

National Aeronautics and Space Administration
Sustainability Report and Implementation Plan
2019

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2019 Sustainability Report and Implementation Plan

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Executive Summary

NASA's Mission and Sustainability

NASA's vision is to discover and expand knowledge for the benefit of humanity. We do this through our missions of scientific discovery of the Earth and its solar system, of other worlds, and of the cosmos as a whole; missions of human spaceflight and operations in and beyond low-Earth orbit; and missions of development that advance new technologies in aeronautics and space systems. NASA's mission support strategy is to steward resources by reducing costs, revitalizing capabilities, integrating capabilities across the Agency, and optimizing operations.

NASA operates ten primary Centers and seven specialized Component Facilities in locations around the country, comprising approximately 47 million square feet in 5000 buildings. The Agency employs 16,500 full-time civil servants supported by a significant contractor workforce providing technical and business operations services.

NASA strives to accomplish our mission with the utmost care, recognizing that we are stewards of taxpayer dollars and one-of-a-kind, often historic, facilities.

NASA's sustainability policy is to execute the mission without compromising the planet's resources so that future generations can meet their needs. In the risk management culture of NASA, that means we use proactive measures to reduce NASA's exposure to environmental, institutional, programmatic, and operational risks. In doing so, we continuously improve the resilience of NASA's space and ground asset operations and performance.

Current Sustainability Successes

For example, the Agency's energy management program reduces risk to NASA's mission by minimizing potential impacts of energy insecurity while also increasing the cost effectiveness of our finite resources. The cost avoidance in our fiscal year (FY) 2018 energy bill was \$42.5 million (based on FY 1995 energy consumption).

NASA also continues to reduce the footprint of its portfolio of built assets through strategic demolition and consolidation efforts. The design of new facilities or major upgrades to existing buildings minimizes long-term infrastructure energy, water, and maintenance costs. In FY 2018, NASA added four high performance facilities with a total of nearly 186,000 gross square feet (GSF) to the sustainable facility inventory. NASA removed about 360,000 GSF of inefficient space from its inventory in FY 2018.

Other sustainability successes include continued data center consolidation and optimization; collaboration with the Department of Defense and the Defense Logistics Agency to prove viability of biobased engine oil; and implementation of an award-winning Center water conservation and stormwater program.

Future Sustainability Priorities

NASA's strategic priorities and objectives for FY 2020-2021 are to advance efficiency and sustainability in Agency operations, meet or exceed goals and requirements, and achieve cost savings by

- Expanding the scope of energy efficiency-focused investments to include mission-intensive facilities that are excluded from Federal energy reduction mandates.
- Continuing implementation of the Strategic Energy Investment Plan (SEIP), which prioritizes energy efficiency projects that decrease facility costs and improve reliability. FY 2019 is the first year of Agency investment informed by the SEIP.

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- Continuing the Existing Building Commissioning Program, which was implemented in FY 2018 and focuses on bringing existing buildings back into top performance.
- Continuing to aggressively reduce the Agency's footprint by demolishing old, inefficient buildings and replacing them, where necessary, with sustainable, high efficiency buildings.
- Continuing to improve sustainable acquisition compliance rates and best practices.
- Prioritizing and resourcing sustainability initiatives according to impact to NASA and developing Agency-wide outreach campaign to support implementation of these initiatives at each Center/Component Facility.

More information on NASA's future sustainability plans can be found in our [2018 Strategic Plan](#) and our [FY 2020 Full Budget Request](#).

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Implementation Summary: Facility Management

FACILITY ENERGY EFFICIENCY

FY18 Energy Intensity Progress (Btu/GSF):

39.4% reduction from FY03

1.1% increase from FY17

FY19-FY20 Plan:

0.5% reduction in FY19 from FY18

0.5% reduction in FY20 from FY19

Implementation Status

In FY 2018, NASA's goal-subject facility energy intensity increased slightly, primarily due to operational issues that have been resolved in FY 2019. This year-over-year increase also reflects the challenges the Agency is increasingly facing as most projects with the highest rate of return on investment (e.g., light-emitting diode (LED) lighting upgrades or heating, ventilation, and air conditioning (HVAC) upgrades) have been completed. Many of the remaining conservation measures have higher costs, longer paybacks, and/or are located in highly specialized facilities. Therefore, while NASA's long-term trend in energy reduction is still moving in the right direction, progress is slower, and operational issues or changes in operational tempo have greater influence on year-over-year metrics.

NASA Centers reduce energy consumption and cost through all available methods. Core strategies include energy efficiency and renewable energy project implementation; operations and maintenance (O&M) best practices; sustainable building design, construction, and renovation; and employee training, outreach, and awareness.

