227 SW Pine St., Suite 300
Portland, OR 97204
+1 503 279 9383
GreenElectronicsCouncil.org

Purchasers Guide for Sustainability and Cloud-Service Procurements

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About GEC

The Green Electronics Council (GEC) is a mission-driven non-profit known for our management of EPEAT, the leading global eco-label for electronic products that is used by institutional purchasers globally as part of their sustainable procurement programs. GEC advocates for a world of only sustainable electronics. We meet our mission by supporting institutional purchasers in leveraging their purchasing power for sustainable products and services to advance the market for those products.

About this Guide

Public- and private-sector institutional purchasers are increasingly procuring "cloud" services. Clouds are essentially virtualized datacenters, infrastructure, platforms, and applications offered as services on a subscription basis. Purchasers buy cloud services to meet their software and computing needs, including Software as a Service, data storage, and big data analytics. Purchasers are choosing cloud services for the anticipated improvements in efficiency, agility, scalability and cost effectiveness, while not necessarily understanding the impact on their organization's sustainability performance. The challenge for purchasers is identifying the potential sustainability implications of migrating to the cloud and knowing the relevant information to ask of suppliers to help them understand those impacts. To address this challenge, GEC has created this Guide to help institutional purchasers identify potential sustainability gains associated with their procurement of cloud services by posing questions to Cloud Service Providers regarding their performance in several relevant areas.

This Guide does not seek to be an exhaustive list of potential procurement questions, nor does it claim to address every sustainability issue associated with cloud services. Instead, it provides an initial list of procurement questions and examples of supporting documentation that can help purchasers gain better insight into cloud-related environmental sustainability topics while meeting their goal of a successful procurement. Procurement, especially public procurement, is a complex field comprised of specific rules and policies, and sustainability questions used in a procurement process must be applicable to the specific service(s) being purchased.

The procurement questions, supporting documentation examples and other resources provided in this Guide can be used by purchasers to:

- Understand where sustainability gains are possible in the provision of cloud services
- Improve the dialogue with Cloud Service Providers on their current and planned sustainability efforts
- Obtain supplier data that can be translated into organizational sustainability benefits associated with the decision to procure cloud services

For feedback, questions or comments on this Guide, please contact:

Nancy Gillis
CEO
Green Electronics Council
NGillis@GreenElectronicsCouncil.org

How this Guide was Developed

This Guide was developed as part of an 18-month process of research and working group discussions. It was prompted by institutional purchasers, both public and private sector, who approached GEC seeking assistance integrating cloud-service procurements into their sustainable procurement program.

In the Fall of 2017, GEC sponsored an Arizona State University (ASU) graduate capstone project that found that Cloud Service Providers' publicly available sustainability data was limited, and that the sustainability metrics and terminology used by those providers were inconsistent and confusing. The ASU research findings assisted in the development of this Guide.

Each GEC Purchaser Guide provides a set of questions and examples of supplier-provided supporting documentation that can be used as part of the procurement process. The Guides also provide an overview of relevant terminology. The goal of this Guide is to help improve Cloud Service Providers' consistent use of terminology and metrics, and to increase their reporting on the sustainability attributes of their services, while empowering institutional purchasers to identify cloud service providers that are likely to offer the greatest sustainability gains.

GEC partnered with the Business for Social Responsibility (BSR) to launch a multi-stakeholder Working Group in the Spring of 2018. The Working Group was driven by a "procurement first" mandate and worked to ensure that the questions in this Guide were directly relevant to the cloud services being procured. Making a direct linkage between labor and human-rights concerns and cloud services proved challenging. Therefore, this first version of the Guide focuses on questions related to environmental sustainability. The Sustainable Purchasing Leadership Council (SPLC) is issuing guidance on use of social considerations in Software as a Service (SaaS) procurements and GEC recommends their report.

The Green Electronics Council is very grateful to all the representatives from business, government, civil society organizations, universities, NGOs and other institutions who are committed to bringing greater transparency to the sustainability benefits of using cloud services. GEC acknowledges the contributions of the following organizations and individuals, and thanks those who chose to provide their input anonymously: Akamai Technologies (Mike Mattera and Nicola Peill-Moelter [formerly of Akamai]); Arizona State University (Professor Todd Taylor); BSR (Michael Rohwer); Center for Resource Solutions (CRS) (Noah Bucon); City of Austin Purchasing Office (Jim Howard and Tim Dombeck); EPA Green Power Partnerships; GEC Board of Directors (Kathrin Winkler); Green House Data (Maxon Duncan and Art Salazar); Hewlett Packard Enterprise; Infrastructure Masons (Jeff Omelchuck); Joint Research Centre - European Commission (Felice Alfieri and Nicholas Dodd); Multnomah County Purchasing Office (Shawn Postera); Qingtech (Dan Williams); Sustainable Purchasing Leadership Council (SaaS Action Team); State of Minnesota (Melissa Peck); Sustainability Accounting Standards Board (SASB) (Sonal Dalal); University of Western Sydney (Dr. Rodrigo N. Calheiros); U.S. Department of Energy (Cate Berard); University of California Procurement Services, IT Strategic Sourcing (Roshni Pratap); VMware (Sujata Banerjee and Nicola Peill-Moelter); Workday (Erik Hansen); and WSP (Derek Fehrer).

