



THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY FY 2022 SITE SUSTAINABILITY PLAN

December 2021



**U.S. Department of Energy
Sustainability Performance Division**

Table of Contents

- Executive Summary** 1
- Energy Management**..... 7
- Water Management** 9
- Waste Management** 10
- Fleet Management** 11
- Clean & Renewable Energy**..... 12
- Sustainable Buildings** 13
- Acquisition & Procurement**..... 14
- Efficiency & Conservation Measure Investments**..... 15
- Travel & Commute**..... 16
- Fugitives & Refrigerants** 18
- Electronics Stewardships & Data Centers**..... 19
- Adaptation & Resilience** 21

Executive Summary

The Thomas Jefferson National Accelerator Facility (TJNAF), located in Newport News, Virginia, is a laboratory operated by Jefferson Science Associates (JSA), LLC, for the Department of Energy's (DOE) Office of Science (SC). The primary mission of the laboratory is to explore the fundamental nature of confined states of quarks and gluons, including the nucleons that comprise the mass of the visible universe. TJNAF is also a world-leader in the development of the superconducting radio-frequency (SRF) technology utilized for the Continuous Electron Beam Accelerator Facility (CEBAF). This technology is the basis for an increasing array of applications at TJNAF, other DOE labs, and in the international scientific community. The expertise developed in building and operating CEBAF and its experimental equipment has facilitated an upgrade that doubled the maximum beam energy to 12 GeV (billion electron volts) and provided a unique facility for nuclear physics research that will ensure continued world leadership in this field for decades. TJNAF's current core capabilities are Nuclear Physics, Accelerator Science and Technology, and Large Scale User Facilities/Advanced Instrumentation. TJNAF is also exploring ways to capitalize on its expertise in the computational sciences to provide large-scale high-performance computing services to an array of research fields for accelerating and maximizing scientific insight in the future.

The TJNAF complex consists of 69 DOE-owned buildings comprising 882,990 square feet (SF) of office, shop, technical, and storage space. JSA leases an additional 37,643 SF of office and shop space from the Commonwealth of Virginia in the Support Service Center (SSC) and 11,435 SF of office and lab space from the City of Newport News in the Applied Research Center (ARC). JSA also leases 17,549 SF of storage space in two offsite storage warehouses within 12 miles of TJNAF. This infrastructure provides office and workspace for approximately 760 JSA contractor, JSA, and federal government employees along with a transient population of 1,600 users and visiting scientists.

TJNAF remains strongly committed to supporting and achieving the targets in the DOE Strategic Sustainability Performance Plan (SSPP). Evidence of this commitment is demonstrated in the significant progress already made in achieving many of the interim goals established. TJNAF remains on target to meet or exceed interim and long term sustainability goals for most identified categories. Sustainability goals are integrated into the Environmental Management System (EMS) in accordance with DOE O 436.1.

Understandably, expansion of the scientific mission at TJNAF has led to significant increases in high energy mission specific facility (HEMSF) electricity and thermal energy (cooling tower water) requirements to support CEBAF accelerator operations when compared with data from established baseline years. While achievement of reduction goals for purchased electricity and potable water represent a significant challenge, multiple reduction strategies have been identified and are under consideration for implementation.

The executive summary table below summarizes current performance status, planned actions and contribution, and overall risk of non-attainment.

Prior DOE Goal	Current FY Efforts	Planned Efforts	Overall Risk of Non-Attainment
Energy Management			
Reduce energy use intensity (Btu per gross square foot) in goal-subject buildings.	14.9% reduction from FY 2015 baseline 10.5% increase from FY 2020 due to increased onsite workforce presence	Improve energy use intensity by 2% annually Seek alternative fuel and energy sources for Goal-subject buildings and non-fleet vehicles	Medium
EISA Section 432 continuous (4-year cycle) energy and water evaluations.	Conducted initial walk-through assessments of buildings and Identified high-priority buildings to conduct energy audits on in FY 2022 Begin to benchmark facilities in Portfolio Manager	Continue meeting auditing requirements by performing energy audits on 25% of required buildings annually and increasing the number of benchmarked facilities in Portfolio Manager	Low
Meter individual buildings for electricity, natural gas, steam, and water, where cost-effective and appropriate.	51.3% of assets do not require metering due to de minimis utility usage or no utilities used 85.4% of relevant assets are at least partially metered for electricity, natural gas, and potable water TJNAF does not use steam for heating	Increase metering for electricity, natural gas, and potable water in all relevant assets to comply with Energy Act of 2020	Low
Water Management			
Reduce potable water use intensity (Gal per gross square foot).	17.8% reduction from FY 2007 baseline 32.6% reduction from FY 2020 due reduced accelerator operations	Implement a storm water reuse project to reduce potable water consumption by 50 million gallons annually to combat an expected increase in consumption due to mission critical tasks	Low
Reduce non-potable freshwater consumption (Gal) for industrial, landscaping, and agricultural.	Data combined with potable water (see previous row)	Data combined with potable water (see previous row)	Low