Some examples of accomplishments, actions, initiatives, and/or projects that were started or completed in FY 2018 include the following:

- Marshall Space Flight Center (MSFC) began replacing its inefficient centralized steam system with localized natural gas boilers. This two-phase project will be implemented throughout the next few years.
- Johnson Space Center (JSC) completed a project that retrofitted outside air demand controls, upgraded lighting, installed variable speed drives, and performed various equipment optimization and scheduling changes. They also initiated repair and replacement of chilled water and steam piping insulation.
- Goddard Space Flight Center-Greenbelt (GSFC-GB) repaired one of its landfill methane boilers and developed additional operational controls for the boiler house. The Center also continued upgrades to its central power plant chiller controls.
- GSFC-Wallops Flight Facility (GSFC-WFF) initiated HVAC efficiency improvements in several buildings.
- MSFC-Michoud Assembly Facility retrofitted interior lighting with LED lighting in three buildings.

Although NASA has been successful in achieving significant energy use intensity (EUI) reductions in its facilities, the Agency faces considerable challenges in continuing to meet the energy intensity metric. NASA excludes many mission-dependent facilities from the energy intensity metric per guidance (e.g., Mission Control Center at JSC and Spacecraft Systems Development and Integration Facility at GSFC-GB) because of their widely varying and often high-intensity energy use due to mission requirements. Historically, NASA has focused on facilities subject to the metric, investing heavily in energy efficiency in those facilities. But after years of investment, NASA has completed most of the high-impact energy efficiency projects in these facilities, so that incremental improvement becomes increasingly difficult to achieve.

Another challenge the Agency faces in this metric is that credits and adjustments in the energy intensity formula also impact NASA's performance. In general, allowing credit for renewable energy systems from goal-excluded facilities

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has positively impacted NASA performance since the rule changed in FY 2016. However, NASA claims goal-subject energy intensity credits for on-site conversion of landfill methane and on-site renewable steam production. These credits are relatively large, totaling 560.4 billion BTUs in FY 2017 and 488.7 billion BTUs in FY 2018. These credits are dependent on full operation of those systems throughout the FY. If there is a long-term outage due to a connection disruption or boiler repair, such as occurred in FY 2018, NASA must supplement these on-site renewable energy sources with natural gas. This alone can negatively affect whether NASA shows annual reductions in energy intensity, as it did in FY 2018, creating a year-over-year incremental increase in EUI that was an artifice of renewable energy credit reporting.

Priority Strategies & Planned Actions

Despite the above challenges, NASA continues to invest in life-cycle cost-effective energy efficiency projects using all available funding streams, including appropriated funds, third-party financing through performance contracting, and Enhanced Use Lease (EUL) Agreements. For example, in FY 2018 NASA launched a cyclical Existing Building Commissioning Program using the Agency 35% of EUL net revenue. (Congress provides NASA authority to lease non-excess but underutilized Agency assets to tenants, and to retain and utilize lease net revenue beyond expenses of hosting tenants; the authority returns 65% of net revenue to the Center that hosted the lease, and provides 35% to the Agency level for use at any Center). In its inaugural year, the program initiated commissioning efforts on over 1.1 million GSF of facilities at four Centers. The program continued in FY 2019 with an additional 1.3 million GSF of facilities at eight Centers and Component Facilities. NASA also called for Center proposals for FY 2020 commissioning projects that will receive funding, subject to actual amounts of EUL net revenue realized.

NASA also uses a portion of its Construction and Environmental Compliance and Restoration appropriation for recurring direct investment in energy/water efficiency and renewable energy improvements. Within the Institutional Construction of Facilities program, NASA funds Energy Savings Investments focused on improving systems efficiencies and reducing utilities expenditures. In FY 2019, Energy Savings Investments began implementing the first projects recommended in the Strategic Energy Investment Plan, and NASA plans to fund additional projects in FY 2020, subject to actual amounts of appropriations received.

In addition to continued investment, and building on the progress made through the development of the SEIP in FY 2017, NASA established three major initiatives to foster continuous improvement in energy/water management at the Agency and Center level. These initiatives include the following:

- Intersecting energy/water program planning with the Agency master planning process to better integrate energy/water initiatives with other facility affordability and reliability efforts.
- Analyzing mission-related energy use to identify any energy use/cost reduction opportunities in goal-excluded facilities.
- Benchmarking the program structure against ISO 50001 to identify and address programmatic gaps.

Implementation of these initiatives will continue through FY 2019 and FY 2020. Next steps will be determined after analyzing the results.

