DATA CENTER Frontier Special Report

Green Data Centers and the Sustainability Imperative

Written by Rich Miller

Photo courtesy of Iron Mountain Data Centers

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The Green Data Center Imperative

The urgent need for climate action is writ large in the headlines of 2020. Devastating wildfires have ravaged California, Oregon and Colorado, while a historic series of powerful hurricanes slammed the Gulf Coast. These disasters have been a tipping point in public awareness, driving home the fact that a changed climate is not a future threat, but a current reality.

The data center industry has been a force for positive change on climate action over the past decade, with cloud computing platforms pioneering advances in sustainable operations and corporate adoption of renewable energy. This impact will be amplified in coming years as more businesses abandon carbon-heavy on-premises data centers and migrate to greener infrastructure operated by cloud platforms and colocation facilities.

In this special report, we will examine the role of green data centers as a catalyst for action on climate change, specific strategies that are reducing carbon impact, and the best ways to embrace the sustainability imperative going forward.

The massive energy footprint of cloud computing enables the data center industry to drive a global shift to renewably-powered business. This opportunity is magnified by a digital transformation that is shifting much of our lives to online platforms—a trend that has been dramatically accelerated by the COVID-19 pandemic and the need for remote work, contactless commerce and automation as tools to reduce viral exposure.

The migration to cloud platforms has slashed the carbon footprint of many IT departments. But it is time for the data center users and operators to raise their game, not just because sustainability is good policy, but because it is good business.

Customers and stakeholders are demanding accountability on climate impact, pushing sustainability near the top of the agenda in selecting sites and providers. The data center industry is in a unique position to accelerate the adoption of sustainable practices and reduce the damage to our changing climate.

Customers Are Driving the Sustainable Shift

The focus on sustainability has intensified in recent years with large cloud platforms making aggressive commitments to climate action. In January Microsoft said it will become "carbon negative" by 2030, and implement new procurement procedures in July 2021 to incentivize suppliers to reduce their carbon emissions.

Meanwhile, Amazon Web Services has committed to use 100% renewable energy by 2025, ahead of the 2030 timeline for Amazon's broader operations. That goal cannot be met without a major acceleration of renewable energy purchases to support Amazon Web Services.

These announcements have huge implications for the data center industry. As the largest cloud builders deepen their commitments to green energy, the entire data center supply chain must embrace sustainability in new ways. Hyperscale customers have driven much of the growth for data center providers with a global footprint, leasing hundreds of megawatts of space on an annual basis.

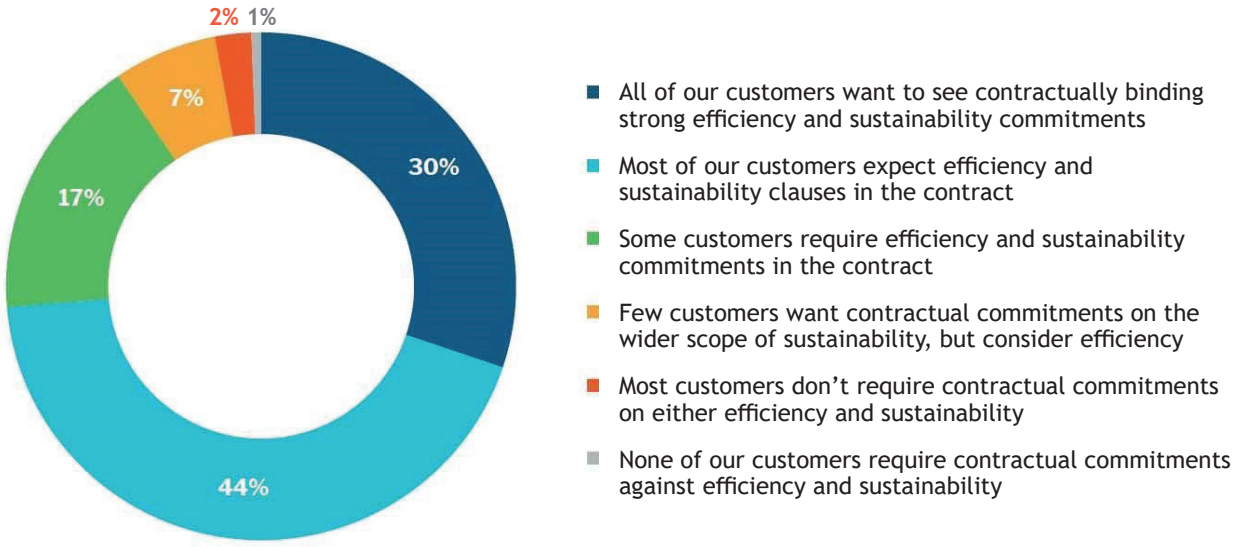
The hyperscale players are leaders in the drive for greener data centers, but they are not alone. Eighty six percent of the companies in the S&P 500 Index published a sustainability report in 2018, up from only 20% in 2011, notes the Governance and Accountability Institute.