Waste Management			
Reduce non-hazardous solid waste sent to treatment and disposal facilities.	74.7% of waste diverted from the landfill5.1% increase in diverted waste from FY 2020	Continue to seek new materials to divert to improve the existing process	Low
Reduce construction and demolition materials and debris sent to treatment and disposal facilities.	100% of construction and demolition waste diverted from landfill16.5% increase in construction and demolition waste diverted from landfill	Continue to seek new materials to divert to improve the existing process	Low
Fleet Management			
Reduce petroleum consumption.	85% reduction in FY 2020 petroleum usage relative to FY 2005 baseline	Continue to encourage use of alternative fuel	Low
Increase alternative fuel consumption.	133.7% increase in FY 2020 alternative fuel consumption relative to FY 2005 baseline	Continue to encourage use of alternative fuel	Low
Acquire alternative fuel and electric vehicles.	71% of all fleet vehicles are Hybrid Electric Vehicles (HEVs), Flex Fuel, or use alternative fuel, such as E-85	Alternative fuel vehicles are always acquired when available and appropriate	Low
Clean & Renewable Energy			
Increase consumption of clean and renewable electric energy.	Clean and renewable electric energy consumed at TJNAF (including renewable energy credits [RECs] and bonuses) accounted for 50.6% of overall electricity consumption24.5% increase in clean and renewable electric energy relative to FY 2020	Continue to identify potential on-site renewable energy projects, such as a PV system, and purchasing RECs in the interim Continue to perform measurements and verification on existing on-site renewable systems to ensure maximum amount of on-site renewable electricity is captured	Low
Increase consumption of clean and renewable non-electric thermal energy.	48% of energy is nonelectric thermal usage16% increase in clean and renewable non-electric thermal energy relative to FY 2020	Continue to investigate cost-effective renewable energy opportunities, such as geothermal and solar thermal applications on new construction Continue to perform measurements and verification on existing on-site renewable systems to ensure maximum amount of non-electric thermal usage	Low

Sustainable Buildings			
Increase the number of owned buildings that are compliant with the Guiding Principles for Sustainable Buildings.	10% of TJNAF's buildings comply with the Guiding Principles 26.47% of GSF of facilities meet the Guiding Principles	Document and confirm compliance for newly constructed and renovated buildings Perform building assessments to determine potential opportunities for existing buildings to meet Guiding Principle requirements where cost effective	Medium
Acquisition & Procurement			
Promote sustainable acquisition and procurement to the maximum extent practicable, ensuring all sustainability clauses are included as appropriate.	100% of all applicable contracts contain sustainability clauses	Continue to seek opportunities to include sustainability clauses in contracts. Continue to purchase biobased materials when appropriate	Low
Efficiency & Conservation Measure Investments			
Implement life-cycle cost effective efficiency and conservation measures with appropriated funds and/or performance contracts.	Investigated the use of cost-effective options to improve energy performance. Identified a number of lighting upgrades across 24 buildings to improve energy performance. Engaged an energy services company (ESCO) to identify potential for energy savings performance contracts (ESPCs) at a site level for TJNAF	Continue to support the opportunity to award an ESPC to an ESCO to implement energy and conservation measures on TJNAF's campus. Investigate and implement cost-effective measures across TJNAF'S campus to comply with the Energy Act 2020 ECM mandate	Low