EFFICIENCY MEASURES, INVESTMENT, AND PERFORMANCE CONTRACTING

FY18 Performance Contracting – Investment value and number of new projects awarded:

\$23.4M value / 1 project in FY18

FY19-FY20 Plan:

\$14.5M / 2 projects in FY19

\$21.2M / 1 project in FY20

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Implementation Status

NASA uses Energy Savings Performance Contracts (ESPCs) and Utility Energy Service Contracts (UESCs) in concert with other mechanisms to improve systems efficiencies and reduce utilities expenditures in support of NASA's mission. In addition to conventional energy conservation measures, projects began implementing more challenging and complex measures with longer development cycles such as data center optimization and large-scale renewable energy.

In FY 2018 NASA awarded a \$23.4M investment value ESPC for data center optimization at Jet Propulsion Laboratory (JPL), which surpassed our plan to award \$5.9M in FY 2018 by nearly \$17.5M. From the start of FY 2019 through the present, NASA awarded over \$14.5M investment value in two ESPCs/UESCs. Stennis Space Center awarded an energy and water efficiency UESC in October 2018, and GSFC-WFF awarded a solar photovoltaic (PV) ESPC modification in February 2019. These contract activities are estimated to annually avoid 31.2 billion Btus of energy and \$0.6M in energy and related expenditures.

Priority Strategies & Planned Actions

NASA will implement and monitor energy performance contracts awarded in FY 2018 and FY 2019. Various Centers continue to develop potential ESPC and UESC projects at different project development phases ranging from initiating preliminary assessments through reviewing investment grade audits. NASA based its FY 2020 planned investment on the most mature potential project under development—a broad UESC in the investment grade audit phase at Kennedy Space Center (KSC).

RENEWABLE ENERGY

FY18 Renewable Electricity Use:

14.9% of total electricity in FY18

FY19-FY20 Plan:

7.5% of total electricity in FY19

7.5% of total electricity in FY20

Implementation Status

NASA Centers employ a diverse mix of renewable sources and technologies, including on-site electricity and thermal energy generation or conversion, direct purchases, a hosted solar PV project, and renewable energy certificate (REC) purchases. On-site generation ranges from small solar parking lot lighting to larger geothermal heat pump systems and solar PV systems, with additional projects in progress.

In FY 2018 and FY 2019 to date, the following accomplishments, actions, initiatives, and/or projects were started or completed:

- KSC installed approximately 2 megawatts (MW) of additional solar PV as an expansion to their existing 900 kilowatt (kW) system. This project was funded through NASA's Energy Savings Investments.
- JSC-White Sands Test Facility (JSC-WSTF) continued construction of a 1.6 MW solar PV plant. This project was funded through Environmental Compliance and Restoration appropriations and site recycling revenue. This solar installation will offset high energy demands from the groundwater remediation system and will provide resiliency during power outages.
- JPL is adding approximately 900 kW of solar PV on a parking structure. This system joins other rooftop systems at JPL, as available land area is very limited. This project was funded through NASA's Energy Savings Investments. Project implementation began in FY 2018.
- From the NASA SEIP, JSC-WSTF and GSFC-White Sands Complex received funding in FY 2018 through NASA's Energy Savings Investments for solar PV; the project is also assessing battery energy storage.

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- GSFC-WFF awarded a contract modification for incorporating a total of 4.3 MW of solar PV into an existing ESPC project.

Priority Strategies & Planned Actions

The future FY targets for renewable energy meet the federal goals. The higher renewable energy use rate in FY18 reflects REC purchases under existing multi-year contracts that were developed to meet prior Federal goals.

The Agency Strategic Energy Investment Plan summarizes potential renewable energy projects (solar, wind, and storage) at each Center and provides estimates for economic viability of projects. Based on this analysis, NASA is now strategically deploying funding to construct renewable energy projects that provide the most economic and resiliency benefit to the Agency. Other planned actions include continued efforts to work with local utilities and/or adjoining military installations on potential projects. Beginning in FY 2020, NASA also plans to centralize REC purchases to reduce costs and gain administrative efficiencies.

KSC also signed a new EUL agreement with its electric utility provider to host 74.5 MW of solar PV. This is in addition to the 10 MW that the Center hosts from a prior EUL with the same utility provider. Like the original hosted system, production from the new hosted system will feed directly into the utility provider's grid, similar to the provider's other rate-based generation assets. In return for using NASA's land, the utility provider will submit monthly cash payments to NASA. The utility provider is further assessing the land to finalize development plans for FY 2020 and FY 2021. If land development is not feasible, the utility provider may terminate the agreement.

