Draft Material

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Ernest Orlando Lawrence Berkeley National Laboratory

Strategic Facilities Plan

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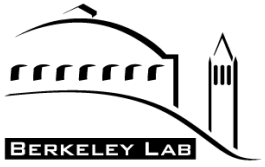

ERNEST ORLANDO LAWRENCE BERKELEY NATIONAL LABORATORY

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Executive Summary

The Lawrence Berkeley National Laboratory's results-based management efforts are directed towards advancing DOE overall strategic interests and to the Office of Science goals to advance the frontiers of the physical sciences and areas of the biological, environmental and computational sciences that deliver the scientific knowledge and discoveries for DOE's missions.

The Laboratory directly addresses the Department of Energy's goal to provide world-class research facilities and essential scientific human capital to the nation's overall science enterprise. Lawrence Berkeley National Laboratory (Berkeley Lab) operates and develops the site to:

- Stimulate and foster a collaborative, world-class scientific work environment that attracts and retains highly qualified professionals.
- Accommodate flexible, state-of-the-art facilities and infrastructure appropriate to Berkeley Lab's research roles for DOE.
- Support the growing user community at the Laboratory's scientific facilities.
- Promote its unique setting and outdoor spaces to maximize opportunities.
- Welcome users, visitors, and neighbors in an enabling, efficient, safe, and attractive manner.

Berkeley Lab's primary challenge in site development planning is operating at a near 100% occupancy while also balancing adaptive reuse of existing buildings with the prioritized replacement of structures which presently or will soon no longer be able to competently or cost-effectively serve the mission.

Berkeley Lab meets this challenge through a coordinated planning program. Space Management and Site Development Planning functions are closely linked. These functions are closely coordinated with the Laboratory's Strategic Planning office such that seamless decision making can be accomplished across the organization.

New and growing mission requirements are evaluated for placement both at locations that already meet their requirements as well as spaces that could be cost-effectively upgraded to meet the project requirements. Opportunities to accommodate growth within existing buildings through further increases in occupancy rates are also actively sought through regular reviews of space management data. These space "mining" actions are at the heart of the Laboratory's ability to renew facilities and address evolving program needs.

Similarly central to this management responsibility is the tracking and evaluation of evolving mission requirements. These data and trends are evaluated against current and projected building capabilities and population projections.

When buildings cannot be cost-effectively adapted to the requirements of modern science they are considered for other uses and for demolition/replacement. Limits to cost-effective space adaptation and mission growth drive the need for new buildings and the replacement of those buildings that can no longer meet functional requirements.

The regular infusion of new research laboratory buildings is fundamental to the over all strategy of maximizing use of all space. It is clear that a number of WWII-era and special purpose structures can not be cost-effectively adapted to meet the needs of modern science. Reuse of these sites and the development of adjacent sites to construct new modern structures

not only provides modern high-caliber laboratory space for the immediate mission but also supports a continuing program of building maintenance and adaptation aimed to obtain maximum value from all investments made to the scientific infrastructure.

The immediate development priorities are construction of the Molecular Foundry, E-Lab, Proteomics and Computational Biology Facility and the Femtosecond Structural Dynamics User Facility. These projects also have strong connections to exceptional and evolving research programs in the scientific community of this Office of Science Laboratory.

Consistent funding of the "Removal of Building 51 Bevatron Complex" project will return this valuable site with the demolition of the Bevatron Complex in 2011. The plan to spread costs over nearly a decade is acceptable to the Laboratory. Berkeley Lab is evaluating a number of development options for this keystone site in order to determine which option provides the greater benefit to the science infrastructure. The development framework will be discussed in the 2003 SFP.

In order to make timely improvements to the current Laboratory buildings an increase in the level of GPP funding is required. Under DOE regulations, these are our sole source of capital funds with which we may accomplish small and moderate scale facility improvements. Such small and moderate capital improvements are fundamental to our ability to adapt space in older buildings so that it serves modern scientific requirements. The GPP funds are a critical factor in our ability to extend the useful scientific life of many existing buildings.

The scientific drivers and buildings identified in Berkeley Lab's infrastructure planning advance DOE missions and the Office of Science programs, principally for the Offices of Basic Energy Sciences, Biological and Environmental Research, High Energy and Nuclear Physics, Advanced Scientific Computing Research, and Fusion Energy Sciences. In addition, technology advancements made by the Laboratory support the Energy Efficiency and Renewable Energy Programs and the Office of Civilian Radioactive Waste Management and other elements of DOE. The programmatic drivers and research facility needs that must be incorporated into the planning for Berkeley Lab and for DOE managers are summarized in this document.

Laboratory Mission and Role

Results-oriented performance in the DOE's scientific mission drives Berkeley Lab. Berkeley Lab is a multiprogram national research facility and an integral element of the Department of Energy's National Laboratory System. Berkeley Lab's programs, support DOE's mission to maintain "a secure and reliable energy system that is environmentally and economically sustainable" and to ensure "continued United States leadership in science and technology," as stated in DOE's *Strategic Plan*. These programs also support the Comprehensive National Energy Strategy to "work internationally on global issues," to "improve the efficiency of the energy system," and to "expand future energy choices through wise investments in basic science and new technologies."

Berkeley Lab's principal role for DOE is fundamental science; for example, developing powerful experimental and computational systems for exploring properties of matter, deepening our understanding of molecular interactions and synthesis, and gaining insights into biological molecules, cells, and tissues.

Berkeley Lab is a major contributor of research on energy resources, including the earth's structure and energy reservoirs, fusion, combustion of fuels, and keys to efficient energy storage and use. In addition, Berkeley Lab is extensively involved in environmental research, including subsurface contaminant transport, bioremediation and indoor air quality.

Berkeley Lab's mission statement, as stated in its FY 2003–2007 *Institutional Plan*, articulates four distinct Laboratory goals that support the DOE mission; Berkeley Lab:

- Performs leading multidisciplinary research in the computing sciences, physical sciences, energy sciences, biosciences, and general

sciences in a manner that ensures employee and public safety and environmental protection.
- Develop and operates unique national experimental facilities for qualified investigators.
- Educates and trains future generations of scientists and engineers to promote national science and education goals.
- Transfers knowledge and technological innovations and fosters productive relationships among Berkeley Lab's research programs, universities, and industry.

User facilities at Berkeley Lab include the Advanced Light Source, National Energy Research Scientific Computing Center, National Center for Electron Microscopy, 88-Inch Cyclotron, Gammasphere, and the Biomedical Isotope Facility.

Laboratory Site and History

Berkeley Lab's asset management programs are directed to attract and retain the outstanding scientific talent to address DOE's missions. Berkeley Lab's continuing record of performance and its unique location are key elements in the Laboratory's success in this arena.

Berkeley Lab is unique among the national multiprogram laboratories in that it is located in the center of one of the nation's premier research and development hubs. (see Figure 1) The physical presence of an Office of Science facility in this internationally recognized scientific/economic region provides unparalleled opportunities for scientific interactions and economic stimulation.

Berkeley Lab is located a non-urban setting immediately adjacent to a preeminent research university–-an environment that is particularly conducive to concentrated scientific focus Berkeley Lab was the first of the National Laboratories. The Laboratory was established at its hillside location above the University of California, Berkeley campus in 1939. Berkeley Lab's role for DOE has changed since the first Manhattan project and 184-Inch Cyclotron facilities were constructed in the early 1940s.

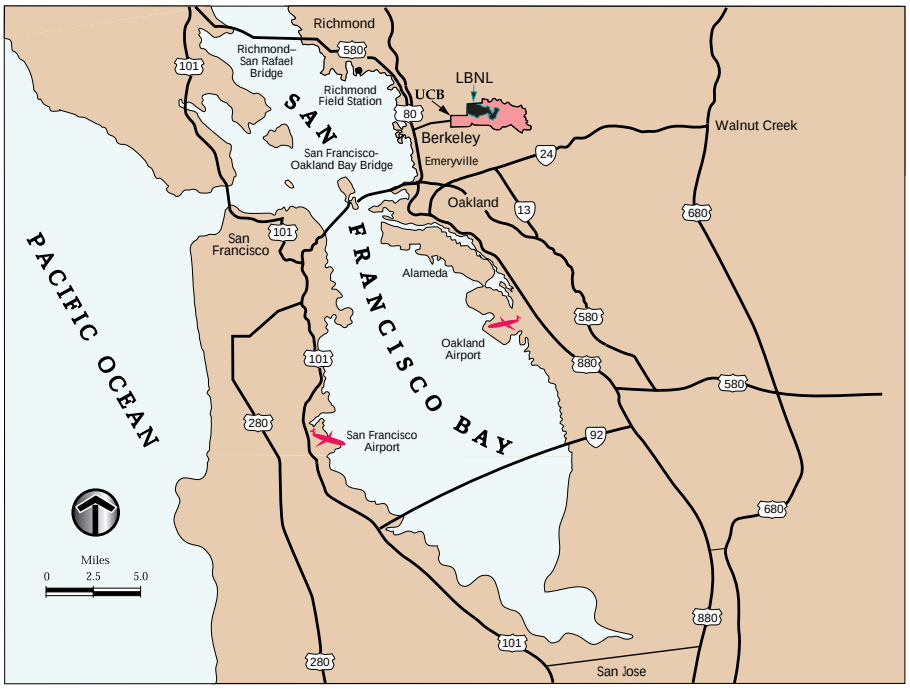

Figure 1: Regional Map, Lawrence Berkeley National Laboratory

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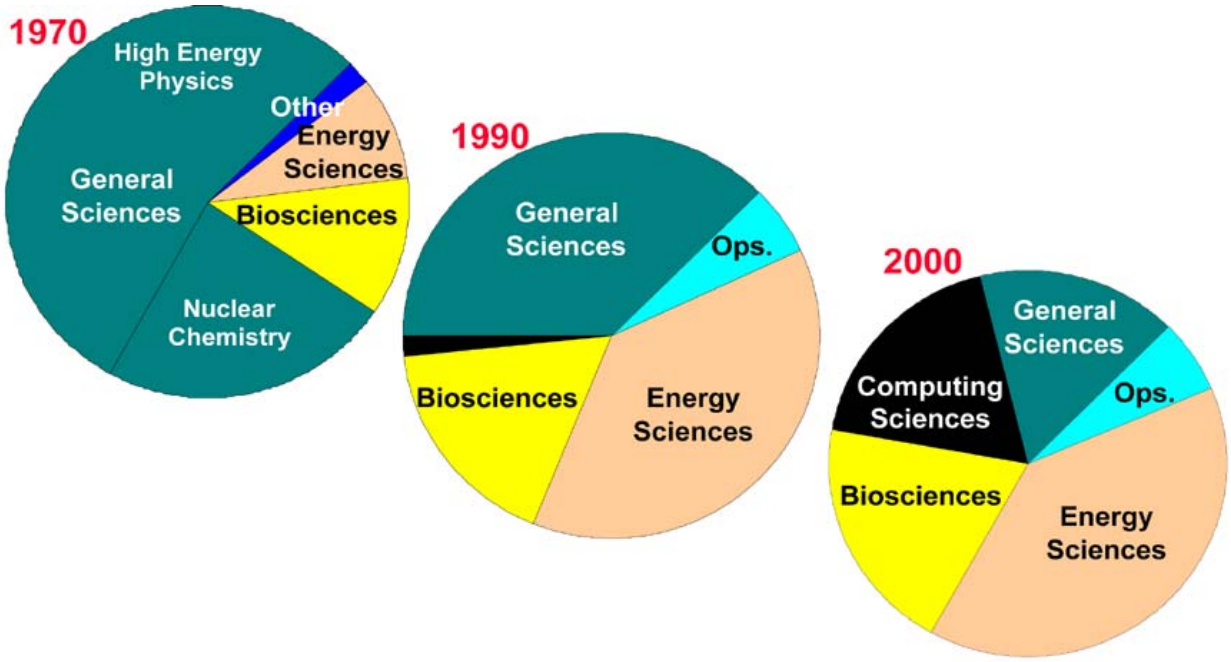


Figure 2 Evolution of the Laboratory

The Laboratory has a sustained history of scientific leadership in the performance of its missions over the years. The evolution of the Laboratory is summarized in Figure 2.

