SAND2015-0709R

Open Collaboration and Research Capabilities on the Livermore Valley Open Campus

COLLABORATION IN RESEARCH AND ENGINEERING FOR ADVANCED TECHNOLOGY AND EDUCATION (CREATE)

AND

HIGH PERFORMANCE COMPUTING INNOVATION CENTER (HPCIC)

CD-1: Alternatives Analysis and Business Case, rev. 1

Non-Major System Acquisition Project
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Lawrence Livermore National Laboratory

Sandia National Laboratories

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ACRONYMS AND ABBREVIATIONS

A&E	Architecture and Engineering
ACT	Agreement for Commercializing Technology
ANL	Argonne National Laboratory
ASC	Advanced Simulation and Computing
AF Proposal	Alternative Finance Proposal
BMS	Building Management System
BOMA	Building Owners and Managers Association
CD	Critical Decision
CEQA	California Environmental Quality Act
CRADA	Cooperative Research and Development Agreement
CREATE	Collaboration in Research and Engineering for Advanced Technology and Education
CRF	Combustion Research Facility
CWG	Construction Working Group
D&D	Decontamination and Demolition
D/B	Design/Build
DDC	Direct Digital Controls
DOE	U.S. Department of Energy
DOR	Development Options Report
EASC	East Avenue Security Corridor
EERE	Office of Energy Efficiency and Renewable Energy (DOE)
EO	Executive Order
FAR	Federal Acquisition Regulations
FF&E	Furniture, Fixtures, and Equipment
FIMS	Facilities Information Management System
FLA	Facility Lease Agreement
FMV	Fair Market Value
FPD	Federal Project Director
FY	Fiscal Year
GAA	General Access Area
GHG	Greenhouse Gas
GMP	Guaranteed Maximum Price
GPP	General Plant Project
GSA	General Services Administration
GSF	Gross Square Feet
GTS	Gas Transfer Systems
HBCU	Historically Black Colleges and Universities
HPC	High Performance Computing
HPCIC	High Performance Computing Innovation Center
HQ	Headquarters
HSI	Hispanic Serving Institutions
HVAC	Heating, Ventilation, and Air Conditioning
IMOG	Integrated Manufacturing Operations Group
IPT	Integrated Project Team
ISM	Integrated Safety Management
IT	Information Technology
LA	Limited Area
LEED	Leadership in Energy and Environmental Design
LEP	Life Extension Program
LFO	Livermore Field Office
LLNL	Lawrence Livermore National Laboratory
LRSO	Long Range Stand-Off
LVOC	Livermore Valley Open Campus
M&O	Management and Operating
MNC	Mission Need Concept
MNS	Mission Need Statement
NEPA	National Environmental Policy Act

NG	Neutron Generator
NIF	National Ignition Facility
NNSA	National Nuclear Security Administration
NPV	Net Present Value
NSE	National Security Enterprise
NW	Nuclear Weapon
O&M	Operation and Maintenance
OMB	Office of Management and Budget
P&I	Principal and Interest
PPA	Property Protection Area
PRD	Program Requirements Document
R&D	Research and Development
RD&D	Research, Development, and Deployment
SC	Office of Science (DOE)
SFO	Sandia Field Office
SNL	Sandia National Laboratories
SNL/CA	Sandia National Laboratories California Site
SSP	Stockpile Stewardship Program
ST&E	Science, Technology, and Engineering
TPC	Total Project Cost
TYSP	Ten-Year Site Plan
USGBC	United States Green Building Council
VAV	Variable Air Volume
NW	Nuclear Weapons

EXECUTIVE SUMMARY

BACKGROUND

While Lawrence Livermore National Laboratory (LLNL) and Sandia National Laboratories (SNL) have remained committed to their core nuclear weapons (NW) mission, the world has changed greatly since the opening of these national labs in the mid-20th century. During this era, U.S. universities were ranked as the top science centers in the world in essentially all fields, and the national laboratories were able to recruit the top graduates—who were predominantly U.S. citizens—from the nation's best academic institutions. Consistent with the times, these new recruits expected to join a single employer for their careers and accepted high levels of security as a natural way of conducting high-security cutting-edge research. Retaining an employee over the many years required to develop a mature national security scientist or engineer was simply not an issue.

Today, the national labs still deliver world-class science, technology, and engineering (ST&E), but must now compete for talent with other organizations across the globe that can equal or even exceed the labs' work in some areas. Two additional factors add to the complexity of recruiting at national security labs: the large proportion of non-U.S. citizens among the nation's ST&E population and the high connectivity of the research world, now seen as a necessary component of the work environment. In short, national labs are challenged to hire the best and brightest talent, as new candidates courted by the labs are also targeted by companies that can offer strong-impact ST&E opportunities in highly paid, connected, and creative work environments. And because most new employees expect to make many career transitions and are likely to change jobs within three to four years, retaining talent can be equally daunting.

To maintain their capabilities and relevance in the future, national labs need to pioneer new work models and structures that enable them to capture the innovation of the external ST&E community—bringing world-class capabilities for mission enhancement and attracting a strong pipeline of ST&E candidates—while appropriately safeguarding national security functions, expertise, and resources. The national labs are not unique in this regard; the National Nuclear Security Administration (NNSA) production plants are facing similar challenges. The plants need to harness new advanced manufacturing processes and industrial technologies for safeguarding the functions, expertise, and capabilities of the national security missions as well as for enhancing those missions.

The Livermore Valley Open Campus (LVOC)—a joint initiative of NNSA, LLNL, and SNL—enhances the national security missions of NNSA by promoting greater collaboration between the world-class scientists at the national security labs, the NNSA production plants, and their partners in industry and academia. As stated in the May 2011 NNSA Strategic Plan, strengthening the ST&E base of our nation is one of the NNSA's top goals. By conducting coordinated and collaborative programs, LVOC enhances both the NNSA and the broader national S&T base—and specifically helps ensure the health of core capabilities at LLNL and SNL, which must remain strong to enable the labs to execute their primary mission for NNSA.

Specifically, these collaborations bolster the labs' access to world-class ST&E expertise and contribute to a dynamic and exciting work environment for lab scientists and engineers, thereby advancing critical national security goals and helping the labs attract and retain an outstanding workforce. Two new planned facilities for the joint LVOC initiative—**Collaboration in Research and Engineering for Advanced Technology and Education (CREATE) and High Performance Computing Innovation Center (HPCIC)**—are key to expanding existing capabilities and realizing the LVOC vision.

The NNSA Administrator and the Under Secretary for Science authorized the creation of LVOC by approving the Mission Need Concept (MNC) on July 20, 2009. This document—along with the LVOC Development Options Report (DOR), which was endorsed by the NNSA Administrator and the Under Secretary for Science in

September 2010—established a mission need and framework for developing LVOC. The need for CREATE and HPCIC, the first new major acquisition projects for LVOC, was documented in the Critical Decision-0 (CD-0) *Statement of Mission Need: Open Collaboration and Research Capabilities in the Livermore Valley Open Campus* (see Appendix A). The NNSA Administrator approved the CD-0 for LVOC development on April 22, 2013 and requested submission of CD-1 for CREATE and HPCIC, specifying that the alternatives presented include an alternative finance option.

This CD-1 document provides a recommended acquisition strategy for CREATE and HPCIC based on a comprehensive evaluation of alternatives that considers mission need, schedule, and cost objectives for these facilities.

CREATE AND HPCIC: ADVANCING THE LVOC VALUE PROPOSITION

The CREATE and HPCIC facilities are designed to meet NNSA mission needs by leveraging the core capabilities of SNL and LLNL, enabling the benefits of broad collaboration and advancing the ST&E in critical areas for NNSA. These pioneering initiatives also help the national laboratories maintain their capabilities and relevance by enabling the labs to capture the innovation of the external ST&E community, attract a strong pipeline of ST&E candidates, and retain an experienced workforce with national security knowledge and skills.

These new planned facilities are described below.

CREATE

A multi-program, mixed-use facility, CREATE will stand as a new intellectual and collaborative center for SNL that will deliver on the core value proposition of LVOC: leveraging the broader ST&E community to enhance laboratory national security programs. Such leveraging will be particularly important over the next 15–20 years to meet the large engineering mission challenges in several nuclear weapons (NW) programs scheduled over this period. To this end, CREATE will house new and expanded programs in areas—such as hydrogen science and technology for energy applications, cybersecurity, advanced engineering and manufacturing, and translational biomedicine—that allow mutually beneficial connections between national security mission ST&E and external partners. CREATE plans are consistent with the SNL *Ten-Year Site Plan* (TYSP), the *SNL/California Site Development Plan*, and mission requirements for critical national security programs.

CREATE will feature the types of innovative work environments found in models around the nation that proactively drive interactions between researchers. This dynamic work venue, coupled with the potential to work on intriguing, high-impact ST&E projects, promises to help retain employees and create a pipeline of new talent for the national security labs—thus helping to address the increasing challenge of attracting the best and the brightest to NNSA's national labs.

As a further benefit, CREATE will improve the configuration, security, cost profile, and accessibility of the Sandia/California (SNL/CA) site. First, CREATE provides an opportunity to move unclassified programs out of classified work space into the open campus where they can grow and thrive, while freeing up much-needed space for critical classified programs. Relocating badging from the current three SNL/CA locations to a single site in CREATE will enhance security and reduce costs through the consolidation of processes and services, and moving other administrative and support functions to LVOC will allow for a more accessible and integrated location for these activities. This relocation of programs to CREATE will also allow the demolition of substandard facilities, reducing operations and maintenance (O&M) costs.

HPCIC

Launched in 2011 to strengthen strategic areas of the Advanced Simulation and Computing (ASC) program, LLNL's High Performance Computing Innovation Center helps achieve the mission goals outlined in the ASC Computing Strategy by encouraging partnerships that increase the flow of ideas into the lab to develop robust tools and codes; bolster efforts to recruit and retain talent; and maintain effective working relationships with other DOE and federal partners, industry, and academia aimed at overcoming critical technology challenges. Preserving NNSA national laboratory leadership in high performance computing (HPC) applications is vital to long-term success in sustaining a safe, secure, and effective nuclear deterrent for the nation.

To these ends, HPCIC partners with American industry and academia to develop, prove, and deploy HPC solutions in multiple areas for which NNSA and DOE share the need for innovative research, including manufacturing, complex energy and infrastructure systems, cyber security, biosecurity, and big data analytics. These broadened collaborations also serve to attract new talent to the lab and retain a world-class workforce by enabling staff to enhance and apply their skills to a diverse set of new and intellectually challenging projects—an important facet to maintaining technological advantage in HPC. More broadly, the objectives of the HPCIC program align with DOE and NNSA's mission to strengthen U.S. ST&E base (Goal 4 of the 2011 Strategic Plan).

Upcoming evolutions in supercomputing hardware and software intensify the urgency to expand beneficial external collaborations. Advanced computers (such as LLNL's Sierra and Vulcan II) that will be deployed from 2016 through 2031 are driving a redefinition of requirements and redesign of the integrated design codes and supporting the development of basic science codes used to meet identified mission needs. Strengthening external collaborations now will be essential to attracting creative new minds and novel approaches to address the multiple challenges facing the labs as they redesign, rewrite, and retool codes critical to the NNSA mission. To ensure that they can maintain a lead position in advancing the maturing applications and foster the expansion of talent capable of engaging at the next level of computing complexity, the national labs must engage broadly as the definitions emerge.

Since its inception in a temporary space in the open campus, the HPCIC has proven to be highly successful. However, the temporary facility is inadequate to meet future needs, and limitations in space, functionality, and equipment are already delaying or curtailing possible engagements. Replacing the temporary facility with a modern, fully equipped building immediately adjacent to NNSA assets will enable mission-aligned unclassified collaborations and applied research with a greater number of external collaborators. These collaborations will be enhanced by features of the new building—including data visualization areas, meeting rooms, and training, education, and other collaboration spaces—and the ability to provide space for a diverse array of projects touching on many different facets of the NNSA mission. At the same time, the collaborations will help the labs transfer their deep HPC knowledge to the nation, closing a growing capability gap and helping create a new cohort of talent able to join the lab to advance the national security mission.

RECOMMENDED ALTERNATIVE IDENTIFIED

For this study, the following five options were analyzed for meeting the mission requirements identified in the CD-0 document:

- Take no action (maintain status quo)
- Renovate an existing onsite facility
- Build a new onsite facility as a DOE line item (line item)
- Lease an offsite facility (offsite lease)
- Lease a commercial onsite facility (alternative finance, or AF)

Through this analysis, leasing a commercial onsite facility (alternative finance) emerged as the best option for acquiring CREATE and HPCIC.

For both facilities, the take no action option fails to meet the mission need, and leasing an offsite facility does not enable or facilitate the interactions with the two labs or lab employees on the main site—interactions that are required to fulfill the mission need. These options were therefore eliminated.

For CREATE, the renovation option is not feasible because the SNL site has no viable candidate facility for renovation. LLNL considered three building complexes for renovation, and performed a financial analysis for the option that best fit the criteria. Beyond revealing operational and access issues with the renovation options, the analysis showed that renovation costs for all three sites would exceed the costs for a new line item facility. Therefore, the renovation option was eliminated.

Within the next 15–20 years, NNSA strategy indicates an expected rise in engineering mission work in NW and a window of opportunity to advance HPC technologies and applications and broaden the HPC user community base. Over this period, alternative finance provides the best value to the government by achieving mission needs while meeting schedule demands and reducing risk to the government. An in-depth financial analysis of the remaining alternatives identified the significant benefits of the alternative finance option over the line item approach for new construction over a proposed 15-year lease period. Specifically, alternative finance decreases project life-cycle costs for CREATE by an estimated $25.4M and for HPCIC by roughly $23M. These findings are consistent with a recent study of four DOE alternative finance facilities, which showed that in all four cases, alternative financing provides cost and schedule advantages and thus the best value to the government. Appendix B highlights the cost comparisons, and the detailed studies are available at https://share.sandia.gov/cfma/best_practices/alternative_financing.php.

Necessary Assumptions for Analysis

DOE G 430.1-7 *Alternative Financing Guide* establishes four phases in the alternative finance process:

- Phase 1—Development of Mission Need
- Phase 2—Development of Alternatives Analysis
- Phase 3—Development of an AF Proposal
- Phase 4—Submittal of the AF Proposal to Headquarters

For LVOC, the process is currently in Phase 2 with the development of the CD-1 proposal. **Since the actual alternative finance model is not developed until Phase 3, it is not appropriate to commit to a particular alternative finance model at this time.** Once they receive authority to engage in Phase 3, SNL and LLNL will develop a transaction model that transfers substantial risk to the third party, as required to meet the OMB A-11 Appendix B criteria. To this end, SNL and LLNL intend to reach out to local government, academic institutions, and commercial partners who are interested in cooperating in LVOC.

To perform an economic analysis, some assumptions must be made about the alternative finance model, including assumptions about lease terms, interest rates, risk transfer models, etc. The proposal team has reviewed the full spectrum of past DOE alternative finance transactions, keeping in mind that because each transaction model has been unique to the individual circumstances, none are expected to be directly transferable. However, the most recently approved alternative finance project was selected as an initial starting point to build upon since it met many of the characteristics of the anticipated LVOC projects, with the understanding that certain aspects of that model are not acceptable in the current environment. This approach

provided the labs a more grounded basis for cost estimating—and helped them avoid the less desirable option of postulating a new approach using only the assumptions and preferences of the project team.

Consistent with the DOE Guidance 430.1-7, approval of this CD-1 document in Phase 2 selects alternative finance as the general acquisition method and approves advancement to the next phase, but does not approve any specific transaction model or financing method or terms. The Alternative Finance Proposal to be created in Phase 3 fully develops the facility leases, land leases, and transaction models specific to the CREATE and HPCIC buildings. Final approval of the AF Proposal can only be granted upon completion of Phase 4, submittal of the AF Proposal to headquarters.

The transaction model in this CD-1, which is based on a special purpose non-profit entity that enables acquisition of the facilities via alternative finance with minimum cost and risk to the government, was assumed for the purpose of the economic analysis. This entity could be a local government or governments, a university or consortium of universities, an existing not-for-profit organization, or a non-profit created solely to construct and operate the CREATE and HPCIC facilities. Although the analysis suggests a specific third-party structure that has a number of attractive features, the only direct connection of such a structure to the economic analysis is the administrative cost of the entity; a similar cost would exist regardless of entity type.

Under this model, CREATE and HPCIC will be developed within LVOC on land leased by DOE to the non-profit entity via a 35-year ground lease. This term is derived from the industry standard construction finance term of 25 years plus a minimum 10-year "cure" period required by the financial community. The non-profit entity would obtain the lowest cost financing for the construction (anticipated to be in the form of bonds at 25-year terms, based on multiple previous DOE alternative finance projects) and contract with a builder to construct the facilities; note that DOE does not and cannot underwrite this loan. The entity would then own and maintain the facilities, which Sandia and LLNL would occupy through facility lease agreements (FLAs) set at 15 years to align with the mission need, allow for desirable financial terms, and meet Office of Management and Budget (OMB) criteria.

This model allows use of private-sector construction processes, thereby lowering cost and transferring schedule, cost, and other risks to the private marketplace. In particular, the leasing and financing agreement timeframes (15-year facility lease agreement, 25-year financing, and 35-year ground lease) are structured to meet the needs of all parties, including NNSA mission needs, OMB operating constraints, and the private-sector need to effectively manage financial risk. The timeframes are interdependent and cannot be varied unilaterally to meet the desires of a single stakeholder.

At the end of the 15-year lease period, Sandia and LLNL would either move into other facilities onsite made available by program transitions or assess alternatives to meet continuing space needs depending on the mission drivers at that time. As needed, the non-profit entity could then rent the space previously occupied by SNL and LLNL to industrial and academic partners and other tenants synergistic with the labs' missions, consistent with the ground lease.

CONCLUSIONS AND NEXT STEPS

This study of funding options for the CREATE and HPCIC facilities within the LVOC initiative reached the following conclusions:

- Alternative finance offers significantly reduced life-cycle costs compared to other funding options. These cost reductions derive from lower construction costs, coupled with attractive bond rates and lower operating and maintenance costs.
- Alternative finance delivers the facilities at least three years earlier than other options, even with aggressive assumptions about line item scheduling, thereby meeting near-term mission requirements over the next 15–20 years in areas of weapons engineering, high performance computing, cybersecurity, and advanced manufacturing.
- Given these cost and schedule advantages, alternative finance offers the best value to the government, while complying with applicable DOE and OMB orders.

Approval of this document would mean agreement from the Acquisition Executive that alternative finance is the acquisition approach that offers the best value for achieving the mission needs as identified in the CD-0 document. Following approval, the next steps in this process would be:

- Developing an Alternative Finance Proposal consistent with DOE G 430.1-7, *Alternative Financing Guide*, while working with all interested stakeholders
- Obtaining approval of the Alternative Finance Proposal by the Acquisition Authority
- Obtaining concurrence from OMB and congressional appropriators that the projects are acceptable and in compliance with operating lease criteria
- Engaging the private sector to execute the development strategy approved in the Alternative Finance Proposal

Following the recent creative acquisition of the National Security Campus at Kansas City, the successful realization of alternative finance projects in LVOC will further broaden the portfolio of capital acquisition alternatives for NNSA to support the overall health of the NW enterprise. The proposed LVOC projects will both enrich the immediate laboratories they serve as vital collaborative S&T resources and provide a broader range of options for providing needed infrastructure within the fiscal constraints of the current environment.

PART I

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CREATE AND HPCIC: TWO ESSENTIAL COMPONENTS OF THE LIVERMORE VALLEY OPEN CAMPUS

1. THE LIVERMORE VALLEY OPEN CAMPUS VISION

Focused on the Livermore Valley Open Campus (LVOC) mission of advancing science and technology in areas of synergistic interest to NNSA and external partners, two new LVOC facilities—Collaboration in Research and Engineering for Advanced Technology and Education (CREATE) and High Performance Computing Innovation Center (HPCIC)—will increase external collaborations that enhance the national security mission and attract and train new talent for the national labs.

1.1 CRITICAL DECISION-0: STATEMENT OF MISSION NEED

To enhance global and national security, the National Nuclear Security Administration (NNSA) is strengthening its ability to ensure that its national laboratories have the resources required to address the spectrum of national security needs. This effort includes investing in the capabilities and infrastructure required to address the broader security challenges within the NNSA mission space, as well as the work of the wider national security community. With this goal in mind, the NNSA Administrator and DOE Under Secretary for Science authorized the creation of the Livermore Valley Open Campus (LVOC) by approving the *Mission Need Concept* (MNC) on July 20, 2009 and endorsing the LVOC *Development Options Report* (DOR) in September 2010 (see Appendix A).

A joint initiative of NNSA, Lawrence Livermore National Laboratory (LLNL), and Sandia National Laboratories (SNL), LVOC is a campus of more than 100 acres dedicated to enhancing the national security mission by strengthening the science, technology, and engineering (ST&E) base of our nation, one of the NNSA's top goals in its 2011 Strategic Plan. Currently encompassing more than a dozen buildings and over 200 employees working in such areas as combustion, biofuels, advanced computing, and cybersecurity, this new campus is specifically designed as an unclassified open environment to encourage and build collaboration with external partners in academia and industry. LVOC expands on the nuclear weapons (NW)–focused partnership initiated between LLNL and SNL in the 1950s into a channeled alliance that is prepared to meet a broad range of 21st century challenges. Capitalizing on the expertise and opportunities of a thriving and innovative community, LVOC draws on new intellect and problem-solving skills to address our nation's most pressing security challenges.

On April 22, 2013, the NNSA Administrator provided LLNL and SNL formal approval of the Critical Decision-0 (CD-0) document, *Open Collaboration and Research Capabilities in the Livermore Valley Open Campus,* and authorization to proceed with development of LVOC and preparation of Critical Decision-1 (CD-1), an alternatives analysis for the first two proposed projects: HPCIC and CREATE. A joint team from LLNL and SNL drafted the CD-1 document and has been working closely with the Livermore Field Office (LFO), designated as the lead NNSA field office, to help coordinate efforts. The CD-1 presents several acquisition options, including an alternative finance option (as specifically requested by the NNSA Administrator), as described in DOE G 430.1-7, *Alternative Financing Guide*.

COLLABORATION: APPLYING WORLD-CLASS EXPERTISE TO NATIONAL SECURITY CHALLENGES

In approving the creation of LVOC in 2009, DOE and NNSA acknowledged the critical role of external collaboration in achieving the core mission of ensuring national security. This section summarizes the value of LVOC before examining in greater detail how the proposed LVOC facilities will enable mission-oriented R&D in response to the specific needs expressed in the DOE and NNSA strategic plans.

While LLNL and SNL have remained steadfastly committed to their core NW mission over decades of operation, the world has changed greatly since the opening of these national labs in the mid-20th century. At that time, U.S. universities were ranked as the top science centers in the world in essentially all fields. To enhance their ST&E

abilities, therefore, the national laboratories simply turned to the nation's best academic institutions to recruit the best and the brightest from among their graduates, who were predominantly U.S. citizens. Consistent with the times, these new recruits expected to join a single employer for their careers, an excellent match for the perceived need of a cloistered national security R&D workforce. They also accepted high levels of security as a natural way of conducting high-security cutting-edge research, and thrived within the "family" atmosphere created at the labs. Retaining an employee over the many years required to develop a mature national security scientist or engineer was simply not an issue.

Today, much has changed. The labs still deliver world-class ST&E, but other organizations across the globe can equal or even exceed the labs' work in some areas. Further, a large proportion of the nation's ST&E educators, students, and employees are not U.S. citizens, even at the highest echelons of preeminent American companies. In addition, the research world is highly connected—enabling worldwide dispersal of concepts within days of publication—and connectivity is seen as a necessary component of the work environment. At the same time, career transitions are common: those entering the workforce today will most likely change jobs within three to four years. Competing for the best and the brightest talent is now extremely difficult, as new candidates courted by the labs are also targeted by companies that can offer intriguing, rewarding, high impact, ST&E opportunities in inviting, highly paid, connected, and creative work environments. In addition, retaining new lab employees has become equally challenging.

To maintain their capabilities and relevance within the 21st century global context, national labs need to pioneer new work models and structures that enable them to capture the innovation of the external ST&E community, bringing world-class capabilities for mission enhancement and attracting a strong pipeline of ST&E candidates, while appropriately safeguarding national security functions, expertise, and resources.

A New Model for the Sites

While many national security programs at LLNL and SNL must remain classified or closely held within the secure areas of each site, numerous unclassified R&D programs would benefit from execution in an open, collaborative environment. LVOC creates that environment, offering an ST&E campus where academia, industry, and national laboratories can work side-by-side to pursue a wide range of challenging R&D programs and engage in the very deep knowledge exchange that occurs only when people work together in close proximity.

The LVOC Master Plan—which calls for thoughtful work areas, connectivity, dynamic reconfigurable spaces, and industry-level security measures—will produce a welcoming and adaptable work environment that meets the expectations of today's employees and seamlessly accommodates work with foreign nationals, who are now often among the best and the brightest. Further, by enabling lab personnel to both pursue R&D within the security fences and collaborate with experts from multiple organizations and institutions outside the fences, LVOC greatly extends the portfolio of projects for current and prospective employees.

Capitalizing on Location

Successful R&D campuses across the nation are designed around unique facilities and environments that encourage innovation, entrepreneurship, and networking, thereby enabling organizations within the campus to grow and thrive. Many of these campuses are anchored by preeminent public and private research laboratories and universities that help attract tenants and talent to the area. They also capitalize on the surrounding region's economic sectors to augment the vision of the campus.

Architecting a similar vision, LVOC draws on the strengths of the national labs and the surrounding region of high-tech industry and academic institutions, along with a local community that supports the role of the national laboratories and LVOC in promoting technology transfer to seed the growth of tech-based businesses. The

campus Master Plan in the *Development Options Report* (DOR) articulates the importance of creating anchor facilities that leverage the resources and facilities unique to each laboratory to allow synergistic growth of unclassified programs that directly benefit the national security programs. Locating CREATE and HPCIC outside the security fence and near the Combustion Research Facility (CRF) and high performance computing (HPC) facilities, respectively, enables laboratory researchers to work in both environments to improve outcomes—which is the primary goal of collaboration within LVOC.

A recent literature survey, *Co-Location Dynamics in Collaborative Research Environments* (April 2013) concludes that the configuration of physical space has a direct effect on the level of interaction in collaborative environments. Studies have concluded that, even with the advent of modern communication methods such as email and social media, knowledge transfer decreases rapidly as distance between collaborators increases. Adjacency to LLNL and SNL takes into consideration the conclusions of this extensive research on the need for co-location when siting facilities for high-productivity R&D environments:

- Regular face-to-face interactions are critical to establishing and maintaining collaborative and innovative productivity among researchers in diverse R&D environments.
- Organizations and personnel are three to four times more likely to share technical knowledge and innovative designs with other organizations and personnel within a 500-meter (roughly one-third-mile) radius than with those farther away.
- Organizations are most likely to collaborate with a research campus when located within a 1.2-mile radius of the campus.

Put briefly, placing personnel in very close proximity is critical to fostering collaborations, especially those involving complex technical topics; even relatively small distances between collaborators can hinder knowledge sharing. For a broad set of co-location references, see Appendix C.