WATER EFFICIENCY

FY18 Water Intensity Progress (Gal/GSF):

- 38.7% reduction from FY07
- 0.4% reduction from FY17

FY19-FY20 Plan:

- 0.5% reduction in FY19 from FY18
- 0.5% reduction in FY20 from FY 19

Implementation Status

NASA Centers reduce water consumption and costs through all available methods. Core strategies include upgrading major water infrastructure and replacing aging distribution systems, optimizing building HVAC systems, re-configuring fire protection systems, retrofitting bathroom fixtures, reducing use of landscaping water systems, and installing meters.

In FY 2018, the following accomplishments, actions, initiatives, and/or projects were started or completed:

- Ames Research Center, JPL, and JPL-Goldstone Deep Space Communications Complex continue to replace turf with drought-tolerant indigenous vegetation and rock scape to reduce water consumption and maintenance costs.
- GSFC-GB began planning a leak detection survey for all water distribution piping and will look for other instances of water waste.
- JSC-WSTF began planning a cooling tower optimization project.

NASA is facing increasing challenges in reducing water consumption and costs. About 94% of NASA water consumption is reported as potable water. Because NASA does not have extensive water metering in place, and because water metering is expensive to install relative to the cost of water, the Agency generally does not have the metering granularity to accurately exclude facilities from the water intensity metric. Therefore, mission activities can have significant impact on NASA's performance with regard to water efficiency. For example, much of the Agency's

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reduction in potable water use is the result of a sharp reduction in consumption after the Space Shuttle Program ended in FY 2011, but increases in wind tunnel activity can have negative impacts on water reduction goals through cooling tower evaporation losses and steam vacuum-driven tunnel tests. In the future, missions such as Space Launch System Program activity may also negatively affect progress.

In addition, because many NASA Centers are comparable to a large campus or small city, drinking water quality standards often require flushing of distribution systems. This flushing requires large quantities of water to be pumped through the system and then discharged without being used, ensuring the water distribution lines are clean and that water quality has not degraded. Furthermore, most water projects, whether regular storage tank maintenance or complete line replacement, require flushing. Year-to-year flushing activities may hinder annual progress for water intensity reduction goals.

Despite these challenges, NASA has continued to reduce water use. Many Centers still have very old water distribution systems, and leaks from these degraded systems impact mission, which in turn makes water distribution repair and rehabilitation projects a high investment priority for the Agency. Much of the Agency's recent success has been from these repair and rehabilitation projects, which mitigate major leaks and many minor leaks that have gone undetected. NASA also uses these projects to install metering wherever feasible, which facilitates better water management.

Priority Strategies & Planned Actions

Several major replace/repair projects are currently underway across the Agency, and NASA Centers continue to conduct leak detection, install metering as appropriate, and use water-efficient landscaping to reduce water use.

HIGH PERFORMANCE SUSTAINABLE BUILDINGS

FY18 Sustainable Buildings Progress:

45 sustainable Federal buildings
20.4% of buildings / 23.3% of gross square footage (GSF)

FY19-FY20 Plan:

21% of buildings / 26% of GSF sustainable in FY19
22% of buildings / 27.6% of GSF sustainable in FY20

Implementation Status

Four newly constructed high performance sustainable buildings totaling nearly 186,000 GSF were completed in FY 2018. The four buildings—Langley Research Center (LaRC) Katherine G. Johnson Computational Research Facility, GSFC-WFF Island Fire Station, GSFC-WFF Mission Operations Control Center, and JSC Human Health and Performance Laboratory—meet the Guiding Principles for Sustainable Federal Buildings. In addition, all four facilities received Leadership in Energy and Environmental Design (LEED) Silver ratings in FY 2018. These additional buildings bring the total count of sustainable buildings at NASA to 45.

Priority Strategies & Planned Actions

In FY 2019, *NASA Procedural Requirement 8820.2G, Facility Project Requirements* is undergoing a thorough revision to incorporate new project funding requirements, new requirements for NASA High Performance Buildings including utility management strategies, and other facility project processes. In FY 2019, NASA expects to add two high performance facilities—a newly constructed building and a re-commissioned existing building—adding 350,000 GSF of area to the inventory and increasing sustainable facilities to 3.3 million GSF. One of these is an existing building aiming for certification to LEED Gold for Existing Buildings, through commissioning, measurement, and verification. This facility is JPL's 200,000 GSF Central Engineering Building 301. The second sustainable facility is the newly

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constructed 147,000 GSF Office Building 4221. This sustainable, high performance building, located at MSFC, has been occupied and is going through a dual certification process, seeking merit for both LEED (Silver) and Green Globes (3).

NASA plans to add another 200,000 GSF of sustainable buildings in FY 2020.