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Why are Cloud Services Being Procured by Institutional Purchasers?

By the end of 2019, 80% of all Information Technology (IT) budgets are expected to include some type of cloud services.[i] The rise in such procurements underscores the evolution from procuring products that perform a task to procuring services that meet a need. For example, purchasers today seldom buy software for specific computers, but instead buy cloud-based functionality that allows them to accomplish the same work from any device. Purchasers often select cloud services due to an anticipated cost reduction or efficiency gain or the need for rapid deployment, yet the overall procurement shift from ownership to utility has increased purchasers' desire to understand and externally report the sustainability impacts of their procurements. This includes procurements for cloud services. Unfortunately, the United Nations' One Planet Network notes a "lack of simple tools to assess the sustainability performance of services,"[ii] which hinders purchasers' attempts to understand and report the sustainability implications of their cloud-service procurements. GEC developed this Guide to help fill that void.

Most cloud-service procurements fall into one of three primary areas: Software as a Service (SaaS), Platform as a Service (PaaS) or Infrastructure as a Service (IaaS). GEC has found that SaaS accounts for the largest number of cloud services procurements, as it includes functions such as customer relationship management and office productivity, yet IaaS has become the fastest-growing segment as purchasers seek increased security and storage. Examples of the cloud services being procured include:

Software as a Service (SaaS)	**Software as a Service (SaaS)**
<u>Office Productivity</u> • Word Processing • Email • Spreadsheets • Presentations • Document Tracking • Project and Portfolio Management <u>Business Operations</u> • Business Continuity/Disaster Recovery • Electronic Records Management • Enterprise Resource Planning • Travel Management, Meeting Planning • Procurement Systems • PC/Desktop "as a service" • Geographic Information Systems • Human Resource Management • Licensing and Registration Systems	<u>Communication and Collaboration</u> • Customer/Citizen Relationship Management <u>Security</u> • Identity & Access Management • Encryption • Data Loss Prevention • Web Security • Email Security • Network Security • Security Information and Event Management • Intrusion Management • DDOS Monitoring / Management • E-Discovery • Authentication Services <u>Business Intelligence</u> • Data Analytics • Data Management

Platform as a Service (PaaS)	**Platform as a Service (PaaS)**
• Database; Electronic Records Management • Development, Testing and Deployment • E-Discovery	• Geographic Information Systems • Integration (iPaaS)

Infrastructure as a Service (IaaS)	**Infrastructure as a Service (IaaS)**
Core Infrastructure Services • Storage • Network • Compute	Disaster Recovery • Business Continuity • High Availability / Failover

Important Considerations when Discussing Cloud Services

Institutional purchasers have a good understanding of the scale and efficiency benefits of cloud services, but they are much less familiar with cloud services' sustainability impacts. Most public- and private-sector organizations have sustainability goals and expect their procurement teams to understand and quantify the sustainability impacts of their high-dollar procurements, including of cloud services. Purchasers have therefore begun to ask questions about cloud services' sustainability. While developing this Guide, GEC gained insight into several topics that are influencing the questions purchasers currently ask Cloud Service Providers about their sustainability attributes. These topics, shown in the table below, are important to clarify and consider when discussing the sustainability of cloud services.

Topic to Consider	Impact on Procurement Questions
1. The provision of cloud services almost always involves more than one data center	Many purchasers incorrectly believe that the cloud service(s) they procure either originate from a single data center or can be easily tracked to exactly which data centers are being used to provide the service(s). This Guide addresses that misconception by highlighting the value of asking Cloud Service Providers about the performance of the *portfolio* of data centers used to provide the cloud service(s) procured under a given contract. Purchasers in the European Union (EU) are subject to the General Data Protection Regulation (GDPR), which has strict requirements about the processing and storage of personally identifiable information on individuals within the EU and the European Economic Area (EEA). This adds some complexity when asking about the portfolio of data centers, some of which may be located outside of the EU. EU purchasers should confirm with the Cloud Service Provider that the data centers used for the provision of services under a given contract are compliant with the GDPR requirements.
2. Cloud-service sustainability encompasses many aspects, from equipment to facilities to organization-wide policies	Purchasers may not know to look beyond the energy efficiency of the equipment within a data center. Purchasers can gain a fuller understanding of a Cloud Service Provider's sustainability attributes by also asking about the provider's relevant sustainability policies, the efficiency of its data center(s), building(s) and systems, and how the data center(s) is/are powered. The questions within this Guide are organized into three relevant impact areas to assist with this evaluation: Environmental Practices and Policies of the Cloud Service Providers; Data Center Facility Management and Equipment; and Data Center Power Sources.

