

ESG FOCUS

Carbon Emissions and Data Centers



Q2 ESG CASE STUDY | April 2020

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While it is useful to analyze a portfolio's exposure to a specific environmental, social and governance (ESG) risk or opportunity as measured by the U.N. Sustainable Development Goals (e.g., No. 7, Affordable and Clean Energy or No. 13, Climate Action), investors may underestimate risks if they fail to drill down to the sector and stock levels.

In this paper, we discuss carbon emissions exposure at the sector and industry levels by considering electricity usage by data centers, a large and growing segment of the information technology (IT) sector. We also present two case studies that illustrate how we assess whether sector ESG risks could translate into risks (or opportunities) for a company's financial condition.



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POWER UP

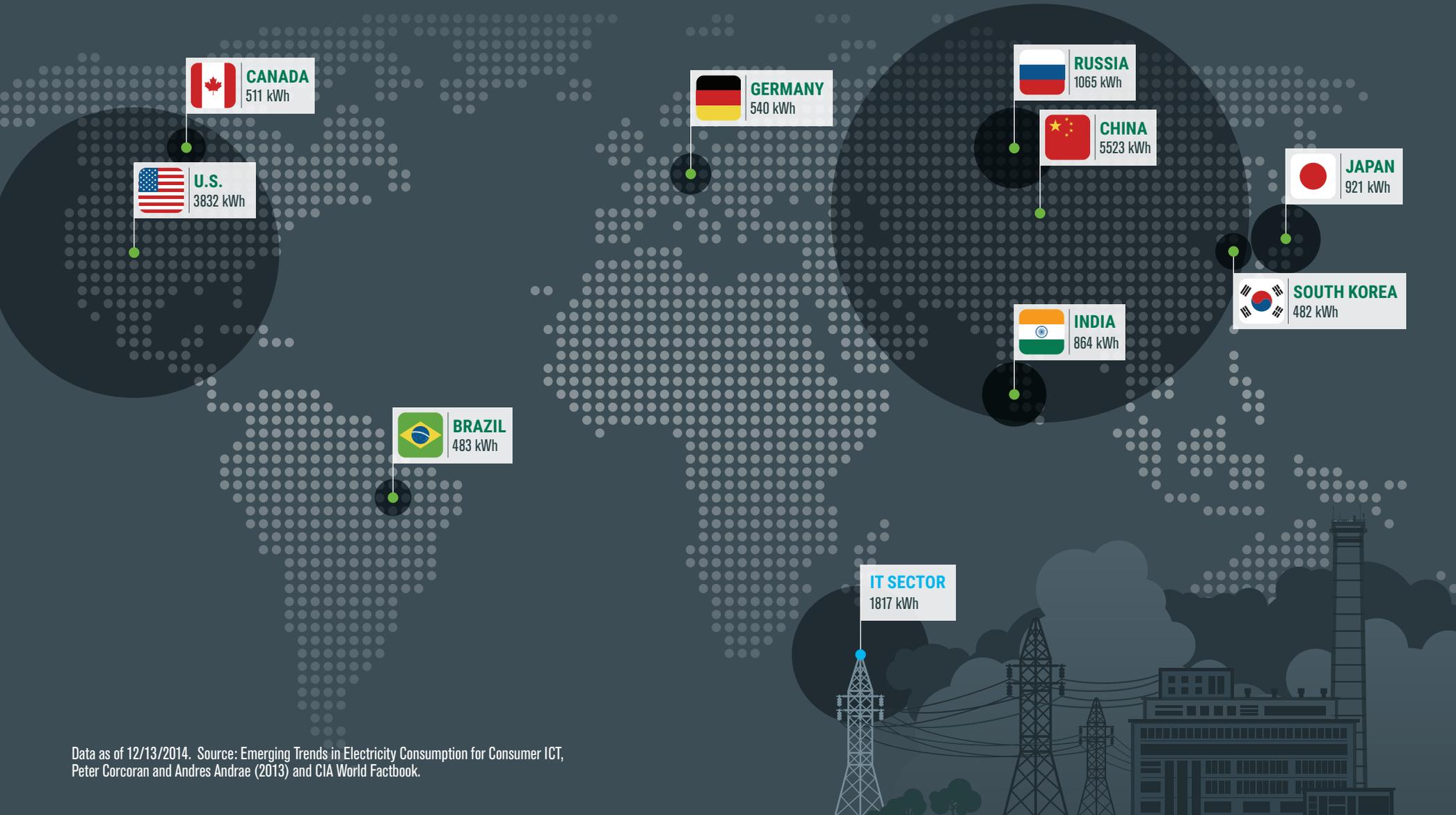
The IT Sector Uses More Energy Than Many Large Countries