A recent survey from 451 Research found that almost a third of multi-tenant data center (MTDC) representatives said all their customers want contractually binding commitments to efficiency and sustainability, while another 44% said it is true for most of their customers.

"Major enterprises and IT service providers (particularly larger cloud firms) typically have stringent infrastructure efficiency demands because it filters through to their own respective sustainability reports," 451 said. "Simply put: they cannot afford to use MTDC providers that do not prioritize high efficiency and sustainability standards."

Importance of efficiency/sustainability to customers

Which of the following best characterizes how important efficiency and sustainability is today for your customers?



Source: 451 Research custom survey

The Data Center Industry's Sustainability Journey

There have been two major phases of green innovation in the data center industry.

In the first phase, from roughly 2007-2014, the largest data center operators dramatically improved the efficiency of their IT equipment and data center facilities. For companies like Google, Facebook and Amazon Web Services, this meant innovating in every aspect of operations, from the chips powering servers to the power infrastructure and cooling systems. This relentless focus on efficiency yielded huge savings in electricity, slashing the carbon impact of these Internet businesses. The efficiency efforts brought a greener bottom line as well as greener data centers.

By imposing sustainable practices upon the supply chain for digital business, the data center industry will be an even more potent force for climate action.

In the second phase of the industry's sustainability journey, large data center operators have focused on procuring renewable energy to power their operations instead of electricity sources based on coal. Google's use of power purchase agreements (PPAs) for renewable energy has been adopted by other cloud providers and data center REITs. As a result, leading technology companies are now the largest users of renewable energy, and the most active buyers in energy markets for solar and wind power generation.

Renewable purchasing was initially concentrated at hyperscale players, but multi-tenant data center service providers have recently begun working with nonprofits to develop best practices for allowing colocation customers to claim pass-through credits for the renewable energy arranged by their data center provider.

This has laid the groundwork for the next phase of the data center industry's green journey—a wholesale shift of the entire supply chain, as the largest players require their suppliers to document their procurement processes and vet them through a sustainability lens.

By imposing sustainable practices upon the supply chain for digital business, the data center industry will be an even more potent force for climate action. To realize its greatest impact, the industry will need to win the confidence of enterprise customers that continue to house IT operations in on-premises data centers, including many older facilities with an outsized carbon footprint.

Data centers have dramatically improved their energy efficiency, resulting in a small increase in industry electricity use during a period of explosive growth for cloud computing and online services.

As enterprise IT users redouble their focus on sustainability, they will be seeking data center service providers who can serve as partners as they slash carbon impact, deliver on corporate climate commitments, and build a greener planet.

The Negawatt Factor

Electricity is the lifeblood of any data center, which is why the industry consumes enormous amounts of power.

The global data center industry used approximately 205 terawatt hours (TWh) in 2018, representing about 1% of the world's electricity use that year, according to a paper by leading energy researchers.

That sounds like a lot, and it is. That's why data centers are routinely characterized as "energy hogs" by media and environmental groups.

The larger story is that data centers have dramatically improved their energy efficiency, resulting in a small increase in industry electricity use during a period of explosive growth for cloud computing and online services. Server farms have become remarkably efficient in their energy use.

Electricity usage by global data centers grew just 6 percent from 2010-18 (from 194 TWh to 205 Twh). During that time, the installed base of physical servers rose 30%, the number of data center compute instances (i.e. virtual machines running on physical hardware) rose by 550 percent. Meanwhile, data center IP traffic rose 11-fold, and installed storage capacity rose 26-fold.

This extraordinary progress illustrates the power of the "negawatt"—the energy that is saved by operating more efficiently.

The data center industry's sustainability journey history highlights the two key steps toward a green economy: Reducing total power use, and ensuring that the power used comes from renewable sources (wind, energy, hydro) rather than fossil fuels.

Data center operators began the process by focusing on the factors they could control within their own organizations, especially energy efficiency. The data center was slow to focus on energy efficiency from 2000 to 2005, reflected in 90 percent growth in data center energy use during that period. Things improved between 2005 and 2010, with energy usage rising just 24 percent, due to an improved emphasis on best practices as well as the economic slowdown.

A pivotal shift occurred in 2007-2009, when data center providers began sharing best practices in industry forums and conferences, a major change from the secrecy that once surrounded data center operations. This period saw the founding of The Green Grid, an industry consortium focused on energy efficiency, as well as a decision by hyperscale pioneer Google to share its closely-held efficiency secrets with the industry.

By sharing these best practices, hyperscale players brought improved energy efficiency to multi-tenant data centers, which extended these benefits to their customers. These efficiency gains grew along with the service provider industry. 451 Research estimates that global MTDC power capacity grew 62.4% in the five years through 2019, a compound annual growth rate of nearly 10.2 percent.

There's an old saying that you "can't manage what you can't measure." Prior to 2010, relatively few data centers had sensors to track energy and water usage and environmental conditions (like temperature and humidity) throughout their environment. As more facilities became instrumented, it allowed more meaningful use of efficiency metrics developed by industry groups, especially Power Usage Effectiveness (PUE), a leading "green" metric developed by The Green Grid.

