Department of Energy Laboratory Plan
For the Office of Science's
The Ames Laboratory

Mission and Overview

The Ames Laboratory (AMES) was formally established in 1947 by the United States Atomic Energy Commission as a result of the AMES Project's successful development of the most efficient process to produce high-purity uranium metal in large quantities for the Manhattan Project. Situated on the campus of Iowa State University, the M&O contractor, the Ames Laboratory's mission is to create materials, inspire minds to solve problems, and address global challenges. AMES operates the Materials Preparation Center (MPC) which prepares, purifies, fabricates and characterizes materials in support of R&D programs throughout the world. AMES also performs research for the DOE's applied energy technology and nonproliferation programs and, through its work for others program, provides research and materials to the National Institute of Justice, Department of Defense, various law enforcement agencies, and corporate entities. AMES researchers have won 17 R&D 100 Awards from R&D Magazine, which selects the 100 most significant technical products and innovations each year. Educating the next generation of scientists is a key component of the research at AMES; since 1947, over 3000 Masters and Ph.D. degrees in science and engineering have been awarded to ISU students working on DOE funded projects.

Six areas of expertise underpin activities at the Ames Laboratory: (1) materials design, synthesis and processing; (2) analytical instrumentation/device design/fabrication; (3) materials characterization; (4) catalysis; (5) condensed matter theory (including photonic band gap and other novel materials); and (6) separation science. These six areas enable AMES to deliver its mission and customer focus, to perform a core role in the DOE laboratory system, and to pursue its vision for scientific excellence and pre-eminence in the areas of:

- Materials research directed towards energy technologies including optical, magnetic, intermetallic, and catalytic materials; studies of high temperature materials and materials in extreme conditions; and
- Analytical techniques and instrument development.

Lab-at-a-Glance

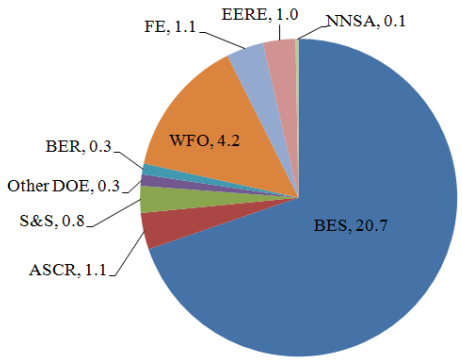
Location: Ames, IA
Type: Office of Science Laboratory
Contractor: Iowa State University
Responsible Site Office: Ames
Website: www.ameslab.gov
Physical Assets:

- 10 acres (lease–long term, no cost) and 12 buildings
- 327,664 GSF in Active Operational Buildings
- Replacement Plant Value: $65.4M
- Deferred Maintenance: $1.5M
- Asset Condition Index:
  - Mission Critical 0.98 (Excellent)
  - Mission Dependent 0.97 (Good)
  - Asset Utilization Index: 0.98 (Excellent)

Human Capital:

- 308 Full Time Equivalent Employees (FTEs)
- 50 Joint faculty (if applicable)
- 73 Postdoctoral Researchers
- 198 Undergraduate and Graduate Students
- 0 Facility Users
- 152 Visiting Scientists

FY 2009 Funding by Source: *(Cost Data in $M):*



FY 2009 Lab Operating Costs: $29.6
FY 2009 Total DOE/NNSA Costs: $25.4
FY 2009 WFO (Non-DOE/Non-DHS) Costs: $4.2
FY 2009 WFO as % Lab Operating Costs: 14.1%
FY 2009 DHS Costs: $0.0

Recovery Act Obligated from DOE Sources in FY 2009: $1.76
Recovery Act Costed from DOE Sources in FY 2009: $0.18

Current Laboratory Core Capabilities

The Office of Science has identified 3 core capabilities at the Ames Laboratory:

- Condensed Matter Physics and Materials Science
- Chemical and Molecular Science
- Applied Materials Science and Engineering

Condensed Matter Physics and Materials Science

The theory, design, synthesis, processing and characterization of innovative, energy-relevant materials comprise one of the Ames Laboratory's primary research foci. The Laboratory is widely recognized for its leading work on rare earth metals and alloys, photonic band gap materials, metamaterials, magnetic materials, high temperature superconductors, surfaces, and biomaterials. It is also widely recognized for its ability to grow high quality samples of unusual materials, which it distributes all over the world; one such example being the iron arsenic samples being supplied to research organizations worldwide. The Lab's condensed matter physics and materials sciences teams develop and use cutting-edge techniques to study these systems, including X-ray and neutron scattering, and solid-state nuclear magnetic resonance (SSNMR). Computational methods such as quantum Monte Carlo simulations, electronic structure calculations, and classical and quantum molecular dynamics simulations are continually being pushed to new limits for 'taming the complexity' of new chemistry and material problems.

The current resurgence of interest in rare earth materials, including their properties, processing and reclamation, has put the Ames Laboratory in the international spotlight. AMES is the only National Laboratory with the background intellectual property, expertise, know-how and world-class researchers to develop new cost-effective processing techniques, improved properties and new materials to replace the rare earth metals that are becoming difficult to obtain. Renewed interest in rare earths and rare earth replacements has brought several potential industrial partners to the Laboratory. In fact, we have several new projects underway funded by DOE or by U.S. industrial partners. Discussions are currently underway to set the direction for AMES to help assure new economically viable rare earth processing techniques and/or new non rare earth materials for national defense and improved energy technologies such as traction motors and magnets, or new techniques to recover these metals from waste and scrap.

Major sources of funding: The Office of Science's Basic Energy Sciences and Advanced Scientific Computing Research programs and the Office of Energy Efficiency and Renewable Energy. Various work for others, mainly from the Department of Defense, but also with various industrial partners helps to maintain this core capability.

Chemical and Molecular Science

The Laboratory develops techniques for characterization of novel materials and rapid, sensitive detection of chemicals and biomaterials that can be used in applications ranging from bioremediation to national security. It develops new simulation and modeling techniques for use in energy and security decision-making, and design of materials. It is internationally recognized in the areas of materials synthesis and characterization, X-ray and neutron scattering, solid state nuclear magnetic resonance (SSNMR), spectroscopy, and microscopy.

Major sources of funding: The Office of Science's Basic Energy Sciences, Biological and Environmental Research, and Advanced Scientific Computing Research programs. Various work for others projects helps to maintain this core capability.