LVOC's location also allows the national laboratories to more fully benefit from proximity to the metropolitan Bay Area, a renowned hub of innovation and home to several world-class universities. As detailed in the 2012 publication *The Bay Area: A Regional Economic Assessment*, the San Francisco Bay Area leads the nation in multiple areas. For example, it captures about 40% of all venture capital in the nation; is home to the highest number of patents granted; contains more than three times the concentration of professionals in computer, mathematical, and engineering occupations than the rest of the nation; and is one of the nation's top four regions in terms of educational attainment, with 46% of workers possessing a bachelor's or other form of advanced degree.

1.2 Objectives and Performance Parameters

As summarized in the CD-0, CREATE and HPCIC are aligned with many of the goals outlined in the DOE and NNSA strategic plans. The sections below provide more details on the CREATE and HPCIC facilities and programs, focusing on their ability to strengthen connections between the national security mission and the broader ST&E community.

CREATE

As an intellectual and collaborative center at the Sandia California (SNL/CA) site, CREATE will house new and expanded programs in areas—such as hydrogen science and technology for energy applications, cybersecurity, advanced engineering and manufacturing, and translational biomedicine—that enable strong, beneficial connections between the national security mission and the external science and technology community.

These connections will be particularly important over the next 15 years to meet the significant engineering workload needed to successfully execute expanded nuclear weapon (NW) classified programs, which include the following:

- W87 Neutron Generator (NG), Gas Transfer System (GTS), and Firing Set
- B83 NG and GTS
- W80-1 NG
- Mk21 Fuze
- W78/88-1 LEP
- Long Range Stand-off (LRSO)
- B61-12 Life Extension Program (LEP)

CREATE will open opportunities to enhance SNL/CA technical capabilities in many key areas that underpin these NW programs. These capabilities include systems engineering of the LLNL weapon systems, as well as of several key components, such as the Mk21 Fuze, gas transfer systems, and joint test assemblies (JTAs). Further, analysts at the SNL/CA site provide support to the full range of stockpile systems in a variety of subject areas, including structural mechanics and dynamics and thermal fluids.

Figure 1. Located near the technical heart of SNL/CA, CREATE will increase synergies between classified and unclassified national security programs, while enhancing collaborations with external partners.

To fulfill its responsibilities for these programs, SNL/CA must address multiple critical needs. These include increasing collaborations to strengthen ST&E competencies and, to meet schedule demands at a reasonable cost, creating space in the Limited Area (LA) by moving unclassified programs to the General Access Area (GAA).

Designed to address these needs, CREATE aligns with several specific objectives of DOE and NNSA:

- **Advance NNSA foundational ST&E competencies:** CREATE will focus on areas with direct connections across the unclassified to classified spectrum, providing lab researchers insight into new challenges and expertise that can transfer back to national security programs.

  For example, Sandia can offer hydrogen expertise, built through decades of world-class R&D in gas transfer systems, to advance the hydrogen fuel cell infrastructure, seen as central to meeting strategic energy security goals. In turn, this collaborative work will build materials science and engineering knowledge that will enhance safe and reliable classified applications. Specific areas of common interest between the GTS and energy missions include the use of non-traditional materials, such as aluminum alloys, for hydrogen application; the application of additive manufacturing to produce high reliability

hardware; and the development of predictive modeling capabilities to address long-term system reliability in high consequence environments. Leveraging the expertise and knowledge developed through the energy programs will allow the NW program to deploy advanced technologies more quickly and at lower cost and risk than would be possible through an isolated NW effort.

CREATE will also provide a focus for collaborative advanced manufacturing programs between NW staff and university and industrial partners. Additive manufacturing shows great promise to create complex parts with novel functionality quickly and at reduced cost. However, without the multi-decade experience-base underpinning the manufacture of parts from machined bulk materials, qualification of additively manufactured parts for critical applications remains problematic. Sandia will work with partners to develop science-based methods to qualify parts made through novel approaches for high reliability applications in national security and other systems.

In addition, CREATE can be a source of developments to enhance materials science research and help supply the competency base for incorporating new technologies into weapon systems to address mechanical properties, materials processing, and system performance in extreme environments. By offering an environment for collaborative cybersecurity R&D, CREATE can also help partners develop the workforce and capabilities needed to increase the nation's overall cybersecurity, as well as provide a deep and more robust knowledge-base for classified programs.

- **Sustain a world-leading technical workforce:** CREATE's modern collaborative space will attract next-generation workforce and external partners to the labs, where they can be introduced to the challenges and relevance of the national security mission. As a result of this experience, some may choose to join the labs or partner with the labs as research collaborators. Further, working on intriguing projects with outside experts will provide employees new challenges, stimulating their growth and providing them a broader science foundation for addressing mission goals.
- **Maintain a vibrant U.S. effort in science and engineering to support economic prosperity:** Collaborations at Sandia have already demonstrated the potential for economic benefits. For example, a multi-year collaboration between Goodyear Tires and Sandia allowed the company to cut their design time by two-thirds and create a better product—leading to a new product line that yielded record profits. The approach used in this project, which involved developing advanced mechanics modeling and simulation codes relevant to Goodyear's tires, has direct application to NNSA programs. Expanding advanced manufacturing partnerships within CREATE that meld national lab and extended expertise promises to better position U.S. industry to compete in an intense world market, while advancing world-class manufacturing technologies for use in national security applications. The NNSA S&T reports include many other examples of technologies developed through private collaborations that have benefited mission-related efforts.

The CREATE building is an integral part of the SNL/CA site plan, which includes an expanded LA to house the staff needed to meet the program goals of the multiple LEP and ALT programs that will be executing simultaneously over approximately the next 15 years. Specifically, CREATE will mitigate the effects of the current 95% space occupancy and vigorous programmatic hiring of SNL/CA NW center by allowing relocation of several appropriate business elements from the LA onto LVOC, as well as the addition of a building into the LA to address the needs of the joint test assembly and the stockpile systems groups. This reconfiguration will also enable integration of badging and other administrative functions within CREATE, leading to more efficient and cost-effective processes and a clear delineation between classified and unclassified areas—again benefitting the classified programs.

HPCIC

LLNL's High Performance Computing Innovation Center was launched in 2011 to work with U.S. industry to develop, prove, and deploy high performance computing (HPC) solutions in areas—such as manufacturing, complex energy and infrastructure systems, cyber security, biosecurity, and big data analytics—where industry and NNSA share the need for better physics models, more efficient algorithms, and world-class computer systems. These collaborations also help maintain NNSA national laboratory leadership in HPC, which is vital to long-term success in sustaining a safe, secure, and effective nuclear deterrent for the nation. HPCIC's unique ability to partner with industry and academia is important to achieving the goals of the NNSA's Advanced Simulation and Computing (ASC) program, as outlined in the *ASC Computing Strategy* (see "External Partnerships," pg. 16). The HPCIC's primary objectives, as described below, address several areas within the ASC program:

- **Encourage and accelerate the exchange of novel ideas impacting key programs:** Every 10–15 years, a new supercomputing epoch emerges, characterized by an evolutionary shift in the programming models used on leadership-class supercomputers. Thus far, in response to the changes in underlying architectures, NNSA laboratories have met the challenges of each epochal transition. However, the trend towards increased reliance on internal expertise at each transitional step has widened the knowledge gap between the national labs and the user community. To meet the challenges of next-generation supercomputing systems, the national labs will maximize their creativity and problem-solving sets by collaborating with strategic partners who offer outside thinking on difficult and relevant problems.
- **Recruit and retain talent with new engagement models:** HPCIC's model of side-by-side interactions with partners in industry and academia helps retain key talent by introducing lab scientists and engineers to a broader repertoire of collaborative projects, as well as attract new talent by offering an intriguing entrée into the lab environment. HPCIC also aims to co-locate synergistic undergraduate and graduate computational programs and integrate the K-12 Discovery Center. Flexible space programming concepts will accommodate the Institute for Computational Research, Cyber-Defenders Program, Hispanic-Serving Institutions (HSI), and Historically Black Colleges and Universities (HBCU) computational students in a more thoughtful and impactful way to complement or augment these workforce pipeline programs. This effort will enable participants to cross-fertilize ideas and provide them greater exposure to exciting programs that showcase future employment opportunities.
- **Broaden the user community and reduce the capability gap:** The capabilities of NNSA lab computational scientists often exceed those of the U.S. industrial and academic computational community, creating a gap that limits industry's ability to leverage HPC resources. By fostering government-industry collaborations, HPCIC will broaden the application of HPC in U.S. industry, which can lead to the creation of more innovative hardware and software solutions that directly benefit the government and increase the community of users that could collaborate with the national labs. Accelerating the involvement of the user community during critical development stages of current and next-generation architectures will enhance returns on the government's national investments in HPC.

Because of its unique offerings, HPCIC has seen significant program growth and use of its temporary incubator facilities by all LLNL programs. The demands for the facility often cause delayed or declined collaboration opportunities.

Figure 2. Located near the high performance computing centers of LLNL, HPCIC will increase synergies between classified and unclassified national security programs, while enhancing collaborations with external partners.

LLNL therefore proposes to build a permanent and more modern facility that fosters external collaborations in order to meet the following DOE and NNSA strategic objectives:

- **Strengthen the ST&E Base**: HPCIC will enhance ST&E competencies for the NW mission by increasing unclassified collaborations that focus on computing in manufacturing, complex energy and infrastructure systems, cyber security, biosecurity, and big data. Although unclassified, the computational science, methodologies, and tools developed under such collaborations are synergistic with the Stockpile Stewardship Program (SSP) and have beneficial applications in other national scientific, economic, and social sectors. In the future, strong value could emerge from lab-industry collaborations to develop and apply manufacturing process–aware modeling, simulation, and data analysis related to direct digital manufacturing technologies, such as additive manufacturing, and new characterization technologies, such as in situ process control. Multidisciplinary teams of laboratory, production plant, academic, and industry partners leveraging the power of HPCIC's resources can accelerate the pace of advanced manufacturing process–aware innovation and speed the certification of digitally manufactured products for both commercial and NNSA applications. Moreover, through its educational spaces, the HPCIC will serve as an important training resource for the future advanced manufacturing experts required by the NNSA complex.
- **Define and Maintain Leadership Computing:** HPCIC is the nexus for linking the extraordinary HPC capabilities of LLNL and other national labs to industry and academia. DOE's strategic goal of maintaining U.S. leadership in HPC over the next 10–15 years will involve the development of new codes and algorithms as novel architectures evolve. The application of these tools to real-world problems has a direct impact on the nation's security.
- **Attract, Retain and Train the Workforce**: HPCIC's modern reconfigurable collaborative space and challenging impactful projects will improve the pipeline for the workforce of the future. HPCIC collaborative projects involving national labs, industry, and academia provide a valuable training ground for graduate students and post-doctoral fellows who are potential candidates for university, industrial, and national laboratory employers, which will ultimately help strengthen the ST&E base, consistent with NNSA goals. In addition, HPCIC's appropriately sized classroom and training workspaces will increase the exposure and attendance of current and future LLNL and SNL education programs.

1.3 GOVERNANCE AND INTEGRATED PROJECT TEAM

A governance model has been co-developed by LLNL, SNL, LFO, and the Sandia Field Office (SFO). It guides the operation of LVOC and provides structure for the CREATE/HPCIC acquisition projects. To describe this governance, LFO has submitted *Governance Process and Coordination Team Charter for the Livermore Valley Open Campus*. As summarized in this document, these governance mechanisms and their related processes are designed to lead LVOC towards its goals and successfully execute the acquisition projects, while maintaining alignment with directives from DOE and NNSA.

1.4 SECURITY

Since 2009, several buildings comprising over 250,000 gross square feet (GSF) in laboratory and office space have been brought into LVOC. These facilities are in a GAA adjacent to fenced Property Protection Areas (PPAs) and adhere to building-level security measures. Both laboratories have engaged and will continue to engage subject matter experts in physical, cyber, and operational security and counter intelligence as integral team members in all phases of LVOC development and implementation to identify and mitigate concerns.

1.5 KEY POINTS

In closing, the following key points are emphasized:

- To maintain their capabilities and relevance, the national labs need to pioneer new models that enable them to capture the innovation of the external ST&E community, attract a strong pipeline of ST&E candidates, and retain an experienced workforce with national security knowledge and skills.
- The LVOC Master Plan enables lab personnel to both pursue R&D within the security fences and collaborate with external organizations outside the fences, thereby greatly extending the portfolio of projects for current and prospective employees. The plan will also produce a welcoming and adaptable work environment that meets the expectations of today's workforce, yielding a powerful tool for attracting and retaining skilled ST&E talent.
- LVOC governance mechanisms and processes will lead LVOC towards its goals and successfully execute the acquisition projects, while maintaining alignment with directives from DOE and NNSA.

PART II

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CREATE OVERVIEW AND ANALYSIS

2. CREATE REQUIREMENTS DEFINITION

A review of specific performance parameters for the CREATE facility, as delineated in the Mission Need Statement (CD-0), shows that CREATE will support the national security mission by increasing collaborations that are complementary to national security programs, freeing up LA space to accommodate current and projected demands, improving the security and layout of SNL/CA, and reducing costs.

2.1 FACILITY TO CAPTURE SYNERGISTIC OPPORTUNITIES

CREATE, one of the first opportunities to expand LVOC beyond its current capabilities, will provide an estimated 86,000 GSF of office, light laboratory, and collaboration spaces that can welcome external visitors for extended partnerships and host seminars and working meetings that attract world-class participants. CREATE will focus on new partnerships between the labs and the external community in three key areas that offer synergistic benefits to both national security and private enterprises:

- **Hydrogen science:** Responsible for the lab's work in GTS, which store and transport hydrogen isotopes, SNL/CA has developed world-class expertise in hydrogen storage and materials science. Sandia shares appropriate aspects of this expertise with external partners through projects aimed at developing safe and economic fueling systems for hydrogen fuel-cell vehicles, a key national and international goal. Because the same SNL experts who work on GTS also staff these collaborative projects, the knowledge gained in this energy-related R&D can be readily applied to the national security mission. CREATE offers an opportunity to expand these outside partnerships, extending SNL's ability to leverage hydrogen knowledge to meet upcoming national security goals through improved GTS designs, while also helping realize the national security gains of weaning transportation from petroleum-based energy sources.
- **Advanced manufacturing:** The current Administration has set the goal of leading the world in advanced manufacturing, which uses novel, innovative tools, such as 3D printers, to reduce the time and cost of manufacturing complicated or low-volume products. Stewards of NW manufacturing, the labs have developed advanced manufacturing processes that promise immense value to industry, as demonstrated by the collaboration between Sandia and Goodyear Tires cited in Section 1.2. Collaborative programs housed in CREATE will enable U.S. industries to develop additional advanced manufacturing resources and techniques—and in turn produce expertise that can be leveraged for the labs' national security programs.
- **Cybersecurity:** Bolstering the security of computers, their networks, and the information they contain is crucial to meeting the imperative to protect key national security and economic assets, including the critical infrastructure that underpins virtually all aspects of modern life. Further, cybersecurity advances are crucial to maintaining the integrity of the stockpile, which relies on advanced computing to ensure the safety and reliability of the nuclear deterrent. Due to its interconnected nature, cybersecurity requires collaboration from across the full spectrum of government, academic, and industrial expertise. Providing an appropriate unclassified environment for such efforts, CREATE can help partners develop the workforce, research tools, and capabilities needed to increase the nation's overall cybersecurity, as well as provide a deep and more robust knowledge base for classified programs.

Sandia's Combustion Research Facility, the first existing complex to become part of LVOC, is a model for CREATE. An internationally recognized DOE collaborative research center, the traditionally financed CRF was opened more than 30 years ago to focus R&D flowing from the NW mission to the national priority of enhancing energy security by improving transportation technologies. It is now home to over 100 scientists, engineers, and technologists—as well as visiting academic and industry experts from around the world—who conduct basic and applied research into combustion and related processes using non-intrusive state-of-the-art laser-based optical diagnostics and advanced computational techniques.

Through close collaborations, CRF investigators advance the science of chemical energy systems and combustion much farther than can individual researchers, creating results that are propagated through a broad web of domestic and international partnerships. Further, the co-location of Sandia researchers with academic and industry collaborators accelerates the transition from basic science to application, giving industry partners vision into the science while providing lab researchers market insights to help guide application and technology transfer. The Director of Research of the largest U.S. automotive company recently underscored the broad and deep impact of the tight partnerships between the CRF and every major U.S. engine manufacturer, noting that the CRF's work has influenced essentially every car on the road today, resulting in dramatic reductions in emissions and increases in engine efficiency. LVOC as a whole and CREATE in particular will build on this heritage of collaboration and technical excellence.

By replicating the success of the CRF in other areas through CREATE and other initiates, LVOC can yield extensive benefits to the national security mission. First, the labs can leverage LVOC work funded or co-funded by non-NNSA organizations to enhance national security ST&E. For example, laser diagnostic techniques developed at the CRF have been applied in the NW fire research program to quantify the impacts of adverse environments on weapons. As the national security threat grows in complexity within a fiscally constrained environment, shared knowledge and solutions from external partners in an array of areas—such as cybersecurity, biology, transportation, and energy—will only become more valuable.

In order to attract and retain both new partners and employees, the labs are embracing LVOC as a gateway into all appropriate facets of their work, particularly in external-facing areas, such as hiring, badging, and technology transfer. Sandia will use CREATE to migrate these functions to the open campus, simultaneously freeing up space elsewhere in the laboratory for growing classified national security work. These functions provide the critical support needed to fully realize the collaborative potential of CREATE and the mission-related programs it enables.

2.2 PROJECT PERFORMANCE PARAMETERS

As noted earlier, CREATE will be designed to foster collaborations to advance ST&E in areas crucial to the national security mission, benefit external collaborators, and attract new scientists and engineers to the national security space. To these ends, CREATE will provide office, light laboratory, and teamwork areas in a state-of-the-art LVOC facility that is more functional and energy-efficient than many existing buildings on the site. CREATE will enable collaboration with academic and industrial partners that build or maintain expertise in unclassified aspects of programs currently housed in the LA.

In addition, CREATE will facilitate a layered approach to security, consistent with the *SNL/CA Site Development Plan*, that will enhance security at a lower cost. Specifically, by serving as the new front door to SNL/CA that provides direct access to LVOC, CREATE will enable streamlined management of the site's visitor security (badging) functions through a single point of entry.

As a summary of CREATE's ability to meet LVOC's and Sandia's needs, Table 1 specifies project performance parameters for CREATE in relation to mission requirements as identified and approved in the CD-0 document.

Table 1. Ability of project performance parameters to meet mission requirements

Project performance parameters	Mission requirements					
	Increase collaborations	Free LA space	Rationalize site layout	Attract future workforce	Improve security/badging	Reduce costs
A facility in close proximity to key Sandia/CA facilities	✓	✓	✓		✓	✓
Flexible work suites and light laboratories for unclassified programs for collaborations with industry, academia, and partners	✓			✓		✓
Collaboration space for the full spectrum of Sandia programs	✓			✓	✓	
A space acting as the Sandia/CA "front door" to consolidate business and security functions; better engage collaborators	✓	✓	✓		✓	✓
Office space to accommodate some 150 staff and 50 visitors with an appropriate mix of hard-walled offices and cubicles	✓	✓		✓		
Meeting rooms and video teleconference space with multiple user IT connections	✓			✓		✓
Impromptu collaboration and break-out discussion space, both open and private	✓					
Flexible classroom and training space	✓	✓		✓		
Technical information media center and other magnet amenities that proactively drive interactions between researchers	✓		✓	✓		
Designed to a 2010 CALGreen California Building Code standard				✓		✓
Flexible security access control system to accommodate changing levels of programmatic or administrative control of individual suites and areas	✓	✓			✓	
Network access with support for multiple users with a robust, modern building distributed communications infrastructure	✓			✓		✓
Summary of parameters satisfied	✓	✓	✓	✓	✓	✓

2.3 FACILITY DESCRIPTION

OVERVIEW

A multi-story 86,000 GSF building, CREATE will be a state-of-the-art, mixed-use, environmentally sustainable facility designed to satisfy the required local California Green Building Code and pertinent DOE regulations. The new facility will provide office and low-hazard, flexible laboratory spaces joined by collaboration areas, as well as a technical information media center and other amenities that support interactions between building occupants. In alignment with current best practice, plans call for less than 50% office space to provide sufficient area for collaborative activities. Flexible design allows for meeting current needs while facilitating future requirements in response to organizational or mission-related changes.

SPACE PROGRAM

The CREATE facility will support customer-driven national security mission requirements by freeing office space in the LA for NW and other classified programs while also strengthening ST&E competencies for these programs through broader unclassified collaborations. When completed, the facility will allow relocation of about 150 staff currently engaged in unclassified research and administrative functions, providing a fiscally responsible means for meeting classified program space demands on the site.

SNL/CA developed a space plan for CREATE through a rigorous process of interviews with program stakeholders to validate space requirements. As shown in Table 2 and detailed in Appendix D, CREATE will provide space for programs centered on hydrogen science, cybersecurity, engineering sciences and manufacturing environments, and translational biomedicine, as well as areas for collaboration and necessary support functions.

Table 2. CREATE space program summary

CREATE Functions	Ft^2
Hydrogen program—thermal fluids/energy systems	12,670
Cybersecurity	4,250
Engineering sciences and manufacturing environments	7,970
Translational biomedicine	4,640
R&D collaboration zones	11,000
Badging and entry*	6,130
Business office* (human resources, procurement, public relations/outreach, tech transfer)	13,850
Technical information media center	6,440
Reconfigurable training and classroom space	13,340
Building support (mechanical and electrical)	5,320
Total	**85,610**

* Relocated to create classified space.

2.4 ESTIMATED TOTAL PROJECT COST RANGE

The estimated total project cost (TPC) for CREATE ranges from $27M for the least expensive alternative to $45M for the most expensive alternative. For the line item estimate, the range of cost estimating uncertainty was quantified by performing predictive Monte Carlo simulations in Crystal Ball, an Oracle application. Based on an 85% certainty level, the TPC range for new line item construction is $38M–$71M. Therefore, the cost range for estimated TPC across all evaluated options is $27M–$71M.

Strong confidence in this range is based on the comprehensive research, market analysis, and planning efforts conducted to date, which include the following:

- Limited conceptual design work and validation of the feasibility of the preliminary statement of work by independent architectural and construction firms
- Cost management success rate under a design-build project methodology
- Leasing market estimates, feedback, and analysis

It is important to note that the final TPC will be highly dependent upon the chosen acquisition strategy and the recommended design/build partner selected as a result of a competitive procurement.

The cost estimates assume that the line item construction option would be completed in accordance with DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets,* and that normal commercial practices would be applied to the alternative finance construction option.

2.5 KEY POINTS

In closing, the following key points are emphasized:

- CREATE will be designed to foster collaborations with academic and industrial partners to advance ST&E in areas crucial to the national security mission and that benefit external collaborators and attract new scientists and engineers to the national security space: initially, hydrogen science, cybersecurity, and advanced manufacturing. These collaborations will build or maintain expertise in unclassified aspects of programs currently housed in the limited area.
- CREATE will be a state-of-the-art 86,000-GSF environmentally sustainable facility that is more functional and energy-efficient than many existing buildings on the Sandia California site. CREATE will provide office and flexible laboratory spaces joined by collaboration areas, space for Sandia site administrative functions, and amenities that support interactions between building occupants.
- Flexible design allows for meeting current needs while facilitating future requirements in response to organizational or mission-related changes.
- The estimated TPC is projected to be $27M for the alternative finance option and $45M for the line item option. Taking into account cost estimating uncertainty, the cost range for estimated TPC across all evaluated options is $27M–$71M. Strong confidence in this range is based on comprehensive research, market analysis, and planning efforts.

3. CREATE ALTERNATIVES ANALYSIS: MISSION PERFORMANCE, SCHEDULE, AND LOCATION

Analyses of acquisition options for CREATE demonstrate that the alternative finance approach best meets CREATE's mission performance requirements and facility specifications, schedule, and location needs.

To assess the viability of the acquisition alternatives and identify the approach that offers a best value option to the government, all feasible options were evaluated against several key criteria essential to meeting the mission need of CREATE, as described in this section. The approaches that present feasible attributes for meeting the CREATE mission need were subjected to financial analysis, as detailed in the subsequent *CREATE Economic Analysis* section. Together, these analyses prioritize each option's ability to:

- Satisfy the mission need requirements, including the ability to meet performance parameters and facility requirements
- Achieve the lowest cost and best value alternative to the government
- Provide a schedule for occupancy that meets mission requirements for critical national security programs

3.1 FUNCTIONAL AND TECHNICAL REQUIREMENTS ANALYSIS

The functional and technical requirements analysis reviewed each scenario in relation to the mission need's targeted facility specifications, including the points noted previously in Section 2.2, *Project Performance Parameters*.

1. **Take no action (maintain the status quo)**

   Representing a decision to maintain the status quo, the take no action scenario ignores the mission drivers as a priority. Specifically, this option would not generate or make available any new facility for the mission need, yielding a negative mission impact, a risk to mission execution, and indirect financial impacts, including the continued operation and maintenance of substandard and inefficient warehouses and trailers that are beyond their useful life. Because addressing the mission need is a strategic imperative, this alternative is eliminated from further consideration.

2. **Renovate an existing onsite facility**

   The analysis considered repurposing and/or renovating (which could include minor modifications, general plant project (GPP) improvements, and/or line item funded modifications) one or more existing onsite facilities as a means to satisfy the mission specifications and facility requirements of CREATE. Findings showed that no 86,000 GSF opportunity facilities exist in or adjacent to LVOC that can meet the functional requirements of CREATE. The only facilities currently unoccupied by national security mission work are trailers and warehouses fragmented across the site. These facilities do not meet code requirements, are not of the necessary type or quality of space, do not comprise enough space to meet the mission need, and are slated for decontamination and demolition (D&D).

   The two facilities (buildings 927 and 928) in close proximity to LVOC that could be made available and that are not fully occupied with national security programs do not provide the necessary square footage. Moreover, because they were designed primarily as storage occupancies, they lack basic infrastructure and cannot meet the current codes and standards applicable to spaces intended as offices and laboratories without significant investment. Resolving these issues would require the equivalent of a complete facility replacement, as outlined in Table 3 below. Because there is no feasible path for existing facilities to meet the mission need, this alternative is eliminated from further consideration.

Table 3. Systems required to make buildings 927 and 928 suitable for occupancy

Requirement	Applies to Building 927	Applies to Building 928
Complete replacement of structural system	✓	
Complete replacement of insulated building envelope	✓	✓
All new HVAC system to meet code requirements	✓	✓
All new plumbing system and bathrooms	✓	✓
All new electrical and communication infrastructure	✓	✓
All new life safety systems to meet code requirements	✓	✓

3. **Build a new onsite facility as a DOE line item (line item)**

   This alternative would meet the mission need of realizing the CREATE facility by acquiring the capital asset through the DOE line item process as outlined in DOE O 413.3B. Under this approach, site selection and facility specification and design can specifically meet the mission need.