Berkeley Lab's 82-hectare (200-acre) main site encompasses 1.76 million gross square feet (mgsf) of building space. In 2002, there are 110 buildings of conventional construction and 86 trailers and other structures at the main site. Additional Laboratory space is located on the UC Berkeley campus (79,000 net square feet); and 330,000 gsf of Laboratory space is located in leased buildings in the cities of Berkeley, Oakland, and Walnut Creek (leased gsf includes 45,000 gsf of exterior warehouse space; therefore the leased building space figure in Figure 3 is 290,000 gsf). (See Figure 3)

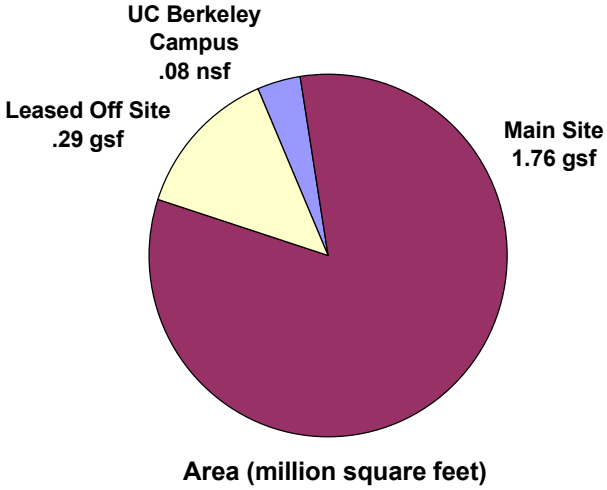


Figure 3 Location of Laboratory Space

All offices, laboratories, and support facilities at Berkeley Lab that can be occupied are 100-percent utilized. All usable space is fully committed to the scientific mission, and maintenance actions ensure that scientific needs are addressed. However, the World War II-era buildings are not well matched to the current research programs. These facilities do not have the mechanical systems (e.g. air handling, heating, cooling, and plumbing) and electrical systems necessary to effectively or efficiently conduct the current research. Many of these systems are vital to providing adequate cleanliness, fume removal, treatment, power, gas handling, and other operations necessary for experimental programs. In other instances, the buildings are not structurally satisfactory, including buildings that are condemned or have occupancy limitations. Frequently, the buildings were intended for temporary occupancy or for specialized functions that are no longer being conducted. Use of unsatisfactory space is costly, and requires reliance on administrative controls to ensure that operational safety requirements continue to be attained.

The closed Bevatron accelerator, and several small trailers/structures that have been determined to be structurally unsound, have been declared "excess". Expeditious demolition and removal of these former assets will allow these sites to be restored to productive service to the DOE's mission. These facilities have made major contributions to earlier missions and the missions of today owe much to the work performed here, still, the scientific questions of today are pressing and these key sites have new roles to perform. Demolition of the Building 51 Bevatron is a top priority.

Laboratory Site Development Planning

The Laboratory's Strategic, Space Management and Site Development planning programs are closely linked and coordinated. They are aligned and focused to achieve the facilities necessary to sustain the Laboratory's results-based research for the DOE mission. Supporting sustained scientific advances at Berkeley Lab is a site development planning program that is focused to:

- Ensure investments are made to the utility infrastructure in order to provide a reliable platform for leading edge science.
- Plan building upgrades and replacements and coordinates with programmed maintenance will ensure that the infrastructure continues to meet research requirements.

An aggressive Space Management program ensures that space is well utilized. Buildings and spaces that might be upgraded to continue to serve the mission are evaluated to determine if cost-effective modifications can be achieved – "mining" of available space.

A closely associated Site Development Planning program that is organized to work with the Strategic Planning and Space Management groups as well as the research units to establish development roadmaps for sustained scientific achievement.

Berkeley Lab has developed a Geographical Information System (GIS) to further strengthen is site planning capabilities. This tool brings together relevant site information into a single data management system. Moreover, this GIS system allows alternative locations of buildings, parking lots, utility corridors and other physical developments to be evaluated relative to natural and constructed landscape elements. Siting is expedited, potential issues identified in the early stages of project development and site development costs can be managed in a highly effective manner.

In 2000-2001 a "Building Massing" analysis of each area of the Laboratory was conducted and the development potential of the entire site considered (both redevelopment and new sites). This analysis was discussed with the research leadership.

In 2002, individual meetings are being held with each of the research units to ensure that their needs and priorities are being appropriately addressed. This planning process informs the

2002 Strategic Facilities Plan and will continue through the end of calendar year 2002 with all current planning analysis and studies incorporated in the 2003 Strategic Facilities Plan.

For the planning horizon of this plan, Berkeley Lab's mission will be sustained in fundamental research, energy resources and environmental quality. Berkeley Lab does not anticipate major growth in programmatic activity, outside of DOE mission initiatives. On the other hand, advances in the Laboratory's scientific programs and the emerging developments in DOE program areas are expected to sustain key trends, such as: a growing population of users at the Advanced Light Source and other user facilities; more powerful computational capabilities integrated with science applications; increased scale of new bioscience programs in proteomics, structural biology and functional genomics, and a new understanding of the universe, matter and energy through advances in astrophysics, detectors, and accelerator science. In addition, energy and environmental issues will reaffirm the research focus on inertial fusion energy science, carbon sequestration, and reliability-of-electric-power and energy-efficiency research as the nation addresses its energy supply problems.

Both the current roles and the anticipated changes—especially in growth of nano-scale science, advanced instrumentation, computation, and the new biology—call for strategic investments and renewal of scientific and support infrastructure that is essential for Berkeley Lab to meet its current and anticipated mission and program obligations. Major new scientific instrumentation and experimental programs including a major new fourth generation synchrotron radiation source offer the prospect for significant scientific and economic benefit consistent with Berkeley Lab's current research expertise. Because of their size and uniqueness, such significant initiatives are planned and advanced through national and international scientific forums. The Laboratory has and will also continue to advance new, novel and innovative accelerators, x-ray sources, and other instrumentation through its ongoing programs.

Some program growth and redirection may occur in selected areas, such as additional operations to accommodate the expanding user communities, current and anticipated national initiatives such as those in nanoscience and computing and, potentially, other areas. Each of the strategic facility investments called for in this plan are result-driven and directly tied to Berkeley Lab's service to DOE scientific missions.

Infrastructure Vision, Goals and Objectives

Building and utility assets are managed and maintained in alignment with the Laboratory's mission and so that researchers are able to obtain the maximum possible level of service from these assets both today and in the future. Significant Laboratory resources have been committed to adapt buildings and upgrade utilities in order to meet the needs of the modern scientific mission. These buildings and utilities are the foundation upon which outstanding scientific talent can apply their talents in the advancement of DOE's missions.

The infrastructure for the DOE National Laboratory system supports some of the most productive scientific institutions in the nation. Berkeley Lab is a renowned and preferred research location. Berkeley Lab has also made substantial infrastructure investments in order to maximize use of its buildings for modern science. Investments have been made to the utility infrastructure and where practical to the structures themselves. The foundation remains firm for sustained scientific advances at Berkeley Lab. Sites for modern multi-story laboratory buildings to replace old wooden and masonry buildings have been identified. Planning analysis demonstrates that new structures can be developed in an orderly manner to directly support both immediate and evolving scientific results.

As indicated in the *Strategic Plan of the Office of Science*, a key objective for this Laboratory is to "provide leading research facilities and instrumentation to expand the frontiers of the natural sciences." Berkeley Lab's

infrastructure planning and management efforts are directed towards sustaining the Office of Science mission and its strategic objective. This will require that several facilities be upgraded and renovated to conform to modern standards, the replacement of a few structures that can no longer be economically upgraded to serve the mission and the development of new laboratory and support facilities to address program growth and evolving mission requirements.

The principal developmental goals used in the development of the Strategic Facilities Plan are to:

- Provide laboratories, offices and infrastructure systems appropriate to Berkeley Lab's research roles as they are required to meet the DOE's research goals.
- Support the growing user community in achieving their research objectives at Berkeley Lab's scientific facilities.
- Provide an environment that is safe, efficient, and fully enabling for staff, guests, and the community.

Consistent with these goals, Berkeley Lab has adopted the following infrastructure planning objectives:

- *Mission*: Anticipate the changes in Berkeley Lab's technological capabilities that will be required to meet programmatic and mission direction in order to accommodate Berkeley Lab's long-term mission for the next 20 to 30 years.
- *Quality and Value*: Continuously improve the quality, uniqueness and value of this world-class scientific research facility to Berkeley Lab's stakeholders (the research and academic communities, institutional researchers, the Federal government, Congress and the general public) so that both current and future research expectations are fully realized.
- *Working Environment*: Provide facilities and a campus that is a "preferred" working environment for the caliber of scientists and engineers that we need to attract and retain.
- *Security:* Provide visiting scientists access and the opportunity to collaborate with Laboratory researchers while protecting security and assets.
- *Flexibility and Versatility:* Building and interior construction will respect the dynamic changes in scientific programs. Interior space/layout will be adaptable for new program work, and office space will require only minimal modifications to accommodate program changes and staff relocation.
- *Durability and Longevity:* We will strive to use materials and construction technologies that yield structures capable of providing 50+ useful years of research use without a major renovation.
- *Environmental Safety and Health:* Building materials, design and construction should provide a safe working environment for the occupants as well as a model of environmentally sustainable design and materials of construction.
- *Sustainability:* Incorporate environmentally sound and energy-saving design, materials and utilities that will use state-of-the-art technology where appropriate.
- *Cost:* Ensure that the proposed investments yield a significantly high rate of return and help minimize operating and maintenance costs.

The mission drivers and facilities identified in this Plan advance DOE missions and Office of Science programs—principally, the Offices of Basic Energy Sciences, Biological and Environmental Research, High Energy and Nuclear Physics, Advanced Scientific Computing Research, and Fusion Energy Science. In addition, technology advancements made by Berkeley Lab support the Energy Efficiency and Renewable Energy programs, the Office of Civilian Radioactive Waste Management, and other elements of DOE.

Science Vision

As Director Charles Shank stated in the 2003-2007 Institutional Plan: Berkeley Lab is strategically directing resources to five key foci: advancing nanoscience, understanding the properties of matter and energy in the universe, developing the new science of quantitative biology, improving energy efficiency and reliability and providing the computational capabilities and expertise that address Department of Energy scientific needs.

Nanoscience. Berkeley Lab is proposing a Molecular Foundry to advance the Office of Science role in the National Nanotechnology Initiative. This scientific research center will focus on the conjunction of soft and hard nanostructure building blocks and their fabrication into functional multicomponent assemblies. The foundry will have an internal research program, a collaborative research facility for visiting scientists, a training program for students and postdoctoral fellows, and portals to major user facilities including the Advanced Light Source, the national Center for Electron Microscopy, and the National Energy Research Scientific Computing Center.

Astrophysicis. Berkeley Lab is undertaking a research and planning effort for an astrophysics satellite program that will define the fundamental properties of the universe through the observations of supernovae. The effort stems from mounting supernova evidence that the expansion of the universe is accelerating, perhaps driven by an unseen dark energy. The observation of sufficient numbers of supernova events is necessary to measure the mass density, energy density, and curvature of the universe and to address this newly discovered dark energy. The international collaboration for this satellite mission will require resources for planning and experimental development during the next several years, in advance of project implementation.

