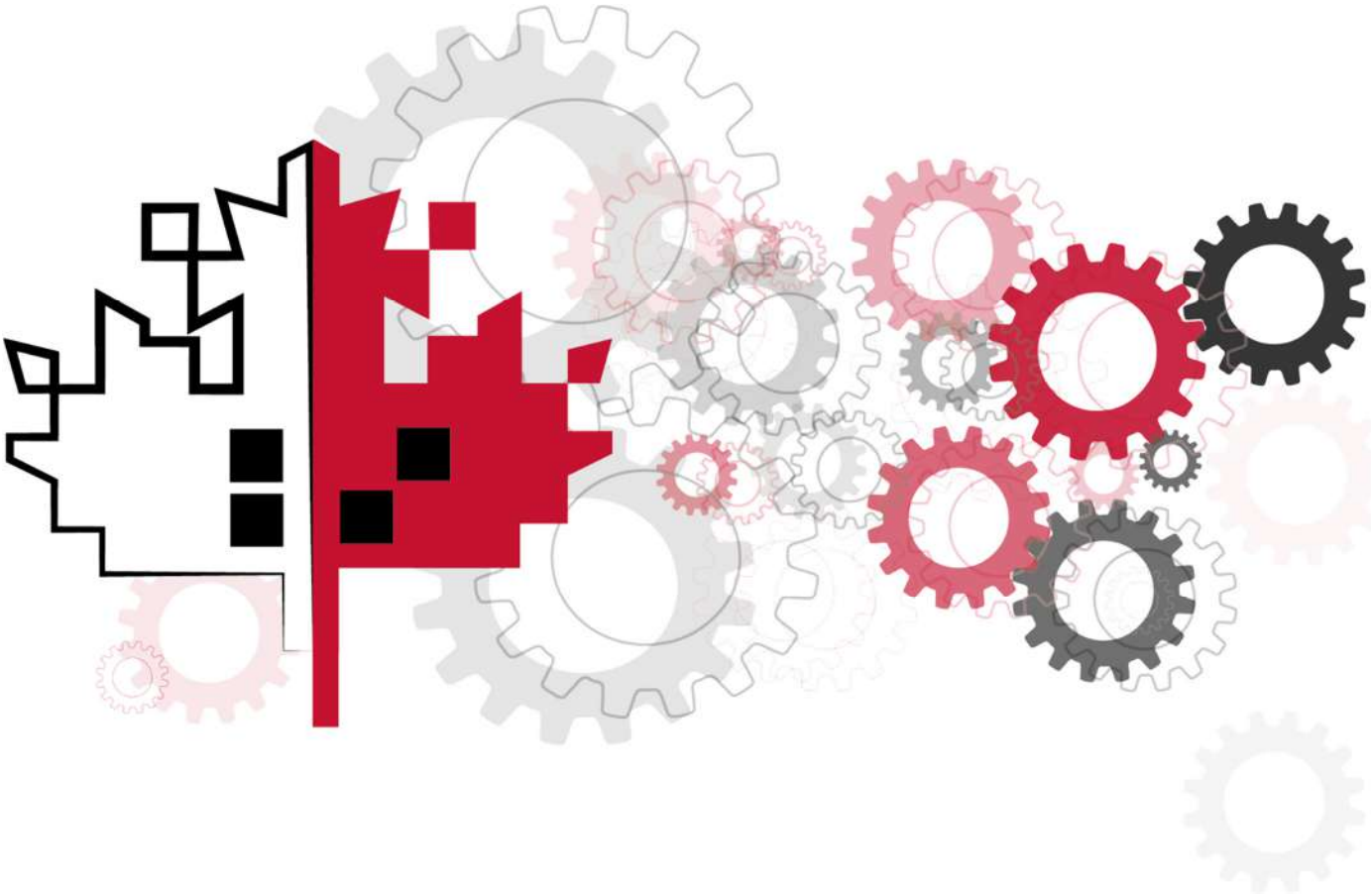
An InsightaaS/DC Foresight Report: July 2020



OVHcloud: Sustainable by Design

A DC FORESIGHT REPORT

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July 2020

OVHcloud

DC Foresight

OVHcloud: Sustainable by Design

Executive Summary

A shift in thinking that positions data centre sustainability as a key component of broader corporate strategy is underway in organizations across the globe. This new thinking has been prompted by several factors; sustainability design in the data centre is no longer 'nice to have', it is a growing requirement from business, regulatory and operational perspectives. First among these factors is increasing climate risk, and the growing impact of GHG emissions associated with the data centre industry. As facilities increase in size and number, governments are responding to recommendations from the scientific community with new guidance for data centre operators. But change is also a function of opportunity. With new technologies that can increase resource efficiency, advance energy maturity, and improve customer service, data centre managers are realizing 'triple E' benefits – efficiency, economy and ecology – as they refine their environmental profiles.

Based on a more holistic approach to design and management that moves beyond the energy consumption/carbon emissions equation, new green data centre strategies consider both external and internal inputs for their potential to reduce risk, generate savings, address stakeholder interests, and increase market competitiveness. In an evolving sustainability plan, global cloud services provider OVHcloud has adopted this new thinking, along with advanced environmental technologies aimed at helping the company achieve carbon neutrality in operations by 2025, and in customer and partner supply chains going forward.

This white paper examines six critical goals in the OVHcloud sustainability agenda, providing industry and market context that demonstrates company leadership across the following green data centre activities:

- Set specific targets – OVHcloud has established a timeline for the achievement of carbon neutrality, identified key activity areas that will help realize this, and created eight expert team streams to execute on goals.

- Establish the path to energy maturity – in data centre site selection, OVHcloud looks to regions that can offer a strong mix of renewables in the utility grid. To offset carbon emissions generated through energy consumption in other regions, it purchases REITs and other financial instruments. As a next step, the company intends to develop with partners high quality renewables projects at the regional grid level. It will also work towards new systems setup that targets 24/7 renewable energy supply/demand matching through both an optimized renewable energy portfolio and new onsite

options including power generation and energy storage. Ultimately, OVHcloud plans to engage customers in matching efforts.

- Lead in WEC optimization – to extend the efficiency advantages of cloud-based IT service delivery, OVHcloud has improved its Water, Energy, Carbon (WEC) profile through the use of proprietary water-cooling technology that brings liquid cooling into the CPU. Combined with free air cooling, this water system has helped the company achieve highly competitive PUE scores. Its cooling system is closed loop, and hence water usage is very moderate. These technologies translate to a low carbon footprint for OVHcloud in most jurisdictions that it operates in, and the company is now working with industry researchers to incorporate server metrics into facilities measures to create a more holistic view of the data centre.

- Advance principles of circular economy – OVHcloud establishes its data centres in existing industrial facilities to reduce the creation of embedded carbon associated with new builds. It also produces its own racks and servers, based on an industrial model that enables standardization in component assembly, which in turn helps to reduce waste. The company has adopted an aggressive Life Cycle Assessment (LCA) program for servers, identifying which are fit for reuse, which can yield reusable parts, and which must be broken down for recycle. The company intends to transmit zero waste to landfill by 2025, and to reinforce traceability in its resale program for used components.