4. **Lease an offsite facility (offsite lease)**

   The analysis considered whether leasing an offsite facility, either by occupying an existing facility or by pursuing a commercial approach, would meet the mission need. While the offsite leasing approaches could address facility functional requirements, they would adversely impact parameters related to co-location for mission efficacy, LVOC operations, and other mission drivers requiring close proximity to existing programmatic operations on Sandia's campus. Because commercial options are at least 2 miles from SNL and existing office facilities are 3 miles from SNL, the offsite opportunities are outside of the 0.3-mile radius for effective collaboration with LVOC. As such, the sites are not able to meet the mission requirements for CREATE and LVOC development, and will not be further considered. For completeness, however, the economics of these offsite leasing options were evaluated and determined to be disadvantageous compared to alternate approaches (see Appendix E). For an offsite commercial approach, the major categorical cost drivers for construction projects are indifferent to the site location. However, the cost basis for an offsite commercial project has the potential for increased costs in areas such as taxes, ground lease rates, permitting, and utility connections and rates. The financial analysis of leasing an existing offsite facility shows that the expected lease rate would also exceed that of an onsite option.

5. **Lease a commercial onsite facility (alternative finance)**

   This third-party leasing approach offers the potential for a private developer to address the functional and technical requirements through a commercial opportunity on Sandia's campus. As Sandia would be the key anchor tenant in the development, the mission and functional requirements could be met. As the co-location studies evidence, close proximity is an enabler of the national security mission imperative outlined for both CREATE and LVOC development.

The use of General Services Administration (GSA) and their extended real estate authority may provide an alternative that falls outside of the usual NNSA acquisition pathways. A lease through GSA would involve a federal-entity-to-federal-entity lease and falls outside the current scope of this analysis. An initial review of this option indicated no clear advantage and some potential disadvantages.

3.2 TIMELINES FOR ALTERNATIVES

As outlined in the approved CD-0 document, driving the effort to secure the CREATE facility is the immediate need to support a range of programs and vibrant ST&E capabilities fundamental to national security programs. Key nuclear weapon programs that require additional LA space to address the significant ramp-up expected in the next two years include efforts for the W87 NG, GTS, and Firing Set; B83 NG and GTS; W80-1 NG; B61-12 LEP; Mk21 Fuze; W78/88-1 LEP; and LRSO. These programs provide the current time-phased planning basis for NW program activities and entail critical roles to be performed at SNL/CA.

Figure 3 outlines the key milestones and timelines associated with the remaining acquisition alternatives under review (line item and alternative finance), beginning with the approval of the CD-0 in April 2013. As occupancy of the CREATE facility is driven by key mission requirements, these schedules play a critical role in the prioritization of the acquisition alternatives.

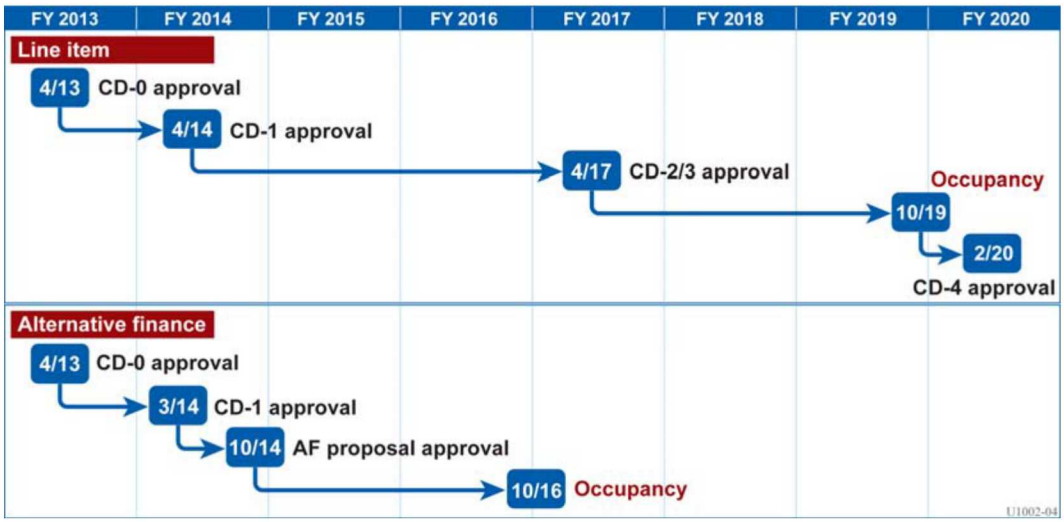


Figure 3. Schedule of options for acquiring CREATE

Based on SNL's experience with comparable line item projects, and assuming immediate DOE approval of the CD-1 and funds allocated for this project, the DOE line item construction alternative is estimated to achieve substantial completion and occupancy by early FY2020. The multi-year gap between project start and occupancy generates mission impacts and further escalates costs due to protracted timelines.

NNSA prioritizes and schedules their capital construction investments through the Construction Working Group (CWG) with the list presented in the *Fiscal Year 2014 Stockpile Stewardship and Management Plan* (see Appendix F). The current list runs through FY38 and is fully committed to a number of high priority, mission-critical facilities for the NNSA complex. It is unlikely that this list will be reprioritized to accommodate the CREATE or HPCIC facilities within this timeframe, precluding the mission opportunities to capitalize on LVOC. The very aggressive assumptions around the line item alternative presented in this document are intended to allow for an equitable cost comparison between alternatives. It should be noted, however, that these line item assumptions—and specifically the assumption that line item funding will be immediately available to begin design in FY14 and occupancy will occur in FY 2020—are impractical. Therefore, line item funding is **not** a viable alternative to meet the mission timeline and is included in the analysis for descriptive purposes only.

In comparison, the alternative finance approach provides schedule efficiencies, compressing the construction duration through more efficient funding mechanisms and project review processes than are available for a federal funded project. Initial market analysis shows that financing is readily available and construction timelines are realistically actionable. Delivering substantial completion by FY2016, alternative finance offers the most efficient option for meeting the mission need's occupancy requirement, providing the best value to the government with the least schedule risk.

3.3 Location Alternatives Analysis

The assessment considered potential offsite and onsite facility locations against CREATE's mission need. As noted earlier, the mission need approval both articulates the need for the CREATE facility and explicitly supports the development of the LVOC site. Further, evidence cited in Section 1.1 demonstrates that national security programs supported by CREATE will derive the greatest benefits and impact by co-locating the activities on the Sandia site to maintain the 0.3-mile radius that encourages effective collaboration. While co-location and collaboration are critical to maximize mission success, the full range of available locations is considered and evaluated below.

Offsite Option

A regional market analysis was conducted to identify potential opportunity sites of existing spaces that could accommodate the facility specifications and requirements enumerated in the performance parameters. Available Class A sites provide the basis for the simplest and least expensive renovations and tenant improvements to meet the performance requirements. (Class A facilities meet the same standards as typical national laboratory line item structures.) The closest available Class A facilities that would provide sufficient space are offered at the California Center in Pleasanton, approximately 12 miles from LVOC. Based upon the co-location and proximity studies, this space would not provide an effective means for collaboration opportunities or magnet amenities, ruling out this option or any other Class A facilities, all of which are farther from LVOC.

Class B spaces were also identified and provided a wider range of available options that could accommodate our space requirements. The closest Class B opportunity site with adequate contiguous space availability is at the Vineyard Business Park in Livermore, approximately 3 miles from LVOC. Because this distance is 10 times the optimal collaboration radius, this option incurs negative impacts to mission. In addition, the necessary improvements to the facilities significantly impact estimated lease rates. (See Appendix E for details.)

Commercial opportunity sites exist in the area, generally to the north and west of Sandia, starting approximately 2 miles from the campus. However, these sites are disadvantageous to the mission drivers of LVOC and CREATE, and the offsite commercial option offers no financial advantage compared to an onsite commercial option. Green-field sites exist immediately to the east of Sandia's campus, but these lands are currently beyond the voter-approved urban growth boundary, are unincorporated, and are zoned for agricultural uses. The City of Livermore and Alameda County do not anticipate changes to these attributes over the time horizons discussed in this analysis.

NEW ONSITE FACILITY OPTION

Consistent with the phased Master Plan for the development of LVOC, initial development is planned in the southern campus in close proximity to the SNL campus. The central LVOC location (on LLNL's campus) was found to be considerably less suitable in the near term. Specifically, this location is currently encumbered by existing operations that would need to be relocated, requires major extension of utilities and roads, and most important, would require significant environmental remediation. In contrast, the southern campus locations evaluated for CREATE are in the immediate vicinity of the Combustion Research Facility complex (buildings 903-907) on the SNL/CA site and close to existing mission activities. These locations are unencumbered green-field sites in the GAA that provide numerous advantages: they are readily accessible to the public, enable optimum collaborative opportunities, advance the campus culture, progress the Ten-Year Site Plan, and provide reasonable proximity to workforce population centers and existing parking and utility connections. To select the preferred location within this area, three potential locations were evaluated for mission efficacy, as well as consistency with other infrastructure goals (see Appendix D).

The preferred site location is a parcel of approximately 3.8 acres, as indicated by Site A in the map in Figure 4. Onsite parking is sufficient to accommodate the relocated CREATE occupants and meet the intent of the municipal parking codes. A reciprocal parking agreement will be formulated, if required. In addition, the site is easily accessible to collaborators from a public road that is close to a major freeway.

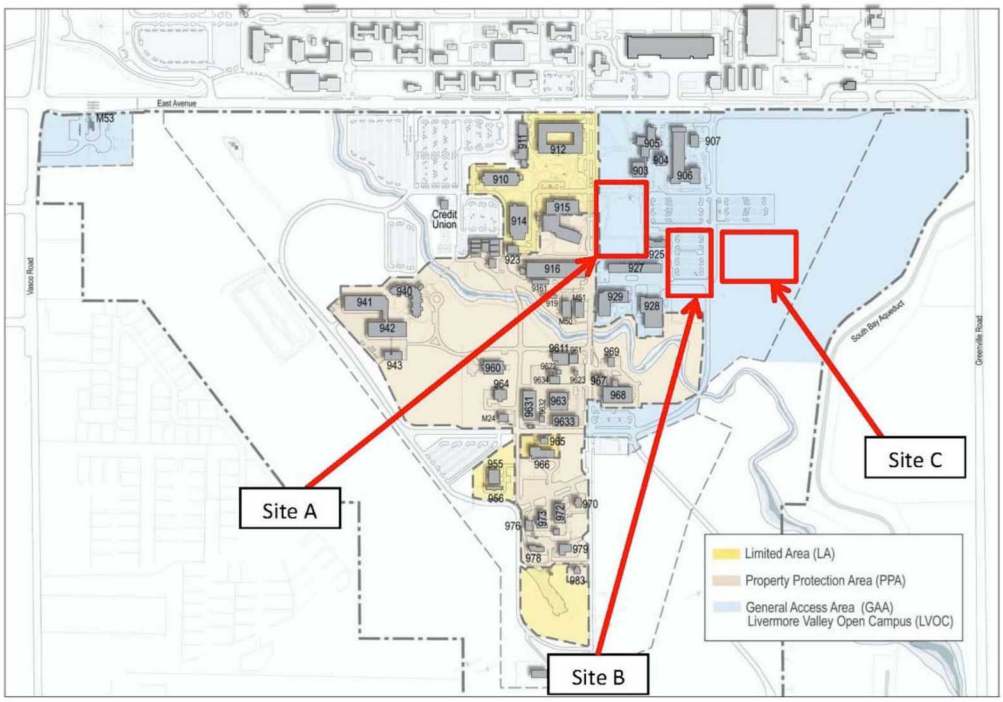


Figure 4. Site A, the preferred onsite location for CREATE is near existing mission-related facilities and close to a major freeway.

The locations analysis included an evaluation of major applicable conditions that considered a number of items, including environmental, regulatory and political sensitivities; safety and security; and infrastructure and site planning. For details, refer to Appendix G.

3.4 KEY POINTS

In closing, the following key points are emphasized:

- The immediate need to support a range of programs fundamental to national security programs is driving the effort to secure the CREATE facility. Key NW programs that require additional LA space include efforts for the W87 NG, GTS, and Firing Set; B83 NG and GTS; W80-1 NG; B61-12 LEP; Mk21 Fuze; W78/88-1 LEP; and LRSO.
- To identify the acquisition approach for CREATE that offers the best value to the government, all feasible options were evaluated against several key criteria. Table 4 prioritizes the alternatives by their ability to meet the mission performance and facility specifications, schedule, and location requirements for CREATE. Shown at the top of Table 4 are the two options that meet the mission need; the three greyed-out options do not meet the mission need.

Table 4. Prioritized alternatives summary for CREATE

Ranked priority	Alternative	Mission performance	Occupancy schedule
1.	**Alternative finance**	Meets mission-driven performance parameters and enables building the facility to meet functional specifications. Preferred onsite location meets requirements.	September 2016
2.	**Line item new construction**		October 2019; realistically, 2–3 decades
3.	**Offsite lease**	Available offsite spaces are too distant to meet the collaborative mission requirement.	November 2015
		Commercial construction offsite provides no cost advantage and incurs negative mission performance impacts compared to the alternative finance option.	July 2016
4.	**Renovate an existing onsite facility through line item**	Lack of available spaces for repurposing prevents this option from meeting mission need or facility requirements, removing this option from further consideration.	
5.	**Take no action**	Lack of action will not meet the mission needs of LVOC or CREATE and is not being further considered.	

- NNSA capital investment commitments over the next 25 years preclude the possibility of line item funding for HPCIC before 2038.
- Delivering substantial completion by FY2016, alternative finance offers the most efficient option for meeting the mission need's occupancy requirement, providing the best value to the government with the least schedule risk. The alternative finance approach compresses the construction duration by eliminating the funding limitations and in-progress review requirements of a federal project.
- Initial market analysis shows that financing is readily available and construction timelines are realistically actionable.

4. CREATE ECONOMIC ANALYSIS

Yielding a net present value (NPV) benefit of approximately $25.4M compared to the line item approach, the alternative finance option for acquiring the CREATE facility offers the best value to the government.

To determine the acquisition approach that provides best value to the government, a detailed economic analysis, including comparative total cost of construction and life-cycle cost analysis, has been performed on the two viable alternatives detailed in the previous section:

- Lease a commercial onsite facility (alternative finance)
- Build a new onsite facility as a DOE line item (line item)

For an alternative finance project, the government's cost is not the cost to construct, as the government does not underwrite the loan, but rather the recurring lease payment. Thus, a life-cycle cost analysis over the term of the lease is needed to determine whether the line item or alternative finance option is the best value.

Since the offsite leasing option does not meet the mission need, it is not included in this section. For completeness, an economic analysis of the offsite leasing option is included in Appendix E. This analysis shows that in addition to failing to meet mission need, the offsite lease option is more costly than the alternative finance option.

4.1 APPROACH

The estimates in this section are represented in 2013 dollars and, for comparison, are formulated following DOE 430.1-1B, *Program and Project Management for the Acquisition of Capital Assets*, and DOE G 413.3-21, *Cost Estimating Guide.* Based upon the defined facility requirements, cost estimates were generated independently for the line item and alternative finance alternatives through a collaborative process by a highly qualified team that included SNL and LLNL construction management and cost estimating staff and external estimators from Strategic Management Solutions, LLC, and Balis & Co. In addition, Cornerstone Project Management conducted the conceptual commercial cost estimate and a cost study to validate the alternative analysis data with market-driven input. These estimates underwent minor revisions to enable a consistent and clear presentation. Following are brief summaries of the key participants in the cost estimating effort:

- Lee Phillips, cost estimating manager of record for LLNL: 45 years of construction experience, including 35 years of experience in cost estimating; served 7 years as LLNL Cost Estimating Manager; past chair of EFCOG Cost Estimating Subgroup
- Bryan Everson, LLNL: 30 years of construction experience, including 20 years in cost estimating
- John Draper, LLNL: 25 years of construction experience, including 15 years in cost estimating
- Doug Vrieling, SNL: 20+ years of construction management experience, including cost estimating and scheduling experience
- Jay Carey, Strategic Management Solutions, LLC: 30 years in cost estimating
- Bob McMartin, Strategic Management Solutions, LLC: 32 years in cost estimating
- Jon Balis, Balis & Co.: 32 years of experience as an independent cost consultant; project reviewer for multiple projects across the DOE complex, including participation in more than 100 independent project review teams for DOE in the past decade
- Mike Yurkovic, Cornerstone Project Management: 14 years of experience managing real estate projects with an expertise in construction estimating/consulting, project procurement, contract administration, lease advisory, and project management

4.2 TOTAL PROJECT COST RANGE OF ALTERNATIVES

The estimated TPC for CREATE ranges from $27M for the alternative finance option to $45M for the line item option. The range of uncertainty in line item cost estimating is quantified by performing Monte Carlo simulations in Crystal Ball, an Oracle application. Based on an 85% certainty level, the TPC range for line item construction is $38M–$71M. Therefore, the cost range for estimated TPC across all evaluated options is $27M–$71M.

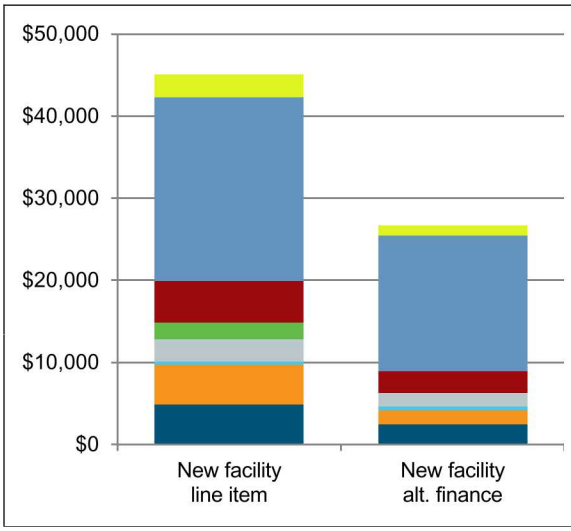
The alternative finance cost estimate assumes that construction will be completed in accordance with normal commercial practices. For the line item estimate, the requirements of DOE O 413.3B *Program and Project Management for the Acquisition of Capital Assets* were observed.

However, several factors in this analysis contribute to very optimistic results for the line item option. As noted earlier, the timeline for line item construction delivery by 2020 is not realistic, given NNSA investment commitments over the next 25 years. The analysis also assumes the more efficient design-build model favored by commercial practice for the type of construction rather than the design-bid-build delivery model used in line item construction. Employing a design-bid-build model for the line item project would incur additional penalties in both cost and schedule.

Furniture, fixtures, and equipment (FF&E), which are normally part of the line item TPC, were excluded from the comparative analysis, since it is assumed that the labs would provide these elements directly under the alternative finance approach. Furthermore, for equitable comparison with the alternative finance option, contingency values commensurate with a CD-2 line item status were applied to the line item estimate.

Table 5 summarizes the TPC for both approaches. Detailed construction estimates are provided in Appendix H.

Table 5. CREATE total project cost comparison ($k)



	New facility line item ($k)	New facility alternative finance ($k)
Design	$2,827	$1,246
Hard construction	$22,388	$16,607
Soft construction	$5,091	$2,618
Laboratory construction burdens	$2,008	—
Tenant improvements	$2,696	$1,592
Misc. other project costs	$380	$540
Total escalation	$4,876	$1,698
Total contingency	$4,832	$2,430
Total project cost	**$45,098**	**$26,731**

The comparison of new facility construction demonstrates the significant cost advantages of commercial construction. The cost differences between the line item and alternative finance options are primarily driven by five cost drivers: contingency, escalation, project oversight, construction requirements, and laboratory construction burdens.

- **Contingency**: Contingency on estimates for projects can vary depending on project complexity and the risks associated with the project. Commercial market analysis has shown that projects with standard office space and light laboratories present low technical risk. This low risk reduces the amount of required contingency compared to that required for similar line item projects within NNSA experience. Standard commercial approaches select builders via competitive procurement and transfer delivery risks (such as through guaranteed maximum price (GMP) contracts), another factor that drives the commercial contingency lower on the alternative finance option. Specifically, contingency of 5% is included in the GMP and an additional 5% is held outside of GMP in the alternative finance option. These amounts were confirmed as appropriate through further market validation conducted by the independent estimator. Contingency differences contribute 13% of the cost estimate differential between the two options.
- **Escalation**: Escalation cost differences relate to the timing variances of facility construction and delivery. Commercially developed facilities can be completed at least three years earlier than facilities constructed by line item, as commercial development does not require the same time-intensive critical decision evaluations and incremental funding limitations. Due to this schedule advantage, the impacts of escalation are significantly less for the commercial option than for the longer-duration line item approach, and accordingly, this component contributes 17% of the cost estimate differential.
- **Project Oversight**: Federally directed line item projects require compliance with DOE O 413.3B, created to manage a diversity of large, technically complex capital construction. The management and operating (M&O) contractor must provide project management, design management, construction management and inspection staff over multiple years for rigorous project management processes. In comparison, commercial developers perform oversight highly optimized for the construction of a single type of building with a relatively simple design. Using a commercial approach leverages the oversight and management experience of the facility owner and requires minimal M&O interaction, resulting in savings in the execution of construction. Accordingly, this component contributes 8% of the cost estimate differential.
- **Construction Requirements**: Facilities constructed and operated for national laboratory use are required to comply with federally mandated regulations that are above commercial codes and standards and adversely affect the cost of construction. Both approaches considered assume compliance with the Davis-Bacon Act. As highlighted by the *DOE Operations Improvement Council Cost Workshop* (Oct 2012), costs on DOE projects can be 10%–40% higher than private construction due to increased regulation in project execution (CFR 851, restricted access site, Buy American, extended funding profiles, Federal Acquisition Regulation, or FAR), as well as requirements for exemplary building design/performance (LEED certification, energy performance, force protection design requirements, environmental restrictions). Construction requirements account for 51% of the cost differential between alternative finance and line item options.
- **Laboratory Construction Burdens:** SNL maintains a full cost recovery accounting model and assesses overhead rates to laboratory activities per Sandia's Cost Accounting Standards Disclosure Statement. The line item cost estimator, who has significant experience across the NNSA complex, parametrically assessed average overhead rates, included in the labor estimates provided. Each NNSA facility has different means to recover overhead costs against construction activities, and therefore estimator's labor costs do not have an overhead component for the hard construction costs. Therefore, this element needed to be augmented to account for the true cost that would be accrued if the line item approach were pursued. This incremental overhead component accounts for 11% of the cost difference between the alternatives.

MARKET VALIDATION OF ALTERNATIVE FINANCE CONSTRUCTION COSTS

To gain further confidence in the commercial estimate, the commercial estimator conducted a market validation process to substantiate the estimated commercial construction costs and market interest in taking on such a project. Five nationally recognized builders responded to the market validation request for information and substantiated the reasonableness of the estimates. This response validates that the preliminary functional requirements and draft statement of work for the CREATE facility can be constructed as estimated. Feedback and cost variability in specific categories from this exercise have also helped clarify and tighten laboratory requirements, which will aid in generating improved performance specifications in the future. Furthermore, this exercise provided real costs of construction for a dozen comparably built facilities in the Bay Area. The mean of these 12 projects was $270/ft^2 with a standard deviation of $23. The CREATE GMP estimate falls within this tight range, very near the mean value.

The cost differentials between the line item and alternative finance options are consistent with DOE's historical studies of government projects compared to commercial construction as presented in *Office of Science Third-Party Financed vs. Line Item Construction Cost Comparison* (Ackerman, 2012), which demonstrated a 42% average reduction with commercial construction. From its own examination of this issue, Logistics Management Institute has also concluded that alternative financing of federal capital projects yields a faster acquisition without increasing life-cycle costs, especially in an environment of uncertain timing for line item appropriations (Gallay, 2006).

4.3 ESTIMATE OF ANNUAL GROSS LEASE RATE

The sections below describe the approaches and assumptions used to estimate the components that make up the annual gross lease rate for the alternative finance option and provide relevant comparisons to the line item option where applicable. Table 6 provides a summary, and the sections following explain the components.

Appendix I provides details on comparison of this lease rate to the private rental market.

Table 6. Estimated gross lease rate for CREATE*

	Annual	$/ft^2
Principal and interest	$1,886,326	$22.03
Operations and maintenance	$481,984	$5.63
Owner administration	$100,000	$1.17
Ground lease	$29,795	$0.35
Major maintenance reserve	$85,610	$1.00
Property taxes	—	—
Insurance	$30,820	$0.36
Gross lease rate	**$2,614,535**	**$30.54**

*All values are assumed to escalate except principal and interest

CONSTRUCTION PRINCIPAL AND INTEREST

The alternative finance approach to acquiring the CREATE facility assumes 100% construction financing obtained in the private marketplace; the government does not underwrite the loan. As such, the greatest component of the gross lease rate is the debt service (principal and interest, or P&I) payment for this construction financing. Section 4.5 further describes the terms of this financing.

OTHER LEASE COMPONENTS

Operations and Maintenance

For operations and maintenance (O&M) of the CREATE facility, SNL can decide whether to manage the facility through standard laboratory operations or by allowing the facility owner to contract with the private market for these services. To provide the best value to the government, we have assumed a private O&M model for CREATE. Local market data from the Building Owners and Managers Association (BOMA) was used for the estimates below, with the exception of utilities. To ensure the best value, it is proposed that SNL pay for utilities directly—tying into existing laboratory utility systems and SNL's beneficial utility rate agreements—and not through the lease. As a result, utility costs are the same for the two alternatives and are therefore excluded from the analysis of both options. For the line item O&M life-cycle estimate, the BOMA-equivalent corporate space charge categories were used to enable the most direct comparison of alternatives. Table 7 shows estimated O&M lease costs.

Table 7. Estimated operations and maintenance costs for CREATE

Category	Annual	$/ft^2
Custodial	$117,286	$1.37
Repairs and maintenance	$222,586	$2.60
Facility management	$118,142	$1.38
Roads and grounds maintenance	$23,971	$0.28
Total O&M	**$481,984**	**$5.63**

Owner Administration

A number of models and owner entities could be utilized to create and operate this type of real estate transaction and provide desirable characteristics from the laboratory's perspective. For simplicity and best value to the government, and to follow successful precedent, the proposed transaction model has assumed a focused and efficient owner administration model that includes a non-profit and fee-based service management construct for legal services, accounting, operations, and required administration. To realize cost efficiencies, strategic coordination, and reduced interfaces, a single transaction entity is assumed to administer both the CREATE and HPCIC projects.

Ground Lease

For CREATE, as with other government assets, DOE will ultimately determine the appropriate fair market value of their real estate and the appropriate land transfer mechanisms to enable an alternative finance project. A ground lease is assumed for this analysis. For cost analysis purposes, the project team established commercial rates for an equivalent property in the area. Two different brokers (Colliers and Jones Lang LaSalle) quoted Livermore commercial real estate land values at $5–8/ft^2. We applied their recommended value of $6.00/ft^2. Furthermore, Colliers indicated that lease rates generally follow property valuations and are linked to the

landowner's cost of capital and risk premium. Following the OMB Circular A-94 methodology of linking rates to applicable Treasury periods, the 3% rate of return assumed is the same as the government's borrowing rate for the period of the ground lease (> 30-year).

Major Maintenance Reserve

It is standard commercial practice to create a fund to serve as a major maintenance reserve and to assess and set aside a portion of rent payments for this purpose; industry average rates have been applied to the lease estimate. The labs do not have an equivalent methodology for funding this type of maintenance. The labs do some of this maintenance through the assessed O&M space chargeback rate, which is included in this analysis, but also perform some maintenance through separately funded GPP and line item projects (not included). The labs also allow some maintenance to remain undone, increasing their residual deferred maintenance balance. The NNSA *FY2014 Stockpile Stewardship and Management Plan* estimates existing deferred maintenance balances on this type of existing facility at 10% of their replacement values. Exclusion of these separately funded and deferred maintenance costs for the line item option is a conservative position compared to the alternative finance approach, which plans and budgets to fully maintain the facility.

