Jefferson Lab 2013
Site Sustainability Plan

Jefferson Lab
Sustainability Matters

Technology Engineering and Development Building LEED Gold

Jefferson Lab
Thomas Jefferson National Accelerator Facility

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List of Acronyms

AFV – Alternative Fuel Vehicle
BTUs / GSF – British Thermal Units per Gross Square Foot
CEDR – Comprehensive Energy Data Report
ECM – Energy Conservation Measure
eGRID – "Emissions & Generation Resources Integrated Database" (EPA, EIA, FERC data)
EUI – Energy Utilization Intensity
FAR – Federal Acquisition Regulation
FIMS –Facilities Information Management Systems
GeV – Billion Electron Volts
GHG – Greenhouse Gas
HEMSF – High Energy Mission Specific Facility
HPSB – High Performance Sustainable Buildings
HVAC – Heating, Ventilation and Air Conditioning
Kwh – Kilo Watt Hour
LEED – Leadership in Energy and Environmental Design
MGal – Million Gallons
MTCO2e – Metric Ton CO2 equivalent
Mwh – Mega watt hour
PPA – Power Purchase Agreement
RPS – Renewable Portfolio Standard
SF6 – Sulfur Hexafluoride
STT – Sustainability Transformation Team
TEDF – Technology Engineering and Development Facility
T&D - Transmission and Distribution

Site Sustainability Plan

1 Executive Summary

The Thomas Jefferson National Accelerator Facility (Jefferson Lab), a nuclear physics user facility, provides unique capabilities for the study of nuclear physics. Jefferson Lab maintains core competencies in Nuclear Physics, Accelerator Science, Applied Nuclear Science and Technology, and Large Scale User Facilities / Advanced Instrumentation to support not only its own research program, but broader Office of Science missions as part of the Department of Energy (DOE) laboratory system, applying these technologies in the national interest.

Jefferson Lab has achieved significant progress and remains on target to meet or exceed the set of diverse sustainability goals regarding Energy Utilization Intensity reduction, Renewable Energy, Scope 1 Greenhouse Gas (GHG) emissions (Fugitive and Fleet Petroleum management), and High Performance Sustainable Building (HPSB) Guiding Principle compliance for existing facilities. Strategies have been identified and are under development to achieve both Water Intensity and Scope 2 and 3 GHG reduction goals, and the Data Center Power Utilization Effectiveness (PUE) target defined in the DOE Strategic Sustainability Performance Plan (SSPP).

Jefferson Lab's new Technology Engineering and Development (TED) Building, a 70,000 Sq Ft office and laboratory complex was completed in FY 2012. The TED Building includes a diverse set of sustainability features designed for energy and water consumption efficiency, and a clean productive work environment for occupants and visitors. The TED Building has subsequently obtained USGBC LEED Gold certification, and represents Jefferson Lab's initial project to comply with the High Performance Sustainable Building Guiding Principles goal.

TED Building

As a High Energy Mission Specific Facility (HEMSF), Jefferson Lab is currently engaged in significant expansion of scientific and support facilities, which will result in significantly increased electrical and thermal energy requirements. Consequently, achievement of the SSPP Scope 2 emission reduction target (purchased electricity) represents a significant challenge for Jefferson Lab.

Jefferson Lab is currently upgrading its accelerator from 6 GeV to 12 GeV to realize a significant expansion of its scientific program. Electricity requirements and related power costs for 12 GeV operations starting around 2014 are projected to double from the FY 2008 baseline.

Major reduction of Scope 2 GHG emissions from purchased electricity requires implementation of a combined set of strategies, including:

- Alternative Financing (ie: UESC / PPA) of HEMSF energy demand reduction and renewable on-site generation projects

- Electric Utility Renewable Portfolio Standard Achievement of Reduced GHG emissions per Mwh of electric generation

- Renewable Energy Credits and / or Green Power Purchasing Agreement

Jefferson Lab's most significant HEMSF support facility is an existing 95K Sq Ft Test Lab. This facility is undergoing a major renovation and expansion designed to achieve LEED Gold certification. The Test Lab project illustrates the efficiency improvements required to reduce Scope 2 GHG emissions. Other HEMSF and support facility Energy Conservation Measures (ECMs) and accelerator and cryogenic based efficiency improvements have been identified to achieve the 28% Scope 2 reduction goal.

Further, as the Jefferson Lab scientific mission continues to expand, thermal energy (cooling tower water) requirements for accelerator operations are projected to significantly increase. Similar to projected electricity increases from 12 GeV operations, Jefferson Lab's water requirements are estimated to double in amount from the FY 2007 baseline of 50 MGal. Approximately 75% of Jefferson Lab's annual consumption of potable water is primarily consumed in cooling tower operations (evaporation/blow down).

Multiple alternative water reduction strategies are under development. An independent consulting firm and water assessment team from Pacific Northwestern National Laboratory (PNNL) conducted on-site water consumption analysis surveys in FY 2012. The PNNL's final report is due for submission by 2012 year end. Recommendations are expected to focus on various water capture and reuse strategies (i.e. process water discharge harvesting, stormwater and condensation water capture) and treatment of the reuse water stream for satisfying cooling tower thermal energy requirements. Further, additional groundwater removal from shallow on-site wells may be required to achieve the significant 26% water intensity reduction goal.

Table 1 summarizes Jefferson Lab's current performance status, planned actions and risk of non-attainment (High / Medium / Low). The "Performance Review and Narrative" section of this document provides both narrative detail and data to support the Table 1 summary and Jefferson Lab's progress regarding all SSPP goals.

Table 1 - DOE Goal Summary Table

SC/SSPP /OMB Goal		DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-attainment
Goal #1		**28% Scope 1 & 2 GHG Reduction by FY 2010 from a FY 2008 baseline**	**Scope 1 GHG:** FY '08 2,996 MTCO2e FY '12 3,063 MTCO2e **Scope 2 GHG:** FY '08 64,708 MTCO2e FY '12 64,044 MTCO2e **Scope 1&2 = 0.9% decrease** vs. FY '08	**Scope 1** maintain successful fugitive and vehicle emission reduction practices **Scope 2** (electricity) requires multiple supply & demand strategies to achieve reduction targets	H
	1.1	Energy Intensity Reduction 30% by FY 2015 from FY 2003 baseline	Energy Intensity Utilization (EIU) reduction 26.4% to date vs. FY '03 baseline	Existing building ECMs identified to reduce EIU and low BTU / Sq Ft new construction projects on line prior to FY '15	L
	1.2	7.5% of annual electricity consumption from renewable sources by FY 2013 and thereafter (5% FY 2010 – 2012)	Purchased Renewable Energy Credit (RECs) certificates in FY ' 12 equal to 6.8% of total Mwh electric consumption vs 5% goal.	Purchase RECs in FY '13 and beyond equal to 7.5% of total electric consumption and evaluate on-site renewable energy generation	L
	1.3	SF6 Reduction	SF6 capture program implemented, capturing approximately 900K MTC02e since installed in 1999.	Continue established SF6 capture best practices.	L
	1.4	Individual buildings metering for 90% of electricity (by October 1, 2012); for 90% of steam, natural gas, and chilled water (recommended) (by October 1, 2015.)	Completed installation of Advanced Metering System for all individual building level and processes for electric, natural gas, and water.	Metering goal achieved, additional metering to be installed for new construction and future renovation projects as appropriate.	L
	1.5	Cool roofs, unless uneconomical, for roof replacements unless project already has CD-2 approval. New roofs must have thermal resistance of at least R-30.	Approximately 52% (295K Sq Ft) of total applicable site roof area (568K Sq Ft) comply with cool roof requirements to date.	Additional 114,601 Sq Ft of cool roof upgrade scheduled in FY '13. All new roofs / replacements will comply as completed.	L
	1.6	Training	Completed Certified Energy Auditor (CEA) training and certification in FY '12. Attended multiple FEMP and industry sponsored web training sessions.	Continue active participation in FEMP sponsored training and AEE, USGBC, ASHRAE energy / sustainability programs.	L
	1.7	Net Zero energy in new or major renovation facilities	Current new construction and or major renovation projects not cost effective to achieve net zero energy	Comply with EO 13514 requiring buildings entering the design process in 2020 are designed to achieve net zero energy by 2030	H

