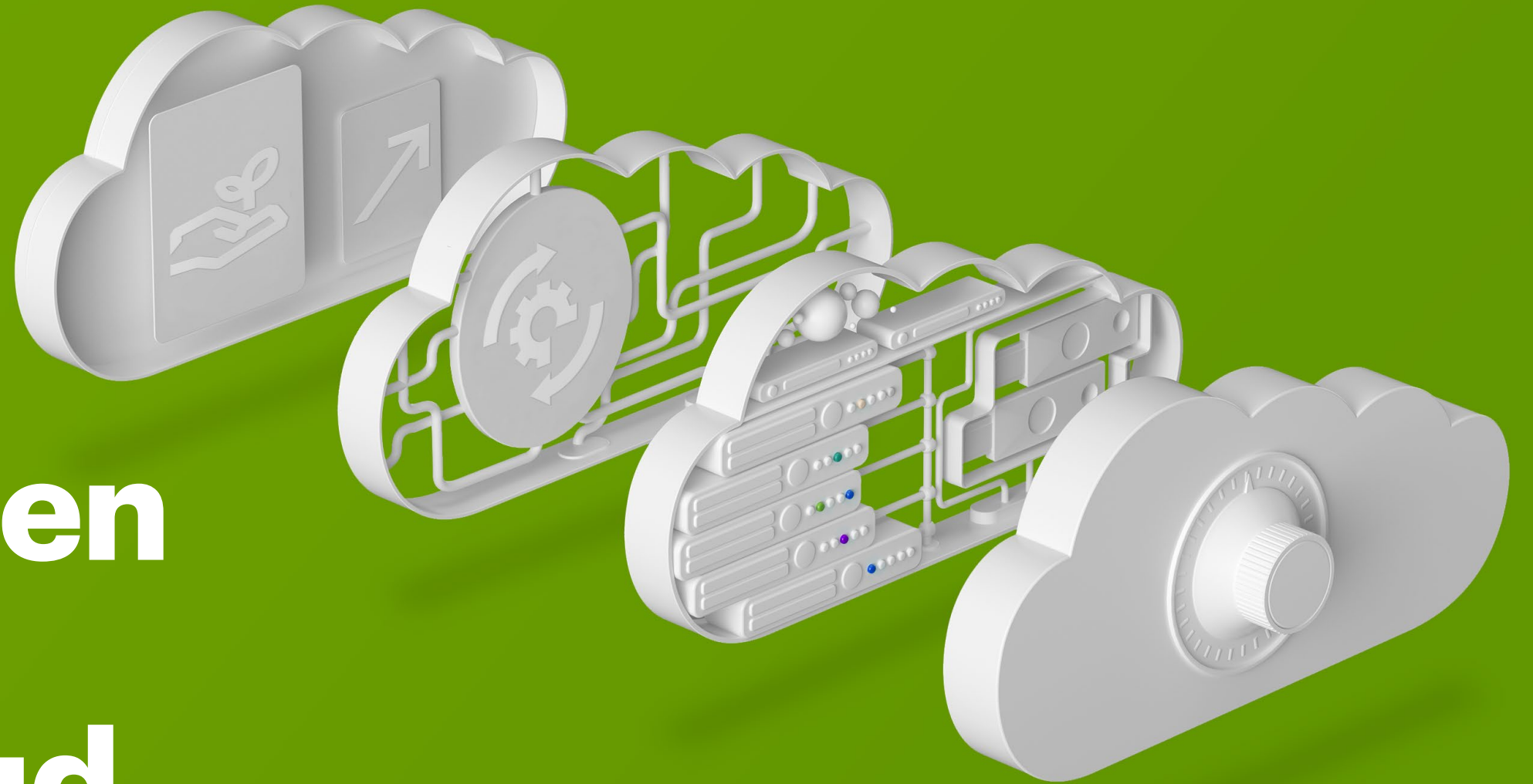




The green behind the cloud



Cloud has moved from “nice-to-have” to “must-have”. But not all approaches to cloud migration are equal. Cloud migration can deliver a double helix effect of shareholder and stakeholder value—simultaneously reducing costs and carbon emissions if approached from a sustainability perspective. Leading to a greener planet and a boost in profitability.

