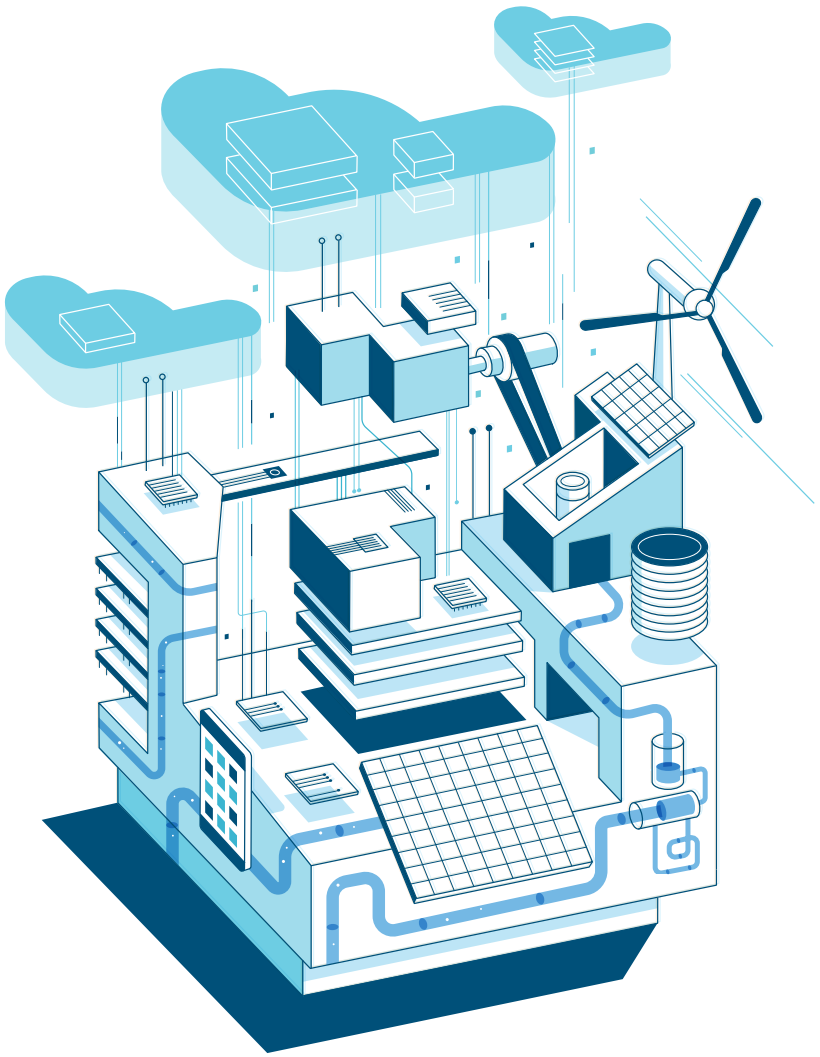
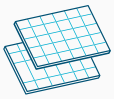
The Cloud

AWS is committed to running our business in the most environmentally friendly way possible and achieving 100% renewable energy usage for our global infrastructure.



Learn how AWS is working to achieve Amazon's goal of 100% renewable energy by 2025.



APR 2015 Amazon announces joining the American Council on Renewable Energy (ACORE) and will participate in the U.S. Partnership for Renewable Energy Finance (U.S. PREF) to increase our work with state and federal policymakers and other stakeholders to enable more renewable energy opportunities for cloud providers.

JUL 2015 AWS announces that it has contracted with Iberdrola Renewables, LLC to construct and operate Amazon Wind Farm U.S. East.

NOV 2015 AWS announces that it has contracted with EDP Renewables to construct and operate Amazon Wind Farm U.S. Central.

JAN 2016 Amazon launches Wind Farm Fowler Ridge, marking the first of our four announced renewable energy projects to move into full operation.

JUN 2016 AWS and Dominion Virginia Power join forces on a landmark renewable energy delivery deal. With this, Dominion Virginia Power will manage and integrate the energy produced from various Amazon wind and solar farm projects onto the grid that serves AWS datacenters.

OCT 2016 Amazon Solar Farm U.S. East is now in production in Accomack County, Virginia.

2014 2015 2016

NOV 2014 AWS shares its long-term commitment to achieve 100% renewable energy usage for the global AWS infrastructure footprint.

SEP 2015 Amazon joins The Buyers' Principles to collaborate with more than 40 other companies on making clean energy solutions more affordable and accessible to all.

JUN 2015 AWS announces that it has teamed with Community Energy, Inc. to construct and operate Amazon Solar Farm U.S. East.

JAN 2015 AWS announces that it has teamed with Pattern Development to construct and operate Amazon Wind Farm Fowler Ridge.