Table 1 (cont'd) - DOE Goal Summary Table

SC/SSPP /OMB Goal		DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-attainment
	1.8	Evaluate 25% of 75% of Facility Energy Use over 4-Year Cycle	Completed 100% energy audits: 4 year cycle ending June 2012.	100% of covered facilities scheduled to audit in new 4 year cycle	L
	1.9	13% Scope 3 GHG reduction by FY 2020 from a FY 2008 baseline	Scope 3 GHG = +7% increase vs FY '08 primarily from staff commuting	Implement a combined telework, alternative work schedule and carpool program in first half of FY '13.	M
Goal #2		**Buildings HPSB, ESPC Initiative, Regional and Local Planning**			
	2.1 a	15% of existing buildings greater than 5,000 gross square feet (gsf) are compliant with Guiding Principles (GPs) for HPSB by 2015.	Achieved initial HPSB GP compliant facility in FY '12. New LEED Gold certified building.	Existing building renovations, due for completion prior to 2015 end are designed to achieve 15% HPSB GP compliance.	L
	2.1 b	All new construction, major renovations, and alterations of buildings greater than 5,000 gsf must comply with GPs	Major renovation project designed to LEED Gold criteria due for completion, USGBC certification and compliance with HPSB GPs prior to 2015 end.	Design all new construction and major renovation projects to comply with HPSB GP Guidance.	L
	2.2	ESPC Initiative	Utility Energy Services Contract (UESC) program and projects under development to comply with President's performance contracting initiative.	Complete contract negotiation with local utility and implement initial task order in FY '13.	L
Goal #3		**Fleet Management**			
	3.1	10% annual increase in fleet alternative fuel consumption by FY 2015 relative to a FY 2005 baseline	Fleet annual alternative fuel consumption (E-85) increased to 2,612 (GEG) in FY '12, approximately 384% above the FY 2005 baseline, exceeding the 10% annual goal.	Continue to utilize alternative fuel as the primary source for site vehicles and equipment.	L
	3.2	2% annual reduction in fleet petroleum consumption by FY 2020 relative to a FY 2005 baseline	Fleet annual petroleum consumption decreased to 3,029 gallons in FY '12, approximately 30% below the FY 2005 baseline, exceeding the 2% annual reduction goal.	Continue to increase alternative fuels and reduce fleet petroleum consumption.	L

Table 1 (cont'd) - DOE Goal Summary Table

SC/SSPP /OMB Goal		DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-attainment
	3.3	100% of light duty vehicle purchases must consist of alternative fuel vehicles (AFV) by FY 2015 and thereafter (75% FTY2000 – 2015)	Light Duty Fleet = 11 Vehicles Light Duty AFV = 11 vehicles 100% of Light Duty Fleet AFV	Jefferson Lab has achieved the FY 2015 goal of 100% Light Duty AFV goal.	L
	3.4	Reduce fleet inventory by 35% by FY 2013 relative to a FY 2005 baseline	Fleet reduction through FY 12 = 16% (FY '05 baseline / 30 vehicles, FY '12 Inventory / 25 vehicles).	Jefferson lab will achieve the 35% reduction goal through reduction of 6 additional vehicles. 3 vehicles in FY '13 and 3 additional vehicles in FY '14	L
Goal #4		**Water Use Efficiency and Management**			
	4.1	26% water intensity reduction by FY 2020 from a FY 2007 baseline	Water intensity (Gallons / GSF) decreased by approximately 19% in FY '12 vs the FY 2007 baseline. FY '07 (63.8 Gallons / GSF) vs FY '12 (51.2 Gallons /GSF).	Water consumption, and subsequent water intensity is estimated to increase significantly due to 12 GeV upgrade requirements. Multiple water reuse and source strategies are under evaluation.	M
	4.2	20% water consumption reduction of industrial, landscaping, and agricultural (ILA) water by FY 2020 from a FY 2010 baseline	N/A, non-potable water sources not used.		L
Goal #5		**Pollution Prevention and Waste Reduction**			
	5.1	Divert at least 50% of non-hazardous solid waste, excluding construction and demolition debris, by FY 2015	Annual non-hazardous solid waste diverted from landfill / recycled = 96.4%.	Continue current best practices that exceed the 50% diversion goal.	L
	5.2	Divert at least 50% of construction and demolition materials and debris by FY 2015	Annual construction materials diverted from landfill / recycled = 85.1%	Continue current best practices that exceed the 50% diversion goal.	L
Goal #6	6.1	**Sustainable Acquisition**			
		Procurements meet sustainability requirements and include sustainable acquisition clause (95% each year)	FAR clauses regarding sustainability included in all appropriate acquisition contracts	Continue current best practices that achieve 95% goal. Implement measurement procedures in FY '13 to assure annual 95% compliance	L

Table 1 (cont'd) - DOE Goal Summary Table

SC/SSPP /OMB Goal		DOE Goal	Performance Status	Planned Actions & Contribution	Risk of Non-attainment
Goal #7		**Electronic Stewardship and Data Centers**			
	7.1	All data centers are metered to measure a monthly PUE (100% by FY 2015)	Primary data center is metered to measure electrical consumption	Expand metering system to include additional measurement of data center HVAC system	L
	7.2	Maximum annual weighted average Power Utilization Effectiveness (PUE) of 1.4 by FY 2015	Current calculated weighted average PUE value for two data centers = 2.29	Developing data center strategies to reduce cooling energy and improve PUE. Planning UESC program to fund data center efficiency projects	M
	7.3	Electronic Stewardship - 100% of eligible PCs, laptops, and monitors with power management actively implemented and in use by FY 2012	Power management system actively manages 100% of PC's and monitor hibernation mode	Continue current practices that achieve the power management goal	L

2 Performance Review and Plan Narrative

<u>Goal #1</u> / 28% Scope 1 & 2 GHG Reduction by FY 2010 From a FY 2008 Baseline

1.1 Performance Status

Scope 1 emissions to date have increased slightly from FY 2008 (1.8%) due primarily to a new facility and construction activities in FY '12. Fugitive and Fleet Petroleum emissions have decreased in FY '12 compared to FY '08 from improved refrigerant capture rates and increased alternative fuel (E-85) consumption. Scope 2 emissions are approximately the same as FY '08, contributing to a combined Scope 1 & 2 decrease of approximately 1% again compared to the FY '08 baseline.

1.2 Plans, Actions and Projected Performance

<u>Scope 1</u>
As indicated in Table 2, Scope 1 GHG emissions have a minimal impact on Jefferson Lab's total GHG emission content. A successful SF6 capture program will continue to minimize fugitive emissions, energy efficiency strategies will limit natural gas emissions from building heating systems, and increased alternative fuel use will maintain Jefferson Lab's low vehicle and equipment emission levels.