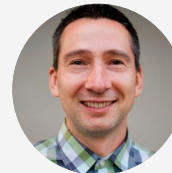
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Forecast for cloud

The business forecast is for more and more cloud with a chance of significant savings...financial and carbon. With the proliferation of data and devices, public cloud will only gather strength. Every business will become a “cloud-first” business.

Consider this: The number of large-scale data centers is increasing by 14% each year¹ and public cloud spend will rise by 17% between 2019-2020.² Some analysts estimate that 11.4% of the United States’ IT spend is dedicated to cloud, with China at 2.7% and catching up rapidly.³ This double-digit growth comes with a price. Global data center electricity consumption is nearly equivalent to the annual consumption of the country of Spain.^{4,5}

However, by pursuing a green approach, our Accenture analysis suggests migrations to the public cloud can reduce global carbon (CO₂) emissions by 59 million tons of CO₂ per year. This represents a 5.9% reduction in total IT emissions and equates to taking 22 million cars off the road. This magnitude of reduction can go a long way in meeting climate change commitments, particularly for data intensive businesses.



From Accenture's experience supporting cloud migrations for hundreds of clients, sustainable cloud positions companies to deliver on financial targets. We've seen up to 30-40% total cost of ownership (TCO) savings. Drivers like greater workload flexibility, better server utilization rates, and more energy-efficient infrastructure all make public clouds more cost efficient than enterprise-owned data centers.

At Accenture, we practice what we preach: Today we run a full 95% of our applications on the cloud. The migration led to \$14.5 million in benefits after the third year. Another \$3 million in annualized costs were saved by right-sizing service consumption.⁶

Outperforming peers through responsible business practices:

Based on Accenture research, between 2013—2019, companies with consistently high ratings for environmental, social and governance (ESG) performance enjoyed **4.7x higher operating margins** than low ESG performers over the same period. High performers generated **higher annual total returns to shareholders, outperforming peers by 2.3x**. Over the past several months, when global markets have faced tremendous pressures and volatility, companies with high ESG scores have continued to outperform, experiencing a cumulative relative return 6.3% higher than bottom performers and facing lower volatility.



As importantly, cloud migrations also unlock new opportunities like clean energy transitions enabled by cloud-based geographic analyses, material waste reductions from better data insights, and targeted medical R&D as a result of faster analytics platforms.

Sustainability as the future of business:

Companies have historically driven financial, security, and agility benefits through cloud, but sustainability is becoming an imperative. According to the latest UNGC-Accenture Strategy CEO Study, more than **99% of CEOs from large companies now agree that “sustainability issues are important to the future success of their businesses.”** Two-thirds view fourth industrial revolution (4IR) technologies as a critical factor for accelerating socioeconomic impact. 59% of CEOs say they are deploying low-carbon and renewable energy across their operations today while **44% see a net-zero future for their company in the next ten years.**⁷

Glossary of Terms



SUSTAINABLE CLOUD—A technology platform that enables organizations to tap on-demand public, private or hybrid computing capabilities through virtual hardware, software and services. Sustainable cloud focuses on the environmentally friendly operation and use of cloud services through a proactive approach to lowering carbon emissions and unlocking new responsible applications of cloud technology.



PUBLIC CLOUD—Computing services provided by third-parties and offered over the public Internet. They are typically available for purchase on-demand.



FOURTH INDUSTRIAL REVOLUTION (4IR)—A term coined by Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, in his book, “The Fourth Industrial Revolution”. 4IR technologies are characterized by a range of new technologies that are fusing the physical, digital and biological worlds.



CLOUD-NATIVE APPLICATIONS—Designed to take full advantage of on-demand computing, higher asset utilization rates, and multi-tenant structures that allow multiple customers to be served with one application installation.



CIRCULAR ECONOMY—The departure from traditional ‘take, make, waste’ production and consumption systems to a system whereby resources are kept in use for as long as possible, the maximum value is extracted from them whilst in use, then products and materials are recovered and regenerated at the end of each life-cycle.

Toward greener cloud

Not all cloud migration approaches are created equal when it comes to sustainability and one size certainly does not fit all. What do we mean by that? The range of benefits possible depend on a company's focus around three things:

01

Select with purpose

02

Build with ambition

03

Innovate further



Select with purpose

01

The first step towards a sustainable cloud-first journey begins with selecting a carbon-thoughtful provider. Cloud providers set different corporate commitments towards sustainability, which in turn determine how they plan, build, power, operate, and retire their data centers.

