Energy Act of 2020
IT Sustainability
Best Practice Guide

An Initiative of

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Background

The Federal Government has stated its intent to provide a more sustainable future for the United States through a variety of statutory and executive policies and legislation. In 2021, President Biden established the Federal Government as a leader in sustainability via [Executive Order 14057](#).[1] To accompany the executive order, the Federal Government also released the [Federal Sustainability Plan](#) to codify a series of goals to deliver the stated purposes of reducing U.S. greenhouse gas emissions by 50 to 52 percent by 2030 (based on 2005 levels) and net zero emissions procurement by 2050, limiting global warming to 1.5 degrees Celsius.[2]

These ambitious goals focus on electricity, vehicles, buildings, procurement, operations, infrastructure, workforce, and partnerships. The Federal Government has organized multiple working groups, white papers, and best practice guides to support federal agencies in the "how" of this government-wide effort.

The Energy Act of 2020 (see section on "Federal Policy on Sustainability" [below](#) for more information) included a task for the Federal Chief Information Officers (CIO) Council to create sustainability best practices for the acquisition, maintenance, and use of sustainable information technology (IT) products and services. The implementing instructions for EO 14057 laid out specific requirements around electronics stewardship for federal agencies. This *IT Sustainability Best Practices Guide* aims to fulfill the requirements of the Energy Act and EO 14057 and drive forward sustainability practices across all federal agencies via informed decisions making and best practices.

While investment in all of the areas identified in the Federal Sustainability Plan will strongly contribute to the success of the whole sustainability ecosystem, an increased investment in IT sustainability presents a tremendous opportunity for the Federal Government to do more to achieve the goals set in the Federal Sustainability Plan and meet the White House's high-level benchmarks.

To help federal agencies advance IT sustainability and meet the Energy Act of 2020 requirements, this *IT Sustainability Best Practices Guide* provides a series of comprehensive recommendations that connect IT modernization and sustainability. The guide can assist agencies in developing targeted IT strategies and policies to support the Federal Government's goals in sustainability and enable the United States' leadership in sustainability across the globe.

These best practices are derived from industry research, agency best practices and lessons learned, and the expertise of leading IT executives within the Office of Management and Budget (OMB), the CIO Council, and the General Services Administration (GSA). These practices were created to support all agencies, large and small, in the push for a more sustainable IT environment. This guidance addresses common questions from Federal agencies and

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[1]https://www.whitehouse.gov/briefing-room/presidential-actions/2021/12/08/executive-order-on-catalyzing-clean-energy-industries-and-jobs-through-federal-sustainability/
[2] https://www.sustainability.gov/federalsustainabilityplan/index.html

increases the number of options agencies have to pursue more sustainable outcomes. Implementation of this guidance will assist the Federal Government in maintaining a more consistent and cost-effective approach to the sustainability of IT across federal agencies.

Federal Policy on Sustainability

As mentioned in the [Background](#), the Federal Government has passed a series of legislative and executive policies and statutes to direct federal agencies to act in alignment with White House and Congressional goals. While agencies like the Environment Protection Agency (EPA), the Department of Energy (DOE), and the General Services Administration (GSA) lead the way for and provide guidance and tools for the executive branch on sustainability efforts, all agencies are expected to contribute to these sustainability efforts. Early legislative drivers of these efforts included the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007.

To catalog the current policy efforts for ease of access, a summary of key legislative and executive actions which address Federal IT Sustainability is included below.

Energy Act of 2020

The bipartisan Energy Act of 2020 (Division Z, P. L. 116-260) contains a number of provisions that focus on energy-efficient data centers; energy-efficient and energy-saving information technologies, energy and water for sustainability; the Federal Energy Management Program; and better energy storage technology.[3]

Executive Order 14057

"Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability"
Executive Order 14057 directs the Federal Government to net zero emissions by 2050.[4] The order sets out a range of ambitious goals to deliver an emissions-reduced pathway by transitioning federal infrastructure to zero-emission vehicles and energy-efficient buildings powered by carbon pollution-free electricity that is "consistent with President Biden's goal of reducing U.S. greenhouse gas emissions by 50 to 52 percent from 2005 levels by 2030 and limiting global warming to 1.5 degrees Celsius."[5] The accompanying OMB Memo 22-06 also requires federal agencies to procure products and services meeting EPA's Recommendations of Specifications, Standards, and Ecolabels, including procurement of EPEAT (Electronic Product Environmental Assessment Tool)-registered electronic products.