<u>Scope 2</u>
As indicated in the Executive Summary section, significant projected increases in Scope 2 electricity will require multiple strategies, innovative HEMSF efficiency improvements projects, conventional ECMs, Greenpower PPA, and REC purchases to achieve the 28% GHG emissions reduction goal.

Table 2 - Scope 1 & 2 GHG Emissions FY '08 – FY '12

Scope 1 GHG Fugitive Emissions, Natural Gas, Fleet Petroleum (gas / diesel / E-85) Emissions

	MTCO2e	**MTCO2e**	**MTCO2e**	
Scope 1 GHGs	FY '08	FY '12	Difference	% Change
Fugitive Emissions	1,821.26	1,750.3	-70.96	-4%
Natural Gas	1,121.25	1,282	+160.75	+14%
Fleet Petroleum	53.47	30.59	-22.88	-54%
Total Scope 1	2,995.98	3,062.89	+54.36	+1.8%

Scope 2 GHG Emissions, Purchased Electricity

	MTCO2e	**MTCO2e**	**MTCO2e**	
Scope 2	FY '08	FY '12	Difference	% Change
Electricity	64,707.6	64,044.21	-663.39	-1.0%

Scope 1 &2 GHG Combined

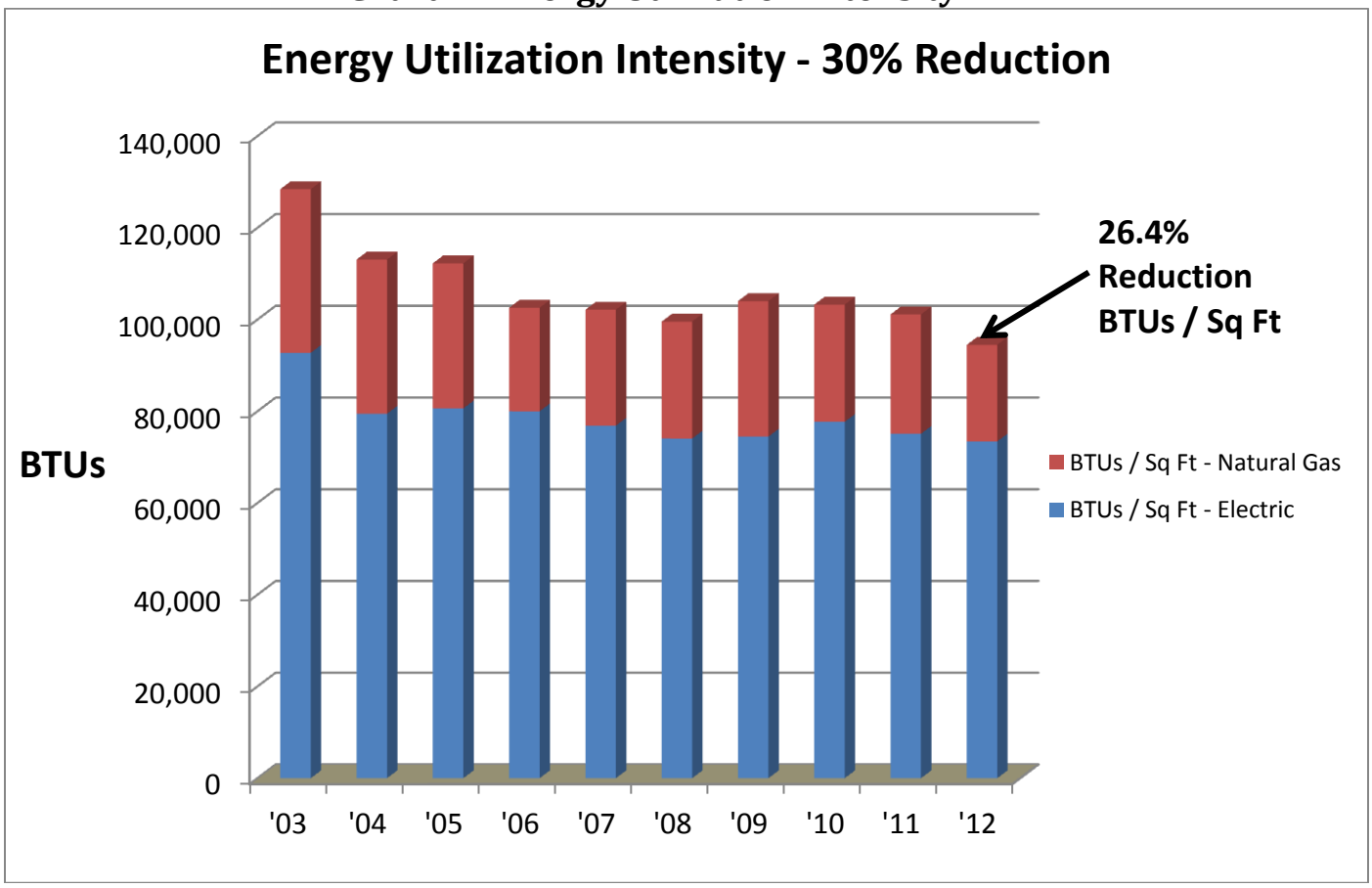
	MTCO2e	**MTCO2e**	**MTCO2e**	
	FY '08	FY '12	Difference	% Change
Scope 1	2,995.98	3,062.89	+54.36	+1.8%
Scope 2 (Electricity)	64,707.6	64,044.21	-663.39	-1.0%
Total Scope 1 & 2	67,703.6	67,107.1	- 596.5	-0.9%

Goal #1.1 / Energy Intensity Reduction, 30% by FY '15

1.1.1 Performance Status

Jefferson Lab's current Energy Utilization Intensity (EUI) in FY '12 was 94,533 BTUs/Square Foot which is a 26.4% reduction (*Chart1*) as compared to the FY 2003 baseline of 128,442 BTUs/Square Foot. Jefferson Lab is on schedule to meet the 30% reduction goal by 2015.

Chart 1 - Energy Utilization Intensity



1.1.2 Plans, Actions and Projected Performance

Jefferson Lab plans to implement Energy Conservation Measure (ECM) projects in existing buildings, complete a new LEED Gold designed facility, and implement energy efficiency strategies in several building renovations prior to FY 2015 end that will significantly reduce EUI to achieve the 30% reduction goal.

Further, Jefferson Lab plans to initiate a Utility Energy Services Contract in FY '13 to include EUI reduction projects:

- Data Center Cooling Energy (and PUE) Improvements
- Interior and Exterior Lighting Upgrades
- Administrative Facility HVAC Replacement / Efficiency Enhancements
- Advanced Building Automation Controls
- Additional Building and Sub-Metering Systems

<u>Goal #1.2</u> / 75% of Annual Electricity Consumption from Renewable Source By FY 2013 and thereafter (5% FY 2010 -2012)

1.2.1 Performance Status

Jefferson lab has and continues to invest and implement renewable energy technologies. Specifically, several existing administrative and industrial facilities, including a newly certified

LEED Gold facility on the Jefferson Lab site utilize geothermal heat pump systems. Jefferson Lab installed several exterior solar powered parking lot style lights, and purchased Renewable Energy Certificates (RECs) equivalent to 6.8% of the total Mwh consumption of electricity in FY 2012. RECs purchased for achievement of the new LEED Gold (TED) Building include a two year contract for 100% of the building estimated annual electricity consumption.