With the completion of Agency-wide Sustainable Facilities Training, the Agency is now focusing on energy modeling training for new construction designs and increasing the number of existing buildings undergoing re-commissioning. These two initiatives will support NASA's ability to meet its goals for high performance sustainable facilities.

WASTE MANAGEMENT AND DIVERSION

FY18 Non-hazardous Waste Management and Diversion:

22,970 metric tons of non-hazardous solid waste generated*

37% sent to treatment and disposal facilities

*not including construction and demolition (C&D) waste

Implementation Status

NASA continued to exceed solid waste reduction goals in FY 2018. The Agency uses several methods to support and improve hazardous and non-hazardous waste reduction efforts at NASA Centers: a) the Recycling and Sustainable Acquisition (RSA) Principal Center that provides technical resources and implementation support for waste reduction, recycling, and sustainable acquisition; b) web-based collaboration tools; c) Environmental Management Systems (EMS) tracking of hazardous chemical reduction/reuse activities and hazardous waste generation that are measured and evaluated on an annual basis; and d) awards programs.

- RSA provided technical resources and program implementation support to community-of-practice members through hosting a face-to-face meeting, sharing lessons learned, hosting quarterly video conference meetings, and conducting a site assistance visit.
- NASA enhanced web-based collaboration tools by improving Agency websites, hosted a series of quarterly training opportunities, and maintained a tracking and reporting system for solid waste in the NASA Environmental Tracking System (NETS) including data on waste diversion. In FY18, of the 14,471 tons of waste diverted, 50% was recycled, 45% reused, and the remaining 5% was either donated, composted, or sent to energy recovery.
- Centers' EMS implementation continued to focus attention on reduction of waste.
- Centers continued to receive recognition for outstanding achievements, including U.S. Environmental Protection Agency's (EPA) Federal Green Challenge as well as Center-specific awards programs.
- In addition to meeting non-C&D goals, NASA continued to exceed C&D goals by sending only 24% of C&D waste to landfill.

Priority Strategies & Planned Actions

- Continue to meet the goal of sending less than 50% of non-C&D and C&D solid waste to landfill annually, using waste reduction strategies (source reduction, reuse and or diversion from landfill and treatment facilities through recycling, composting, and energy recovery).
- Through RSA, continue to provide technical resources and program implementation support to community-of-practice members through hosting face-to-face meetings and quarterly video conference meetings, sharing lessons learned, assisting awards nominations, and conducting site assistance visits.
- Continue to maintain and improve Agency websites, host a series of quarterly training opportunities for Agency participants, and maintain a tracking and reporting system for solid waste in NETS including data on recycling, reuse, donation, composting, and waste to energy.
- EMS implementation will continue to assess waste reduction at the Centers.

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- Improve Center recycling programs based on the Center’s flexibility or ability to identify and explore new waste stream opportunities as resources allow. Lessons learned will be shared to assist other Centers.

Implementation Summary: Fleet Management

TRANSPORTATION / FLEET MANAGEMENT

FY18 Petroleum Reduction Progress (Gal):

- 73.1% reduction in petroleum fuel since 2005
- 19.0% reduction in petroleum fuel since FY17

FY19-FY20 Plan:

- 0% reduction in FY19 from FY18
- 0% reduction in FY20 from FY19

Implementation Status

NASA has been aggressively executing its Fleet Management Plan to a) optimize use of the vehicle fleet; b) acquire and/or adjust the size and functional utility of each vehicle to match the program’s needs and/or mission’s requirement (right sizing the vehicle fleet); and c) acquire alternative fuel vehicles (AFV), flex fuel vehicles (FFV), low greenhouse gas (GHG) emitting and zero emission vehicles during end-of-life cycle replacements. In FY 2018, NASA acquired 263 vehicle assets and earned 268 EPart credits based on alternative fuel vehicle acquisitions, for an EPart compliance rate of 101%. NASA’s transportation fleet is now optimized to NASA’s FY 2019 mission with a fleet of 2707 vehicle assets: 367 Heavy Duty, 541 medium duty, 1270 light duty, 343 sedans and 186 low speed electric vehicles. NASA continues its Vehicle Utilization Review Board (VURB) process of reviewing and evaluating vehicle requirements for both existing and new requests. In FY 2018, NASA reported a total alternative fuel consumption usage of 19%. Due to past VURBs of transportation requirements and the nature of NASA’s owned fueling centers, the Agency does not expect to see noticeable reductions in petroleum fuel use or increases in alternative fuel use in FY 2020 or FY 2021 unless currently unknown reduction opportunities arise.