Electronic Stewardship & Data Centers			
<p>Electronics stewardship from acquisition, operations, to end of life.</p>	<p>97.4% of all eligible electronics purchases are environmentally sustainable. 2.9% increase relative to FY 2020.</p> <p>100% of all eligible monitors, laptops, and PCs actively use power management features</p> <p>100% of all eligible printers actively use duplex printing</p> <p>100% of electronics are reused or recycled</p>	<p>Continue to implement power saving and duplex printing across all eligible devices.</p> <p>Continue to recycle and dispose of electronics through certified recyclers.</p> <p>Continue to purchase environmentally sustainable electronics when possible</p>	<p>Low</p>
<p>Increase energy and water efficiency in high-performance computing and data centers.</p>	<p>Data Center PUE of 1.3</p>	<p>Continue to improve efficiency of power and cooling equipment in current and any future data center expansion projects</p>	<p>Low</p>
Adaptation & Resilience			
<p>Implement climate adaptation and resilience measures.</p>	<p>Last assessment completed in 2014; improvements to infrastructure and operations have significantly reduced risk of flooding and power outages in key facilities. Last assessment identified critical supply chain threats for deliveries of Nitrogen and Helium gases; TJNAF obtained additional suppliers to avoid this threat</p>	<p>Complete a Vulnerability Assessment and Resiliency Plan in conjunction with DOE VARP guidance in FY 2022. Identify opportunities to improve resiliency site-wide and integrate findings into future emergency response operations and infrastructure capital plans</p>	<p>Low</p>

Multiple Categories			
Reduce Scope 1 & 2 greenhouse gas emissions.	<p>77.6% reduction relative to FY 2008 baseline</p> <p>27.2% reduction relative to FY 2020</p>	Continue to identify opportunities to reduce facility energy consumption and non-fleet vehicle and equipment fuel consumption. Identify and implement opportunities to prevent and reduce fugitive emissions.	Low
Reduce Scope 3 greenhouse gas emissions.	<p>85.2% reduction relative to FY 2008 baseline</p> <p>19.9% reduction relative to FY 2020</p>	Develop a commuter assistance website to increase awareness and continue to promote alternative commuting options. Revamp sustainability awareness at a laboratory level through the use of a newly designed website and cross-departmental communication. Continue to utilize teleworking when applicable to decrease employee commute mileage and emissions.	Low

Energy Management

Performance Status

Energy Usage and Intensity

TJNAF annual energy-use intensity (EUI) was established in FY 2015 at a baseline of 89, 778.1 Btu/GSF for goal subject buildings. In FY 2021, EUI performance was measured at 76,434.7 Btu/GSF, which constitutes a 14.9% reduction from the FY 2015 baseline. Notably, however, the FY 2021 EUI does reflect a 10.5% increase from the FY 2020 EUI performance due to a minor ramp up of on-site staffing levels and activity compared to the previous fiscal year. As on-site staffing levels continue to increase and accelerator runtime increases, achievement of any significant reduction in energy intensity remains one of TJNAF's most challenging sustainability goals.

Metering Status

TJNAF currently has 85.4% of all relevant assets at least partially metered for electricity, natural gas, and potable water with plans to convert additional relevant assets to partially or fully metered within the next five years. To meet the requirements set forth by the Energy Act of 2020, TJNAF has plans to meter all federally owned buildings that have electricity and/or potable water in FY 2022.

EISA Section 432 Benchmarking and Evaluations

In FY 2020, TJNAF performed desk audits on all covered facilities because of limited on-site operations due to COVID-19. In FY 2021, TJNAF began a new reporting cycle and performed walk-throughs of several covered facilities in preparation for more in-depth energy audits expected to take place in FY 2022. Benchmarking of covered facilities in Energy Star's Portfolio Manager was started in FY 2021 with completion projected by the end of TJNAF's current 4-year cycle. In the interim, covered facilities not currently in Portfolio Manager are being benchmarked internally using a combination of utility bills, metered data, and an in-house energy dashboard.

Plans and Projected Performance

Facility Acquisitions

TJNAF has a Science Lab Infrastructure (SLI) funded project which will impact the infrastructure portfolio. The CEBAF Renovation and Expansion (CRE) project includes the following scope:

- Elimination of three leased facilities: Support Service Center (34,739 SF), Facilities Maintenance Shop (2,904 SF), and Applied Research Center (11,097 SF)
- Renovation of CEBAF Center (127,511 SF) and construction of a moderate expansion (22,000 SF)
- Acquisition and renovation of the Applied Research Center (121,241 SF)

In FY 2022, TJNAF will acquire the Applied Research Center, which will increase the goal subject energy consumption and, ultimately, affect the EUI score. Renovations of the Applied Research Center will be complete by FY 2024 and CEBAF Center by FY 2026. Both buildings will meet the High Performance Sustainable Building Guiding Principles.

Within the next five to ten years, TJNAF plans to construct a new High Performance Data Facility. The facility is expected to be approximately 90,000 SF of office and high performance computing space. TJNAF expects this project to substantially increase the electricity and water consumption on-site. While the new facility will be considered excluded, TJNAF will seek opportunities for energy efficiency as well as opportunities for on-site renewables to reduce overall energy consumption and reduce the EUI.