1.2.2 Plans, Actions and Projected Performance

The following renewable energy actions are being planned for the next few years:

- Evaluate feasibility of on-site utility scale renewable electric energy generation system, and solar PV system through a Power Purchase Agreement (PPA) in FY 2013.
- Purchase RECs equivalent to at least 7.5% of total Mwh consumption in FY '13 and thereafter.
- Continue implementation of exterior solar powered lighting.
- Install a solar thermal system to satisfy domestic water heating requirements for the Test Lab renovation project.
- Continue implementation of geothermal heat pump systems.

Goal # 1.3 / SF6 Reduction

1.3.1 Performance Status

Free Electron Laser Facility

Jefferson Lab's utilization of Sulfur Hexafluoride (SF6) is limited to the Free Electron Laser (FEL) facility DC photocathode electron gun and Gun Test Stand (GTS) operation. SF6 is used to suppress arcing in high voltage DC electron sources.

The FEL is equipped with a unique and efficient SF6 emissions management system designed to automatically or manually transfer SF6 between the high voltage equipment and a flexible storage bladder. This capture / recycle system has enjoyed multiple refinements and improvements since 1999, saving an estimated 900K MTCO2e.

GTS SF6 Storage (building exterior / filled)

1.3.2 Plans, Actions and Projected Performance

Jefferson Lab's SF6 emissions are highly stabilized at minimum values due to the unique FEL capture and recycle system. Subsequently, future SF6 emission management will continue to utilize and improve Jefferson Lab's mature and successful system and best practices.

<u>Goal # 1.4</u> / Individual Buildings Metered for 90% of Electricity (by Oct 2012); For 90% of Steam, Natural Gas, and Chilled Water (by Oct 2015)

1.4.1 Performance Status

As indicated in the Executive Summary, Jefferson Lab invested significantly during FY 2011 to complete an advanced Energy Metering and Management System (EMMS) that exceeds goal deadlines for electric, natural gas and water metering. Currently, 100% of the connected electrical load, natural gas service, and water supply are connected to the EMMS. Jefferson lab does not purchase steam or chilled water.

The EMMS includes a Graphical User Interface (GUI) for system navigation, a high level dashboard for frequent monitoring of energy and water consumption on a building and sub-system basis, and an open Tridium Energy Analysis software package for detailed trending and historical analysis of energy and water operations.

1.4.2 Plans, Actions and Projected Performance

Additional building level metering of energy, natural gas and water is scheduled for installation and integration into the EMMS as new construction projects are completed. All existing High Performance Sustainable Building target facilities are connected to the EMMS and collecting data to profile each building with Energy Star Portfolio Manager, and measure compliance with guiding principles goals.

<u>Goal # 1.5</u> / Cool roofs, Unless Uneconomical, for Roof Replacements Unless Project already has CD-2 approval. New roofs must have Thermal Resistance of at least R-30

CEBAF CENTER COOL ROOF

1.5.1 Performance Status

Currently, approximately 52% (295K GSF) of total applicable site cool roof area (568K GSF) currently comply with cool roof requirements. Jefferson Lab is tracking all of its future cool roof activities in the FIMS database.

1.5.2 Plans, Actions and Projected Performance

An additional 114,601 Sq Ft of cool roof upgrades are scheduled in FY '13 as multiple existing facility renovation projects are completed. All new construction roofs will include compliance with cool roof requirements.

Goal # 1.6 / Training

1.6.1 Performance Status

Completed energy audit training sponsored by the Association of Energy Engineers, and acquired Certified Energy Auditor (CEA) credential in FY '12. Attended FEMP sponsored live training to develop and manage Utility Energy Service Contracts, and multiple web based FEMP and industry provided training sessions.

1.6.2 Plans, Actions and Projected Performance

Staff will continue to participate in Federal and private industry sustainability training events as appropriate (ie: GovEnergy, ASHRAE, AEE, USGBC), and schedule monthly web based training programs.

Goal # 1.7 / Net Zero Energy in New or Major Renovation Construction

1.7.1 Performance Status

Current new construction, and or major renovation projects not cost effective to achieve net zero energy design.

1.7.1 Plans, Actions and Projected Performance

Evaluate all future new construction and or major renovation projects for opportunities to comply with EO 13514 requiring buildings entering the design process in 2020 are designed to achieve net zero energy performance by 2030.

Goal # 1.8 / Evaluate 25% of 75% of Facility Energy Use over 4-Year Cycle

1.8.1 Performance Status

Completed 100% of site energy and water audits; 4 year cycle ending June 2012 in compliance with EISA Section 432. Conducted a site wide water survey by an independent consulting firm, and initiated a PNNL team water assessment in FY '12.

1.8.2 Plans, Actions and Projected Performance

Finalize the PNNL water assessment and implement economic water reduction measures. Scheduled to conduct energy and water audits for 100% of covered facilities starting in FY '13 (25% per year) as described in CEDR (tab 11 "Covered Facilities).

Goal # 1.9 / 13% Scope 3 GHG reduction by FY 2020 from a FY 2008 baseline

1.9.1 Performance Status

Table 3 defines Scope 3 GHG emissions by category for FY '12 compared to FY '08 baseline. As indicated, except for staff commuting emissions, other "controllable" Scope 3 emissions are stable or declining, and have minimal contribution opportunity to achieve a 13% reduction goal. Achieving the Scope 3 reduction goal will primarily rely on implementing a successful staff commuting emissions reduction program.

Table 3 – Scope 3 GHG Emissions

	MTCO2e	**MTCO2e**	**MTCO2e**	
Scope 3 GHGs	FY '08	FY '12	Difference	% Change
T & D Losses	*2,448	*2,423	-25	-1.0%
Staff Commuting	1,374	1,910	+536	+39%
Business Air Travel	600	601	+1	+.02%
Business Ground	135	99	-36	-26%
Off-Site Landfill	259	137	122	-47%
Off-site Wastewater	4	4	0	0%
Total Scope 3	**4,820**	**5,174**	**+354**	**+7%**

*T&D Losses = actual utility T&D loss percentage (3.783%) vs. national (6.587%) used in CEDR calculations.

1.9.2 Plans, Actions and Projected Performance

Limited public transportation alternatives are available to the Jefferson Lab location. The Jefferson Lab human resources organization is researching telework and alternative work schedule programs developed by other DOE sites to determine best practices to include in a staff commuting reduction program.

A Lab leadership team is assigned to evaluate recommendations, develop policies and implement a combined telework, alternative work schedule, and car pooling program in the first half of FY '13 to reduce employee commuting emissions.

Initiatives to minimize Scope 3 emissions from business travel will continue, including an increased focus on video conferencing opportunities.