3. The provision of cloud services can be difficult to align with labor and human-rights issues	Institutional purchasers increasingly require vendors to demonstrate the social responsibility of their supply chain. Cloud-service procurements are challenging in this regard, because human involvement in cloud-service provision is predominantly in the manufacture and assembly of the data center equipment or in the "office" environment of the cloud-service providers (e.g. sales and marketing staff). Working conditions at the relevant data center(s) may be applicable, though data centers traditionally have low staffing requirements.

How to Use this Guide

This Guide provides examples of questions that institutional purchasers can ask throughout the procurement process – from market assessment and supplier qualifications to Request for Proposals and tenders – to solicit information about a Cloud Service Provider's sustainability attributes. These questions are grouped based upon GEC's identification of three distinct areas where sustainability gains are possible, and able to be measured and/or evaluated.

1. **Environmental Practices and Policies of the Cloud Service Providers**
   These questions are designed to understand the broad systems, policies and practices that a Cloud Service Provider has in place for its data center(s) to improve their sustainability performance, meet their legal requirements and achieve continual improvement across their organization and supply chain. The presence of such policies, or the willingness to create them, may indicate a provider's alignment with the same sustainability principles and progress valued by institutional purchasers. It may also indicate areas in which the provider's performance can support the purchaser's own corporate sustainability efforts.

2. **Data Center Facility Management and Equipment**
   The delivery of cloud services is dependent upon IT hardware and the physical spaces that house it. This section recognizes the important role of proactively and effectively managing facilities and equipment to maximize the sustainability of the services provided. Many topics apply to this area, from energy efficiency and siting/location to water usage and certifications.

3. **Data Center Power Sources**
   Data centers require storage equipment, networking equipment, power distribution and cooling systems – all of which cumulatively require a large amount of energy – to provide cloud services. Different energy sources have different sustainability implications. This section helps purchasers better understand how Cloud Service Providers power their data centers, with a focus on renewable energy.

Procurement Process Questions

Each question within one of the three groupings is accompanied by examples of supporting documentation that a Cloud Service Provider could provide in answering the question. Although each question has been crafted to elicit a meaningful response, purchasers may wish to reword certain parts or even entire questions to meet their specific needs. GEC has included an "objective" for each question

that captures its underlying motivation, with the hope that this will assist any purchasers who pursues such rewording.

While the Guide provides examples of questions and of associated supporting documentation, it does not recommend a specific criteria evaluation methodology. The questions within the Guide can be tailored for use in a pass/fail, simple scoring, or weighted attribute criteria evaluation approach.

Supporting Documentation

Each question is followed by a list of potential supporting documentation that a Cloud Service Provider may submit. In some instances, the supporting documentation may take several forms and/or have relevant equivalents. This Guide does not dictate a preference for one form or another, as it seeks to provide clarity without becoming overly prescriptive.

Some supporting documentation may require more effort than others to collect and report. This Guide does not include information about which supporting documentation may require more effort, because that depends on the resources and existing sustainability commitment of the Cloud Service Provider.

Small- and medium-sized Cloud Service Providers may find it challenging to provide some of the supporting documentation outlined in this Guide, especially supporting documentation that relies on data not directly under their control. Purchasers are encouraged to consider the willingness of small- and medium-sized Cloud Service Providers to engage on these questions and consider allowing extra time for them to collect and provide the supporting documentation.

Additional Notes about Using this Guide

Cloud Service Providers may use different, and multiple, vendors to deliver a specific cloud service. Purchasers should therefore not assume that the supporting documentation listed will be the same for different cloud services from the same provider. Purchasers should also not assume that a Cloud Service Provider has only one set of responses or supporting documentation for any of the questions in this Guide. Purchasers should verify that a Cloud Service Providers vendors (subcontractors) also comply with the environmental sustainability requirements applicable to the contract.

Procurement Questions and Supporting Documentation

The questions within each of the three sustainability impact areas are not organized by priority or importance. In all cases, the questions should be read as covering all (and only) facilities that are intended to be used to service the contract requirements, whether directly owned by the respondent, leased, co-located or otherwise occupied.

1. Environmental Practices and Policies of the Cloud Service Providers

The provision of cloud services is dependent upon hardware as well as facility systems that consume large amounts of energy and produce greenhouse gas emissions. Many different considerations go into delivering sustainable cloud services, from using energy-efficient equipment and a facility's use of renewable power to implementing facility-wide policies for minimizing the greenhouse gas emissions associated with providing that service.