- Use procurement as a means to improve carbon impact in a full LCA approach – OVHcloud is developing a Sustainability Code of Conduct for suppliers, extending environmental requirements throughout its supply chain. The company is developing an approach to sustainable packaging and plans to establish low impact shipping within its own operations.

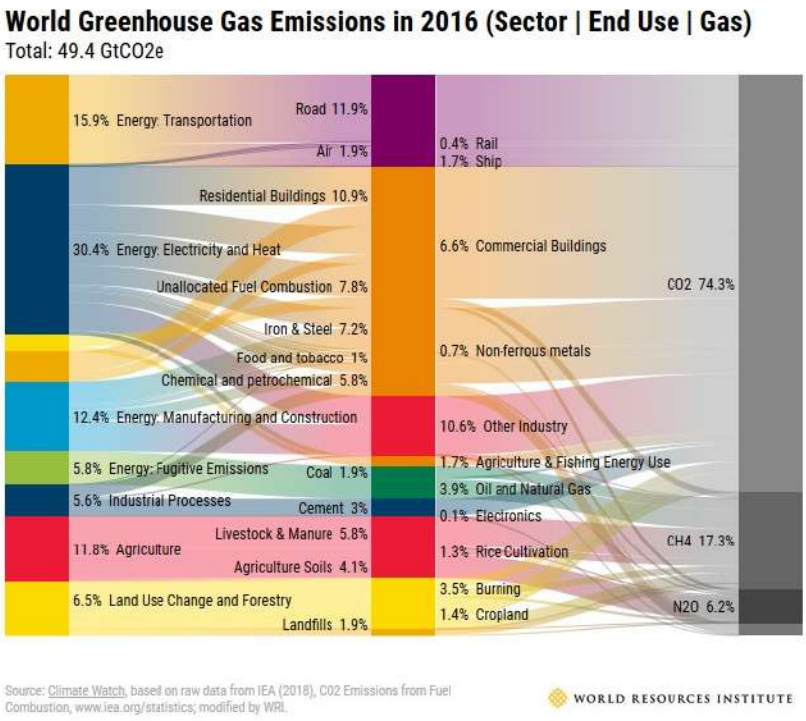
- Educate customers to amplify green impact – while cloud providers ultimately have little direct control over clients' usage patterns, OVHcloud is developing energy metrics that will deliver the visibility cloud users need to optimize workloads for energy consumption reduction. OVH is also helping to develop low energy source code techniques to help customers further reduce their own carbon impact.

The paper concludes with a discussion of metrics, outlining new potential to deploy metrics that can report progress on the sustainability agenda. As a baseline for action, metrics help OVHcloud plan forward momentum to address sustainability goals in the data centre, but they also support outreach, providing environmental data to workers, investors, regulators, partners, and new and existing customers, which positions the company as a pivot point in sustainable data centre initiatives.

Introduction

The need for government, research and business communities around the world to join common cause in addressing climate and environmental challenges has never been more clear, or more urgent. In a recent IPCC Summary document, international scientists urged broad action to limit global warming to 1.5 degrees C above preindustrial levels; to keep warming to this level, where climate impacts are more predictable, they called for the achievement of Carbon Neutrality by 2030 and Carbon Zero by 2050. These ambitious climate goals will require significant investment in sustainability strategies from government and business leaders across all sectors.

Carbon-intensive activities such as energy production, agriculture/forestry, industry and transport are widely recognized as the major sources of global GHG emissions. However, residential/commercial and institutional sectors are also key carbon contributors, based largely on the energy they consume – for heating, lighting and for operation of systems and equipment. Within this last category lies the information and communications technology (ICT) sector. Historically, researchers have estimated that the ICT industry accounts for 2 percent of global emissions, a rough equivalent to carbon footprint for the airline industry.



Today, estimating ICT impact is a wildcard that varies with anticipated levels of innovation designed to improve resource efficiency, and with overall demand forecasting for services that are growing quickly with the rapid digitization of economic and social life. One ongoing study that released data most recently in 2018 calculated the ICT sector's carbon footprint at 1.4 percent of overall global emissions, based on ICT consumption of 3.6 percent of the global electricity – a share that has remained consistent over time despite the exponential growth of data traffic since 2010. Other research, which is perhaps less bullish on the potential for innovation to mitigate impact, estimates ICT energy usage at 5–9 percent or higher, and

emissions at 2 percent of global totals. In another study that includes embedded carbon, the proliferation of devices built using current production methods pushes ICT's GHGE contribution from 1–1.6 percent of global totals in 2007 to 14 percent of the 2016-level global GHGE by 2040, or more than half of the relative contribution of the entire transportation sector today. In a widely circulated forecast for ICT share of global electricity usage 2015 - 2025, researchers have provided a wide range of estimates (from 9–20 percent of the total) that describe best and expected cases, with and without significant energy efficiency improvements. Over the forecast period, researchers point to the data centre industry as consuming an increasing share of global electricity – from 0.9 percent in 2015 to 4.5 percent of the total – in the *best-case scenario*.

This wide variation in estimates of technology's carbon footprint is due largely to purview – what's in, and what's out of the count. But whether focus is placed on scope 1, scope 2 emissions, embedded carbon or energy consumption, AR, VR or AI, our increasing reliance on technology translates to risk of significant, growing climate impact, assuming business as usual in the industry's building and operational practices. Recognizing the nature of this risk, the European Commission has included the ICT industry in its plan for a new European Green Deal aimed at further reduction of GHG emissions reductions targets for 2030 (to half of 1990 levels), a milestone on the path to achieving carbon neutrality by 2050.[1] The EU Commission notes, "Europe needs a digital sector that puts sustainability at its heart. The Commission will also consider measures to improve the energy efficiency and circular economy performance of the sector itself, from broadband networks to data centres and ICT devices." In an explanatory statement, the EU establishes clear guidelines for improvement, and overall targets for the data centre industry: "Data centres and telecommunications will need to become more energy efficient, reuse waste energy, and use more renewable energy sources. They can and should become climate neutral by 2030,"[2] a goal that is consistent with IPCC recommendations.