<u>Goal #2</u> Buildings HPSB, ESPC Initiative

<u>Goal # 2.1a</u> / 15% of Existing Buildings greater than 5,000 gross square feet (gsf) are compliant with Guiding Principles (GPs) for HPSB by 2015

2.1a.1 Performance Status

Jefferson Lab's initial High Performance Sustainable Building complying with the Guiding Principles was completed in FY '12. A 70,000 Sq Ft new construction office and laboratory project, the **Technology Engineering and Development (TED) Building** earned LEED Gold certification, and includes many energy, water efficiency and sustainable construction features:

Technology Engineering and Development Building

<u>ENERGY and Water Efficiency</u>

- Geothermal Heat Pump System provides 80% of HVAC requirements

- Greywater Reuse system delivers 100% of sanitation water

- Solar thermal / domestic water heating system

- 44% potable water reduction / low flow plumbing fixtures

- 100% of electricity from renewable energy generation sources

<u>Improved Indoor Air Quality</u>

- Low Volatile Organic Compound Emitting Construction Materials and Furnishings

- Green Housekeeping Program (non-toxic materials, and cleaning practices)

- Outdoor air delivery CO2 monitoring and control system

2.1a.2 Plans, Actions and Projected Performance

Jefferson Lab's existing and/or new buildings targeted for compliance with HPSB guiding principles include 15 qualifying (>5K Sq Ft) facilities. Consequently, three (3) buildings achieving HPSB compliance by 2015 end will achieve the 15% goal. In addition to the recently certified LEED Gold (TEDF) project, three (3) additional existing buildings are scheduled to complete renovations including HPSB guiding principle compliant features. Jefferson Lab will achieve the 15% of existing buildings > 5K Sq Ft compliance with HPSB Guiding Principles.

<u>Goal # 2.1b</u> / All New Construction, Renovations >5K Sq Ft Comply with HPSB GPs

2.1b.1 Performance Status

As indicated in Goal 2.1a, Jefferson Lab's new construction project "TED" achieved LEED Gold certification and subsequent compliance with HPSB GPs.

2.1b.2 Plans, Actions and Projected Performance

The Jefferson Lab "Test Lab" project, a significant renovation of an existing 95K Sq Ft laboratory, and 30K Sq Ft new addition is scheduled for completion in FY 2014. This project is designed to achieve LEED Gold certification and subsequently comply with the HPSB GPs.

Test Lab Addition and Existing Facility

Test Lab Renovation Project

Renovation projects on three (3) existing buildings > 5K Sq Ft and targeted for compliance with the HPSB GPs are scheduled for completion in FY '13. These active renovation projects include energy, and water efficiency and sustainable features designed to upgrade these buildings to HPSB GP compliance.

Goal # 2.2 / ESPC Initiative

2.2.1 Performance Status

Jefferson Lab is developing alternative financing programs to fund both energy demand reduction projects and potential on-site electrical and thermal energy generation systems. Financing options under consideration include a Utility Energy Services Contract (UESC). Preliminary discussions regarding a UESC have begun with AGL Resources, Inc. AGL is the parent organization of Virgnia Natural Gas, Jefferson Lab's natural gas provider. Other utilities, Dominion Virginia Power (electric utility) and Newport News WaterWorks (water utility) will be contacted and invited to propose a UESC agreement. Laboratory staff completed FEMP sponsored UESC training in FY '2012 and are working with FEMP representatives to implement a UESC agreement and initiate initial task order(s) in FY '2013.

2.2.2 Plans, Actions and Projected Performance

Identification and preliminary development of UESC agreement projects has been completed. Formal UESC negotiations and selection of a utility organization through an Area-Wide Contract is planned to occur in Qtr 2 / FY 2013. Following finalization of the contract selection and master agreement, development of both the preliminary assessment and feasibility study / investment grade audit phases of the UESC process is anticipated to occur by FY 2013 end. Execution and scheduling of initial task orders for the most favorable financial and energy impacting projects can begin to proceed immediately in FY 2013 following completion of above activities.

Goal # 2.3 / Regional and Local Planning

2.3.1 Performance Status

Jefferson Lab's Environmental, Safety, Health & Quality organization participates with emergency management organizations (Virginia Emergency Management Association and the Local Emergency Planning Committee) that address local transportation issues regarding disaster planning. The Jefferson Lab campus location qualifies for LEED "Development Density & Community Connectivity" credit for previously developed sites requiring pedestrian access to 10 basic services located within a ½ mile radius, and at least one residential zone of 10 units per acre. Although existing public transportation to / from the Jefferson Lab suburban campus is currently limited, the site does qualify for LEED "Public Transportation" credit requiring a minimum of one stop on two bus lines accessible within 1/4 mile of a pedestrian route.

2.3.2 Plans, Actions and Projected Performance

- Develop and implement alternative staff commuting programs to reduce regional transportation congestion in FY '13.
- Ensure participation in regional transportation planning is incorporated into site policy and guidance documents.
- Identify regional transportation planning, ecosystem, watershed, and environmental management initiatives affecting sites and opportunities to work with local authorities to align energy policies and placement of renewable energy infrastructure.

<u>Goal # 3.1</u> / 10% Annual Increase in Fleet Alternative Fuel Consumption By FY 2015 Relative to a FY 2005 Baseline

3.1.1 Performance Status

Jefferson Lab's annual alternative fuel (E-85) consumption increased to 2,612 Gasoline Equivalent Gallons (GEG) in FY 2012, or approximately 384% above the FY 2005 baseline. Subsequently, Jefferson Lab has exceeded both the 2012 progress target and 10 year goal period.

3.1.2 Plans, Actions and Projected Performance

Jefferson Lab's current vehicle fleet of twenty five (25) vehicles includes only three (3) are gasoline only powered. As fleet inventory is reduced in compliance with the 35% fleet reduction goal, the balance of fleet vehicles will include alternate fuel vehicles only. Consequently, Jefferson Lab's fleet will continue to consume alternative fuel, assuring achievement of the 10% annual increase goal and 100% increase for the 10-year goal period.

<u>Goal # 3.2</u> / 2% Annual Reduction in Fleet Petroleum by FY 2020 Relative To a FY 2005 Baseline

3.2.1 Performance Status

Jefferson Lab's annual petroleum consumption decreased to 3,029 gallons in FY 2012, approximately 30% below the FY 2005 baseline. Consequently, Jefferson Lab has achieved both the annual 2% reduction goal and 15 year (FY 2005 to FY 202) 30% reduction goal.

3.2.2 Plans, Actions and Projected Performance

Both a reduction in Jefferson Lab's total vehicle fleet and specifically all gasoline fueled vehicles will assure the decrease in petroleum consumption will continue to a zero level.

<u>Goal # 3.3</u> / 100% of light duty vehicle purchases must consist of alternative fuel vehicles (AFV) by FY 2015 and thereafter (75% FTY2000 – 2015)

3.3.1 Performance Status

Jefferson Lab's Light Duty Vehicle fleet consists of eleven (11) vehicles

- (7) Pickup Trucks
- (3) Minivans
- (1) Cargo Van

All Light Duty Vehicles purchased since FY 2000 are Alternative Fuel Vehicles

3.3.2 Plans, Actions and Projected Performance

Jefferson Lab's overall "mission critical" vehicle fleet will be reduced following conclusion of a major multi-year projects (12 GeV Expansion). All light duty vehicles will comply with the alternative fuel goal.

<u>Goal # 3.4</u> / Reduce fleet inventory by 35% by FY 2013 relative to a FY 2005 baseline

3.4.1 Performance Status

Jefferson Lab's overall fleet inventory has been reduced by five (5) vehicles to twenty five (25) vehicles currently in service (16% reduction).

3.4.2 Plans, Actions and Projected Performance

Jefferson Lab will reduce the current fleet inventory by six (6) additional vehicles, three (3) vehicles in FY '13 and three (3) additional vehicles in FY '14, reducing the total fleet size to 19 mission critical vehicles. A fleet of this size is essential to sustain safe and efficient operations at TJNAF. The right-sized fleet of 19 vehicles for Jefferson Lab results in **a 36% reduction of the 2005 baseline** of 30 vehicles.