Carbon emissions can differ widely across providers even though many providers have focused on driving down energy consumption to standard benchmarks. Differences arise from varying ranges of corporate investments in renewable energy generation, the reusability and recyclability of data center hardware, and advanced analytics for better management of asset operations. And cloud customer-facing services like transparent real-time reporting of associated carbon emissions can help track actuals against sustainability goals.

Things to consider when selecting a public cloud provider:

- ✓ Carbon neutral or carbon negative corporate goals of the provider
- ✓ Source of electricity, the renewable power mix, and the cloud provider's support for developing new renewable generation sources rather than purchasing carbon offsets
- ✓ Direct match of energy usage with 100% renewable energy purchases, ideally in real-time (See [Google](#) case study on next page)
- ✓ Commitment to the most energy efficient underlying infrastructure, including optimized network & servers, smart construction, state-of-the-art cooling, and responsible water management (See [Amazon Web Services](#) case study on next page)
- ✓ Customer-facing services like carbon calculators or granular cloud lifecycle emissions reporting to help companies monitor their cloud footprint (See [Microsoft](#) case study on next page)
- ✓ Circular value chains of cloud provider's hardware

CLOUD PROVIDER CASE STUDIES



Google Cloud Platform

Google currently utilizes a **carbon-intelligent computing platform** that shifts timing of non-urgent data center workloads to when low-carbon sources of energy are most plentiful. The company has also been matching 100% of its annual energy usage with renewables since 2017.⁸ The company has a **bold commitment to operate its data centers carbon-free 24/7 by 2030**, rather than rely on annual direct energy matches. In 2020, Google became the first company to achieve a **zero lifetime net carbon footprint**, meaning the company has eliminated its entire legacy operational carbon emissions.⁹



Amazon Web Services (AWS)

AWS's expansive infrastructure is **3.6 times more energy efficient** compared to median US enterprise data centers, largely due to efficient servers and high capacity utilization rates.¹⁰ The company's water-cooled facilities actively measure water efficiency and select conservation options in the context of regional climate patterns and local resources.¹¹



Microsoft Azure

Microsoft, carbon neutral since 2012, has committed to shifting its data centers to 100% supply of renewable energy by 2025 through power purchase agreements (PPAs). The company recently launched its ambition to be carbon negative by 2030 and **by 2050 to remove all carbon emitted by the company** since 1975.¹² Microsoft Azure's **customers can access a carbon calculator** that tracks emissions associated with their own workload on the cloud.¹³