Priority Strategies & Planned Actions

The Agency will continue investment and development of NASA’s Fleet Information Management System (FIMS) to improve data and cost information of the fleet. Information technology investment in FIMS will allow improved cost and data collection for NASA’s transportation fleet. NASA will also continue its Vehicle Utilization Review Board process of reviewing and evaluating vehicle requirements for both existing and new requests. VURB reviews ensure right sizing of the NASA fleet, allowing NASA to identify end-of-life vehicle assets and consider opportunities for optimal AFV, FFV, low GHG and zero emission replacement selections. As noted above, the Agency does not expect to see noticeable reductions in petroleum fuel use or increases in alternative fuel use in FY 2020 or FY 2021 unless currently unknown reduction opportunities arise. NASA plans to continue to invest in Alternative Fueled Vehicles, including low greenhouse and zero emission vehicle assets in the future FYs.

Implementation Summary: Cross-Cutting Operations

SUSTAINABLE ACQUISITION / PROCUREMENT

FY18 Sustainable Acquisition Progress:

- 14.5% of contract actions and 18.6% of obligations (in dollars), for a total of \$2,668M in contract actions with statutory environmental requirements.

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Implementation Status

In FY 2018, NASA continued to use several avenues to support and improve sustainable acquisition efforts including, but not limited to, the following activities:

- NASA's Principal Center for RSA was established in 1998 and provides technical resources and program support for NASA Headquarters Environmental Management Division. In FY 2019, RSA:
 - o Conducted training sessions for NASA contracting personnel for the Research Center Policy Group, which includes four NASA Centers (LaRC, Armstrong Flight Research Center, Ames Research Center, and Glenn Research Center).
 - o Provided training sessions for NASA contractors at four NASA Centers (MSFC, JSC-WSTF, KSC, and LaRC).
 - o Provided input for the NASA government purchase card procedures and instructions, and the associated module in NASA's internal web-based training system.
 - o Worked with NASA Shared Services Center to obtain purchase card reports for the Centers for review of government-wide purchase card purchases to identify areas of improvement for sustainable acquisition.
- In addition, Center Contracting Officers:
 - o Examined NASA Form 1707 (Special Approvals and Affirmations of Requisitions), Section 3 (Environmental / Sustainable Acquisition) completed by the intended acquisition end users for sustainability requirements. The NF 1707 is a form required with every requisition above the micropurchase threshold (\$10K) and includes required approvals and affirmations on various subjects, including sustainability and the environment.
 - o Performed additional pre-solicitation and pre-award reviews, including use of sustainability requirements.
- The Headquarters Office of Procurement (HQ OP) regularly inspects NASA Center procurement operations for adherence to procurement regulations, efficiency and effectiveness. Included in these Performance Management Reviews (PMRs) are reviews to:
 - o Evaluate sustainable acquisition within contracts.
 - o Identify root causes of any issues found in the PMRs and potential corrective actions.
 - o Provide support needed to improve acquisition and acquisition reporting efforts.

NASA switched to a new contract writing system during 2017. The learning curve from the contract writing system change continued throughout FY 2018 and continues to date.

Priority Strategies & Planned Actions

- RSA will continue to:
 - o Provide training sessions for NASA contractors and contracting office personnel.
 - o Provide input for NASA purchase card procedures and instructions, as well as the associated training module.
- Center procurement offices will continue to:
 - o Examine the Environmental / Sustainable Acquisition sections of NASA Form 1707s completed by the intended acquisition end users for sustainability requirements.
 - o Perform additional pre-solicitation and pre-award reviews, including use of sustainability requirements.
- HQ OP will continue to use the PMRs (performed at each NASA Center on a three-year review cycle) to inform development of specific training tailored to spur continuous improvement at each Center in FY 2019.
- HQ and RSA will work together to ensure that FPDS data on new awards entered by NASA contracting personnel accurately reflect actual sustainability clauses in contract awards via data reviews and additional training of NASA personnel inputting into FPDS.
- In addition, in a new initiative, HQ OP will review FPDS Sustainability Report calculations to ensure calculation basis is fully in accordance with federal acquisition regulations and other requirements.

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NASA FY Award Targets:

- FY 2019: 16% contract actions and 20% obligations in dollars of contract actions with statutory environmental requirements.
- FY 2020: 17% contract actions and 21% obligations in dollars of contract actions with statutory environmental requirements.
- FY 2020: 160 biobased contract actions and \$100M estimated dollar value.