Comparing data center energy consumption to a large-scale economy helps put the situation in perspective. Considering the electricity consumption of the IT sector as a whole, only China and the U.S. (the world's two largest economies) would use more electricity annually. Our billions of devices, the networks that connect them and the servers that house and transfer their data are a large contributor to this situation. The amount of energy that is used annually to run Google's servers could power a small city of 200,000.¹

¹ Camplin, Troy. "Why Big Tech Companies Are After Big Energy Solutions." January 24, 2019. <https://marketscale.com/industries/energy/google-taiwan-electricity>, (accessed January 15, 2020).

IT's Electricity Consumption Rivals That of the World's Largest Economies

BILLION KILOWATT (kWh)–HOURS



Data as of 12/13/2014. Source: Emerging Trends in Electricity Consumption for Consumer ICT, Peter Corcoran and Andres Andrae (2013) and CIA World Factbook.



New Technologies Drive the Growing Demand for Data

- 5G wireless computing
- Connected devices and the “internet of things” (IoT)
- Electronification of automobiles
- Artificial intelligence and robotics
- Cryptocurrencies

DRILLING DOWN

Carbon Emissions Risk in Data Centers

Increasing demand for online services and cloud computing has helped make data centers the cornerstone of modern technology infrastructure and one of the fastest-growing consumers of energy on the planet. The world's data centers consume vast amounts of electricity. And, with global data traffic doubling every four years, their energy consumption is expected to grow rapidly. All told, data centers are responsible for carbon dioxide (CO₂) emissions comparable to those of the entire airline industry.²

Globally, data is created and exchanged at a rapidly increasing pace. One estimate claims 90% of today's data was created in the last few years.³ That pace of growth will likely accelerate as adoption of new technologies increases.

The computational power required to run all this data comes from banks of servers housed in data centers. Data centers are non-descript windowless blocks, often in remote locations, that provide the physical security, uninterrupted cooling and redundant power needed to run these servers. Housing servers in data centers provides advantages, such as lower costs and the ability to locate servers near customers. The latter is why firms like Netflix have servers close to distributors Verizon and AT&T.

The combined demand for power to run and cool these servers results in an enormous amount of energy consumption. And, while many data centers have expressed commitments to renewable energy sources, a significant portion of the energy they consume is still generated by fossil fuel and other nonrenewable sources.

The Impact of CO₂ Emissions

Servers operate best at temperatures below 80 degrees Fahrenheit, so the energy required to cool them is significant. Unfortunately, most data centers are in deserts where land is inexpensive or in temperate regions such as Northern Virginia, which offers proximity to Washington, D.C., and a large concentration of customers. Such placement increases the amount of energy required to operate.

While China is generally focused on transitioning to other energy sources, its data centers source approximately 75% of their power from widely available and less expensive coal—resulting in more than 99 million tons of CO₂ emissions in 2018. This output is expected to increase by two-thirds by 2023 even as Chinese coal consumption is projected to decline to 35% in 2040, from 60% in 2017.⁴

Additionally, smaller, independently run data centers are less efficient and consume more energy than larger cloud-based enterprises such as Amazon Web Services (AWS).

Ways for Data Centers to Reduce CO₂ Emissions

Many companies have expressed commitments to “greening” their data center operations. Several options are available to reduce CO₂ emissions and an individual data center's energy footprint.

Locate Servers in Remote Areas Where Renewable Energy Sources Are Available

Companies could establish data centers in Nordic locations (e.g., Iceland, Sweden, Finland), where

hydroelectric power can generate electricity, and Arctic air can cool servers. The heat servers generate can, in turn, help produce heat and hot water for consumers.

- Google has contracted with a solar energy park in the Netherlands to supply energy to one of its European data centers.
- Visa has achieved its goal of using 100% renewable electricity by 2020 by leveraging renewable energy options at four key operations in the U.S. and U.K.

Increase Server Virtualization

Using a small number of physical servers to run a host of virtual servers could increase operating efficiency and reduce energy and cooling costs. Adding virtual servers can achieve scale without the need to greatly expand the infrastructure of physical servers.

Shift to Large, Cloud-Based Centers

Companies looking to reduce their carbon footprints could transition from smaller enterprise data centers to hyperscale providers such as AWS. This can help replace smaller-scale and more inefficient systems with potentially more power-efficient cloud-based providers.