Applied Materials Science and Engineering

Civilization depends on the capability to create new or improved materials. Applying the fundamental knowledge derived from the Laboratory's basic computational, theoretical and experimental research, researchers at AMES create diverse research teams to invent, design and synthesize new materials with specific energy- and environment-relevant properties. It develops, demonstrates, and deploys materials that accelerate technological advancements in a wide range of fields; from a lead-free solder that is used virtually in all electronics to a nanotube with the potential to deliver drugs or other materials to a specific site within a living cell. The Ames Laboratory is world-renowned for developing materials that improve energy efficiency and conversion, and reduce environmental impact. Key impacts of the Ames Laboratory's work in applied materials science and engineering include catalysts, ultra-hard materials, low friction materials, special magnetic alloys, light-weight high-strength materials and engineering alloys that are responsive to energy and environmental concerns.

Major sources of funding: The DOE Office of Energy Efficiency and Renewable Energy programs, specifically, Biomass, Vehicle, and Industrial Technologies. Various work for others with industrial partners help to maintain this capability.

The Ames Laboratory's core capabilities contribute to the DOE Missions listed below. Included within the table are other capabilities that are inherent within the Ames Laboratory but not related to Office of Science Programs such as national nuclear security (NN), simulation and decision modeling (SDM) and work for others projects (WFO).

Core Capability	DOE Mission	Funding Sources
	Scientific Discovery and Innovation	
CMP&MS; C&MS;	1. Develop mathematical descriptions, models, methods, and algorithms to enable scientists to accurately describe and understand the behavior of the earth's climate, living cells, and other complex systems involving processes that span vastly different time and/or length scales to advance DOE missions in energy and environment	*BES; BER; ASCR; Royalties*
C&MS;	3. Advance key areas of computational science and discovery that advance the missions of the Office of Science through partnerships within the Office of Science, R&D integration efforts with the Department's applied programs, and interagency collaborations. For example, ASCR's new applied mathematics research efforts in optimization and risk assessment in complex systems has been identified as important to the research efforts in the Office of Electricity Delivery and Reliability (OE), Office of Nuclear Energy (NE) and other applied energy programs, and critical to cyber security research in other federal agencies	*ASCR*
CMP&MS; C&MS; AMSE	6. Discover and design new materials and molecular assemblies with novel structures, functions, and properties, and to create a new paradigm for the deterministic design of materials through achievement of atom-by-atom and molecule-by-molecule control	*BES; BER*
CMP&MS; C&MS; AMSE	7. Conceptualize, calculate, and predict processes underlying physical and chemical transformations, tackling challenging real-world systems – for example, materials with many atomic constituents, with complex architectures, or that contain defects; systems that exhibit correlated emergent behavior; systems that are far from equilibrium; and chemistry in complex heterogeneous environments such as those occurring in combustion or the subsurface	*BES; BER; ASCR; Royalties*
CMP&MS	8. Probe, understand, and control the interactions of phonons, photons, electrons, and ions with matter to direct and control energy flow in materials and chemical systems	*BES; Royalties*
CMP&MS; C&MS; AMSE	10. Foster integration of the basic research conducted in the program with research in NNSA and the DOE technology programs, the latter particularly in areas addressed during the studies of the past six years, e.g., in areas such as solar energy conversion, electrical energy storage and transmission, solid state lighting and other aspects of energy efficiency, geological sequestration, catalysis, and materials in extreme energy environments	*BES; BER; EERE; WFO*
C&MS	11. Obtain new molecular-level insight into the functioning and regulation of plants, microbes, and biological communities to provide the science base for cost-effective production of next	*BER; Royalties*

	generation biofuels as a major secure national energy resource	
C&MS	12. Understand the relationships between climate change and Earth's ecosystems, develop and assess options for carbon sequestration, and provide science to underpin a fully predictive understanding of the complex Earth system and the potential impacts of climate change on ecosystems	*EERE; Royalties*
C&MS	14. Make fundamental discoveries at the interface of biology and physics by developing and using new, enabling technologies and resources for DOE's needs in climate, bioenergy, and subsurface science	*BES; BER*
AMSE	26. Foster integration of the research with the work of other organizations in DOE, in other agencies and in other nations to optimize the use of the resources available in achieving scientific goals	*EERE; WFO*
AMSE; NN; WFO	32. Foster integration of the research with the work of other organizations in DOE, such as in next generation nuclear reactors and nuclear forensics, and in other agencies and nations to optimize the use of the resources available in achieving scientific goals	*BES; NN; WFO*
	Energy Security	
SDM	4. Supply-Wind	*EERE; Royalties*
SDM; AMSE	7. Supply - Coal	*FE*
C&MS	8.Supply - Bioenergy/Biofuels	*EERE; WFO*
SDM; AMSE	13. Use - Industrial Technologies (including efficiency and conservation)	*EERE; WFO; Royalties*
AMSE	15. Use - Vehicle Technologies (including efficiency and conservation)	*EERE; WFO; Royalties*

The Laboratory's effort within these core capabilities contributes to the DOE mission of "Scientific Discovery and Innovation, and Energy Security." Inherent in all research at the Ames Laboratory is the education and mentoring of future scientists. This is achieved through the coupling of DOE sponsored educational programs with the various programs and opportunities inherent in the Laboratory's Contractor. In addition to the missions serviced by the Laboratory's core capabilities, other research areas within the Laboratory contribute to or enhance the functionality of the DOE mission areas. The Laboratory's work for others also contributes to maintaining and advancing our core capabilities, and many of our major initiatives will enable us to contribute to additional missions. These are:

Core Capability	DOE Mission	Funding Source
Education	33. Increase opportunities for under-represented students and faculty to participate in STEM energy and environment education and careers leveraging the unique opportunities at DOE national laboratories	*WDTS*
Education	34. Contribute to the development of STEM K-12 educators through experiential-based programs.	*WDTS*
Education	35. Provide mentored research experiences to undergraduate students and faculty through participation in the DOE research enterprise	*WDTS*
ADD'L	15. Foster integration of research by leveraging DOE computational capabilities across BER programs and promoting coordination of bioenergy, climate and environmental research across DOE's applied technology programs and other agencies such as the Department of Agriculture, the National Aeronautics and Space Administration, and the National Oceanic and Atmospheric Administration	*WFO; Royalties*
ADD'L	13. Understand the molecular behavior of contaminants in subsurface environments, enabling prediction of their fate and transport in support of long term environmental stewardship and development of new, science-based remediation strategies	*NN (Anticipated)*
AMSE (New)	Energy Security: 10. Distribution - Electric Grid	*Royalties; EERE (Anticipated)*

Science Strategy for the Future/Major Initiatives

The Ames Laboratory's vision is to be our Nation's premier research institute in critical areas of condensed matter science, its related technologies, and the strategic applications of advanced materials. Dramatic energy efficiency improvements require new ways of harvesting and converting energy from one form to another, enabled by new materials with enhanced functionalities. AMES will focus its efforts over the next 10 years on developing improved energy conversion techniques, materials for energy efficiency and new integrated methods to more efficiently discover and process materials with desired functionalities. AMES excels in the areas of materials processing methods, computational and theoretical materials science, rare earths, catalysts, magnetic and photonic materials, and analytical instrumentation development. The Ames Laboratory links basic and applied research across the scientific spectrum resulting in an impressive record of technology transfer success. We solve challenging problems by engaging teams of world-renowned experts from a variety of disciplines, including researchers from other National Laboratories, and universities.