Genomes to Life. In the era that follows the sequencing of the human genome, a new biology program for the Office of Science is directed at developing a more predictive and quantitative understanding and control of microbiological systems. This includes characterizing the regulatory networks of microorganisms and creating data-driven, validated models of biological responses in the integrated program of environmental microbiology, functional genomic measurements, and computational analysis and modeling to understand the basic biology of microbial systems and to restore contaminated environments.

Energy Efficiency and Security. Berkeley Lab has a distinguished record of research that improves the energy security of the nation while reducing environmental impacts. Successes include low-emissivity windows, high-frequency ballasts for fluorescent lamps, and efficient fixtures for compact fluorescent lamps. The Laboratory is working to establish E-Lab, an energy efficiency and electricity reliability laboratory that will enable programs in DOE's Office of Energy Efficiency and Renewable Energy to further develop the most advanced energy efficiency and reliability technologies and to partner with industry so that these can be introduced into the marketplace. The Laboratory is working with the State of California to reduce energy demand and improve electricity distribution reliability through modeling and improved technology. The Laboratory also proposes to develop the next generation of energy efficient technologies for carbon dioxide emissions reduction and to work toward advancing research in potential long-term solutions using inertial confinement fusion.

Scientific Computation. The National Energy Research Scientific Computing Center (NERSC) provides high-performance computational resources that are highly valued by its DOE user community. NERSC applies capabilities in computational science-to-scale to address national challenges for climate prediction, combustion modeling, subsurface transport, functional genomics, accelerator physics, nanoscience, and other research areas. NERSC emphasizes

comprehensive scientific support, leveraging the Office of Science initiative on Scientific Discovery through Advanced Computing, and providing a unified environmental that integrates computing with experimental sciences.

To sustain the Laboratory's scientific efforts, the nation needs to invest in the science infrastructure that underpins our discoveries and, ultimately, the security, economic prosperity, and health of our citizens. The Laboratory will fall short of its scientific goals if the infrastructure of previous generations is relied upon for a new generation of science. These next few years are artificial turning point – either towards advancement of the natural sciences through investment, or erosion through continued reliance on facilities constructed a half-century ago.

Working with the Office of Science, we are committed to building the user infrastructure necessary for our national scientific facilities. We have allocated significant Laboratory resources to completing the Users Mezzanine of the Advanced Light Source (ALS), opening the Oakland Scientific Facility for scientific and administrative computing, and constructing additions to the 88 inch Cyclotron and National Center for Electron Microscopy. Now we must join with DOE to further address space and other infrastructure needs of the growing user base as well as other facility needs. The Molecular Foundry will be a key resource for the National Nanotechnology Initiative. Working with the Office of Energy Efficiency and Renewable Energy, we are exploring the concept of E-Lab as a "living laboratory" facility that would combine offices and laboratories to investigate, test, monitor and demonstrate new energy efficiency technologies and design processes. In addition, the Office eof Science must sustain its support for dismantling the Bevatron following its illustrious career in high energy physics, heavy ion nuclear physics and nuclear medicine.

Ten-Year Facility Development Program

New Construction - Programmatic Research Projects

The Molecular Foundry

Berkeley Lab facilities must be planned and expanded to address the National Nanotechnology Initiative. Current facilities lack the quality and integration of adjacent complementing facilities. To meet this need the construction of the Molecular Foundry Building is planned.

The Molecular Foundry Building will include state-of-the-art materials characterization, manipulation and synthesis laboratories for studies of matter of nanometer dimensions. Materials at this size display unexpected properties that can be exploited in designing materials and devices with previously unattainable but critically required characteristics. These materials and devices will have a major impact on energy technologies and protection of the environment.

The Molecular Foundry will utilize LBNL's major user facilities—ALS, NCEM, and ERSC—for investigations of nanoscale materials and structures. These facilities will be instrumental in supporting the characterization, simulation and theory functions that will be a critical part of this program.

The Molecular Foundry Building will be a new, six story facility sited between Buildings 66 and 72 with a total gross area of approximately 86,000 square feet and net assignable area of approximately 53,000 square feet. A separate single story utility plant with a gross area of approximately 8,000 square feet will also be provided. Laboratory and office space in the new facility will be designed to support highly interdisciplinary studies in nanostructures involving the collaboration of experts in materials science, physics, chemistry, biology, molecular biology and engineering. Cleanroom laboratories with low vibration will be provided. The TEC of this Line Item Project is $83.7M and it is identified as a FY2003 start.

The Molecular Foundry is sited on the slope between the building in the foreground in the image below (Building 72 – the National Center for Electron Microscopy) and the laboratory buildings in the background (Buildings 66 and 62). The molecular foundry is the keystone building in this scientific complex.

E-Lab

The Energy Efficiency and Electricity Reliability Laboratory (E-Lab) will serve as a regional resource to focus federal, state, and private sector resources on advancing energy efficiency and renewable energy technologies and achieve their rapid commercial deployment.

The E-Lab is a 32,000 gsf research facility featuring innovative design elements. It will provide excellent experimental facilities and will function as a living laboratory and collaborative center to develop, evaluate, and demonstrate advanced energy efficiency and renewable energy technology components, systems and processes.

The Laboratory will build on Berkeley Lab's research experience in lighting, windows, ventilation, laboratory and office equipment, building simulation and design tools, performance benchmarking, advanced sensors and controls, diagnostics and commissioning, appliance standard-setting research, electricity storage and transmission, and electric reliability. It will extend the Lab's successes in working with private sector and state organizations.

E-Lab will contribute significantly to achieving EERE's energy savings goals by introducing new technologies and practices in both existing and new buildings. The work will also directly address the growing need to effectively manage electric loads in buildings so as to enhance electricity grid reliability.

Testing and demonstration of energy-efficient technologies and practices in a "living laboratory," in close cooperation with industry and public sector partners, will encourage both innovation and market acceptance. The estimated cost is $19.0M and the project is identified as a FY 2004 start.

Proteomics and Computational Biology Facility

Berkeley Lab's growing and well regarded research in structural biology, computational crystallography and related functional genomics require space to work more closely together and co-locate scientific instruments that can be utilized by multiple research groups. These groups are currently located at facilities which are up to one-mile distance from each other, co-location a common building which provides appropriate facilities and interaction space can further improve research capabilities in this DOE mission.

The new 50,000 gsf Proteomics and Computational Biology research building will replace three small wooden support buildings that date from WWII. The site is immediately adjacent to the ALS that houses the growing scientific efforts of the Berkeley Center for Structural Biology (BCSB) at the ALS, with this new building other key research will also be co-located in this area. These groups include the computational crystallography program, other structural biology groups and the Lab's functional genomics program, theoretical and computational biology groups, and advanced microscopies. The building will be key to the scientific integration of Berkeley Lab's physical biosciences programs.

The building will also house important and highly sensitive instruments including advanced biosciences microscopes. For this purpose, a section of the building will offer ultra-low vibration laboratory space. The estimated cost of this building is $45.0M and it is identified as a FY 2005 start.

Femtosecond Structural Dynamics User Facility

A major new facility is proposed in the area of femtosecond structural dynamics. The use of femtosecond optical lasers has revolutionized the study of many phenomena in solid state physics, chemistry and biology in the last 30 years. For example, the direct observation of intermediate conformations between reactant and product species, transition states, has been a major goal of physical chemists since the pioneering work of Eyring and Polanyi in the 1930's. However, it was

recognized at the time that the lifetime of such states would be extremely short, in some cases on a timescale of a vibrational period, 100 fsec. Study of transition states was enabled by the invention of the modelocked cw dye laser in 1971, and development of laser techniques has led to the availability of a powerful range of spectroscopic tools with 10 fsec resolution across a spectral range from the ultra-violet to the infra-red. The timescale of a few picoseconds typically separates two classes of reaction dynamics, a longer timescale in which intermediate species occupy conformations around minima in the potential energy surface and are governed by Boltzman statistics, and a shorter timescale where atoms move collectively on the potential energy surface. An understanding of such excited state dynamics not only is of academic interest, but potentially shows us ways to manipulate chemical reactions at a fundamental level. The scientific significance of transition state chemistry was recognized with the award of the 1999 Nobel Prize in chemistry to A. H. Zewail. Many other examples of the importance of femtosecond optical studies exist, from laser driven solid-solid phase transitions to the study of photochemistry in biological systems, and clearly this area has grown into one of the most dynamic in modern science.

While great progress has been made, optical spectroscopy probes electronic states, whereas the information most needed is the motion of atoms. This is where x-ray techniques excel; x-ray diffraction (XRD) can give you direct 3d information, and x-ray absorption (EXAFS) gives you a radial distribution function of atomic positions. Combining XRD and EXAFS techniques with a source of 100 fsec x-rays would revolutionize many of the fields in which ultra-fast optical techniques are used. We propose to build such a source at Berkeley Lab and create a National Femtosecond Structural Dynamics User Facility. This work comes out of a program initiated in 1993 to establish Berkeley Lab as the leading center in structural dynamics worldwide using x-rays. Several sources have been built based on Thompson scattering and on the interaction of an intense laser beam with the ALS electron beam, and have been used to study a variety of dynamics, in particular the dynamics of ultra-fast melting. While these studies have been successful in the study of solid state dynamics in perfect single crystals, it is clear that to attack the wide range of science currently studied using optical techniques, we need to have a much more powerful source. The proposed facility will provide an increase in flux of more than 10^6 compared to our present ALS beamline, and in addition will provide for up to 8 simultaneously operating experimental stations.

The proposed facility is based on several robust new technologies, 1) a high brightness photogun to produce intense short pulses of electrons, 2) a linear accelerator to accelerate electrons to high energy, 3) a recirculator to direct electrons several times through the same linac structure 4) radio-frequency 'crab' cavities to kick the electron beam to produce a longitudinal tilting of the beam, and 5) optical pulse compression. All of these technologies are robust and well understood. For example, the superconducting linear accelerator is based on technology built for the TESLA hgh energy physics program in Germany and is commercially available. The rf photo-gun is available from a number of sources developing free electron lasers. By using an assembly of these technologies, we can provide an ultra-fast x-ray facility with unprecedented performance, in the environment of a national user facility.

X-ray free electron lasers have been proposed that offer very high peak power and short pulse length, and so clearly it is important to understand the limitations and strengths of each type of source. The main point is that X-FELs being proposed and discussed are very much at the forefront of accelerator development, and for example will require a thousand-fold reduction in wavelength from present machines to become useful as a source for structural dynamics. There are many technical goals to be overcome before such machines would become user facilities, and it is likely that the first X-FELs will be only a stepping stone to a robust, dedicated user facility.

While a linac source such as the one we aim to build at LBNL will have performance 1000 times lower in average flux than candidate X-FELs, it can be built today using robust technology as a multi-investigator user facility, and based on our work at LBNL pioneering ultra-fast structural measurements, the 10^6 higher flux compared to our present source will open up an enormous range of applications. Flux will not be an issue for many years in using such a source, and indeed it is a logical stepping stone on the way to sources of higher performance. The linac based source also has the advantage of absolute synchronization of laser pump and x-ray probe, and a pulse length of 50fsec, much shorter than that predicted for X-FELs. It is our belief that ultra-fast linac sources and X-FELs are complementary and both should be supported; the linac source provides a source that could be guaranteed to work using robust present day technology and would give outstanding performance compared to present day facilities, in the context of a national user facility. X-FELs will provide the ultimate in average and single pulse flux, but are at the leading edge of accelerator technology and therefore unlikely to be the basis of a robust user facility. X-FELs however must be developed in parallel with a linac based national user facility, in order to provide the route to even higher performance in the future.

It is anticipated that the facility will cost approximately $250M, including a 1st phase of beamlines, and could be constructed in 5 years on an existing site at Berkeley Lab. The anticipated start for this project is 2006.

Center for Atomic, Molecular & Chemical Science

This project scope is currently under review. This project will be described fully in the 2003 SFP.

Stable Beam Facility

This project is currently under review. This project will be described fully in the 2003 SFP.