Question 1.1
Objective: The purpose of this question is to evaluate whether the provider has demonstrated a commitment to supply-chain sustainability by implementing sustainable-procurement policies.
Describe specific aspects of your sustainable procurement activities: a) Does your company have a sustainable purchasing policy for the IT hardware/equipment associated with the cloud service(s) provided under this contract? b) What are the management systems and processes in place to support the endorsed policy? c) Does the policy require the IT hardware/equipment to be certified to any sustainability ecolabels, energy-efficiency standards or guidelines? If yes, please provide a copy of the policy.
1.1 Supporting Documentation
• A copy of the sustainable procurement policy(ies) that address(es) the procurement of data center hardware/equipment • Proof of an environmental management system certified to ISO 14001 or EMAS, and/or an energy management system certified to ISO 50001, that addresses procurement of sustainable and/or energy efficient data center hardware/equipment

Question 1.2
Objective: The purpose of this question is to evaluate the steps a provider has taken to minimize the environmental impacts associated with the siting of the data center(s) that will be used to provide cloud services, particularly related to water resources.
Please share the environmental-impact and/or water-management policy(ies) related to the siting/location of the data center(s) that will be used to provide service(s) under this contract, whether those data center(s) be owned by your company, leased or co-located. Explain how you address data center locations in regions of High or Extremely High Baseline Water Stress.
1.2 Supporting Documentation
• A copy of the policy(ies) • Audited/verified water data (ideally)

- Water Risk Management Plan (water-stressed areas can be identified via tools such as the World Resources Institute Aqueduct Water Risk Atlas)
- Proof of an environmental management system certified to ISO 14001 or EMAS that addresses water management and use

Question 1.3
Objective: The purpose of this question is to evaluate whether a provider has policies and management systems in place to reduce its production of several greenhouse gases (GHGs) that are byproducts of certain data-center cooling mechanisms.
Does your organization identify, monitor and reduce the fluorinated gases (hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride) associated with the refrigerants used in the data center(s) to provide cloud service(s) under this contract, whether the data center(s) is/are owned by you, leased or co-located? If so, please share the related policy and describe the management systems and processes used to monitor and reduce the use of fluorinated gases.
1.3 Supporting Documentation
• A copy of the policy(ies) • Description of how the provider monitors and addresses refrigerants • Data outputs from the method described in Annex IV of Regulation (EU) No 517/2014 • Proof of an environmental management system certified to IS0 14001 or EMAS that includes monitoring the use of fluorinated gases

2. Data Center Facility Management and Equipment

Whether leased or owned, a data center and the equipment within it can be managed to maximize sustainability including sustainable procurement strategies, responsible end-of-life disposition of relevant hardware, measuring the progress made against established efficiency goals, and the use of virtualization.

Question 2.1
Objective: The purpose of this question is to evaluate whether a provider has credibly committed to the sustainability of its data center(s) facilities. This question acknowledges that some providers may not own the facility, and thus seeks similar information from the owners, if applicable.
What percentage of the total capacity required under this contract (whether in data centers owned by you, leased or co-located) will be provided at facilities certified to Leadership in Energy and Environmental Design (LEED), Building Research Establishment Environmental Assessment Method (BREEAM), Green Star, Comprehensive Assessment System for Building Environmental Efficiency (CASBEE), the DGNB System, ENERGY STAR, Green Globes, HQE, ISO 50001, Superior Energy Performance, or another relevant sustainability standard? ☐ 0% to 20% ☐ 21% to 40% ☐ 41% to 60% ☐ 61% to 80% ☐ 81% to 100%
2.1 Supporting Documentation
• Documentation showing the percentage of the total capacity required under the contract that will be hosted in data centers that have attained relevant certifications/registrations. If information is publicly available, supplier should highlight its publicly available location.

Question 2.2
Objective: The purpose of this question is to evaluate the degree to which a provider tracks, calculates and publicly reports the GHG emissions and/or energy use of its data center(s), and can extrapolate that information to the cloud service(s) being procured.
Does your company measure and report the GHG emissions of the data center(s) used to provide services under this contract using the GHG Protocol or an inventory that follows the GHG Protocol accounting standards (e.g. CDP, The Climate Registry)? Can you quantify the GHG emissions associated with the cloud service(s) being procured in this contract and demonstrate reductions achieved for GHG emissions? What are your GHG reduction targets? What steps have been taken and will be taken to reduce the GHG emissions associated with the cloud service(s) being procured under this contract?
2.2 Supporting Documentation
• GHG Inventory report • GHG emissions data for each cloud service being provided, and a description of how the GHG emissions data and/or energy use were calculated or estimated • Demonstrated GHG emissions reductions achieved

Question 2.3
Objective: The purpose of this question is to evaluate whether a Cloud Service Provider measures and reports the efficiency of its data center(s) and aims to improve that efficiency over time. Power-utilization effectiveness (PUE) and water-utilization efficiency (WUE) are both referenced due to their wide recognition, though some purchasers have begun to question those metrics' viability as environmental sustainability indicators.
Does your company have publicly stated goals for the efficiency of the data center(s) that will provide cloud service(s) under this contract? Efficiency goals may include targets for Power Utilization Effectiveness (PUE), Water Utilization Efficiency (WUE) or another relevant and credible means of measuring efficiency. How do the data center(s)' current efficiency metrics compare to those goals, and what is your roadmap to achieve those goals? How do the efficiency metrics for the data center(s) that will provide cloud service(s) under this contract compare to the efficiency metrics across your data center portfolio?
2.3 Supporting Documentation
• Copy of the stated efficiency goal(s) • Documentation of the current PUE data for data centers that will provide cloud services under this contract and whether the PUE data is independently verified (and, if so, by whom) • Documentation of the current WUE data for data centers that will provide cloud services under this contract and whether the WUE data is independently verified (and, if so, by whom) • Copy of policy(ies) showing how the company addresses water-usage audit findings • *NOTE*: General PUE assessment: below 1.15 (best in class), below 1.5 (acceptable), above 2 (worst in class)