Energy Saving Performance Contracts (ESPCs)

In FY 2021, TJNAF began investigating opportunities to perform energy conservation measures (ECMs) that are funded through ESPCs. At least one ESPC is expected to be in place by the end of FY 2022 to meet requirements set forth in the Energy Act of 2020. TJNAF will perform measurement and verification on all implemented projects.

Non-Fleet Vehicles and Equipment (V&E)

In FY 2021, TJNAF's consumption of diesel fuel for V&Es increased. In FY 2022, TJNAF plans to investigate opportunities to reduce reliance on diesel fuel for V&Es where cost-effective.

Water Management

Performance Status

TJNAF has an extensive inventory of water meters which are closely monitored and used for monthly reporting and utility billing purposes. FY 2021 potable water consumption decreased by approximately 24.1 million gallons (or 32.6%) from FY 2020. TJNAF's GSF increased by 179,461 SF from the FY 2007 baseline. This increase in square-footage along with the reduction in potable water gave TJNAF a water-usage intensity (WUI) of 52.5, which represents a 17.8% reduction from the FY 2007 baseline.

In FY 2021, the accelerator underwent an extensive period of downtime to perform scheduled maintenance. During this period, potable water consumption significantly decreased due the reduced need for evaporative cooling. However, as normal accelerator operations resume, achievement of any significant reduction in water intensity remains one of the most significant challenges for TJNAF sustainability goals.

Multiple water reduction and alternative water source strategies have been evaluated during the past several years. One identified strategy was successfully completed in FY 2019. The project reduced potable water consumption by 4.9 million gallons in FY 2021 by using ultra-pure water (UPW) waste which was previously discharged from the Test Lab building to sanitation and diverting this to a nearby cooling tower for use as a make-up water supply source.

Plans and Projected Performance

In FY 2021, TJNAF received \$3.9 million to implement another alternative water source strategy. The project captures storm water for treatment and reuse in cooling towers. This project will reduce potable water consumption by approximately 50 million gallons annually and enhance infrastructure resiliency. Design is scheduled for FY 2022 with estimated construction completion in FY 2023.

Waste Management

Performance Status

TJNAF aggressively recycles non-hazardous solid waste. Of the 283.4 tons of non-hazardous solid waste produced in FY 2021, approximately 75% (211.6 tons) of building and office waste, paper and metal were recycled and/or diverted from landfill deposit. Although TJNAF produced more waste in FY 2021 than in FY 2020, approximately 5% more of the waste was diverted from landfills in FY 2021. Verification of recycled material quantities is reported by the recycling service center and recorded by TJNAF.

Construction activity at TJNAF in FY 2021 produced approximately 9.5 tons of construction and demolition materials and debris. 100% of the waste was recycled/diverted from landfill deposit, which is a 16.5% increase in diverted and recycled construction and demolition materials from FY 2020.

Plans and Projected Performance

Overall municipal solid waste is expected to increase with the acquisition of the Applied Research Center. Construction and demolition materials debris is also projected to increase over the next several fiscal years relative to FY 2021 as significant major renovation and construction activities are conducted. TJNAF will continue existing processes to recycle non-hazardous waste to continue to exceed the 50% waste diversion from landfill goal. Further, TJNAF will seek to participate in a waste-to-energy program.

Fleet Management

Performance Status

TJNAF annual petroleum consumption decreased to 645 gallons in FY 2020, approximately 85% below the FY 2005 baseline. From FY 2019 to FY 2020, TJNAF reduced annual petroleum consumption by 872 gallons, which is approximately 51%. Annual alternative fuel consumption increased by approximately 134% relative to the FY 2005 baseline as the Laboratory continued to make use of 1,262 gallons of E-85 fuel. In FY 2020, TJNAF increased annual alternative fuel consumption by 157 gallons relative to FY 2019, which is an approximately 29% increase in alternative fuel.

TJNAF conducts annual reviews and comparisons of the Laboratory needs and vehicles available for lease through GSA. In FY 2021, the fleet inventory remained unchanged. Approximately 71% of the TJNAF leased fleet are low GHG vehicles, consisting of Hybrid Electric Vehicles (HEVs), Flex Fuel vehicles, or alternative fuel vehicles, and agency vehicles are predominately electric vehicles. Industrial fleet vehicles operate on diesel, propane or electric. Alternative fuel vehicles (AFVs) are being extensively used with the exception of some diesel heavy duty trucks that meet the load capabilities required for operations.