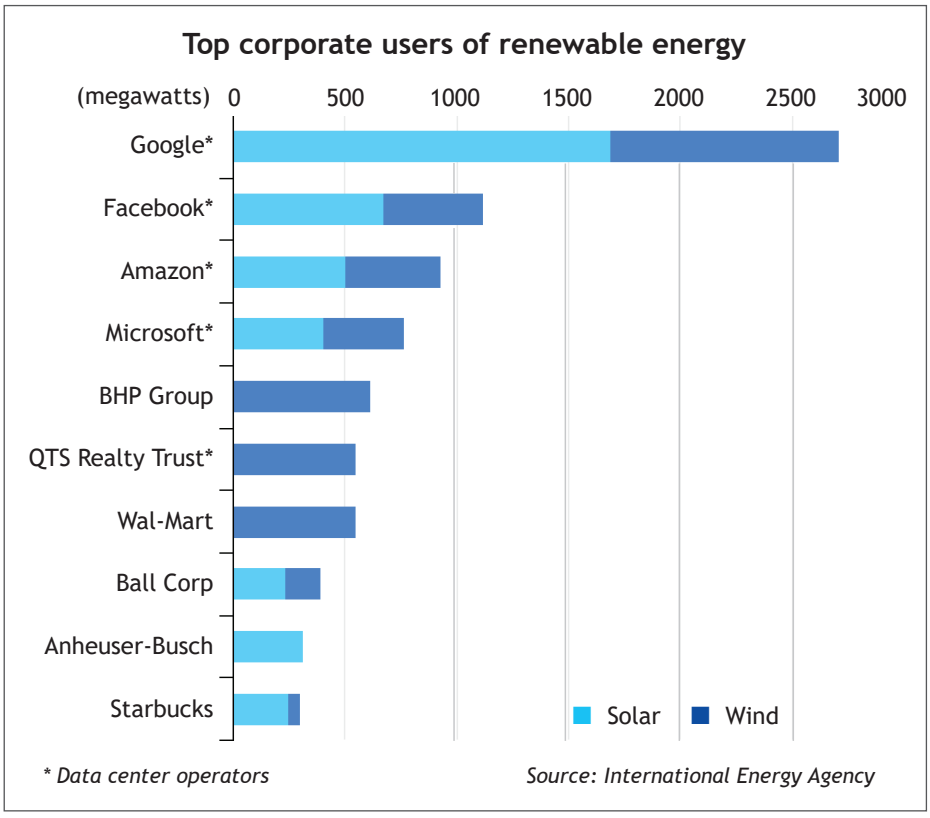
PUE dropped by 25% from 2010 to 2018, while the energy intensity of the global data center industry) Expressed as energy use per compute instance) dropped by around 20% per year between 2010 and 2018.

The sharing of best practices has been pivotal in allowing the broader industry to embrace the innovations of the world's most sophisticated technology companies.

Beyond Efficiency: Sourcing Renewable Energy

Cloud computing has emerged as a surprising force for the commercialization of renewable energy at Internet scale, with Google, Amazon, Microsoft, Apple and Switch sourcing renewable energy to power their cloud data centers. This usually happens through utility-scale power purchase agreements (PPAs), with hyperscale operators buying the output of generators of solar and wind power, bringing new renewable energy onto the grids supporting their data centers.

The International Energy Agency found that the four largest purchasers of renewable energy in 2019 were all data center operators, including the three major cloud computing platforms along with the leading social network. Data center specialist QTS Realty was not far behind in the sixth position.



The depth of the data center industry's impact on purchases of solar and wind power is even greater in the United States, In the U.S. Environmental Protection Agency's most recent Top 100 list of the largest users of renewable power for calendar year 2018, tech firms dominated the top of the list, occupying five of the top 6 positions, and 11 of the top 25.

Partner Name	Annual Green Power Usage (kWh)	GP % of Total Electricity Use	Green Power Resources
1. Google	7,492,567,647	106%	Solar, Wind
2. Microsoft	5,982,112,000	100%	Small-hydro, Solar, Wind
3. Intel	4,256,664,960	101%	Various
5. Equinix	2,360,296,352	104%	Solar, Wind
6. Apple	2,094,103,551	101%	Various
9. Samsung	1,246,201,605	99%	Various
10. T-Mobile	1,182,171,000	34%	Wind
13. Cicso Systems	1,089,027,261	100%	Solar, Wind
22. Switch	689,679,362	100%	Solar, Wind
23. Digital Realty	620,524,636	11%	Solar, Wind
25. Iron Mountain	544,840,984	86%	Various
33. QTS Realty Trust	412,051,000	35%	Wind
36. Dell Technologies	365,624,956	53%	Solar, Wind

Source: U.S. Environmental Protection Agency

A number of other large data center operators don't participate in the EPA's data collection, but have had their PPA activity documented by the Renewable Energy Buyers Alliance (REBA) Deal Tracker, which reveals that Facebook and Amazon were among the largest buyers of renewable energy in 2019.

