 24% | 26%

SoundCloud.com is a online audio streaming and social media platform that allows users to download and share music and other audio creations. SoundCloud relies heavily on AWS for the processing and storage of its audio recordings.[274]

F **Energy Transparency:** SoundCloud does not provide any information on its energy footprint

F **Renewable Energy Commitment:** SoundCloud has not adopted a commitment to renewable energy or goals to increase its supply.

F **Efficiency and GHG mitigation:** SoundCloud has not provided any evidence about increased energy efficiency.

F **RE procurement:** SoundCloud has not offered any evidence of renewable energy leadership or made investments to increase the amount of renewable energy it uses.

F **Advocacy:** SoundCloud has not provided any evidence of renewable energy advocacy.

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Explained

Spotify.com

D | 56% | 14% | 15% | 10%

Spotify is one of the largest audio streaming companies in the world, with 75 million active users globally. Spotify relies on Google's data centers to deliver its music.[275]

F Energy Transparency: Transparency: Spotify does not provide any information on its energy footprint

F Renewable Energy Commitment: Spotify has not adopted a commitment to renewable energy or goals to increase its supply.

F Efficiency and GHG mitigation: Spotify has not provided any evidence about increased energy efficiency.

C RE procurement: Spotify recent transition from AWS to Google's cloud platform provides a significant boots in renewable energy powering its online infrastructure.[276]

F Advocacy: Spotify has not provided any evidence of renewable energy advocacy.

Podbbang.com

F | 2.2% | 38.7% | 19.1% | 31%

Podbbang.com, a podcast website, appears to be hosted by KangNam CableTV.[277] Podbbang.com did not provide Greenpeace with information about its energy use.

F Energy Transparency: Podbbang.com does not provide any information about its energy footprint or greenhouse gas emissions.

F Renewable Energy Commitment: Podbbang.com has not set any energy goals.

F Efficiency and GHG mitigation: Podbbang.com did not provide evidence of the energy efficiency of its operations.

F RE procurement: Podbbang.com has not offered evidence of renewable energy procurement.

F Advocacy: Podbbang.com did not provide evidence of renewable energy advocacy.
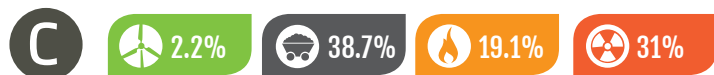
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Messaging

iMessage

A | 83% | 5% | 4% | 5%

iMessage is the instant messaging client for Apple devices, which allows users to send messages, photos, videos and more over wi-fi. Owned and operated by Apple, iMessage relies primarily on Apple data centers. Please see page 49 for a detailed evaluation of Apple's performance

Kakao & KakaoTalk

C | 2.2% | 38.7% | 19.1% | 31%

Kakao.com, an internet company, has digital infrastructure residing in a mix of colocation facilities via KT, LG CNS, LG U+, SK broadband, SK C&C. Kakao.com proactively reponded and disclosed full information to Greenpeace.

C **Energy Transparency:** Kakao reported the data center and collocation information to Greenpeace. Also the company disclosed fleet level energy and electricity consumption data. However, the company does not provide webpage or report that public can easily access to the information.

D **Renewable Energy Commitment:** Kakao did not make 100% renewable energy commitment. However, the company has made an internal agreement to purchase the renewable energy when market mechanism is created. Also prioritized the renewable energy procurement of the data center operator when opening a new contract.

D **Efficiency and GHG mitigation:** Despite Kakao does not own data center, the company decreased one of its data centers' energy consumption by 23% compared to last year and plans to utilize the technology to all data centers. Also, the company applied uniquely designed blanking panel and brush panel technology, adopted cold air flow structure and CACS(Cold Aisle Containment System), and operated highly integrated servers and REC. However, Kakao should set a higher end goal to increase the energy efficiency to achieve global competence.

F **RE procurement:** Kakao has not offered evidence of renewable energy procurement.

C **Advocacy:** Kakao has sent an official letter to all data center operators in contract requesting for renewably powered service.

QQ

F | 24% | 67% | 3% | 3%
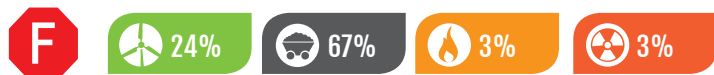
QQ is one of China's largest instant messaging platforms with an estimated 900 million active users. It is owned and operated by Tencent. Please see page 56 for a detailed evaluation of Tencent's performance.

Skype

B | 32% | 31% | 23% | 10%
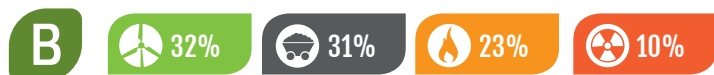
Skype, the video, telephony and messaging service, is owned and operated by Microsoft, which operates a large global fleet of data centers. Please see page 53 for a detailed evaluation of Microsoft's performance.

WeChat

F | 24% | 67% | 3% | 3%
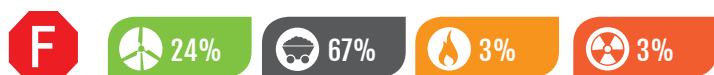
WeChat is one of China's largest instant messaging platforms for smartphones, with over 800 million active users. It is owned and operated by Tencent. Please see page 56 for a detailed evaluation of Tencent's performance.

WhatsApp

A | 67% | 15% | 7% | 9%

WhatsApp, the encrypted instant messaging smartphone application, is owned and hosted by Facebook, which operates its own data centers and also has servers in colocation facilities. For further details on WhatsApp's scores, see Facebook's write up on page 50.

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Search

Bing.com

B | 32% | 31% | 22% | 10%

Bing.com, the search engine, is operated by Microsoft, which operates a large global fleet of data centers. Please see page 53 for a detailed evaluation of Microsoft's performance

Baidu

F | 24% | 67% | 3% | 3%

Baidu is the most used internet search provider in China. Approximately 92% of Chinese internet users used Baidu as their internet search engine. Baidu uses colocation and owns self-built data centers. Baidu did not respond to our request for company's energy data. Please see page 49 for a detailed evaluation of Baidu's performance.

F **Transparency:** Baidu has no publicly available information on energy or greenhouse gas.

F **Renewable Energy Commitment & Siting Policy**: Baidu has no publicly available evidence.

D **Energy Efficiency & GHG Mitigation:** Baidu's Yangquan Data Center and the M1 Data Center have applied innovative technology to increase energy efficiency and reduce greenhouse gas.

F **RE Procurement:** A very small solar power facility has been installed in the Yangquan Data Center. The total capacity of renewable energy generated by Baidu is 66.79 kW. No further information has ever been provided by Baidu.
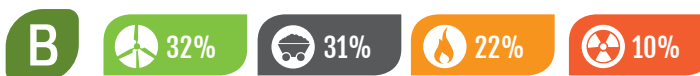
F **Advocacy:** No publicly available evidence.

Daum.net

C | 2.2% | 38.7% | 19.1% | 31%
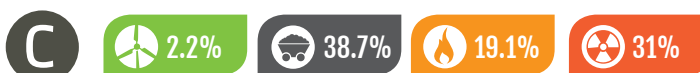
Daum.net, a search engine in Korea, is owned and operated by Kakao, after a merger in 2014. See page 71 for a detailed evaluation of Kakao's performance.

Google.com

A | 56% | 15% | 14% | 10%

Please see page 51 for a detailed evaluation of Google's performance.

Nate.com

F | 2.2% | 38.7% | 19.1% | 31%
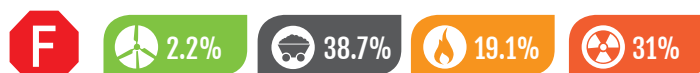
Nate.com, a web portal owned by SK Communications, appears to be hosted by SK Communications Corp.[278] Nate.com did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Nate.com does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Nate.com has not set any energy goals.

F **Efficiency and GHG mitigation:** Nate.com did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** Nate.com has not offered evidence of renewable energy procurement.

F **Advocacy:** Nate.com did not provide evidence of renewable energy advocacy

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Explained

Naver.com

C | 2.2% | 38.7% | 19.1% | 31%

Naver.com, a web portal owned by Naver Corporation, has self operated data center in Seongnam, South Korea. Naver Corp., Please see page 54 for detailed evaluation of Naver.

Yahoo!

B | 74% | 12% | 5% | 6%
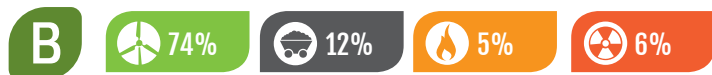
Yahoo has long ranked near the top of Greenpeace's Click Clean evaluations of major data center operators. While Yahoo remains in the top 25%, other companies both larger and smaller have continued to innovate and find new means of building a greener online world, while Yahoo has been gradually drifting down.