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[3] https://www.congress.gov/116/plaws/publ260/PLAW-116publ260.pdf, PDF pp. 1239-1436 (134 STAT 2418-2615)
[4] https://www.federalregister.gov/documents/2021/12/13/2021-27114/catalyzing-clean-energy-industries-and-jobs-through-federal-sustainability
[5] https://www.federalregister.gov/documents/2021/12/13/2021-27114/catalyzing-clean-energy-industries-and-jobs-through-federal-sustainability

Implementing Instructions for EO14057

The [implementation instructions for EO 14057](#) include specific direction regarding electronic stewardship practices as well. These instructions contain sustainability goals and targets against the Federal Sustainability Plan.

Executive Order 14030

"Climate Related Financial Risk"
To help the Federal Government increase the sustainability of their supply chains, Executive Order (EO) 14030 directs the Federal Acquisition Regulatory Council to explore requiring major suppliers to provide their greenhouse gas emissions inventories and climate-related financial risk information to the Federal Government, and to set science-based climate impact reduction targets.

President's Management Agenda Priorities

The latest Biden-Harris Management Agenda focuses on advancing an equitable, effective, and accountable Federal Government that delivers results for all Americans. Priority 3 of this President's Management Agenda focuses on managing the business of the Federal Government, including "driv[ing] progress on new technology and solution development" and "lead[ing] by example toward sustainable climate solutions."[6] By harnessing the collective purchasing power, the Federal Government can support new solutions that address climate-related risks and enhance sustainability. In addition, Strategy 1 of Priority 3 highlights federal acquisitions to support the Federal goals that address the climate crisis and enhance sustainability.

Federal Sustainability Plan[7]

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[6] https://www.performance.gov/pma/slideshow/
[7] [Federal Sustainability Plan PowerPoint Presentation](#), Sustainability.gov

Agency Sustainability Plans

The Office of Federal Chief Sustainability Officer (CSO), which is part of the [White House Council on Environmental Quality](#), is leading the implementation of Executive Order 14057 and issued the President's Federal Sustainability Plan.[8] The Executive Order requires federal agencies to each appoint an agency CSO to lead agency-wide implementation of sustainability and climate adaptation policy and to meet the President's goals and priorities. The Order also laid out agencies' responsibilities to lead their planning, implementation, and related actions to achieve the policy goals within the Order.

Sustainability plans and reporting dashboards for 39 agencies are available at: https://www.sustainability.gov/performance.html

Additional Guidance on IT Sustainability

- GSA Bulletin FMR B-34, "[Disposal of Federal Electronic Assets](#)"[9]

- [EPA's Recommendations of Specifications, Standards, and Ecolabels for Use in Federal Purchasing](#)[10]

- [Office of Federal Sustainability's Resources and Guidance for Federal Agencies](#)[11]

- [Memorandum for the Heads of Executive Departments and Agencies: Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability](#)[12]

Best Practices for IT Sustainability

For the purposes of the ***IT Sustainability Best Practices Guide***, the document is organized to help agencies find the information most relevant to their individual needs. The document explores:

- [Physical Assets Best Practices](#)

- [Virtual Assets Best Practices](#)

- [Business Functions and Strategy](#)

Each component represents an opportunity for the Federal Government to create a more sustainable federal IT ecosystem, with each component supporting the others. Each component has unique challenges and benefits. For instance, in comparison to virtual assets, physical assets are typically more costly to acquire and divest, and procurement of virtual assets instead

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[8] https://www.whitehouse.gov/ceq/
[9] https://www.gsa.gov/cdnstatic/FMR_Bulletin_B-34.doc
[10] https://www.fedcenter.gov/Bookmarks/index.cfm?id=39055&pge_prg_id=45855&pge_id=1944
[11] https://www.fedcenter.gov/Bookmarks/index.cfm?id=34062&pge_prg_id=45855&pge_id=1944
[12] https://www.fedcenter.gov/Bookmarks/index.cfm?id=39069&pge_prg_id=45855&pge_id=1944

of physical assets can help reduce overall environmental impacts. However, focus can be placed on reducing the impact of all virtual, physical, and business-related IT decisions.

Physical Assets

Physical and hardware assets take the shape and form of servers, computer processing units, data center components, cooling systems, cables, imaging equipment, monitors, laptops, mobile phones, and many more tools. While each federal agency has unique needs that require different types of equipment and tools, sustainability can be built into every choice to purchase, maintain, and use various types of physical hardware.

Acquire Hardware Products That Align with Federally-recommended Sustainability Guidelines

The Federal Government has developed guidelines to assess the sustainability and energy efficiency of products, buildings, and services. As the Federal Government continues to make strong investments in cutting-edge technologies and hardware assets and retires legacy hardware, agencies can rely on proven programs, such as Energy Star and the Global Electronics Council's (GEC's) Electronic Products Environmental Assessment Tool (EPEAT) to inform decision making for new IT investments.