2019 Top U.S. Large Energy Buyers

Ranking	Company	Volume (Gigawatts)
1	Facebook	1.546
2	Google	1.107
3	AT&T	.960
4	Microsoft	.624
5	T-Mobile	.581
6	Walmart	.541
7	Amazon	.487
8	Ball Corporation	.388
9	McDonald's	.380
10	Honda	.320

Source: Renewable Energy Buyers Alliance Deal Tracker

REBA noted two positive trends—larger purchases of wind and solar energy by the leading players, as well as broader participation in renewable energy markets.

"The continued growth of large-scale energy buyer led procurement of renewable energy, as well as a surge of first-time buyers accounting for more than half of transactions, contributes to REBA's overall goal to catalyze 60 GW of renewable energy by 2025."

Matching a company's entire data center energy use with renewable energy purchases can be challenging, but several companies have reached this milestone, including Iron Mountain Data Centers, which also operates a 7 megawatt solar array on the roof of its New Jersey data center. Switch says it has also matched 100 percent of energy use with renewables, and recently broke ground on a 555-megawatt solar generation facility in Nevada.

As data centers have become larger players in power markets, they have begun adopting sophisticated strategies to provision green power and manage the pricing and risk profile of its energy. This includes the use of third parties to craft virtual power purchase agreements to buy capacity through liquid marketplaces.

Energy brokers from Citi cited three tools that can be used to procure renewable energy at scale:

- **As-Generated Power Purchase Agreements (PPAs)** These agreements, which have been used by Google, Amazon, Microsoft and Facebook, allow users to buy generation capacity from a renewable energy project for a fixed price and fixed term. The primary challenges involve managing intermittency risk and power price fluctuations.
- **Wholesale Block Hedges** These tools fix the price on a portion of a customer's energy use, using a tradeable contract in a liquid market with counterparties. This approach also has challenges in managing variability and risk, but less than PPAs.
- **Intermediation Structures** These are custom agreements in which users work with a market maker like Citi or retail energy provider to create vehicles to funnel power to end user.

The data center industry's growing clout in the power markets comes with increased exposure to the complex economics of power in the United States, where utilities operate under a variety of business models and regulatory oversight, and prices fluctuate widely based on geography and weather trends.

That's why three of the largest players—Google, Apple and Amazon—have gained approval from the Federal Regulatory Energy Commission (FERC) to buy and sell electricity in energy markets.

Some of the largest financial players in the data center sector are also stepping up their investment in energy generation, and looking for opportunities to integrate more renewable energy sources into their power mix, including more on-site and adjacent power generation.

Global operator NTT and infrastructure funds Macquarie Infrastructure Partners (which controls Aligned and Netrality) and Stonepeak Infrastructure Partners (Cologix) are among those hoping to deploy new power generation infrastructure to support their data center footprints.

Last year NTT founded NTT Anode Energy to create distributed systems bringing together telecom and data center infrastructure with advanced electric supply systems that integrate renewable energy, battery storage, and microgrids. NTT Global Data Centers operates in the US through its RagingWire portfolio.

Data Centers Bring Renewable Energy to the IT Mass Market

Even as hyperscale operators and service providers provision more green power, one of the major shortcomings in the system has been the difficulty in allowing colocation customers to claim credit for renewable energy that is provisioned by their data center service provider.

In 2019, a new reporting protocol that makes it easier for companies to apply green energy credits from their use of third-party colocation space to their corporate sustainability goals. The new guidelines for carbon accounting were developed through the Future of Internet Power, a collaboration between data center operators and several non-profit groups promoting corporate sustainability.

Iron Mountain Data Centers was the first provider to implement the new approach productized as Green Power Pass, and other providers are expected to follow suit, as Digital Realty, Equinix, IBM, Aligned and Interxion also participated in developing the supplier energy accounting rules.

Previously, there hasn't been an easy way to address credits in a multi-tenant environment, so this energy has been usually claimed by the facility operator who purchased it. Reporting rules are designed to prevent "double counting" the same electrons by more than one company.

The solution was to develop a formula that details the chain of custody of the energy, and apply it to different phases of the power distribution path, based on who controls the power usage – the provider or tenant. As an example, the provider controls the cooling, but the tenant controls the power used for IT load.

As more data center operators focus on energy souring, there are signs that sustainability can provide an advantage in the heated competition for large hyperscale deals.

As it prioritizes its green power initiatives, Iron Mountain Data Centers has exceeded the leasing goals for its business. Through the first three quarters of 2020, the company has leased 51 megawatts of space, versus a year goal of 15-20 MWs. Among private players highlighting sustainability, Aligned has reportedly landed substantial deals with a number of hyperscale operators.