C **Energy Transparency:** While Yahoo continues to provide energy footprint and sustainability efforts through its annual submission to CDP, including consumption and energy performance data for its data centers.[279] Despite having a good story to tell, Yahoo has fallen far behind other sector leaders in providing accessible information on its energy performance outside of CDP, offering only a single page of information on its sustainability site, with very little in the way of actual data.[280]

B **Renewable Energy Commitment:** Yahoo has maintained since 2009 its intention to become sustainable through a long-term focus on energy efficiency and renewable energy, and has remained near the top among major data operators for clean energy percentage since we began evaluating the sector, primarily through locating its data centers where in locations where they can tap into existing hydropower resources in Washington and New York State.

B **Efficiency and GHG mitigation:** Yahoo successfully achieved a long-term goal of reducing the carbon intensity of its data center operations 40% by 2014, which was achieved in part by transitioning out of inefficient data centers in high carbon regions.[281] Yahoo has not established a new target to drive further improvements in performance.

B **RE procurement:** Yahoo signed a Virtual PPA for 24 MW of wind power in Kansas, which came online in 2015,[282] which shares the same grid as its data center in Nebraska. Yahoo's clean energy strategy has primarily relied upon securing blocks of hydroelectric supply from existing resources.

D **Advocacy:** Yahoo previously supported the extension of the Federal Renewable Production Tax Credit (PTC) in the United States, as well as legislation to enable long-term energy contracts in Nebraska, but Yahoo's advocacy efforts have steadily declined at the same time other companies are becoming more vocal.

Zum.com

F | 2.2% | 38.7% | 19.1% | 31%
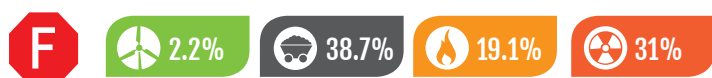
Zum.com, a web portal, appears to be hosted by KT.[283] did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Zum.com does not provide any information about its energy footprint or greenhouse gas emissions.
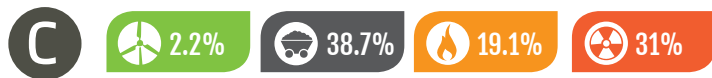
F **Renewable Energy Commitment:** Zum.com has not set any energy goals.

F **Efficiency and GHG mitigation:** Zum.com did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** Zum.com has not offered evidence of renewable energy procurement.

F **Advocacy:** Zum.com did not provide evidence of renewable energy advocacy.

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Social Media Sites

82cook.com

F | 2.2% | 38.7% | 19.1% | 31%

82cook.com, an online community in Korea, appears to be hosted by Dacom Kidc.[284] 82cook.com did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** 82cook.com does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** 82cook.com has not set any energy goals.

F **Efficiency and GHG mitigation:** 82cook.com did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** 82cook.com has not offered evidence of renewable energy procurement.

F **Advocacy:** 82cook.com did not provide evidence of renewable energy advocacy.

Band.us

F | 2.2% | 38.7% | 19.1% | 31%

Band.us, a mobile application owned by Naver Corp, appears to be hosted by Lg Telecom Kidc.[285] Band.us did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Band.us does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Band.us has not set any energy goals.

F **Efficiency and GHG mitigation:** Band.us did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** Band.us has not offered evidence of renewable energy procurement.

F **Advocacy:** Band.us did not provide evidence of renewable energy advocacy.

Clien.net

F | 2.2% | 38.7% | 19.1% | 31%

Clien.net, an online forum, appears to be hosted by KT.[286] Clien.net did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Clien.net does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Clien.net has not set any energy goals.

F **Efficiency and GHG mitigation:** Clien.net did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** Clien.net has not offered evidence of renewable energy procurement.

F **Advocacy:** Clien.net did not provide evidence of renewable energy advocacy.

Coolenjoy.net

F | 2.2% | 38.7% | 19.1% | 31%

Coolenjoy.net, a hardware community in Korea, appears to be hosted by SK Broadband. Coolenjoy.net did not provide Greenpeace with information about its energy use.[287]

F Energy Transparency: Coolenjoy.net does not provide any information about its energy footprint or greenhouse gas emissions.

F Renewable Energy Commitment: Coolenjoy.net has not set any energy goals.

F Efficiency and GHG mitigation: Coolenjoy.net did not provide evidence of the energy efficiency of its operations.

F RE procurement: Coolenjoy.net has not offered evidence of renewable energy procurement.

F Advocacy: Coolenjoy.net did not provide evidence of renewable energy advocacy.

DCinside.com

F | 2.2% | 38.7% | 19.1% | 31%

DCinside.com, an online community, appears to be hosted by Hanaro Telecom.[288] DCinside.com did not provide Greenpeace with information about its energy use.

F Energy Transparency: DCinside.com does not provide any information about its energy footprint or greenhouse gas emissions.
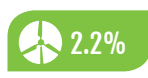
F Renewable Energy Commitment: DCinside.com has not set any energy goals.

F Efficiency and GHG mitigation: DCinside.com has not offered evidence of renewable energy procurement.

F RE procurement: DCinside.com did not provide evidence of renewable energy advocacy.

F Advocacy: DCinside.com did not provide evidence of the energy efficiency of its operations.

Facebook.com

A | 67% | 15% | 7% | 9%
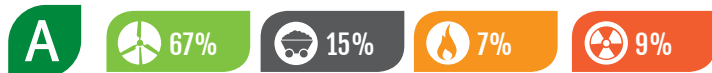
Please see page 50 for a full evaluation of Facebook's performance

Gasengi.com

F | 2.2% | 38.7% | 19.1% | 31%

Gasengi.com, an online community, appears to be hosted by KINX.[289] Gasengi.com did not provide Greenpeace with information about its energy use.

F Energy Transparency: Gasengi.com does not provide any information about its energy footprint or greenhouse gas emissions.
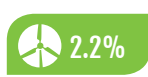
F Renewable Energy Commitment: Gasengi.com has not set any energy goals.

F Efficiency and GHG mitigation: Gasengi.com did not provide evidence of the energy efficiency of its operations.

F RE procurement: Gasengi.com has not offered evidence of renewable energy procurement.

F Advocacy: Gasengi.com did not provide evidence of renewable energy advocacy.

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Ilbe.com

F | 🌱 2.2% | ⚫ 38.7% | 🔥 19.1% | ☢ 31%
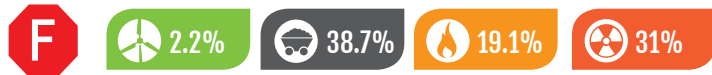
Ilbe.com, an online community, appears to be hosted by CloudFlare.[290] Ilbe.com did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Ilbe.com does not provide any information about its energy footprint or greenhouse gas emissions.
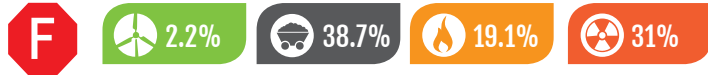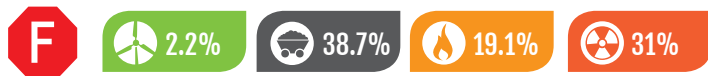
F **Renewable Energy Commitment:** Ilbe.com has not set any energy goals.

F **Efficiency and GHG mitigation:** Ilbe.com has not offered evidence of renewable energy procurement.

F **RE procurement:** Ilbe.com did not provide evidence of renewable energy advocacy.

F **Advocacy:** Ilbe.com did not provide evidence of the energy efficiency of its operations.

Instagram.com

A | 🌱 67% | ⚫ 15% | 🔥 7% | ☢ 9%

Instagram.com, the photo and video sharing social network, is owned and hosted by Facebook, which operates its own data centers and also has servers in colocation facilities. For further details on Instagram's scores, see Facebook's write up on page 50.

Instiz.net

F | 🌱 2.2% | ⚫ 38.7% | 🔥 19.1% | ☢ 31%

Instiz.net, an online community, appears to be hosted by DACOM.[291] Instiz.net did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Instiz.net does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Instiz.net has not set any energy goals.

F **Efficiency and GHG mitigation:** Instiz.net has not offered evidence of renewable energy procurement.

F **RE procurement:** Instiz.net did not provide evidence of renewable energy advocacy.

F **Advocacy:** Instiz.net did not provide evidence of the energy efficiency of its operations.