Biosciences Research Building

Berkeley Lab's Bioscience research programs advance understanding of the complexity of biological systems through multidisciplinary research including biological experiments, structural studies, genomics and proteomics approaches, and new computational methods. These integrated approaches are addressing regulation of gene expression, structural biology of multi-protein complexes with emphasis on those functioning in DNA repair and transcription,

Table I. Biological Sciences Research and Support Facilities Conditions

Building	Staff	Area (gsf)	Date Built	Mechanical Systems	Electrical Systems	Structural Systems
Building 1	201	41,000	1941	A	A	U
Building 3, 3A, 3B	117	17,500	1956	U	A	U
Building 83	35	7,000	1978	A	A	U
Trailer 83A	1	550	1965	U	U	U
Total	354	66,050				

U= Unsatisfactory for current research and support activities, substandard systems
A = Acceptable systems for current research and support activities, systems meet current standards

biological responses to low-dose radiation at all levels including cells, tissues, and whole organisms, and genetic and tissue microenvironment interactions in carcinogenesis, and are also being employed to decipher the language of non-coding portions of the genome. The experimental approaches are closely coupled with significant development projects in biological and medical imaging and other advanced instrumentation, probes, and computational tools to create a new level of understanding of biological systems from the molecular scale to the complete organism.

With the exception of the early 1990's Genome Sciences Building (Building 84), much of the existing Life Sciences Division space was constructed between the 1940s and 1970s and was often constructed to serve other purposes. This space has been adapted has reached the end of its service life (see Table 1). An aggressive replacement plan for the outmoded facilities together with construction of a new Biosciences Research Building will provide the necessary modern laboratories for new research and facilities initiatives and the coalescing of current burgeoning projects in quantitative biology.

The proposed 50,000 gsf Biosciences Research Building located in the East Canyon will provide the modern, efficient laboratories centered around advanced instrumentation facilities and linked to research computing cores that are key for the conduct of quantitative biological research. The building will include approximately 50 laboratories, 150 offices and dedicated spaces for large shared instrumentation, computing facilities, and interaction rooms. The estimate for this project is $50.0M.

Energy Sciences Building

This project scope is currently under review. This project will be described fully in the 2003 SFP.

Computational Sciences Research Facility

To meet the multiprogram needs in computational sciences research and to relieve overcrowded conditions, a centralized computational and mathematical sciences research facility is planned that will enable the joint development of algorithms and protocols for solving complex problems of scale. These algorithms include systems of equations for physical, chemical, and biological processes and for petabyte data analysis and visualization of complex systems and peta-scale experiments. The problems to be addressed include forthcoming peta-scale efforts at the frontiers of high energy and nuclear physics; problems of global environmental data analysis and modeling; problems of molecular design and materials simulation; and data problems and analysis for structural biology, genomics, microbial cell simulation, and plasma science. The 50,000 gsf office building has an estimated cost of $25M.

Over the next ten years, the computing and networking facilities at LBNL must grow to match the growing needs of at least two major experimental facilities, as well as the general needs of Berkeley Lab scientists

Accelerator Research Support Building

A 25,000 gsf replacement office, fabrication, and testing facility is required to advance the understanding of the properties of matter through the coming generations of accelerator systems. This building will include the offices, equipment fabrication, assembly, and testing areas needed to support new accelerator system concepts and components. The facility will address new concepts such as optical accelerators, integrated design systems, novel ion source concepts, advanced power sources, innovative magnet systems, high vacuum systems, and other advanced components.

The proposed Accelerator Research Support Building will provide the necessary modern infrastructure to efficiently and successfully address mission needs while replacing 1940's facilities

that are at have been adapted to the maximum extent possible and now at the end of their useful and cost-effective life. The estimated cost of this project is $25M.

Astrophysics Research Facility

Berkeley Lab is advancing astrophysics through a multidisciplinary program that is studying many fundamental parameters of matter and energy. These studies include supernova observations, cosmic microwave background radiation studies, neutrino physics, dark matter searches, high-energy nuclear astrophysics, theoretical astrophysics, and geoastrophysics. Some key instrumentation and detector technologies being developed that are a part of this work are high-resistively charge-coupled device (CCD) automated telescopes, a proposed supernova astrophysics satellite probe, the KamLAND neutrino detector, and the cubic kilometer neutrino detector.

The scientific impact of this area of research is revolutionizing the understanding of matter, energy, and the universe. Berkeley Lab is now poised to gain an understanding of the forces that created the big bang and the dark energy that is accelerating the expansion of the universe; and the underlying energy density, mass density, and geometry of the universe. The effective and efficient conduct of the program will require a new facility for astrophysics, primarily for offices but with laboratories and staging areas for instrumentation development. These staging areas should provide for instrument assembly under conditions appropriate to the high sensitivity and complexity of the detector systems required. The facility will include the offices, meeting areas, and control systems for the earth-based and satellite-based programs. The 40,000 gsf building will require space and communications utility systems for modern communications and conferencing requirements. The estimated cost of this structure is $40.0M.

Earth Sciences Center

To address the global and national environmental challenges of the next decade, office and laboratory facilities are needed for advanced research in carbon sequestration, global change, radioactive waste management, and other vital areas. Laboratory facilities must also be available for new research in engineered remediation of metals and radionuclides through biological methods such as immobilization of contaminants *in situ*. Offices and laboratories are needed for geological engineering research in storage of high-level nuclear wastes. This research includes characterizing geologic formation and understanding the processes occurring in rock formations, such as hydrologic and chemical transport mechanisms.

The Earth Sciences Center is an office and laboratory building. This building will house programs closely coupled to computationally intensive research, including global climate modeling, carbon sequestration modeling, computational seismology, and the development of computational models for complex transport in heterogeneous media. These offices are located in close proximity to the proposed Computational Sciences Research Facility. The building will also include staging areas for field research, including staging for specialized large mobile instrumentation in seismology, geology, and geochemistry, and for ocean science carbon sequestration studies. This component of the facility is in closer proximity to the current staging area and will share equipment and facilities with the current operation. The combined area of the Earth Sciences Center is approximately 30,000 gsf, with an estimated cost of $20M

Existing Facilities – Demolitions

The Building 51 complex (the Bevatron) is not cost effective to reuse due to contamination and code issues. Demolition of the abandoned Bevatron is necessary so that this large area of Berkeley Lab can be used productively.

The Bevatron requires attention as a separate project. The Bevatron comprises 164,100 gsf of Laboratory space, about 10 percent of the space on the main site. Since it ceased operation in 1992, the Bevatron has been largely abandoned by the Department of Energy, with no source of funds for its decontamination and demolition.

The demolition of the Bevatron facility is the highest priority for Berkeley Lab's renewal and rehabilitation. This complex is at the very heart of the Laboratory and there is a pressing need for usable space in this area.

Removal of Building 51 Bevatron Complex

Building 51 was constructed in the 1950's and houses the Bevatron, an accelerator, which ceased operation in 1993 after an illustrious DOE career. The accelerator is ~180 ft in diameter, consisting of ~20,000 tons of concrete shielding blocks and ~11,000 tons of steel and nonferrous metals. A large portion of the metals, and some portion of the concrete shielding, will require management as low-level radioactive waste. The original building and subsequent high-bay structures (e.g. the EPB Hall– the External Proton Beam Hall) are steel frame construction and total 164,000 gsf, approximately 10 percent of the total building space on the LBNL site.

The land occupied by the Building 51 Bevatron Complex holds the key to addressing the evolution of science at Berkeley Lab in the next decade.

The Building 51 Bevatron Complex is the largest facility at LBNL that no longer supports DOE programs. Building 51 is the best building site at Berkeley Lab. Surrounded by hills and overlooking the San Francisco Bay, it is flat, geologically stable, and accessible. It is centrally located on Berkeley Lab's main entrance road. In addition, it is a node for utilities, including power, communications, water, sewers and other infrastructure. This combination of size, location, accessibility, and infrastructure makes the Building 51 site ideal for priority DOE missions. The site is top priority for the Berkeley Lab's 21st century science capital improvement program. The location is immediately adjacent to Office of Science research facilities, including programs for high energy and nuclear physics, computing, accelerator research, and biological and environmental research. The construction of multi-program space contemplated at this location will improve mission efficiency and open up vast new opportunities for collaborative research.

The nine year demolition project has been developed jointly by the Laboratory and DOE Office of Science. This timeline permits consistent funding in the $10M/year range. The site is returned to productive use in 2011. The demolition project consists of dismantling, demolishing and any required decontamination of the Building 51 Bevatron Complex. The work includes removal of the accelerator, shielding, buildings, related structures, foundations and site restoration .

The Bevatron Complex is located on a large flat site in a central area of the Laboratory. The Laboratory is currently assessing development options to identify the future that can best serve mission needs in the next decade. This analysis will be concluded in late 2002 and discussed in the 2003 SFP.

Existing Facilities – Rehabilitation Projects

Berkeley Lab has effective maintenance and space improvement programs that work to allow researchers to use building space and other assets for the maximum number of years. Most Berkeley Lab buildings remain usable under this program and the Resource Requirements matrix in Appendix A of this report describes a number of GPP projects that are currently at the core of this ongoing effort.

There are also a few buildings that require major rehabilitation because their basic operating systems are not capable of meeting the requirements of modern science. These buildings are fundamentally sound and with major renovation of their operating systems to incorporate modern utilities and address current codes will have extended useful scientific lives of many more decades—at a fraction of the cost of new construction. These projects cannot be undertaken with GPP funds as they exceed the dollar cap for this funding source. Under DOE regulations, these few projects require use of Line Item Funds. The highest priority rehabilitation projects are summarized below.

Building 77 Rehabilitation of Building Structure and Systems, Phs.I & II

Building 77 and the adjacent annex (77A) are multiprogram buildings that provide specialized technical services and assembly space. This project will correct mechanical, electrical and architectural deficiencies in buildings 77 and 77A. Both buildings house machine shop and assembly operations and have a combined net area of 78,000 sf in which production of highly sophisticated research components for a variety of DOE research projects takes place. Current work includes precision machining, fabrication and assembly of components for the Advanced Light Source, DAHRT, the Spallation Neutron Source (SNS), and the ATLAS Detector. Infrastructure systems installed by this project include HVAC, power distribution, lighting, and noise absorption materials.

The improvements are necessary to satisfy urgent demands for high levels of cleanliness, temperature and humidity control, OSHA and reliability requirements. This is the second of two related projects, the first project, Phase I was funded in FY1999 corrected structural deficiencies in Building 77. Phase I was competed in FY 2001. Phase II has an estimated cost of $13.36M and is proposed as a 2003 project.

Building 62 – Upgrade of Building Operating Systems

At 56,314 gsf, Building 62 is one of Berkeley Lab's largest multipurpose laboratory facilities. Building 62 urgently needs a comprehensive upgrade of its infrastructure systems to support current and future research demand for wet chemistry laboratories and clean rooms, and to provide for the health and safety of building occupants.

This project will replace aged wooden fumehoods, install a new centralized exhaust system, and install a modern acid waste neutralization system.

To obtain constant air temperature and pressure conditions in the laboratories and provide for clean room capability, the project will modify the building heating, ventilation, and air conditioning (HVAC) system and install variable air volume controls in the laboratories.

The existing low-conductivity water (LCW) system will be expanded and upgraded to meet existing demand and furnish ample LCW for the new wet chemistry labs.

This Line Item Project has an estimated cost of $11.5M and is identified as a FY2005 project start.

Building 74 - Rehabilitation of Building Operating Systems

Building 74 was originally constructed as an animal holding facility. As animal studies have been replaced with laboratory techniques that

reduce the need for animals, four alteration projects have been completed over the past 40 years. Today more than 75% of this building has been converted from animal holding to research laboratory functions.