Building A Greener Tomorrow

As the drive for data center sustainability enters a new and more urgent phase, what are the next frontiers beyond efficiency and energy sourcing? Here's a look at the technologies, strategies and best practices we are watching at Data Center Frontier:

Sustainable Construction Strategies

More data center projects will integrate sustainability into design and construction, with early collaboration between teams to minimize the environmental impact of the construction process and create a building with low operational carbon impact, enabling more effective and cost-efficient offset strategies. Design collaboration is essential in seeking to integrate cleaner technologies into the power chain and cooling systems.

Several data center providers are working with CarbonCure, which makes a low-carbon "greener" concrete material for the tile-up walls that frame data centers. Concrete's durability and strength are ideal for industrial construction, but the production of cement requires the use of massive kilns, which require large amounts of energy, and the actual chemical process emits staggeringly high levels of CO2. CarbonCure takes CO2 produced by large emitters like refineries and chemically mineralizes it during the concrete manufacturing process to make greener and stronger concrete. The process reduces the volume of cement required in the mixing of concrete, while also permanently removing CO2 from the atmosphere.

Managing packaging for equipment that is shipped to a data center facility is an important and often underlooked facet of waste stream accountability.

Waste Stream Accountability and the "Circular Economy"

A key priority is tracking the environmental impact of construction components, including a "reverse logistics" process to track the waste stream and disposition of debris. Asset recovery and recycling specialists will become key partners, and the most successful projects will communicate goals and best practices across the contractors and trades participating in each project. The goal is a "circular economy" that reuses and repurposes materials.

Managing packaging for equipment that is shipped to a data center facility is an important and often underlooked facet of waste stream accountability. There are also opportunities in reuse of components and equipments that that can still be productive (although this must be closely managed in a mission-critical environment).

The ability to document a net-zero waste stream impact has the potential to emerge as an additional metric for data center service providers, as customers consider the entirety of their supplier's sustainability programs.

Green Certifications

As customers ask tougher questions about a providers' environmental practices and corporate social responsibility policies, certifications may emerge as another avenue for service providers to differentiate themselves.

Several ISO certifications, including ISO 50001 and ISO 14001, which Iron Mountain is certified for across its global data center portfolio, focus on energy management and provide frameworks that can assure stakeholders that the provider is considering energy impact and environmental goals in audits, communications, labeling and equipment life cycle analysis.

Water Conservation and Management

Amid changing weather patterns, many areas of the world are facing drought conditions and water is becoming a scarcer and more valuable resource. Data center operators are stepping up their efforts to reduce their reliance on potable water supplies.

Sustainable water strategies include both sourcing and design. On the sourcing front, several Google facilities include water treatment plants that allow it to cool its servers using local bodies of water or waste water from municipal water systems. Data center districts in Ashburn (Va.), Quincy (Washington) and San Antonio offer "grey water" feeds that provide recycled waste water to industrial customers.

On the design front, more providers are choosing cooling systems with minimal need for water, while others are incorporating rainwater recovery strategies that capture rain from huge roofs or parking lots and store it on site, reducing potential burden on local water systems.

Matching Workloads to Renewable Energy

Google has been a leader in the use of artificial intelligence and sophisticated energy provisioning to match its operations to carbon-free energy sources. The company recently said it will power its entire global information empire entirely with carbon-free energy by 2030, matching every hour of its data center operations to carbon-free energy sources This marks an ambitious step forward in using technology to create exceptional sustainability.

Google can currently account for all its operations with energy purchases. But the intermittent nature of renewable energy creates challenges in matching green power to IT operations around the clock. Solar power is only available during daylight hours. Wind energy can be used at night, but not when the wind dies down. Google created a "carbon-intelligent computing platform" that optimizes for green energy by rescheduling workloads that are not time-sensitive, matching workloads to solar power during the day, and wind energy in the evening, for example. The company also hopes to move workloads between data centers to boost its use of renewables, a strategy that offers even greater potential gains by shifting data center capacity to locations where green energy is more plentiful, routing around utilities that are slow to adopt renewables.

Google has pledged to share its advances with the broader data center industry, providing others with the tools to reduce carbon impact. Continued instrumentation of older data centers is a key step in this direction.

Eliminating Diesel Generators

Microsoft recently announced plans to eliminate its reliance on diesel fuel by the year 2030, which has major implications for the company's data centers, many of which use diesel-powered generators for emergency backup power. With its new deadline, Microsoft sets in motion a push to either replace its generators with cleaner technologies, or perhaps eliminate them altogether by managing resiliency through software.

Eliminating expensive generators and UPS systems has been a goal for some hyperscale providers. Facebook chose Lulea, Sweden for a data center because the robust local power grid allowed it to operate with fewer generators. In the U.S., providers have experimented with "data stations" that operate with no generators on highly-reliable locations on the power grid.

There are four primary options companies have pursued as alternatives to generators—fuel cells, lithium-ion batteries, shifting capacity to smaller edge data centers that can more easily run on batteries, and shifting to cloud-based resiliency.