Property Taxes

The matter of property taxes is a complicated issue for this type of transaction. For this analysis, we assumed the proposed transaction model that facilitates the construction and operation of the CREATE facility would result in exemption from all property taxes. The proposed property within Sandia's existing campus is owned by the United States of America and managed by DOE. As a ground lease is contemplated, ground use rights would be transferred to a non-profit, non-governmental third party that would finance, construct, own, and operate the facility. Further legal analysis and discussion with local and state authorities will ensue if this alternative is ultimately, selected. At this time, the tax assessment would be approximately $300K per year (with 2% annual inflation).

Insurance

The insurance estimate was generated on the basis of market-provided data for actual insurance rates assessed to comparable facilities in the area. Required insurance levels (potentially above market norms) have been previously dictated in ground lease documents generated by the government, and the ultimate insurance rates will be guided by the negotiation of coverage levels specified in the ground lease. For comparison purposes, the government's self-insurance approach for a line item facility is a conservative assumption due to the disregard of inherent risks and implied liabilities in government ownership.

LESSOR'S ANNUAL COST STATEMENT

Following the GSA *Lessor's Annual Cost Statement Form 1217*, Table 8 summarizes the annual income and expenses for the proposed lease from the perspective of the third-party owner. Rent payments to the non-profit facility owner offset expenses only.

Table 8. Proforma annual rental income statement for CREATE

	Annual
Income	
Minimum lease payment (including owner administration)	$1,986,326
"Pass through" insurance and taxes	$30,820
Operation costs	$597,389
Total income	**$2,614,535**
Expenses	
Fixed	
Taxes	—
Insurance	$30,820
Major maintenance reserve	$85,610
Ground lease	$29,795
Owner administration	$100,000
Variable	
Operations and maintenance (excluding utilities)	$481,984
Total expenses	**$728,209**
Net rent (excluding owner administration)	**$1,886,326**
Debt service to cover cost of construction	**$1,886,326**
Profit (Loss)	**—**

4.4 TENANT IMPROVEMENTS

It is standard commercial practice to segregate the base facility from specific tenant improvements and other enhancements in both construction and financing. This approach was followed in comparing construction costs and in comparing the alternative finance gross lease rate to that of the local market. Facility tenant improvements are broken out, and the resulting financial treatment of these items provides a range of acquisition options for the tenant, including provision of funding up front, an accelerated financing schedule to pay off a full loan principal over the duration of the facility lease agreement, or an amortization schedule mirroring the overall facility financing with a balloon payment at the end of the facility lease term. For the purposes of this analysis, we have assumed the same overall facility amortization schedule with a balloon payment, which allows for simpler financing models while having only a minor effect on the NPV calculations.

4.5 PROJECT FINANCING

The alternative finance acquisition option assumes 100% construction financing. It is assumed that this project will be financed by the issuance of rated bonds, due to their favorable ratings and attractive interest rates (for more, see the Standard & Poor's document found in Appendix J). Subject matter experts in bond financing for government projects of this nature estimated a 25-year bond term at 4.00%, consistent with market conditions at the time of the most recent revision of OMB Circular A-94 Appendix C, in December 2012.

Table 9 provides details of the anticipated financing structure and requirements.

Table 9. Sources and uses of funds for CREATE ($k)

Source of funds	
Total borrowing/principal	$30,468
Total sources	**$30,468**
Use of funds	
Construction costs	$23,894
Architecture and engineering	$1,246
Owner establishment and administration	$150
Tenant improvements	$1,730
Capitalized interest (net)	$1,719
Ground lease during construction	$45
Other uses	
Cost of issuance	$705
Underwriter's discount	$305
Deposit to debt service reserve fund	$471
Deposit to third-party expense fund	$100
Deposit to operating reserve fund	$100
Deposit to expense fund	$4
Total uses	**$30,468**

4.6 Life-Cycle Cost Analysis

To properly compare an alternative finance project to a line item project, a life-cycle cost analysis was performed that included capital construction and operating costs for both alternatives. The life-cycle cost analysis of alternatives was conducted using Army Corps of Engineers ECONPACK software (see Appendix K).

Escalation and Discounting Approach

Per OMB Circular A-94, the discount rate used to compute net present values is commensurate with the timeframes analyzed in the proposed facility lease agreement. As prescribed by A-94, inflation was estimated using rates specified in the President's FY14 budget, except for construction cost estimates, where a more suitable rate was identified based on regional construction cost indices. The analysis conservatively assumes escalation of all cost elements other than the construction P&I payments, because this P&I component requires a fixed bond repayment amount over time. Negotiation of the facility lease agreement will provide the opportunity to minimize/eliminate escalation on other lease components.

Net Present Value Profile

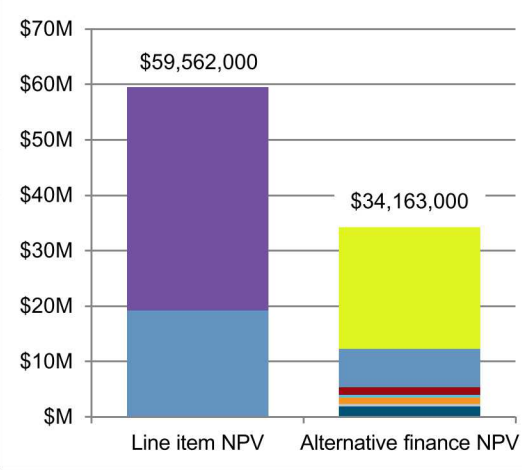
A net present value analysis affords an effective means to compare the line item and alternative finance acquisition approaches. The line item project pays for capital construction upfront and operates the facility through standard laboratory O&M approaches. The alternative finance approach allows the laboratory to pay a lease rate that includes capital construction principal and interest as well as private sector management of the facility, including items such as insurance, O&M, owner administration, and the ground lease. While the annual operating cost is greater for the alternative finance option due to recovery of principal and interest, the NPV analysis demonstrates that alternative finance provides a significantly better value to the government for the duration of the lease term. Table 10 summarizes inputs for the economic analysis.

Table 10. Summary of ECONPACK model inputs for the CREATE economic analysis

	Line item	Alternative finance
Construction period	April 2017–October 2019	July 2015–September 2016
O&M	$15.94/ft^2 per year	$5.63/ft^2 per year
Insurance	Government self-insures	$30,820/year
Cash flows	Presented in 2013 base-year dollars	
Discount rate	2.35% (OMB Circular A-94, Appendix C)	
Inflation	1.9% year over year	
Major maintenance	Partially included in O&M	$1.28M over lease term; $85,610 per year
Ground lease term	n/a	35 years
Financing term	n/a	25 years
Facility lease term	n/a	15 years
Gross lease rate	n/a	$2.6M per year
Property taxes	n/a	n/a
Financing amount	n/a	$30.5M
Capital market borrowing rate	n/a	4.00%
Owner administration	n/a	$100,000 per year
Ground lease	n/a	$29,795 per year

Table 11 illustrates the most direct and conclusive comparison of the options, showing the life-cycle NPV by cost type for a 15-year occupancy period with a decisive savings of $25.4M for the alternative finance approach.

Table 11. Net present value for a 15-year occupancy term for CREATE



	Line item NPV ($k)	Alternative finance NPV ($k)
Total project cost	$40,335	—
Principal and interest	—	$21,899
Operations and maintenance	$19,227	$6,881
Owner administration	—	$1,428
Ground lease	—	$408
Major maintenance reserve	—	$1,222
Property taxes	—	—
Insurance	—	$440
Tenant improvements	—	$1,884

LIFE-CYCLE ANALYSIS RESULTS

The life-cycle cost analysis, which is based on a 15-year occupancy term, shows the alternative finance option represents the best value to the government with a significant NPV spread of $25.4M. The additional lifetime expenses incurred for the alternative finance option are more than offset by large cost savings realized in two main ways:

- Lower construction costs, as described in Section 4.2, coupled with attractive bond rates, account for $18.4M. This is driven by differences in contingency, escalation, construction methodologies, project oversight, and laboratory burden requirements.
- Lower O&M costs for private industry account for an additional $12.3M savings for the alternative finance model.

Additional financial benefits not illustrated in this analysis include the following:

- Unlike the line item, in which the NNSA bears the full construction cost, the alternative finance lease is paid through a reallocation of existing laboratory overhead. Anticipated program growth, along with elimination of an amount of substandard space equal or greater the space of CREATE, will partially offset the lease cost.
- Further flexibility afforded to NNSA and Sandia is the opportunity to exit the facility should the mission requirement end, with a minimal penalty of one-year annual rent.
- The alternative finance approach offers a shorter acquisition timeframe, enabling the ability to address mission requirements sooner than the line item alternative.

The alternative finance model provides the best value for the government, offering significantly lower cost, faster delivery, and greater flexibility to support NNSA and the mission need.

NNSA conducted an independent cost review of the construction estimates presented in this document. After clarification was provided, NNSA concluded the review in support of the CD-1 analysis with no additional actions required (See Appendix N).

A recently released study analyzed the economics of four existing DOE alternative financed facilities. This study incorporates data from the transactions for these facilities—which share many attributes of the structure contemplated here—and compares the costs to those for line item funding. The conclusion from all four case studies show that in practice, alternative finance provides cost and schedule advantages and thus the best value to the government. Appendix B highlights the cost comparisons, and the detailed studies are available at https://share.sandia.gov/cfma/best_practices/alternative_financing.php.

4.7 KEY POINTS

In closing, the following key points are emphasized:

- A detailed economic analysis, including a comparative total cost of construction and life-cycle cost analysis, was performed on the alternative finance and line item options.
- Conservative assumptions about construction schedules and delivery models lead to overly optimistic and unrealistic results for the line item option.
- The alternative finance approach assumes the following:

  - 100% construction financing obtained in the private marketplace; the government does not underwrite the loan.
  - Project financing through the issuance of rated 25-year bonds at 4.00%, consistent with subject matter expert counsel and market conditions at the time of the most recent revision of OMB Circular A-94 Appendix C, in December 2012.

- Estimated at $27M, the TPC for the alternative finance option is considerably lower than the estimated TPC of $45M for the line item option.
- The life-cycle cost analysis shows the alternative finance option represents the best value to the government with a NPV spread of $25.4M.
- The alternative finance cost savings more than offset additional lifetime expenses in two main ways:
  - Construction costs, coupled with attractive bond rates, account for a $18.4M cost reduction, driven by differences in contingency, escalation, construction methodologies, project oversight, and laboratory burden requirements.
  - Lower O&M costs for private industry account for an additional $12.3M in savings.
- The reasonableness of the TPC estimate for alternative finance was substantiated by information from five nationally recognized builders and a study of real construction costs of 12 comparable facilities in the San Francisco Bay Area. The alternative finance GMP estimate falls very near the mean value of these projects, which was $270/ft^2 with a standard deviation of $23.
- The range of uncertainty in line item cost estimating is quantified by performing Monte Carlo simulations in the Crystal Ball software program. The TPC range for the line item alternative is based on this analysis using an 85% certainty level, providing substantial confidence in the estimate.

5. CREATE RECOMMENDED OPTION: ALTERNATIVE FINANCE

The recommended acquisition approach, alternative finance, is the best option to meet the mission need, as summarized in Table 12.

Because alternative finance provides the lowest life-cycle cost, most effective support of the mission, and most expeditious schedule in the acquisition of CREATE, this option offers the best overall value to the government, as summarized in Table 12. Under this option, the building would be privately owned and financed, developed on DOE land (within the Sandia LVOC), and operated by the facility owner under a ground lease from the DOE. The building would be constructed in accordance with local building codes and leased to the SNL management and operating contractor for its use in support of NNSA missions. Assuming timely government approval, the schedule allows for construction to begin in 2015, with initial occupancy targeted in 2016. The construction milestones assume a 15-month design-build construction schedule, based on preliminary industry feedback and experience.

Table 12. Summary of key conclusions from analysis of alternatives for CREATE

Overarching conclusions	
• Because the mission need of LVOC and CREATE emphasizes collaboration, close proximity to the existing Sandia campus is a requirement to achieve maximum mission efficacy and impact. • Offsite leasing significantly compromises mission need, and the properties evaluated would require major modification to meet facility requirements, driving up lease costs. • The take no action option ignores the mission drivers as a priority and therefore fails to meet mission need. • Due to a lack of onsite renovation opportunities, the onsite renovation option cannot meet the mission need.	
Section 3.4 Prioritized alternatives	**Conclusion**
Alternative finance	• Fully meets the national security mission and collaborative needs of both LVOC and CREATE. • Best value to the government with gross lease rates about $30/GSF. • Private development offers the optimal occupancy schedule. • Substantial risk is transferred to the private sector.
Line item	• Fully meets the national security mission and collaborative needs of both LVOC and CREATE. • Significantly increases TPC and life-cycle cost impact. • Schedule delayed; DOE funds unlikely to be available during mission need timeframe.

6. CREATE SENSITIVITY ANALYSIS

The recommendation to pursue the alternative finance approach is robust to uncertainty, as only major changes to assumptions would change the ranking of this recommendation.

The life-cycle cost analysis demonstrates that alternative finance is the lowest cost alternative. However, because this analysis was undertaken for a model transaction, it contains uncertainties that can only be fully resolved by the execution of the actual transaction. To understand the potential impact of these uncertainties on the recommendation to use the alternative finance option, a sensitivity analysis was conducted. Examining multiple variables, the sensitivity analysis identified three primary variables that, if changed, would impact the ranking of the alternative finance option. As shown in Table 13:

- The total project cost of the line item option would need to decrease by 63% to change the ranking of the alternative finance option
- The assessed alternative finance lease rate (principal and interest) would need to increase by 116% to change the ranking
- The alternative finance O&M rate would need to increase by 369% to change the ranking

By concluding that only major changes to baseline assumptions would affect the ranking of options, the sensitivity analysis confirms that the recommended alternative finance approach is robust to major uncertainties. ECONPACK-generated sensitivity charts are presented in Appendix K.

Table 13. Percent changes needed in key variables to impact alternative finance ranking for CREATE

Cost model input	% change required to impact ranking
Line item TPC	–63%
Alternative finance lease rate (principal and interest)	+116%
Alternative finance operations and maintenance	+369%

Our analysis has assumed exemption from all property taxes. For the sensitivity analysis, we estimated the impact of a property tax assessment against this project and found that the net present value of the taxes would be ~$4 million. While this amount would add cost to the alternative finance option, the impact is relatively small, as it is only about 16% of the difference between the alternative finance approach and the line item option.

The sensitivity analysis also examined bond rates, which are market-driven and near historical lows. While an increased rate would increase the gross lease rate, the relative priority of options is not highly sensitive to changing rates because as market rates increase, so do the discount rates prescribed in A-94. The spread between bond rates and discount rates was found to be conservative when estimated against both market conditions and previous alternative finance transactions.

Market estimates established baseline assumptions whenever possible. Since a ground lease is an agreement between the third party and the government, it is not clear whether a preferred approach would be to apply a nominal rate or establish a market-based rate for ground use rights. The economic analysis is insensitive to this range of options and can accommodate either approach.

Sensitivity analysis was also conducted on the duration of the facility lease and demonstrates that the ranking of alternatives is not affected by the lease term. Figure 5 shows the cumulative NPV comparison at any point during the life of the facility.

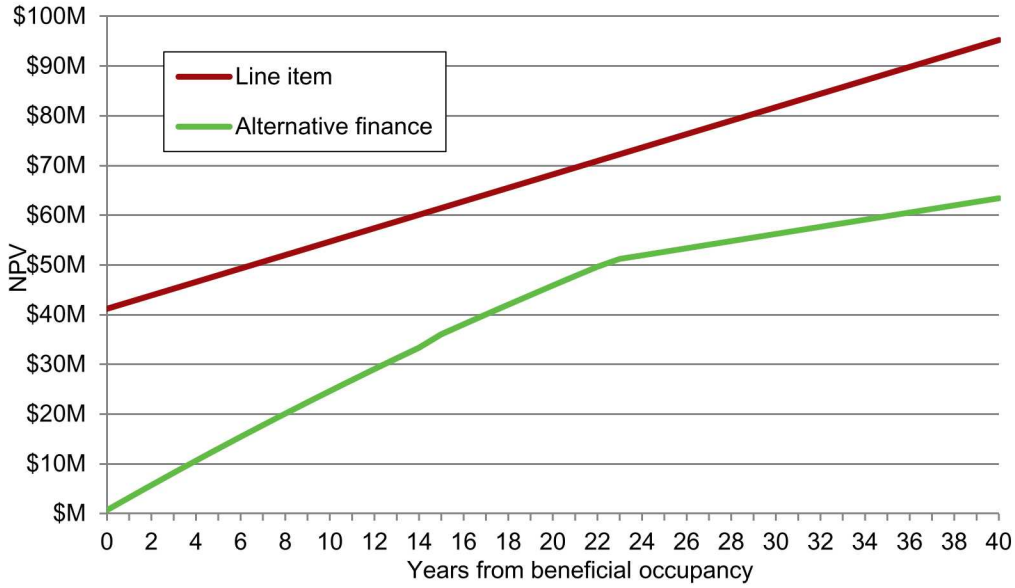


Figure 5. Cumulative net present value comparison for CREATE

At the conclusion of the construction debt obligations, scheduled 8.5 years beyond the duration of the 15-year facility lease, the structure of the transaction model would yield significantly reduced rent payments as all principal and associated interest would be retired and only operating cost recovery would ensue. Longer-term life-cycle comparative analysis suggests that this lease option never exceeds that of the line item approach during the useful life of the facility.

We also evaluated the effect of a more aggressive line item schedule on the net present value life-cycle cost analysis. Since the CREATE and HPCIC projects are identical in their schedule assumptions and similar in costs, the analysis was carried out for HPCIC only and is described in Section 9 (HPCIC). The analysis demonstrates that the more aggressive timeline has a negligible effect on the net present value life-cycle cost of a line item project. As a result, the economic analysis is insensitive to an accelerated Line Item schedule.

PART III
—
HPCIC OVERVIEW AND ANALYSIS

7. HPCIC REQUIREMENTS DEFINITION

A review of specific performance parameters, as delineated in the Mission Need Statement (CD-0), shows that HPCIC will support the national security mission by increasing collaborations that are complementary to national security programs. The knowledge transfer through these collaborations will offer lab researchers an opportunity to enhance their skills on a diverse set of new and intellectually challenging projects and provide industry powerful new tools for advancing competitiveness.

7.1 FACILITY TO CAPTURE SYNERGISTIC OPPORTUNITIES

Aligned with *Mission Need Statement for Open Collaboration and Research Facilities*, which documents the importance and strategic need for LVOC programs that benefit DOE missions, LLNL will initially focus on leveraging and enhancing HPC modeling and simulation for NNSA and DOE missions. High-end computing is a core strategic capability of the NNSA laboratories and at LLNL in particular since its founding in 1952. The nuclear security mission space is the original and critically important driver for maintaining this strategic capability.

Under the ASC Program, the NNSA laboratories have developed and are continuing to develop sophisticated methodologies and techniques necessary to accurately model physical systems. The unclassified work at HPCIC contributes to several areas of the current ASC program identified in the *ASC Computing Strategy* issued in May 2013: develop robust tools to support stockpile needs; deliver verified and validated physics and engineering codes; implement a balanced computing strategy of platform acquisition and operational infrastructure to meet the mission needs; and maintain effective working relationships with other DOE and federal partners, industry, and academia to overcome critical technology challenges. The key areas of emphasis for HPCIC are described below:

- **Encourage and accelerate the exchange of novel ideas impacting key programs:** A technical challenge facing the weapons program is the uncertainty associated with the next generation of computer architectures. Historic trends show that every 10–15 years, the programming models used on leadership-class supercomputers change in response to evolutions in the underlying architecture, ushering in new supercomputing "epochs." To date, the labs have met the challenges of each epochal transition in supercomputing, from the monolithic mainframes to vector processing to microcomputers and parallel computing. However, the reliance on internal expertise has increased at each step; conducting computational science on a supercomputer has become almost solely the province of the national labs. As a result, the labs have become more intellectually insulated, thereby contributing to a growing knowledge gap between the national labs and user community. To meet the challenges of next-generation supercomputing systems, the national labs will maximize their creativity and problem-solving set by collaborating with strategic partners that offer outside thinking on difficult and relevant problems.
- **Recruit and retain talent with new engagement models:** For decades, the NNSA labs have attracted young scientists by maintaining a powerful presence in multiple scientific communities by performing cutting-edge research in applied fields of national importance, collaborating with the world's intellectual best, authoring seminal publications, presenting key findings in public forums, and receiving prestigious awards. These vital attributes of the national labs have allowed talented researchers to stay current in their fields by engaging in the broader community and participating in technically difficult projects outside the weapons program. The HPCIC's model of side-by-side interactions with partners in industry and academia help retain key talent by introducing lab scientists and engineers to a broader repertoire of collaborative projects, as well as attract new talent by offering an intriguing entrée into the lab environment.

Additionally, HPCIC will co-locate synergistic undergraduate and graduate computational programs and the K-12 Discovery Center. Flexible space programming concepts will accommodate the Institute for Computational Research, Cyber-Defenders Program, Hispanic-Serving Institutions (HSI), and Historically Black Colleges and Universities (HBCU) computational students in a more impactful way to complement or augment these workforce pipeline programs. This will allow cross-fertilization of ideas and provide participants greater exposure to exciting programs that showcase future employment opportunities.

- **Broaden the user community, thereby reducing the capability gap:** DOE's historical investments in simulation provides a unique capability that can be leveraged through HPCIC to benefit DOE missions requiring HPC solutions, as well as strengthen U.S. competitiveness in the 21st century global economy, consistent with the FY2011 National Defense Authorization Act. HPCIC brings government, national laboratories, research institutes, industry, and academia together in an ecosystem where partners leverage the strengths and talent of entities across the globe with new partnering constructs. This ecosystem helps bridge the gap between national lab computational scientists and U.S. industrial communities, allowing these entities to apply HPC resources to shrink design cycles, reduce testing and validation costs, and decrease production times while creating safer, more reliable, and more innovative products. By fostering government-industry collaborations, HPCIC will increase the application of HPC in U.S. industry, which can lead to the creation of more innovative hardware and software solutions that directly benefit the government and increase the community of users that could collaborate with national labs researchers.

Upcoming changes in hardware and software intensify the need to expand beneficial external collaborations. Advanced computers (such as LLNL's Sierra and Vulcan II) that will be deployed from 2016 through 2031 are driving a redefinition of requirements and redesign of the integrated design codes, as well as supporting the basic science codes used to meet identified mission needs. Strengthening external collaborations now will be essential to attracting creative new minds and new approaches to address the multiple challenges facing the labs as they redesign, rewrite, and retool codes critical to the NNSA mission.

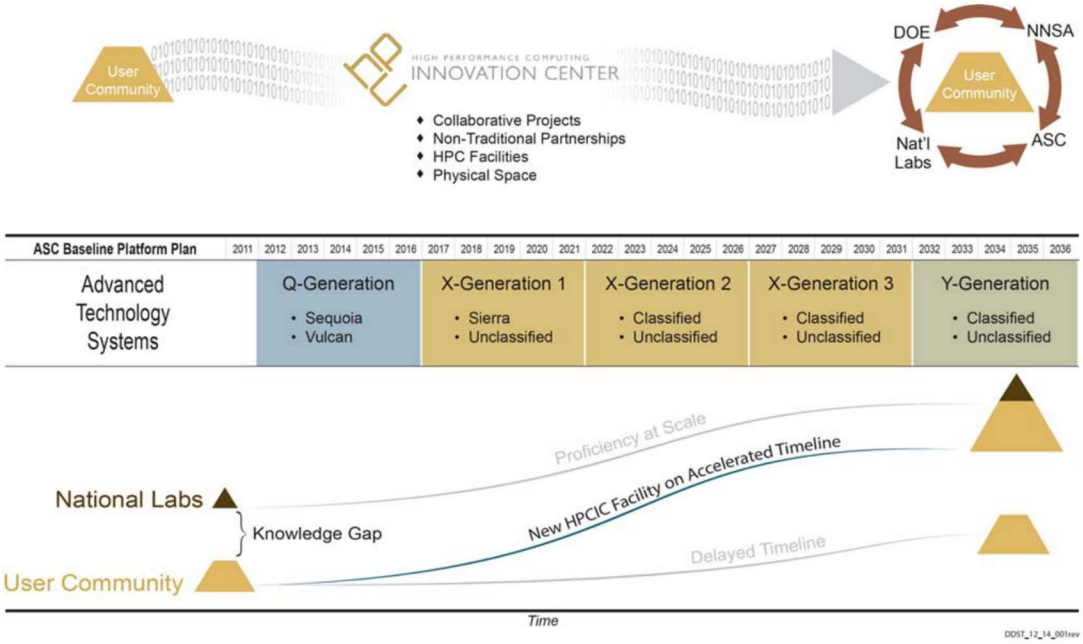


Figure 6. HPCIC engagements with the user community will help expand HPC know-how on problems of scale that benefit NNSA and ASC programs during a key transition period between computer architectures.

Today, HPCIC programmatic activities have grown in scale and complexity and now require a transition from a temporary incubator into more permanent and efficient facilities that better meet the program needs. The meeting space in the HPCIC facility is often oversubscribed, with half-year wait lists, and is too small for most technical workshops and international meetings. And due to space limitations, HPCIC programs and personnel continue to be dispersed throughout the PPA.

To move forward with the mission need and vision for NNSA's future, modern permanent structures and facilities are required in the open areas adjacent to NNSA assets to facilitate and enable mission-aligned unclassified collaborations and applied research in a high tech region that embraces the assets and resources the national labs offer. This new proposed facility with an estimated 98,000 GSF will consist of offices, as well as meeting, training, education, visualization, and other collaboration spaces that can welcome external visitors for extended partnerships and host international and national meetings for students and researchers.

7.2 PROJECT PERFORMANCE PARAMETERS

HPCIC will provide expanded opportunities for collaborative activities that are complementary to national security programs and strengthen key competencies needed for the national security mission. Dedicated to partnering with American industry to develop innovative HPC solutions, the facility will enable enhanced collaboration with industry, support development and delivery of stronger workforce pipeline programs, and help attract a new generation of scientists and engineers into the DOE/NNSA network of opportunities.

To these ends, HPCIC will provide space for open and closed offices; meeting, training, education, and data visualization and other collaboration areas; and amenities in a state-of-the-art facility. This facility will offer the LLNL workforce significantly greater ability to expand the boundaries of traditional engagements to a much larger and diverse population of partners, including government, national laboratories, research institutes, industry, and academia. The accessible workshop and training spaces will create opportunities (currently not available) for networking and national and international meetings, thus bringing greater awareness to the resources and capabilities of SNL and LLNL. HPCIC's flexible design will allow for ready space reconfiguration to adapt to evolving program needs and accommodate the co-location and collaboration of lab researchers and strategic partners. The facility will be more energy- and space-use efficient than many existing buildings on the site and operate with a layered approach to security consistent with the LLNL Site Development Plan.