Energy Star: Energy Star is the Federal Government-backed standard for identifying energy-efficient energy consuming products and provides information to consumers and businesses on improving energy efficiency. Federal agencies can use Energy Star certification to identify the most efficient products for purchases related to buildings, data center hardware assets, computers, displays, HVAC equipment, and other necessary products within federal facilities.

EPEAT: EPEAT helps federal agency procurement teams evaluate and compare electronic products based on their impact to the environment. EPEAT-registered products are required to be ENERGY STAR certified, and also go beyond energy efficiency to focus on "materials selection, supply chain greenhouse gas emissions reduction, design for circularity and product longevity, energy conservation, end-of-life management, and corporate performance."[13] EPEAT covers multiple hardware assets, such as computers, displays, mobile phones, televisions, imaging equipment, servers, network equipment, and PV modules and inverters.

Other Policies and Reports:
- The Lawrence Berkeley National Laboratory developed a report for the Federal sector "Computer Server Selection Guidelines for Energy Efficiency and Decarbonization in Data Centers[14]" to further explore these programs.

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[13] https://www.epa.gov/greenerproducts/electronic-product-environmental-assessment-tool-epeat

[14] https://datacenters.lbl.gov/sites/default/files/2022-03/Computer%20Server%20Selection%20Guidelines%2012-22%20%284%29.pdf

- OMB has already issued requirements to make sustainable purchases of desktop and laptop assets in M-16-05, and for other EPEAT-registered product categories and related services (mobile phones and wireless services, imaging equipment and print management services, servers and network equipment and cloud services, televisions, and PV modules and inverters and power purchase agreements and energy savings performance contracts in M-22-06.[15]
- Federal agencies can continue aligning procurement and investments with sustainable outcomes using Federal requirements and guidelines to procure products that are Energy Star certified and EPEAT registered.
- FAR Subpart 23.704 also contains language, with some expectations that "as required by E.O.s 13423 and 13514, agencies, when acquiring an electronic product to meet their requirements, shall meet at least 95 percent of those requirements with Electronic Product Environmental Assessment Tool (EPEAT®)-registered electronic products."

Implement Sustainable Practices Within Enterprise Data Centers

With data centers currently using 2 percent of the United States energy consumption and using 10 to 50 times more energy than the average commercial building, to meet the net zero emissions procurement goal, the U.S. government has prioritized sustainability practices for its remaining agency-owned data centers. The Federal IT Acquisition and Reform Act (FITARA) is also a major drive of the consolidation of Federal data centers through the Data Center Optimization Initiative.

Further adoption of cloud service providers and colocation facilities is a best practice that agencies should consider when operating their data centers. Detailed best practices on how to operate these data centers are included below. Energy Star has several "Ask the Expert" resources that may be helpful as well:

1. Temperature Set Point (in conjunction with ASHRAE)
2. Other Potential Savings for efficiency IT
3. Using SERT to measure server efficiency
4. Saving Idle Energy in servers
5. Deployed Power Analysis

For additional information on energy efficiency and sustainable practices within data centers, visit the Center of Expertise (COE) for Energy Efficiency in Data Centers, a program managed by the Department of Energy (DOE).[16] The COE provides a wide variety of tools for assessing performance and improving efficiency. Performing a Data Center Profiler (Data Center Pro)[17]

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[15]
https://www.whitehouse.gov/wp-content/uploads/legacy_drupal_files/omb/memoranda/2016/m-16-02.pdf

[16] https://datacenters.lbl.gov/

[17] https://datacenters.lbl.gov/dcpro

assessment through the COE tools[18] provides agencies with a list of best practices they can implement at the data centers they assess.

Automate Utilization Management: Automated utilization of hardware assets is an important element of the modern data center. Not only does automation increase operational efficiency, it also enables enterprises to deliver services in an agile and repeatable manner. The "spin up" and "spin down" features of automated utilization allow agencies to optimize the use of power, electricity, and cooling strategies throughout data centers to meet operational needs.

Automated utilization is a concept that is core to cloud computing, but is used less in agency-owned data centers. Advancements in artificial intelligence (AI) and machine learning have enabled the creation of Automated Infrastructure Management (AIM) solutions, Network Automation tools, and others. While automation tools may be more costly short-term, over time the intelligent provisioning and utilization of data center servers, network cables, and other physical equipment will extend the life of the equipment and reduce power and cooling requirements, reducing overall costs. With an increased focus on cloud computing given the nature of automatic provisioning with cloud resources, it is prudent agency-owned data centers automate provisioning and utilization within the agency's own facilities. The LBL developed a report for the federal sector "Accessing Onboard Server Sensors for Energy Efficiency in Data Centers". It discusses how key information can be accessed from the servers without any external measurement devices. This information can be imported to several software tools, including Data Center Infrastructure Management (DCIM) tools[19].
Agencies can acquire automated management tools using contract vehicles that offer the procurement of DCIM tools.