Beyond carbon footprint, the EU and other organizations have also focused on more positive dynamics – data centre potential to clean its own house, as well as digital support for improved efficiency and sustainability in other sectors. According to the EU, "As powerful enablers for the sustainability transition, digital solutions can advance the circular economy, support the decarbonisation of all sectors and reduce the environmental and social footprint of products placed on the EU market. For example, key sectors such as precision agriculture, transport and energy can benefit immensely from digital solutions in pursuing the ambitious sustainability objectives of the European Green Deal."[3] This balance that ICT strikes between carbon impact and ability to decarbonize other sectors was outlined in compelling detail in the seminal GeST

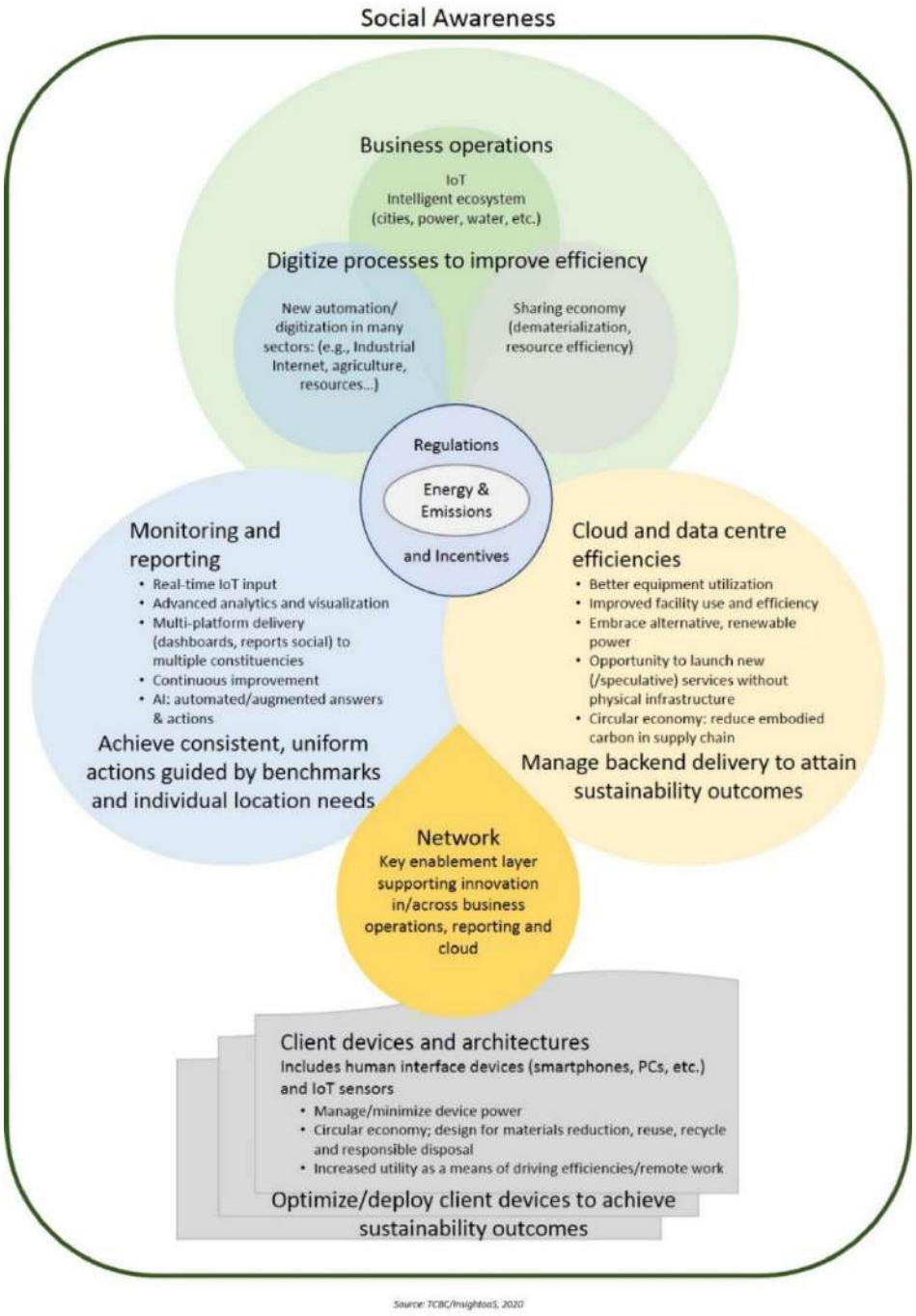
[1] EU plans will be enshrined in a new Climate Law in March 2020.
European Commission. *The European Green New Deal*. Brussels. December 11, 2019.

[2] EU Commission. *Shaping Europe's Digital Future*. February 2020.

[3] *Ibid.*

study, SMARTer 2020, which found that "While ICT's own footprint is projected to rise to 1.27 GtCO2e by 2020, its abatement potential is 7 times higher." Many of the inputs to this balancing act are outlined in Figure 1, which centres on the energy and emissions equation, but describes key technologies and technology-enabled activities that can move the needle forward on sustainability outcomes.

Figure 1. ICT-enabled sustainability opportunity



As primary enabling technologies, data centre and cloud lie at the heart of this ICT sustainability graph. Powering client devices and supported by extensive global networks, the cloud and data centre industry helps business operations optimize processes to address UN Sustainable Development Goals, while supporting better monitoring and reporting on their achievement. At the same time, through ongoing innovation, the cloud and data centre industry is itself working, successfully, to meet key UN SDG recommendations – including goal 7, which recommends the use of clean energy, goal 9, which calls for industry innovation and infrastructure, goal 12, which requires responsible consumption and production, and 13, which calls on organizations and individuals to demonstrate climate action. Most importantly, for data centre operators that embrace the sustainability challenge with intent, thoughtful planning, requisite institutional structures, advanced technology and clear targets, the journey is one that can be achieved without compromise to operations, that can improve bottom line, enhance performance, and boost client satisfaction. The experience of French service provider, OVHcloud illustrates this 'triple' line benefit that is crucial to sustainability efforts across all sectors, and to the data centre industry, in particular.

What is to be done? Establish core values and plan execution

Founded in 1999, OVHcloud opened its first OVHcloud data centre in 2001; in the following year, the company embarked on a green journey based on an industrial model designed to optimize resource requirements, increase the use of renewable energy, and support implementation of new technologies that can help improve environmental profile. As the company's Green Cloud timeline in Figure 2 shows, OVHcloud has pursued these aims consistently through its 20-year history.

Figure 2. OVHcloud green timeline

Today, OVHcloud operates 30 data facilities in Europe, North America and Asia. Achieved through site acquisition and greenfield build, this expansion pattern has introduced sustainability challenges that are not uncommon to global service providers. While acquisition invariably introduces variation in building specs or facilities infrastructure, different regions will have different climates, jurisdictional requirements, and carbon intensity in their grids: specific requirements and/or opportunities at the local level may not readily conform to harmonized sustainability principles or metrics. So while OVHcloud was an early adopter of advanced cooling techniques, its data centre in Virginia continues to rely on an energy-intense chiller, and its Warsaw subsidiary has a higher carbon intensity than facilities in France or Quebec due to heavy reliance on coal powered generation in the Polish electrical grid. In the US and Asia, the company now operates out of colocation facilities, which may not readily provide the

appropriate sustainability data.[4] For individual data centres, OVHcloud has been gathering environmental data for some time now; however, site variation means that translating monitoring to consistent reporting will entail ongoing effort.

Like all effective projects, sustainability initiatives are most successful when driven by vision, strategic planning, and when ad hoc endeavours give way to creation of the institutional foundations that can support continuous innovation. At OVHcloud, this process is evolving out of adherence to core values that have animated company development – efficiency, economy and an integrated model of operation for the delivery of cloud and data centre services, which are designed to generate financial and environmental benefits for the organization and the broader community. Today, the OVHcloud vision is to support explosive growth in computational requirements, leveraging its frugal, industrial model to achieve this in a sustainable way. A current priority for the company is to define key goals for the next five years that will position sustainability as an integral element in the OVHcloud brand transition from web hosting to sustainable cloud.