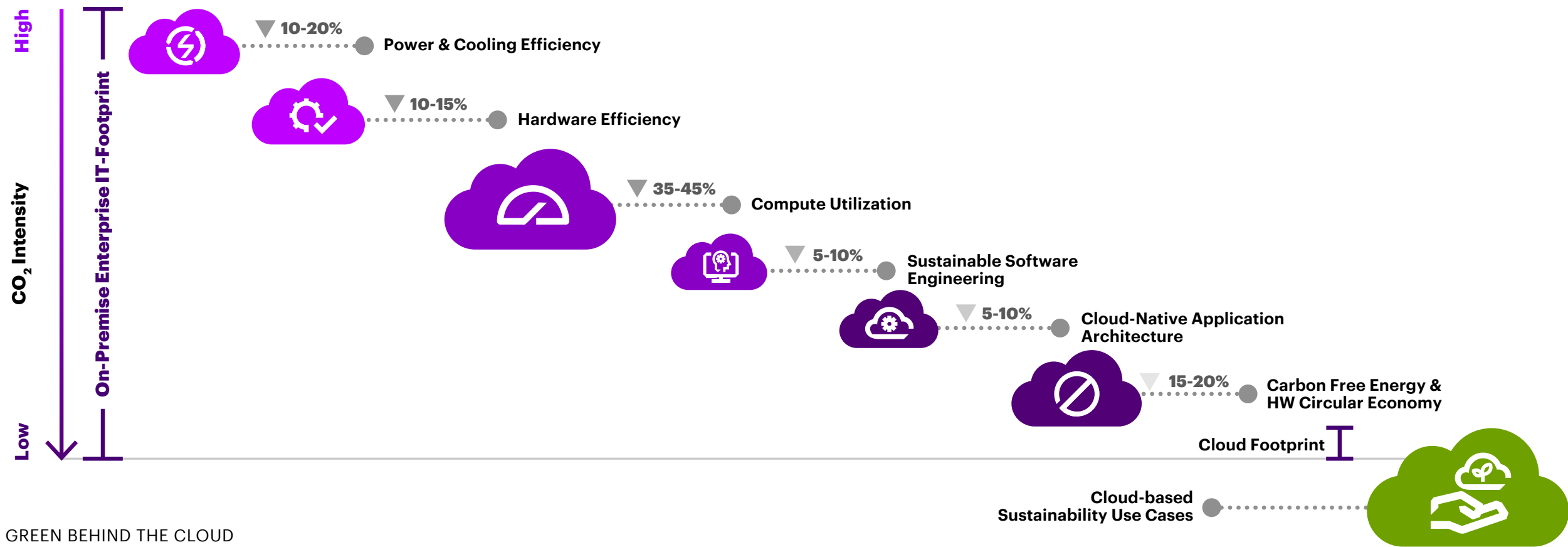


Build with ambition

02

The journey toward a sustainable cloud involves three ambition levels: infrastructure as a service (IaaS also referred to as “lift-and-shift”) migrations (bronze level) without major redesign, application of sustainable software engineering practices (silver level), and application optimization for the “fabric of the cloud” (gold level). IaaS migrations can reduce carbon emissions by more than **84%** compared with conventional infrastructure. Reductions can be pushed even higher—by up to a whopping **98%**—by designing applications specifically for the cloud. The graphic below indicates the incremental levels of carbon reduction that can be achieved—the greater the ambition, the greater the reduction in carbon emissions.

Reducing carbon emissions (estimated ranges based on Accenture research and analysis)



Shifting enterprise-owned computing to the cloud

IaaS migrations involve migrating applications from enterprise-owned to cloud without major redesigns of applications or workflows. These basic cloud-first journeys pave the way for significant carbon reduction opportunities. The main drivers of IaaS include better power and cooling improvements that allow for less energy per compute unit, newer and more efficient hardware optimized by cloud providers, and server utilization rates several times greater than typical enterprise-owned rates. In most cases, cloud providers also have greater renewable energy mixes than cloud users and minimize data center carbon footprints through renewable energy.

Our analysis of the largest public cloud service providers shows average enterprise-owned-to-cloud migrations can lead to an **impressive 65% energy reduction and 84% carbon reduction.**





Applying sustainable software engineering practices

Sustainable software development approaches deliver even more improvements. Companies must make intentional choices to consider cost and performance in the context of sustainability outcomes. For example, our experiments indicate that selecting the right “fit-for-purpose” coding language can reduce energy consumption. Maintaining balance between accuracy of analytical models and cloud resource consumption can result in significant savings.

Accenture Labs’ research in sustainable software engineering revealed that for certain types of programming techniques, **the choice of coding language can impact energy consumption by as much as 50 times.** In dealing with AI, which is typically hosted on the cloud, choices related to accuracy can also make a big difference in energy use. Consider this: Accenture found that while training a simple AI model for identifying flowers, increasing model accuracy from 96% to 98% resulted in a nearly 7X jump in energy consumption.

Sustainable software engineering practices drive energy and carbon reductions. But with limited resources, companies need to prioritize which applications will deliver the biggest carbon benefit when it comes to sustainable development efforts. What’s also important: executives should back sustainability as an outcome for optimizing software, shifting away from their traditional focus on performance and cost reduction.

EXAMPLE OF SUSTAINABLE SOFTWARE ENGINEERING



Amazon’s CodeGuru machine learning service helps the company identify and act upon the lines of code that hinder application performance. From 2017 to 2018, Amazon used it to increase application efficiency, driving a **325%** increase in Central Processing Unit (CPU) utilization and reducing the number of instances needed to manage Prime Day, the company’s largest shopping event of the year.¹⁴

Optimizing software applications for the cloud

Companies drive even greater carbon reductions through cloud-native architectures and deployments. Our analysis shows that customizing applications to be cloud-native can stretch carbon emission reduction to 98%. Customization requires designing applications to take full advantage of on-demand computing, higher asset utilization rates, and dynamic allocation of computing resources. For applications that are not fully migrated, companies can use digital decoupling to take the core parts of legacy applications and build efficient cloud architecture around them.