²Pearce, Fred. "Energy Hogs: Can World's Huge Data Centers Be Made More Efficient?" Yale Environment 360, April 3, 2018. <https://e360.yale.edu/features/energy-hogs-can-huge-data-centers-be-made-more-efficient>, (accessed January 15, 2020).

³IBM Marketing Cloud. "10 Key Trends for 2017." <https://paulwriter.com/wp-content/uploads/2017/10/10-Key-Marketing-Trends-for-2017.pdf>, (accessed January 5, 2020).

⁴Elegant, Naomi Xu. "The Internet Cloud Has a Dirty Secret." September 18, 2019. <https://fortune.com/2019/09/18/internet-cloud-server-data-center-energy-consumption-renewable-coal/>, (accessed January 5, 2020).

⁵Marashi, Ali. "How to Improve Data Center Power Consumption & Energy Efficiency." February 12, 2020. <https://www.vxchnge.com/blog/power-hungry-the-growing-energy-demands-of-data-centers>, (accessed February 12, 2020).

CONSIDER THESE Data Center Energy Facts⁵

Data centers consume roughly **3% of all electricity** generated on the planet.

ALL ELECTRICITY ON THE PLANET

3%

Their energy consumption, while moderating, is growing at a rate of approximately **4% per annum.**

4%

GROWTH PER ANNUM

In 2017, U.S.-based data centers accounted for more than **90 billion kilowatt-hours of electricity—the equivalent of 34 coal-powered plants.**

**90^B
kWh-HOURS**

**34
COAL-POWERED PLANTS**

Global data centers' power consumption is **greater than the annual energy consumption of the U.K., the world's sixth-largest economy.**

**CONSUMPTION EXCEEDS THE U.K.,
WORLD'S SIXTH-LARGEST ECONOMY**

6TH



ESG Risk Assessment of Two Data Centers

CASE STUDIES

Equinix is a U.S.-based operator of cloud-neutral data centers. The company provides data and network hosting and colocation facilities where internet service providers, telecommunication companies and content providers can station equipment and connect networks and operations.

- Approximately 30% of its data centers are ISO 14001-certified for environmental management best practices, and the company is working to boost the number of certified data centers. ISO 14001 is the international standard that specifies requirements for establishing and maintaining environmental management systems to help mitigate potential adverse impacts.
- We are encouraged by the significant decline in the company's greenhouse gas emissions intensity over three years (-42.9% compound annual growth rate between 2015-2018).
- Equinix is also focused on its role as an environmentally efficient part of customers' supply chains, with more than 90% of energy sourced from renewables in 2018 (compared to 34% in 2015). The company's long-term goal is 100% clean and renewable energy across its portfolio.

GDS Holdings is a China-based operator of data centers. It has a similar business description as Equinix. The company has relationships with the largest hyperscale users in China, including Alibaba and Tencent.

- While we like the business story and its alignment with two key emerging ESG trends—IoT and asset digitalization—we recommended engagement with GDS to learn more about China's evolving environmental regulatory framework and the firm's carbon and energy management practices.
- Our engagement with GDS revealed the company's proactive power management initiatives have resulted in a dramatic improvement in its power usage effectiveness (PUE) over the last five years—from close to 2 to around 1.3-1.4 now.
- We also discovered that GDS is making progress toward increasing the share of renewables in the supply mix for its data centers. Around 15% of the company's power capacity is sourced from renewable energy, mainly hydroelectric power in Chengdu and wind power in Hebei. GDS is also installing rooftop solar modules at some of its data centers. The company's new site in Changshu will be designed to use a combination of different renewable energies where appropriate. Other company efforts include recycling heat and recycling used batteries.

We use a proprietary scoring model to assess whether sector ESG issues could result in risks to a company's market valuation or cause a downgrade of its fundamental profile. The model generates quality ESG scores based on various quantitative and qualitative ESG indicators that are sector-specific and derived from reported and third-party data. The ESG scores are considered in the context of our analysts' fundamental research. Engagement with company management also contributes to our ESG views on selected companies.

ESG RISK SCORE



Source: American Century Investments. Overweight means the ESG desk recommends the stock as the company has an above-average ESG profile compared to peers. Stable means the ESG profile of the company has neither improved nor worsened over the last three years.



Source: American Century Investments. Market weight means the ESG desk is neutral on the stock as the company has an average ESG profile compared to peers. Stable means the ESG profile of the company has neither improved nor worsened over the last three years.



ISO 14001-2015

Specifies the requirements for an environmental management system that an organization can use to enhance its environmental performance. ISO 14001-2015 is intended for use by an organization seeking to manage its environmental responsibilities in a systematic manner that contributes to the environmental pillar of sustainability.



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