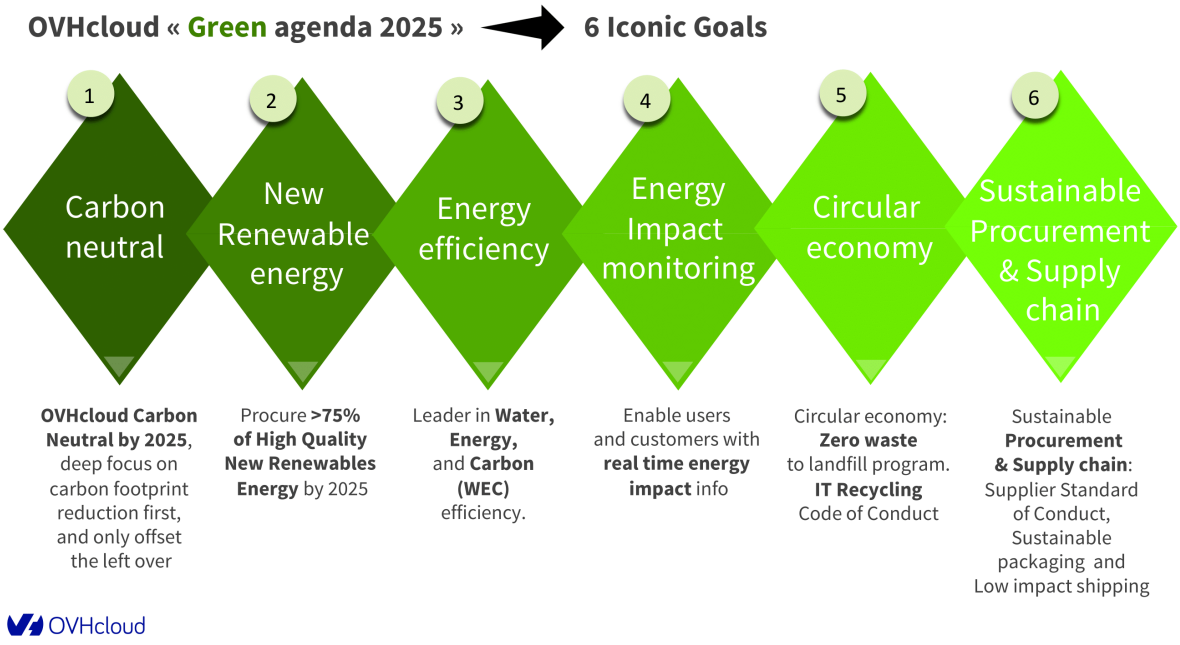
Building on this vision, the company has now developed a more holistic approach to data centre management that combines key elements of sustainability programming in a more structured way. At OVHcloud, sustainability is now directed by two executive sponsors – Chief Industrial Officer François Sterin, who is responsible for technical aspects of the OVHcloud program, and Head of Marketing Ludivine Boutry, who will deliver the CSR messaging and communications outreach that are critical to maintaining internal program momentum and to socializing achievements through external channels. At a next level, the company has created eight program streams, led by stream leaders who have demonstrated expertise in their respective areas through work in other job roles at OVHcloud. These sustainability streams will focus on transition in energy management, renewables, supply chain, training, building facilities, communications, policy, and brand transformation.

[4] OVHcloud inherited several colocation contracts through its purchase of vCloud Air facilities from VMware in 2017.
https://www.ovh.com/world/news/press/cp2456.ovh_completes_acquisition_of_vmwares_vcloud_air_business

Defining Goals

Working with stream leaders, OVHcloud has developed an ambitious sustainability agenda consisting of six iconic goals with specific targets for discrete activities in each. These goals are outlined in Figure 3, which underscores OVHcloud's intent to map company programming to recommendations advanced by the UN and EU in their climate guidance to the service provider community. By 2025, the company expects that ongoing resource efficiency improvements, purchase of renewable energy and offsets, customer empowerment, and the extension of circular economy and sustainable procurement principles through facilities and IT infrastructure build will enable OVHcloud to achieve Carbon Neutrality.

Figure 3. OVHcloud sustainability goals



The remaining five goals represent both recognized and innovative strategies for reducing environmental footprint. Energy efficiency gains are widely acknowledged as a starting point for sustainability improvements, and a range of technologies and design approaches have been implemented across the data centre sector to achieve carbon and cost savings. More recently, many data centre operators have included water resource consumption reduction efforts. Mindful of rapid growth in the data centre industry – in terms of facilities size and number – environmental activists have long argued that If efficiency improvements are helpful, the overall footprint of the data centre industry is so massive that any energy used to power large facilities must be generated from renewable sources. Today, this approach – featured here as the second goal in the OVHcloud sustainability roadmap – is not restricted to the activist: its adoption is recommended by global regulatory bodies, and is an increasingly important component in the sustainability strategy of many service providers. But as it looks to achieve Carbon Neutrality, OVHcloud is also planning additional innovation, building on circular

economy processes currently in place to become a zero waste facility, and working with its broader customer and supplier community to advance an ecosystem approach that promotes sustainability throughout the compute supply chain.

These six goals define increasing levels of commitment to environmental management in the data centre, and OVHcloud activity in each of these areas is noteworthy. Details on current activities, which follow below, provide a benchmark and baseline for measuring performance and company progress towards addressing EU Green Deal recommendations. With timeframes built in, OVHcloud has developed a blueprint that can help ensure environmental programs are supported with reasonable investments and leadership, and which supports the innovation needed for future enhancement of the OVHcloud sustainability profile.

Renewable energy, matching supply and demand

Utility providers in many jurisdictions rely on a mix of water and energy resources that have been weighted towards the burning of fossil fuels to create electricity, which in turn is consumed in massive quantity by data centres. To address water *and* carbon impact produced through this pattern of consumption, many data centre operators today are turning to the use of alternative sources of energy. Relative to other sectors, the ICT industry, and data centres in particular, have demonstrated willingness to engage in the green energy shift that renewables offer. Prodded by environmental activists who pointed over a decade ago to the carbon impact of the 'energy hogs' – large Internet companies with seemingly limitless appetite for electricity – many data centres are now committing to energy transition. Increasing use of renewables is also inspired by the improved price, performance and availability of renewable energy sources, such as wind and solar, and by the emergence of new technologies, including better battery storage, fuel cells, and grid control devices, that enable their integration. Today, more than 20 of the largest data centre operators have made public their intent to run digital infrastructure with 100 percent renewable electricity, commitments that have prompted many local utility providers to increase their own investment in renewables.[5] While questions remain around the mechanics and timing of this shift on the part of various operators, OVHcloud has outlined its strategy for transition to clean energy.