While most of the space within Building 74 has been converted to uses other than those for which the building was designed, Building 74's, electrical and structural systems have not been correspondingly upgraded. The proposed project will correct electrical and structural problems. This Line Item Project has an estimated cost of $18.0M and is proposed as a 2006 project.

Rehabilitation of Building 90 Operating Systems

Rehabilitation of Building 72 Operating Systems

These two Line Item building system renovation projects are identified as FY 20012 and 2013 starts. The Laboratory is currently reviewing the condition of building operating systems in these buildings and a few others which maintenance records indicate are likely to require major system upgrades in the early years of the next decade. This planning analysis will be completed in late 2002 and the outcome will be discussed in the 2003 SFP.

Existing Facilities – Environmental Remediation

Berkeley Lab is completing an assessment of its site survey to comprehensively identify any contaminated areas. Working with DOE, Berkeley Lab will advance and adopt a remediation plan in the near future.

Existing Facilities - Information Technologies Infrastructure

The vision of network support for Berkeley Lab in the next ten years calls for substantially enhanced performance parameters and capabilities. Increases in performance demand have been readily measured at 100% per year over the past several years, and over a ten-year extrapolation translates to a conservative growth factor of 1,000. Whereas Berkeley Lab is now deploying 100 mega bit-per-second to 1 gigabits-per-second switched infrastructure today, growth to equivalent performance levels of 100 gigabits-per-second to 1 terabits-per-second over a ten-year timeframe can be anticipated. Additionally, it can be expected that the range of components and systems that will be "network smart" will increase dramatically, resulting in the need to attach end-systems numbering in the hundreds of thousands to millions for a laboratory facility such as Berkeley Lab.

Beyond simple extrapolation of performance and connectivity, it also can be expected that other laboratory research network services capability will be greatly expanded. The network is expected to become the research infrastructure backbone providing improved interconnection among scientific resources and researchers. Some researchers are anticipated to perform significant portions of their work in a "virtual laboratory". Research activities will include remote interactions involving massive distributed computing resources, experimental facilities, support services, and communications systems. The impact on Laboratory infrastructure will be significant. Substantial wireless technology will be necessary to support the anticipated conversion to that technology and the anticipated significant growth in end-systems connected to LBLnet. High-end performance networks will remain "wired" and will probably require significant upgrade of fiber-optic facilities. The computers, storage, and network equipment required to implement this multi-year Laboratory computing initiative is expected to require approximately $40M in General Purpose Equipment (GPE) funds.

To meet expanding information technology needs and a significant short term increase in

funding for GPE projects is requested (see Appendix A).

Existing Facilities - Utilities

The utilities systems have been maintained and most are in reasonably good condition. All systems are maintained and improved as necessary, usually with Operating and General Plant Project funds (GPP projects are listed in Appendix A). However, significant system wide weak points in the water distribution utility system have been identified and these upgrade requirements are beyond the scope of GPP projects. Therefore a Line Item Project was proposed and this project has been funded as s FY 2001 start. This Line Item Project will be completed in 2003 and is summarized below. Over the next year, Berkeley Lab will review utility operating and maintenance data, projects needs identified in this review will be discussed in the 2003 SFP.

Sitewide Water Distribution Upgrade, Phase 1

This funded project will replace 1.4 km of cast iron pipe with ductile iron, install cathodic protection on 1.9 km of cement-lined coated steel pipe, install new or replace approximately 100 pressure reducing and isolation valves, complete seismic upgrade of an existing fire protection water storage tank, and construct a new 200,000 gallon fire water storage tank in the east canyon area including a service access road. Completion of this work will correct serious performance deficiencies in the high-pressure water system to assure an ample water supply under normal operating conditions as well as during fire and earthquake emergencies.

Under the *Wildland Fire Risk Management Plan*, the eastern edge of Berkeley Lab is maintained as a critical fuel-break protecting Berkeley Lab assets from the periodic and dangerous Diablo-wind-driven wildland fires that occur in the East Bay Hills. The service road to the tank site will be upgraded and fire hydrants installed so that mutual-aid fire suppression forces can safely fight any flame front approaching Berkeley Lab. The project is funded at the requested $8.0M.

New Construction – SLI Facilities

General purpose facilities infrastructure is required to meet the needs of Berkeley Lab's scientific programs and to conduct operational and administrative support. This support includes the operations function; general engineering support; general computing support infrastructure; service needs for personnel, including environmental, health, and safety resources; property protection and emergency services; transportation services; cafeteria and conference services; and other infrastructure needs. The following building projects are important elements of the *Strategic Facilities Plan*.

Research Support Building (Replace Building 29)

The new 25,000 gsf (15,500 nsf, eff. 62%) office building will replace the structurally unsound and condemned Building 29 (which was demolished in 2002) and four associated condemned trailers. It will house ~70 people from a variety of essential research support functions that are currently scattered across the LBNL site including Library Services, Laboratory Directorate, Center for Science and Engineering, Laboratory Counsel, Technology Transfer, Technology Transfer, Procurement and Patent Department. Relocation of these functions from existing research buildings will free up ~ 20,000 gsf of research space and result in operational cost savings, efficient management and improved access for staff and guest researchers. Payback ~7 years. The estimated cost is $15.0M and the project is identified as a FY 2004 start.

Replace Building 7

This new 30,000 gsf (20,100 nsf, eff. 67%) will replace Building 7, a wooden 21,500 gsf

structure constructed as a service building during WWII. Building 7 cannot be cost-effectively upgraded to serve modern science requirements. The building contains structural and life safety elements that restrict use. The building is inadequate and costly to maintain in a condition that is even barely usable. The new multi-user structure will incorporate office space, medium bay assembly space, clean room, and general wet and dry lab space to be used by resident and visiting researchers from all Divisions. This space will support activities to prepare experiments and to address other critical but short term high-activity work activities. Demolition of sub-standard space and improved productivity combine for a payback of approximately 5 – 6 years. The estimated cost is $12.0M and the project is identified as a FY 2005 start.

Operations Building

The new 25,000 gsf (16,260 nsf, eff. 65%) office building will consolidate Facilities Department functions in a single location. The project will improve the efficiency of highly interdependent functions by co-locating personnel from various fragmented and dispersed site locations. Occupants will include Facilities Management, Administration, Planning, Project Management, Architecture and Engineering, and Operations & Maintenance personnel. The new facility will house ~100 people and eliminate overlap and duplication of administration and support functions, reduce travel time and strengthen communications. Payback ~ 6 years. The facility has an estimated cost of $15.0M and the project is identified as a FY 2006 start.

Engineering Support Facility

This addition to B77A of 19,000 gsf (11,400 nsf, eff. 60%) of dry laboratory, computer, and office space for 38 Engineering Support Personnel will free up badly needed production and assembly space in the Building 77 complex. Consolidation of engineering functions at a single site will improve coordination, efficiency, and research support. Payback ~ 8 years. The estimated cost is $15.3M.

Replace Building 25 (Seismic Stability)

This project will demolish existing 50+ year old 28,000 gsf Building 25. Building 25 was constructed in many increments and contains structural deficiencies that can not be cost-effectively upgraded to modern standards in order to meet the needs of modern science. Building 25 does not meet current seismic construction standards and would not be usable after a significant earthquake. This project will construct a new 25,000 gsf (16,250 nsf, eff. 65%) office and support services building at a nearby site and relocate the staff prior to demolition of the current building. The new building will house staff from Building 25 and Operations Division support personnel who are currently housed in off-site leased space. The new facility will allow improvement in overall service quality while reducing lease costs. Payback ~ 6 years. The estimated cost is $20.2M.

Environment, Health, and Safety (EH&S) Support Facility

Approximately 90 EH&S staff will be housed in this new 21,000 gsf (approx. 14,000 nsf, eff. 65%) facility. Consolidating these highly interactive staff will improve both internal and external EH&S communications, increase productivity, improve responsiveness, and further minimize potential risks of injury and environmental contamination. This project will demolish an inefficient trailer-complex and replace it with a building that makes effective use of the site and which is suitable for EH&S staff and research. Increased productivity, the removal of an inefficient trailer complex, and the reassignment of space currently used by EH&S staff to address pressing research needs combine for a payback of approximately 5 – 6 years. The estimated cost is $15.5M.

Training Center and Auditorium

This new 14,000 gsf (9,000 nsf, eff. 65%) center will serve all research groups and support staff. The Laboratory currently has no suitable training/communication facility. The center will support effective communication both within and

among research disciplines, it will also serve to coordinate group communications within virtual research activities. The new multi-purpose training facility will also allow staff to be efficiently trained in safe, secure, and efficient approaches to their work, and support general conference and DOE tele-conference needs. Reduced travel and training costs, productivity gains, and reallocation of existing training spaces to research functions combine for a payback of less than 10-years. The estimated cost is $16M.

Site Support Service Facility

This new 13,000 gsf (approx. 8,500 nsf, eff. 65%) building and associated yard space will establish a single facility for the management and staging of Facilities Department field operations. Currently larger equipment is stored along streets, in parking lots and in general storage spaces where it is available; and smaller equipment and supplies are housed in temporary shelters and cargo containers and other otherwise un-usable locations across the site. The new facility will house ~ 55 staff adjacent to their equipment and supplies in an energy efficient facility that is fully compliant with OSHA and Clean Water Act regulations. Demolition of sub-standard units, recovery of parking and general storage spaces, and improved productivity combine for a payback of approximately 5 – 6 years. The estimated cost is $9.5M.

Replace Building 73

This new 19,000 gsf facility will provide approximately 8,000 nsf of multi-program research office and project-team space and 5,000 nsf of seminar space and short-term housing for visiting graduate students and post-docs (eff. 65%). Approximately 75 staff and graduate students will be accommodated. State of the art communications systems and project-team workspaces will be coupled with facilities specifically designed to assist graduate students and post-doc's to advance into the ranks of the nation's top DOE/SC scientists. This facility will replace a specialized research facility that is no longer used for its design purpose and which is not cost-effective to rehabilitate for other uses. Demolition of sub-standard space and improved productivity combine for a payback of approximately 5 – 6 years. The estimated cost is $14M.

Third-Party Buildings

Berkeley Lab has worked with DOE and the University of California to issue a Request for Qualifications and a request for Proposals to construct a 60,000 gsf office building on the site. This building is sited adjacent to the Building 50 complex and is intended to relieve overcrowding this facility. Office allocations are currently less that 110 gsf (including support space) while comparable GSA standards call for approximately 150 gsf. Proposals are expected in 2002 and a decision is anticipated in late 2002 or early 2003. The 2003 SFP will review the selection process and lessons learned and will discuss the status and direction of this project.

Resources Needs Summary

Science Lab Infrastructure (SLI) Support

Historically, SLI funding at LBNL has been an average $3.8M per year. Over the period of FY1998-FY2002, the funding level has been only slightly above this average level, at $4.2M per year. The profile of funding has been irregular and broad, ranging from $9.3M in FY 1993 to $2.4M in FY96 to no new starts in FY 1994, FY 1995, FY 1997, and FY 2000. The following SLI chart provides more detail.

While Berkeley Lab's funding trend has increased slightly in actual dollars, this program has not been able to address pressing concerns at current funding levels. Moreover, we have been alarmed by the overall trend of the size of this DOE program. The SLI budget has been cut almost in half over the last 10 years. The SLI program is the only available strategic capital

renewal program in the Office of Science for non-programmatic infrastructure. Funding levels should, at a minimum, be restored (corrected for inflation) in order to begin to achieve the infrastructure renewal needed at the multiprogram labs.

General Plant Projects (GPP)

As illustrated in the following GPP chart, GPP funds have been relatively flat ($3.3M to $3.5M[1] in actual dollars) at LBNL since 1993. However, relative to FY 1993, in FY 2002 the purchasing power of these funds will have dropped to about $2.6M due to inflation alone.