ELECTRONICS STEWARDSHIP

FY18 Electronics Stewardship Progress:

- 100% of newly purchased or leased equipment met energy efficiency requirements
 - 100% of equipment with power management enabled*
 - 100% of electronic equipment disposed using environmentally sound methods
- *excluding exempted equipment

Implementation Status

NASA continues to ensure procurement preference for Electronic Product Environmental Assessment Tool (EPEAT) Gold-registered products. The EPEAT is a third-party registry of electronic products that meet environmental performance criteria (e.g., product longevity/lifecycle extension, energy conservation, end-of-life management, packaging, etc.). EPEAT Gold-registered products meet the U.S. EPA ENERGY STAR® rating for energy efficiency, thus meeting the requirements for energy efficient products procurement in FAR Part 23.203, the Energy Policy Act of 2005, and the Energy Independence and Security Act of 2007. NASA also continues to maintain policies to enable power management, duplex printing, and other energy-efficient features; employ environmentally sound practices with respect to the disposition of electronic products; and procure Energy Star and Federal Energy Management Program designated electronics.

Priority Strategies & Planned Actions

NASA will continue to implement an Agency-wide enterprise contract that contains energy efficiency clauses for the purchase and maintenance of desktops, laptops, network printers, multifunction devices, and other computing devices. NASA also will continue to implement standardized configurations to manage and monitor energy efficiency settings as well as ensure efficiencies in desktop service functions, costs, and compliance with federal initiatives. The normal refresh cycle for the Agency Consolidated End-User Services enterprise contract for procured office automation equipment will be maintained, ensuring 100% compliance with EPEAT standards. NASA will continue to ensure all NASA Enterprise IT Support and Services contracts contain clauses on environmentally sound practices for disposition of all Agency excess or surplus equipment.

GREENHOUSE GAS EMISSIONS

FY18 Scope 1&2 Greenhouse Gas (GHG) Emissions:

- 38.5% reduction from FY 2008
- 9.5% reduction from FY 2017

Implementation Status

NASA reduced Scope 1 and 2 GHG emissions by 38.5% through FY 2018, compared to FY 2008 levels. Scope 1 includes direct GHG emissions from sources owned by NASA; Scope 2 includes indirect GHG emissions from purchased electricity, heat, or steam. Reducing purchased electricity and steam and lowering on-site fossil fuel consumption were notable contributors to reductions from the baseline. In general, the electrical grid also has continued to transition toward a less carbon-intensive fuel supply since the baseline year, which has led to decreased emissions over time.

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NASA continues to manage its GHG emissions primarily through energy systems. Energy projects, such as JSC's Combined Heat and Power (CHP) facility, have resulted in the overall reduction of Scope 1 and 2 GHG emissions. Although the use of on-site power generation at JSC rather than purchasing off-site generated grid electricity shifts emissions from Scope 2 (indirect) to Scope 1 (direct), *overall* GHG emissions are reduced through inherent CHP efficiencies. Under a full year of operation, NASA anticipates a reduction approaching 20 metric tons per year of CO₂-equivalents or a JSC overall Scope 1+2 emissions reduction of 15%. In addition, operation of the CHP facility has caused JSC to cross the annual reporting threshold of 25,000 metric tons onsite CO₂-equivalent emissions under EPA's Mandatory GHG Reporting program, thus JSC must report its 2018 onsite GHG emissions to EPA on a calendar year basis.

NASA will continue tracking Scope 3 GHG emissions because these data are useful for NASA Center level master planning objectives and multi-modal access planning efforts. NASA conducts a biennial commuter survey to assess trends in employee commuter habits, a source of Scope 3 emissions; this survey will be conducted in FY 2019.

Priority Strategies & Planned Actions

NASA will advance efforts to continue reducing GHG emissions through life-cycle cost-effective strategies. Scope 1 and 2 efforts include investing in more efficient building equipment (boilers, generators, furnaces), replacing or renewing inefficient legacy buildings to standards that exceed required levels of efficiency, and reducing facility footprints to maximum extent practical. NASA also developed an Agency policy to guide deployment of charging stations at Centers to accommodate employees who commute to work in privately-owned electric vehicles.

JSC's CHP facility serves as an example for other NASA Centers as a way forward to meet the objective for providing reliable and resilient energy to meet a Center's needs, as well as reducing the Center's overall Scope 1 and 2 GHG emissions. Similar energy projects are being considered at other NASA Centers. Further, as indicated in the Renewable Energy section, NASA intends to reduce the purchase of renewable energy certificates (RECs), and this would additionally impact net GHG emissions in the future.

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Agency Priorities and Highlights

NOTABLE PROJECTS AND HIGHLIGHTS

In addition to the primary sustainability priorities and objectives identified in the executive summary of this plan, NASA also implemented the following sustainability initiatives or projects.