Conduct an Assessment of Data Centers with a Data Center Energy Practitioner (DCEP): The Energy Act of 2020 states that "each federal agency shall consider having the data centers of the agency evaluated once every 4 years by energy practitioners certified pursuant to the program, whenever practicable using certified practitioners employed by the agency."[20] The certified practitioner mentioned is pursuant to the DOE Data Center Energy Practitioner (DCEP) Training Program. More information on the DCEP Program is available here.[21]

Consider Using Pre-Production Environment Tools: The commercial sector is charging forward in creating more tools and resources to help data center owners and managers understand their data centers' level of sustainability. At the core of these tools is the concept of creating a "digital twin" platform using model based systems engineering (MBSE).[22] A digital twin is a virtual lab environment that can provide real-time data and model future data at no risk to the actual physical systems.

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[18] https://datacenters.lbl.gov/tools
[19] https://datacenters.lbl.gov/resources/accessing-onboard-server-sensors-energy
[20] https://science.house.gov/imo/media/doc/Energy%20Act%20of%202020.pdf
[21] https://datacenters.lbl.gov/dcep
[22] https://www.computerweekly.com/news/252521028/How-digital-twins-can-improve-datacentre-operations

Many agencies, including the Social Security Administration (SSA) and DOE, already use lab or pre-production environments designed to test and model certain investment and tool choices. Digital twins and other lab virtualization environments give agencies the ability to measure several key sustainability performance indicators without investing a dollar into physical equipment. This informs agency decision making and improves the agency's ability to invest in equipment and hardware that meets agency and data center sustainability goals at no risk or cost to the taxpayer or the agency.

Agencies should also consider the building, design, and systems that comprise data centers. New innovative technologies such as Rear Door Heat Exchangers or raised flooring tiles, can help create a more sustainable bottom line for data centers.

Track Usage Effectiveness (UE) and Other Data Center Metrics

As discussed, data centers are large consumers of not only energy and power, but also water. Agencies should consider building on the progress made over the past decade on data center consolidation and optimization by tracking power usage effectiveness (PUE), water usage effectiveness (WUE), and carbon usage effectiveness (CUE). Armed with an understanding of how data centers consume power and water and emit carbon, agency data center managers can make more informed decisions that reduce consumption and save taxpayer dollars.

NREL suggest the following approach to effective sustainability with metrics from the Power Usage Effective (PUE) family of metrics:

Energy

- **Power Usage Effectiveness (PUE):**

  - **Goal:** Reduce energy use by making systems as efficient as possible.

  - Maximize compute <u>entering</u> temperature to maximize energy efficiency

  - Use "free" cooling to reduce or eliminate compressor (chiller, DX) based cooling:

    - Install direct liquid cooled computers that use warm water

    - Capture as much heat as possible directly to the liquid cooling system

  - Optimize fan/pump speeds

- **Energy Reuse Effectiveness (ERE)**

  - **Goal:** Reuse heat and achieve as low an Energy Reuse Effectiveness as possible

  - Maximize compute <u>leaving</u> temperature to maximize energy reuse

<u>**Sustainability**</u>

- **Water Usage Effectiveness (WUE)**

  - **Goal:** Reject as much remaining heat to dry coolers as possible

  - Maximize compute <u>leaving</u> temperature to maximize heat rejected dry

- **Carbon Usage Effectiveness (CUE)**

  - **Goal:** Maximize energy from renewable systems (RE) onsite or within region

Agencies should be aware that Executive Order 14507 states: *"(B) Increasing Energy and Water Efficiency: Each agency shall increase facility energy efficiency and water efficiency and shall establish targets for fiscal year 2030 for agency wide facility energy use intensity and potable water use intensity…"* Agencies should place increased emphasis on the PUE family of metrics for agency-owned data centers.

Agencies should be careful of unintended consequences when "optimizing" or "maximizing" any one usage effectiveness metric. As many data center owners have discovered since the introduction of PUE as a key performance indicator, hyperfocusing on achieving a "good" PUE can hamper sustainable outcomes. Agencies should look to balance – as well as strive to make consistent progress against – all usage effectiveness ratings.

Consider the Impact of Procuring "New" Hardware Assets Against Maintaining Legacy Hardware

Federal procurement teams purchase hardware assets as part of a long-term investment decision for a federal agency. Given the vast amount of energy and resources required to build, retire, and/or recycle large-scale hardware assets, environmentally-conscious agencies should first consider the lifespan of these investment decisions.

Procuring New Hardware Assets: If an agency plans to maintain and update its hardware assets over the long term, it should procure hardware that meets or exceeds minimum energy efficiency standards, even if there is an additional cost up front. The purchase of even the most energy efficient hardware will not outweigh the environmental costs of manufacturing new IT hardware and the premature retirement of these assets.