GPP funding is extremely valuable to the Laboratory. Typically, it is the only source of funds available to address short-term capital improvement needs. LBNL has turned to GPP to address ES&H and security needs, as well as key infrastructure needs such as additional labs and offices at our National User Facilities, and upgrades to support the study transgenic rats.

A three-year increase of GPP funding to the $12M+ range will allow the current backlogged priorities to be addressed, and continued funding at $10.5M per year would allow the Lab to continue to continuously upgrade and reuse facilities to meet all scientific mission requirements. Without this increase, these projects would require 20+ years to complete and the schedule for completion of the *Strategic Facilities Plan* would be negatively impacted.

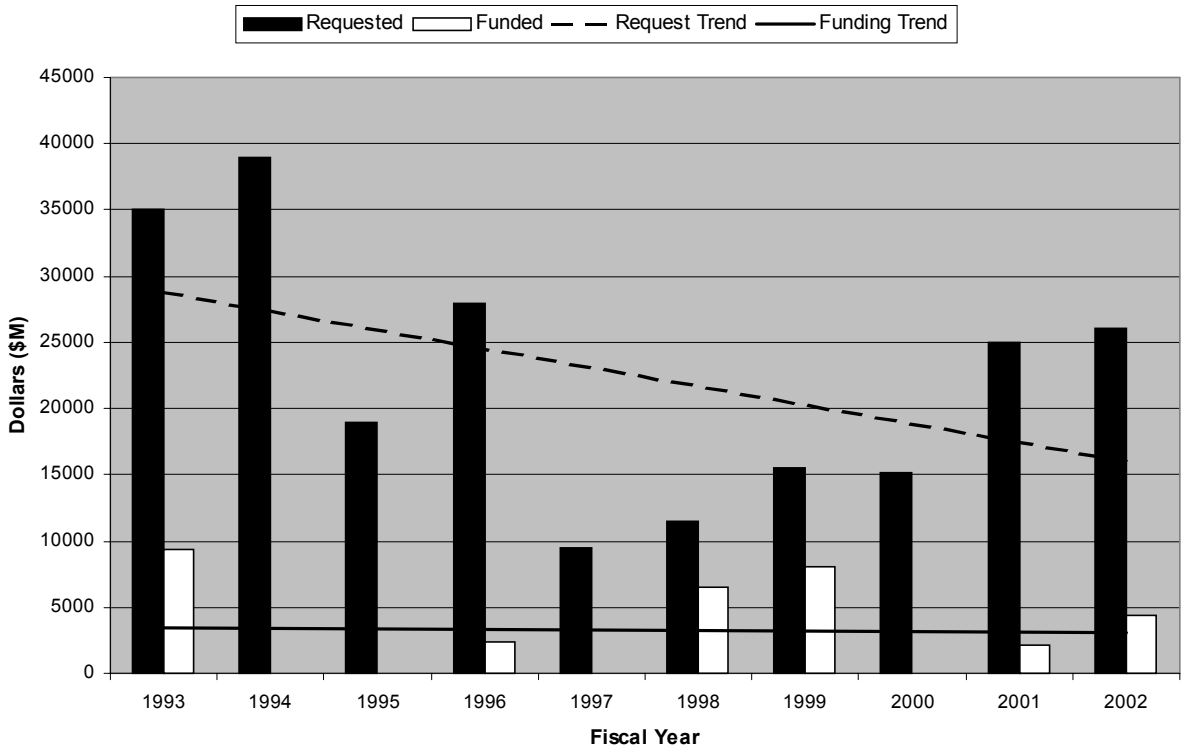
General Purpose Equipment (GPE)

GPE funding has also been historically flat at LBNL, ranging from $1.87M in FY 1993 to $1.95M[2] for the last several years. The following GPE chart illustrates the actual allocations and purchasing power of those allocations adjusted for inflation only. GPE requests each of the last three years have been approximately $8M per year for computer/ networking equipment and another $7-8M per year for non-computer related items. Because many of LBNL's administrative functions were operating on obsolete systems that are no longer supported by vendors, computer-related purchases have received approximately 75% of the available funds each year. The limited funding has severely restricted our ability to implement a full range of modern multi-site conferencing facilities, and upgrade certain infrastructure items, including our hillwide radio network and general purpose maintenance and fabrication shops. While some reuse of computer/ networking equipment can occur, equipment required to complete the addition or modernization of the facilities covered in this plan, as well as that required to provide for substantially enhanced support in terms of performance, require a short-term increase of GPE funding.

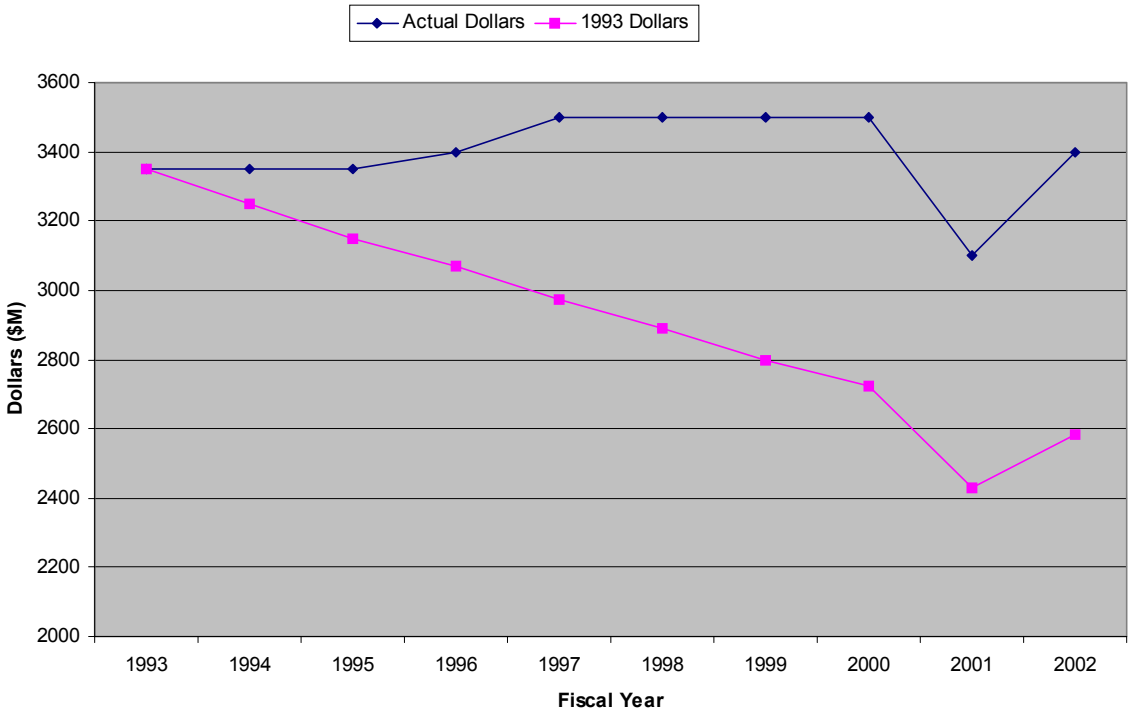
[1]The FY2000 GPP allocation of $3.5M is used in this comparison even though it was necessary to convert $530K to operating funds for the completion of the Oakland Scientific Facility.

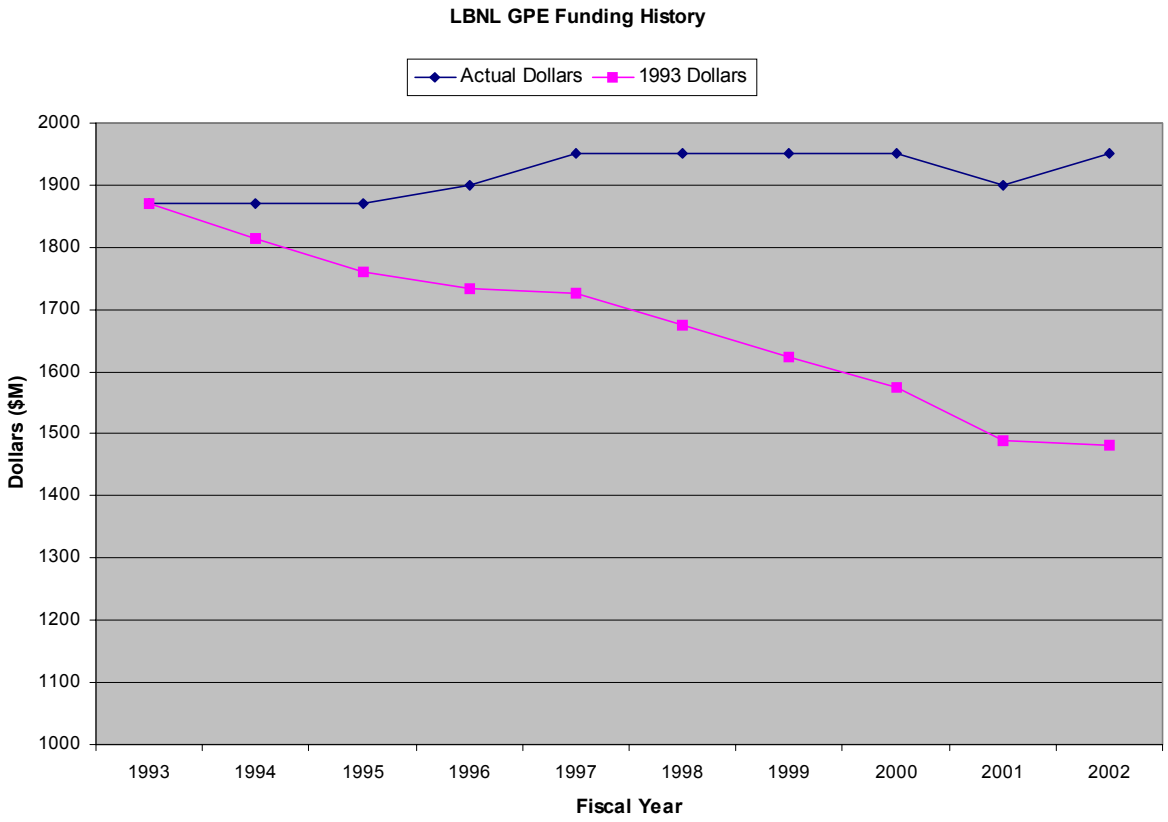
[2] The FY2000 GPE allocation of $1.95M is used in this comparison even though it was necessary to convert $800K to operating funds.

LBNL SLI Funding History



LBNL GPP Funding History




LBNL GPE Funding History
Actual Dollars
1993 Dollars
Dollars ($M)
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
Fiscal Year

Real Property Maintenance

As modernization efforts proceed to meet the current and future research needs at LBNL it is expected that maintenance and operations costs will also rise. Currently we have been doing a good job of maintaining the existing old facilities with the funding provided. However, as expectations rise, the frequency and severity of complaints are expected to increase as the mismatch between obsolete and modern facilities increases. Additionally, as more modern buildings are provided with more sophisticated mechanical and electrical systems, it is expected that the associated maintenance costs will rise. Maintenance costs are therefore expected to increase as projected due to either aging facilities during rising expectations or modernized facilities with more sophisticated services.

The latest projections indicate that the approximately $1.5M annually budgeted from operating funds may need to be increased to approximately $2.0M in order to complete priority planned-maintenance projects and keep potential backlog growth under control.

Operating Funding

For budget purposes, the "non-cap" base level at LBNL has remained at approximately $2.9M for the past five years. Annually, $800K is reserved for emergencies, laboratory initiated relocations, and ES&H corrections, leaving $2.1M for requested projects. This provides very little opportunity to address the over 100 needs totaling over $25M, that are currently unfunded in the Project Call Database. Among projects on the backlog are wildland fire management and seismic upgrades, both of which can be only partially funded each year; replacements of outdated electrical and mechanical systems that are outside of GPE scope; and numerous projects to improve the utilization or quality of our office and laboratory space, a significant problem due to the aging and overcrowding of our buildings.