Inven.co.kr

F | 🌱 2.2% | ⚫ 38.7% | 🔥 19.1% | ☢ 31%
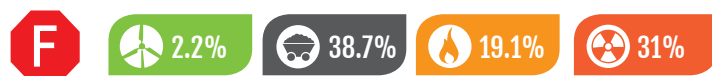
Inven.co.kr, a game webzine, appears to be hosted by GABIA.[292] Inven.co.kr did not provide Greenpeace with information about its energy use.
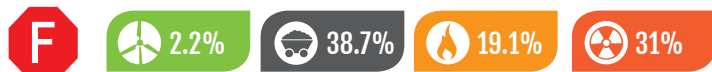
F **Energy Transparency:** Inven.co.kr does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Inven.co.kr has not set any energy goals.

F **Efficiency and GHG mitigation:** Inven.co.kr has not offered evidence of renewable energy procurement.

F **RE procurement:** Inven.co.kr did not provide evidence of renewable energy advocacy.

F **Advocacy:** Inven.co.kr did not provide evidence of the energy efficiency of its operations.

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Jjang0u.com

F | **2.2%** | **38.7%** | **19.1%** | **31%**

Jjang0u.com, an online community, appears to be hosted by Korea Telecom.[293] **Jjang0u.com did not provide Greenpeace with information about its energy use.**

F **Energy Transparency:** Jjang0u.com does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Jjang0u.com has not set any energy goals.

F **Efficiency and GHG mitigation:** Jjang0u.com has not offered evidence of renewable energy procurement.

F **RE procurement:** Jjang0u.com did not provide evidence of renewable energy advocacy

F **Advocacy:** Jjang0u.com did not provide evidence of the energy efficiency of its operations.

Lezhin.com

D | **56%** | **14%** | **15%** | **10%**
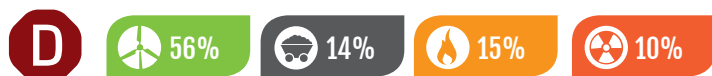
Lezhin.com, a webtoon site, appears to be hosted by Google.[294] **The company did not provide Greenpeace with information about its energy use.**
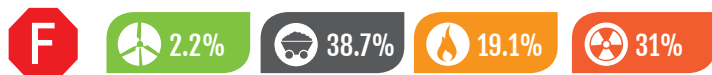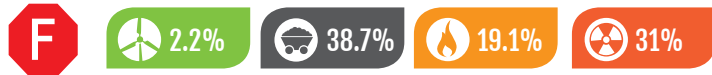
F **Energy Transparency:** Lezhin.com does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Lezhin.com has not set any energy goals.

F **Efficiency and GHG mitigation:** Lezhin.com has not offered evidence of renewable energy procurement.

C **RE procurement:** Lezhin.com's decision to use Google's cloud for hosting provides a significant boost in its use of renewable energy.

F **Advocacy:** Lezhin.com did not provide evidence of the energy efficiency of its operations.

LinkedIn.com

B | **10%** | **23%** | **31%** | **20%**

LinkedIn, the professional social networking site recently acquired by Microsoft, operates data centers in Virginia, Texas, California, Oregon, Georgia and Singapore, according to data provided by LinkedIn to Greenpeace.

A **Energy Transparency:** LinkedIn received full credit for providing electricity footprint and carbon data for each of its data centers and for its overall data center operations to Greenpeace.

A **Renewable Energy Commitment:** LinkedIn received full credit for a data center siting policy that prioritizes sustainability. For new data centers, LinkedIn has committed to sustainability being one of five primary factors in the decision-making process around locations, according to its submission to Greenpeace.

B **Efficiency and GHG mitigation: I**n 2016, Linkedin executed a direct access contract for renewable energy in Oregon, increasing the company's renewable energy mix from 26% to 85% in that region, according to information provided to Greenpeace.

B **RE procurement:** Linkedin recieved credit for appealing to Virginia regulators, as a major customer of Dominion Virginia Power, in support of greater access to renewable energy.[295]

A **Advocacy:** LinkedIn received credit for writing PUE expectations into its contracts with data center vendors and managing them daily to ensure that vendors are meeting the contractual obligations. LinkedIn operates real-time energy monitoring equipment to quickly and effectively monitor, manage, and adjust to its energy usage, and manages utilization with a goal of using 100% of its rack space, according to its submission to Greenpeace.

Greenpeace USA

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Who is Winning
the Race to Build
A Green Internet?

Appendix II:
Company Scores
Explained

Nexon.com

F | ⚡ 2.2% | ⛏ 38.7% | 🔥 19.1% | ☢ 31%
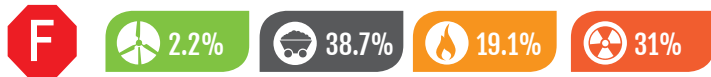
Nexon.com, a video game developer and publisher company, appears to be hosted by Korea Telecom.[296] Nexon.com did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Nexon.com does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Nexon.com has not set any energy goals.

F **Efficiency and GHG mitigation:** Nexon.com has not offered evidence of renewable energy procurement.

F **RE procurement:** Nexon.com did not provide evidence of renewable energy advocacy.

F **Advocacy:** Nexon.com did not provide evidence of the energy efficiency of its operations.

Pinterest.com

F | ⚡ 17% | ⛏ 30% | 🔥 24% | ☢ 26%

Pinterest, an online platform which allows users to curate and share images, relies on Amazon Web Services for delivering its content to its users.[297]

F **Energy Transparency:** Pinterest does not provide any information on its energy footprint. Pinterest is still privately held.

F **Renewable Energy Commitment:** Pinterest has not adopted a commitment to renewable energy or goals to increase its supply.

F **Efficiency and GHG mitigation:** Pinterest has not offered any evidence of renewable energy leadership or made investments to increase the amount of renewable energy it uses.

F **RE procurement:** Pandora has not provided any evidence of renewable energy advocacy.

F **Advocacy:** Pinterest has not provided any evidence about increased energy efficiency.

Ppomppu.co.kr

F | ⚡ 2.2% | ⛏ 38.7% | 🔥 19.1% | ☢ 31%

Ppomppu.co.kr, an online community, appears to be hosted by LG Dacom.[298] Ppomppu.co.kr did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Ppomppu.co.kr does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Ppomppu.co.kr has not set any energy goals.

F **Efficiency and GHG mitigation:** Ppomppu.co.kr has not offered evidence of renewable energy procurement.

F **RE procurement:** Ppomppu.co.kr did not provide evidence of renewable energy advocacy.

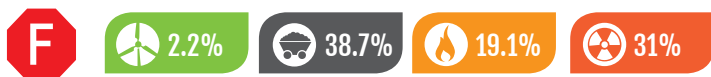**F** **Advocacy:** Ppomppu.co.kr did not provide evidence of the energy efficiency of its operations.

Greenpeace USA

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Appendix II:
**Company Scores
Explained**

Reddit.com

F | 17% | 30% | 24% | 26%

Reddit, the widely visited social networking and news site, appears to be hosted by Amazon Web Services. [299]

F **Energy Transparency:** Reddit does not provide any information about its energy footprint.

F **Renewable Energy Commitment:** Reddit has not set any energy goals.

F **Efficiency and GHG mitigation:** Reddit has not offered evidence of renewable energy championship.

F **RE procurement:** Reddit has not provided evidence of renewable energy advocacy.

F **Advocacy:** Reddit did not provide any details on its energy performance or efforts to increase data center energy efficiency.

Twitter.com

F | 10% | 21% | 43% | 14%
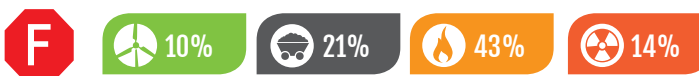
Twitter hosts its growing digital footprint in colocation data centers in Georgia, California and Virginia [300]**, where it recently expanded with a 21 MW lease in 2014.** [301] **Twitter has not provided Greenpeace or the public with any information about its energy footprint.**

F **Energy Transparency:** Twitter does not publicly provide information about its energy footprint.

F **Renewable Energy Commitment:** Twitter has not set any energy goals, or shown that it is factoring in its energy footprint when it chooses where to lease wholesale data center space.

F **Efficiency and GHG mitigation:** No evidence of Twitter taking steps to secure a renewable supply of electricity has been provided by the company or documented publicly.

F **RE procurement:** Despite its influential role within the sector, Twitter has not used its standing to advocate for clean energy policies, unlike peers Facebook and LinkedIn.

F **Advocacy:** Twitter did not provide any details on its energy performance or efforts to increase data center energy efficiency.