NOV 2016 AWS announces five new solar farms across the Commonwealth of Virginia. These solar farms join the company's existing project, Amazon Solar Farm U.S. East, which went into production in October 2016. Amazon worked with developers Virginia Solar LLC and Community Energy Solar on the projects and will further collaborate with an affiliate of Dominion Resources, Inc. to own and operate the solar farms.

APR 2016 Amazon joins Apple, Google, and Microsoft in filing an Amicus Brief that supports the continued implementation of the U.S. Environmental Protection Agency's Clean Power Plan (CPP) and discusses the technology industry's growing desire for affordable renewable energy across the U.S.

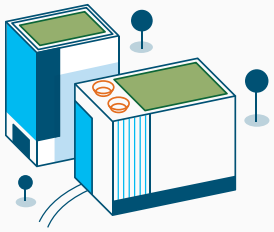
DEC 2017 Five solar farms that AWS previously announced are now in operation in the Commonwealth of Virginia. Together with Amazon Solar Farm U.S. East, the six solar farms bring 260 MW of renewable energy capacity onto the grid.

OCT 2019 AWS announces three new renewable energy projects in the U.S. and UK. Combined, these projects are expected to produce 265 MW of additional renewable capacity and approximately 670,000 MWh of energy annually.

DEC 2020 Amazon announces three new renewable energy projects in the U.S. and Spain, which are expected to produce a combined 329 MW of additional renewable capacity and almost 700,000 MWh of energy annually.

MAR 2020 AWS announces four new renewable energy projects in Australia, Spain, Sweden, and the U.S. Combined, these projects are expected to produce almost 300 MW of additional renewable capacity and approximately 840,000 MWh of energy annually.

2017 2018 2019 2020



2018 AWS exceeds 50% renewable energy usage for 2018.

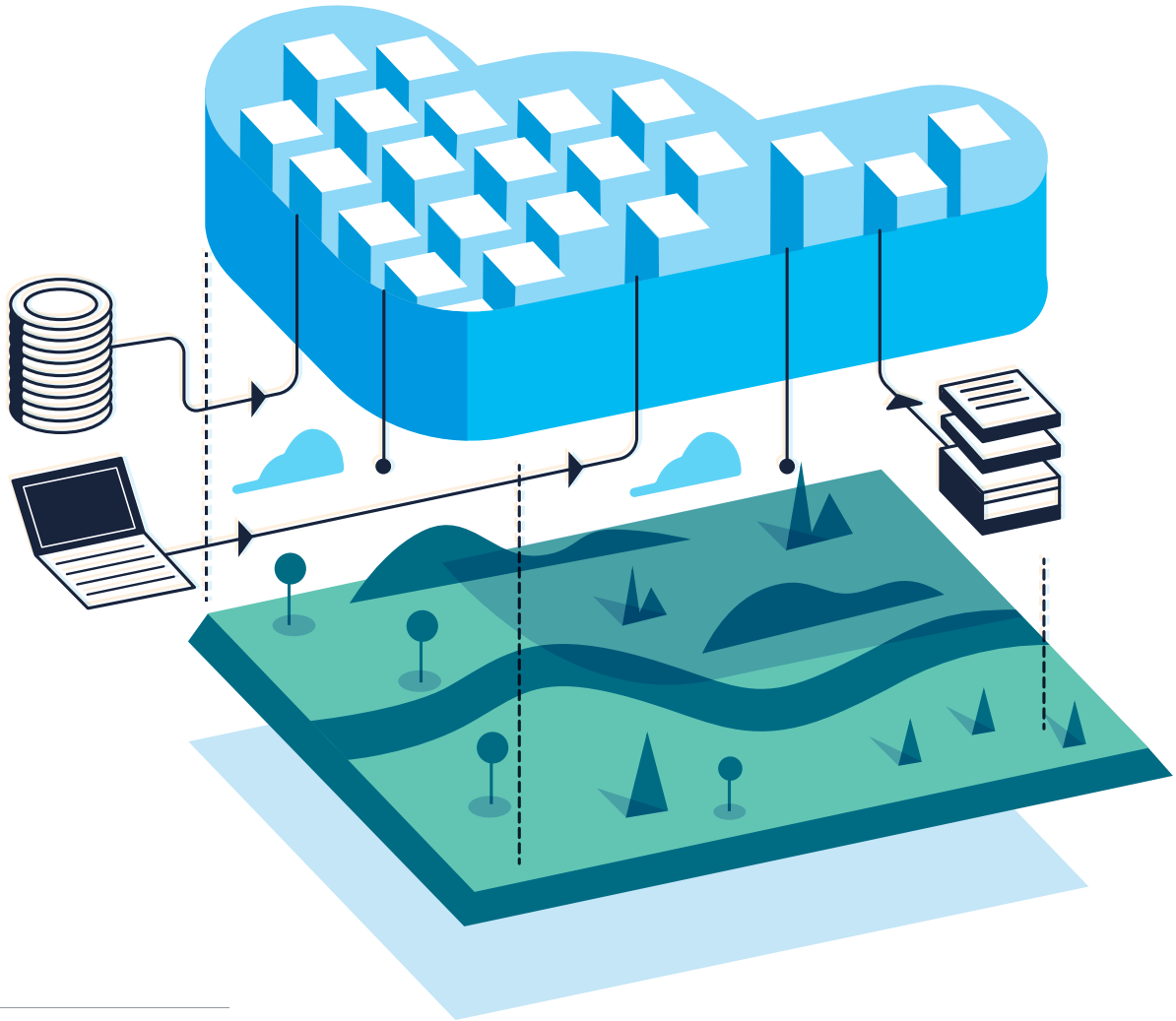
APR 2019 AWS announces three new wind farms—one in Ireland, one in Sweden, and one in the U.S. When complete, these projects are expected to produce 670,000 MWh of renewable energy annually.