We propose initiatives that are designed to transform our nation's energy future and fill critical technological gaps. These initiatives build upon our core capabilities, and upon our core values of excellence, people, agility, safety, inspiration, innovation, and collaboration. Our work will continue to exemplify how research can transform and lead the way for the U.S. to reduce energy demand, control energetic processes, develop innovative materials, and use our Nation's biorenewable resources.

Infrastructure/Mission Readiness

Overview of Site Facilities and Infrastructure

The Ames Laboratory is a Government-owned, contractor-operated facility located on the campus of and operated by Iowa State University (ISU) in Ames, Iowa. AMES is located in central Iowa approximately 35 miles north of the capital city of Des Moines. There is no federally owned land at the site (See The Ames Laboratory Land Use Plan, http://www.ameslab.gov/final/About/Plan46300-008-LandUse.pdf). Instead, the Laboratory is situated on approximately 10 acres of state-owned land on the ISU campus under long-term, no cost lease. The lease line can be adjusted to accommodate new Laboratory facilities in the future.(See Attachment 1) The real property assets include 12 buildings that total 327,664 gross square feet. The three laboratory research buildings represent over 70% of the area and have an average age of 56 years. The newest research building in the inventory was constructed 50 years ago. The newest building of any type is an administration building that is 15 years old and represents less than 15% of the site floor area. The other eight buildings are smaller shop and storage buildings that provide support functions. The average age of the entire inventory (prorated by area) is 47 years. The buildings are highly utilized with an Asset Utilization Index (AUI) of 0.981. The buildings have been well maintained over their lifetimes and are currently in good condition as indicated by an Asset Condition Index (ACI) of 0.979. However, the research buildings were designed and built for the research needs and activities of the 1950's. As such, even though they are in good condition, they do not provide the effective and efficient infrastructure needed to support for current and future research activities at the cutting edge of materials research. Staffing in FY2009 was 308 full time staff (FTEs). In addition there were also approximately 400 staff associates who perform research in the Ames Laboratory facilities. There are also two other real property assets defined in the Facility Information Management System (FIMS), an electrical switch pit and parking lot.

Being located on the University campus allows the Laboratory to take full advantage of the infrastructure services provided by ISU, such as steam, chilled water, water and sewage service, compressed air, grounds maintenance, telecommunication systems, and roads without the need for Federal investment to construct, maintain, or recapitalize. The availability of these services allows the Laboratory to focus on maintaining and operating its research and support buildings. The relationship with ISU also enables the Laboratory to use space in University–owned buildings through a space usage agreement without investing in permanent space or long-term leases (33,000 nusf in 11 buildings). No real estate actions are planned for FY2010 or FY2011.

Table 2. SC Infrastructure Data Summary

Replacement Plant Value ($M)		65.43
Total Deferred Maintenance ($M)		1.46
Asset Condition Index	Mission Critical	0.98
	Mission Dependent	0.97
	Non-Mission Dependent	N/A
Asset Utilization Index	Office	0.942
	Warehouse	1.000
	Laboratory	0.983
	Housing	N/A
Prior Year Maintenance ($M)		1.105

Facilities and Infrastructure to Support Missions
The Ames Laboratory is dedicated to providing facilities and infrastructure that will effectively enable and support its mission. AMES also strives to be an effective steward of the DOE assets entrusted to it by managing them with a long-term view which is quality driven, looks at the life cycle of the assets, utilizes best industry practice, and is commensurate with the value and mission impact of the asset. This management links real property asset planning, programming, budgeting, and evaluation to program mission projections and performance outcomes. Resources are directed to facilities and infrastructure in the context of the overall needs and operation of the Laboratory to carry out its mission.

The Ames Laboratory is in the process of implementing and documenting the Mission Readiness process. A peer review is scheduled for FY2011. This year's interviews with Program Directors, key researchers and Functional Managers were led by the Chief Research Officer, the Chief Operations Officer and the Facilities Services Manager. The input and insight obtained from these interviews was incorporated into the Laboratory infrastructure plans. The Facilities Services Manager and the Chief Operations Officer participated as observers in the peer reviews at Argonne and are scheduled to participate as reviewers on peer reviews later this year. The process helps Laboratory management and facilities personnel have an excellent understanding of the facility condition and needs. In addition to the readiness review process, the preparation of the Mission Need Statement for the Metals Development Replacement utilized broad stakeholder input in the planning process. Key researchers provided valuable input into the limitations of existing facilities and the characteristics of a new facility that would enhance their effectiveness. A study committee with key researchers, the Budget Officer and the Facilities Services Manager was created by the Director to perform a needs analysis on scientific facilities. The study committee prepared a gap analysis for the research buildings and created an initial draft for the CD-0 submission to replace the MD building. This work provides an excellent basis for identifying the capability gaps in the Facilities and Infrastructure.

The Mission Readiness tables (Attachment 2) provide a summary of the condition of the facilities from a mission readiness point of view, now and into the future. These tables list the core capabilities and the investments required to make the facilities and infrastructure fully capable to meet the mission needs within the 10-year planning window. In accordance with the definitions from the Mission Readiness Model, the research buildings are currently considered "Marginal." This means that deficiencies require major resources (work-arounds) to ensure achievement of mission and that the resources needed to make assets fully capable require capital investments in excess of the GPP limit. Two major needs identified in the mission readiness process are computation center space and space for sensitive research instruments. Current state of the art instruments, such as electron microscopes, have increasingly demanding infrastructure requirements for vibration, noise, temperature control, dust, power quality and electromagnetic interference to perform to their full potential. Good space for these sensitive instruments is not available without extensive modifications and, even then, they must be sited in locations that are marginally acceptable. Installation into this type of space compromises the ability to achieve optimal results. The computation facilities are filled to capacity so that expansion requires creating new space for each new machine or retiring existing computers to create space in existing data centers.