Question 2.4
Objective: The purpose of this question is to evaluate whether the provider demonstrates a commitment to sustainability by using equipment that meets the requirements of credible, third-party sustainability standards or ecolabels.
What percentage of the data center equipment inventory associated with cloud service(s) delivery under this contract has been certified to or registered with any of the sustainability ecolabels, energy efficiency standards or guidelines listed below? Equipment may include servers, routers, switches, and data storage. 1. Energy Star (indicate level) 2. EPEAT (indicate level) 3. ASHRAE guidelines (indicate level) 4. Other third-party certifications setting equivalent requirements
2.4 Supporting Documentation
• Annual reporting data on purchase of IT hardware that has been certified to or registered with the standards or guidelines indicated above, or equivalent third-party certifications

Question 2.5

Objective: The purpose of this question is to evaluate the provider's commitment to reducing its generation of e-waste through reuse and recycling, and by minimizing the amount of e-waste that goes to landfill, even after being processed through a formal facility.

Is a procurement, property management, and/or recycling policy(ies) in place that requires the IT equipment used in the data center(s) providing cloud service(s) under this contract to be reused or recycled at end-of-life?

What percentage of the total number of data center equipment used to provide service(s) under this contract is reused or recycled? What is your e-waste-to-landfill percentage for the volume of data center(s) equipment used to provide the cloud service(s) under this contract?

2.5 Supporting Documentation

- A copy of the relevant procurement policy(ies)
- A copy of the relevant property management policy(ies)
- A copy of the relevant recycling policy(ies)
- Paperwork indicating recycling rates for relevant equipment (ideally verified by a third party)
- Monthly or annual hardware recycling data
- Evidence of using E-Stewards, R2, ISO 14001 or another credible WEEE certification system
- Certificates for recycling or waste to landfill dealt by another company

The provider's answer to Dow Jones Sustainability Index (DJSI) End of Life Cycle Responsibility

NOTE: Context for potential answers:

a. Ideally 75% - 100% diversion of waste to landfill – anything below should be explained
b. Old devices should be recycled completely to the degree technology exists to recycle it (and within reason of cost)

Question 2.6

Objective: The use of virtualized servers can deliver efficiency gains and a reduced environmental impact when compared to the use of physical hardware units. Each physical server will have at least one operating system as standard, but many more can be installed to provide multiple virtual servers on one physical server. This question seeks to understand the degree to which the provider will use virtualized servers to provide the cloud service(s) being purchased.

What percentage of the total capacity required under this contract (whether in data centers owned by you, leased or co-located) will be provided through virtual servers rather than physical server with a single operating system or instance?

- ☐ 0% to 20%
- ☐ 21% to 40%
- ☐ 41% to 60%
- ☐ 61% to 80%
- ☐ 81% to 100%

2.6 Supporting Documentation

- Documentation showing the percentage of total capacity that will be provided through virtualized servers

3. Data Center Power Sources

A cloud data center is comprised of many networked computers, storage and networking subsystems, power distribution and cooling infrastructures, all of which drive significant energy consumption. Renewable energy sources, especially green power, can play a large role in providing this power while resulting in significantly lower GHG emissions than carbon-based methods of power generation. Green power is a subset of renewable energy and represents those renewable energy resources and technologies that provide the highest environmental benefit. The US EPA defines green power as electricity produced from solar, wind, geothermal, biogas, eligible biomass, and low-impact small hydroelectric sources.[iii]

Question 3.1
Objective: The purpose of this question is to evaluate a provider's commitment to using renewable energy for its data center(s) through a public goal for renewables usage and a procurement strategy designed to achieve that goal. This question acknowledges that some providers may not own the facility, and thus seeks similar information from the owners if applicable.
Are you actively procuring or producing renewable electricity for the data centers to be used under this contract? Does your company have a publicly stated target regarding the use of renewable energy to power your data center(s)? When do you expect to achieve this target? If you are not directly responsible for electricity consumption at the data center(s) you use, does your company have criteria that address renewable energy use by your suppliers?
3.1 Supporting Documentation
• Evidence of publicly disclosed renewable energy target for powering data centers • Relevant excerpts from annual sustainability reporting, corporate environmental policies, or procurements policies • Relevant excerpts from supplier code of conduct, supply chain sustainability goals Note: For a data center to claim purchase of voluntary renewable energy, or green power, for their operations, they must retain the renewable energy certificate (REC).