Demolition/Removal of Contaminated and Non-Contaminated Excess Facilities

The Building 51 Bevatron complex has been closed for a decade. This large facility needs to be demolished and the site used for productive scientific pursuits. The project is not an EM candidate, because the environmental risks are minimal; but this complex is a DOE legacy that requires near-term attention.

A specific demolition project is proposed. This $74M project will allow for proper management of all materials with induced radiation and for all possible recycling of materials.

While there are other aged buildings that also require demolition, these are typically small and light frame structures that can be demolished as part of a new construction project.

Environmental and Community Considerations

All plans and projects are assessed by the National Environmental Policy Act and California Environmental Quality Act review group for appropriate environmental documentation.

Facilities Department planning staff and Office of Planning and Communications planning staff participate in the Community Relations Advisory Group (CRAG), so that community issues can be considered and appropriate communications planned and implemented.

Berkeley Lab follows the Executive Order 13123 on "Greening of America" by promoting environmentally responsible design and construction. The impact of new construction is reduced through attention to sensitive site development, water and energy conservation, indoor air quality, waste reduction, and environmentally responsible building materials that minimize environmental impact throughout their life cycle.

Performance Metrics and Change Indicators

Although qualitative measures can often best describe performance; such measures are difficult to benchmark. The following quantitative performance-based metrics are developed to address the use and condition of Laboratory assets relative to the research requirements.

Deficiency Correction Index (DCI)

$$DCI = \frac{\text{sq. ft. of replaced facilities (inc. demolition)}}{\text{sq. ft. rated "replacement needed" in FIMS}}$$

This metric provides direct assessment and benchmarking of efforts to correct the most obsolete buildings. Replacement of these structures is a paramount concern as these structures are significant ES&H problems, are exceptionally difficult research environments, and have significant negative impacts on overall site utilization rates.

Facilities Condition Index (FCI)

$$FCI = \frac{\$\text{deferred maintenance}}{\$RPV}$$

This widely used metric provides insight into the effectiveness of the maintenance program. This metric measures the relative cost of remedying maintenance deficiencies listed in the deferred maintenance backlog and conveys condition information.

New Metric Proposed with the 2002 SFP -

Total Summary Condition Index (TSCI)

TSCI = the sum of Deferred Maintenance (DM) plus Rehab and Improvement Costs (RIC) divided by the facility's Replacement Plant Value (RPV).

Deferred Maintenance (DM) is defined as maintenance that was not performed when it should have been or was scheduled to be and which, therefore, is put off or delayed for a future period. It specifically excludes major 'like-in-kind' rehabs normally funded from GPP/GPE and line item projects.

Rehab and Improvement Cost (RIC) is defined as the total of all rehab and improvement costs, including needed function or capacity upgrades and the costs to bring the facility in compliance with all applicable building codes, ADA/UFAS, and Life Safety requirements, etc. as well as the costs to make facilities suitable for planned mission needs. These costs are normally funded via GPP/GPE or line item funding but could include large operating expense funded projects or Infrastructure General Plant Projects (IGPP).

This metric provides insight into the overall management of space.

Appendix A – Resource Needs Spreadsheet

LBNL Resource Requirements

DRAFT

June 6, 2002

$ in Millions

Project/Activity	GSF New Const.	GSF Removed	Net New GSF	Vision/ Goal	TEC	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Simple Payback *	TEC ($ / gsf)	Const. Cost ($ /gsf) **
REAL PROPERTY MAINTENANCE																					
Real Property Maintenance ***						7.53	7.26	7.26	7.26	7.26	7.26	7.26	7.26	7.26	7.26	7.26	7.26	7.26			
% of Replacement Plant Value (RPV)						1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0			
GENERAL PLANT PROJECTS AND EQUIPMENT																					
General Plant Projects (GPP):																					
Bldg. 6 Second Floor Office and Lab Space (FY 2000 start)				M, O, W	4.99	1.26															
Bldg. 77 142C Clean Room				M, O, W	1.35	1.35															
Bldg. 2 Ventilation Upgrade				E, M, W	0.60	0.35	0.15														
Radio Communication System				E, M, O, W	0.85	0.08	0.57	0.20													
Bldg. 83 Remodel Culture Room (PGPP)				E, M, O, W	0.20		0.20														
Bldg. 74 Renovate Animal Area				M, O, W	0.07		0.07														
Bldg. 71 Modify Caves L & M and Seismically Upgrade				M, O, W	1.25		1.25														
Bldg. 2 Laboratory Upgrade				M, O, W	0.90		0.90														
Bldg. 77 Install Sump Pump				M, O, W	0.04		0.04														
Bldg. 6 Rm. 2145 Install Ventilation				E, M, O, W	0.03		0.03														
Bldg. 90 HVAC System Upgrade				E, M, O, W	0.77		0.20	0.57													
Bldg. 76 Dust Collection System Upgrade				E, M, W	0.20		0.13	0.07													
Bldg. 6 Enclose Offices				M, W	0.35			0.35													
Bldg. 58 Expansion	500	0	500	M, O, W	0.75			0.75												1,500	
Bldg. 50 Rm 2265 Convert to Office Space				M, W	0.25			0.25													
Bldg. 70A Rm 2245 Convert to Wet Lab				E, M, O, W	0.50			0.50													
Bldg. 70A Rm 2253 Convert to Cell Culture Lab				M, O, W	0.25			0.25													
Bldg. 64 Rm 163 Upgrade High Bay Heating				M, O, W	0.07			0.07													
Bldg. 73 Rm 001 Convert to NMR Lab				M, O, W	0.38			0.38													
Bldg. 64 Rm 150 Create Lab and Office Space				M, O, W	1.40			0.90	0.60												
Bldg. 70A Superconducting Detector Array Laboratory				E, M, O, W	2.00			0.50	1.50												
Bldg. 6 Rm 1000 Electrical Power Upgrade				M, O, W	0.08				0.08												
Bldg. 50 - Construct Communication Grid Center				M, O, W	1.50				1.50												
Bldg. 37 Install New Low Conductivity Water Cooling Tower				M, O, W	1.50				1.50												
Bldg. 58A Extension	1,950	0	1,950	E, M, O, W	2.95				2.95											1,500	
Bldg. 10 Improve Staging And Vacuum Assembly Facility				E, M, O, W	1.00				1.00												
Bldg. 70 Improve And Expand Existing Vacuum System				E, M, W	0.21				0.21												
Upgrade 2MW Standby Generator Connection to Electrical Distribution System				E, M, O, W	0.75				0.75												
Bldg. 88 Area - Create Parking Lot on Fill Site				M, W	0.70				0.70												
Construct Sensitive Instrument Facility				M, O, W	3.00				3.00												
Bldg. 62 Highbay Conversion to Laboratory				M, O, W	3.00				3.00												
Construct Isolation Kennel	400	0	400	M, O, W	0.40				0.40											1,000	
Blackberry Canyon - Create Fill Site to Expand Parking Lot				M, O, W	0.50				0.50												
Expand Cooling Tower Capacity Lee Road Area				M, O, W	1.50					1.50											
Bldg. 71 Highbay Improvements				M, O, W	3.70					3.70											
Construct Medium Height Bay Research Bldg.	10,000	0	10,000	M, O, W	4.50					4.50										450	
Upgrade Intersection of Lawrence Road, Glaser Road and Road "S"				E, M, O, W	0.70					0.70											
Bldgs. 62/66 - Conversion of Support Space to Wet Lab				E, M, O, W	2.00					2.00											
Bldg. 50 Office Reconfiguration				M, O, W	4.00					2.00	2.00										
Realignment of Grizzly Gate Road				E, M, O, W	3.70						3.70										
Completion of Storm Drain Piping Upgrade				E, M, O	2.16						2.16										
Construct SNAP Control Room and Support Facilities				M, O, W	0.80						0.80										
NCEM Addition	5,000	0	5,000	M, O, W	4.00						4.00									800	
Improve Access Road on West and South sides of Bldg. 70A				E, M, O, W	1.00							1.00									
Upgrade Laboratories in Bldg. 70				M, O, W	1.50							1.50									
Upgrade Laboratories in Bldg. 70A				M, O, W	1.50							1.50									
Bldg. 88 - Upgrade Electrical Systems				E, M, O, W	1.70							1.70									
Fill Draw to Southwest of Bldg. 70A				M, O, W	0.80							0.80									
Upgrade of ALS Access - Convert Pathway to Roadway				E, M, O, W	1.50							1.50									
Construct Parking Area on Fill Site between Operations and Engineering Areas				E, M, O, W	1.00							1.00									
Upgrade Unit Substations				M, O, W	1.10							0.54	0.56								
Realign McMillan Road Intersection at Chamberlain Road				E, M, O, W	1.20								1.20								
Improve Ventilation in 50/50A				E, M, O, W	4.80								4.80								
Storm Drain Upgrades				E, M, O, W	2.50								2.50								
Upgrade Civic Center Assembly Area				M, O, W	0.50									0.50							
Addition to Cafeteria	8,000	0	8,000	E, M, O, W	4.50									4.50						562	
Construct Primary Shuttle Bus Transfer Station in Civic Center				M, O, W	0.50									0.50							
Widen and Straighten Cyclotron Road at Main Entrance				E, M, O, W	3.70									3.70							
Complete Office Addition at Bldg. 88	4,600	0	4,600	E, M, O, W	2.00										2.00					435	
Bldg. 70 Rm 108 Fumehood Exhaust Fan Upgrade				E, M, O, W	0.01										0.01						
Bldg. 70 Improve and Expand Vacuum System				M, O, W	0.21										0.21						
Extend Sanitary Sewer Line between Chicken Creek and Centennial Drive				E, M, O, W	1.50										1.50						
Road and Utility Corridor Improvements in Chicken Creek				E, M, O, W	1.50										1.50						
Bldg. 90 - Construct Large Communication Grid Space				M, O, W	3.10										3.10						
Construct Large Vehicle Wash Facility	2,000	0	2,000	E, M, O, W	0.93										0.93					465	
Compressed Air Distribution System Upgrade				M, O, W	0.18										0.18						
Bldg. 80 Provide Process Cooling Water Backup				M, O, W	0.03											0.03					
Bldg. 34 Add Chilled Water Expansion Tank				M, O, W	0.02											0.02					
Bldg. 55 Area Office/Lab Expansion				M, W	4.90											4.90					
Upgrade Upper East Canyon Egress Roadway				M, O, W	1.50											1.50					
Bldg. 70 Upgrade Bldg. Exhaust System				E, M, O, W	2.50											2.50					
Bldg. 70A Upgrade Bldg. Exhaust System				E, M, O, W	2.80												2.80				
Bldg. 72 Add Two Chilled Water Storage Tanks				M, O, W	0.02												0.02				
Natural Gas Distribution System Upgrade				E, M, O, W	1.10												1.10				
Create Corridor Connecting the Main Floors of Bldgs. 66 and 62				E, M, O, W	1.00												1.00				
Upgrade HVAC System in Bldgs. 50B, 50E and 50F				E, M, O, W	4.60												4.60				
Bldg. 54 - Upgrade Mechanical Systems				M, O, W	2.30													2.30			
Low Conductivity Water System Upgrade				E, M, O, W	4.30													4.30			
Lawrence Road Sightline Improvements				E, M, O, W	2.80													2.80			
Other GPP Priorities						0.00	0.00	0.00	0.00	0.00	0.00	0.96	1.44	1.30	1.06	1.55	0.98	1.10			
Total GPP:	32,450	0	32,450			3.04	3.53	4.79	17.69	14.40	12.66	10.50	10.50	10.50	10.50	10.50	10.50	10.50			