The *Mission Need Statement* and the *LLNL Program Requirements Document* identified the need for a facility with the features described to meet the following project performance parameters for an open collaboration and research space:

- Location within LVOC
- Enhanced accessibility by LLNL staff as well as outside partners to create an effective mechanism to leverage LLNL science and innovation through collaboration
- Flexible work environment with a mix of hard-walled and open spaces
- Training, classrooms, meeting, education, and other collaboration spaces
- Communication equipment and network and data visualization capabilities
- Opportunities for industry, academia, and other strategic partners to co-locate
- Approximately 100,000 GSF of space
- Designed to a 2010 CALGreen California Building Code standard
- Flexible security access control system to accommodate changing levels of programmatic or administrative control of individual suites and areas

7.3 FACILITY DESCRIPTION

OVERVIEW

HPCIC will be a state-of-the-art, mixed-use, environmentally sustainable facility designed to satisfy the required local California Green Building Code and all pertinent DOE regulations. The planned multi-story 98,000-GSF building will provide office space joined by meeting, training, data visualization, education, and collaboration areas, as well as other magnet amenities that support interactions between building occupants. Aligned with current best practice, areas will be sufficiently large to accommodate collaborative activities, and a built-in flexible design will meet both current and future space needs in response to organizational or mission-related changes.

SPACE PROGRAM

Program stakeholders at LLNL were engaged through a rigorous interview process to develop a space plan and requirements for HPCIC. As shown in Table 14, the facility will provide significant space for programs centered on high performance computing applications in an array of areas: energy production and infrastructure, cyber security, translational biomedicine, advanced materials, manufacturing, climate, combustion, high energy density physics, fusion, space, and others.

The completed facility will allow relocation of about 360 staff engaged in unclassified research, administrative, and technology transfer activities who will benefit from the new teaming arrangements and work relationships with outside collaborators enabled by HPCIC. Approximately 50 offices will be used as flexible space for visitors and short-term collaborators. For details, see Appendix L.

Table 14. HPCIC space programming summary

Detailed program areas	Ft^2
HPCIC staff and computations	4,600
Livermore computing	1,220
Advanced simulation and computing	2,020
Energy infrastructure and cyber security	4,240
Bioinformation, pharma, toxicology, and big data	3,260
Materials engineering and manufacturing	2,260
Geomechanics, seismology, wind, and climate	1,120
Critical materials, electronics, and advanced materials	2,260
Environment and combustion	2,300
HEDS, fusion, imaging, and space	1,520
University programs, industry and academic partners, and incubator programs	9,546
Collaboration space (training, meeting, visualization and education)	15,375
Industrial partnerships office	13,000
Building support services areas (stairwells, elevators, restrooms, electrical rooms, mechanical rooms, telephone, data, & network closets, etc.)	18,117
Building circulation areas (lobbies, reception areas, elevator lobbies, walk ways, corridors, interior circulation, etc.)	16,745
Total	**97,583**

7.4 Estimated Total Project Cost Range

The estimated TPC for HPCIC is $29M for the alternative finance option, $42M for the new facility line item option, and $55M for the renovation line item option. For the line item estimates, the range of cost estimating uncertainty was quantified by performing predictive Monte Carlo simulations in Crystal Ball, an Oracle application. Based on an 85% certainty level, the TPC range for new line item construction is $33M–$64M, and the TPC range for the renovation option is $49M–$69M. Therefore, the cost range for estimated TPC across all evaluated options is $29M–$69M.

Confidence in this range is based on the comprehensive research, market analysis, and planning efforts conducted to date, which includes the following:

- Validation of the feasibility of the preliminary statement of work and limited conceptual design by independent architectural and construction firms
- Cost management success rate under a design-build project methodology
- Leasing market estimates, feedback, and analysis

The final TPC will be highly dependent upon the chosen acquisition strategy and the recommended design/build partner selected through a competitive procurement.

The cost estimates assume that the line item construction options would be completed in accordance with DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, and that normal commercial practices would be applied to the alternative finance construction option.

7.5 Key Points

In closing, the following key points are emphasized:

- The unclassified work at HPCIC contributes to several areas of the current ASC program identified in the *ASC Computing Strategy* issued in May 2013: develop robust tools to support stockpile needs; deliver verified and validated physics and engineering codes; and implement a balanced computing strategy of platform acquisition and operational infrastructure.
- Strong external collaborations will be essential to attracting creative new minds and approaches as the labs redesign, rewrite, and retool codes critical to the NNSA mission for advanced computers with paradigm shifts in architecture (such as LLNL's Sierra and Vulcan II) to be deployed in 2016–2031.
- Another HPCIC goal is to enable American industry to learn and benefit from the HPC advances found within the labs, thereby bolstering economic competitiveness and strengthening the pipeline of skilled talent able to contribute to national security HPC programs.
- The facility will also provide space for HPC applications in an array of areas, such as energy production and infrastructure, cyber security, translational biomedicine, advanced materials, manufacturing, climate, combustion, high energy density physics, fusion, and space.
- Offering an estimated 98,000 GSF space—for open and closed offices; meeting, training, education, data visualization, and other collaboration areas and amenities—HPCIC will provide a state-of-the-art permanent facility in an open area adjacent to NNSA assets to enable mission-aligned unclassified collaborations and applied research.
- The estimated TPC for HPCIC is $29M for the alternative finance option, $42M for the new facility line item option, and $55M for the renovation line item option. Taking into account cost estimating uncertainty, the cost range for the estimated TPC across all evaluated options is $29M–$69M. Strong confidence in this range is based on the comprehensive research, market analysis, and planning efforts.

8. HPCIC ALTERNATIVES ANALYSIS: MISSION PERFORMANCE, SCHEDULE, AND LOCATION

Analysis of acquisition options for HPCIC demonstrates that the alternative finance approach meets HPCIC's mission performance requirements and facilities specifications, schedule, and location needs.

This section evaluates all feasible options for acquiring HPCIC against key criteria essential to meeting the mission need. Consideration is given to the project performance parameters listed in Section 7.2, functional and technical requirements, the schedule range for beneficial occupancy, and location alternatives. The options that present characteristics that would enable the HPCIC to feasibly meet the mission need are then subjected to financial analysis. The five evaluated alternatives follow:

1. **Take no action (maintain status quo).**
2. **Renovate an existing onsite facility** through the line item process as outlined in DOE O 413.3B.
3. **Build a new onsite facility** though the DOE line item process as outlined in DOE O 413.3B.
4. **Lease a facility offsite** after analyzing the local market for facilities that meet the mission need.
5. **Lease a commercial onsite facility** through an alternative finance acquisition process that would involve leasing a building site to a third-party entity. This entity would design, finance, construct, lease, and operate the HPCIC facility. Once constructed, the facility would be leased back to the M&O contractor of LLNL.

8.1 FUNCTIONAL AND TECHNICAL REQUIREMENTS ANALYSIS

The functional and technical requirements analysis reviewed each option for its ability to meet the project performance parameters summarized in Section 7.2.

1. Take no action (maintain status quo)

The option to take no action and maintain the status quo does not address the mission drivers and in particular, the priority of leveraging the capabilities of the national labs to enhance global and national security. The option would not generate or make available new facility space, which would negatively impact mission execution and continue the use of substandard and inefficient trailer facilities. Because addressing the mission need is a strategic imperative, this alternative is eliminated from further consideration.

2. Renovate an existing onsite facility

The analysis considered renovating an existing LLNL facility as a means to meet the mission need and project performance parameters of HPCIC. Three building complexes (B543, B551E/W and B571/671) were evaluated and shown as Locations 1-3 in Figure 7. These buildings are currently functioning as standard office buildings with LLNL occupants. In each case, significant modifications would be required to meet HPCIC project performance parameters. All locations posed issues; and two were ultimately considered unworkable.

Location 1—Based on building size, location, and compatibility of building layout for offices, as well as the need for meeting, training, visualization, education, and other collaboration space, B543 provided the closest fit to the criteria and will be included in the economic analysis. However, several factors, to be discussed in more detail in Section 8.3, limit the feasibility of this option. First, B543 is fully occupied; its renovation for HPCIC would require existing residents to be permanently relocated to multiple facilities across the site currently slated for other purposes—a change that could reverse the operational efficiencies gained through the current use of B543. Further, this 33-year-old building would require

significant interior and exterior renovations, including a new HVAC duct system, upgraded seismic structures, and upgraded utilities. Moreover, use of B543 would require relocation of an existing fence. The dotted line in Figure 7 indicates the fence relocation needed for B543. (The solid line shows the proposed fence location for implementing either option 3 [new building—line item] or 5 [new building—alternative finance] above.)

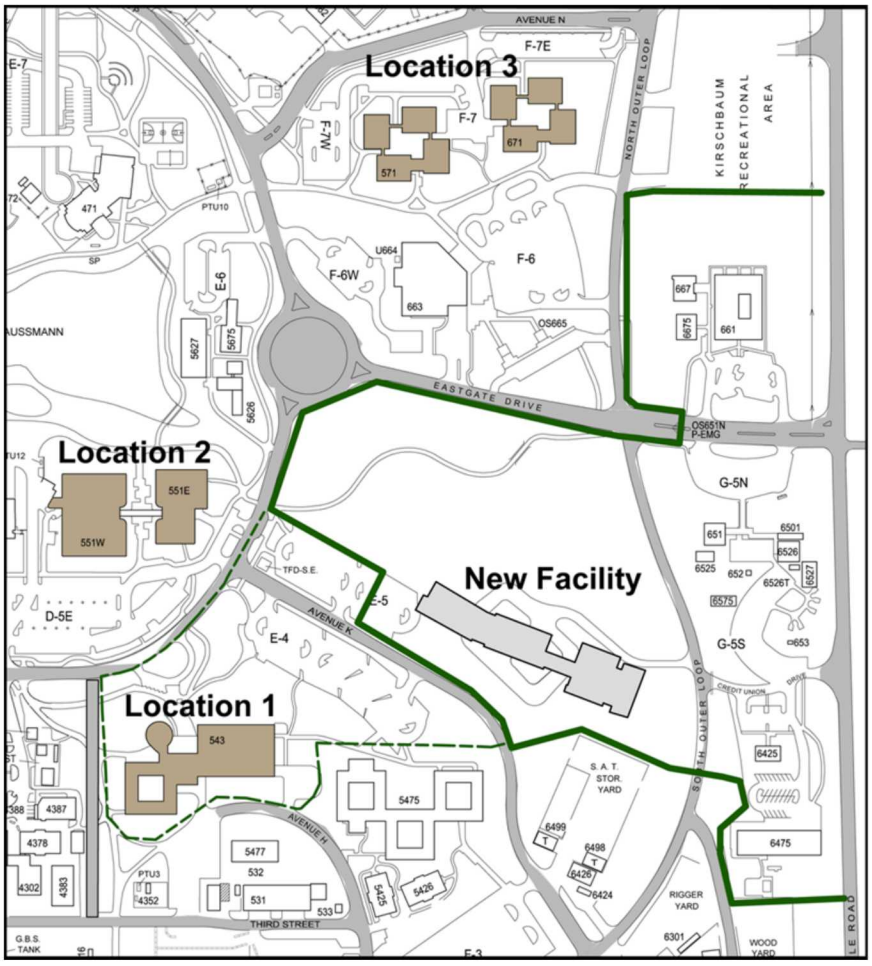


Figure 7. Onsite facilities evaluated for renovation and potential site of new HPCIC facility. Solid line: proposed fence location for implementing either option 3 (new building—line item) or 5 (new building—alternative finance). Dotted line: fence relocation needed for B543 or Location 1.

Location 2—Buildings 551E and 551W are currently outside the boundary of the LVOC Master Plan described in the DOR. Bringing these buildings within LVOC would require closing two arterial roads (South Outer Loop and Inner Loop Roads) to PPA traffic. These closures would significantly disrupt traffic within the central core of the PPA and eliminate approved and permitted routes for transporting hazardous material from the existing waste accumulation area to B695, the Decontamination and Waste Treatment Facility, located north of these buildings. Further, these buildings do not have suitable space to meet the project performance parameters. Due to these concerns, these buildings were eliminated from further consideration.

Location 3—Buildings 571 and 671 are also outside the boundary of the LVOC Master Plan described in the DOR. In addition, these facilities and the LLNL programmatic staff working within are specifically co-located to support the National Ignition Facility program and advanced laser technology activities. Further, these buildings do not have suitable space, even with renovations to meet project performance

parameters, particularly the meeting, training, visualization, education, and collaboration spaces. These buildings were therefore not considered for further evaluation.

Table 15 summarizes the evaluation of possible buildings and locations for the renovation option.

Table 15. Summary of evaluation criteria for renovation options for HPCIC

Key evaluation attributes	Renovation options		
	Location 1: 543	Location 2: 551E & 551W	Location 3: 571 & 671
Square footage	**78,261**	**106,742**	**82,883**
Current occupancy capacity	**259**	**296**	**438**
Meets all project performance parameters as configured			
• Meets space requirement (97,583 ft^2)		✓	
• With renovations could contain meeting, training, visualization, education, and other collaboration space	✓		
• Within LVOC Master Plan boundary			
Adjacent to LVOC Master Plan boundary	✓	✓	
Avoids significant rerouting of roadways/disruption of traffic			
Meets current seismic requirements			
Vacant or underutilized facility			
Selected for total project cost analysis	✓		

Green = Meets requirements, Yellow = Partially meets requirements, Red = Does not meet requirements

3. Build a new onsite facility as a DOE line item

A new facility acquired as a DOE line item construction project in accordance with DOE O 413.3B would address all of the project performance parameters since this alternative allows tailoring of site selection, facility specification, and design. Figure 7 shows an outline of the area for the potential location of this facility.

4. Lease an offsite facility

This analysis considered whether leasing an offsite facility would meet the mission need. While the offsite leasing approaches could address facility functional requirements, this option would adversely impact key parameters related to co-location of staff to the main site for mission efficacy and other mission drivers requiring close proximity to LLNL's campus. Because offsite lease options are at least 2–12 miles from LLNL, the offsite opportunities are outside of the effective LVOC collaboration radius of 0.3 miles. As such, the sites are not able to meet the mission need or project performance requirements for HPCIC and LVOC development, and will not be further considered.

5. Lease a commercial onsite facility (alternative finance)

A third-party leasing approach offers the potential for a private developer to address the functional and technical requirements through a commercial opportunity on Livermore's campus. LLNL would be the key anchor tenant in the development; the mission and functional requirements could be met. As the co-location studies evidence, close proximity is an enabler of the national security mission imperative outlined for both HPCIC and LVOC development. This option would enable compliance with all of the project performance parameters.

The use of GSA and their extended real estate authority may provide an alternative that is outside of the usual NNSA acquisition pathways. A lease through GSA would involve a federal-entity-to-federal-entity lease and falls

outside the current scope of this analysis. An initial review of this option indicated no clear advantage and some potential disadvantages.

8.2 TIMELINES FOR ALTERNATIVES

As outlined in the approved CD-0 document, there is a target of opportunity supporting the immediate need to replace the current HPCIC facility with a modern permanent structure having expanded capabilities. Two key drivers are as follows:

- Due to inadequate space and equipment, the undersized temporary facilities cannot meet the demand by LLNL and industry entities to pursue collaborative partnerships or the desire to co-locate researchers within the HPCIC.
- The 2016–2031 deployment timeline for advanced computers and architectures (such as LLNL's Sierra and Vulcan II) creates a strategic widow of opportunity expand our partnerships and project portfolio consistent with the NNSA ASC baseline platform plan.

LLNL is currently defining requirements and designing basic science codes and new visualization techniques for the advanced computers. A new HPCIC facility designed to amplify and accelerate researcher efforts in these areas, while stimulating creativity through intellectually engaging projects with industry and academia, would benefit the national laboratories. The excitement ensuing from enhanced visibility of the NNSA labs will assuredly attract creative new talent to the DOE family of national labs at large.

Figure 8 illustrates key milestones and timelines associated with the remaining acquisition alternatives under consideration. Each option commences with the approval of CD-0 in April 2013. The alternative finance approach allows the new HPCIC facility to have beneficial occupancy in 2016, whereas the other two alternatives project beneficial occupancy in early 2020, more than three years later. Early occupancy allows more rapid realization of the HPCIC technical and collaborative outcomes that benefit NNSA and DOE missions.

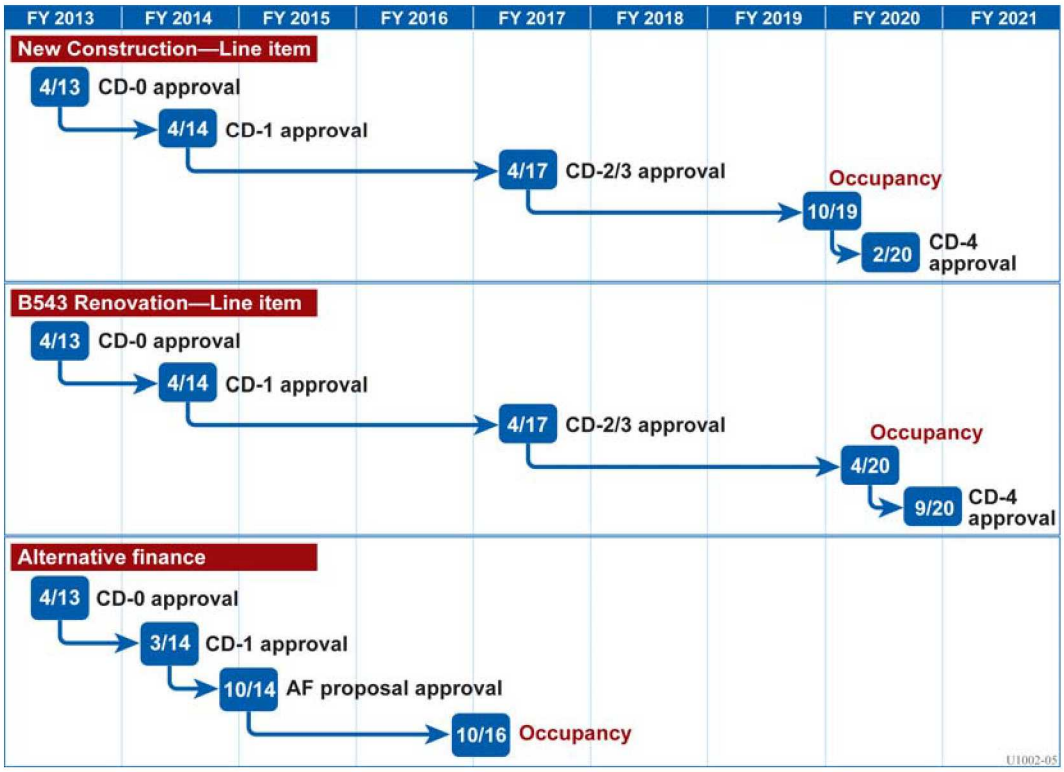


Figure 8. Schedule of alternatives for HPCIC

Moreover, the FY2020 occupancy date for line item construction is not realistic. As discussed in Section 3.2 and shown in Appendix F, NNSA has committed its capital investment funding for the next 25 years, so funding for HPCIC could not be considered until 2038. Therefore, line item funding is not a viable option and is included here for descriptive purposes only.

8.3 Location Alternatives Analysis

Based on the approved LVOC Master Plan as a guide, the area on the east side of LLNL is evaluated for renovation of an existing building and for construction of a new facility, under either line item or alternative finance funding. The offsite option is also considered (and dismissed).

Offsite Option

A market analysis was conducted in the region to identify potential opportunity sites of existing spaces that could accommodate the facility specifications and requirements enumerated in the performance parameters. The discussion in Section 3.3 also applies to HPCIC, in that no nearby Class A or Class B facilities within the region that offered sufficient space met co-location requirements. In addition, necessary improvements needed for Class B facilities would significantly impact estimated lease rates. (See Appendix E for details). Nearby commercial options offer no financial advantage compared to an onsite commercial option, and nearby green-field areas are zoned for agricultural uses. Therefore, offsite lease options were eliminated from further consideration.

RENOVATION OPTION

As discussed above, B543 was selected for evaluation of the renovation alternative. Analysis revealed several factors that limit the feasibility of this option.

The first limiting factor is the potential reversal of operational efficiencies gained from the current use of B543. This building now houses 231 personnel from three LLNL organizations:

- Chief Financial Office
- Environmental Restoration Department
- Strategic Human Resources Management

Staff in these business units had previously been scattered across the LLNL site in obsolete buildings with poor efficiency, low occupancy, and high monthly and deferred maintenance costs. As a result of the concerted effort over the last few years to co-locate these units within B543, many obsolete facilities were closed, and the efficiency of operations has greatly improved. Fracturing groups in B543 by placing them into multiple programmatic buildings, as would be necessary in the renovation option, will revisit inefficiencies that the lab has already corrected.

In contrast, co-locating small computing research units that are currently housed in programmatic space within a new HPCIC facility would free up technical space across the lab. These vacated spaces will in turn be used for relocating technical staff currently in non-optimal locations and allow closure of additional buildings as a part of the site's space consolidation program. As a further benefit, co-locating computing teams working in multiple disciplines (biology, energy, cyber, and manufacturing, to name a few) within HPCIC will enable these researchers to advance their skills and expose newer employees to an array of projects and partners.

In addition to issues raised above, it was found that while B543 was compliant with the standards in place when it was built 33 years ago, the facility would require extensive modification to meet current environmental, safety, and health standards, as well as significant reconfiguring of the layout to meet the HPCIC mission need. A number of specific renovations are required: updating building automation systems; ensuring energy efficiency standards are met; and completing a seismic review and retrofit to meet current codes.

Further, the building is currently listed in the DOE Facilities Information Management System (FIMS) database as an Office of Science Facility. Therefore, facility ownership would have to be transferred to NNSA. The current deferred maintenance backlog for this facility is valued at $4 million.

An additional limiting factor is the need for fence relocation. Incorporating B543, which is currently in the PPA, into the LVOC would also require site modifications—such as moving existing fencing and pathways—to maintain the security posture of adjacent PPA facilities while allowing B543 to become part of LVOC, as shown in Figure 7 above. In turn, this change would eliminate Avenue K, a major access road, as a traffic route between Outer Loop Road and Inner Loop Road. Because the road modifications will lead to blockage of Avenue K, an alternate route would need to be established to maintain access to the southeast quadrant of the site, which houses the fire department. This alternate route must also comply with requirements for a permitted route to allow transport of hazardous waste material to the Decontamination and Waste Treatment Facility (B695).

This construction is included in the renovation cost estimate discussed in Section 9.2.

NEW ONSITE FACILITY OPTION

Phase 1 of the DOR calls for a north village center in close proximity to major LLNL programs and supercomputing facilities. Consistent with this plan, the on-site location evaluated for the HPCIC facility is in an open area on eastern edge of the LLNL site bordering a public road (Greenville Road) near a major freeway that facilitates ease of public access to the building. This location is also adjacent to the planned Livermore Computing Center to be built with programmatic GPP funding. This facility will become the center for LLNL's unclassified high performance computer development within LVOC. This location offers the advantage of being close to existing utilities, such as electrical power, sewer, city water, and telecommunications. The selected parcel spans approximately two acres within an open field shown in Figure 7, and the parking for the facility will require another two acres. The new parking area can be used as a material and equipment laydown area during construction.

8.4 KEY POINTS

In closing, the following key points are emphasized:

- The need for a new HPCIC facility is driven by the inability of the current undersized temporary HPCIC facility at LLNL to meet the growing need for collaborative partnerships and to co-locate researchers during a strategic window of opportunity to expand our partnerships and project portfolio during the 2016–2031 deployment timeline for advanced computer systems consistent with the NNSA ASC baseline platform plan.
- To identify the acquisition approach for HPCIC that offers the best value to the government, all feasible options were evaluated against several key criteria. Table 16 prioritizes the options by their ability to meet the mission need and project performance parameters, schedule, and location requirements for HPCIC. Shown at the top of Table 16 are the three options that meet the mission need; the two greyed-out options do not meet the mission need.

Table 16. Summary of primary considerations for selecting the optimal acquisition strategy for HPCIC

Ranked priority	Option	Mission performance	Occupancy schedule
1.	**Alternative finance**	Meets mission-driven performance parameters and enables building the facility to meet functional specifications. Preferred onsite location meets requirements.	September 2016
2.	**Line item new construction**		October 2019; realistically, not before 2038
3.	**Renovate an existing onsite facility through line item**	Facility will be modified and renovated to meet functional specifications. LVOC perimeter will be expanded to incorporate site. Office of Science Facility with a maintenance backlog of $4M.	April 2020; realistically, 2-3 decades
4.	**Offsite lease**	Available offsite spaces are too distant to meet the collaborative mission requirement. As a result, this option will not be considered further.	
5.	**Take no action**	Status quo will not meet the mission needs of LVOC or HPCIC. As a result, this option will not be considered further.	

- NNSA capital investment commitments over the next 25 years preclude the possibility of line item funding for HPCIC before 2038.

- An analysis that identified facility B543 as the best onsite renovation option also revealed significant barriers that limit the feasibility of renovating this building:
  - Relocating staff that are currently housed in B543 would fracture the operation of three strategic business units specifically co-located to this building and could reverse the operational efficiencies gained through the facility's current use.
  - Major modifications are required to meet current environmental, safety, and health standards and to reconfigure the facility layout to meet mission need.
  - The facility would need to be transferred to NNSA from the Office of Science; the current deferred maintenance backlog for this facility is valued at $4 million.
  - Incorporating B543 into LVOC from its current PPA location would require moving existing fencing and pathways and road modifications that impact traffic and access.
- The success of the HPCIC model is predicated on collaboration with strategic partners through face-to-face interactions that are best advanced with co-location. The research staff in these computing fields will clearly benefit from a work environment that includes researchers from organizations outside of LLNL. Successful research parks across the nation employ this model. A third-party financed building allows LLNL to execute a phased approach to accomplish these objectives.
- A third-party leasing approach would enable compliance with all of the project performance parameters.
- The alternative finance approach allows the new HPCIC facility to have beneficial occupancy in 2016, whereas the other two alternatives project beneficial occupancy in early 2020, more than three years later. Early occupancy allows more rapid realization of the HPCIC technical and collaborative outcomes that benefit NNSA and DOE missions.

The barriers outlined above preclude renovation of B543 from being a viable option. However for completeness, this option was carried into the Section 9 where a cost analysis eliminates renovation from further consideration.

9. HPCIC ECONOMIC ANALYIS

The alternative finance option for acquiring the HPCIC facility offers the best value to government, yielding a net present value benefit of $23M compared to other approaches.

To determine the acquisition approach that provides best value to the government, a detailed economic analysis, including a comparative total cost of construction and life-cycle cost analysis, has been performed on the three viable alternatives from the previous section:

- Renovate an existing onsite facility with DOE line item funding (renovation line item—option 2)
- Build a new onsite facility as a DOE line item (line item—option 3)
- Lease a commercial onsite facility (alternative finance—option 5)

For an alternative finance project, the government's cost is the recurring lease payment, which transfers the cost to construct to a third party. Thus, a life-cycle cost analysis over the term of the lease is performed to determine whether a line item or alternative finance option is the best value.

Since the offsite leasing option does not meet the mission need, it is not included in this section. For completeness, an economic analysis of the offsite leasing option is included in Appendix E. This analysis shows that in addition to failing to meet mission need, the offsite lease option is more costly than the alternative finance option.