Fuel Cells and On-Site Power

Microsoft has successfully tested the use of hydrogen fuel cells to power its data center servers. The company called the test "a worldwide first that could jump-start a long-forecast clean energy economy built around the most abundant element in the universe."

Microsoft said it recently ran a row of 10 racks of Microsoft Azure cloud servers for 48 hours using a 250-kilowatt hydrogen-powered fuel cell system at a facility near Salt Lake City, Utah. Since most data center power outages last less than 48 hours, the test offered a strong case that fuel cells could be used in place of diesel generators to keep a data center operating through a utility outage.

Some companies, like Equinix and eBay, have deployed Bloom Energy fuel cells to improve reliability and cut energy costs, but have powered them with natural gas. The use of biofuels looms as another potential avenue to pair fuel cells with renewable sourcing.

Energy Storage

Utility-scale energy storage has long been the missing link in the data center industry's effort to power the cloud with renewable energy. Energy storage could overcome the intermittent generation patterns of leading renewable sources. Solar panels only generate power when the sun is shining, and wind turbines are idle in calm weather. Energy storage could address that gap, allowing renewable power to be stored for use overnight and on windless days.

A new project in Nevada will showcase a potential solution from Tesla, the electric car company led by tech visionary Elon Musk. Data center technology company Switch will use new large-scale energy storage technology from Tesla to boost its use of solar energy for its massive data center campuses in Las Vegas and Reno. It is a promising project in pioneering a holistic integration of renewable power, energy storage and Internet-scale data centers.

Heat Recycling and District Heating

Servers generate lots of heat, and a growing number of data centers are using this heat to warm nearby homes. These heat recycling projects allow huge data centers to contribute large amounts of heat energy to their communities.

Temperatures in most data center hot aisles range from 80 to 115 degrees Fahrenheit (27 to 46 degrees Celsius), still fairly low temperatures for some heat recovery strategies. Data centers can use heat pumps to boost the temperature of the waste heat, making it more valuable for use in district heating, often by transferring the heat to liquids that are easier to transport and incorporate into heating systems. This approach requires additional ducting and pipes, but these costs can be offset by selling the heat energy to local utilities. District heating systems like data centers because they provide steady heat around the clock, including the weekend.

Most projects that user server waste heat in district heating are in Europe, including the Facebook cloud campus in Odense, Denmark, which will connect to a neighborhood district heating system. that warms 6,900 homes. Stockholm Data Parks is a new data center campus in Sweden that builds upon the region's early successes in heat recycling.

These data centers are designed for peak sustainability, combining renewable energy, efficient cooling systems, and heat recycling to dramatically reduce their impact on the environment, while boosting their usefulness to the local community. It's a virtuous cycle that aligns all facets of data center operations to optimize energy impact.

Green Finance

The financial sector is also more focused on sustainability, which creates several strategic options for data center developers. Digital Realty and Equinix have each used "green bonds" in which the borrowing will directly fund a sustainable project, which could include green building certifications, energy and water conservation, clean energy purchases, and renewable energy projects.

Aligned recently lined up a $1 billion credit facility using a sustainability-linked loan (SLL), in which the borrower earns a lower interest rate by hitting benchmarks for sustainable practices. Sustainability-linked debt instruments are not project-specific, but look instead to ensure a company's overall ESG performance through sustainable performance targets agreed upon by the company and its investors.

Edge Computing

One of the most important frontiers for data center sustainability is edge computing. As a result, we're seeing innovative approaches to how to power and manage edge data centers, most of which will be unstaffed.

- EDJX has developed edge infrastructure for a "circular economy" that reuses and recycles IT equipment and operates with a small energy footprint. The EdjBlock systems will feature hardware from ITRenew, an asset recycler that removes equipment from hyperscale data centers and repurposes it through its Sesame line of rack-scale solutions built on open architectures. EDJX also integrates a software-defined power system from VPS, which uses a combination of software and distributed batteries to conduct peak shaving, using the batteries to store power and allocate it to the system when needed, creating a more elastic system for distributing power.
- TMGcore has launched a modular data center platform that uses robots to swap high-density servers immersed in coolant fluid. The two-phase immersion cooling system is extremely efficient and can handle extreme density. Servers are immersed in coolant fluid that boils off as the chips generate heat, removing the heat as it changes from liquid to vapor. A closed-loop water system is used to condense the fluid and return it to the tank.
- Microsoft has deployed underwater data centers as part of its strategy for edge computing, noting that more than half of the world's population lives within about 120 miles of the coast. Microsoft recently retrieved its 40-foot container that houses 864 servers in 12 racks on the ocean floor, and found that the servers housed in a sealed nitrogen environment were substantially more reliable than those in traditional data centers. The cooling design also achieves extraordinary efficiency a heat-exchange process commonly used for cooling submarines, piping seawater directly through the radiators on the back of each of the 12 server racks and back out into the ocean.