The journey to energy maturity involves balancing increasing financial investment, risk and potential impact on operations against the benefits of greater penetration of renewables. Today, the OVHcloud energy profile shows significant utilization of renewable energy; data centres in France, for example, rely to a great extent on electricity produced through nuclear generation, while data centres in Canada rely on clean hydro power. As part of its transition to 100 percent high quality renewables, in most regions, the company has invested in RECs (Renewable Energy Credits), a financial investment designed to offset the clean energy shortfall in other areas. A next step involves signing supply contracts with local utilities that specify

[5] Clicking Clean Virginia. The Dirty Energy Powering Data Center Alley. Greenpeace. February 2019. https://www.greenpeace.org/usa/reports/click-clean-virginia/#dirty-data

delivery of energy from specific renewable assets. At a next level, OVHcloud utility contracts would entail delivery from a renewable portfolio to ensure a 24/7 supply that matches data centre demand, and at a next level, long-term supply contracts would commit to sustained demand to enable the utility to finance the development of new generation assets. At a final stage, renewable energy produced on and offsite would be stored to guarantee the real time matching of supply and demand for power resources at the data centre location. At this last stage, 100 percent renewable usage is achieved, and with it, defined benefits, including the ability to align the 24/7 supply of renewable energy to specific data centre assets, enabling real-time source analysis of power consumption and identification of any potential need for offsets. Based on capital investment in the systems and equipment needed to deliver energy directly at source, this final renewable energy phase entails upfront financial impact; but as equipment is depreciated, the 'cost' for free solar and wind may introduce ongoing savings, along with a new measure of energy security derived from the creation of grid independent energy sources.

WEC (Water, Energy, Carbon) efficiency improvements reduce consumption and risk

A traditional view of data centre operation set service delivery performance against energy efficiency gains. While 'green IT' techniques, such as free air cooling, use of low power IT equipment, data centre consolidation and use of various data centre infrastructure management tools have long promised to reduce energy consumption, their use has been held hostage to the prevailing notions of broader economic and social need. A shift in attitude towards green IT, for example, was apparent in the wake of the economic downturn of 2008 – 09, when highly competitive markets drove a need to reduce cost while boosting data centre capacity. In this environment, many operators began to view green solutions as a handicap in meeting overarching cost/capacity goals.

Today, however, green techniques are no longer considered a performance liability or a threat to bottom line; rather sustainability planning and activities are seen increasingly as an integral element in data centre design and operation that can reduce cost and risk associated with water, energy and carbon. Today, sustainability does not compete, but instead complements scalability, reliability, manageability, security, and availability as an essential attribute that can support service delivery excellence. This newer view of sustainability is based on a more holistic data centre construct that views both internal and external factors as inputs to operational success planning. The deployment of renewable energy sources, for example, is now considered a means of circumventing reliability issues that have emerged in aging electricity grid distribution networks; waste reduction generates cost savings, but also addresses potential resource shortages in global supply chain that fall from irresponsible exploitation; and carbon reduction serves CSR goals, but will also help to satisfy increasingly demanding regulatory regimes, that in many jurisdictions have introduced carbon/environmental taxation.

Energy

In the data centre, scope 2 emissions produced through the consumption of electricity in operations are the primary contributor to environmental footprint. Driven by a seemingly-insatiable demand for compute resources to manage the data explosion associated with digital transformation, the data centre industry has grown in terms of market value[6], and scale of operations.[7] Interestingly, while compute demand has increased – by a factor of six from 2010 to 2018, according to one study – increases in energy consumption have scaled more slowly, due in large part to energy efficiency improvements introduced over this period. As Figure 4[8] from Science magazine shows below, innovation at the hardware level and in the data centre have worked to mitigate anticipated growth in the industry's consumption levels. Commenting on this research, OVHcloud Chief Industrial Officer François Sterin noted: "The demand for data compute and storage has grown fast, more than six times between 2010 and 2018. But thanks to energy efficiency measures, both at the hardware level and at the data centre level, combined with greater use of cloud computing solutions, data centre energy consumption only rose 6 percent between 2010 and 2018. Data compute energy intensity has dropped 20 percent per year, data storage energy intensity has almost been divided during that period… Lots to be done yet, and this is only the start, but worth noting this efficiency improvement rate is much greater than rates observed in other key sectors of the global economy over the same period."

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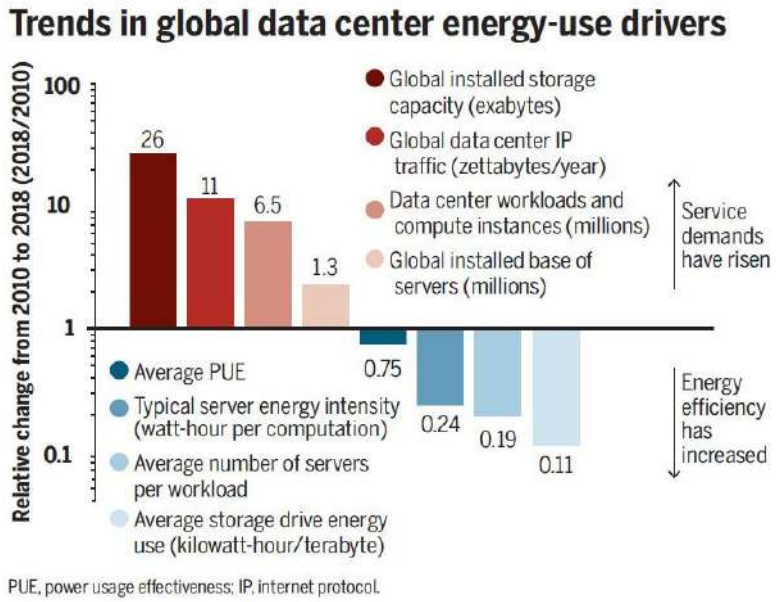
[6] The global data center market was valued US$ 18 Bn in 2017 and is expected to reach US$ 39 Bn by 2026, to achieve a CAGR of 10.15% during the forecast period.
Paloma Jones. Global Data Center Market Trends, Growth, Opportunities, Industry Overview, Statistics, Size, Share 2019–2026. Medium. March 28, 2020. https://medium.com/@palomajones1608/global-data-center-market-trends-growth-opportunities-industry-overview-statistics-size-f60e1c6e1f88

Stephen Hardy. 2019 hyperscale data center spending growth exceeds capex growth: Synergy Research. Lightwave. March 2020. 2019 hyperscale data center spending growth exceeds capex growth: Synergy Research. https://www.lightwaveonline.com/business/market-research/article/14172682/2019-hyperscale-data-center-spending-growth-exceeds-capex-growth-synergy-research

[7] At the end of 2019, there were over 500 hyperscale data centres globally.
Yevgeniy Sverdlik. Analysts: There are Now More than 500 Hyperscale Data Centers in the World. Datacenter Knowledge. October 2019. https://www.datacenterknowledge.com/cloud/analysts-there-are-now-more-500-hyperscale-data-centers-world

[8] A summary of findings contained in Masanet, Eric, Arman Shehabi, Nuoa Lei, Sarah Smith, and Jonathan Koomey. "Recalibrating global data center energy-use estimates." Science 367, no. 6481 (2020) is provided in: How Much Energy Do Data Centers Really Use? Energy Innovation. March 2020. https://energyinnovation.org/2020/03/17/how-much-energy-do-data-centers-really-use/

Figure 4. Global data centre energy consumption drivers vs. efficiency improvements, 2010 to 2018



Source: Masanet, Eric, Arman Shehabi, Nuoa Lei, Sarah Smith, and Jonathan Koomey. "Recalibrating global data center energy-use estimates." Science 367, no. 6481.2020

Air intake at OVHcloud data centre

At OVHcloud, many of these innovations have been implemented in efforts to improve energy profile. At the facilities level, the company has made use of free air cooling in new OVHcloud-built data centres, based on an air flow management system that optimizes the use of cooler air from the outside. While fresh air passes across the front of servers, hot air is evacuated through the back of the racks and hot air/cold air are kept separate. Since 2010, free air cooling has accounted for approximately 30 percent of cooling needs; a proprietary water-cooling system delivers the remaining requirements.