Maintaining Legacy Hardware: Agencies that already have hardware assets in place need to keep pace with the ever-evolving security requirements and technology advancements. Given the rapid advancement of sustainable monitoring technologies, technologies may be quickly outdated and labeled as "legacy" hardware. While each case is unique, agencies should consider that the overall energy impact of maintaining legacy hardware may be less than the up-front energy cost of purchasing and installing new hardware assets.

Recycling and Retiring Legacy Hardware Through ITAD Programs: When the eventual decision is made to retire legacy hardware that either no longer fits the agency's mission needs or is consuming energy at a significantly higher rate than newer available technologies, agencies should consider investing in IT Asset Disposition Services (ITAD) programs. The ITAD industry, with additional regulation and federal recommendations, provides safe and effective removal and recycling of retired hardware, and encourages stronger and more effective end-of-life outcomes for IT hardware. To ensure agencies are engaging with companies that follow best practices for sustainability IT asset retirement *and* handling of sensitive data, follow EPA's recommendations that the recycler be certified in one of two known standards - R2 or eStewards. More information on these standards can be found at [EPA Greener Products](.).[23]

[GSA Bulletin B-34](.) provides more guidance for agencies on how to reuse, donate, and recycle IT assets ready for disposition.[24] [NIST Publication 800-88](.) can also support agencies with media sanitization guidance during this process.[25]

Implement Sustainability Practices for Power and Hardware Management

Strong management practices for hardware assets can assist agencies in creating more sustainable outcomes. The energy, power, and resources that hardware assets use can be effectively managed using policy and practices. A few examples agencies can consider are included below.

Power Management: The Implementing Instructions for E.O. 14057 direct agencies to use power management of computers and displays to meet sustainability goals. Power management policies force inactive devices into "sleep" mode and save power. Multiplied across an entire agency and its existing assets, these policies have a significant impact on the amount of power used by an agency. For more information on common myths and implementation guidance for power management, read this [Energy Star site](.).[26]

Automatic Duplexing and Print Management: Imaging and print equipment can also be configured to automatically print double-sided, unless there is a strong business case for otherwise. The Implementing Instructions for E.O. 14057 direct agencies to ensure double-sided printing is enabled and set to "default" on software and printing devices. Energy Star has additional recommendations [here](.).

Assess and Improve the Climate Resilience of Agency Owned Data Centers: Ensuring that the location of data centers owned by Agencies is not vulnerable to severe weather events, such as flooding, hurricanes, and sea level rise can significantly reduce operation risks and improve security and continuity of operations long term. FEMP provides [tools and resources](.) for assessing, planning and implementing for resilience at Federal facilities.

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[23] https://www.epa.gov/greenerproducts/electronics-recycling-services
[24] https://www.gsa.gov/cdnstatic/FMR_Bulletin_B-34.doc
[25] https://csrc.nist.gov/publications/detail/sp/800-88/rev-1/final
[26] https://www.energystar.gov/products/low_carbon_it_campaign/put_your_computers_sleep

Virtual Assets

The Federal Government's ongoing investment in new virtual products will continue to better position agencies to meet mission needs. Given the often inflexible nature of physical assets, the discussion around sustainable hardware and equipment is focused heavily on long-term thinking and strategy. Meanwhile, the agile nature of software allows us to focus far more on the optimization and efficiency of these virtual assets.

Continue the Movement to the Cloud

Agencies continue to move to the cloud at a rapid pace. The Federal Government's DCOI and Federal Cloud Computing Strategy ("Cloud Smart") have supported and driven agencies to invest heavily in cloud technologies and close or consolidate enterprise data centers.[27] Cloud computing has a direct correlation to sustainability and significantly reduces an agency's carbon footprint. Cloud-native applications consume fewer resources, resulting in more efficient resources and reduced electricity consumption as cloud service providers (CSPs) continue to increase renewable energy sources.

Industry cloud migration efforts have also contributed to better sustainability, as seen in the following examples:

- Amazon Web Services (AWS) asserts migration to their cloud services resulting in an 88 percent lower carbon footprint.[28] Capital One's migration of all eight of its on-premises data centers to AWS reportedly led to 103 tons of copper and steel being recycled.[29]

- Microsoft has an Emissions Impact Dashboard tool that helps users estimate their carbon savings potential when using Microsoft cloud products (Microsoft Azure, Microsoft Office 365).[30] Microsoft reports its cloud services are 98 percent more carbon efficient than on-premises solutions.[31]

- Google found that migration to cloud-based Google Apps reduced direct energy for servers and energy for server cooling by 70 to 90 percent.[32] Google Apps helped GSA reduce energy consumption by nearly 90 percent and carbon emissions by 85 percent,