Goal # 4.1 / 26% water intensity reduction by FY 2020 from a FY 2007 baseline

4.1.1 Performance Status

Water intensity (potable water use per GSF) at Jefferson Lab is primarily (75%) consumed for cooling tower operations and landscape irrigation. Water intensity to date has decreased approximately 19% compared to the FY 2007 baseline. However, as indicated in the Executive Summary, water required for thermal cooling purposes is predicted to increase significantly in future years as the Jefferson Lab scientific mission and 12 GeV expansion progress to completion.

4.1.2 Plans, Actions and Projected Performance

Multiple alternative water reduction strategies are under development. An independent consulting firm and water assessment team from PNNL conducted on-site water consumption analysis surveys in FY '12. The PNNL final report is due for submission by 2012 year end. Recommendations are expected to focus and various water capture and reuse strategies (ie: process water discharge harvesting, storm water and condensation water capture) and treatment of the reuse water stream for satisfying cooling tower thermal energy requirements. Further, additional ground water removal from shallow on-site wells may be required to achieve the significant 26% water intensity reduction goal.

Goal # 4.2 / 20% Water Consumption Reduction of Industrial, Landscaping, and Agricultural (ILA) Water by FY 2020 from a FY 2010 baseline

4.2.1 Performance Status

Currently, Jefferson Lab has not utilized non-potable water for either industrial, landscaping or agricultural purposes. All water requirements have been satisfied with potable water sources.

4.2.2 Plans, Actions and Projected Performance

Achievement of the 26% potable water intensity goal may require Jefferson Lab to rely on supplementing previously unutilized ILA water sources.

<u>Goal # 5.1</u> / Divert at least 50% of Non-Hazardous Solid Waste, Excluding Construction and Demolition Debris, by FY 2015

5.1.1 Performance Status

Jefferson Lab aggressively recycles non-hazardous solid waste. Of the 1,858.3 tons of non-hazardous solid waste produced in FY '12, approximately 97% or 1,791.9 tons of building and office waste, paper and metal was recycled. Further, approximately 67 tons of non-hazardous waste was diverted from landfill deposit to a local waste to steam energy conversion plant, reducing the Lab's landfill contribution to near zero.

Jefferson Lab Materials Management staff prepare 80K pounds of lead scrap for shipment to a lead smelting and processing company. The Lab has received in return approximately 55K pounds of lead (2,069 lead bricks) that are used for shielding purposes for physics experiments

5.1.2 Plans, Actions and Projected Performance

Jefferson Lab will continue to recycle non-hazardous waste to continue to exceed the 50% recycling goal by FY '15.

<u>Goal # 5.2</u> / Divert at least 50% of Construction and Demolition Materials and Debris by FY 2015

5.2.1 Performance Status

Significant construction activity at Jefferson Lab in FY '12 produced approximately 811 tons construction and demolition materials and debris. 690 tons of construction material or approximately 85% recycled / diverted from landfill deposit.

5.2.2 Plans, Actions and Projected Performance

Continued significant construction activity is projected for FY '13 and FY '14 as a major Lab expansion program occurs. Jefferson Lab will continue to recycle construction and demolition materials and debris to continue to exceed the 50% recycling goal by FY '15.

<u>Goal # 6.1</u> / Procurements meet Sustainability Requirements and include Sustainable Acquisition Clause (95% each year)

6.1.1 Performance Status

FAR clauses regarding sustainability included in all appropriate acquisition contracts

6.1.2 Plans, Actions and Projected Performance

Implement compliance measurement procedures in FY '13 to assure 95% compliance. Continue current practices that achieve the 95% goal

<u>Goal # 7.1</u> / All data centers are metered to measure a monthly PUE (100% by FY 2015)

7.1.1 Performance Status

Supply power to all data centers are currently metered to measure total data center electrical power. Metered data is integrated with a recently commissioned site wide system with software capable of calculating monthly Power Utilization Effectiveness values.

7.1.2 Plans, Actions and Projected Performance

Install additional electric meters to measure computer room A/C in FY '13 to perform PUE measurement. Although electrical consumption for the data centers is currently metered, as stated above, some cooling energy load is satisfied by chilled water sources that are not metered at the data center. Subsequently, planning to install additional BTU meters for each data center in FY '13 to capture the total data center energy load.

Goal # 7.2 / Maximum annual weighted average Power Utilization Effectiveness (PUE) of 1.4 by FY 2015

7.2.1 Performance Status

Jefferson Lab owns and operates two on site data centers, with a combined square footage of approximately 13,500. Both centers are located in the same facility and independently electrically powered and served with chilled water for Computer Room Air Conditioning (CRAC) unit cooling. The current calculated weighted average Power Utilization Effectiveness value is 2.68. Tier I data center PUE = 2.12. Tier III data center PUE = 4.03.

7.2.2 Plans, Actions and Projected Performance

Both data centers are targeted for potential cooling system renovation to be included in a planned UESC program. Following completion of renovations, a Data Center Pro energy assessment will be conducted to determine a more accurate data center profile, and reduced PUE value.

Goal # 7.3 / Electronic Stewardship - 100% of eligible PCs, Laptops, and Monitors with Power Management Actively Implemented and in use by FY 2012

7.3.1 Performance Status

Currently, Jefferson Lab utilizes a central power management system for 100% of Windows desktop PC's and monitors that can "hibernate" without impacting lab mission operations. Laptops are also independently versus centrally power management enabled.

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 / copiers are set to "sleep mode" when idle for a prescribed time period.

7.3.2 Plans, Actions and Projected Performance

A new version of the power management software utilized at the lab (called Surveyor) is reported to support Mac desktop power management. Jefferson Lab IT organization plans to investigate and implement this feature when available.

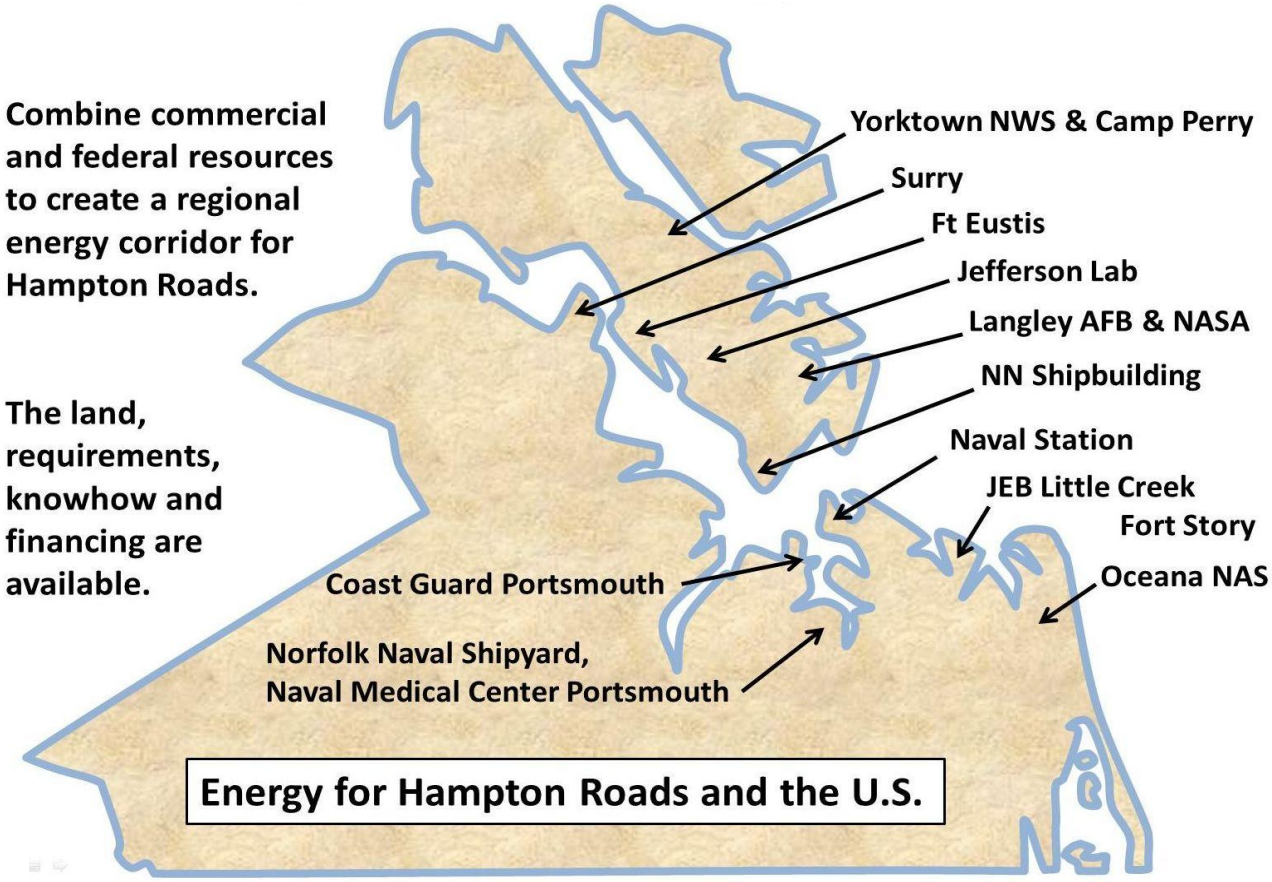
Finalize the PNNL water assessment and implement economic water reduction measures. Scheduled to conduct energy and water audits for 100% of covered facilities starting in FY '13 (25% per year) as described in CEDR (tab 11 "Covered Facilities).