Greenpeace USA

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Appendix II:
Company Scores
Explained

Blogs

Blog.me

C | 2.2% | 38.7% | 19.1% | 31%
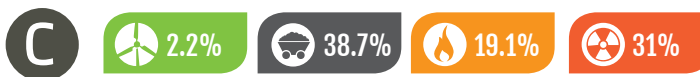
Blog.me, a blog publishing service owned by Naver Corp., is hosted in NHN data center in Seongnam, South Korea. The blog publishing service is embedded in Naver.com, a web portal by Naver Corp., which has self-operating datacenter. See page 54 for a detailed assessment of Naver.

Blogger.com

A | 56% | 14% | 15% | 10%

Blogger.com, the blogging platform, is owned and hosted by Google, which operates a fleet of global data centers. See page 51 for a detailed assessment of Google.

Egloos.com

F | 2.2% | 38.7% | 19.1% | 31%
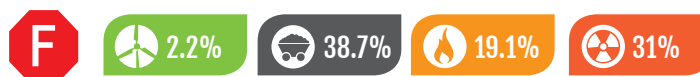
Egloos.com, a blog publishing service website owned by Zum Internet Corp., appears to be hosted by KT (Korea Telecom).[302] Egloos.com did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Egloos.com does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Egloos.com has not set any energy goals.

F **Efficiency and GHG mitigation:** Egloos.com has not offered evidence of renewable energy procurement.

F **RE procurement:** Egloos.com did not provide evidence of renewable energy advocacy

F **Advocacy:** Egloos.com did not provide evidence of the energy efficiency of its operations.

Tistory.com

F | 2.2% | 38.7% | 19.1% | 31%

Tistory.com, a blog publishing service website owned by Kakao Corp., appears to be hosted by NTT America in Korea.[303] Tistory.com did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Tistory.com does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Tistory.com has not set any energy goals.

F **Efficiency and GHG mitigation:** Tistory.com has not offered evidence of renewable energy procurement.

F **RE procurement:** Tistory.com did not provide evidence of renewable energy advocacy.

F **Advocacy:** Tistory.com did not provide evidence of the energy efficiency of its operations.

Tumblr.com

B | 74% | 12% | 5% | 6%

Tumblr.com, the image hosting site, is owned by Yahoo. Please see page 73 for a detailed evaluation of Yahoo.

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Appendix II:
Company Scores
Explained

WordPress-D

D | 13% | 29% | 34% | 15.6%
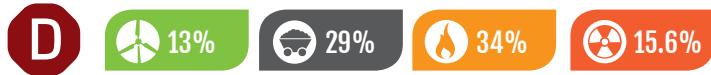
Wordpress.com is a blogging platform owned by Automattic, which operates data centers in 13 colocation facilities in the US, Europe, Asia and Australia.51 Its largest colocation vendor is Equinix, along with DataBank, CoreSite, and Verizon.[304]

B **Energy Transparency:** Automattic for providing Greenpeace with a comprehensive electricity footprint and carbon data for each of its data centers, and its full data center footprint.

F **Renewable Energy Commitment:** Automattic has not made a commitment to power its operations with renewable energy.

F **Efficiency and GHG mitigation:** Automattic did not provide details on efforts to improve the energy efficiency of its data center operations or reduce its GHG emissions.

F **RE procurement:** Automattic has not deployed or purchased any renewable energy.

D **Advocacy:** Automattic has not yet spoken out better access to renewable energy to power its operations.

E-Commerce

11st.co.kr

F | 2.2% | 38.7% | 19.1% | 31%
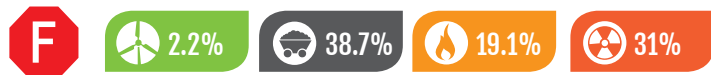
11st.co.kr, an e-commerce website, owned by SK Planet Co., Ltd., appears to be hosted by SK Telecom.[305] **11st.co.kr did not provide Greenpeace with information about its energy use.**

F **Energy Transparency:** 11st.co.kr does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** 11st.co.kr has not set any energy goals.

F **Efficiency and GHG mitigation:** 11st.co.kr did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** 11st.co.kr has not offered evidence of renewable energy procurement.

F **Advocacy:** 11st.co.kr did not provide evidence of renewable energy advocacy.

Aladin.co.kr

F | 2.2% | 38.7% | 19.1% | 31%
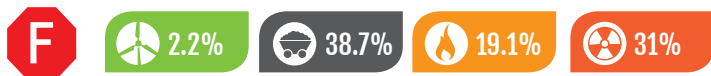
Aladin.co.kr, an online bookstore, appears to be hosted by Intellicenter.[306] **Aladin.co.kr did not provide Greenpeace with information about its energy use.**

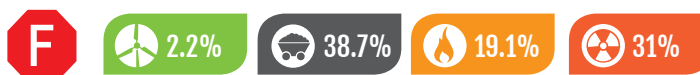**F** **Energy Transparency:** Aladin.co.kr does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Aladin.co.kr has not set any energy goals.

F **Efficiency and GHG mitigation:** Aladin.co.kr did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** Aladin.co.kr has not offered evidence of renewable energy procurement.

F **Advocacy:** Aladin.co.kr did not provide evidence of renewable energy advocacy

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Appendix II:
Company Scores
Explained

Amazon.com

C   17%   30%   24%   26%

Amazon.com, the e-commerce site, is hosted by its subsidiary, Amazon Web Services (AWS), which operates a global fleet of data centers. See page 47 for a detailed assessment of AWS.

Auction.co.kr

F   2.2%   38.7%   19.1%   31%

Auction.co.kr, an e-commerce website owned by eBay, appears to be hosted by KT. Auction.co.kr[307] did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Auction.co.kr does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Auction.co.kr has not set any energy goals.

F **Efficiency and GHG mitigation:** Auction.co.kr did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** Auction.co.kr has not offered evidence of renewable energy procurement.

F **Advocacy:** Auction.co.kr did not provide evidence of renewable energy advocacy

Bobaedream.co.kr

F   2.2%   38.7%   19.1%   31%

Bobaedream.co.kr, a automobile shopping website, leases SK Broadband datacenter (100%) and uses cloud service by Gabia. Bobaedream.co.kr has provided minimum information to Greenpeace.

D **Energy Transparency:** Bobaedream.co.kr disclosed the datacenter and cloud service information to Greenpeace.

F **Renewable Energy Commitment:** Bobaedream.co.kr has not set any energy goals.

F **Efficiency and GHG mitigation:** Bobaedream.co.kr did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** Bobaedream.co.kr has not offered evidence of renewable energy procurement.

F **Advocacy:** Bobaedream.co.kr did not provide evidence of renewable energy advocacy.

Coupang.com

F   2.2%   38.7%   19.1%   31%

Coupang.com, an e-commerce website, owned by Foward Ventures Co., Ltd., appears to be hosted by KT(Korea Telecom).[308] Coupang.com did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Coupang.com does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Coupang.com has not set any energy goals.

F **Efficiency and GHG mitigation:** Coupang.com did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** Coupang.com has not offered evidence of renewable energy procurement.

F **Advocacy:** Coupang.com did not provide evidence of renewable energy advocacy.

Greenpeace USA   *Clicking Clean:*   Appendix II:
Who is Winning   Company Scores
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Danawa.com

F   2.2%   38.7%   19.1%   31%

Danawa.com, an e-commerce website, appears to be hosted by KT(Korea Telecom).[309] Danawa.com did not provide Greenpeace with information about its energy use.
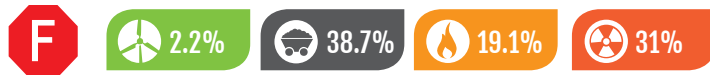
F **Energy Transparency:** Danawa.com does not provide any information about its energy footprint or greenhouse gas emissions.
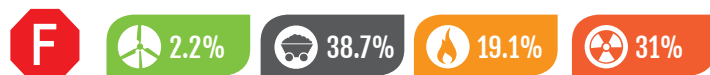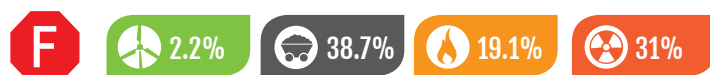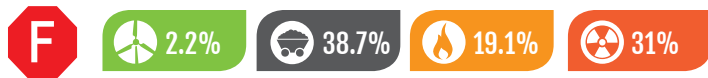
F **Renewable Energy Commitment:** Danawa.com has not set any energy goals.

F **Efficiency and GHG mitigation:** Danawa.com did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** Danawa.com has not offered evidence of renewable energy procurement.