AUG 2019 AWS announces two new renewable energy projects in Europe and the U.S., which are expected to produce approximately 168,000 MWh of clean energy annually.

MAY 2020 Amazon announces five new renewable energy projects in China, Australia, Ohio, and Virginia, with a combined 615 MW of additional renewable capacity and an expected generation of 1.2 million MWh of energy annually.

Cloud Efficiency

"Our results show that AWS's infrastructure is 3.6 times more energy efficient than the median of the surveyed U.S. enterprise data centers. More than two-thirds of this advantage is attributable to the combination of a more energy efficient server population and much higher server utilization. AWS data centers are also more energy efficient than enterprise sites due to comprehensive efficiency programs that touch every facet of the facility. When we factor in the carbon intensity of consumed electricity and renewable energy purchases, which reduce associated carbon emissions, **AWS performs the same task with an 88% lower carbon footprint.**" › amzn.to/cloud-efficiency



Source: 451 Research, 2019.

Reducing Water in AWS Data Centers

AWS has always focused on efficiency and continuous innovation in our data centers to improve operational excellence and reduce our impact on the environment. In addition to our efforts on energy efficiency and our goal to achieve 100% renewable energy for our global infrastructure, AWS has multiple initiatives to improve our water use efficiency and reduce the use of potable (drinking) water for cooling data centers.

AWS develops our water use strategy by evaluating climate patterns for each AWS Region, local water management and availability, and the opportunity to conserve drinking water sources. Taking a holistic approach, we assess both the water and energy usage of each potential cooling solution to select the most efficient method.

Evaporative Cooling

When possible, AWS incorporates direct evaporative technology for cooling our data centers, significantly reducing energy and water consumption. During cooler months, outside air is directly supplied to the data center without using any water. During the hottest months of the year, outside air is cooled through an evaporative process using water before being pushed into the server rooms, and we have optimized our cooling systems to use minimal water. AWS is constantly innovating the design of our cooling systems to further reduce water use, and we utilize real-time sensor data to adapt to changing weather conditions.

Recycled Water

AWS is expanding its use of non-potable water for cooling purposes to help conserve local drinking water sources. In Northern Virginia, AWS was the first data center operator to be approved to use recycled water with direct evaporative cooling technology. We partnered with Loudoun Water to demonstrate the benefits of recycled water for industrial cooling applications, and shared our operational best practices for utilizing recycled water in our data centers. In the AWS U.S. West (Oregon) Region, we have partnered with a local utility to use non-potable water for multiple data centers, and we are retrofitting AWS data centers in Northern California to use recycled water.

The process for utilizing recycled water begins when wastewater from residential and industrial customers is treated at a local facility and redistributed through its own piping infrastructure. Recycled water has to meet stringent health standards and safe surface discharge standards.

AWS is working with local utilities to expand distribution infrastructure and drive faster implementation and adoption of recycled water for data center cooling applications, in order to reduce our usage of potable water.

On-Site Water Treatment

AWS is implementing on-site modular water treatment systems in multiple regions. As water is cycled through evaporative cooling units, minerals build up as water evaporates, eventually reaching a level of concentration that requires replacement with fresh water. On-site water treatment allows us to remove scale-forming minerals and reuse water for more cycles. Increasing our "cycles of concentration" allows us to continue to reduce water intake for cooling our data centers.