EXAMPLE OF SOFTWARE APPLICATIONS



Microsoft Exchange

Taking advantage of Microsoft's cloud-native Exchange Online platform rather than Microsoft Exchange instances deployed in traditional data centers can result in significant energy and carbon reductions. A Microsoft study of 10,000 users found Exchange Online led to a **93% carbon emission reduction** from energy savings and the company's renewable electricity purchases.¹⁵



Innovate further

03

Cloud is critical to unlocking greater financial, societal and environmental benefits through cloud-based circular operations and sustainable products and services. **Leading companies are pushing further when it comes to innovation; going beyond data center carbon improvements.**



Cloud-based circular operations

Cloud providers have unique scale and financial incentives and can work closely with stakeholders in adopting the circular economy when it comes to hardware. Accenture estimates show enterprise technology manufacturers can capture an additional **16% of operating profit** by designing products for longevity, modularity, and circularity. Embedded emissions from the manufacture and transfer of hardware to data centers also represent significant value satisfying the needs of both shareholders and stakeholders.

Cloud consumers use cloud-based platforms to trace upstream and downstream value chains more rigorously and to recover value from unused materials and industrial waste streams. See examples on the next page.

EXAMPLES OF CLOUD-BASED CIRCULAR OPERATIONS



Banyan Nation

Banyan Nation is **India's first vertically integrated plastics recycling company** using mobile and cloud-based technology platforms. They collaborate with the informal supply chain of plastic and proprietary plastic cleaning technology to create new quality granules which can then be used for packaging of new products. The company has **recycled over 7 million pounds** of plastic and integrated thousands of formerly informal sector waste workers into Banyan Nation's supply chain. They won the Dell People's Choice Award for Circular Economy Entrepreneur as part of the Circulars Awards at the World Economic Forum in Davos.¹⁶



AMP Robotics

AMP Robotics is a **pioneer in AI and robotics for the recycling industry**. In 2019, the company launched its new AMP Cortex dual-robot system ("DRS") focused on **material recovery in municipal solid waste, electronic waste, and construction and demolition**. Guided by AI, robots sort, pick and place material. Data from each material stream is captured in the cloud and made available through AMP Insights, a visualization tool that makes informed decisions to optimize operations. The company won The Ecolab Award for Circular Economy Digital Disruptor in 2019 and was the Rising Star Company of the Year in the 2020 Global Cleantech 100.¹⁷

Better sustainable products and services

By combining cloud with fourth industrial revolution (4IR) technologies, leading companies promote better customer outcomes. This has been especially true for data-rich sectors.



Winnow's cloud-based solutions use **AI and analytics tools to help chefs cut food waste** in commercial kitchens. Using computer vision, the company's system harvests large volumes of food waste images which are used to train a predictive model. Winnow saves kitchens **3-8% on food cost and drives an ROI of 2x to 10x** in less than a year. Its existing manual system is already used by thousands of chefs in more than 40 countries. The company has helped divert the equivalent of \$42 million in food from landfills and saved 61,000 tons of CO2 emissions.¹⁸