Question 3.2
Objective: The purpose of this question is to evaluate a provider's current use of renewable energy to power the data center(s) to be used under this contract.
What percentage of the annual electricity use at the data centers to be used under this contract is provided by renewable power or green energy sources? Measurement may be based on the U.S. EPA's Green Power Partnership definitions[iv], the EU Renewable Energy Factor (EN50600-4-3) or an equivalent methodology.
3.2 Supporting Documentation
• Documentation showing the percentage of data centers' annual energy use that is renewable, such as a product/power content label provided by the supplier's electricity service provider.

NOTE: renewable energy procurement options, as well as the instruments used to track and verify the associated environmental attributes, vary regionally – especially between countries and continents.

Question 3.3
Objective: The purpose of this question is to evaluate the specific means by which a provider buys and uses renewable energy to power its data center(s). Some purchasers feel that certain mechanisms are more impactful than others. This question attempts to gather details that some purchasers may wish to see, without indicating a preference for one mechanism over another.
How do you, or the co-located entity providing the cloud service(s), purchase and/or generate renewable electricity? For example, are you enrolled in a utility's/supplier's green power program, have you signed a renewable power purchase agreement (PPA), or are you purchasing renewable energy certificates (RECs) separately from electricity? Are RECs retired for all claimed renewable electricity usage? Are these purchases verified and certified by an independent third party?
3.3 Supporting Documentation
• Proof of procurement, such as documentation of enrollment in a green tariff or green pricing program, or an excerpt from a PPA or REC procurement contract • Press releases, annual reports or other public documents defining the source and destination of renewable energy certificates • Proof of independent third-party certification, such as Green-e Energy, that verifies the quality and quantity of purchased renewable energy and requires that proper disclosures be provided to the end-use consumer.

Appendix 1: Common Terminology Used to Discuss Cloud Services

The terms used in this Guide and to discuss cloud services are aligned with widely adopted language used by organizations that provide, enable, purchase or are otherwise engaged in cloud services, including Green Grid, the European Commission, International Organization for Standardization (ISO), U.S. National Institute of Science and Technology (NIST), International Electrotechnical Commission (IEC), U.S. Environmental Protection Agency (EPA) and the Institute of Electrical and Electronics Engineers (IEEE), among others.

Term	Definition
Carbon Usage Effectiveness (CUE)	Metric used to assess the total greenhouse gas (GHG) emissions of a data center, relative to its IT energy consumption. CUE is computed as the total carbon dioxide emission equivalents (CO_2eq) from the energy consumption of the facility divided by the total IT energy consumption (in kilowatt-hours).[v] The output is measured in kilograms of carbon dioxide per kilowatt-hour.
Cloud Computing	A model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction.[vi] Cloud computing is used for many types of services, the three main types being Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS).
Cloud Service Provider(s)	Entity(ies) that make cloud services available, where cloud services are defined as one or more capabilities offered through cloud computing and invoked using a defined interface.[vii]
Data Centers	Structures, or groups of structures, dedicated to the centralized accommodation, interconnection and operation of information technology and network telecommunications equipment providing data storage, processing and transport services together with all the facilities and infrastructures for power distribution and environmental control, together with the necessary levels of resilience and security required to provide the desired service availability.[viii] They may range in size from small rooms within a conventional building to large buildings that are used only to house servers, storage devices and networking equipment.
Dedicated Cloud	A type of Infrastructure as a Service (see below) whereby specific hardware is committed to a specific customer and is completely isolated from other cloud tenants with dedicated security, capacity and performance.[ix]
GDPR - EU General Data Protection Regulation (GDPR)	An EU regulation on data protection and privacy for all individuals within the European Union (EU) and the European Economic Area (EEA). For EU purchasers, data centers used in the provision of the services covered in a contract need to show compliance with GDPR.
Hybrid Cloud Computing	A type of cloud service in which customers use both private and public cloud.[x] According to Gartner, this is among the fastest-growing cloud strategies for global organizations.