Strategic Site Investments
The Ames Laboratory has embraced the Office of Science SLI Infrastructure Modernization Initiative that will have all of the SC laboratories operating thoroughly modernized complexes by the end of the ten-year period (FY2010-FY2020). Modernized facilities will encompass the following characteristics:

- Safe, Secure, and Environmentally Sound Infrastructure
- A Highly Productive Working Environment
- Efficient Operations and Maintenance

The Ames Laboratory has developed a modernization strategy to achieve this goal in this time period. It will result in infrastructure that is fully mission ready, will enhance research efforts, contribute to sustainability and energy conservation goals, and provide a preferred work environment to attract and retain world-class scientists.

The cornerstone of this strategy is the replacement of the Metals Development Building under the Infrastructure Modernization Initiative. It will build a state of the art facility that will provide space to meet the need for more exacting research infrastructure. The remaining research buildings will be able to house the research activities that have less stringent requirements. Other funds such as GPP, overhead, and energy savings will be used to focus on the improvement of the remaining research buildings. In this way the infrastructure for all of the core competencies will be mission capable at the end of the ten-year planning window.

Replacement of the Metals Development Building is crucial to meeting the infrastructure goals. The $47M project will build a new 66,500 square foot building with funding slated to begin in FY2012. Upon completion, the critical and sensitive research activities from the existing research buildings will be moved into the new building. Any remaining activities in the Metals Development Building will then be relocated into the space vacated in the other buildings and the Metals Development Building will be demolished. The new building will provide specialized space for current and anticipated state-of-the-art instrumentation such as high resolution transmission electron microscopes and scanning probe microscopes, which in turn will dramatically improve the resolution and stability of these instruments and the range of measurements that they can accomplish. Data center space will be provided in the building to house computation resources needed to support the core capabilities. Designing the data center into a new building will enable it to be incorporated into the overall energy systems of the building allowing it to operate more efficiently than could be done otherwise. The new building will have the capability to efficiently deal with the more stringent ventilation requirements of working with new and advanced materials that may be more toxic or reactive. A building with flexibility designed into it will allow space to be reconfigured quickly and efficiently when there are changes in research activities and technologies. A building design that uses space more efficiently will allow the area of the building to be reduced approximately 5%. It is also anticipated that AMES would be able to reduce the amount of space rented from ISU. The new building will provide a preferred work environment that will help attract and retain high quality staff. It will also contribute to increasing staff productivity and enhancing the collaboration and teaming that characterizes research at AMES. The project will eliminate 1/3 of the total deferred maintenance at the site. The building will be designed to achieve LEED Gold Certification. The focused application of current technology and design will achieve energy savings that would not be possible within the existing building. References indicate Gold Certification typically results in energy savings of 50% to 60%. This will represent a savings of up to 12% of the total energy use of the site. The savings can be redirected into other energy conservation or modernization efforts in other buildings.

The Engineering Development Laboratory is proposed for line item funding beginning in FY2013 to support a major new initiative and is estimated at $80M. The building will support a unique new paradigm in technology development. This paradigm seeks to integrate the building and its energy systems with the industrial or manufacturing processes being developed within it in a way that maximizes energy efficiency and is environmentally friendly. The building will provide flexible spaces of suitable volume to evaluate and prove the processes needed to scale up promising technologies. It will also house ongoing operations that are more closely aligned with these initiatives such as the Engineering Services machine shop and electronic shop, and the Materials Processing Center. The building itself will be part of the test bed for this development process. Since space in the building will need to support a variety of development initiatives over its lifetime, the building will be very flexible in its ability to support the scale up new energy technologies. The need for flexibility will go far beyond just the internal building structure and direct support systems. The building envelope itself and energy systems will need to be

flexible in order to configure those components and systems to maximize their efficiency as they are integrated with the processes being developed. The facility itself will provide a test bed for the application and evaluation of new building system components and technologies. The building will have extensive monitoring and data collection capability in order to evaluate the relationship between building systems and the internal industrial process as well as perform comparative analysis between different building systems or control schemes. The building will also provide office space, collaboration space, support space, virtual reality capability, and maintenance space. Housing these services within the building will enable them to be very responsive to the engineering development activity.

AMES was unable to utilize funding for energy savings projects through an Energy Savings Performance Contract (ESPC) due to beryllium contamination discovered in Spedding Hall and Wilhelm Hall. The ESPC partner had indentified projects that would generate savings of 15% in energy consumption and 16% of water consumption. The project included stack lining, lighting upgrades and low-flow water fixtures. Though the ESPC was discontinued, AMES will pursue other ways to complete the conservation projects.

GPP funding will focus on the remaining research buildings. GPP funding plans are shown in the IFI Budget Data Sheet included in the latest Field Budget submission (see Attachment 3). ARRA funds were received that increased FY2009 GPP funding by $1.71M. With this funding, an Infrastructure Upgrade project was scoped to fund capital improvements that were previously planned for GPP funding in FY2013 through FY2016. The ARRA project includes upgrading space in an existing warehouse facility as a secure, fire resistant records holding facility to house records in compliance with Vital Records Protection requirements, upgrading exit doors on the stair towers of Wilhelm Hall to meet all the current code requirements, and Phase one of upgrading the Assess Control system to current technology for using proximity card readers.

A heating, ventilating, & air conditioning (HVAC) upgrade project in Spedding Hall is currently in progress with existing GPP funding. This project will upgrade the existing systems of heating, ventilating and air conditioning (HVAC) and makeup air controls in Spedding Hall to improve the safety, reliability, energy efficiency and flexibility of the systems. The system has been in service for nearly 50 years and cannot provide the level of control, air balance, reliability and safety monitoring that is beneficial for laboratory activities. The HVAC system will be upgraded for variable air volume operation which will provide temperature control in each space independently. Because the size of the project is much greater than the annual GPP funding level, it is phased over several years using GPP funds into FY2012. In addition, a project to Upgrade Utility Metering was funded in FY2009 and completed in FY2010 that installed smart meters on the electrical services to all the buildings where they are required by DOE Order 430.2B.