F **Advocacy:** Danawa.com did not provide evidence of renewable energy advocacy.

eBay.com

B   38%   13%   38%   10%
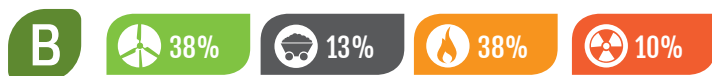
eBay, the online seller and auction company, is hosted in its own data centers in Utah and Arizona, and by Switch in Nevada. EBay's recent separation from PayPal appears to have resulted in a temporary loss in its level of ambition to measure and improve its environmental performance. However, eBay's renewable electricity supply received a significant boost as the result of Switch's efforts, and eBay has remained a vocal advocate for climate and clean energy policy.

B **Energy Transparency:** eBay has improved its energy disclosure in the past year, providing details on energy performance(PUE), total energy consumption, and water consumption at its three primary data centers.[310] Unfortunately, eBay no longer makes public the Digital Service Efficiency(DSE) Dashboard,[311] which had established a model in energy transparency within the sector. Absent a return of this dashboard, eBay should provide details on the amount of renewable energy powering its data centers at the corporate and facility level.

D **Renewable Energy Commitment:** EBay had previously established a goal of 8% total electricity from "cleaner sources"[312] by 2015, but currently does not have any emission reduction or renewable energy consumption target in place. EBay informed CDP it expects to establish updated goals in 2017.[313]

C **Efficiency and GHG mitigation:** The dramatic adjustment to eBay's energy performance baselines following its separation from PayPal, along with the elimination of the DSE dashboard, make it difficult to assess the current state of energy performance. EBay continues to maintain its GHG mitigation efforts for its Utah data center, which utilize an innovative combination of fuel cells and electricity from a combined heat and power project to substitute for the coal fired power on the state electricity grid.[314]

C **RE procurement:** EBay's received a significant boost in renewable electricity supply as Switch was able to secure a deal with NV Energy under Nevada's new Green Energy Rider to power its massive Las Vegas data center that eBay operates from with 100% renewable energy. EBay reported it purchased bundled renewable electricity products for both its Utah and Arizona data centers, but without additional details, its remains difficult to assess whether this represents additional renewable energy or only repackaging from existing sources.[315]

A **Advocacy:** eBay has remained vocal on the importance of stronger climate and clean energy policies. Most significant was eBay's support for aggressive new clean energy legislation in California[316] and its support for President Obama's Clean Power Plan.[317] EBay also signed the Low Carbon USA ad in the Wall Street Journal.[318]

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Appendix II:
Company Scores
Explained

Etsy.com

B | 14% | 36.25% | 18.6% | 31.53%

Etsy.com, the online marketplace focused on vintage or handmade items, remains one of the leaders among internet companies who do not own and operate their own data centers. Etsy has continued to strengthen its commitment to renewable energy, and push its colocation vendors to help it achieve its commitment to be 100% renewably powered by 2020.

A Energy Transparency: Etsy's most recent sustainability report catalogued its electricity use and carbon emissions, including a breakdown of major electricity sources with specific data on its data centers.[319] [320] Etsy provided Greenpeace with information detailing its fuel mix and consumption at each of its data centers.

A Renewable Energy Commitment: Etsy has established an aggressive goal to have all of its operations 100% renewably powered by 2020, with data centers representing 70% of its energy footprint.[321] Etsy has established principles to guide its renewable energy procurement towards maximizing impact and supporting local communities.

B Efficiency and GHG mitigation: Although Etsy does not operate its own data centers, it has made progress in improving the utilization of its servers, including the development and refinement of new software to improve the performance of its servers, which it has contributed to open source software repositories for others to build upon.[322]

B RE procurement: Etsy has not purchased renewable energy directly to date, but it recently shifted a significant portion of its data center operation to a different colocation operator in large part because of their ability to offer a data center that was primarily powered with clean sources of electricity, which significantly advance Etsy towards it 100% renewable energy goal.[323] Etsy has also established a detailed data center vendor screening survey on renewable energy and carbon performance that is used as part of its ongoing procurement.[324]

B Advocacy: Despite lacking the market share and political clout of larger internet companies, Etsy has shown its willingness to push both larger data center operators and government policy makers on better access to renewable sources of electricity, including government policy makers at the federal and state level in the US. Etsy is also working to provide the sellers on Etsy easier access to renewable energy by facilitating a discount for the purchase of rooftop solar.[325]

Gmarket.co.kr

F | 2.2% | 38.7% | 19.1% | 31%
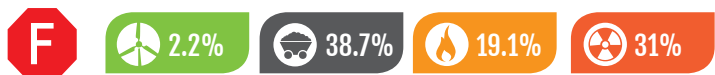
Gmarket.co.kr, an e-commerce website owned by ebay, appears to be hosted by KT[326]. Gmarket.co.kr did not provide Greenpeace with information about its energy use.

F Energy Transparency: Gmarket.co.kr does not provide any information about its energy footprint or greenhouse gas emissions.

F Renewable Energy Commitment: Gmarket.co.kr has not set any energy goals.

F Efficiency and GHG mitigation: Gmarket.co.kr did not provide evidence of the energy efficiency of its operations.

F RE procurement: Gmarket.co.kr has not offered evidence of renewable energy procurement.

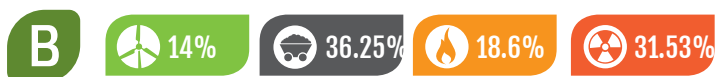**F Advocacy:** Gmarket.co.kr did not provide evidence of renewable energy advocacy.

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Appendix II:
Company Scores
Explained

Interpark.com

F **2.2%** **38.7%** **19.1%** **31%**

Interpark.com, a large Korean e-commerce company which operates B2C/C2C online auction and shopping website, appears to be hosted by LG Dacom.[327] Interpark.com did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Interpark.com does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Interpark.com has not set any energy goals.

F **Efficiency and GHG mitigation:** Interpark.com did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** Interpark.com has not offered evidence of renewable energy procurement.

F **Advocacy:** Interpark.com did not provide evidence of renewable energy advocacy.

Wemakeprice.co.kr

F **2.2%** **38.7%** **19.1%** **31%**
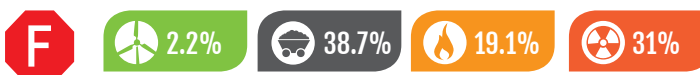
Wemakeprice.co.kr, a social commerce website, appears to be hosted by LG Dacom.[328] Wemakeprice.co.k did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Wemakeprice.co.kr does not provide any information about its energy footprint or greenhouse gas emissions.

F **Renewable Energy Commitment:** Wemakeprice.co.kr has not set any energy goals.

F **Efficiency and GHG mitigation:** Wemakeprice.co.kr did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** Wemakeprice.co.kr has not offered evidence of renewable energy procurement.

F **Advocacy:** Wemakeprice.co.kr did not provide evidence of renewable energy advocacy

Yes24.com

F **2.2%** **38.7%** **19.1%** **31%**

Yes24.com, a e-commerce website, appears to be hosted by LG Dacom.[329] Yes24.com did not provide Greenpeace with information about its energy use.

F **Energy Transparency:** Yes24.com does not provide any information about its energy footprint or greenhouse gas emissions.
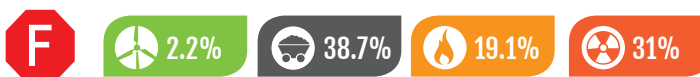
F **Renewable Energy Commitment:** Yes24.com has not set any energy goals.

F **Efficiency and GHG mitigation:** Yes24.com did not provide evidence of the energy efficiency of its operations.

F **RE procurement:** Yes24.com has not offered evidence of renewable energy procurement.

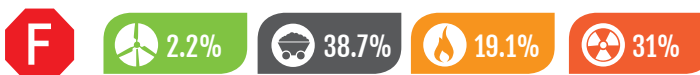**F** **Advocacy:** Yes24.com did not provide evidence of renewable energy advocacy.