Project/Activity	GSF New Const.	GSF Removed	Net New GSF	Vision/ Goal	TEC	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Simple Payback *	TEC ($ / gsf)	Const. Cost ($ /gsf) **
General Plant Equipment (GPE):																					
Information Technology: Conferencing and Collaboration Equipment				M, O, W				0.3	0.2	0.3	0.2	0.3	0.1		0.1			0.1			
Information Technology: Digital Libraries and Information Management				M, O, W				0.2	0.2	0.2	0.1			0.1			0.1				
Information Technology: "Network Smart" Equipment Infrastructure				E, M, O, W				0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3			
Information Technology: Networking Facilities Needs				E, M, O, W		0.8	1.1			8.0	8.0	8.0	8.0	8.0							
Other GPE Priorities						1.3	0.8	11.8	9.4	2.2	2.4	2.4	2.6	3.1	11.1	11.2	11.1	11.1			
Total GPE:						2.1	1.9	12.6	10.1	11.0	11.0	11.0	11.0	11.5	11.5	11.5	11.5	11.5			
LINE ITEM CONSTRUCTION:																					
Program Related Projects:																					
Molecular Foundry	94,500	0	94,500	M, O, W	83.70			83.70												886	
E-Lab	29,000	0	29,000	E, M, O, W	19.00				19.00											655	
Proteomics and Computational Biology Facility	50,000	0	50,000	E, M, O, W	45.00					45.00										900	
Femtosecond Structural Dynamics User Facility	TBD			E, M, O, W	TBD						TBD										
Center for Atomic, Molecular & Chemical Science	33,000	15,173	17,827	M, O, W	30.00						30.00									909	
Stable Beam Facility	TBD			M, O, W	TBD						TBD										
Biosciences Research Bldg.	50,000	7,533	42,467	E, M, O, W	50.00							50.00								1,000	
Energy Sciences Bldg.	30,000		30,000	E, M, O, W	18.00								18.00							600	
Computational Sciences Research Facility	50,000		50,000	E, M, O, W	25.00									25.00						500	
Accelerator Research Support Bldg.	25,000	5,168	19,832	E, M, O, W	25.00										25.00					1,000	
Astrophysics Research Facility	40,000		40,000	M, O, W	40.00											40.00				1,000	
Earth Sciences Center	30,000		30,000	E, M, O, W	20.00												20.00			667	
Total Programmatic Line Item Projects:	431,500	27,874	403,626			0.00	0.00	83.70	19.00	45.00	30.00	50.00	18.00	25.00	25.00	40.00	20.00	0.00			
Science Lab Infrastructure (SLI) Projects:																					
Bldg. 77 Rehabilitation, Phs. 1 (FY 1999 start)				E, M, O, W	8.00	1.11															
Sitewide Water Distribution Upgrade, Phase 1				E, M, O, W	8.30	1.00	4.40	2.90													
Bldg. 77 Rehabilitation of Bldg. Structure & Systems, Phs 2				E, M, O, W	13.36			13.36													
Research Support Bldg.	25,000	15,475	9,525	M, O, W	15.00				15.00										6.8	600	
Bldg. 62 - Upgrade of Bldg. Operating Systems				E, M, O, W	11.50					11.50											
Replace Bldg. 7	30,000	21,459	8,541	E, M, O, W	12.00					12.00										400	
Bldg. 74 - Rehabilitation of Bldg. Operating Systems				E, M, O, W	18.00						18.00										
Operations Bldg.	25,000	16,975	8,025	M, O, W	15.00						15.00								5.7	600	
Engineering Support Facility	19,000	0	19,000	M, O, W	15.30							15.30								805	
Replace Bldg. 25 (Seismic Stability)	25,000	27,975	-2,975	E, M, O, W	20.20							20.20								800	
Environmental, Health and Safety Support Facility	21,000	3,603	17,397	M, O, W	16.40								16.40							781	
Training Center and Auditorium	14,000	0	14,000	M, O, W	16.00									16.00						1,100	
Site Support Services Facility	13,000	4,000	9,000	E, M, O, W	9.50										9.50					731	
Replace Bldg. 73	19,000	4,631	14,369	E, M, O, W	14.00											14.00				737	
Rehabilitation of Bldg. 90 Operating Systems				E, M, O, W	18.00												18.00				
Rehabilitation of Bldg. 72 Operating Systems				E, M, O, W	12.00													12.00			
Total SLI Line Item Projects:	191,000	94,118	96,882			2.11	4.40	16.26	15.00	23.50	33.00	35.50	16.40	16.00	9.50	14.00	18.00	12.00			
THIRD PARTY FUNDED BUILDINGS:																					
50X ****	60,000	0	60,000	M, O, W	TBD																
Total Third Party Projects:	60,000	0	60,000																		
OPERATING FUNDING NEEDED FOR REMOVAL OF RETIRED FACILITIES:																					
Removal of Bldg. 51 Bevatron Complex	0	164,000	-164,000	E, M, O, W	74.45		2.50	0.95	10.00	10.00	10.00	10.00	10.00	10.00	11.00						
Total Operating Funded Removal of Retired Facilities:	0	164,000	-164,000				2.50	0.95	10.00	10.00	10.00	10.00	10.00	10.00	11.00						

Sub-Totals By Category:

	GSF New Const.	GSF Removed	Net New GSF	TEC	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total Change in Gross Square Feet of DOE Assets (GSF):	654,950	285,992	368,958														
Total GPP/GPE/GPF ($M):					7.25	9.83	33.65	42.79	48.90	56.66	57.00	37.90	38.00	31.50	36.00	40.00	34.00
Total Operating Funding Needed for Removal of Retired Facilities ($M):					0.00	2.50	0.95	10.00	10.00	10.00	10.00	10.00	10.00	11.00	0.00	0.00	0.00
Total Operating Funding for Real Property Maintenance ($M):					7.53	7.26	7.26	7.26	7.26	7.26	7.26	7.26	7.26	7.26	7.26	7.26	7.26
Programmatic Modernization Projects ($M)					0.00	0.00	83.70	19.00	45.00	30.00	50.00	18.00	25.00	25.00	40.00	20.00	0.00
Third Party Funding ($M)				TBD													

Information Technology (IT) Needs Crosscut ($M)

Operating Funds: Networking Facilities Needs (GPE)							0.3	0.2	0.3	0.2	0.3	0.1		0.1			0.1
Information Technology: Conferencing and Collaboration Equipment (GPE)							0.2	0.2	0.2	0.1			0.1			0.1	
Information Technology: Digital Libraries and Information Management (GPE)							0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Information Technology: "Network Smart" Equipment Infrastructure (GPE)					0.8	1.1			8.0	8.0	8.0	8.0	8.0				
Total IT:					0.8	1.1	0.8	0.7	8.8	8.6	8.6	8.4	8.4	0.4	0.3	0.4	0.4

KEY to Vision/Goals : E = Environmental Health & Safety
M = Mission
O = Maintenance & Operations
W = Working Environment

Note: GSF = Gross Square Feet
TBD = To Be Determined
$M = Million Dollars
$B = Billion Dollars

Footnotes:

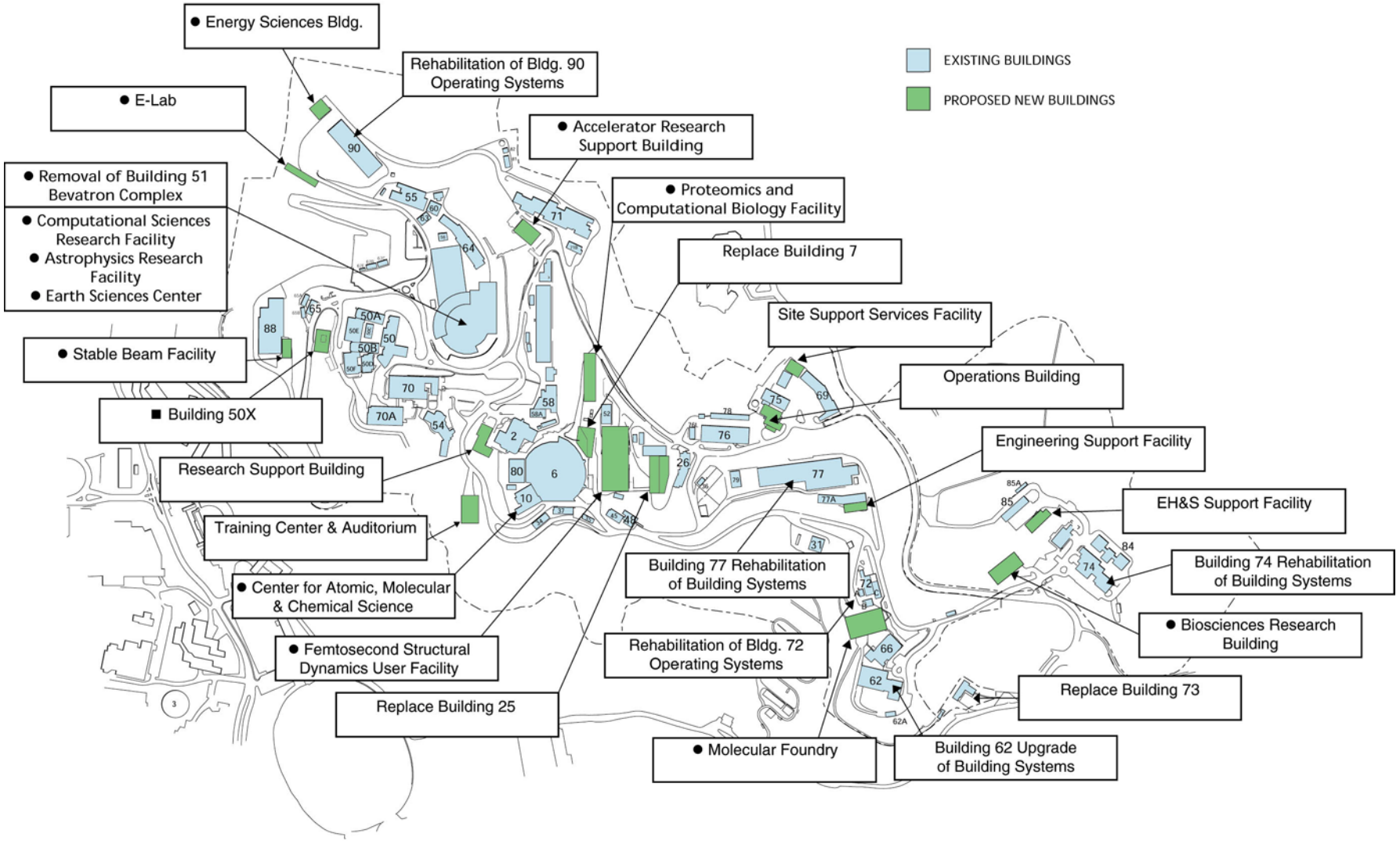
* = Payback has been calculated for both the Operations Bldg. and the Research Support Bldg..
Based on these calculations, we anticipate that other building projects will also have simple paybacks in the 5 to 10 year range

** = Construction Cost is being calculated.

*** = Per DOE budget definition, these figures do not include grounds, pest control etc. The FY 2001 figure including these activities is 7.97M.
The FY 2002 - 2013 figures are consistent with the budget forecast submittal of FY 2002, these figures are flat as LBNL is evaluating maintenance activities and SAFA 6 guidelines; it is anticipated that this section of the table will be modified in the 2003 SFP.
The FIMS RPV figure ($1.253B in FY 2002) is similarly held constant pending conclusion of this evaluation.

**** = Request for Qualifications review completed in FY 2002. Request for Proposals to be issued in FY 2002.

Appendix B — Proposed Major Construction Map – DOE Funded SLI and Programmatic Line Item Projects and Third-Party Funded Projects



Map of major SLI and programmatic line item construction projects described in Berkeley Lab's Strategic Facilities Plan. Programmatic projects are designated with a dot (●) in front of their names. The third-party building is designated with a square (■) in front of its name.