9.1 APPROACH

The estimates in this section are represented in 2013 dollars and, for comparison, are formulated following DOE 430.1-1B, *Program and Project Management for the Acquisition of Capital Assets*, and DOE G 413.3-21, *Cost Estimating Guide.* Based upon the defined facility requirements, cost estimates were generated independently for the line item and alternative finance options through a collaborative process by a highly qualified team that included SNL and LLNL construction management and cost estimating staff and external estimators from Strategic Management Solutions, LLC, and Balis & Co. In addition, Cornerstone Project Management conducted the conceptual commercial cost estimate and a cost study to validate the alternative analysis data with market-driven input. These estimates underwent minor revisions to enable a consistent and clear presentation. Following are brief summaries of the key participants in the cost estimating effort:

- Lee Phillips, cost estimating manager of record for LLNL: 45 years of construction experience, including 35 years of experience in cost estimating; served 7 years as LLNL Cost Estimating Manager; past chair of EFCOG Cost Estimating Subgroup
- Bryan Everson, LLNL: 30 years of construction experience, including 20 years in cost estimating
- John Draper, LLNL: 25 years of construction experience, including 15 years in cost estimating
- Doug Vrieling, SNL: 20+ years of construction management experience, including cost estimating and scheduling experience
- Jay Carey, Strategic Management Solutions, LLC: 30 years in cost estimating
- Bob McMartin, Strategic Management Solutions, LLC: 32 years in cost estimating
- Jon Balis, Balis & Co.: 32 years of experience as an independent cost consultant; project reviewer for multiple projects across the DOE complex, including participating in more than 100 independent project review teams for DOE in the past decade
- Mike Yurkovic, Cornerstone Project Management: 14 years of experience managing real estate projects with an expertise in construction estimating/consulting, project procurement, contract administration, lease advisory, and project management

9.2 TOTAL PROJECT COST RANGE OF ALTERNATIVES

The estimated TPC for HPCIC is $29M for the alternative finance option, $42M for the new facility line item option, and $55M for the renovation line item option. For the line item estimates, the range of cost estimating uncertainty was quantified by performing predictive Monte Carlo simulations in Crystal Ball, an Oracle application. Based on an 85% certainty level, the TPC range for new line item construction is $33M–$64M, and the TPC range for the renovation option is $49M–$69M. Therefore, the cost range for estimated TPC across all evaluated options is $29M–$69M.

The cost estimates assume that the line item construction options would be completed in accordance with DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*, and that normal commercial practices would be applied to the alternative finance construction option.

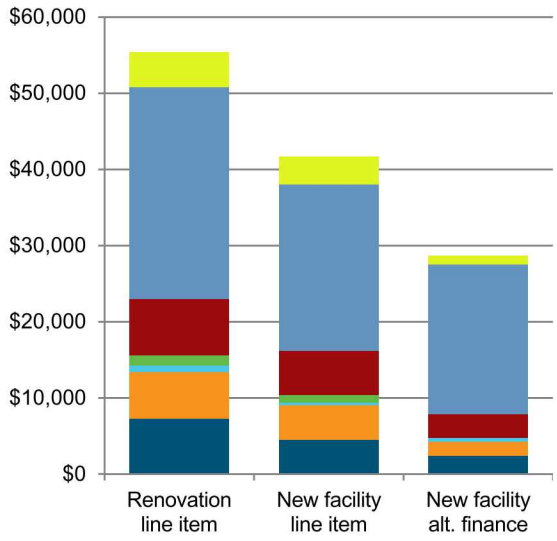
However, several factors in this analysis contribute to very optimistic results for the line item option. As noted earlier, the timeline for line item construction delivery by 2020 is not realistic, given NNSA investment commitments over the next 25 years. The analysis also assumes the more efficient design-build model favored by commercial practice for the type of construction rather than the design-bid-build delivery model used in line item construction. Employing a design-bid-build model for the line item project would incur additional penalties in both cost and schedule.

For purposes of this analysis, FF&E, which are normally part of a line item TPC, were excluded from the comparative analysis, since under the alternative finance approach it is assumed that LLNL would provide these elements directly. Furthermore, for equitable comparison with the alternative finance option, contingency values commensurate with a CD-2 line item status were applied to the line item estimates.

Table 17 summarizes the cost of construction. Detailed construction estimates are provided in Appendix H. As shown, the alternative finance option provides the lowest cost to construct. The lower cost to construct is incorporated into the lease rate for the alternative finance option in the life-cycle cost analysis.

The higher cost of the renovation line item option is driven by the extensive work required to enable this option to meet the project performance parameters. Since the renovation and the new facility line item options are both financed through the same process, only the lower cost option (new facility) is retained for the life-cycle cost analysis.

Table 17. HPCIC total project cost comparison ($k)



	Renovation line item ($k)	New facility line item ($k)	New facility alternative finance ($k)
Design	$4,592	$3,680	$1,162
Hard construction	$27,896	$21,820	$19,680
Soft construction	$7,364	$5,783	$3,102
Laboratory construction burdens	$1,280	$1,009	—
Misc. other project costs	$855	$310	$540
Total escalation	$6,181	$4,583	$1,855
Total contingency	$7,225	$4,462	$2,356
Total project cost	**$55,393**	**$41,649**	**$28,694**

The TPC comparison demonstrates the significant cost advantages of commercial construction. The cost of construction for the alternative finance option is $13M less than the new facility line item. The cost differences between the line item and alternative finance options are driven primarily by five cost drivers: contingency, escalation, project oversight, construction requirements, and laboratory construction burdens. Each driver is discussed below.

- **Contingency:** Contingency on estimates for projects can vary depending on project complexity and the risks associated with the project. Commercial market analysis has shown that projects with standard office space and light laboratories present low technical risk. This low risk reduces the amount of required contingency compared to that required for similar line item projects within NNSA experience. Standard commercial approaches select builders via competitive procurement and transfer delivery risks through guaranteed maximum price contracts—another factor that reduces the commercial contingency on the alternative finance option. Specifically, contingency of 5% is included in the GMP and an additional 5% is held outside of GMP in the alternative finance option. These amounts were confirmed as appropriate through further market validation conducted by the independent estimator. Contingency differences contribute 16% of the cost differential between alternative finance and new facility line item.
- **Escalation:** Escalation cost differences relate to the timing variances of facility construction and delivery. Commercially developed facilities can be completed three years earlier than facilities constructed by line item, as commercial development does not require the same time-intensive critical decision evaluations and incremental funding limitations. Due to this schedule advantage, the impacts of escalation are significantly less for the alternative finance option than for the line item options. Escalation accounts for 21% of the cost differential between alternative finance and new facility line item.
- **Project Oversight:** Federally directed line item projects require compliance with DOE O 413.3B, created to manage large, technically complex capital construction. The management and operating contractor must provide project management, design management, construction management, and inspection staff over multiple years for rigorous project management processes. In contrast, the alternative finance approach transfers the oversight and management burden of the project to the facility owner and greatly minimizes M&O interaction, resulting in significant savings in the execution of construction. Project oversight accounts for 13% of the cost differential between alternative finance and new facility line item.

- **Construction Requirements:** Facilities constructed and operated for national laboratory use are required to comply with federally mandated regulations that are above commercial codes and standards and adversely affect the initial cost of construction. Both the line item and alternative finance approaches assumed compliance with the Davis-Bacon Act. As highlighted by the DOE *Operations Improvement Council Cost Workshop* (Oct 2012), costs on DOE projects can be 10%–40% higher when compared to construction in the private sector due to increased regulation in project execution (CFR 851, restricted access site, Buy American, extended funding profiles, FAR) as well as requirements for exemplary building design/performance (LEED certification, energy performance, force protection design requirements, and environmental restrictions). Construction requirements account for 42% of the cost differential between alternative finance and new facility line item.
- **Laboratory Construction Burdens:** LLNL maintains a full cost recovery accounting model and assesses overhead rates to laboratory activities per LLNL's Cost Accounting Standards Disclosure Statement. Construction burdens account for 8% of the cost difference between the alternatives.

MARKET VALIDATION OF ALTERNATIVE FINANCE CONSTRUCTION COSTS

To gain further confidence in the alternative finance estimate, the commercial estimator conducted a market validation to substantiate the estimated commercial construction costs and test market interest in construction of this type of project. Four nationally recognized builders responded to the market validation request for information and substantiated the reasonableness of the estimates. This response validates that the preliminary functional requirements and draft statement of work for the HPCIC facility can be constructed as estimated. Feedback and cost variability in specific categories from this exercise have also helped clarify and tighten laboratory requirements, which will aid in generating improved performance specifications in the future. Furthermore, this exercise provided real costs of construction for a dozen comparably built facilities in the Bay Area. The mean of these 12 projects was $\$270/ft^2$ with a standard deviation of $23. Our GMP estimate falls within this range, very near the mean value.

The cost differentials between the line item and alternative finance options are consistent with DOE's historical studies of government projects compared to commercial construction as presented in *Office of Science Third-Party Financed vs. Line Item Construction Cost Comparison* (Ackerman, 2012), which demonstrated a 42% average reduction with commercial construction. From its own examination of this issue, Logistics Management Institute has also concluded that alternative financing of federal capital projects yields a faster acquisition without increasing life-cycle costs, especially in an environment of uncertain timing for line item appropriations (Gallay, 2006).

9.3 ESTIMATE OF ANNUAL LEASE RATE

The sections below describe the approaches and assumptions used to estimate the components that make up the annual gross lease rate for the alternative finance option and provide relevant comparisons to the line item options, where applicable. Table 18 provides a summary, and the sections following explain the components.

Table 18. Estimated gross lease rate for HPCIC*

	Annual	$/ft^2
Principal and interest	$2,140,835	$21.94
Operations and maintenance	$549,392	$5.63
Owner administration	$100,000	$1.02
Ground lease	$29,795	$0.31
Major maintenance reserve	$97,583	$1.00
Property taxes	—	—
Insurance	$35,130	$0.36
Gross lease rate	**$2,952,735**	**$30.26**

* All values are assumed to escalate, except principal and interest.

CONSTRUCTION PRINCIPAL AND INTEREST

The alternative finance approach to acquiring the HPCIC facility assumes 100% construction financing obtained in the private marketplace; the government does not underwrite the loan. As such, the greatest component of the gross lease rate is the debt service (principal and interest) payment for this construction financing. Section 9.4 further describes the terms of this financing.

OTHER LEASE COMPONENTS

Operations and Maintenance

For O&M of the HPCIC facility, LLNL can decide whether to manage the facility through standard laboratory operations or by allowing the owner to contract with the private market for these services. To provide the best value to the government, we have assumed a private O&M model for HPCIC. Local market data from BOMA was used for the estimates below, with the exception of utilities. To ensure the best value, it is proposed that LLNL pay for utilities directly—tying into existing laboratory utility systems and LLNL's beneficial utility rate agreements—and not through the lease. As a result, utility costs are the same for both alternatives and are therefore excluded from the analysis of both options. For the line item O&M life-cycle estimate, the BOMA-equivalent corporate space charge categories were used to enable the most direct comparison of alternatives. Table 19 shows estimated O&M lease costs.

Table 19. Estimated operations and maintenance costs for HPCIC

Category	Annual	$/ft^2
Custodial	$133,689	$1.37
Repairs and maintenance	$253,716	$2.60
Facility management	$134,665	$1.38
Roads and grounds maintenance	$27,323	$0.28
Total O&M	**$549,392**	**$5.63**

Owner Administration

A number of transaction models and owner entities could be utilized to develop and operate this type of facility and provide desirable characteristics from the laboratory's perspective. For simplicity and best value to the government, and to follow successful precedent, the proposed transaction model is a focused and efficient owner administration model that includes a non-profit and fee-based service management construct for legal services, accounting, operations, and required administration. To realize cost efficiencies, strategic coordination, and reduced interfaces, a single transaction entity is assumed to administer both the CREATE and HPCIC projects.

Ground Lease

For HPCIC, as with other government assets, DOE will ultimately determine the appropriate fair market value of their real estate and the appropriate land transfer mechanisms to enable an alternative finance project. A ground lease is assumed for this analysis. For cost analysis purposes, we established the commercial rates for an equivalent property in the area. Two different brokers familiar with the East Bay Area (Colliers and Jones Lang LaSalle) quoted Livermore commercial real estate land values at \$5–8/ft^2. We applied their recommended value of \$6.00/ft^2. Furthermore, Colliers indicated that lease rates generally follow property valuations and are linked to the landowner's cost of capital and risk premium. Following the OMB Circular A-94 methodology of linking rates to applicable Treasury periods, the 3% rate of return assumed for the lease is the same as that for the government's borrowing rate for the same period as the ground lease (> 30-year).

Major Maintenance Reserve

It is standard commercial practice to create a fund to serve as a major maintenance reserve and to assess and set aside a portion of rent payments for this purpose. Industry average rates have been included in the lease estimate to fully maintain the facility during the life of the lease. The labs do not have an equivalent methodology for funding this type of maintenance. LLNL performs some of this maintenance through indirect budgets, which is included in this analysis within the O&M costs.

Property Taxes

The matter of property taxes is a complicated issue for this type of transaction. For our analysis, we assumed the proposed transaction model that facilitates the construction and operation of the HPCIC facility would result in exemption from all property taxes. The proposed property within LLNL's existing campus is owned by the United States of America and managed by DOE. As a ground lease is contemplated, ground use rights would be transferred to a non-profit, non-governmental third party that would finance, construct, own, and operate the facility. Further legal analysis and discussion with local and state authorities will ensue if this alternative is ultimately selected. At this time, the tax assessment would be \$300–400K per year (with 2% annual inflation).

Insurance

The insurance estimate was generated on the basis of market-provided data for actual insurance rates assessed to comparable facilities in the area. Required insurance levels (potentially above market norms) have been previously dictated in ground lease documents generated by the government, and the ultimate insurance rates will be guided by the negotiation of coverage levels specified in the ground lease. For comparison purposes, the government's self-insurance approach for a line item facility is a conservative assumption due to the disregard of inherent risks and implied liabilities in government ownership.

LESSOR'S ANNUAL COST STATEMENT

Following the GSA *Lessor's Annual Cost Statement Form 1217,* Table 20 summarizes the annual income and expenses for the proposed lease from the perspective of the third-party owner. Rent payments to the non-profit facility owner offset expenses only.

Table 20. Proforma annual rental income statement for HPCIC

	Annual
Income	
Minimum lease payment (including owner administration)	$2,240,835
"Pass through" insurance and taxes	$35,130
Operation costs	$676,770
Total income	**$2,952,735**
Expenses	
Fixed	
Taxes	—
Insurance	$35,130
Major maintenance reserve	$97,583
Ground lease	$29,795
Owner administration	$100,000
Variable	
Operations and maintenance (excluding utilities)	$549,392
Total expenses	**$811,900**
Net rent (excluding owner administration)	**$2,140,835**
Debt service to cover cost of construction	**$2,140,835**
Profit (Loss)	**—**

9.4 PROJECT FINANCING

The alternative finance acquisition option assumes 100% construction financing. It is assumed that this project will be financed by the issuance of rated bonds, due to their favorable ratings and attractive interest rates (for more, see the Standard & Poor's document found in Appendix L). Subject matter experts in bond financing for government projects of this nature estimated a 25-year bond term at 4.00%, a rate consistent with market conditions at the time of the most recent revision of OMB Circular A-94 Appendix C, in December 2012. Table 21 summarizes sources and uses of funds for financing.

Table 21. Sources and uses of funds for HPCIC

Source of funds	
Total borrowing/principal	$32,581,420
Total sources	**$32,581,420**
Use of funds	
Design and construction costs	$28,694,420
Owner establishment and administration	$150,000
Capitalized interest (net)	$1,921,984
Ground lease during construction	$44,693
Other uses	
Cost of issuance	$705,301
Underwriter's discount	$325,814
Deposit to debt service reserve fund	$535,209
Deposit to third-party expense fund	$100,000
Deposit to operating reserve fund	$100,000
Deposit to expense fund	$4,000
Total use of funds	**$32,581,420**

9.5 Life-Cycle Cost Analysis

This life-cycle cost analysis evaluates the NPV of the acquisition alternatives over the period of utilization by DOE, balancing the initial monetary investment with the long-term expense of operating and maintaining the facility. The life-cycle cost analysis of alternatives was conducted using Army Corps of Engineers ECONPACK software (see Appendix K).

Escalation and Discounting Approach

Per OMB Circular A-94, the discount rate used to compute net present values is commensurate with the timeframes analyzed in the proposed facility lease agreement. As prescribed by A-94, inflation was estimated using rates specified in the President's FY14 budget, except for construction cost estimates, where a more suitable rate was identified based on regional construction cost indices. The analysis conservatively assumes escalation of all cost elements other than the construction P&I payments, because this P&I component requires a fixed bond repayment amount over time. Negotiation of the facility lease agreement will provide the opportunity to minimize/eliminate escalation on other lease components.

Net Present Value Profile

An NPV analysis is an effective means to compare differing approaches to financing a facility. The line item project (new construction) provides for capital construction up front and operates the facility through standard O&M processes provided within LLNL. The alternative finance approach allows the laboratory to pay a lease rate that includes capital construction principal and interest as well as private sector management of the facility, including items such as insurance, O&M, owner administration, and the ground lease. While the annual operating cost is greater for the alternative finance option due to recovery of principal and interest, the NPV analysis demonstrates that alternative finance provides a significantly better value to the government for the duration of the lease term.

Table 22 summarizes key inputs and assumptions used in developing the economic analyses.

Table 22. Summary of ECONPACK model inputs for HPCIC economic analysis

	Line item	Alternative finance
Construction period	April 2017–October 2019	July 2015–September 2016
O&M	$16.73/ft^2 per year	$5.63/ft^2 per year
Insurance	Government self-insures	$35,130 per year
Cash flows	Presented in 2013 base-year dollars	
Discount rate	2.35% (OMB Circular A-94, Appendix C)	
Inflation	1.9% year over year	
Major maintenance	Partially included in O&M	Incorporated in lease: $97,583 per year
Ground lease term	n/a	35 years
Financing term	n/a	25 years
Facility lease term	n/a	15 years
Gross lease rate	n/a	$3.0M per year
Property taxes	n/a	n/a
Financing amount	n/a	$32.6M
Capital market borrowing rate	n/a	4.00%
Owner administration	n/a	$100,000 per year
Ground lease	n/a	$29,795 per year

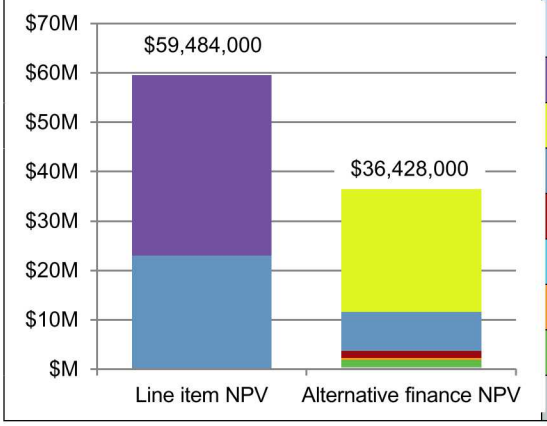
LIFE-CYCLE ANALYSIS RESULTS

The values in Table 23 summarize the output from the life-cycle cost analysis for a 15-year occupancy period, indicating that the alternative finance option provides the most cost-effective delivery method to the government.

The life-cycle cost analysis shows the alternative finance option represents the best value to the government with a significant $23M difference in NPV. The additional lifetime expenses incurred for the alternative finance option are more than offset by large cost savings realized in two main areas:

- Construction costs, as described in Section 9.2, coupled with attractive bond rates, are about $12M less. This is driven by differences in contingency, escalation, construction methodologies, project oversight, and laboratory burden requirements.
- Present value for O&M costs for private industry represents a $15M savings for the alternative finance model.

Table 23. HPCIC life-cycle cost analysis for a 15-year occupancy term



	Line item NPV ($k)	Alternative finance NPV ($k)
Total project cost	$36,482	—
Principal and interest	—	$24,854
Operations and maintenance	$23,002	$7,844
Owner administration	—	$1,428
Ground lease	—	$408
Major maintenance reserve	—	$1,393
Property taxes	—	—
Insurance	—	$501

Additional financial benefits adding value to the alternative finance option, not illustrated in this analysis include the following:

- Unlike the line item options which require NNSA to bear the full construction cost up front, the alternative finance lease is paid through a reallocation of existing laboratory overhead. Anticipated program growth, along with the elimination of an amount of substandard space equal or greater to the HPCIC space, will partially offset the lease cost.
- Further flexibility afforded to NNSA and LLNL is the opportunity to exit the facility with a minimal penalty of one-year annual rent should the mission requirement cease.
- The alternative finance approach offers a shorter acquisition timeframe, enabling the ability to address mission requirements sooner than would the line item alternative.

The alternative finance model provides the best value for the government, offering significantly lower cost, faster delivery, and greater flexibility to support NNSA and the mission need.

NNSA conducted an independent cost review of the construction estimates presented in this document. After clarification was provided, NNSA concluded the review in support of the CD-1 analysis with no additional actions required (See Appendix N)

A recently released study analyzed the economics of four existing DOE alternative financed facilities. This study incorporates data from the transactions for these facilities—which share many attributes of the structure contemplated here—and compares the costs to those for line item funding. The conclusion from all four case studies show that in practice, alternative finance provides cost and schedule advantages and thus the best value to the government. Appendix B highlights the cost comparisons, and the detailed studies are available at https://share.sandia.gov/cfma/best_practices/alternative_financing.php.

9.6 KEY POINTS

In closing, the following key points are emphasized:

- A detailed economic analysis, including a comparative total cost of construction and life-cycle cost analysis, was performed on the renovation line item, new facility line item, and alternative finance options.
- Conservative assumptions about construction schedules and delivery models lead to overly optimistic and unrealistic results for the line item funding.
- The alternative finance approach assumes the following:
  - 100% construction financing obtained in the private marketplace; the government does not underwrite the loan.
  - Project financing through the issuance of rated 25-year bonds at 4.00%, consistent with subject matter expert counsel and market conditions at the time of the most recent revision of OMB Circular A-94 Appendix C, in December 2012.
- The estimated TPC for HPCIC is $29M for the alternative finance option, $42M for the new facility line item option, and $55M for the renovation line item option. Because the cost for the renovation line item option exceeds that of the new construction option, renovation was eliminated from further financial analysis.

- The range of cost estimating uncertainty was quantified by performing predictive Monte Carlo simulations in the Oracle software program Crystal Ball. The TPC range for each line item alternative is based on using an 85% certainty level. Taking into account cost estimating uncertainty the full range for TPC for HPCIC is $29–$69M. This range encompasses $29M for alternative finance, $33–$64M for new line item construction, and $49–$69M for the renovation option.
- The life-cycle cost analysis shows the alternative finance option represents the best value to the government, with a $23M difference in NPV.
- The additional lifetime expenses for the alternative finance option are more than offset by large cost savings realized in two main areas:
  - Construction costs, coupled with attractive bond rates, account for a $12M cost reduction, which is driven by differences in contingency, escalation, construction methodologies, project oversight, and laboratory burden requirements.
  - Lower O&M costs for private industry account for an additional $15M in savings.
- The reasonableness of the TPC estimate for alternative finance was substantiated by information from four nationally recognized builders and a study of real construction costs of 12 comparable facilities in the San Francisco Bay Area. The alternative finance GMP estimate falls very near the mean value of these projects, which was $270/ft^2 with a standard deviation of $23.

10. HPCIC RECOMMENDED OPTION: ALTERNATIVE FINANCE

The recommended acquisition approach, alternative finance, is the best option to meet the mission need, as summarized in Table 24.

Because alternative finance provides the lowest life-cycle cost, most effective support of the mission and most expeditious schedule in the acquisition of HPCIC, this option offers the best overall value to the government, as summarized in Table 24. Under this option, the building would be privately owned and financed, developed on DOE land (within the LLNL LVOC), and operated by the facility owner under a ground lease from the DOE. The building would be constructed in accordance with local building codes and leased to the LLNL management and operating contractor for its use in support of NNSA missions. Assuming timely government approval, the schedule allows for construction to begin in 2015, with initial occupancy targeted in 2016. The construction milestones assume a 15-month design-build construction schedule, based on preliminary industry feedback and experience.

Table 24. Summary of key conclusions from analysis of alternatives for HPCIC

Overarching conclusions	
• Because the mission need of LVOC and HPCIC emphasizes collaboration, close proximity to the existing LLNL campus is a requirement to achieve maximum mission efficacy and impact. • Offsite leasing significantly compromises mission need, and the properties evaluated would require major modification to meet facility requirements, driving up lease costs. • The take no action option ignores the mission drivers as a priority and therefore fails to meet mission need.	
Prioritized alternatives	**Conclusion**
Alternative finance	• Fully meets the national security mission and collaborative needs of both LVOC and HPCIC. • Best value to the government with gross lease rates about $30/GSF. • Private development offers the optimal occupancy schedule. • Risks to the lab and government are minimized.
Line item—Both renovation and new construction	• Meets facility requirements. • Might restrict the activities that partners could undertake in the building, making their co-location less likely. • Significantly increases TPC and life-cycle cost impact. • Schedule delayed; DOE funds unlikely to be available during mission need timeframe.

11. HPCIC SENSITIVITY ANALYSIS

The recommendation to pursue the alternative finance approach is relatively insensitive to uncertainty, as only major changes to assumptions would change the ranking of this recommendation.

The life-cycle cost analysis demonstrates that the alternative finance option is the lowest cost alternative. However, because this analysis was undertaken for a model transaction, it contains uncertainties that can only be fully resolved when an actual transaction is realized. To understand the potential impact of these uncertainties on the recommendation to use the alternative finance option, a sensitivity analysis was conducted. Examining multiple variables, the sensitivity analysis identified three primary variables that, if changed, would impact the ranking of the alternative finance option, as shown in Table 25:

- The total project cost of the line item option would need to decrease by 63%.
- The alternative finance lease rate (principle and interest) would need to increase by 93%.
- Operating and maintenance costs for the alternative finance option would have to increase by 294%.

By concluding that only major changes to baseline assumptions would affect the ranking of options, the sensitivity analysis confirms that the recommended alternative finance approach is robust to major uncertainties. ECONPACK-generated sensitivity charts are presented in Appendix K.

Table 25. Percent changes needed in key variables to impact alternative finance ranking for HPCIC

Cost model input	% change required to impact ranking
Line item (new construction) TPC	–63%
Alternative finance lease rate (principal & interest)	+93%
Alternative finance operations and maintenance	+294%

Our analysis has assumed exemption from all property taxes. For the sensitivity analysis, we examined the impact of a property tax assessment against this project and found that the net present value of the taxes would be ~$5M. While this amount would add cost to the alternative finance option, the impact to the analysis is relatively minor at 22%.

The sensitivity analysis also examined bond rates, which are market-driven and near historical lows. While an increased rate would increase the gross lease rate, the relative priority of options is not highly sensitive to changing rates because as market rates increase, so do the discount rates prescribed in A-94. The spread between bond rates and discount rates was found to be conservative when estimated against both market conditions and previous alternative finance transactions.

Market estimates established baseline assumptions whenever possible. Since a ground lease is an agreement between the third party and the government, it is not clear whether a preferred approach would be to apply a nominal rate or establish a market-based rate for ground use rights. The economic analysis is insensitive to this range of options and can accommodate either approach.