Once the HVAC upgrade project is completed and the remaining phase of the Access Control Upgrade is completed, GPP funding will be directed to other projects as defined by our planning process. Projects will include Energy Conservation Projects; Upgrade Windows; Upgrade Electrical Distribution System in Spedding Hall; Spedding Hall Data Center; and Upgrade of Handicapped Access. The completion of the Infrastructure Upgrades with the ARRA funds will enable the Laboratory to begin work on subsequent GPP projects, including the Systematic Space Modernization, sooner than planned. The space modernization project will systematically take out-of-date research space out of service and completely refurbish it to modern standards. This will provide the resources to restructure and reorganize space utilization to improve the work environment for research operations. Unused and underutilized space will be reclaimed and modernized. This will allow research programs to be housed for more efficient operations. It will also create the space needed to house new initiatives planned within the planning window. The complete list of the GPP funding plan is shown in the attached Integrated Facilities and Infrastructure (IFI) Budget Crosscut. (Attachment 3)

The maintenance program consists of maintenance and repair activities necessary to keep the existing inventory of facilities in good working order and extend their service lives. It includes regularly scheduled maintenance, corrective repairs, and periodic replacement of components over the service life of the facility as well as the facility management, engineering, documentation, and oversight required to carry out these functions. Historically, the facilities have been well maintained so that the service lives of the buildings have been extended. The historical data shows that the Laboratory has been able to control and slightly reduce deferred maintenance levels with modest levels of indirect funded maintenance, allowing AMES to operate with a 1.8% target Maintenance Investment Index. Historical experience shows that the current levels of expenditures have been adequate to maintain the facilities. Therefore, future maintenance funding levels are projected by escalating the maintenance budget to continue this level of effort.

There are currently no excess facilities at the Ames Laboratory. With the exception of the replacement of the Metals Development building, none of the existing buildings are planned for excess in the ten-year planning window.

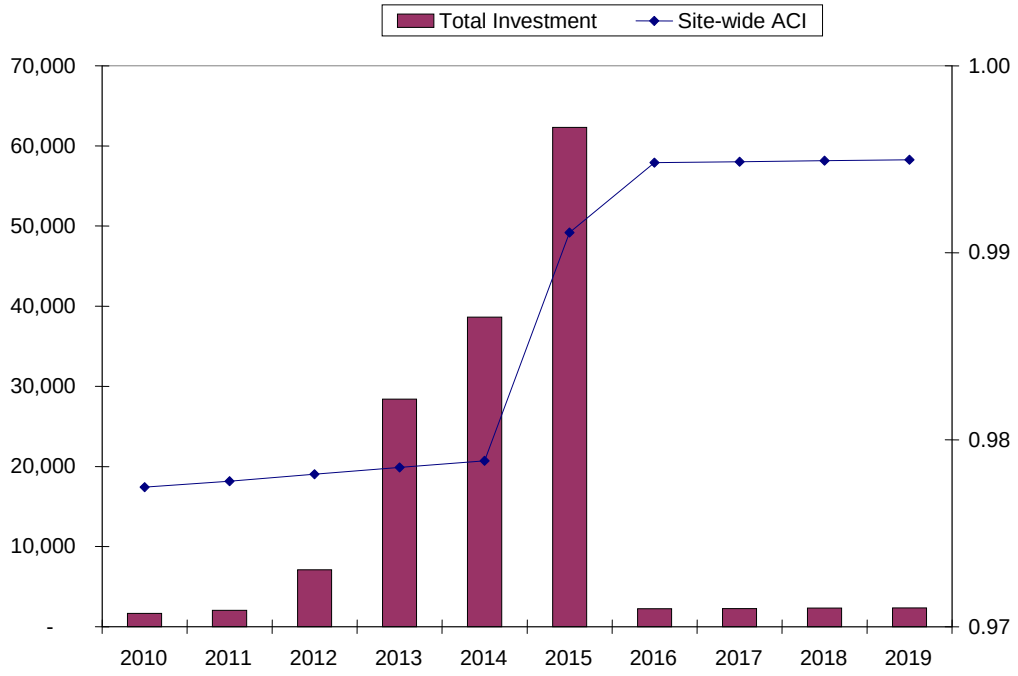
Trends and Metrics

Performance measures are utilized to link facility and infrastructure performance to outputs and outcomes. Broad-based measures are used so a small number of results can provide a high level, integrated grasp of the stewardship of DOE assets at the Ames Laboratory. The DOE corporate wide measures defined in the Real Property Asset Management Order are the Asset Condition Index and the Asset Utilization Index. These values are reported directly in the DOE Facility Information Management System as well as being incorporated in the Laboratory Performance Evaluation and Measurement Plan (PEMP). AMES continues to perform well in the measures with high values for Asset Utilization and Asset Condition that continue to improve. It's important to note that even when old buildings are maintained in good condition, it does not guarantee that they can provide infrastructure that meets the mission needs of cutting-edge research. At AMES, this is reflected in an ACI of 0.98 and mission readiness ratings of "Marginal" for Core Capabilities. In the EOY 2009 PEMP, Section 7.1 contained nine measures concerning management of facilities and infrastructure and Section 7.2, contained two measures concerning planning and acquisition of facilities and infrastructure. All results either met or exceeded expectations and the overall grade was an A-.

Table 3. Facilities and Infrastructure Investments ($M) – Impact to Asset Condition Index

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Maintenance	1.1	1.1	1.1	1.2	1.2	1.3	1.3	1.3	1.4	1.4	1.4
DMR	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Excess Facility Disposition	-	-	-	-	-	-	-	-	-	-	-
GPP	0.6	1.0	1.0	1.2	1.4	1.1	1.0	1.0	1.0	1.0	1.0
Line Items	-	-	5.0	26.0	36.0	60.0	-	-	-	-	-
Total Investment	1.7	2.1	7.1	28.4	38.6	62.4	2.3	2.3	2.4	2.4	2.4
RPV	65.4	66.9	68.5	70.0	71.7	97.5	169.8	173.7	177.7	181.7	185.9
Deferred Maint.	1.5	1.5	1.5	1.5	1.5	0.9	0.9	0.9	0.9	0.9	0.9
Site-wide ACI	0.977	0.978	0.978	0.979	0.979	0.991	0.995	0.995	0.995	0.995	0.995

Figure 1. Facilities and Infrastructure Investments



Sustainability
The FY2010 Executable Plan Update was submitted in December 2009. It articulates the Laboratory's commitment to meet the DOE goals through the projects, tasks, and activities described in it. The age of the facilities makes it very challenging to achieve energy efficiency and sustainability in the existing facilities. The core strategy to achieve the goals is the line item project to replace the Metals Development Building under the Office of Science SLI Infrastructure Modernization Initiative and a variety of retrofit projects funded by capital improvement funds and indirect funds.