The Future of Sustainable Data Centers

Data Center Frontier Editor Rich Miller recently had a conversation about the future of sustainable data centers, with Kevin Hagen, Director, Corporate Responsibility at Iron Mountain, and Alex Sharp, Global Head of Design & Construction – Data Centers at Iron Mountain.

RICH MILLER: Let's start with the big picture. How would you assess the data center industry's progress on green data centers and sustainability?

Kevin Hagen
Iron Mountain

KEVIN HAGEN: What we're learning is that social responsibility isn't a tax on the good guys. It requires us to think differently about business, to think like systems thinkers, and to get more outside our walls.

When we hold ourselves to the higher expectation of delivering these innovations, we actually are finding new ways to do things that are better for the business, better for the environment, and better for the community. It actually isn't a trade-off: you don't have to choose between doing the right thing, and doing the green or socially responsible thing.

Renewable energy is a great example. In the early days it was perceived as more expensive and had all kinds of challenges. But when we work together, as individual organizations and collectively through organizations like the Renewable Energy Buyers Alliance and the Future of Internet Power working group to develop thought across the industry, we can all take advantage of those efforts.

> "Renewable energy suppliers offer long-term fixed price contracts with a lot less risk factored into the pricing, and the price stability that our customers love."
> – *Kevin Hagen, Iron Mountain*

We realized that over the long term, renewable energy had huge advantages over fossil fuel in the cost of energy. Renewable energy suppliers offer long-term fixed price contracts with a lot less risk factored into the pricing, and the price stability that our customers love. There was this sudden realization that what we thought was more expensive is actually the cheapest.

There's just so many ways in which the old stereotype of the trade-off is about to get blown up. And we need to hold ourselves to the higher standard.

This is an incredibly innovative, creative industry. What we know is we're probably thinking too small. We need to keep making these improvements but also think about the bigger picture, so that we can keep finding the breakthrough opportunities that change the picture.

RICH MILLER: Let's talk about construction. How do you approach sustainable construction that and how is the process different from the way things have always been done?

Alex Sharp
Iron Mountain

ALEX SHARP: One of the key points in construction is that you have to start looking at it right from the outset of design, because if you don't, you'll miss opportunities. And as we all know, doing anything retrospectively is expensive.

The other thing that we need to see is that environmental sustainability issues in construction need to be treated like health and safety are, where they're not negotiable. They are absolutely first items on the agenda.

We need to look at the removal of waste from the construction site, and look at recyclable products and the content of the materials that we use to build out data centers. We're minimizing on waste, and we're looking at reverse logistics so that if equipment has packaging with it, that the packaging is taken away on the vehicle. This may seem very simple, but not many people look at these things with that level of detail.

I think it's also about looking at cleaner technologies. A staple of our industry is the diesel generator. We'll be looking at things that are a lot cleaner in terms of the emissions, like gas generation with biomass. We will look at whether we could potentially convert the waste heat from our plant back into energy. And by ensuring all of our data centers and powered by renewable energies.

> "The easiest way to reduce water consumption is to raise the temperature in the aisles and make better use of cold aisle containment."
> – *Alex Sharp, Iron Mountain*

I think it also means challenging the norm in terms of what temperatures racks can run at. Chips are being developed that can operate at a much higher temperature than they previously could

Rainwater harvesting is something that can produce bulk storage of water. The issue with that is the quality of the water, so we need to look at water treatment. The easiest way to reduce water consumption is to raise the temperature in the aisles and make better use of cold aisle containment.

KEVIN HAGEN: Iron Mountain is in an interesting place. I'll use my Tour de France metaphor. There are a few companies that have the resources and depth to be out in front, folks like Google and Microsoft and Facebook and Salesforce. I think where Iron Mountain comes in is that we are a leader in certain aspects, but by and large from a size scale, we look a lot more like one of the regular folks than Google. There's a lot of organizations that look like us.

I think our job is to organize the peloton, because once it gets organized, we know we can catch the chase, not because the chase is slowing down, but because the peloton can drive a lot faster when we work together. We can be the organizers, and get riding when we work together, we're going to move the whole thing.

RICH MILLER: I want to shift over to thinking about energy sourcing and what that picture looks like right now.

KEVIN HAGEN: I think there's an acceleration of using renewable as part of the solution for many customers, especially offsite renewables.

There is a tremendous disruption in the utility space. We want to be thoughtful and constructive partners in the disruption, but also we need utilities to get on board. We need them to help think through what the future grid looks like, and how big loads like the data center industry can be part of the solution.

Renewable energy certificates (RECs) were an absolute necessary way to get the industry started (on offsetting carbon), but now they probably aren't a great solution.

(In the data center industry) we have more generating capacity, collectively, then many utilities. Why would we put all that capital into backup power on-site (generators), hoping we don't ever use it. We need to be relianle and resilient. But what if are able to be part of the solution by taking more power when it's cheap, and providing power when it's expensive and helping fix the grid.

RICH MILLER: When you look at the number of megawatts and gigawatts the data center industry is now provisioning, it seems like the pricing on renewables is getting really interesting.

