

ClearBridge

Investments

ESG Investment Program



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Key Takeaways

- ▶ The explosion of digital data is creating stresses on power, water and business resources necessary to run the technologies that keep data accessible and secure.
- ▶ The efficiencies of the cloud business model should help lessen these impacts and promote new sources of growth for both hyperscale cloud providers and the data centers they utilize.
- ▶ Data centers contribute to energy savings and lower emissions through their strategic locations and growing use of renewable power sources.

Cloud Providers Work to Lessen Impacts of Big Data

With 400 hours of video being uploaded to YouTube every minute and fleets of self-driving cars mapping high definition 3D maps of roads all over the world, data is being created, stored and processed at a rate never seen before. Ninety percent of the world's data has been created in the last two years, according to IBM and other industry sources, and with new data hungry applications on the rise (autonomous driving, the Internet of Things, artificial intelligence), there's no sign of this trend abating.

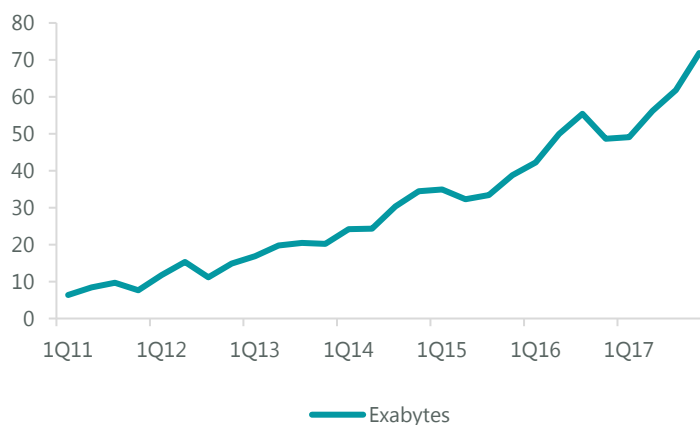
Organizing, storing and processing all that data comes with not only business, but also environmental challenges. In fact, networking and telecom equipment maker Huawei has estimated that global computing power could consume as much as 20% of global electricity in 2025 and account for 3.5% of global emissions.¹ All this data processing also requires large amounts of water to keep servers from overheating - roughly 1.8 liters for every kWh consumed - according to the U.S. Department of Energy (DOE).

The hypergrowth in demand for computing has propelled the major cloud providers to rapidly expand their facilities to house the large number of servers, storage and networking equipment required to process the billions of customer requests and petabytes (one million gigabytes) of data stored. Given the pace of deployments, hyperscale companies have turned to leasing space and capabilities from wholesale and retail data center companies to supplement their own internally developed and

¹ <https://www.theguardian.com/environment/2017/dec/11/tsunami-of-data-could-consume-fifth-global-electricity-by-2025>

built data centers. These data center companies source, develop, build and maintain facilities in strategic locations and offer some value-added services.

Exhibit 1: Data Storage Needs are Accelerating



High capacity hard drive shipments for cloud storage. Source: TrendForce as of Dec. 31, 2017.

Cloud service providers that build mega data centers tend to lease their facilities on a “wholesale” basis, offering long-lived leases (5-10 years) and providing minimal services such as secure shell security protocols, physical security and energy. The wholesale providers tend to be used primarily by large public cloud players that have the sophistication to build and maintain their server farms, and desire for large scale. Data centers that focus on the network “edge” on the other hand, such as ClearBridge holding Equinix, tend to offer shorter leases (1-3 years), but also offer several services — primarily interconnections between customers and network and cloud providers — on top of space and power. These “retail” leases are utilized by a much broader customer base. We believe both wholesale and retail models are poised to enjoy strong growth going forward.

Under both models, data center companies charge for the energy they provide, which has been a growth driver for the industry as customers clamor for higher power density for their hosted servers. Providing energy from sustainable sources is critical for their long-term success, as loss of service, high power costs, or use of “dirty” energy sources dissuades customers from leasing space for long duration contracts. Given that energy is typically the highest input cost for these data centers, savings can also be meaningful to their customers’ bottom lines.

Efficiency of Cloud Mitigates Environmental Burden

The efficiencies that cloud computing bring to bear should help to lessen the impact of energy costs and environmental stresses. By sharing resources across multiple organizations, centralized

Some cloud companies have pushed to improve their energy usage using new techniques like artificial intelligence.

data centers allow for higher facility utilization, thus limiting wasted resources. More specifically, by consolidating various companies' workloads on fewer servers, hyperscale companies can achieve higher utilization rates on average than the typical organization can by operating its own data center. As a result, fewer servers, less power, and less carbon is required to accomplish the same job.

Moreover, hyperscale vendors typically operate centralized mega server farms of larger than 200,000+ square feet that consume >20 megawatts of power near strategic power sources. Maintaining large scale data centers closer to low cost, sustainable power sources rather than near corporate operations (which are typically in higher cost, urban or suburban areas) also helps to both drive down power costs and lessen the environmental impact.

Commitment to Renewable Energy

Additionally, both mega tech names and the data center companies supporting them have increasingly pushed to procure energy from cleaner, more sustainable sources. Google was an early pioneer in this regard, setting a long-term goal to reach 100% renewable energy for their operations worldwide back in 2012. After many years, the company finally reached this goal in 2017 across both their global data center and office footprint and has now become the world's largest corporate buyer of renewable power, with commitments of 2.6 gigawatts (2,600 megawatts) of wind and solar energy.

While slightly further behind, Amazon's AWS and Microsoft also have long-term commitments to get to 100% longer-term renewable energy usage. AWS exceeded its goal of 40% renewable energy by the end of 2016 and set a goal of 50% in 2017. Well on track to its goal of 50% utilization of renewable energy in 2018, Microsoft's target is 60% by 2020. Microsoft is also investing in clean energy sources and infrastructure (primarily via partnerships) in developing nations to raise supply of these more finite resources in regions where they are less prevalent.

Similarly, Equinix has increased their usage of renewable energy from 33.5% of total energy sourced in 2015 to 56% of total energy sourced in 2016 and has set a long-term goal of sourcing 100% of their energy from renewable sources. The shift to renewables also significantly lowers carbon emissions. Equinix, for example, drove down carbon emissions per unit of revenue by 32% year-over-year in 2016. Utilizing more renewable energy sources and creating denser, more energy efficient shells are key goals for the data center industry going forward.

Some companies are also opening data centers with carbon-neutral footprints. For example, AWS offers five separate carbon-

neutral regions for customer use (including Oregon, Frankfurt, Ireland, Montreal, and the U.S. Government Cloud). With a 100% carbon neutral footprint today, Microsoft has pledged to reduce its carbon emissions by 75% by 2030 against a 2013 baseline.

Innovation Also Playing a Crucial Role in Sustainability

Leveraging the greater computing power available today, these same companies have also pushed to improve their energy usage using new techniques like artificial intelligence (AI). Google, for example, has noted it can consistently deliver about 15% energy savings when applying AI techniques towards power usage in its data centers. By applying a machine learning algorithm designed to optimize its power usage, Google was able to save about 40% on cooling costs at one of its data centers. Microsoft is similarly applying its strong capabilities in AI and deep learning to improve data center efficiency through automation.

Because of all these improvements, the DOE estimates that energy consumption for U.S. data centers will be relatively muted through 2020 as a combination of higher server utilization, lower power draw from devices and higher infrastructure efficiency offset the dramatic growth in usage. Massive data growth presents significant stresses on energy and environmental infrastructures. At ClearBridge, we see long-term value creation for companies that seek to minimize these stresses.

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