Goal # 8 / Agency Innovation & Government-Wide Support

Jefferson Lab is actively supporting an innovative, interagency initiative to develop a long term sustainable energy model for the significant concentration of Federal government sites in the greater Hampton Roads, Virginia region. Outline of the "Hampton Roads Energy Corridor" plan and opportunities for technological, financial and advancement of sustainable, secure energy benefits as follows:

Hampton Roads Energy Corridor

Vision: ***Establish an energy corridor in Hampton Roads based on unique regional assets providing a variety of long-term sustainable power options for the region's facilities, and act as a centerpiece for business development, R&D, education and training for the region, state and U.S.***



Unique Opportunity: Hampton Roads with its distributed federal facilities, innovative technologies and commercial infrastructure has a unique combination of expertise, space and mission need to leverage the region's political and financial interests to create a long-term sustainable energy corridor. With resources such as wind, expertise in Small Modular Reactors (SM-Reactors) on ships, commercial large reactors, some solar, bio fuel R&D, and ample areas to generate the base materials, a strong foundation exists in Hampton Roads.

Approach for Sustainable Energy Sources: Accounting for technology maturity, costs, licensing, financing, and infrastructure, a multi stage program can be advanced: 1) start with biomass, photovoltaic solar, and prototypes for wind and biofuel; 2) expand to offshore wind, biomass to liquid fuels, and prototype energy storage; and 3) advance to SM-Reactors and energy storage.

Siting, Space and Security: Many of our federal facilities need to be able to go off-grid in case of an emergency or threat situation. Since many of these same facilities have adequate land/space and can provide the security of that space, a natural solution is to distribute the sustainable energy sources as required.

Integrating Operations: To reduce costs and manage complexity, the Hampton Roads Energy Corridor would integrate the distributed facilities via the local power grid supported by local modeling and simulation capabilities. In this way an inherently resilient system can be supported that takes advantage of weather, fuel availability and end user demand.

Licensing: The U.S. Department of Energy (DOE) is taking on the task of working with commercial vendors to fast track advanced wind energy licensing and SM-Reactor licensing.

Waste: For SM-Reactors DOE's Savannah River Site (SRS) has offered to partner with the Hampton Roads Energy Corridor. One of SRS's strategic directions is to reprocess spent nuclear fuel to create the fuel for a new generation of reactors currently under development. These new advanced reactors along with Accelerator Driven Systems with technology from Jefferson Lab will greatly reduce the lifetime of the much smaller remaining waste from ~100,000 years to ~300 years.

Liability and Risks: A leading management option is to use a Government Owned Contractor Operated (GOCO) model for operating the Hampton Roads Energy Corridor. This results in a shared liability/risk model that has proved very successful for the operation of the U.S. DOE laboratories (several of which have nuclear activities) and some DoD and NASA facilities.

Financing: The goal is to select projects with projected stable rates compared to fossil fuel driven rates when adjusted for sustainable energy credit. The conventional commercial rates will likely go up as fuel prices increase. Consequently, financing will be available that both the commercial and federal facilities can utilize for affordable energy.

Liquid Fuels: As part of a long-term diversified energy independence strategy, Hampton Roads is rich in biomass that power from SM-Reactors that can be used to convert biomass to liquid fuels (e.g. gas, diesel and jet fuel).

Field Operations Training: Some U.S. military requirements for operating outside of the U.S. may be optimally met by deploying sustainable energy technologies. Local operational experience with sustainable technology facilities will allow commercial and military facilities personnel to be trained on the newest technologies for energy systems, including those that could be deployed in the field in military operations to provide a reliable power source.

Community Participation and Economic Engine: The Hampton Roads Partnership has existing relationships that can bring the community together to support a regional Hampton Roads Energy Corridor that benefits all of the elements of the region in terms of new businesses, job creation, and sustainable energy solutions thereby keeping the region globally competitive.

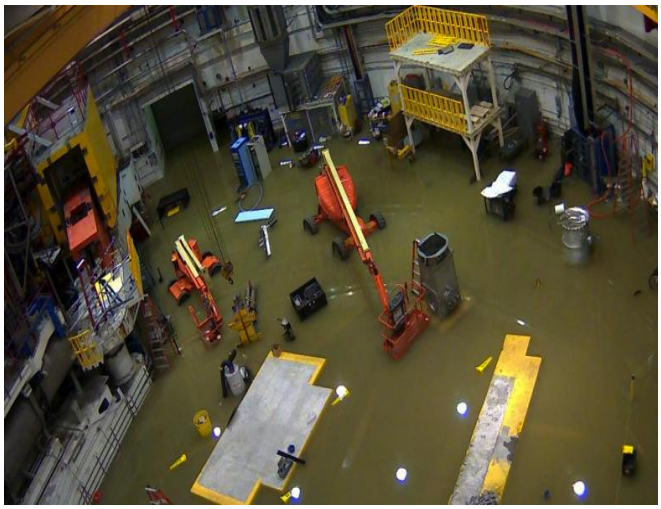
3 Climate Change Adaptation

Jefferson Lab's coastal Mid-Atlantic location has increased vulnerability to extreme coastal storms (hurricanes) and potential related flooding that may increase in frequency and intensity if climate change impact advances. Neighboring communities, especially Norfolk, Virginia have significant exposure to increasing sea levels and resulting coastal erosion and flooding. Norfolk and New Orleans, Louisiana have been identified as the two most endangered cities in the U.S. from rising sea levels. Although Jefferson Lab may experience indirect negative effects of seal level rise from staff residing in the Norfolk area, the Lab's specific site location at thirty three feet

above sea level should not see direct sea level increase impact. However, coastal storms have disrupted Lab operations and caused significant site damage.