KEVIN HAGEN: I'll make a broad generalization. We're up to 100% of our data center load and 80% of our current corporate load worldwide from renewables. And we've never paid more than grid for green power.

It is possible to negotiate and find attractive deals. Timing matters, like when you're negotiating a deal before the before the wind farm is built, you have a little more influence on how that conversation goes.

> "We have a real responsibility to ensure that sustainability is really at the forefront of everything we're doing."
> – *Alex Sharp, Iron Mountain*

ALEX SHARP: We are a colocation business and our biggest base of customers is smaller retail colo. We need to make sure that they're considered as well.

We are one of the very few industries at the moment that is actually flourishing in lockdown and in the current pandemic. We have a real responsibility to ensure that sustainability is really at the forefront of everything we're doing.

This year I think it's helped the data center industry more than ever before to understand its ability to make a huge difference, being the lifeline to the world. That can and should happen on climate as well.

Sponsor: Iron Mountain Data Centers

ironmountain.com/data-centers

Iron Mountain Data Centers, a division of Iron Mountain incorporated, is a leading provider of data center and colocation services. Our global portfolio consists of hyperscale-ready, strategic edge, and underground data centers comprising over 3.5 million square feet across fifteen locations in five countries.

More than 1,200 customers including cloud providers, global enterprises, and local market organizations choose Iron Mountain Data Centers for our thirty-year proven track record, risk mitigation, and operational efficiency. Iron Mountain colocation facilities are sustainable and provide the most logical venue for hybrid IT with easy access to the carriers, cloud providers, exchanges, and IT services necessary for digital transformation.

Comprehensive compliance support ensures highly regulated enterprise and public sector customers are protected as they change their organizations to thrive in a multi-cloud world.

Iron Mountain offers some of the world's most secure data centers. Our multi-layered approach to security in our highly-protected facilities includes a combination of technical and human security measures.

Green Power: Building Block for Future Hyperscale Growth

The rapid growth of hyperscale computing has underscored the data center industry's important role in retooling the economy for a sustainable future.

Iron Mountain recently became the first provider to implement a new reporting protocol that makes it easier for companies to apply green energy credits from their use of third-party colocation space to their corporate sustainability goals.

The Iron Mountain Green Power Pass (GPP) provides an annual certificate validating that 100 percent of the power a tenant uses is from qualifying renewable resources. Participating customers receive a detailed report on their power consumption and full documentation on the amount, source, and chain-of-custody of the wind, solar or other renewable electricity associated with that facility.

The Green Power Pass is the latest step in the growing focus on sustainability at Iron Mountain, which has arranged power purchase agreements (PPA) of renewable energy to offset the use of electricity in its data centers. Iron Mountain has achieved a 100% renewable energy utilization rate for Data Center operations worldwide in 2019.

Hyperscale data center providers like Iron Mountain offer the security, reliability, scalability and sustainability that hyperscale cloud providers need.

Optimized for Hyperscale

Hyperscale data centers are in a league of their own. They need to be able support thousands of services and millions of virtual machines. Systems are optimized for storage and speed with a flexible and agile environment and scalability.

The biggest benefit of a hyperscale colocation solution is the ability to quickly scale up or down. Hyperscale data center providers like Iron Mountain offer the security, reliability, scalability and sustainability that hyperscale cloud providers need.

Our hyperscale data centers support wholesale deployments with consumption-based power pricing, the ability to secure low electrical rates on a long-term basis and optimal PUE through geothermal cooling and containment innovations.

Infrastructure Everywhere Your Data Needs to Be

From Amsterdam to Virginia to New Jersey, our hyperscale data centers bring you closer to end users. Iron Mountain has a global portfolio of hyperscale colocation facilities to meet your specific needs.

Iron Mountain operates more than 1,400 facilities in 50 countries, and brings significant real estate expertise and the relationships required to quickly source opportunities in new markets.

Iron Mountain operates international data centers in Amsterdam, London and Singapore to support global customers. It is actively preparing to deploy capacity in Frankfurt.

Beyond its existing footprint, Iron Mountain operates more than 1,400 facilities in 50 countries, and brings significant real estate expertise and the relationships required to quickly source opportunities in new markets.

A Bridge to the Cloud

Iron Mountain is a global leader in storage and information management services with more than 42,000 data management customers and 120 exabytes in storage. Our recently expanded Data Restoration and Migration Services (DRMS) enable customers to accelerate digital transformation efforts with seamless data migration in and out of any cloud or location. Our cloud partners include Amazon Web Services (AWS), Microsoft Azure, and Google Cloud. Iron Mountain recently announced it has joined the AWS Partner Network (APN) as a Select Technology Partner.

Iron Mountain partners with customers to formulate a data strategy that helps save time and money and maximizes the value of tape-based data migrated to the cloud. The expanded DRMS accelerates IT modernization, aligning to an organization's digital transformation initiative while providing data protection to meet with regulatory and compliance requirements.

For more, visit www.ironmountain.com/data-centers