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[27] References include: 1) Executive Office of the Present, Office of Management and Budget (2016, August 1). Data Center Optimization Initiative (DCOI) (M-16-19).
https://datacenters.cio.gov/policy/m-16-19/; 2) Executive Office of the Present, Office of Management and Budget (2018, June 25). Update to Data Center Optimization Initiative (DCOI) (M-19-19).
https://datacenters.cio.gov/policy/
[28] https://d39w7f4ix9f5s9.cloudfront.net/e3/79/42bf75c94c279c67d777f002051f/carbon-reduction-opportunity-of-moving-to-aws.pdf
[29] https://aws.amazon.com/solutions/case-studies/capital-one-all-in-on-aws/
[30] https://www.microsoft.com/en-us/sustainability/emissions-impact-dashboard
[31] https://www.microsoft.com/en-us/download/details.aspx?id=56950
[32] https://static.googleusercontent.com/media/www.google.com/en/us/green/pdf/google-apps.pdf

according to GSA data. Gmail use for small businesses versus a locally hosted server can result in as much as a 100 kg CO2 carbon footprint reduction.[33]

Procure Cloud Software and Services With Preference to Companies That Prioritize Sustainability

As more of the Federal Government's assets are transitioned to the cloud, the acquisition of cloud services becomes a higher priority for the government.

Agencies need to ensure the move to the cloud is designed toward desired sustainability outcomes. While calling cloud adoption a "win" for our environment is an appealing proposition, the reality is more complex. For example, many modern data centers are excellent examples of highly efficient assets. Many major cloud infrastructure-as-a-service (IaaS) providers are building and deploying sustainable technologies every day, but increased transparency into the sustainability of platform-as-a-service (PaaS) and software-as-a-service (SaaS) companies and products is also needed.

Building a Checklist for Procuring Sustainable Cloud Software and Services: Agencies should consider using the questions below as a standardized checklist for making sustainable cloud purchases.

- Require cloud service providers to:

    - Report their greenhouse gas emission inventories via the Carbon Disclosure Project (CDP).

    - Create Science Based Targets Initiative (SBTI)-validated climate impact reduction targets.

    - Demonstrate they are running on renewable electricity, minimizing energy usage, and utilizing EPEAT-registered and ENERGY STAR-certified servers and other IT hardware.

    - Share progress in reducing their climate impacts.

- Sustainability Policies

    - What are the company's policies on sustainability?

    - How transparent is the company about its impact on the environment and sustainable outcomes?

- Data Center Management

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[33] https://static.googleusercontent.com/media/www.google.com/en/us/green/pdfs/google-green-computing.pdf

- - Where are the company's data centers located? Are they vulnerable to extreme weather events (flooding, sea level rise, hurricanes) and not climate resilient?

    - What are the timelines for Data Centers that are vulnerable to extreme weather mitigating the impact (contingency plans)?

    - Do these data centers have efficient operations?

    - What certifications does the data center and managers hold?

- Power and Energy Sources

    - Where is the power and energy sourced from?

    - Does the company use renewable energy?[34]

    - *If the company does not;* do they have an approach for utilizing renewable energy? It would also be beneficial to understand how they plan on increasing/leveraging innovation to improve.

    - Is the company actively advocating for provision of more renewable electricity from their energy supplier?

There are many additional resources on sustainability purchasing checklists available from leading IT organizations. The Global Electronics Council (GEC) has published a [Purchasers Guide for Sustainability and Cloud-Service Procurements](#) that includes additional questions on how to assess and understand the sustainability impacts of Cloud Service Providers.[35]

Utilize Virtual Technologies that Enable Sustainable Outcomes

There are countless technologies that have been developed over the past two decades that, while not intentionally created with sustainable outcomes in mind, have nonetheless been a net positive for sustainability. Agencies should consider investing more heavily in technologies that increase energy efficiency and enable more sustainable outcomes.

Edge Computing: In most cases, cloud computing moves packets of data and information longer distances from the cloud provider's data center to the enterprise's resources and assets. Transmission over longer distances requires more energy. At the individual resource, the energy demands are negligible. But as cloud computing grows across the globe, the demands become substantial. Edge computing technologies move portions of infrastructure significantly closer to the actual applications and services. These technologies can run some processing and storage jobs far more efficiently due to the shortened physical distance from an edge node to the device, as compared to a cloud service provider's main data center.

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[34]https://globalelectronicscouncil.org/wp-content/uploads/GEC-Sustainable-Cloud-Services_Purchasers-Guide_FINAL-March-2021.pdf
[35]https://globalelectronicscouncil.org/wp-content/uploads/GEC-Sustainable-Cloud-Services_Purchasers-Guide_FINAL-March-2021.pdf

Still, edge computing is not necessarily an easy win for agencies. They should carefully consider the utilization and costs associated with edge computing nodes or assets. With each edge node is a new piece of hardware. In some environments, regulating the temperature and health of the node may be more expensive and costly than initially realized. Each case for edge computing should be considered uniquely by agencies.