Facility Tables

For companies listed in this Appendix, the Clean Energy Index and the associated company level electricity mix at the top of each section are calculated based on estimates of power capacity and resource mix of the facilities listed below. Greenpeace contacted all companies and invited them to provide details on the power capacity of their data centers at the facility level. When data has not been provided, or is incomplete, Greenpeace has used the best information available to derive designed power capacity and energy mix for each facility. Please see Appendix I: Methodology (page 42), for full explanation of Clean Energy Index data sources and basis of calculations.

amazon.com web services

CLEAN ENERGY INDEX 17%
NATURAL GAS 24% / COAL 30% / NUCLEAR 26%

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility			
			Natural Gas	Nuclear	Coal	
Ashburn, Virginia (IAD6, IAD13, IAD54)	64	3%	32%	33%	31%	This three building campus has received permits for 99 MW of backup generator capacity.
Ashburn, Virginia (IAD50 & IAD60)	60	3%	32%	33%	31%	This facility received permits for 103 MW of backup generator capacity in 2014.
Ashburn, Virginia (IAD71 & IAD78)	48	3%	32%	33%	31%	Adjoining IAD50 & IAD60, AWS was issued permits for 75MW of backup generator capacity in 2016
Chantilly, Virginia (IAD1 & IAD9)	3	3%	32%	33%	31%	Has been issued permits for just under 40 MW of backup generator capacity. Estimated power capacity of 26MW reduced to 3MW to reflect offset in demand from 23MW of renewable energy capacity added to surrounding grid by US East 6 AWS solar facility(Nameplate capacity 100MW)Facility not credited as renewably powered as it is unclear whether AWS has retained the associated renewable energy credits associated with the project.
Chantilly, Virginia (IAD61)	14	3%	32%	33%	31%	New Facility, issued permits for 200MW of backup generator capacity in 2015. Estimated power capacity of 128MW reduced by 114 MW to reflect offset in demand from the estimated additional capacity added to the surround grid in Virginia by 5 local renewable energy contracts signed by AWS (total nameplate capacity of 368MW). Facility not credited for renewably powered as it is unclear whether AWS has retained the associated renewable energy credits from these projects.
Haymarket, Virginia (IAD 55 & IAD64)	141	3%	32%	33%	31%	New facility, issued permits for 75 MW of backup generator capacity in 2014 and 130MW in 2015 (total 205MW)
Manassas, Virginia (IAD7, IAD11, IAD24)	53	3%	32%	33%	31%	This facility has been issued permits for 79 MW of backup generator capacity.
Manassas, Virginia (IAD14, IAD52, IAD59)	82	3%	32%	33%	31%	This facility has been issued permits for 132 MW of backup generator capacity.
Manassas, Virginia (IAD73 & IAD74)	64	3%	32%	33%	31%	New Facility, issued permits for 90MW of backup generator capacity in 2015
Sterling, Virginia (IAD 10 & IAD 32)	32	3%	32%	33%	31%	This facility has been issued permits for over 50 MW of backup generator capacity.
Sterling, Virginia (IAD12, IAD 15, IAD16)	64	3%	32%	33%	31%	This facility has been issued permits for 117 MW of backup generator capacity.
Sterling, Virginia (IAD51,IAD56, IAD88, IAD89)	90	3%	32%	33%	31%	Expanded facility, issued permits for additional 90MW of backup generator capacity in 2016, in addition to 56 MW of backup generator capacity in 2014, for total of 146MW.
Sterling, Virginia (IAD57 & IAD58)	48	3%	32%	33%	31%	This facility has been issued permits for 90 MW of backup generator capacity.
Sterling, Virginia (IAD 62)	160	3%	32%	33%	31%	New facility, issued permits for 225MW of backup power generation capacity in 2015
Boardman, Oregon (PDX1)	40	85%	0%	10%	0%	AWS claims its Oregon region (US West-Oregon & AWS GovCloud) is one of two that are "carbon neutral." This facility has been issued permits for 33 MW of backup generator capacity.
Umatilla, Oregon (PDX2)	40	85%	0%	10%	0%	AWS claims its Oregon region (US West-Oregon & AWS GovCloud) is one of two that are "carbon neutral." This facility has been issued permits for 33 MW of backup generator capacity.

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility			
			Natural Gas	Nuclear	Coal	
Boardman, Oregon (PDX4)	40	85%	0%	10%	0%	AWS claims its Oregon region (US West-Oregon & AWS GovCloud) is one of two that are "carbon neutral." This facility has been issued permits for 32 MW of backup generator capacity.
Hayward, California (SF01)	20	30%	24%	21%	0%	This facility has been issued permits for approximately 34 MW of backup generator capacity.
Santa Clara, California (SF02)	16	40%	46%	0%	9%	This facility has been issued permits for approximately 24 MW of backup generator capacity.
Ohio (Hilliard)	66	3%	16%	34%	46%	New Facility, AWS issued 224MW of backup power generation capacity. Estimated power capacity of 160MW reduced by 94MW to reflect offset in demand from estimated additional capacity to local grid by two wind contracts signed by AWS(total nameplate capacity of 250MW) Facility not credited for renewable as it is unclear if AWS has retained the associated renewable energy credits from these projects.
Ohio (Dublin)	160	3%	16%	34%	46%	New Facility, AWS issued 224MW of backup power generation capacity New Facility, AWS issued 224MW of backup power generation capacity
Ohio (New Albany)	160	3%	16%	34%	46%	New Facility, AWS issued 224MW of backup power generation capacity
Dublin (DUB8)	58	61%	15%	0%	15%	Amazon's Irish subsidiary has been issued greenhouse gas permits for approximately 72 MW of backup generator capacity, assuming a generator size of 2 MW.
Dublin (DUB9)	51	61%	15%	0%	15%	Amazon's Irish subsidiary has been issued greenhouse gas permits for approximately 64 MW of backup generator capacity, assuming a generator size of 2 MW.
Dublin (DUB10)	58	61%	15%	0%	15%	Amazon's Irish subsidiary has been issued greenhouse gas permits for approximately 72 MW of backup generator capacity, assuming a generator size of 2 MW.
Dublin (DUB54)	27	61%	15%	0%	15%	Amazon's Irish subsidiary has been issued greenhouse gas permits for approximately 38 MW of backup generator capacity, assuming a generator size of 2 MW.
Frankfurt, Germany (FRA1)	20	18%	11%	15%	46%	
Frankfurt, Germany (FRA2)	20	18%	11%	15%	46%	
London, UK	10	21%	29%	19%	21%	
Montreal, Canada	10	99%	1%	0%	0%	
Asia Pacific (Mumbai)	10	15%	5%	3%	73%	
Asia Pacific (Seoul)	10	1%	19%	31%	39%	
Asia Pacific (Tokyo)	15	9%	65%	1%	18%	
Asia Pacific (Singapore)	10	0%	91%	0%	1%	
Asia Pacific (Syndey)	15	12%	21%	0%	65%	
China (Beijing)	10	25%	3%	3%	67%	
China (Ningxia)	5	25%	3%	3%	67%	
South America (Sao Paulo)	15	70%	12%	3%	4%	

CLEAN ENERGY INDEX 83%
NATURAL GAS 4% / COAL 5% / NUCLEAR 5%

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility			
			Natural Gas	Nuclear	Coal	
Athenry, Ireland	?	100%?	45%	0%	34%	Facility scheduled to open in 2017. Apple has pledged to secure 100% renewable electricity
Maiden, NC	25	100%	12%	51%	33%	Due to continued growth, Apple has relied on in-state RECs for 36% of its renewable supply in 2015. However, Apple has a third solar farm (18MW) coming on line in 2015, and signed deal for new renewable energy under Duke Energy's GreenSource Rider, for total renewable capacity equivilent to over 27MW of demand
Mesa, AR	13	100%	13%	20%	58%	Apple announced new data center and commitment to be 100% renewably powered, beginning with 70 MW of solar to be done in partnership with local utility. Apple credited for nearby new solar farm already online in 2016
Newark, CA	15	100%	24%	21%	0%	Apple is currently using direct access for wind energy, Apple announced a PPA for 130MW of solar power that will replace that current supply
Prineville, OR	4	100%	15%	0%	62%	Powered by Apple owned micro-hydro facility and by wind secured through state direct access program.
Reno, NV	5	100%	48%	1%	36%	Apple is partnering with its utility to provide renewable energy for 100 % of the 2013 load of its Reno facility.
New Colocation (Chicago)	6	3%	25%	37%	34%	Apple reported to have signed contract for 6MW of capacity in Dupont Fabros Technology data center in Chicago
New Colocation (Virginia)	8	3%	32%	33%	31%	Apple reported to have signed contract for 8MW of capacity in Dupont Fabros Technology ACC7 data center in Virginia
Existing Global Colocation	16	85%	–	–	–	Apple 2016 Environment Responsibility Report
Viborg, Denmark	?	100%	7%	3%	30%	Facility scheduled to open in 2017. Apple has pledged to secure 100% renewable electricity