Developed in 2003, the OVHcloud cooling technology is deployed on an 'industrial' basis – optimized and standardized for use in servers that are assembled by the company – across its fleet of 30 data centres. Using heat exchangers that cool processors and other heat-emitting components, the proprietary system brings liquid inside servers for precision delivery of cooling. Approximately 70 percent of the heat generated by the servers is captured, and then transferred though a closed loop system that pipes heated liquid to the building exterior for

cooling. By eliminating the need for air-cooling infrastructure such as server fans, air channels and filters, this approach delivers significant energy cost savings; one observer estimates that liquid cooling uses five times less energy than air cooling, and that precision techniques deliver 1000 times more capacity to extract heat from electronics than do air-cooling solutions.[9]

PUE leadership

Typically, cooling accounts for close to 40 percent of energy consumption in the data centre, and a hefty share of facilities budgets. With free air and water cooling, OVHcloud avoids the use of energy hungry, free-standing air conditioning units, such as chillers and condensers; the outcome is cost savings on electricity bills and reduced carbon impact. OVHcloud efforts to improve energy efficiency are reflected in the KPIs detailed in Figure 5 below, which compares the performance of OVHcloud data centres with a broader sample of facilities researched by ASHRAE and The Uptime Institute. A key metric developed by The Green Grid consortium in 2007 is Power Utilization Effectiveness (PUE), a ratio of total energy used by a data centre facility, divided by the energy consumed by computing equipment, in which 1 is an impossibly perfect score (no energy used by the facility). Despite some issues with PUE reporting, this metric was adopted as a global standard under ISO/IEC 30134-2:2016 in 2016, and continues to be the most popular measure for calculating the energy efficiency of a data centre facility. To ensure the reliability of its PUE data, OVHcloud adheres to Category 2 of the PUE standard, which involves measurement of the IT load at the power distribution unit level, to generate an "instant" power ratio value. This instant PUE is represented in Figure 5; in addition, power values are integrated over time in line with requirements defined in ISO/IEC 30134-2:2016. Another input that may affect data centre energy measurement is IT device utilization; PUE estimates are less reliable when IT is not working at full capacity.[10] While ultimately the customer controls IT load, as a cloud provider, OVHcloud operates at maximum efficiency, reducing potential for PUE variation.

[9] David Craig. Liquid cooling at the Edge – the coming technology is already here. Techerati. April 2020. https://techerati.com/features-hub/opinions/liquid-cooling-at-the-edge-the-coming-technology-is-already-here/

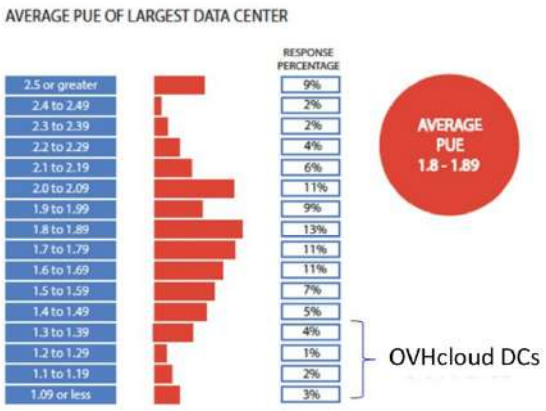
[10] Brady, Gemma, Nikil Kapur, Jonathan Summers, and Harvey Thompson. "A Case Study and Critical Assessment in Calculating Power Usage Effectiveness for a Data Centre." Energy Conversion & Management, 76, 2013.

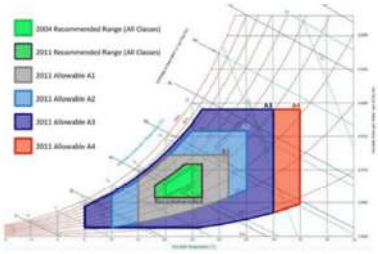
OVHcloud water cooling; blue pipes pump cooled liquid to the CPU and red pipes capture heat for transfer.

Across its sites, OVHcloud reports an average PUE of 1.2 and a best performance of 1.09, results that position the company at the leading edge of hyperscale providers in terms of energy efficiency. OVHcloud PUE scores compare favourably with an average for European data centres of 1.80 (2017)[11], and to the average PUE of 1.67 (2019)[12] estimated for data centre operations of all sizes in the most recent Uptime Institute Global Data Centre Survey. Only a handful of providers have achieved a PUE of less than 1.2. The Figure also details OVHcloud operating temperatures, which, based on the ASHRAE class A2 specifications, range from 15-35 degrees C in cold aisle, with a minimal delta between cold and hot aisle temperatures.

Figure 5. OVHcloud Power Usage Effectiveness

Power usage effectiveness: OVHcloud very competitive PUE





OVHcloud can operate data centers within class A1 or A2

Figure 5.1: Uptime Institute survey of PUE for 1100+ data centers. This detailed data is based on a 2012 study [Upl12] but the trends are qualitatively similar to more recent studies (e.g., 2016 LBNL study [She+16]).

PUE (Power Usage Effectiveness) = Total Electricity used/Power used for critical load

[11] Luca Castellazzi. Trends in data centre energy consumption under the European Code of Conduct for data centre energy efficiency. European Commission Technical Report. December 2017. https://www.researchgate.net/publication/322223249

[12] Andy Lawrence. Is PUE really going up? Uptime Institute Intelligence Note 11. Q2 2019.

Migration to cloud a key green tactic

Closely related to efficiency improvement is migration to cloud, a technology shift that relies on the sharing of compute resources to maximize energy consumption reduction. For OVHcloud, migration to cloud is closely aligned with evolving with customer requirements and 'cloud first' a key technology attribute across each of its service delivery options.

Reflecting 2019 rebranding designed to better describe core operations and service offerings, OVHcloud operates today as a fully enabled cloud provider, with hyperscale capability to optimize workload sharing across cloud, private cloud and dedicated server offerings – and with it, the ability to reduce energy and carbon footprint.