A set of projects have been identified in the Executable Plan that will enable the Laboratory to exceed the target reduction in energy and water use intensity. Progress has already been made on a number of the other tasks and activities contained in the Executable Plan:

- Retro-commissioning of TASF administration building has been completed.
- Work has begun on retro-commissioning of Wilhelm Hall.
- The installation of advanced electrical metering has been completed.
- The HVAC Upgrade in Spedding Hall has been completed in additional areas of the building.
- The required renewable energy requirements will be met through the purchase of electric Renewable Energy Credits.

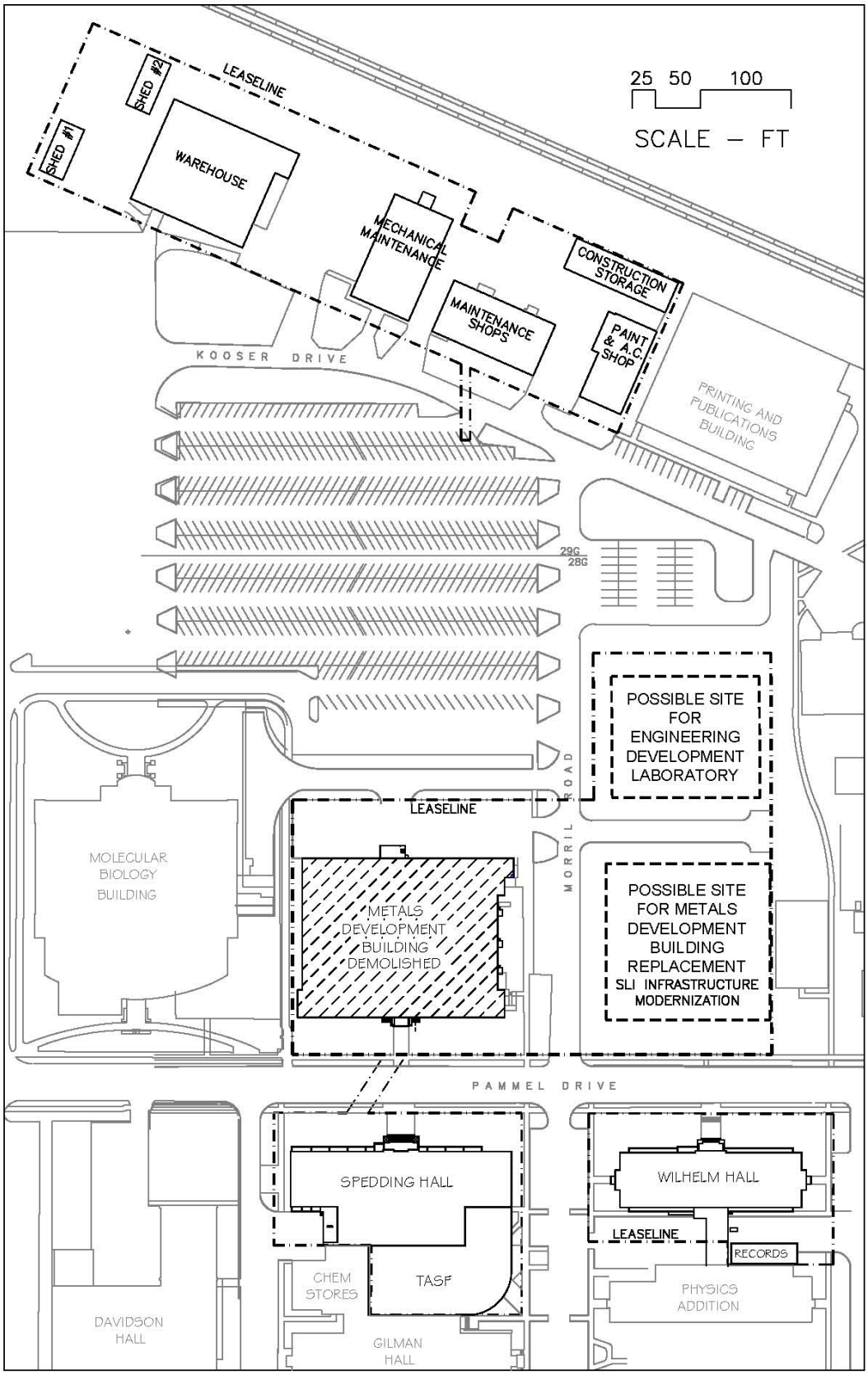
Table 4. Progress Against TEAM Goals

Requirement	DOE Corporate Goal	Status
Energy Reduction	30% from FY 2003 to 2015.	In FY2009, energy use per square foot was 13.1% below the FY2003 baseline. Completion of the items listed in the Executable Plan will allow the Laboratory to exceed the goal. Items include: • Spedding HVAC Upgrade 2% • Lighting & water conservation retrofit project 1% • Replace Spedding Windows 1.4% • Seal Exhaust Stacks 13% • Metals Development Replacement Building 12% • Retro-commissioning existing buildings 1.6%
Renewable Energy	At least 7.5% of annual electricity and thermal produced on-site by FY 2010	The Preliminary Survey performed by the ESCO looked at on-site renewable energy opportunities and found no viable options to meet the target value. A small-scale, on-site renewable project will be installed to demonstrate technology. Because significant generation of on-site renewable energy is not feasible, a waiver of the target level on-site generation will be requested. Renewable Energy Certificates (REC) for electrical power are available at a reasonable premium and will be purchased to reach the target percentage.
Fleet	Maximize use of Alternative Fuel Vehicles	The small fleet size exempts the Laboratory from the TEAM requirements; however the goals are pursued as much as possible within the limitations. Gasoline powered vehicles currently use a 10% ethanol blend. As vehicles are replaced, the Laboratory will pursue acquisition of flex fuel, compressed natural gas, biodiesel, or hybrid electric vehicles.
Water Reduction	16% by FY 2015 relative to FY 2007 use	FY2009 water use intensity was 2.7% below the baseline. There is no water used for irrigation or landscaping at the site. Completion of the items listed in the Executable Plan will allow the Laboratory to exceed the goal. Items include: • Replace Fixtures and Flush Valves 10% • Metals Development Replacement Building 28%
Buildings	15% of existing space meets guiding principles by FY 2015	A formal High Performance and Sustainable Buildings Plan has been developed to ensure that at least 15% of the existing building inventory meet the guiding principles by 2015. Screening of individual buildings and gap analysis will establish the priority and schedule for progress.
	All new construction LEED Gold certified	The Ames Laboratory will require that principles of sustainability will be included in the design and construction of all new buildings in order to achieve LEED Gold certification.