CLEAN ENERGY INDEX 67%
NATURAL GAS 7% / COAL 15% / NUCLEAR 9%

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility			
			Natural Gas	Nuclear	Coal	
Prineville, Oregon	70	13%	15%	0%	62%	
West Coast Colocation	21	40%	46%	0%	9%	
Forest City, North Carolina	70	1%	12%	51%	33%	Like Google, Facebook is a top 20 electricity of Duke Energy in NC following the expansion of its Forest City data center. Despite pushing Duke Energy for a green energy tariff, unlike Apple or Google, Facebook has not yet signed up to buy renewable electricity from Duke Energy.
East Coast Colocation (Virginia)	35	3%	32%	33%	31%	
Los Lunas, New Mexico	60	100%	13%	40%	37%	Facebook announced in 2016 plans its newest data center in New Mexico, and negotiated for ability to fully power facility with renewable electricity
Clonee, Ireland	70	100%	45%	0%	7%	Facebook signed long term renewable PPA with Brookfield for renewable electricity supply in Ireland
Fort Worth, Texas	70	100%	48%	11%	28%	Facebook has agreed to buy full output from 200MW wind farm in Texas to meet facilities electricity needs
Lulea, Sweden	70	100%	1%	38%	1%	Facebook is powering its Sweden facility with 100 % hydropower
Altoona, Iowa	70	100%	0%	13%	39%	Facebook has co-developed a new wind project nearby its Altoona Data center with its utility to provide renewable energy for the first phase of this facility.

Google CLEAN ENERGY INDEX 56%
NATURAL GAS 14% / COAL 15% / NUCLEAR 10%

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility			
			Natural Gas	Nuclear	Coal	
Douglas County, Georgia	38	5%	55%	9%	29%	
Berkeley County, South Carolina	84	0%	23%	9%	48%	
Jackson County, AL	?	?	16%	23%	55%	Google has indicated it will secure a renewable supply for its data center under contruction at site of a retired coal fired power plant
Lenoir, North Carolina	84	16%	12%	51%	33%	Google signed deal under Duke Energy's Greensource Rider for 61MW solar project, credited for renewables output using typical capacity factors for solar in NC
Council Bluffs, Iowa	105	100%	0%	13%	39%	Google has a PPA for wind energy associated with its Iowa facility.
Dalles, Oregon	140	85%	1%	10%	0%	
Pryor, Oklahoma	140	100%	29%	0%	52%	Google has multiple PPAs for wind energy associated with its Oklahoma Facility, and has also been lobbying in Oklahoma for the creation of a renewable electricity tariff
Eemshaven, Netherlands (Google Owned)	31	100%	42%	3%	35%	Google has signed a PPA with Eneco for 62MW wind farm nearby the data center.
Eemshaven, Netherlands (Colocation)	36	13%	42%	3%	35%	Google has signed a PPA with Eneco for 62MW wind farm nearby the data center.
Dublin, Ireland	41	14%	45%	0%	34%	
Singapore	8	0%	91%	0%	1%	
Taiwan	42	6%	35%	16%	36%	
Hamina, Finland	19	100%	0%	23%	6%	Google has two PPAs for wind energy for its Hamina facility.
St. Ghislain, Belgium	24	5%	29%	57%	0%	
Quilicura, Chile	11	100%	15%	0%	41%	Google has signed contract for output of 80MW solar facility in Chile

hp CLEAN ENERGY INDEX 50%
NATURAL GAS 17% / COAL 27% / NUCLEAR 5%

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility			
			Natural Gas	Nuclear	Coal	
Wynard, England	10	100%	29%	19%	21%	
Atlanta (Alphareetta), GA	12	3%	39%	23%	35%	
Atlanta (Suwanne), GA	15	3%	39%	23%	35%	
Austin, TX	25	100%	16%	23%	26%	HP signed PPA for 112MW wind project in Texas to power its five data centers in the state
Houston, TX	30	100%	48%	11%	28%	HP signed PPA for 112MW wind project in Texas to power its five data centers in the state
Colorado	22	10%	34%	0%	56%	
Tulsa, OK	20	17%	22%	3%	57%	
Sydney, Australia	10	12%	21%	0%	65%	

CLEAN ENERGY INDEX 29%
NATURAL GAS 29% / COAL 27% / NUCLEAR 15%

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility		
			Natural Gas	Nuclear	Coal
Amsterdam, Netherlands	5	13%	42%	3%	35%
Bogota, Colombia	2	79%	15%	0%	6%
Boulder, Colorado	16	22%	25%	0%	53%
Dallas, Texas	20	30%	48%	11%	28%
Ehningen, Germany	4	82%	3%	4%	11%
Frankfurt, Germany	2	27%	10%	16%	45%
Hortlandia, Brazil	2	85%	7%	2%	2%
Hong Kong	1	0%	25%	0%	75%
Houston, Texas	4	48%	48%	11%	28%
London, UK	3	21%	29%	19%	21%
Melbourne, Australia	5	12%	21%	0%	65%
Ontario, Canada	5	61%	10%	16%	12%
Paris, France	3	17%	4%	73%	4%
Querétaro, Mexico	2	14%	51%	3%	12%
Research Triangle Park, North Carolina	17	1%	12%	51%	33%
San Jose, California	5	40%	46%	0%	9%
Seattle, Washington	4	93%	0%	4%	1%
Singapore	5	0%	91%	0%	1%
Tokyo, Japan	3	6%	65%	1%	18%
Washington DC	4	3%	23%	36%	37%

6 facilities. IBM reports that it has purchased 100% renewable electricity for two Dallas facilities.

IBM purchased renewable electricity which fulflled approximately 82% of the electricity needs for this facility.

Microsoft CLEAN ENERGY INDEX 32%
NATURAL GAS 23% / COAL 31% / NUCLEAR 10%

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility			
			Natural Gas	Nuclear	Coal	
Chicago, Illinois	73	100%	25%	37%	34%	Microsoft signed a PPA for wind power for its Chicago data center, totally 175MW.
Dublin	70	14%	45%	0%	34%	
San Antonio, Texas	27	100%	18%	24%	41%	Microsoft buys wind power through a long-term PPA to power its San Antonio facility.
Quincy, Washington	46	89%	2%	3%	6%	
Boydton, Virginia	95	3%	32%	33%	31%	Microsoft increased investment in Virginia data center by $350 million in 2014
W Des Moines, Iowa	140	36%	0%	13%	39%	Microsoft announced a major expansion in Iowa, a with a new $1.1 billion data center, bringing its total data center investment in the state to over $2 billion.
Cheyenne, Wyoming	34	13%	15%	0%	62%	Microsoft expanded Wyoming data center by at least $200 million in February 2015.
Amsterdam, Netherlands	140	13%	42%	3%	35%	
Australia	10	12%	21%	0%	65%	Microsoft has announced the opening of two data centers in Australia, but has not announced any details on size, so Greenpeace assumed a 5MW energy demand for each facility
Beijing	5	25%	3%	3%	67%	
Cardiff/London	10	21%	29%	19%	21%	
Chennai/ Mumbai/ Pune	15	24%	9%	2%	60%	Microsoft annonced investment in three data centers in India, totally approximately $220 million USD
Frankfurt	10	18%	11%	15%	46%	
Hong Kong	5	0%	25%	0%	75%	
New Victoria, Australia	10	12%	21%	0%	65%	
Saitama (Japan)	5	9%	65%	1%	18%	Microsoft has announced the opening of a new data centers in Tokyo, but has not announced any details on size, so Greenpeace assumed a 5MW energy demand.
São Paulo	5	70%	12%	3%	4%	
Seoul	10	2%	19%	31%	39%	
Shanghai	5	25%	3%	3%	67%	Microsoft has announced the opening of a new data centers in Singapore, but has not announced any details on size, so Greenpeace assumed a 5MW energy demand.
Singapore	5	0%	91%	0%	1%	Microsoft has announced the opening of a new data centers in Singapore, but has not announced any details on size, so Greenpeace assumed a 5MW energy demand.
Santa Clara, California	32	40%	46%	0%	9%	Microsoft expanded colocation lease with DuPont Fabros Technologies by 6 MW.
Northern Virginia (colo)	55	3%	32%	33%	31%	Microsoft is reported to have leased an additional 35MW of colocation space in Northern Virginia in 2016.