Infrastructure as a Service (IaaS)	A type of cloud service that allows the customer to provision and use processing, storage or networking resources.[vi] Users may run whichever operating system or software they choose on hardware hosted and maintained by the cloud-service provider. Examples of large IaaS providers include Amazon Web Services, Microsoft Azure, Google, Alibaba and Rackspace.
Platform as a Service (PaaS)	A type of cloud service that enables users to deploy, manage and run customer-created or customer-acquired applications using one or more programming languages and one or more execution environments supported by the Cloud Service Provider.[vi] Some common examples include computing platforms such as Microsoft Azure, Heroku, and Google App Engine.
Power Usage Effectiveness (PUE)	A metric used to measure the energy efficiency of data centers. It is calculated by the total energy consumption of the data center divided by the energy consumption of the IT equipment within it (servers, networking, and storage).[i] A PUE of 2.0 would mean that all the energy consumed by IT equipment is matched by the energy use of items such as cooling, heating and lighting. A PUE of 1.4 would mean 40% of the energy consumed by IT was used by cooling, heating and lighting.
Private Cloud	A type of cloud service whereby the services are used exclusively by a single cloud service customer, and the resources are controlled by that cloud service customer.[vi] It may be owned, managed, and operated by the organization, a third party, or some combination of them, and it may exist on or off premises. Private cloud may be operated by an external cloud operator but on the customer's own site. If managed locally, it is often called **On-Premises Cloud.**
Public Cloud or **Shared Cloud**	A type of cloud infrastructure whereby services are potentially available to any cloud service customer, with resources controlled by the Cloud Service Provider.[vi] In this model, the Cloud Service Provider maximizes virtualization across their hardware and compels customers to used shared devices that exist on the Provider's premises.
Purchaser(s)	Purchasers represent institutional buyers, including local, state and national governments, health care systems, research facilities, school districts, higher education institutions and private companies.
Renewable Energy	Energy from sources that are naturally replenishing but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time.[xi] Many cloud-service providers use renewable energy to fully or partly cover their data center energy consumption. This can range from purchasing offset credits to directly using energy generated on-site.
Renewable Energy Certificates (RECs)	RECs are the tradable, legal rights to the environmental benefits of green power. These rights can be sold separately from the actual electricity. In order for power to be considered "green," the organization must own the RECs.[xii]

Software as a Service (SaaS)	Allows users is to utilize the cloud-service provider's applications running on a cloud infrastructure. The applications are accessible from various client devices through either a thin client interface, such as a web browser, or a program interface. The user does not manage or control the underlying cloud infrastructure.[v] Common examples include web-based email (e.g. Gmail and Outlook) and organizational productivity tools (e.g. Microsoft Office 365, Google Docs, Workday or Salesforce). This is the largest overall category of cloud service, with projections estimating the SaaS market was $73.6 billion in 2018.
Utilization	The overall extent to which data center servers are being used, usually recorded as a percentage.[xiii] Utilization may be dependent upon the device type, design, software and use type. The type of cloud may also impact utilization.
Virtualization	Enables one piece of physical hardware to run multiple and independent software instances via software-based Virtual Machines.
Water Usage Effectiveness (WUE)	A metric that measures the amount of water used by data centers to cool and regulate the humidity of the facility. It is calculated by dividing the facility's annual water usage (in liters) by the annual energy consumption (in kilowatt hours) of the IT equipment inside it.[xiv]

Appendix 2: Useful Resources

The resources listed below provide purchasers with useful background information, corresponding to the procurement questions in this Guide.

Environmental Practices and Policies of the Cloud Service Providers	
Dow Jones Sustainability Index	This is the first global index to track the leading sustainability-driven companies based an analysis of financially material Environmental, Social, and Governance (ESG) factors. Cloud Service Providers may submit information for DJSI, which may be leveraged as part of their supporting documentation.
Global Reporting Initiative (GRI)	GRI helps businesses and governments worldwide understand and communicate their impact on critical sustainability issues. Its reporting requirements can provide insight into the types of corporate-level practices and policies that Cloud Service Providers and Purchasers might find relevant for their own adoption. Cloud Service Providers may report data to GRI that could be leveraged as part of their supporting documentation.
CDP	CDP, formerly the Carbon Disclosure Project, runs one of the most comprehensive collection of self-reported environmental data in the world. Its global disclosure system enables companies, cities, states and regions to measure and manage their environmental impacts. Their reporting tools can provide insight into the types of corporate-level practices and policies that Cloud Service Providers and Purchasers might find relevant for their own adoption. Cloud Service Providers may track data in CDP that could be leveraged as part of their supporting documentation.
University of California Procurement Excerpt	"The nature of services accorded in this sector will require a heavy dependence on IT devices, physical space and transportation. Thus, this prompts use of energy-efficient equipment, renewable power supply, education and awareness. Additionally, this also requires organizational policy to manage energy use as well as promote eco-friendly transportation options. Describe the steps your organization takes to reduce its greenhouse gas emissions, including organizational policy, industry benchmarks used, goals, etc. Criteria to be commented on in responding to this requirement include: • Initiatives that the organization has undertaken to calculate its GHG emissions, including whether these calculations are based on recognized guidelines. • An endorsed policy with respect to reduction of GHGs indicating the management systems and processes in place to support the endorsed policy. • GHG reduction targets and proposed actions to achieve GHG reductions. • Demonstrated GHG reductions achieved."
Data Center Facility Management and Equipment	
Microsoft and WSP Study on the Environmental Benefits of Cloud Computing	This co-authored report, published in late 2018, documents a variety of sustainability gains associated with the migration from an on-premises to a cloud environment. The document addresses facility management, power sources, and multiple issues related to carbon efficiency. It is one of the most-recent reports currently available on this topic.