Experimental Hall B / 6 inches of water

For example, a recent severe storm (Aug, 2012) produced approximately 6 inches of rain at the Lab site and surrounding area in about one hour. Consequently, significant flood damage occurred to sub surface experimental hall facilities and other infrastructure.



Experimental Hall C / 30 inches of water

Jefferson Lab's site surface waste drainage, with an extensive network of feeder and main ditches, had been adequate protection from previous storm events. However, the combination of prior ground saturation, followed by torrential rain and increased construction in the surrounding community, overwhelmed the capacity of the off-site (municipal) drainage systems and streambeds.

Site Mitigation Plans

Subsequent to the above event, Jefferson Lab is preparing to develop a storm water management system (retention pond) on site to control storm water flow from extreme quantities of future rain events. Further, water control remediation systems (flood gates) will need to be installed at access points to all sub surface experimental halls to prevent future flood damage.

4 High Energy Mission Specific (HEMSF)

4.1 HEMSF Description

Jefferson Lab's list of "excluded" (add self certification / FIMS list) facilities includes all equipment and operations that support the scientific mission of the laboratory and qualify as HEMSF. A list of HEMSF and respective FIMS identification is shown in Table 4:

Jefferson Lab HEMSF qualified facilities, FIMS identification and size (GSF)

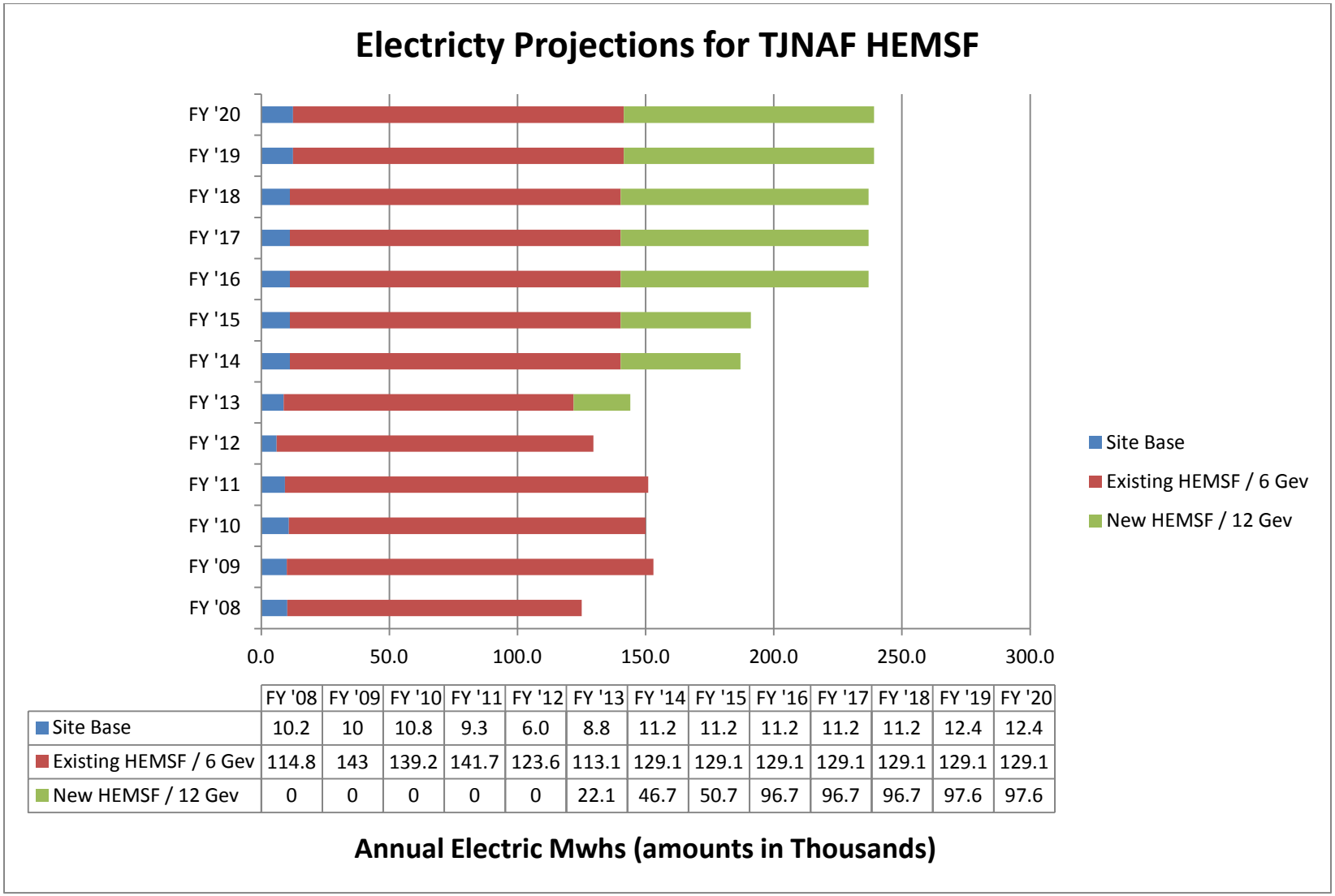
Table 4 – HEMSF List / FIMS

Property ID	FIMS Real Property Unique ID	Property Name	Gross SF.
999	137536	Accelerator Tunnel	113,868
08	130258	Central Helium Liquefier (CHL)	21,731
97	130256	Counting House	17,101
39	137579	East ARC Service (E2)	460
49	137580	East ARC Service (E3)	548
63	137582	East ARC Service (E4)	460
50	137581	East ARC Service (E5)	548
102	130260	End Station Refrigeration (ESR)	3,005
104	208920	End Station Refrigeration (ESR) II	6,638
101	141725	Experimental Hall A	34,861
94	141723	Experimental Hall B	17,706
96	141724	Experimental Hall C	28,415
18	134102	Free Electron Laser (FEL)	31,893
91	137539	Hall A Beam Dump Cooling	630
95	137550	Hall C Beam Dump Cooling	630
53	137524	Injector Service	3,402
85	130257	Machine Control Center (MCC)	7,626
67	137567	North Access	8,535
21	137589	North Extractor Service (E1)	460
01	137526	North LINAC	12,850
92	137621	Service Building	2,487
38	137565	South Access	8,535
82	137598	South Extractor Service (W1)	2,289
02	137527	South LINAC	12,850
68	137586	West ARC Service (W2)	1,217
56	137585	West ARC Service (W3)	460
40	137583	West ARC Service (W4)	460
45	137584	West ARC Service (W5)	548

4.2 Actual and Projected Electricity

Chart 2 depicts projected annual Mwhs consumption for HEMSF and Site (non-HEMSF) buildings and accelerator operations.

Chart 2



	FY '08	FY '09	FY '10	FY '11	FY '12	FY '13	FY '14	FY '15	FY '16	FY '17	FY '18	FY '19	FY '20
Site Base	10.2	10	10.8	9.3	6.0	8.8	11.2	11.2	11.2	11.2	11.2	12.4	12.4
Existing HEMSF / 6 Gev	114.8	143	139.2	141.7	123.6	113.1	129.1	129.1	129.1	129.1	129.1	129.1	129.1
New HEMSF / 12 Gev	0	0	0	0	0	22.1	46.7	50.7	96.7	96.7	96.7	97.6	97.6

Annual Electric Mwhs (amounts in Thousands)