Sensitivity analysis was also conducted on the duration of the facility lease and demonstrates that the ranking of alternatives is not affected by the lease term. Figure 9 shows the cumulative NPV comparison at any point during the life of the facility.

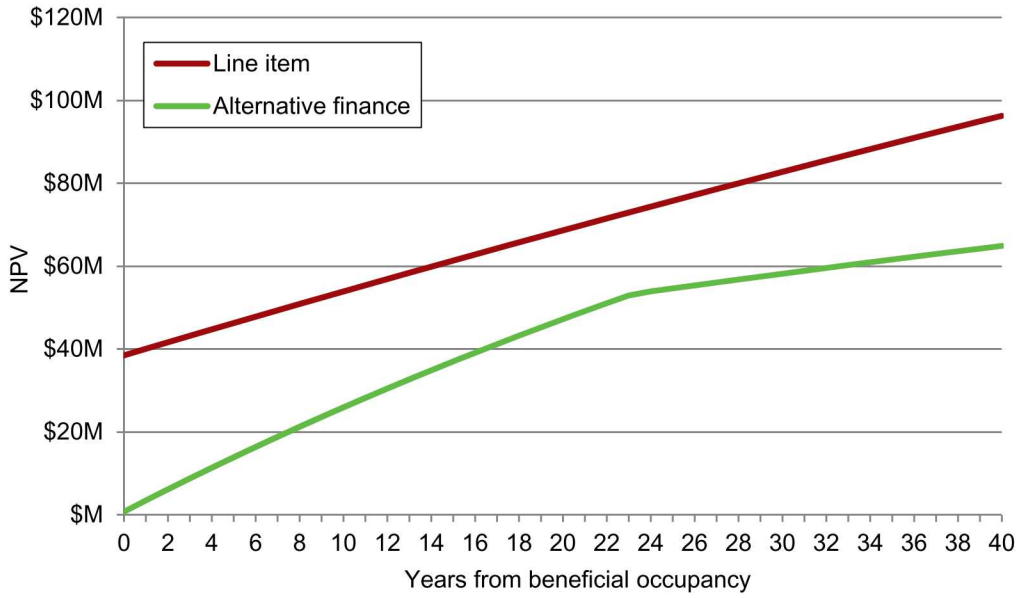


Figure 9. Cumulative net present value comparison for HPCIC

At the conclusion of the construction debt obligations, scheduled 8.5 years beyond the duration of the 15-year facility lease, the structure of the transaction model would yield significantly reduced rent payments as all principal and associated interest would be retired and only O&M cost recovery would ensue. Longer-term life-cycle comparative analysis suggests that this lease option never exceeds that of the line item approach during the useful life of the facility.

In order to assess the effects of schedule assumptions, we examined a very aggressive scenario for the line item, which would result in beneficial occupancy at the same time as the alternative finance option. Note that this is scenario would have required line item funding to be appropriated for the project in FY14 and thus is not a practical schedule, but rather serves as a limiting case.

Schedule changes affect the net present value of the life-cycle cost analysis through the difference in the discount rate and the escalation/inflation rates. The life-cycle cost comparison requires considering the effects of schedule on both the construction (discount-escalation) and O&M costs (discount-inflation). Since the magnitude of these rate differences is small, less than 0.5%, the effects on the construction and O&M life-cycle cost elements individually is a negligible $300k. By chance, the magnitude and sign of the cost differences almost exactly cancel even this small difference. Table 26 summarizes the sensitivity of the NPV to schedule acceleration.

As a result, the economic analysis is insensitive to assumptions regarding schedule.

Table 26. Line item life-cycle cost (NPV) sensitivity to schedule acceleration

Life cycle cost element	Discount rate	Escalation rate	Inflation rate	Delta	Line item (base case)	Line item (same occupancy as alt. finance)
Total project cost	2.35%	2.79%		–0.44%	$36.5M	$36.2M
Operations & maintenance	2.35%		1.90%	+0.45%	$23.0M	$23.3M
Total					**$59.5M**	**$59.5M**

PART IV

—

CREATE AND HPCIC BUSINESS CASE AND ANALYSIS

12. PREFERRED BUSINESS AND ACQUISITION APPROACH

This section outlines the preferred acquisition strategy for the proposed CREATE and HPCIC facilities: to lease third-party buildings to be constructed onsite (alternative finance). The buildings would be privately owned and financed, developed on LVOC land, and operated by the facility owner under a ground lease from DOE. The buildings would be constructed in accordance with local building codes and leased to the M&O contractors for their use in support of the NNSA mission.

DOE G 430.1-7 *Alternative Financing Guide* establishes four phases in the alternative financing process:

- Phase 1 - Development of Mission Need
- Phase 2 – Development of Alternatives Analysis
- Phase 3 - Development of an AF Proposal
- Phase 4 - Submittal of the AF Proposal to Headquarters

The LVOC process is currently in Phase 2 with the development of this CD-1 proposal. Since the actual alternative finance model is not developed until Phase 3, it is not appropriate to commit to a particular alternative finance model at this time. In this section, we review attributes of models that could meet the needs of the broad spectrum of stakeholders present in an alternative finance transaction. Once authority to engage in Phase 3 has been gained, SNL and LLNL will develop a detailed transaction model that transfers substantial risk to the third party, as required to meet the OMB A-11 Appendix B criteria. SNL and LLNL intend to reach out to local government, academic institutions, and commercial partners who are interested in cooperating in LVOC.

At this time, it is contemplated that the third-party owner would be an overarching entity to support the financing, development, and ongoing operations and maintenance of CREATE and HPCIC, as well as potential future facilities to be developed in LVOC. The intent of such a strategy would be to leverage the cost efficiencies and strategic synergies of the development entity to the benefit of LVOC growth in support of the NNSA mission.

The specific transaction model described below has been assumed at this stage for the cost modeling because it offers several desirable characteristics, including positive experiences in similar projects, beneficial cost considerations, substantial transfer of risk to the private sector, and protection of the government's interests. Other models will be considered that can also meet or exceed the project requirements. See Appendix M for an analysis of potential transaction entity structures.

Because alternative finance exists outside of the normal appropriations process, the proposed investment is being discussed openly and will be described within the appropriate budget documents. Further, NNSA staff will actively engage with the authorizing and appropriations committees that play a role in determining NNSA investment decisions to ensure their full awareness and understanding of the proposal.

12.1 PROPOSED FUNDING AND TRANSACTION MODEL

The preferred acquisition strategy is for leased facilities to be privately owned, financed, developed, and operated by the facility owner without government ownership or participation (alternative finance). The project sites will be transferred by DOE to the facility owner by ground lease. The facility owner would be a non-profit special purpose entity established solely for this purpose and operating under the conditions outlined in Appendix M. The facility owner would lease the facilities to the M&O contractors for a period of 15 years, with the approval of the federal government.

DESIRABLE ATTRIBUTES OF A THIRD PARTY

As noted above, a third-party non-profit, special purpose entity—whether a trust, limited-liability corporation, or a non-profit corporation—possesses the desired characteristics described in Appendix M. A third-party entity brings other attributes that are beneficial to the project. For example, such a structure is stable and simple, which minimizes costs and interface needs, and will operate transparently without conflict of interest. While structured to be at arm's-length from the labs, the third party would be aligned with the goal of the labs and government interests. In addition, due to its non-profit status, it would be tax exempt and eligible for beneficial financial rates. Further, use of a third party has proven successful in alternative finance construction and can now be confirmed as a best practice option.

Significantly, the third-party entity offers measured liability protection to DOE and the M&O contractors, as any agreements entered into by the entity, such as those for the financing, development, construction, and operation of the projects, would be commitments of the third party only, not of DOE or the M&O contractors. As a result, the risks, liabilities, and debts of the entity are contained and do not burden any of the other parties.

Under the guidance of the overarching third-party entity, other third-party entities might be created for each project to cleanly isolate assets and liabilities in order to secure the necessary financing. For consistency of purpose and cost efficiency, the same administrative organizations and personnel would manage these organizations whenever possible. This is a standard commercial practice when managing multiple real estate or development projects.

The following contract mechanisms are anticipated within the possible transaction model shown in Figure 10:

- The facility owner leases the sites from DOE by ground lease.
- The facility owner enters into financing agreements with financier(s) to secure development financing.
- The facility owner enters into development agreements with developer(s) for the development of the facilities.
- The facility owner enters into additional agreements with DOE, the M&O contractors, and financier(s).
- The facility owner enters into facility lease agreements (FLA) with the SNL and LLNL M&O contractors, subject to the approval of the federal government.

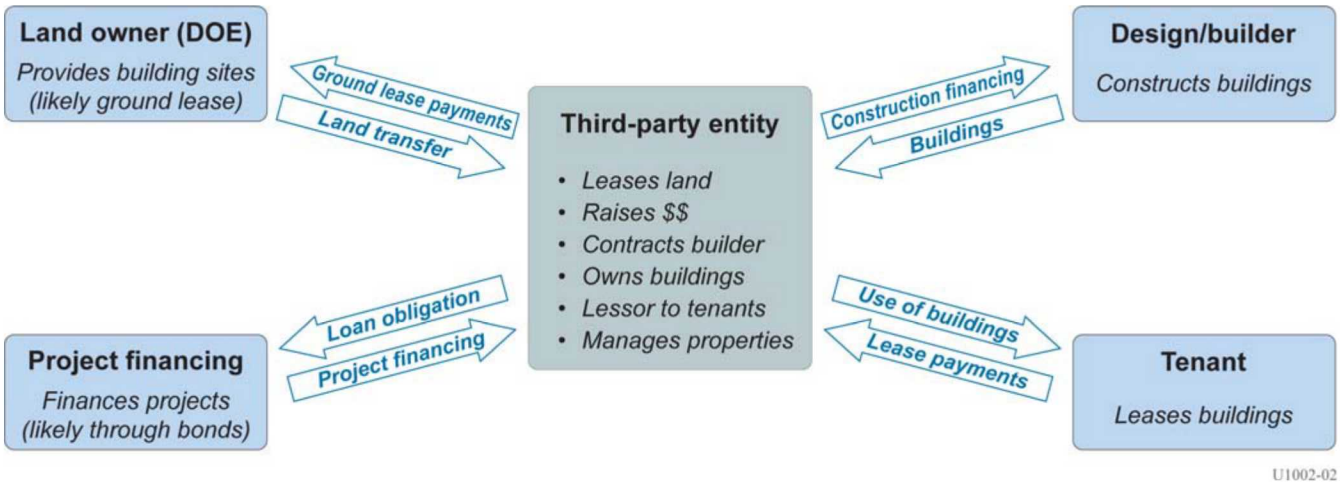


Figure 10. Working version of transaction model

MODEL FOR CREATE AND HPCIC

Elements of the potential transaction model for CREATE and HPCIC are described below. The acquisition strategy as outlined above is believed to be the most economic and efficient approach to address the capability and infrastructure requirements to meet the programmatic objectives of SNL, LLNL, and NNSA. In addition, the financial community has underscored its appreciation and understanding of these types of projects, as demonstrated by a formal rating guide for alternative finance projects published by Standard & Poor's and the rating of these bonds at double-A minus.

Particular attention is given to the timeframes for the leasing and financing agreements, which have been constructed to meet the needs of all parties, including NNSA mission imperatives, OMB operating constraints, and financial risk management requirements set by private sector. It's important to note that these timeframes are interdependent and cannot accommodate any unilateral change to meet the needs of a single stakeholder.

- **Facility Lease:** The facility owner will enter into FLAs with the SNL and LLNL M&O contractors for a period of 15 years. DOE will not be a signatory to these agreements. The 15-year timeframe aligns with NNSA mission drivers, complies with OMB A-11 criteria (including the 90% rule), and is the minimum timeframe required by the market to ensure favorable financial terms.
- **Financing:** Project financing will be entirely the responsibility of the third-party facility owner. There is no explicit or implicit guarantee of financing by the government, and neither DOE nor the M&O contractors will be a party to the financing or to any financing agreement. Financing will occur over a 25-year term, which is the market standard for 100% financing and which also allows for amortized lease payments that are consistent with market levels. It is anticipated that project financing will take the form of bonds pursuant to financing agreements between the facility owner and the financier(s). There could be an assignment of rents and revenues derived from CREATE and HPCIC to the financier(s).
- **Ground Lease:** CREATE and HPCIC will be developed within LVOC on land leased by DOE to the third-party facility owner via a 35-year ground lease. This term comprises two elements: the industry-standard construction finance term of 25 years and an additional 10 years to allow for recuperation of any funds lost due to unexpected vacancies. As such, the 35-year term provides sufficient time for construction and occupancy by the M&O contractors, as well as for the owner to re-lease to others and collect rent in order to make the bondholders whole, should the M&O contractors exercise their right to end their leases early or the facility owner experiences vacancies.

The facility owner will pay DOE an annual ground lease payment based on the fair market value of the sites as determined by DOE. The ground lease will permit the facility owner to construct the facilities on the sites and operate them under the terms of facility leases between the facility owner and the M&O contractors. The ground lease will also permit the facility owner to occupy, use, assign, or sublease a portion of the facilities for certain other uses should the facilities cease to be used for the current or any future DOE mission, subject to the consent of DOE under conditions to be expressed in the ground lease.

- **Facility Owner:** The third-party facility owner is anticipated to be a non-profit special purpose entity. The third party will be an entirely non-federal entity and no federal entity will be involved in its establishment or governance, or as a party or beneficiary. The third party will be the lessee under the ground lease, the borrower under the financing agreement, and the owner of the facilities. The facility title will vest in the third party as the facility owner until the end of the ground lease.
- **Construction:** The third-party facility owner will be solely responsible for the selection of the developer(s) to construct CREATE and HPCIC. The development opportunities will be competed, with the selected developer(s) designing and constructing the facilities under development agreements. These agreements will include construction contract language, such as GMP terms, that will transfer the risks

associated with the design and construction process to the private sector. It is anticipated that the construction period will be 15 months, based on current assumptions regarding the requirements for the facilities.

ACQUISITION AND CONTRACT TYPES

For the proposed CREATE and HPCIC projects, it is expected that the following key agreements involving DOE or its M&O contractors will be evaluated and crafted. Some of the key elements expected to be contained in these documents, while not comprehensive, are outlined below. Once approval is obtained for the alternative finance option, detailed agreements will be drafted and included in the follow-on alternative finance business case document.

DOE Ground Lease

A ground lease provides for the leasing by the third party (lessee) of the site from the DOE (lessor) under the terms and conditions stated therein. Since DOE would be a party to the agreement, any such agreement would be subject to DOE negotiation and approval. Terms may include the following:

- Identification of the parties (DOE as lessor, facility owner as lessee)
- Term: 35 years
- Security and access requirements
- Rental payment
- Access to site infrastructure
- Final disposition at end of term; the opportunity exists to follow commercial practice and allow all improvements to convey to the government upon termination of the ground lease
- Facility owner required to enter into facility lease agreements with M&O contractor
- M&O contractor's right to terminate facility lease agreements
- Any subsequent use of facility after early termination subject to DOE reasonable approval for non-interference with mission and security
- DOE right to terminate under certain conditions

Facility Lease Agreement

An FLA (lease) provides for the leasing by the M&O contractors (lessees) of the facilities from the third party (lessor) under the terms and conditions stated therein. The following terms may be appropriate for the agreements in these transactions:

- Identification of the parties (facility owner as lessor, M&O contractor as lessee)
- Term of 15 years from beneficial occupancy
- Subleasing rights
- Fixed rental amount
- No option to extend or renew
- Right for the M&O to terminate early with 365 days' notice
- Right to assign by M&O contractor in the event of a change in contractor
- Provision on risk of loss or damage and insurance requirements
- Ground lease prevails in the event of any inconsistency

Other Agreements

Depending on the type of financing structure used, parties will enter into additional agreements as required.

12.2 Overview of Roles and Responsibilities

Table 27 summarizes the roles and responsibilities for each party in the proposed projects.

Table 27. Roles and responsibilities for the CREATE and HPCIC projects

Phase	Party	Role and responsibility	Potential liability
Establishment of the third-party entity	DOE	Sign letter of intent regarding ground lease to third party	Environmental, site owner
	M&O contractors	Develop draft performance specifications for buildings and model RFPs; develop programmatic plan and receive programmatic buy-in	None
	Third party	Validate transaction structure with respect to accounting treatment	None
		Conduct due diligence and establish team to manage subsequent third-party actions	Contractual
Execution of ground lease	DOE	Execute ground lease, contingent on closing of financing	Contractual
	M&O contractors	As M&O contractors and not a party, as may be directed by DOE	None
	Third party	Execute ground lease, contingent on closing of financing	Contractual
Raising of capital	DOE	Provide information regarding DOE leasing authority, national laboratories, and ongoing M&O contracts	None
	M&O contractors	State intent to lease buildings under FLAs	None
	Third party	Enter into loan agreements with bond representative by the California Municipal Finance Authority (CMFA)	Contractual
	CMFA	Prepare offering circular and retain bond counsel and underwriter	None
	Rating agency	Rate the bonds	None
	Underwriter	Market the bonds	Contractual
	Bond holders	Buy bonds	Investment risk
Soliciting and procuring developer(s)	DOE	N/A	None
	M&O contractors	Provide opinion regarding developers to the third party (in capacity as tenants of proposed buildings)	None
	Third party	Issue RFPs and evaluate offers and select developer(s)	None
Managing construction	DOE	N/A	None
	M&O contractors	Inspect for compliance with FLAs and consult with third party	None
	Third party	Deliver buildings per specification on time, pay developer(s)	Contractual
	Developer(s)	Build buildings per specification on time; provide warranty	Contractual
Building occupancy	DOE	Review FLAs in light of M&Os' occupancy	None
	M&O contractors	Inspect and move in, payment	Contractual
	Third party	Complete punch list	None
	Developer(s)	Complete punch list	Contractual
Maintenance and operation	DOE	N/A	None
	M&O contractors	Pay rent	None
	Third party	Collect rent; provide maintenance and operations	Contractual

12.3 Incentive Approach/Linkage to Performance Metrics

Performance-based contracting methods are preferred and will be used to the maximum extent feasible. Thus far, these have been incorporated into the existing project requirements and related documentation.

12.4 Competition

All major contracts associated with the recommended acquisition strategy will be competitively solicited and awarded by the third party. Initial market analysis has confirmed interest from the private sector in the development, construction, and financing for these projects. Consistent with the ground lease and associated agreements, the third party will be required to compete to the maximum extent practical, a standard widely used.

12.5 Exit Strategy

For SNL, current expected CA-based weapon system activities include the following programs: W87 NG, GTS, and Firing Set; B83 NG and GTS; W80-1 NG; B61-12 LEP; Mk21 Fuze; W78/88-1 LEP; and LRSO. These are all significant program activities that will affect LA space availability over the next two decades.

For LLNL, programmatic work involving the redesign of integrated design codes using advanced simulation and computational tools—which must coincide with planned platform acquisition timelines—creates a unique window of opportunity for HPCIC to amplify its engagement with industry and academia over the next two decades. During this period, HPCIC projects will evolve in their scale, sponsorship, and partnering and co-tenancy models, and LLNL staff in the facility will adjust accordingly.

The proposed 15-year term of the LLNL and SNL facility leases, with no renewal options, aligns with the planning basis for NW program requirements and LLNL's programmatic and platform acquisition timelines, as well as the planning restrictions related to availability of line item funding for future capital infrastructure.

As these and other programs wind down, further analysis of each site's space needs will be conducted. If an overall reduction of space is warranted, LLNL and/or SNL will vacate leased facilities at the end of the 15-year lease period, and may reconfigure existing facilities and fence lines to correspond to future program mix and security requirements. The third party would then lease HPCIC and/or CREATE to industrial and academic partners or other synergistic tenants. Consistent with the ground lease, the third party would limit the leases to only those appropriate for a location adjacent to a national laboratory.

If ongoing space needs remain after the conclusion of the facility leases, a new analysis will be undertaken to determine the best option. This schedule is consistent with the current NNSA Construction Working Group priority list, which has planned commitments of line item funding until the 2030s.

12.6 KEY POINTS

In closing, the following key points are emphasized:

- The preferred alternative finance acquisition strategy calls for the leased facilities to be privately owned, financed, developed, and operated by the facility owner without government ownership or participation.
- The facility owner is anticipated to be a non-profit special purpose entity established solely for this purpose. A third party, the assumed structure, offers measured liability protection to DOE and the M&O contractors. The facility owner will be solely responsible for the selection of developer(s) to construct CREATE and HPCIC.
- The facility owner would lease the facilities to the M&O contractors for a period of 15 years, with the approval of the federal government, a timeframe that meets the mission need, allows for desirable financial terms, and meets OMB operating criteria.
- Project financing will entirely be the responsibility of the facility owner. It is anticipated that project financing will take the form of bonds at 25-year terms, the market standard for 100% financing and a timeframe that allows for amortized rents aligned with market norms.
- CREATE and HPCIC will be developed within LVOC on land leased by DOE to the facility owner via a 35-year ground lease. This term is derived from the industry standard construction finance term of 25 years plus a minimum 10-year “cure” period required by the financial community.
- Leasing and financing agreement timeframes (15-year facility lease agreement, 25-year financing, and 35-year ground lease) are structured to meet the needs of all parties. The timeframes are interdependent and cannot be varied unilaterally to meet the desires of a single stakeholder.
- The exit strategy aligns with the planning basis for NW program requirements and LLNL’s programmatic and platform acquisition timelines, as well as the planning restrictions related to the availability of NNSA line item funding for future capital infrastructure.
- As these and other programs wind down, further analysis of each site’s space needs will be conducted. If an overall reduction of space is warranted, LLNL and/or SNL will vacate leased facilities at the end of the 15-year lease period, and may reconfigure existing facilities and fence lines to correspond to future program mix and security requirements.

13. RISK ANALYSIS

The alternative finance acquisition strategy for CREATE and HPCIC transfers significant risk to the private sector.

A risk identification and analysis was performed—based on the *DOE Risk Management Guide* (DOE G 413.3-7A)—that identifies the risks associated with the alternative finance acquisition strategy for the CREATE and HPCIC projects. The alternative finance approach transfers substantial risks borne by DOE and the operating contractors in a typical construction project to the private sector.

For the risks that remain with DOE and the operating contractors, the plan assessed the probability of occurrence and potential consequences on the project. It then identifies a risk mitigation strategy and rated the residual risk as high, medium, or low. Table 28 below describes the residual risks that are not rated low.

Table 28. Risks to DOE and the operating contractors not rated "low"

Risk area	Description	Probability	Consequence	Risk rating
Planning	Costs change significantly from those used in planning, resulting in unaffordable costs.	Low	High	Medium
Technical	Safety, security, or significant environmental issues emerge during private sector development and ownership of a facility on leased federal land, damaging the reputation of LLNL, SNL, NNSA, or DOE.	Low	High	Medium
Organizational	Lack of clarity of roles, responsibilities, and authorities for DOE/NNSA, delaying the project.	Medium	Medium	Medium
Project execution	Delays in required governmental actions or approvals, delaying the project.	Medium	Medium	Medium

14. OMB A-11 ANALYSIS

14.1 OMB A-11 PRELIMINARY SCORING ANALYSIS

Per OMB Circular A-11, the transactions as described have been evaluated in the context of the criteria and guidelines governing capital and operating leases defined in Appendix B.

OMB Circular A-11 mandates meeting six criteria in order to score as an operating lease. This preliminary scoring analysis indicates that the facility leases as contemplated comply with all of the A-11 Appendix B operating lease criteria, and therefore would be considered operating leases. Discussion for each of these mandatory provisions follows, and analysis worksheets are shown in Tables 29 and 30. For clarification during this discussion, "lease" shall mean the facility lease and "lessor" shall represent the facility owner.

The assumptions used in this analysis follow:

- Project financing of $30.5M for CREATE and $32.6M for HPCIC was assumed.
- It is assumed that these projects will be financed by the issuance of rated bonds. A 25-year bond term at 4.00% was estimated by subject matter experts in bond financing for government projects of this nature and is consistent with market conditions at the time of the most recent revision of Circular A-94 Appendix C, in December 2012.
- Budget authority was calculated as two years of rental payments (one year plus the one-year cancellation penalty).

14.2 COMPLIANCE WITH THE OMB CIRCULAR A-11 OPERATING LEASE CRITERIA

Criterion 1—Ownership of asset remains with the lessor during the term of the lease and is not transferred to the Government at or shortly after the end of the lease term.

- During the 15-year facility lease terms, the lease hold interest and ownership of improvements remain with the lessor and are not transferred to the DOE, or its M&O contractors, unless the facility owner fails to comply with certain ground lease provisions.
- DOE's M&O contractors' use of the facilities and/or other improvements is limited to the duration of the facility lease terms.
- Title to the improvements remains with facility owner throughout the 35-year term of the ground lease.
- The facility owner is an entirely non-profit private entity. There is no DOE (or any federal entity) or M&O contractor participation in the third party.

Criterion 2—The lease does not contain a bargain-price purchase option.

- The leases between the facility owner and the M&O contractor do not contain a bargain-price or any other purchase option.

Criterion 3—The lease term does not exceed 75% of the estimated economic life of the asset.

- The economic life of a commercial office building equals 36 years (per Bureau of Economic Analysis, U.S. Department of Commerce); 75% of 36 years is 27 years.
- The 15-year term for the facility leases is less than 27 years.

Criterion 4—The present value of the minimum lease payments over the life of the lease does not exceed 90 percent of the fair market value (FMV) of the asset at the beginning of the lease term.

- FMV is calculated to be $28.9M for CREATE and $33.1M for HPCIC.
- Present value of the estimated 15-year minimum lease payments totals $24.9M for CREATE, representing 86.3% of its FMV, and $28M for HPCIC, representing 84.7% of its FMV (see Section 14.3 and the worksheets in Tables 29 and 30).

Criterion 5—The asset is a general-purpose asset rather than being for a special purpose of the government and not built to the unique specifications of the government as lessee.

- Specifications for CREATE and HPCIC are for modern office buildings to include some light lab and collaboration spaces. These spaces are intended to be flexible and reconfigurable to meet the needs of changing mission requirements. Detailed project specifications have been included for reference so as to verify their general-purpose nature (see Appendix D and Appendix L).
- The facilities are not specified to any unique government specifications or requirements.
- The facilities are to be built in accordance with local building codes and requirements, not to federal construction specifications.
- The design and construction of the facilities are to be led by a private sector entity, in its role as facility owner and lessor.
- OMB A-11 states that a project constructed or located on government land will be presumed to be for a special purpose of the government. A-11 also states that if the government leases property to a non-federal entity and subsequently leases back the improvements, the lease will not be considered a leaseback from a public/private partnership, as long as the lessor is a totally non-federal entity. Such a leaseback may be treated as an operating lease if the lease otherwise meets the criteria for an operating lease.

Criterion 6—There is a private sector market for the asset.

- Marketability of the assets has been validated based on market research at the projected lease rates.
- The local market vacancy rate is 9.9% for Class A office space.
- Private sector funding sources—including banking institutions, capital markets, underwriters, and bond insurers—would not support construction loans or mortgages if the facilities had low marketability.
- With cancellation provisions of one year, the facility owner and its financier(s) assume the full risk that the facilities can be leased to tenants other than the M&O contractors.
- The San Francisco/East Bay Area geographic location has strong market appeal.
- Public roads into the CREATE and HPCIC sites and proximity to major freeways assure easy access.