ORACLE CLEAN ENERGY INDEX 8%
NATURAL GAS 26% / COAL 36% / NUCLEAR 25%

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility			
			Natural Gas	Nuclear	Coal	
Austin, Texas	7	21%	16%	23%	26%	
West Jordan, Utah	8	13%	15%	0%	62%	
Colorado Springs, Colorado	2	10%	34%	0%	56%	
Northern VA	26	3%	32%	33%	31%	Oracle reported to have leased over 26MW of colocation space in Northern Virginia in 2016
Chicago	7	3%	25%	37%	34%	
Linlithgow, UK	2	21%	29%	19%	21%	

rackspace
the open cloud company

CLEAN ENERGY INDEX 29%
NATURAL GAS 25% / COAL 26% / NUCLEAR 19%

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility			
			Natural Gas	Nuclear	Coal	
Chicago, Illinois	15.0	3%	25%	37%	34%	
Dallas, Texas	12.0	12%	48%	11%	28%	
London, UK	10.0	100%	29%	19%	21%	Rackspace has arranged to procure 100% renewable electricity to meet the demand of its existing London facility.
Virginia	9.0	3%	32%	33%	31%	
Hong Kong	1.0	0%	25%	0%	75%	
Sydney, Australia	2.0	12%	21%	0%	65%	

salesforce

CLEAN ENERGY INDEX 43%
NATURAL GAS 12% / COAL 16% / NUCLEAR 15%

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility			
			Natural Gas	Nuclear	Coal	
California	3	26%	24%	21%	0%	
Chicago, Illinois	[7]	3%	25%	37%	34%	Salesforce signed a Virtual PPA for wind power in the same which services both their Chicago and Virginia data centers. Salesforce not credited for renewable as it is unclear if Salesforce retired the associated renewable energy credits from these projects, but their demand in this region was fully offset
Dallas, Texas	4					
France	2					
Germany	2					
Phoenix, Arizona	6	10%	22%	30%	38%	
Slough UK	2	89%	29%	19%	21%	Salesforce is powering its UK data center, built by NTT, with 100 % renewable energy, but 11% of which was biomass, which is not counted as renewable (see page 26)
Virginia	[2]	3%	32%	33%	31%	Salesforce signed a Virtual PPA for wind power in the same which services both their Chicago and Virginia data centers. Salesforce not credited for renewable as it is unclear if Salesforce retired the associated renewable energy credits from these projects, but their demand in this region was fully offset

CLEAN ENERGY INDEX 21%

NATURAL GAS 33% / COAL 25% / NUCLEAR 19%

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility			
			Natural Gas	Nuclear	Coal	
Amsterdam	38	13%	42%	3%	35%	
Atlanta	58	5%	55%	9%	29%	
Boston	42	14%	46%	33%	6%	
Charlotte	10	1%	12%	51%	33%	
Chicago	133	3%	25%	37%	34%	
Dallas	133	42%	48%	11%	28%	Digital Realty signed PPA for wind project in Texas, providing estimated 46MW of actual renewable capacity, with remaining demand calculated on local grid mix
Hong Kong	26	0%	25%	0%	75%	
Houston	25	0%	55%	10%	35%	
London	151	57%	13%	0%	27%	Digital Realty reports buying sufficient Levy Exempt Certifcates (LECs) to cover 100% of its electricity demand in London. However, the generation breakdown of the generation mix associated with the LECs shows Biomass(27%) and waste gas(13%). These have been allocated to coal and natural gas respectively, given their similar with the carbon profile.
Los Angeles	40	25%	24%	9%	23%	
Northern Virginia	145	3%	32%	33%	31%	
New York Metro	96	14%	45%	25%	13%	
Paris	29	4%	4%	73%	4%	
Phoenix	74	10%	16%	23%	46%	
San Francisco	71	30%	24%	21%	0%	
Silicon Valley	91	40%	46%	0%	9%	
Singapore	21	0%	91%	0%	1%	
Sydney	6	12%	21%	0%	65%	

CLEAN ENERGY INDEX 7%
NATURAL GAS 32% / COAL 29% / NUCLEAR 31%

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility		
			Natural Gas	Nuclear	Coal
Ashburn, Virginia (ACC2)	19	3%	32%	33%	31%
Ashburn, Virginia (ACC3)	18	3%	32%	33%	31%
Ashburn, Virginia (ACC4)	51	3%	32%	33%	31%
Ashburn, Virginia (ACC5)	47	3%	32%	33%	31%
Ashburn (ACC6)	34	3%	32%	33%	31%
Ashburn, Virginia (ACC7)	48	3%	32%	33%	31%
Ashburn, Virginia (ACC9)	32	3%	32%	33%	31%
Chicago, Illinois (CH1)	47	3%	25%	37%	34%
Chicago, IL (CH2)	32	3%	25%	37%	34%
Chicago, IL (CH3)	32	3%	25%	37%	34%
Santa Clara, California (SC1)	46	40%	46%	0%	9%
Reston, Virginia (VA3)	18	3%	32%	33%	31%
Bristow, Virginia (VA4)	13	3%	32%	33%	31%

Data Source for facility power capacity: http://www.dft.com/data-centers/location-information

CLEAN ENERGY INDEX 20%

EQUINIX

NATURAL GAS 30% / COAL 29% / NUCLEAR 20%

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility			
			Natural Gas	Nuclear	Coal	2 facilities
Seattle	12	93%	0%	4%	1%	2 facilities
California	34	100%	27%	6%	0%	
Denver	2	22%	25%	0%	53%	
Dallas	10	100%	48%	11%	28%	6 facilities
Chicago	26	3%	25%	37%	34%	4 facilities
Atlanta	9	5%	55%	9%	29%	3 facilities
Miami	7	0%	67%	22%	4%	2 facilities
Boston	1	7%	37%	28%	6%	
New York Metro	67	5%	20%	34%	39%	9 facilities
Philadelphia	1	3%	18%	35%	44%	
Northern Virginia	97	3%	32%	33%	31%	11 facilities
Brazil	15	70%	12%	3%	4%	4 facilities
Toronto	3	28%	11%	58%	2%	
Netherlands	40	17%	37%	3%	29%	5 facilities
London	14	21%	29%	19%	21%	5 facilities, not including Telecity data centers from merger
Paris	32	17%	4%	73%	4%	4 facilities, not including Telecity data centers from merger
Switzerland	23	58%	0%	36%	0%	6 facilities
Germany	50	18%	11%	15%	46%	10 facilities
Dubai	5	0%	99%	0%	0%	
Japan	35	9%	65%	1%	18%	7 facilities, not including recent Bit-Isle acquisition
Shanghai	8	25%	3%	3%	67%	4 facilities
Hongkong	35	0%	25%	0%	75%	3 facilities
Singapore	38	0%	91%	0%	1%	3 facilities
Australia	32	12%	21%	0%	65%	4 facilities

CLEAN ENERGY INDEX 100%

switch

NATURAL GAS 0% / COAL 0% / NUCLEAR 0%

Facility Location	Estimated Nameplate Power Capacity	% of Clean Energy Supply to Data Center	Resource Mix of Local Utility			Data Source for facility power capacity: http://www.switch.com
			Natural Gas	Nuclear	Coal	
Grand Rapids, Michigan	?	100%	23%	21%	46%	Switch has announced commitment to negotiate 100% renewable energy supply with Consumers Energy in Michigan
Las Vegas, Nevada	60	100%	76%	1%	11%	Switch has signed two contracts for a total of 180MW of renewable energy capacity in Nevada. Given its rapid growth plans, Switch will have to remain extreamly aggressive in purchasing additional renewables to maintain 100% renewables for its Nevada customers
Reno, Nevada	10	100%	53%	2%	27%	Switch has signed two contracts for a total of 180MW of renewable energy capacity in Nevada. Given its rapid growth plans, Switch will have to remain extreamly aggressive in purchasing additional renewables to maintain 100% renewables for its Nevada customers

Endnotes

1 Emerging Trends in Electricity Consumption for Consumer ICT, Peter Corcoran and Andres Andrae(2013)

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3 Ibid.

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7 Cisco Network Traffic Forecast, 2016. pg 5

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9 Based on government documents provided to Greenpeace East Asia, Seoul.

10 Emerging Trends in Electricity Consumption for Consumer ICT, Peter Corcoran and Andres Andrae(2013)

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12 https://www.cia.gov/library/publications/the-world-factbook/rankorder/2233rank.html

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14 http://www.mdpi.com/2078-1547/6/1/117/htm Anders S. G. Andrae and Tomas Edler. On Global Electricity Usage of Communication Technology: Trends to 2030. 27 February 2015. Huawei Technologies Sweden.

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16 Andrae and Edler (2015), p 9.

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