Optimizing Data Centers

Recognizing the significant energy savings through data center closures or consolidation, NASA closed four data centers in FY 2018, including a data center not previously identified to the Office of Management and Budget for “Closure.” This resulted in

- 55,956 square feet of whitespace flooring identified as “Disposed or Repurposed”;
- 312 servers decommissioned and excessed;
- 2,554 servers consolidated to NASA’s remaining nineteen Tiered Data Centers; and
- A Power Usage Effectiveness of 1.5.

In FY 2019, NASA is beginning an Agency-wide initiative to further optimize data center energy/water use.

A New 3D Printer Turns Waste Plastic into Useful Products on the International Space Station

MSFC worked with its contractors to develop the In-Space Refabricator which demonstrates the first hybrid 3D Printer and Recycler on board the International Space Station. The Refabricator recycles waste plastic materials into high quality 3D printer filament, providing the potential for sustainable fabrication, repair, and recycling capabilities on long-duration space missions. This application currently used in space can also be used on Earth, enabling recycling of water bottles, plastic bags, and other materials that otherwise would go to the landfill.



Expanding the Use of Biobased Materials

NASA began collaborating with Department of Defense (DoD) Aviation and Defense Logistics Agency to participate in a demonstration project at several NASA Centers to evaluate biobased engine oil for use in non-tactical DoD and civilian federal agency equipment. Biobased engine oil is a product category designated for preferred procurement by the USDA BioPreferred Program.

The KSC Visitor Complex installed over 22,000 square feet of biobased turf in the guest viewing launch areas and under an event pavilion. The turf allows water to drain through, eliminates watering and pesticide applications in those areas, is compliant with the Americans with Disabilities Act, and is more cost effective than concrete. The Visitor Complex is operated for NASA by Delaware North under a concessionaire’s agreement and is entirely visitor-funded.

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New Solar Trees at Kennedy Space Center Visitor Complex Provide Multiple Benefits

Five solar “trees” were installed at the KSC Visitor Complex in coordination with Florida Power & Light’s (FPL) SolarNow program. A total of 60 solar panels sit atop the trees, installed and maintained by FPL. They are interactive, educational tools for the millions of visitors at the complex, encouraging the curious to learn more about renewable energy. All energy generated goes into the grid for the complex.



Langley Research Center Recognized for its Comprehensive Water Program

LaRC was awarded a 2018 EPA Federal Green Challenge Award for the Mid-Atlantic region for its water conservation program. LaRC's quality stormwater pollution prevention program efforts have served as a model for other federal agencies, as well as neighbors in the watershed and beyond. LaRC staff integrate sustainability as a guiding principle in their future development, including reducing impervious surfaces, building high-performance green buildings, upgrading infrastructure, implementing water conservation measures, and identifying long-term plans for reducing pollutants.

Over the last year, LaRC experienced a 37% increase in green infrastructure square footage, including low impact development features around the new Katherine G. Johnson Computational Research Facility, which is U.S. Green Building Council LEED Silver Certified. New stormwater features include three bio-retention cells and two compost amended grass channels. To prevent future stormwater pollution to the Chesapeake Bay watershed and foster environmental stewardship, employee volunteers planted over 1,000 tree seedlings (hardwood mix) over two acres (adjacent to local waterways) during Earth Day and Arbor Day events. Additionally, a total of 11,800 sedum plugs, small succulent plants, were added to a 9,600-square foot green roof to improve green roof performance.

Through LaRC's strategic water conservation program, the Center has realized a total potable water consumption decrease of 20% since 2011. Additionally, LaRC also conserved potable water through improving steam plant operations and infrastructure, resulting in an industrial water consumption decrease of 36%.

Jet Propulsion Laboratory Earns LEED Existing Building Gold

JPL's Central Engineering/Project Formulation Building was awarded LEED Gold for Existing Buildings, the third NASA facility to attain the LEED rating for Existing Buildings. The rating acknowledges the innovative green features and efficient operations of the 200,000 GSF building, originally constructed 30 years ago. The Existing Buildings certification process included a thorough review of building performance data and existing sustainability initiatives as well as a LEED action plan with further recommendations for optimization and an analysis of building systems, design, and operational practices.



LEED credits included building and landscaping design that reduces the amount of water used for irrigation. The Center employees are sensitive to limiting potable water use within the building and site-wide through tracking and monitoring. Also, strategies such as vegetative shading and downward facing night illumination minimize the site's

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overall contribution to heat island effects and light pollution. Building performance is enhanced with energy production through a 285 kW solar array on the roof. The building energy consumption is in the 73rd percentile of comparable buildings. The building diverts 43% of waste generated during normal operation to recycling and/or reuse streams. Policies encourage carpool, vanpool, and telework options as popular transportation choices for employees to reduce pollution. Building features encourage physical activity while reducing environmental impact.