Plans and Projected Performance

TJNAF has no major initiatives or changes to missions relating to this category. Passenger fleet inventory remains well managed and is limited to only what is necessary. As vehicles are scheduled for replacement, existing vehicles are replaced with AFVs, zero emission or hybrids whenever appropriate. TJNAF will continue to investigate opportunities for electric vehicles, which meet medium duty truck needs and industrial fleet vehicles which consume diesel will be replaced by biodiesel capable vehicles when the cost of repairs exceeds the long-term value of replacement. On-site electric vehicle charging stations will continue to be evaluated and discussed for budget and infrastructure planning.

Clean & Renewable Energy

Performance Status

TJNAF invests and implements clean and renewable energy technologies. Several existing facilities utilize geothermal heat pump systems (GTHP) which produce and consume approximately 15,333 MMBTU/Yr of thermal energy. In FY 2021, TJNAF performed measurement and verification on the GTHP systems and discovered that the systems were producing and consuming 10,027 more MMBTUs/Yr than reported in FY 2020. Additionally, approximately 51% of TJNAF total electric energy (114,588 MWh's) consumption in FY 2021 was accounted for with renewable energy through the purchase of an equivalent amount (35,125 MWh's) of renewable energy certificates and the on-site renewable energy bonus for the geothermal heat pump systems.

In FY 2021, it was discovered that TJNAF did not receive credit for the on-site renewable energy produced and consumed by the GTHP systems. This correction in the Sustainability Dashboard increased TJNAF's renewable electricity to approximately 26% of total agency electric consumption. Therefore, TJNAF increased renewable energy use by approximately 25% relative to FY 2020.

Plans and Projected Performance

TJNAF will continue to comply with the renewable energy requirements for interim goal years and the 30% by FY 2025 goal by implementing renewable electric energy generation projects and/or purchasing renewable energy certificates equivalent to the goal levels. Expanded opportunities for solar are being considered with an alternate location currently under consideration which would be capable of supporting a 3-4 MW photovoltaic array. In addition to making progress towards federal renewable goals, TJNAF would benefit from increased energy resiliency and security by utilizing photovoltaic technology to produce electricity.

Sustainable Buildings

Performance Status

TJNAF currently has two facilities (10% by building count; 26.47% by gross square feet) which are documented as fully compliant with High Performance Sustainable Building (HPSB) Guiding Principles.

In FY17, construction of a new office and laboratory facility (Environmental, Safety, & Health Building) was completed and occupied. This 12,000 GSF building was designed to comply with all HPSB Guiding Principles. Energy and water efficient sustainable features include LED lighting, solar tube daylight harvesting, and a highly efficient variable refrigerant flow (VRF) system for heating and cooling. This building was designed and constructed to consume 35.4% less energy than the ASHRAE 90.1 - 2007 baseline which exceeds the HPSB requirements of 30%. In FY 2021, TJNAF began to evaluate the ES&H Building to officially record its compliance with the HPSB requirements. In FY 2022, TJNAF will complete this evaluation.

Plans and Projected Performance

In the next five years, FY 2022 to FY 2027, TJNAF plans to complete renovations on the Applied Research Center and CEBAF Center that will result in both facilities complying with the HPSB Guiding Principles. TJNAF plans to perform evaluations on several recently renovated buildings to determine their compliance with the HPSB requirements that were delayed due to limited on-site operations during the COVID-19 pandemic. In total, TJNAF plans to increase the current building count of HPSBs from two to six by FY 2027. This increase in sustainable buildings will increase the building count percentage from 10% to 30%, allowing TJNAF to meet and exceed the HPSB goal.

Acquisition & Procurement

Performance Status

TJNAF actively promotes sustainable acquisition and procurement to the maximum extent possible. FAR clauses regarding sustainability are included in 100% of appropriate acquisition contracts. The Laboratory strives to purchase parts and services that comply with GreenBuy standards and TJNAF has been awarded the Gold Level GreenBuy Award by the Department of Energy for the fourth consecutive year, which made TJNAF one of two sites to receive the Prime Award. By conducting regular and consistent staff education courses, posting awareness notices, and identifying vendors and products that are environmentally friendly, TJNAF was able to exceed DOE requirements in FY 2021.