Infrastructure Summary

The Ames Laboratory has been a good steward of the government assets and resources by maintaining the facilities and infrastructure in excellent condition. AMES remains committed to directing the resources necessary to continue this philosophy. Since all of the research buildings are old, the Laboratory has no research facilities built with the modern design methods and technologies targeted to serve the current research paradigm. This plan lays out a broad strategy for achieving the facilities and infrastructure goals laid out by Executive Order, DOE Orders, Office of Science and best management practices. The plan uses a wide range of resources to accomplish this effort through line item financing, GPP, overhead, and savings from improved efficiencies. The result of this plan will be infrastructure that enables the research efforts rather than limiting it.

Attachment 1. Site Map



Attachment 2 Mission Readiness Tables

Support Facilities and Infrastructure (Assumes TYSP Implemented)							
Real Property Capability	**Mission Ready Current**				**Facility and Infrastructure Capability Gap**	**Action Plan**	
						Laboratory	**DOE**
	N[a]	M[b]	P[c]	C[d]			
Work Environment				X	Services such as recreational/fitness, child care, cafeteria etc. are provided to the Ames Laboratory by Iowa State University in accordance with the operating contract. The age of the research buildings makes it difficult to provide modern energy efficient preferred office facilities.	Systematic Space Modernization (GPP)	
User Accommodations				X	Visitor housing is available near the site by private enterprise. The size of the laboratory does not support a dedicated visitor center. Visitors are served by host personnel in existing laboratory facilities.		
Site Services				X	Many site services such as fire service, emergency medical and library services are provided by off site personnel or the contractor. On site services such as storage and shop facilities are capable.		
Conference and Collaboration Space		X			Existing auditorium facilities limit the effectiveness of large group meetings and presentations due to outdated A/V, limited network access, inflexible space with fixed seating and outdated furnishings. It also presents a poor image of the laboratory for program reviews, visitors and staff. Adequate amount of conference room space is available but A/V and network capability is not uniformly available. Space for large gatherings is limited. Collaboration space is very limited and is not integrated architecturally.	Remodel Spedding Auditorium (Indirect) Systematic Space Modernization (GPP)	Metals Development Replacement Building (SLI Infrastructure Modernization)
Utilities				X	Utility services are provided by off site utilities, the contractor, the municipality, and private enterprise.		
Roads & Grounds					Roads and grounds are provided and maintained by Iowa State University in accordance with the operating contract.		
Security Infrastructure				X	Fifteen year old electronic access control is being upgraded to current proximity technology (FIPS 201 compliant). Coverage is being expanded on the site to begin replacing pin and tumbler locks..	Upgrade Access Control (GPP)	ARRA Infrastructure Improvement (access control upgrade)
N[a] = Not, M[b] = Marginal, P[c] = Partial, C[d] = Capable							

Attachment 2 Mission Readiness Tables

Technical Facilities and Infrastructure									
Core Capabilities		**Mission Ready, Assumes TYSP Implemented**				**Key Buildings**	**Facility and Infrastructure Capability Gap**	**Action Plan**	
		N[a]	M[b]	P[c]	C[d]			**Laboratory**	**DOE**
Condensed Matter Physics and Materials Science	Now		X			SPH, HWH, MD	Note 1	-Infrastructure Upgrade (ARRA) -SPH. HVAC Upgrade (GPP) - Remodel SPH. Auditorium (Indirect)	
	In 5 Years		X			SPH, HWH, MD	Note 1	-Infrastructure Upgrade (ARRA) -SPH Data Center (GPP) -Energy Conservation Project (GPP) -Upgrade Windows (GPP) -Upgrade Electrical Distribution, SPH (GPP)	-Metals Development Replacement Building (SLI Infrastructure Modernization)
	In 10 Years				X	SPH, HWH, MDR		-Systematic Space Modernization & Misc Small Projects (GPP)	
Chemical and Molecular Science	Now		X			SPH, HWH, MD	Note 1	-Infrastructure Upgrade (ARRA) -SPH. HVAC Upgrade (GPP) - Remodel SPH. Auditorium (Indirect)	
	In 5 Years		X			SPH, HWH, MD	Note 1	-Infrastructure Upgrade (ARRA) -Energy Conservation Project (GPP) -Upgrade Windows (GPP) -Upgrade Electrical Distribution, SPH (GPP)	Metals Development Replacement Building (SLI Infrastructure Modernization)
	In 10 Years				X	SPH, HWH, MDR		-Systematic Space Modernization & Misc Small Projects (GPP)	

Attachment 2 Mission Readiness Tables

Core Capabilities		Mission Ready, Assumes TYSP Implemented					Key Buildings	Facility and Infrastructure Capability Gap	Action Plan
		N[a]	M[b]	P[c]	C[d]			Laboratory	DOE
Applied Materials Science and Engineering	Now		X			SPH, HWH, MD	Note 1	-Infrastructure Upgrade (ARRA) -SPH. HVAC Upgrade (GPP) - Remodel SPH. Auditorium (Indirect)	
	In 5 Years		X			SPH, HWH, MD	Note 1	-Infrastructure Upgrade (ARRA) -Energy Conservation Project (GPP) -Upgrade Windows (GPP) -Upgrade Electrical Distribution, SPH (GPP)	Metals Development Replacement Building (SLI Infrastructure Modernization)
	In 10 Years				X	SPH, HWH, MDR		-Systematic Space Modernization & Misc Small Projects (GPP)	

[a]N = Not [b]M = Marginal [c]P = Partial [d]C = Capable
SPH = Spedding Hall HWH = Harley Wilhelm Hall MD = Metals Development Building MDR Metals Development Replacement

Note 1 The buildings are in good shape but are old and do not provide the modern infrastructure to serve current research paradigms. Good space for increasingly sensitive instruments, such as electron microscopes, is not available due to vibration, noise, or electromagnetic interference. Research using some new materials such as nano-scale particulates is limited by existing ventilations systems. Such installations require extensive modifications and work-arounds to provide space for those operations. The computation facilities are filled to capacity so that expansion requires creating new space or retiring existing computers to create space. In particular, the Metals Development Building was built for pilot plant materials operations and does not provide the modern work environment and functionality needed to support the materials discovery, design and synthesis efforts. Existing auditorium facilities limit the effectiveness of large group meetings and presentations due to outdated A/V, limited network access, inflexible space with fixed seating and outdated furnishings. It also presents a poor image of the laboratory for program reviews, visitors and staff.