LBNL Report on Data Center Energy	This 2016 report estimates historical data center electricity consumption back to 2000 and forecasts consumption to 2020 based on new trends and research. Though it focuses on overall energy use, the report has extensive discussion about equipment utilization and efficiency.
Multnomah County (OR) Procurement Excerpts	1. "Do you participate in Better Buildings (DOE) Datacenter efficiency program? Are you willing to negotiate participating in Better Buildings (DOE) Datacenter efficiency program? Do you participate in the DOE SEP energy-efficiency program? Are you willing to negotiate participating in the DOE SEP energy-efficiency program? If you are a small business, do you participate in the Small Business Energy Efficiency Program? Do you encourage all businesses to participate in the Small Business Energy Efficiency Program? Are you willing to participate in the Small Business Energy Efficiency Program?" 2. "Are you currently incorporating Green Grid technical specifications for Power Utilization Efficiency (PUE) in the data centers that you lease or maintain? Are you willing to negotiate Green Grid technical specifications as targets to meet yearly for PUE in the data centers that you lease or maintain?"
Data Center Power Sources	
BSR's "Future of Internet Power" White Paper	Available on BSR's Future of Internet Power homepage, this document outlines efforts by Cloud Service Providers and related parties to increase the use of renewable energy to power data centers.
Greenpeace "Clicking Clean" Report	This comprehensive report describes the sustainability efforts by large Cloud Service Providers and some of the leading Internet companies to power their data centers with renewable energy. The document also evaluates the organizations' transparency with regard to sustainability issues. Each company is then awarded a letter grade for their overall performance.
U.S. EPA's Guide to Purchasing Green Power	The guide provides information about the green power procurement process, different green power supply options, benefits of green power purchasing, as well as information on how to capture the greatest benefit from your purchase. It is the product of a cooperative effort between EPA, the U.S. Department of Energy, World Resources Institute, Center for Resource Solutions, and the National Renewable Energy Laboratory. https://www.epa.gov/sites/production/files/2016-01/documents/purchasing_guide_for_web.pdf
GHG Protocol Scope 2 Guidance	The Scope 2 Guidance standardizes how corporations measure emissions from purchased or acquired electricity, steam, heat and cooling (called "scope 2 emissions"). The GHG Protocol is a partnership between World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). https://ghgprotocol.org/sites/default/files/standards/Scope%202%20Guidance_Final_0.pdf
General Resources	
Data Center Energy	This 2013 study by LBNL discusses the potential for cloud computing to reduce data center energy demand due to server consolidation and increases in facility efficiencies.

Efficiency Potential	
University of Melbourne Study about "Green Cloud Computing"	This 2011 study describes several aspects of environmental sustainability as it relates to cloud computing. Though it focuses on energy issues, the report includes relevant information about how cloud services work, and the different types of cloud services available.

[i] https://www.forbes.com/sites/louiscolumbus/2017/04/23/2017-state-of-cloud-adoption-and-security/#580334218483

[ii] http://www.oneplanetnetwork.org/sites/default/files/using_product-service_systems_to_enhance_sustainable_public_procurement_1.pdf

iii https://www.epa.gov/greenpower/what-green-power

iv (https://www.epa.gov/greenpower/what-green-power)

[v] U.S. EPA "Harmonizing Global Metrics for Data Center Energy Efficiency," access Nov. 13, 2018: https://www.energystar.gov/ia/partners/prod_development/downloads/Harmonizing_Global_Metrics_for_Data_Center_Energy_Efficiency_2012.pdf?5237-f817

[vi] The NIST Definition of Cloud Computing, accessed Nov. 13, 2018: https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-145.pdf

[vii] ISO/IEC 19944:2017, accessed Nov. 13, 2018: https://www.iso.org/obp/ui/#iso:std:iso-iec:19944:ed-1:v1:en

[viii] European Commission's May 2018 Draft Green Public Procurement Guidelines for Data Centers, accessed Nov. 13, 2018: http://susproc.jrc.ec.europa.eu/Data_Centres/docs/Draft_Technical_Report_EU-GPP_Data-Centres-v2.0_JRC_May2018.pdf

[ix] Definition on TechTarget, accessed Nov. 13, 2018: https://searchstorage.techtarget.com/definition/Dedicated-Cloud

[x] ISO/IEC 17788:2014, accessed Nov. 13, 2018: https://www.iso.org/obp/ui/#iso:std:iso-iec:17788:ed-1:v1:en

[xi] U.S. Energy Information Administration definition of renewable energy, accessed Nov. 13, 2018: https://www.eia.gov/energyexplained/?page=renewable_home

xii https://portfoliomanager.zendesk.com/hc/en-us/articles/211697257-What-is-a-REC-

xiii IEEE "Analyzing utilization rates in data centers for optimizing energy management," accessed Nov. 13, 2018: https://ieeexplore.ieee.org/document/6322248

[xiv] Definition from The Green Grid, accessed Nov. 13, 2018: https://www.thegreengrid.org/en/newsroom/blog/why-water-use-key-consideration-when-cooling-your-data-center