TJNAF does report all sustainable acquisition contracts to the DOE site office for reporting in the Federal Procurement Data System (FPDS). TJNAF also uses the Sustainable Acquisition Contracts workbook provided by the Sustainability Dashboard to maintain an internal record of all sustainable acquisition contracts and their costs. TJNAF does not report biobased data to the System for Award Management (SAM) because the contract that biobased products are purchased under predates the SAM system.

Plans and Projected Performance

In the upcoming fiscal years, TJNAF will maintain current procurement strategies to comply with GreenBuy standards to achieve additional Gold Level GreenBuy Awards and DOE recognition.

In upcoming fiscal years, TJNAF believes that it would be beneficial to all employees involved in the sustainable acquisition process to receive more detailed guidance and training on the various clauses included in sustainable acquisition contract reporting process. In the upcoming fiscal years, TJNAF also has plans to review all clauses currently being reported in the FPDS to ensure that all sustainable contracts and their costs are accurately being reported. In the future, TJNAF believes that it would be beneficial to integrate the Sustainable Acquisition Contracts and Biobased Products Workbooks into the Sustainability Dashboard to increase reporting accuracy and increase data accessibility.

Efficiency & Conservation Measure Investments

Performance Status

TJNAF has invested significantly for many years in achievement or progress regarding various sustainability goals. Participation in an ongoing demand response program primarily provides funding for a site-wide metering system, which TJNAF has implemented in accordance with the Energy Act of 2020 metering requirements. Additional potential enhancements to the system and opportunities for on-site photovoltaic systems are currently being evaluated, which the demand response program will assist in funding. All new construction and renovation projects include sustainability features designed to continually progress all applicable facilities to achieve compliance with the HPSB Guiding Principles.

In FY 2021, TJNAF was awarded \$3.9 million from DOE to design and implement a water reuse project in conjunction with the City of Newport News. This project will complete construction in FY 2023. The water reuse project is expected to reduce TJNAF's potable water consumption by approximately 50 million gallons.

In FY 2021, TJNAF began to investigate opportunities for UESCs to complete at least half of all life cycle cost effective ECMs as required by the Energy Act of 2020. In FY 2021, TJNAF focused on analyzing their ECM pipeline to determine what ECMs have already been completed, identify any new opportunities, and record newly identified ECMs that are expected to be completed by the Energy Act of 2020 deadline. TJNAF fully expects to meet the SPD ECM snapshot deadline in January 2022.

Plans and Projected Performance

In the upcoming fiscal years, TJNAF is seeking to incorporate UESCs site-wide to identify and complete ECMs. Any ECMs completed at TJNAF funded by a UESC will undergo the proper measurement and verification procedure. In FY 22, TJNAF plans to complete lighting upgrade ECMs identified in FY 21 as well as identify additional water and energy conservation measures site-wide. From FY 22 to FY 24, TJNAF plans to complete their remaining energy and water evaluations as required by EISA 432.

In the upcoming fiscal years, TJNAF plans to train and certify two facility energy managers. As a part of TJNAF's mission to ensure quality performance, TJNAF plans to evaluate the prospective managers on the FBPTA core competencies and identify any competencies that need improvement. Any competencies that require improvement will be included in employee yearly performance goals and addressed with additional on-the-job training or supplemental education as required.

Travel & Commute

Performance Status

Business Travel Strategies

Specific initiatives have not been established to reduce ground or air travel for the purpose of reducing scope 3 GHG emissions. However, corporate travel policy does encourage efficiency in business travel. Business travel may be undertaken only when alternative methods, such as videoconferencing, are not available. To assist in this effort, most conference rooms at TJNAF are equipped with video and collaboration equipment.

Due to the increased availability of videoconferencing during the COVID-19 pandemic, TJNAF reduced overall air travel by approximately 1.5 million miles. This reduction led to a substantial decrease in scope 3 GHG emissions caused by air travel resulting in an approximately 92% decrease relative to FY 2020 and an approximately 97% decrease relative to the FY 2008 baseline. TJNAF also reduced overall ground travel due to the COVID-19 pandemic and the increased availability of teleconferencing. In FY 2021, TJNAF reduced ground travel by 71,440 miles resulting in a scope 3 GHG emission reduction of approximately 91% relative to FY 2020 and 98% relative to the FY 2008 baseline.

Commute Strategies

Staff commuting emissions remain the largest controllable contributor to scope 3 GHG emissions. Current estimates for employee commuting GHG emissions is relatively low at only 499.8 mtCO₂e. This is a reduction of approximately 42% relative to FY 2020 and approximately 64% relative to the FY 08 baseline. The figure takes into account the limited presence of staff on-site since April 2020 due to the COVID-19 pandemic. Due to limited participation in voluntary surveys, commuter data is obtained by validation of employee home address zip code and periodic field observations.