The green benefits of cloud technology are well documented. Built on virtualization technologies that optimize the sharing of compute resources, cloud offers energy savings by boosting server utilization. Through cloud consolidation, operators use fewer physical servers, decreasing waste heat and electricity consumption across data centre devices. Energy savings at the server level are amplified at the facility level, by reducing the energy needed to power infrastructure equipment, including power distribution units (PDU), uninterrupted power supplies (UPS), and building transformers, and by reducing the energy needed to remove heat produced by (fewer) servers.[13] Typically, these savings are most readily available in large data centre facilities, which can achieve higher levels of sharing and consolidation through economies of scale, and which have the resources needed to invest in modernization to address core business needs through technologies like tailored chips, high-density storage, virtualization, software defined data centre solutions, and customized airflow and cooling systems. The power savings that can be achieved through use of cloud have been estimated at the micro level in several use case studies, including the Lawrence Berkeley National Laboratory research which estimated in 2013 that if all US business users shifted email, productivity tools and CRM software to the cloud, the primary energy footprint of these applications would be reduced by 87 percent.[14]

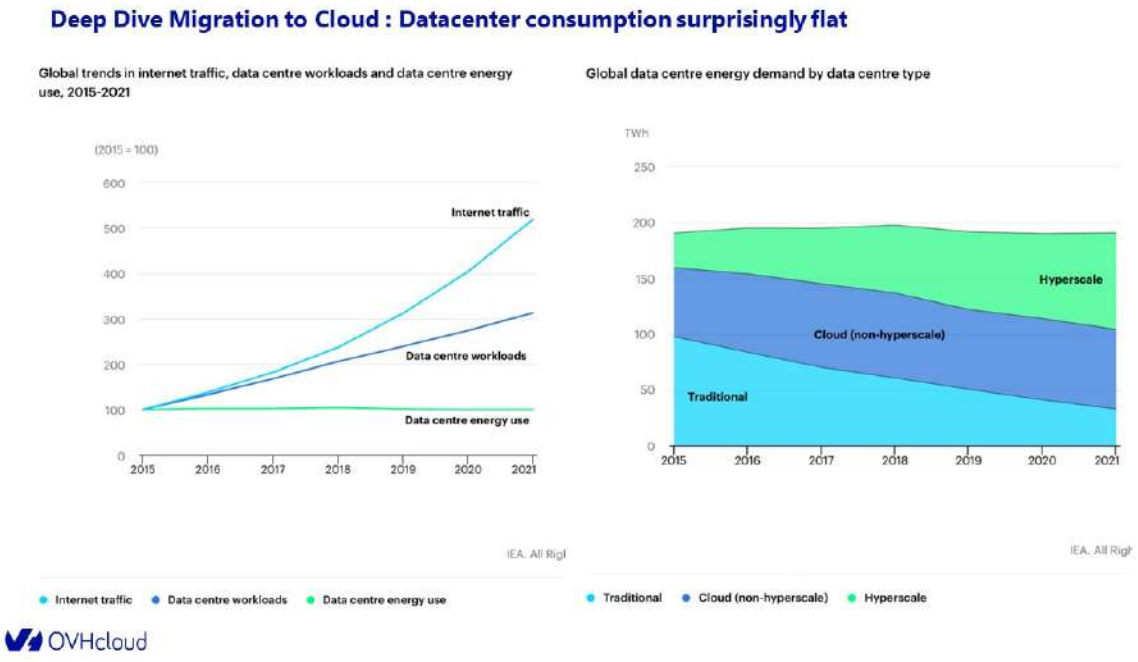
Higher levels of efficiency in larger facilities has prompted an overwhelming shift to cloud: while approximately 79 percent of data center computing was carried out in smaller traditional computer centers, largely owned and run by non-tech companies, researchers have found that

[13] One study has estimated that one watt-hour of energy savings at the server level can produce roughly 1.9 watt-hours of facility-level energy savings by reducing energy waste in the power infrastructure and by reducing energy needed to cool the waste heat produced by the server.
New Strategies for Cutting Data Center Energy Cost and Boosting Capacity, Emerson Network Power presentation, 2012. www.emersonnetworkpower.com/documents/en-us/latest-thinking/edc/documents/white%20paper/is03947_2012_energylogic_fin.pdf

[14] Eric Masanet, et al. The Energy Efficiency Potential of Cloud-Based Software: A U.S. Case Study. Lawrence Berkeley National Laboratory. June 2013.

by 2018, 89 percent of data center computing took place in larger, utility-style cloud facilities.[15] The net effect of several trends – increasing computing demand, combined with a shift away from traditional, enterprise computing towards cloud-based based computing – has produced an intriguing result, illustrated in Figure 6. As data on energy usage developed by the International Energy Agency shows, the energy efficiency gains associated with transition to cloud, and indeed hyperscale cloud computing, have effectively neutralized increased consumption levels anticipated for a future marked by explosive digitization.

Figure 6. Migration to cloud impact on data centre energy consumption, IEA



Water wise

By running its data halls at higher temperatures, OVHcloud is able to reduce chilling requirements, a factor that contributes to the company's impressive PUE reporting. These outcomes are based largely on cooling of computing equipment with water, a more efficient cooling medium than air, but a resource that is increasingly short supply worldwide due to overuse, pollution and climate change. In 2019, the World Economic Forum listed water scarcity as one of the primary global risks over the coming decade.[16]

Data centres consume water in two ways: by using electricity generated through use of water resources, and through direct consumption of water for cooling on site. As compared to other sectors in the economy, the data centre industry is relatively efficient in its use of water. In a

[15] Eric Masanet, et al. Recalibrating global data center energy-use estimates.
[16] Global risks report 2019. World Economic Forum. March 2019. https://www.weforum.org/reports/the-global-risks-report-2019.

report on US data centre energy consumption, researchers found that approximately 1.8 liters of water is used by the average data center for every 1kWh of power it consumes, while an average of 7.6 liters of water is used to generate 1kWH of energy in other major US industries.[17] However, the increasing popularity of water cooling approaches, combined with increasing resource scarcity, call for operators to ensure the highest possible levels of efficiency in onsite water usage. The potential for greater water conservation is a largely a function of technology: evaporative cooling or use of cooling towers introduce greater water losses, while closed loop systems have proved more efficient due to their reuse of water. To gauge the success of their water conservation efforts, data centre operators can apply another metric designed by The Green Grid, Water usage effectiveness (WUE), which is defined as a site's annual usage, divided by IT equipment energy consumption. The impact of different approaches to water usage is illustrated in Figure 4, which shows the industry average for data centre water consumption, five year performance of a hyperscale provider that prides itself on water stewardship, and OVHcloud leadership in this area. At 0.21, OVHcloud's WUE is impressive; strong performance on water usage is due to closed loop technology, and represents an especially important result, given OVHcloud reliance on water cooling across most of its fleet.

Circular economy – lifecycle management in the data centre

At a fundamental level, the term 'circular economy' refers to an industrial system that is regenerative, that replaces linear, end-of-life thinking with a new approach that rebuilds capital, enhancing the flow of goods and services to support a 'value circle' or feedback system that serves all stakeholders. As a set of principles aimed at supporting sustainability in economic and social life, circular economy is inspired by several specific goals: transition to renewable energy, the elimination of toxic chemicals that prevent reuse and the return of elements to the biosphere, and the elimination of waste through the redesign of products, systems and business models.[18]

The data centre industry is well positioned to capitalize on many of these principles. OVHcloud, for example, has embarked on a green energy transition, and has deployed many of the cloud, cooling and other technology innovations that are helping to reduce energy consumption today, and that will drive the carbon neutral goal outlined in its plans for 2030. But this ambitious target depends on a more comprehensive view of the data centre, that transcends the operational energy equation to also consider the impact of embedded carbon, as well as opportunities to reuse, up-and-recycle for the elimination of carbon and other waste. For OVHcloud, waste management is a strategic issue that is addressed through tight control of the production chain, which extends from server manufacture to building and maintaining its data

[17] United States Data Center Energy Usage Report, LBNL, 2016.