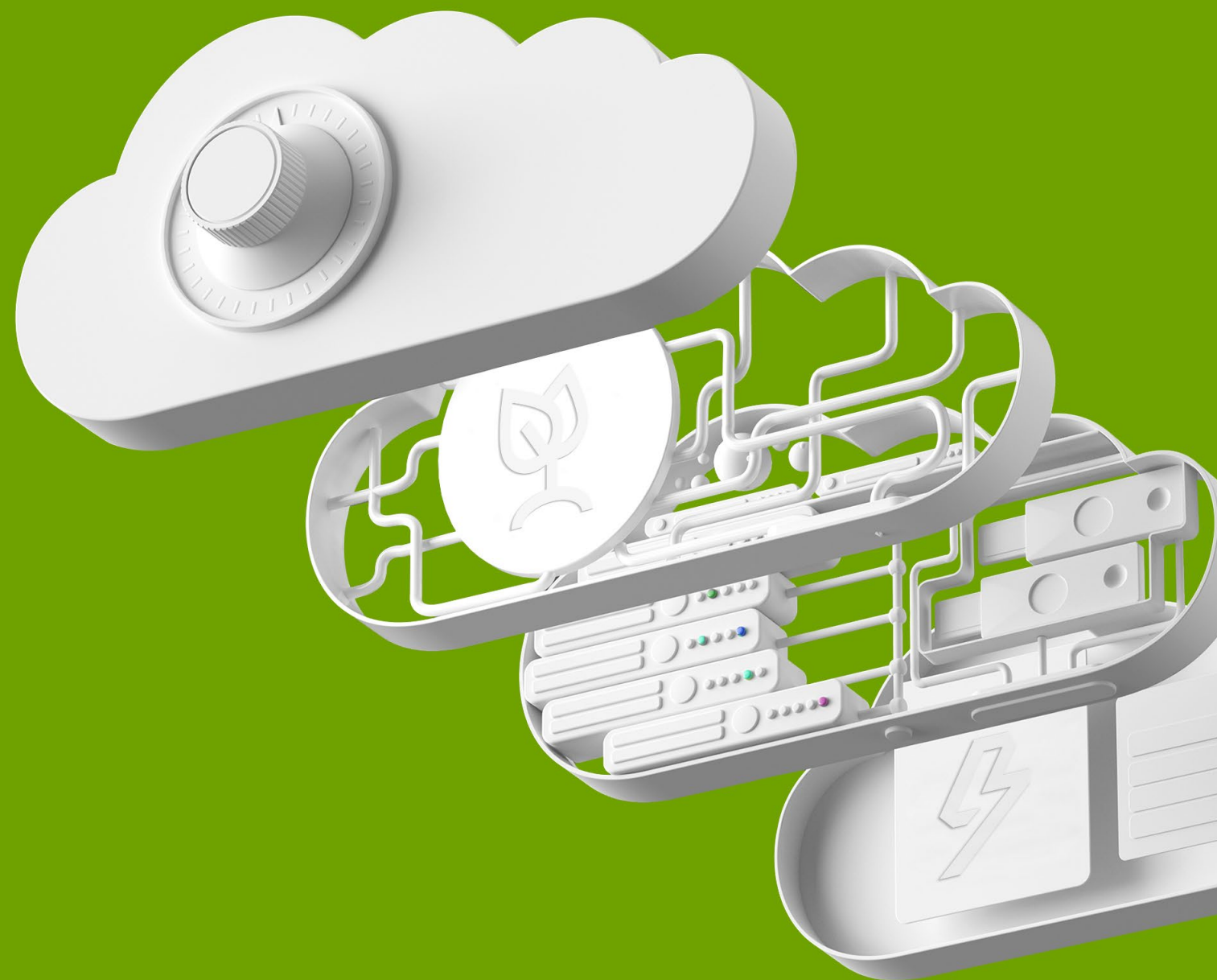
Artemis – AI Against Human Exploitation

Accenture is collaborating with Splunk and Global Emancipation Network to combat human trafficking using the power of analytics. The Artemis solution uses **AI, machine learning, and cloud computing to help law enforcement** partners proactively and rapidly identify high risk business establishments and individuals. The technology **greatly improves the ad-hoc and tip-based approaches** typically used by law enforcement.¹⁹

How Accenture can help

Companies beginning their cloud journey confront a number of questions: Which cloud provider is best? How should applications be modernized to meet needs today and tomorrow? And which cloud-driven innovations should be priorities? The decisions they make will directly determine how sustainable their solutions are and the benefits they drive. Those who choose wisely will gain unprecedented levels of innovation leading to both a greener planet and a greener balance sheet.

At Accenture, we are committed to helping all companies become cloud-first and accelerate their digital transformation. Our newly created multi-service group, **Accenture Cloud-First**, brings together the full power and breadth of Accenture's industry and technology capabilities, ecosystem partnerships, and deep commitment to responsible business. We will deliver the business value, innovation acceleration and technical know-how you need. Our experience will be your advantage, now more than ever.



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About Accenture

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