Since limited public transportation alternatives are available in the area, achieving reduction goals primarily relies upon implementation of a successful staff commuting emissions reduction program. The following steps have been taken as part of this effort:

- Since FY 2013, preferred parking spaces around the site have been strategically designated for carpooling and low emission vehicles
- In FY 2019, an alternate work schedule (AWS) policy was implemented. JSA now offers a 4/10 schedule and a 9/80 schedule as options to a standard workweek. These options reduce the total number of days driven to and from work by the workforce.
- Communication tools such as newsletters, Earth Day events, and EMS objectives encourage TJNAF personnel to improve commuting habits and use alternatives to single-passenger vehicles.
- In FY 2020, TJNAF implemented remote working to continue mission critical operations despite the COVID-19 pandemic. This practice remained in place throughout FY 2021.

Plans and Projected Performance

Efforts will continue to educate employees about their carbon footprint and maintain results that meet or exceed requirements in this category. The following efficiency measures will be undertaken:

- In FY 2022, JSA plans to approve an official remote working policy, which will continue to contribute towards scope 3 GHG reduction goals.
- Investigate options for the installation of electric vehicle charging stations for fleet and workplace reimbursable charging.
- Encourage TJNAF participation in regional transportation planning, recognition of existing community transportation infrastructure, or incorporation of such efforts into site policy and guidance documents.
- Redesigning the existing TJNAF Sustainability Website to encourage employee participation in commuter surveys and on-site initiatives to reduce their carbon footprint. The website is expected to launch by FY 2023.

Fugitives & Refrigerants

Performance Status

A variety of activities and operations at TJNAF use greenhouse gases for different purposes. The majority of fugitive GHG emissions in FY 2021 were due to refrigerant leaks or other corrective maintenance in facility HVAC system equipment. TJNAF reported usage of 144 lbs of R-22, 312 lbs of R-422B, 18 lbs of R-410A, and 100 lbs of R-134a. However, these emissions are still minimal and represent a significant reduction of approximately 67% relative to the FY 2008 baseline.

Sulfur hexafluoride (SF6) is used at TJNAF in several facilities to suppress arcing in high-voltage DC electron sources. Pressures in these systems are closely monitored and preventative maintenance tasks are conducted to mitigate the risk of leakage or an unexpected release. Inventory is closely monitored and controlled. In FY 2021, TJNAF experienced a loss of 16.6 lbs of SF6. To replenish some of this loss and continue to perform mission critical operations requiring SF6, TJNAF purchased an additional 115 lbs of SF6. The additional bottle of SF6 increased the total SF6 inventory to 483 lbs. TJNAF will continue to closely monitor and control inventory as well as perform preventative maintenance to prevent a loss of this magnitude in the future.

When high voltage systems need to be opened for maintenance, two methods of capture and storage are used. The Low Energy Recirculator Facility (LERF) utilizes a custom built recovery system, which earned an environmental excellence award from the Commonwealth of Virginia in 2011. The system includes a remote cesiator – a purification and dehydration component. As a result, the gas is not only safely captured, but it can be conserved and reused rather than being replaced by new product. The second method of capture utilizes newer DILO mini series mobile service carts.

Plans and Projected Performance

In upcoming fiscal years, TJNAF has no major initiatives or changes to mission relating to this category. TJNAF plans to continue existing practices to achieve results that meet or exceed requirements.

Electronics Stewardships & Data Centers

Performance Status

Acquisition Strategies

TJNAF purchase requisition and approval processes ensure that eligible electronics procurements are environmentally sustainable whenever possible. In FY 2021, approximately 97.4% of eligible products were compliant with EPEAT (bronze, silver, or gold) registration requirements. This was

Operations Strategies

TJNAF utilizes a central power management system for 100% of desktop computers, laptops, and monitors that can hibernate without impacting Laboratory mission operations. Printing operations are also managed for maximum efficiency. Default queue settings for printers are set for duplex printing in black and white. Users must explicitly select simplex or color printing. Additionally, power management settings on printers and copiers are set to sleep mode when idle for a prescribed time period.

End of Life Strategies

Property Management standard procedures ensure that 100% of all excess ADP equipment is screened for first screened for potential reuse whenever possible. When reuse is not possible, however, 100% of disposals are sent to an accredited recycle organization.