Attachment 3. IFI Crosscut

FY 2012 Budget					FY2011-2015												
Office of Science					Facilities and Infrastructure Budget Crosscut												
Site Name: Ames Laboratory																	
Integrated Facilities and Infrastructure Budget Data Sheet (IFI)	Project Number	Funding Program	Net (sf) + Added - Subtracted Building Area	Total Project Cost ($000)	FY 10 Approp. ($000)	FY 11 Request ($000)	FY 12 Budget ($000)	FY 13 Budget $000)	FY 14 Budget ($000)	FY 15 Budget ($000)	FY 16 Budget ($000)	Estimated Annual Energy Savings (Mbtu/Yr)*	Estimated Annual Energy Cost Savings ($)*	Estimated Annual Water Savings (Kgal/Yr)*	Estimated Annual Water Cost Savings ($)*	Project Needed to Meet Sustainability Goals? (Yes/No - If yes, explain in notes field*	Notes*
1.0 Line Item Projects (Include project number & identify Funding Program)																	
1.1 New Construction (facilities and additions)																	
Metals Development Replacement Building	L0002	KG	-3,163	47,000	.....	.....	5,000	15,000	21,000	6,000	.....	9,859	132,524	1,333	7,324	Yes	New building will be LEED Gold and will replace a building that does not meet High Performance Sustainable Buildings.
Engineering Development Laboratory	L0003	KG	100,000	80,000	.....	.....		11,000	15,000	54,000	.....					No	
Subtotal, New Construction			**96,837**	**127,000**	**.....**	**.....**	**5,000**	**26,000**	**36,000**	**60,000**	**.....**	**9,859**	**132,524**	**1,333**	**7,324**		
1.2 Other Projects (replacements and conversions)																	
(list specific projects)					.....	.....	.....	.....	.....	.....	.....						
Subtotal, Other Projects			**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**		
1.0 Total Line Item Projects (Totals 1.1 and 1.2)			**96,837**	**127,000**	**.....**	**.....**	**5,000**	**26,000**	**36,000**	**60,000**	**.....**	**9,859**	**132,524**	**1,333**	**7,324**		
2.0 General Plant Project (GPP)																	
2.1 GPP																	
KC-03 GPP Spedding HVAC Upgrade	AA2D0001	KC		3,515	610	610	820					1,718	20,367			No	
KC-03 GPP Energy Conservation Projects	AA9D0005	KC		485			135	350				667	16,944	495	2,832	No	Mis-categorized under indirect funding in March 2010 Green House Gas data submission. GPP funding moves schedule up and decreases cost due to escalation.
KC-03 GPP Upgrade Access Control System	AA5D0003	KC		780				780								No	
KC-03 GPP Upgrade Spedding Hall Windows	AA4D0002	KC		450				450				1,124	14,013			No	
KC-03 GPP Upgrade Electrical Distribution, Spedding Hall	AA8D0001	KC		560					560							No	
KC-03 GPP Handicapped Access	A98D0031	KC		245					245							No	
KC-03 GPP Spedding Hall Data Center	AA9D0002	KC		600					600							No	
KC-03 GPP Systematic Space Modernization	AA5D0002	KC		4,900						700	700					No	
KC-03 GPP Sprinkler System, Maintenance Shop Building	A97D0005	KC		120						120						No	
KC-03 GPP Misc Small Projects	A98D0027	KC		1,750						250	250					No	
Subtotal, GPP			**.....**	**13,405**	**610**	**610**	**955**	**1,580**	**1,405**	**1,070**	**950**	**3,509**	**51,324**	**495**	**2,832**		
2.2 ARRA GPP																	
Infrastructure Upgrades	R199	KG		1,710												No	
Subtotal, ARRA GPP			**.....**	**1,710**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**		
2.0 Total GPP Projects (Totals 2.1 and 2.2)			**.....**	**15,115**	**610**	**610**	**955**	**1,580**	**1,405**	**1,070**	**950**	**3,509**	**51,324**	**495**	**2,832**		
3.0 Institutional General Plant Project (IGPP)																	
3.1 New Construction (facilities and additions)																	
(list specific projects)																	
Subtotal, IGPP New Construction			**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**		
3.2 Other (replacements and conversions)																	
(list specific projects)																	
Subtotal, IGPP Other			**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**		
3.0 Total IGPP Projects (Totals 3.1 and 3.2)			**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**		
4.0 Maintenance & Repair																	
4.1.1 Direct Funded																	
(list specific projects)																	
Subtotal, Direct Funded			**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**		
4.1.2 Direct Deferred Maintenance Reduction																	
(list specific projects)																	
Subtotal, Direct Deferred Maintenance Reduction			**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**		
Total Direct Funded Maintenance and Repair			**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**		
4.2.1 Indirect Funded (from Overhead or Space Charges)																	
General Maintenance & Repair		KC			1,060	1,104	1,147	1,192	1,225	1,260	1,295	11,980	152,658			No	
Subtotal, Indirect Funded			**.....**	**.....**	**1,060**	**1,104**	**1,147**	**1,192**	**1,225**	**1,260**	**1,295**	**11,980**	**152,658**	**.....**	**.....**		
4.2.2 Indirect Deferred Maintenance Reduction																	
(list specific projects)																	
Subtotal, Indirect Deferred Maintenance Reduction			**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**		
Total Indirect Funded Maintenance and Repair			**.....**	**.....**	**1,060**	**1,104**	**1,147**	**1,192**	**1,225**	**1,260**	**1,295**	**11,980**	**152,658**	**.....**	**.....**		
4.0 Total Direct and Indirect Maintenance and Repair (4.1 and 4.2)			**.....**	**.....**	**1,060**	**1,104**	**1,147**	**1,192**	**1,225**	**1,260**	**1,295**	**11,980**	**152,658**	**.....**	**.....**		
5.0 Disposition of Excess Facilities																	
5.1 Direct Funded Disposition of Excess Facilities																	
(list specific projects)																	
Subtotal, Direct Funded Disposition of Excess Facilities			**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**		
5.2 Indirect Funded Disposition of Excess Facilities																	
(list specific projects)																	
Subtotal, Indirect Funded Disposition of Excess Facilities			**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**		
5.0 Total Direct and Indirect Disposition of Excess Facilities			**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**	**.....**		

* Provide this information only for line item, GPP, IGPP projects that have initial funding in FY 2010, FY 2011, or FY 2012. Provide information only as a summary for all activities funded as maintenance and as funded as excess facilities disposition (not by Project).