Containerized Applications: Use of containerized applications and kubernetes orchestration are important additions to agency IT modernization efforts. They present a great opportunity for agencies to better align and optimize their resources, thus creating a more efficient energy usage for applications and systems. Containerized applications optimize resources and lead to a direct connection between efficient applications and decreased energy use.

Software Development: Implementation of agile DevSecOps software development best practices and use of microservices versus monolithic waterfall development cycles and code often result in rapid improvements and significant efficiency gains. Analysis of inefficient code using modern monitoring tools can enable quick identification and refactoring. Organizations such as the Green Software Foundation[36] are looking to promote greater sustainability in software through more efficient coding. EnergyStar also has additional information here.

Business Functions and Strategy

Build Sustainability into Existing IT Plans

Agencies across the Federal Government spend significant time planning and managing IT systems across physical, virtual, and service assets. These plans typically prioritize increasing operational efficiency and reducing the cost to the taxpayer. However, sustainability offers a tool to CIOs for increasing efficiency and reducing costs, given the correlation between sustainable outcomes and efficiency (e.g., energy efficiency, utilization efficiency, etc.).

In the reverse way, IT is a much-needed tool for agencies to meet sustainability goals. Without emerging technologies and well-planned architectures and infrastructure, sustainability goals will be impossible to reach. In reviewing agency sustainability plans, many agencies focused heavily on facility efficiency goals. While facilities are an important piece of an agency's sustainable outcomes, they are not the complete picture. Many sustainability plans lack focus on tangible technologies and the use of these technologies to meet sustainability goals.

Therefore, agencies should weave sustainability in IT into agency-wide strategic planning efforts and align the business and use cases of sustainable IT solutions with agency and administration priorities. Additional alignment with existing sustainability plans is a strong starting point for Offices of Chief Information Officers (OCIOs); fostering a relationship between the CIO and CSO should be an immediate first step. A unified front for investment and outcome, in alignment

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[36] https://greensoftware.foundation

with an agency's and the administration's strategies, offers a jumpstart to all IT sustainability outcomes.

Consider Utilizing Elements of IT-as-a-Service (ITaaS)

IT-as-a-Service is a new business and delivery model that goes beyond the traditional CSP platform models (IaaS, PaaS, SaaS) and focuses on offering customers a "catalog" of available IT solutions on demand. This type of service gives agencies access to pre-approved IT services and can move typical in-house IT services to an external cloud provider to manage.

ITaaS provides organizations with several benefits, including helping agencies predict costs and scale as needed. ITaaS as a delivery model also addresses two key challenges - underutilization of servers and physical equipment and poor lifecycle management due to overprovisioning. These outcomes are inherently intertwined with sustainable outcomes. ITaaS can further improve utilization on demand for networks and servers, maximize provisioning, and eliminate redundant equipment and hardware.

Consult Experts Prior to Making Large-scale IT Decisions

Federal IT leaders are proficient at implementing and maintaining IT systems across the Federal Government. While IT professionals often interact with sustainability professionals through discussions on IT efficiency and optimization, the two generally work in distinct silos. IT teams across the Federal Government should strongly consider *integrating* IT sustainability experts within their IT teams and utilizing consulting services to better align IT decision making with sustainable outcomes. One program agencies can look to for training is the DOE Data Center Energy Practitioner (DCEP) Training Program.[37]

Sustainability experts offer IT teams insight into real-world applications, data, case studies, and best practices. Agencies can gain additional efficiencies from these integrations.

Encourage Regular Communications Between Agency Chief Sustainability Officers and IT Teams

The Federal Government has made strides over the past decade to formalize sustainability operations at the governmentwide and agency levels. The Federal Government now has a Chief Sustainability Officer (CSO) position and all agencies are now required to have their own sustainability officers to drive sustainable practices and decision making with agency mission support teams.

Sustainability officers within the Federal Government are experts in their field and rely on proactive communications from functions, such as IT, to create successful outcomes. IT teams should proactively engage these sustainability officers to better align IT planning with overall agency strategy and make better informed decisions for IT investment, use, and maintenance.

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[37] https://datacenters.lbl.gov/dcep

CSOs give IT teams an agency-wide perspective on sustainability and can create direct connections with agency leadership to influence leadership priorities and direction, which gives sustainability and IT teams a seat at the leadership table. In turn, IT professionals can increase awareness of IT sustainability issues and coordination with IT sustainability experts in the US government by joining the CIO Council's IT Sustainability Working Group. To join, please contact dccoi@gsa.gov.