Water Efficiency Metrics

In the infrastructure regions where we use water for cooling, AWS has developed water efficiency metrics to determine and monitor optimal water use for each AWS Region, and we employ a data-driven approach to select the most effective water reduction technologies. Water metrics from each of our Regions help AWS evaluate technologies and understand the long-term impacts on our water usage, in order to increase efficiency as our infrastructure grows and we expand to new regions.

We are partnering with utilities to connect directly to utility water meters, and we are also installing our own meters to track real-time water usage to provide consistent data for our operations and sustainability teams. By analyzing this data, AWS can identify opportunities to reduce water usage and rapidly make operational changes, rather than waiting for bills or usage reports.

AWS will continue to implement these strategies and test new technologies in order to reduce our water consumption and conserve potable water sources. Saving water is good for the environment and also benefits our customers as we increase our operational efficiency.

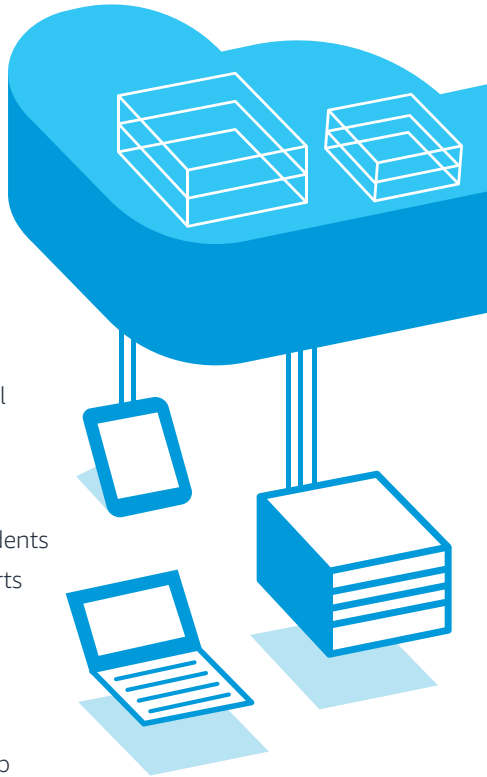
Amazon Sustainability Data Initiative

The Amazon Sustainability Data Initiative (ASDI) seeks to accelerate sustainability research and innovation by minimizing the cost and time required to acquire and analyze large sustainability datasets.

ASDI currently works with scientific organizations like NOAA, NASA, the UK Met Office and Government of Queensland to identify, host, and deploy key datasets on the AWS Cloud, including weather observations, weather forecasts, climate projection data, satellite imagery, hydrological data, air quality data, and ocean forecast data. These datasets are publicly available to anyone. In addition, ASDI provides cloud grants to those interested in exploring the use of AWS' technology and scalable infrastructure to solve big, long-term sustainability challenges with this data. The dual-pronged approach allows sustainability researchers to analyze massive amounts of data in mere minutes, regardless of where they are in the world or how much local storage space or computing capacity they can access.

Innovating for Sustainability in the Cloud

From university researchers to local governments, federal agencies to private startups, many organizations are leveraging ASDI to better understand the long-term opportunities to address big challenges like climate change. Below are some examples of how AWS customers are innovating and problem solving for sustainability.



- Satellite imagery for five countries in Africa has been compiled in the African Regional Data Cube (managed by the UN Global Partnership for Sustainable Development Data), a tool developed in the AWS Cloud that enables authorities in countries like Ghana, Sierra Leone and Senegal to monitor deforestation, illegal mining and manage coastal erosion.
- In Virginia, flood-prone towns are using sensors to monitor water levels and upload them to the AWS cloud as part of the StormSense project. Local residents can ask Alexa about water levels in specific places or subscribe to an app with alerts on dangerous flooding. "The only way you can scale this well is by being in the cloud," said Sridhar Katragadda, data officer for the City of Virginia Beach, which is participating in the project.
- Projects like Temperate and CalAdapt are also providing cloud-based tools to help communities better understand and prepare for climate change. These projects leverage large datasets staged on AWS to evaluate future climate changes and how those changes may impact people, assets, and operations.

- The BlueDot Observatory is using open satellite Earth Observations on AWS to monitor closely at-risk inland water bodies. The tool hopes to raise awareness about the vulnerability of these water resources and to provide timely insights that inform water management efforts.
- Some work that ASDI is enabling is more foundational and is expanding our knowledge and understanding of key processes. For example, a group of researchers at the Cornell Lab of Ornithology and the American Bird Conservancy published some exciting understandings about bird migration patterns based on NOAA's NEXRAD weather data that is freely available on AWS.

ASDI supports innovators and researchers with the data, tools, and technical expertise they need to move sustainability to the next level.