Data Center Strategies

In FY 2017, TJNAF completed a major data center consolidation and renovation project that included a significant central chiller plant upgrade and continuous power usage effectiveness (PUE) monitoring energy dashboard. This project included consolidation of a tier III data center operating at a PUE of 2.44 and renovation and reconfiguration of a tier I data center operating at a PUE of 1.70. As a result of the combined high performance and core computing data centers, a new average PUE of 1.30 was achieved. Data center operational efficiency achievements were recognized in FY 2018 with a Federal Energy and Water Management Award in the data center category. In FY 2021, the TJNAF data center maintained the average PUE of 1.3.

Plans and Projected Performance

In FY 2022, an additional row of hot aisle containment is expected to be constructed in the data center to support expansion of scientific computing equipment. Additionally, TJNAF has developed a vision for an advanced computational facility to accelerate scientific discovery across DOE Office of Science programs by providing large-scale high-performance computing that brings parity between simulated, experimental, and observational data to accelerate and maximize scientific insight. This facility will provide services to Office of Science programs that enable interdisciplinary teams of scientists to attack fundamental problems in science

and engineering that require nimble shared access to large data sets, often aggregated from multiple sources. As a projected HEMSF, this new facility will significantly impact energy and water utilization intensity figures.

Adaptation & Resilience

Performance Status

Resilience Strategies

TJNAF is committed to the development of a resilient and secure energy program. In FY 2015, TJNAF performed a Climate Vulnerability Screening to identify potential climate risks to critical operations on-site. In FY 2021, TJNAF used this preliminary report as the basis for the site's Vulnerability Assessment and Resilience Plan (VARP) discussions. In FY 2022, TJNAF plans to create a multi-divisional team to complete the VARP document by the September 30, 2022 deadline. As a part of the VARP process, TJNAF plans to use key tools provided by SPD including but not limited to: FEMP's Technical Resilience Navigator, the National Climate Assessment, and the U.S. Climate Resilience Toolkit. TJNAF has performed a preliminary review of these resources and they appear to be effective tools for creating a comprehensive VARP document.

Primarily, site flooding from coastal hurricanes and major rain events represent the most significant forms of climate impact to the TJNAF site. Although located in the coastal mid-Atlantic/Hampton roads area, the site elevation (34 feet above mean sea level) is favorable. Therefore, rising sea levels represent a minimal direct threat to TJNAF. Damage mitigation strategies, such as tunnel ramp flood gates, have already been implemented and other storm water related infrastructure improvements are currently under consideration.

Coronavirus Pandemic

Site operations at TJNAF have been negatively impacted by the coronavirus pandemic. On March 17, 2020, TJNAF entered Medical Condition (MEDCON) Level 5 and the majority of staff were immediately transitioned to remote working conditions. On March 23, 2020, the Commonwealth of Virginia issued Executive Order 53 which called for a closure of non-essential businesses and TJNAF entered MEDCON 6 and subsequently initiated a controlled shutdown of accelerator operations which lasted until June 8, 2020 when TJNAF downgraded back to MEDCON 5. On June 7, 2021, TJNAF downgraded again to MEDCON 4, which remains the current status. During MEDCON 4, TJNAF continues to maximize teleworking while opening the campus to additional employees and users critical to the experimental run schedule, other priority projects that require on-site presence, and activities essential to our collaborative mission.

In response to the pandemic, TJNAF developed and is following a Resumption of On-Site Operations Plan. This plan describes additional hazard controls necessary to conduct on-site operations, due to the risk of COVID-19 infection. This plan supplements the TJNAF Worker Pandemic Protection and Response Plan of March 13, 2017. This supplemental plan is necessary to address the unique nature of hazards associated to COVID-19 and the expectation that an elevated health risk may continue for an extended period. Both the TJNAF Worker Pandemic Protection and Response Plan and this supplementary plan are components of the TJNAF Worker Safety and Health Program.

Plans and Projected Performance

TJNAF continues to advance several resilience-related infrastructure projects. The storm water reuse project is currently integrated into the Lab's Campus Plan and capital investment strategy, which will provide 50 million gallons of water from a nearby storm water pond source. Construction will be completed by FY 2023. A separate project to provide a 3-4 MW photovoltaic and battery storage system has been identified and funding is currently being pursued. Lastly, a project to provide 18 MW of natural gas turbine generators to the accelerator site and an additional 6 MW on the campus is under consideration.

TJNAF will continue to follow the Resumption of On-Site Operations Plan in FY 2022 and will incorporate any additional lessons learned regarding pandemic response into future resilience strategies.