[18] World Economic Forum. From linear to circular—Accelerating a proven concept. https://reports.weforum.org/toward-the-circular-economy-accelerating-the-scale-up-across-global-supply-chains/from-linear-to-circular-accelerating-a-proven-concept/

centres. A good example of broad reuse activity can be found in the company's siting strategy; while an array of factors, including power mix and cost, tax, permitting and regulatory regime, geo-security and connectivity provide input into data centre site decisions, OVHcloud typically builds in existing industrial facilities with low carbon grids, such as the abandoned, hydro powered aluminum smelter in Quebec, which now houses the state of the art server assembly and cloud service delivery facility at Beauharnois. And in efforts to boost LUE (land usage effectiveness), the company has adopted a modular approach to scaling operation at brownfield sites – it brings data centre whitespace online with power and connectivity only as customer demand warrants it.

Waste reduction is a key element in circularity, and in OVHcloud's 'industrial' approach to data centre build and management[19]. With precision tooling, the company mass-produces containers and racks in standardized format at its manufacturing facility in Croix, France to optimize materials usage, and to speed time to IT deployment. Servers have been designed in-house, with a goal of extending lifespan for all types and ranges, according to a principle of 'use smarter, use longer, use less'. Through mastery of its global supply chain for externally-sourced, standardized server components and facilities equipment, the company engages in bulk purchases, to enable the sharing of components across regions in order to reduce overstock and other waste outcomes – typically from partners with environmental accreditation. Control of production allows OVHcloud to make the most of each component through the application of rigorous life cycle assessment.

Today, LCA (life cycle assessment) is becoming a standardized way of measuring the impact of a product, from its creation, through use, to end-of-life, which is applied in social contexts by UNEP and by other organizations in other scenarios.[20] Designed to support long term sustainability, LCA encompasses many goals that translate to the data centre. For example, when a slowdown is detected on a server, OVHcloud deploys a dedicated team to oversee testing of all the components and proceeds to an evaluation of the equipment to determine its potential for repair, repurpose, and/or part recovery. Servers that cannot be reused are broken into components, and sold through specialty brokers to return some financial benefit, but more importantly, to prevent irresponsible disposal in landfill. Ultimately, the aim is to produce zero waste across the data centre structure and from internal equipment, an ambitious agenda that begins with designing for reuse and disassembly during planning and construction.

[19] Industrialization of the Data Centre: the Compute Factory. An InsightaaS/DC Foresight Best Practice Report. June 2019.

[20] Report authors argue for the use of Waste "RE" Effectiveness (WREE). s new sustainability metric to measure the relative ability to use all waste from a product or service. "RE" in WREE refers to actions that can be taken with waste: reduction, reuse, recycling, and remanufacturing. A perfect WREE means that no waste is generated because all potential waste has been prevented or captured and used for another purposes.
Susanna Kass and Alberto Ravagni. Designing and Building the Next Generation of Sustainable Data Centers. Sustainable Development Goals. December 2019.

OVHcloud has achieved considerable success in its server assessment program; as Figure 7 shows, 100 percent of components are valued and sorted.

Figure 7. OVHcloud sustainability indicators

Measuring progress

The benchmark activity indicators highlighted in Figure 7 align with a key tenet of sustainability programing – management thinker Peter Drucker's maxim "What gets measured gets managed." With these baseline figures, OVHcloud has established the foundations for a sustainability agenda that anticipates progress across the four pillars outlined in its current, near term, and aspirational planning. PUE, WUE, total data centre energy consumption and gCO2/MWH celebrate success achieved through improved resource and energy efficiency activities, the broader migration to cloud, and a shift to renewable sources of energy. Measures of component sorting/valuation, server reuse, and diversion of waste from landfill speak to efforts towards greater circularity. Taken together, they define the framework that OVHcloud will use to further improve its carbon footprint, and illuminate the path to zero carbon that OVHcloud aspires to achieve in 2025. Unique among cloud providers, OVHcloud also manufactures servers, and includes scope 3 emissions in carbon footprint calculations. Since 2017, it has included all three emissions scope measurements – direct emissions, indirect emissions related to energy consumption, and other indirect emissions – in this measure of sustainability performance. Preparing for the future, the company has begun the process of certification on the ISO14001/ISO50001 Environmental and Energy Management standards.

As indicators of progress on the sustainability front, these activities also translate to success for OVHcloud from a business perspective. The company's green journey was inspired by its business case, and OVHcloud's strong belief in the 'triple E', where it is possible to achieve efficiency, economy and ecology simultaneously. Reduced carbon intensity achieved through ongoing efficiency improvements, cooling diversity, grid technologies, and site selection based on climate, for example, produce direct savings on energy cost. A shift to 100 percent use of onsite renewables for a carbon free data centre may address green regulatory requirements, and mitigate risk associated with aging utility grid infrastructure, in addition to reducing cost. Transition to cloud is good for the climate, but also necessary to address market demand, which is moving steadily away from smaller enterprise computing to large, cloud-based provider systems. And through waste reduction, creative reuse of assets, and the ultimate elimination of toxic minerals in components, OVHcloud benefits financially, while addressing a growing CSR requirement that responds to greater social awareness of climate and environmental issues.

But most importantly, OVHcloud's ability to report progress on sustainability initiatives helps the company better serve customers, who are also expected, increasingly, to demonstrate their own path forward on sustainability. OVHcloud energy intensity reporting, for example, may be integrated into a client's own sustainability planning, creating an important input to supplier decision making. Measurement capabilities may also help customers improve their own environmental profile. For example, OVHcloud is currently working with a French research institute to develop a consumer-facing metric for the company's dedicated server offering, which will report energy consumed by applications, per server per year, providing customers with energy impact monitoring that can help in the optimizing of workloads for carbon reduction. By sharing best practices on the creation of energy-efficient software code, the company may help customers to further improve their own carbon footprint. While these kinds of services may help to improve the company's sustainability outlook, client education and metrics also serve as a value add that may hep differentiate OVHcloud in a highly competitive cloud provider marketplace.

Today, new monitoring, analysis and reporting capabilities are delivering a more holistic view of sustainability challenge and opportunity in the data centre to address primary UN SDGs for better resource consumption and waste reduction across a range of activities and inputs. This exercise serves data centre operators, owners and investors, their partners and clients, as well as citizens who experience environmental benefits. As the foundation for forward momentum on environmental stewardship, for cost savings and improved bottom line, for better customer relations and public profile, these capabilities are helping to position sustainability as a key input to broader corporate decision making that can impact company success more broadly as