Utilize Federal Procurement Programs and Contract Vehicles to Make Sustainable Investment Decisions

The Federal Government does not expect agencies to make all acquisition and strategy decisions independently. Both GSA and the EPA have developed agency-wide programs and strategies for buying "green." Agencies are highly encouraged to utilize these programs to make informed acquisition decisions.

EPA Environmentally Preferable Purchasing (EPP) Program: The EPA EPP Program offers many tools and resources, including standards and ecolabels recommended for use in federal procurement, to best inform agency decisions buying and leasing products and services.[38] The program:

- Coordinates USG input into the regular update of EPEAT sustainability criteria for IT products.

- Co-chairs the CIO Council's IT Sustainability Working Group to provide a venue for agencies to share best practices and insights into IT sustainability issues.

- Offers support to IT contract managers on how to best incorporate sustainability into procurements.

- Offers tech support to OMB's Category Management Leadership Council's Category Management Sustainability Check Program by reviewing all Best in Class (BIC) contracts for alignment with federal sustainable procurement requirements, and sharing the review results with BIC contract managers and CMLC leadership.

GSA Green Purchasing Program: GSA's Green Purchasing Program includes two components, the GSA Advantage! Environmental Aisle [39] and the GSA Global Supply[40], which both offer agencies options to view and shop for environmentally-compliant and sustainable products and services, such as:

- Electronics

- Servers

- Other IT Hardware

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[38] https://www.epa.gov/greenerproducts
[39] https://www.gsaadvantage.gov/advantage/main/start_page.do
[40] https://www.gsaglobalsupply.gsa.gov/advantage/ws/main/start_page?store=FSS

GSA's programs integrate with the agency's multiple award schedules and Best in Class contracts, making it easier for agencies to do business.

GSA Acquisition Gateway: GSA Acquisition Gateway incorporates the Green Check, which identifies contracts like BPAs and GWACs that include appropriate sustainability requirements. Agencies can easily see which solutions in the [IT Hallway](#) incorporate these requirements.[41]

Other Tools: Additionally, [SFTool.gov](#) is a federal resource created to help all agencies build sustainability into their procurements and achieve high performance.[42] Contracting officers can use the Green Procurement Compilation tool to browse a comprehensive list of sustainable products. From buildings to cell phones, this resource allows users to compare products and services to the life cycle benefits of various green products available to them. To support these tools and help the Federal Government make sustainable decisions, courses are offered through the Facilities Management Institute (FMI), such as FAC 038, "How to Integrate Green into Acquisition."[43] All contracting officers are encouraged to complete these courses.

The CIO Council has also set up its IT Sustainability Working Group as part of the Cloud & Infrastructure Community of Practice (C&I CoP). The IT Sustainability Working Group is an interagency group of federal sustainability experts tasked with helping their agencies improve electronics stewardship in the Federal Government. This group is open to all agency staff and provides a venue for sharing best practices and getting technical assistance and policy updates. Guidance documents and resources developed by this group are accessible on the FedCenter.gov page for the predecessor [Federal Electronics Stewardship Working Group](#) and the [C&I CoP page on OMB Max](#).[44] [45]

Implementing Best Practices

While the *IT Sustainability Best Practices Guide* provides agencies with a general foundation for making sustainable IT decisions for the acquisition, use, and maintenance of hardware and software assets, agencies will need to chart their own sustainability journeys while weighing their specific missions and needs.

As more American consumers push for sustainable products and services, industry has responded by investing in sustainability itself. While consumers still need to wade through superficial marketing techniques branded as sustainability, many organizations are making a genuine effort to decrease energy consumption, increase efficiency of resources, and build a more sustainable future.

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[41] https://hallways.cap.gsa.gov/app/#/solutionsfinder?agency=8746&category=1
[42] https://sftool.gov/
[43] https://www.gsa.gov/events/fcl-gsa-0038-how-integrate-green-acquisition
[44] https://www.fedcenter.gov/members/workgroups/feswg/index.cfm
[45]
https://community.max.gov/display/Egov/CIO+Council+Cloud+and+Infrastructure+Community+of+Practice

Agencies are encouraged to explore IT sustainability topics further using resources from leading American technology companies, which now commonly employ sustainability teams and experts who have written countless resources, white papers, and case studies on the effectiveness of various sustainability techniques.

Next Steps

The Federal Government continues to make strides in investing in sustainable IT infrastructure through physical assets, virtual assets, and IT services. Agencies like the DOE, EPA, and GSA will continue to lead federal efforts in sustainable IT procurement and use.

We encourage all agencies to continue the education and training of procurement and IT professionals in creating sustainable outcomes for the United States. If you have any questions, please reach out to dccoi@gsa.gov.