14.3 Calculation of 90% Rule (Including Fair Market Value)

For CREATE, the worksheet in Table 29 provides detail supporting the calculation of the 90% rule discussed in the prior section under criterion #4. The worksheet in Table 30 provides the same detail for HPCIC.

Key considerations include:

- The minimum annual lease payments include the principal and interest associated with construction financing and the ground lease, as well the relevant facility owner administration obligations.
- In the context of this calculation, FMV follows OMB circular A-11 guidelines and includes cost of design and construction, land value, site improvements, and other direct/indirect costs.
- FMV is based upon the private sector's cost to design and construct the facilities.
- Additionally, FMV considers the additional capitalized costs as appropriate under Financial Accounting Standards Board accounting guidelines.

Table 29. CREATE OMB A-11 analysis worksheet

Calculation of 90% rule using discount rate specified in OMB A-94 Appendix C Calculation of budget authority and fair market value	
Borrowing amount	$30,468,324
Total uses of funds	$30,468,324
Issue date	4/1/2015
Lease commencement date	10/1/2016
Lease termination date	9/30/2031
Estimated fair market value of facility	**$28,887,843**

	Monthly	Annually
Principal and interest	$157,194	$1,886,326
Ground lease (initial)	$2,652	$31,824
Owner administration (initial)	$9,028	$108,331
Minimum lease payment	**$168,873**	**$2,026,481**

Date	Minimum annual lease payments	Discount factor	PV of rental payments comp. Treasury rates
Year 1	$2,026,481	0.953	$1,931,678
Year 2	$2,028,539	0.931	$1,888,773
Year 3	$2,030,637	0.909	$1,846,854
Year 4	$2,032,774	0.888	$1,805,899
Year 5	$2,034,952	0.868	$1,765,885
Year 6	$2,040,976	0.848	$1,730,017
Year 7	$2,043,237	0.828	$1,691,746
Year 8	$2,045,542	0.809	$1,654,355
Year 9	$2,047,890	0.790	$1,617,823
Year 10	$2,050,282	0.772	$1,582,130
Year 11	$2,052,721	0.754	$1,547,257
Year 12	$2,055,205	0.736	$1,513,185
Year 13	$2,057,737	0.719	$1,479,894
Year 14	$2,060,317	0.702	$1,447,367
Year 15	$2,060,946	0.686	$1,415,587
Total	**$30,670,235**		**$24,918,452**

Fair market value	
Design and construction	$25,139,236
Owner administration	$150,000
Capitalized interest (net)	$1,719,237
Ground lease during construction	$44,693
Other uses	$1,684,677
Site improvements	$150,000
Total fair market value	**$28,887,843**
PV of rental payments as % of fair market value	**86.3%**

Calculation of budget authority	
Principal and interest	$28,294,884
Operations and maintenance	$8,964,645
Owner administration	$1,859,945
Ground lease	$531,154
Major maintenance reserve	$1,592,299
Property taxes	—
Insurance	$573,228
Tenant improvements	$2,567,230
Total payments over 15 years	**$44,383,385**
Calculation of budget authority (First 2 years of lease payments)	**$5,595,206**

Table 30. HPCIC OMB A-11 analysis worksheet

Calculation of 90% rule using discount rate specified in OMB A-94 Appendix C Calculation of budget authority and fair market value			
Borrowing amount			$32,581,420
Total uses of funds			$32,581,420
Issue date			4/1/2015
Lease commencement date			10/1/2016
Lease termination date			9/30/2031
Estimated fair market value of facility			**$33,111,291**
		Monthly	**Annually**
Principal and interest		$178,403	$2,140,835
Ground lease (initial)		$2,652	$31,824
Owner administration (initial)		$9,028	$108,331
Minimum lease payment		**$190,083**	**$2,280,990**
Date	**Minimum annual lease payments**	**Discount factor**	**PV of rental payments comp. Treasury rates**
Year 1	$2,280,990	0.953	$2,174,281
Year 2	$2,283,048	0.931	$2,125,747
Year 3	$2,285,146	0.909	$2,078,329
Year 4	$2,287,283	0.888	$2,032,003
Year 5	$2,289,461	0.868	$1,986,743
Year 6	$2,294,534	0.848	$1,944,936
Year 7	$2,297,746	0.828	$1,902,474
Year 8	$2,300,051	0.809	$1,860,193
Year 9	$2,302,399	0.790	$1,818,885
Year 10	$2,304,792	0.772	$1,778,527
Year 11	$2,309,867	0.754	$1,741,078
Year 12	$2,313,230	0.736	$1,703,161
Year 13	$2,315,762	0.719	$1,665,462
Year 14	$2,318,342	0.702	$1,628,630
Year 15	$2,323,266	0.686	$1,594,214
Total	**$34,505,916**		**$28,034,664**

Fair market value	
Design and construction	$28,154,420
Management costs	$690,000
Capitalized interest (net)	$1,921,984
Ground lease during construction	$44,693
Other uses	$1,770,324
Site improvements	$529,871
Total fair market value	**$33,111,291**
PV of rental payments as % of fair market value	**84.7%**

Calculation of budget authority	
Principal and interest	$32,112,521
Operations and maintenance	$10,218,397
Owner administration	$1,859,945
Ground lease	$531,154
Major maintenance reserve	$1,814,991
Property taxes	—
Insurance	$653,399
Total payments over 15 years	**$47,190,407**
Calculation of budget authority (First 2 years of lease payments)	**$6,055,948**

14.4 Budget Authority and Budget Outlay

In accordance with Section 4 of OMB Circular A-11, the following budget authority and budget outlays have been calculated.

- **Budget authority:** Per OMB Circular A-11, budget authority for operating leases is required for the first year of the contract in the amount necessary to cover the government's legal obligations, consistent with the requirements of the Anti-deficiency Act. If the contract includes a cancellation clause, as is the case with these leases, the budget authority includes an amount sufficient to cover the lease payments for the first year plus an amount sufficient to cover the costs associated with cancellation of the contract. Budget Authority under this analysis is estimated to be $5,595,206 for CREATE and $6,055,948 for HPCIC.
- **Budget outlays:** Per OMB Circular A-11, for lease analysis with substantial private risk, annual outlays are equal to the minimum lease payments used for analysis of the 90% rule. The estimated minimum annual lease payment is $2,026,481 for CREATE and $2,280,990 for HPCIC.

14.5 Project Evaluation of Governmental Risk

In addition to setting the six criteria discussed in Section 14.2, OMB Circular A-11 also requires a proposed operating lease to be relatively low risk to the government. Substantial private risk means the absence of substantial government risk. That is, if the project is less governmental in nature, the private sector risk is considered to be higher. The government should not bear risks incidental to ownership when involved in an operating lease.

Table 31 outlines how the proposed projects and leases address each of the OMB A-11 illustrative criteria for substantial private sector risk, indicating that the relative risk to the government is low, and supports operating lease designation.

Table 31. Nongovernmental risk of CREATE and HPCIC projects

OMB indicators that projects are less governmental	CREATE and HPCIC project characteristics substantiating low government risk and supporting operating lease designation
There is no provision of government financing and no explicit government guarantee of third-party financing.	No such provisions exist in the financing as contemplated. The government is not providing financing or financial guarantees for these projects. The facility owner retains sole risk to retire its debt for 8.5 years after the end of the lease term.
Risks incident to ownership of the asset (e.g., financial responsibility for destruction or loss of asset) remain with the lessor unless the government was at fault for such losses.	The facility owner retains the risk of loss or destruction of the assets. Further, the government does not bear the risks incidental to ownership of the assets, including unsatisfactory performance, obsolescence, idle capacity, losses in realizable value, and uninsured damage.
The asset is a general-purpose asset rather than being for a special purpose of the government and is not built to the unique specification of the government as lessee.	Specifications are consistent with modern office buildings. Light lab spaces are built to local code and zoning requirements. The facilities as specified are not built to any unique government specifications or requirements. Construction costs have been validated within commercial norms.
There is a private sector market for the asset.	Preliminary research validates the marketability of assets based on current market conditions and the projected lease rates.
The project is not constructed on government land.	OMB Circular A-11 Appendix B states: *If the Government ground-leases property to a non-Federal party and subsequently leases back the improvements, the lease will not be considered a lease-back from a public/private partnership, as long as the lessor is a totally non-Federal entity. Such lease-backs may be treated as operating leases if they meet the criteria for an operating lease.* A ground lease to a totally non-Federal entity is contemplated in this transaction, and the leases meet the operating lease criteria.

15. CONCLUSIONS AND NEXT STEPS

Alternative finance presents an exceptional opportunity to realize the CREATE and HPCIC facilities, which will substantially advance the development and resulting mission impacts of the Livermore Valley Open Campus. This option thus enables DOE and the federal government to dramatically accelerate mission-enabling infrastructure and programs—with a proven model that minimizes risk and delivers a tremendous financial value.

15.1 CONCLUSIONS

Given current federal budget pressures and NNSA's capital investment funding commitments over the 25 years, line item funding is not a viable option for CREATE and HPCIC. In contrast, alternative finance is a fully feasible option and provides the additional benefit of delivering facilities several years faster than would be possible by line item financing. In turn, this earlier delivery date supports mission drivers over the next two decades and provides dramatic cost savings driven by commercial construction practices and a cost-efficient transaction model. As such, alternative finance provides a timely, strategic, and cost-effective means of acquiring new assets, as well as a viable path forward to realizing the vision and benefits of LVOC.

LVOC is pioneering an approach for helping the NNSA laboratories maintain their relevance and maximize their value to the nation in the rapidly evolving 21st century. Specifically, LVOC serves as a highly effective bridge between the external world and the labs, actively seeking out external collaborations to advance national security missions and broader DOE program imperatives—and provides positive benefits to other national industrial, economic, and security interests. At the same time, by offering lab employees access to a wider array of challenging projects and providing external partners new insight into the importance of the national security mission, such collaborations serve as an important tool for recruiting and retaining talented lab employees. As the first new major projects within LVOC, CREATE and HPCIC will target strategic collaborations that not only advance programmatic interests in key mission areas, but also set the foundation for future industrial and academic engagement for the laboratories, as well as broader governmental approaches to cost-effective capital infrastructure and operations.

The alternative finance structure recommended here encompasses thorough benchmarking and proven transaction approaches to mitigate governmental risks, address concerns, and provide features explicitly desired by DOE. For example, the non-profit third party provides minimized and absolutely transparent costs to the labs, while mitigating concerns of undue profit and conflict of interest. It also offers a stable and amenable structure whose interests will remain aligned with those of the labs and the government, and effectively transfers the majority of risks to the private sector. In addition, the recommended option allows the government to realize the benefit of the conveyed improvements at the conclusion of the ground lease, if their missions would benefit from continued use of the assets.

Moreover, the labs and government do not guarantee the financing or make commitments beyond a fixed-duration operating facility lease with a 365-day cancellation provision, minimizing budget authority commitments while maximizing flexibility to the government over time. Direct and otherwise-accepted liabilities inherent in government ownership are further alleviated by requiring the private owner to maintain and insure the facilities. The labs have the ability to pay the operating lease costs by prioritizing existing overhead accounts, and do not require augmented funding from any government entity.

The proposed financing of the projects also provides great benefit to the government. Due to successful experiences in the past, the bond market now understands these deals and provides very favorable construction financing rates, which translates into reduced and very competitive lease rates to the labs. Standard & Poor's has scored these deals, and has even recently upgraded their bond ratings, resulting in rates that are only

marginally above long-term treasuries. The history of the labs operating successful Work for Others programs and the vibrant technology-based economy of the Bay Area present assurances to the financial markets that the assets will have enduring value without government guarantees. This attractive financing, coupled with competitive commercial construction and operations practices, substantially lowers costs and provides significant life-cycle cost benefits to the government regardless of occupancy timeframe.

15.2 NEXT STEPS

With near-term mission requirements spanning the areas of weapons engineering, high performance computing, cybersecurity, and advanced manufacturing, alternative finance offers the best value and mission-enabling alternative to the government. Government concurrence to this acquisition and transaction approach will allow the projects to proceed without delay. The next steps in process, following the approach outlined in DOE 430.1-7, *Alternative Financing Guide*, are summarized below:

- NNSA approves this CD-1 Alternatives Analysis that establishes alternative finance as the acquisition approach that offers the best value for CREATE and HPCIC.
- LLNL, SNL, and NNSA jointly develop a complete Alternative Finance Proposal with a fully developed transaction model for submittal to DOE and OMB that includes:
  - Selection of preferred third party from the available options
  - Draft of DOE land lease
  - Draft of facility leases
  - Financing plan
  - OMB operating lease analysis
  - Risk analysis of selected transaction model
  - Additional agreements as required
- DOE approves the Alternative Finance Proposal, after a process that includes review of the proposal by the following stakeholders:
  - Acquisition and Project Management (APM)
  - General Council (GC)
  - Chief Financial Officer (CFO)
  - External Independent Review (EIR)
- DOE submits the Alternative Finance Proposal to OMB for concurrence that:
  - CREATE and HPCIC Alternative Finance Proposal qualifies as an operating lease
- In parallel with the actions above, NNSA, in coordination with SNL and LLNL, communicates about the project with congressional authorizers, appropriators, and other stakeholders through appropriate vehicles, including formal budget document submissions as required and informal information briefings.
- Upon positive completion of DOE and OMB reviews, NNSA issues an action memo directing the SNL and LLNL to proceed with the transactions.

APPENDICES

APPENDIX A: CD-0 ACCEPTANCE LETTER

Department of Energy
National Nuclear Security Administration
Washington, DC 20585

April 22, 2013

OFFICE OF THE ADMINISTRATOR

MEMORANDUM FOR KIMBERLY DAVIS LEBAK
MANAGER, LIVERMORE FIELD OFFICE

GEOFFREY BEAUSOLEIL
MANAGER, SANDIA FIELD OFFICE

FROM: NEILE L. MILLER
ACTING ADMINISTRATOR

REFERENCE: MEMORANDUM K. DAVIS/G. BEAUSOLEIL TO N. MILLER, *Livermore Valley Open Campus Joint Critical Decision-0 Document,* dated January 24, 2013

SUBJECT: Approval of Critical Decision-0, Mission Need and Program Requirements Document for the Livermore Valley Open Campus

We have received your subject memorandum dated January 24, 2013. The Associate Administrator for Acquisition & Project Management, NA-APM-1, recommends approval of the Mission Need and Program Requirements Document (PRD). The CD-0 document provides justification of Mission Need for the LVOC and supports the future growth of the LVOC.

I approve the Mission Need, and PRD for LVOC as a blanket CD-0 approval and I approve Mr. Tony Sy as the Federal Project Director for future LVOC CD-1 projects and documentation. Should the future project require a Level 2 or higher project director, please include that change in the CD-1 documentation.

The Livermore Field Office (LFO) shall continue leading this joint effort and coordinate the future project document submittals with the Sandia Field Office (SFO). It is recommended that the LFO develop and establish the Integrated Project Team and project charter for the future CD-1 and beyond submittals. It is also recommended that the CD-1 documentation for the High Performance Computing Innovation Center and the Collaboration in Research and Engineering for Advanced Technology and Education be submitted separately.

It is understood that one of the financing options that will be presented in CD-1 will be an alternatively financed project. DOE G 430.1-7, *Alternative Financing Guide,* provides guidance on identification, planning and approval of alternatively-financed projects. Should the Alternatives Analysis present this as the best case for the government and ultimately approved, then the execution of Department of Energy Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets,* will no longer be required. However, tailoring and following the Order's principles are important elements of the acquisition process and may be appropriate for the development of the LVOC area within the Sandia and Lawrence Livermore National Laboratories.

cc: D. Kusnezov, NA-1.1
R. Raines, NA-APM-1
D. Sanchez, NA-00-SN
D. Nakahara, NA-00-LL
M. Brown, NA-00-LL
R. Kong, NA-00-LL
T. Sy, NA-00-LL
S. Graham, NA-00-LL
R. Stulen, SNL
A. McIlroy, SNL
P. Albright, SNL
T. Gioconda, SNL
B. Koonce, SNL
C. Bibeau, SNL

Concurred by:

Kimberly Davis Lebak
Manager, Livermore Site Office
National Nuclear Security Administration

1/24/13
Date

Concurred by:

Geoffrey L. Beausoleil
Manager, Sandia Site Office
National Nuclear Security Administration

24 JAN 2013
Date

Approved by:

Neile L. Miller
Principal Deputy Administrator
National Nuclear Security Administration

4/22/13
Date

Concurred by:

Michael K. Lempke
Associate Administrator for Infrastructure and Operations
National Nuclear Security Administration

18 April 13
Date

Concurred by:

Dimitri Kusnezov
Chief Scientist
National Nuclear Security Administration

4.22.13
Date

APPENDIX B: ECONOMIC ANALYSIS OF FOUR DOE ALTERNATIVE FINANCE FACILITIES

Economics of an Alternatively Financed Facility

Four Case Studies

November 2013

Background

- DOE labs have executed seven successful Alternatively Financed (AF) facility transactions
- Each successive one has become more difficult to obtain OMB concurrence
  - Perception: Not in the best interest of the government - too costly compared to a line item
- Conducted case studies on the four most recent of these AF transactions to evaluate actual results :
  1. **PNNL Biological Sciences Facility (BSF)**
  2. **Computational Sciences Facility (CSF**) - combined analysis with BSF
  3. **ORNL Multiprogram Research Facility (MRF)**
  4. **ANL Theory & Computing Sciences (TCS) Building**

What is an Alternatively Financed (AF) Facility Transaction

New facility constructed by a private entity using commercial construction practices and leased to a governmental entity (e.g., a DOE lab). Typically:

- Builder/operator selected by competitive process
- Use of bond financing to fund construction backed by a long term lease
  - Bond financing runs longer than initial lease term (e.g. a tail)
- Facility owned by a bankruptcy remote Limited Liability Company (LLC) established by builder
  - Required by bondholders to secure debt service payments
  - Manages, constructs, operates and maintains facility
- Includes an early termination provision, usually 365-notice
- Structured to meet the OMB A-11 operating lease test

Benefits of AF (compared to a line item)

- Lower cost of construction*
- Lower cost to operate*
- Quicker to execute/build*
- In many cases avoiding costly interim measures to meet mission need
- Private sector assumes the financial risk of long term need
- Better allocation of cost to all clients of a lab via overhead

** Favorable elements of AF transaction factored into the lifecycle cost analysis*

Dilemma

- In obtaining approval most Alternatively Financed transactions considered only the initial lease term to demonstrate a favorable cost comparison to a line item
- However, inherent in the transaction is a presumption that facility would be needed longer
- Mostly ignored was how does an AF transaction compare to a line item over the full lifecycle of a facility
  - What if the lease goes longer than initial term – is it still more favorable than a line item?

Purpose

- Conduct an economic analysis of an AF facility compared to equivalent line-item facility using actual cost data and operational experience (e.g., a post mortem)
- Address three key questions:
  - How does the AF facility compare to a line-item over the full Life Cycle Cost (LCC) of the facility (e.g., 40 years)?
  - Did the AF facility meet the mission requirements within the parameters approved by DOE and in compliance with the OMB A-11 criteria?
  - Did the facilities represent the best value to the government, and if so, what best practices can be extracted from the case studies?

PNNL Biological Sciences Facility and Computational Sciences Facility (BSF/CSF)

Contributors: Kevin Adamson, Angus Bampton, Marty Conger
Contact: martin.conger@pnnl.gov

BSF/CSF Mission Need & Approach

- Relocate PNNL research facilities on the Hanford Site standing in the way of EM cleanup
  - Mostly older 1950 to 1970 vintage facilities representing 700K ft^2 of PNNL lab space (~40%)
  - At risk were major research capabilities validated as essential to PNNL Clients - primarily SC, NNSA and DHS
- Initial replacement plan was all line item but need exceeded budget so multi-funded approach approved:
  - Line item for capabilities unique to the government
  - Alternative financing for normal commercial type space
  - Life extension mods to select federal facilities outside major cleanup zones on Hanford site
- Great comparison opportunity with the Physical Sciences Facility (PSF) as a line item constructed simultaneously
  - Equivalent mission complexity

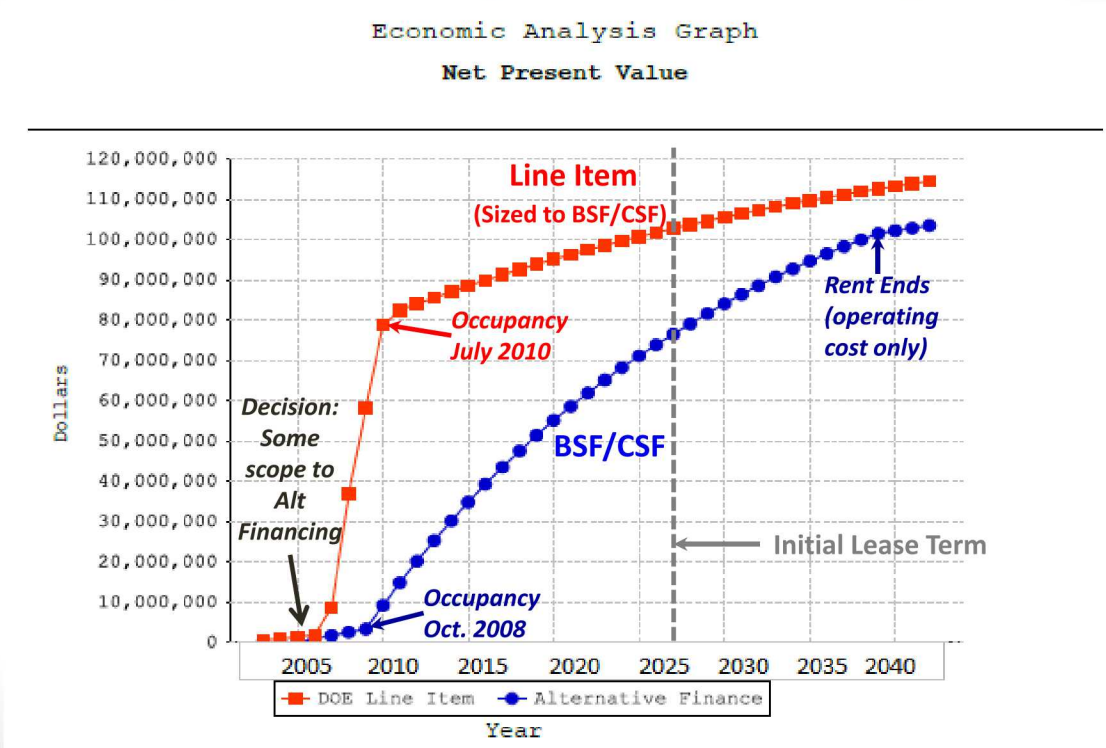
BSF/CSF Parameters & Assumptions

- Initial lease term of 19 years (with 365 day termination clause)
  - Met A-11 test for an operating lease
- Underlying financing of 25 years
- Battelle owned land leased to developer
- DOE gets rent free use at 30 years if lease continuity maintained
- Used actual cost of construction for both BSF/CSF & PSF
- Operating cost differential based on 3 years of actual operating cost history
- Bond rate for borrowing 6.58% (actual)
- Used OMB Circular A-94 for present value analysis
  - 5.25% discount rate when transaction approved (2007)
  - Result is 1.33% spread over borrowing rate

BSF/CSF Advantages & Disadvantages

- Advantages:
  - Construction and oversight cost 25% lower
  - Operating cost ~10% lower (operated by a commercial landlord)
  - Available contingency lower with risk passed to developer and all was applied to incremental scope (plus construction savings)
  - Time to execute much shorter (by ~ 3 years) avoiding a costly impact to cleanup of an incremental line item approach
  - DOE has termination clause (365 day notice) and can end lease if mission need evaporates for even more significant savings
- Disadvantages:
  - Interest on financing and land rent increase cost
  - Incremental cost to execute transaction (included in borrowing)
  - Above mitigated by rent payments ending shortly after financing is retired (DOE gets rent free use as long mission need exists)

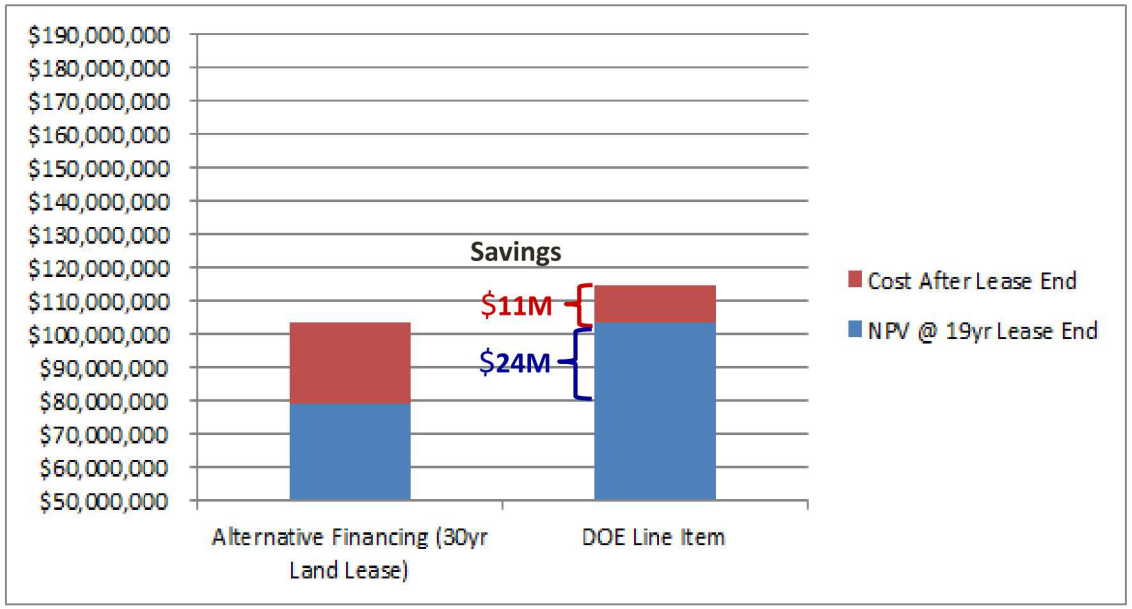
BSF/CSF Life Cycle Cost Comparison



Note: Rates in effect at transaction approval (current rates provide same result slightly lower difference)

BSF/CSF Net Present Value

End of Lease vs. Long Term



BSF/CSF Conclusions

- How did BSF/CSF compare to a more traditional line-item over the long term based upon Life Cycle Cost (LCC)?
  - BSF/CSF delivered at a lower cycle cost than an equivalent line item (confirming it was the best value)
    - Quicker and cheaper, given DOE rent free use after 30 years
    - Savings from commercial construction and operating practices exceed incremental cost of borrowing/transaction on NPV basis
    - Avoided costly schedule delay for Hanford cleanup
- Did BSF/CSF meet or exceed the parameters approved by DOE and in compliance with OMB A-11 criteria?
  - Met or beat all parameters approved by DOE and fully complied with OMB A-11
  - More flexible approach than a line item as DOE can terminate if mission need evaporates

ORNL Multiprogram Research Facility (MRF)

Contributors: Scott Branham, LeAnne Stribley, Jeff Ault
Contact: branhams@ornl.gov

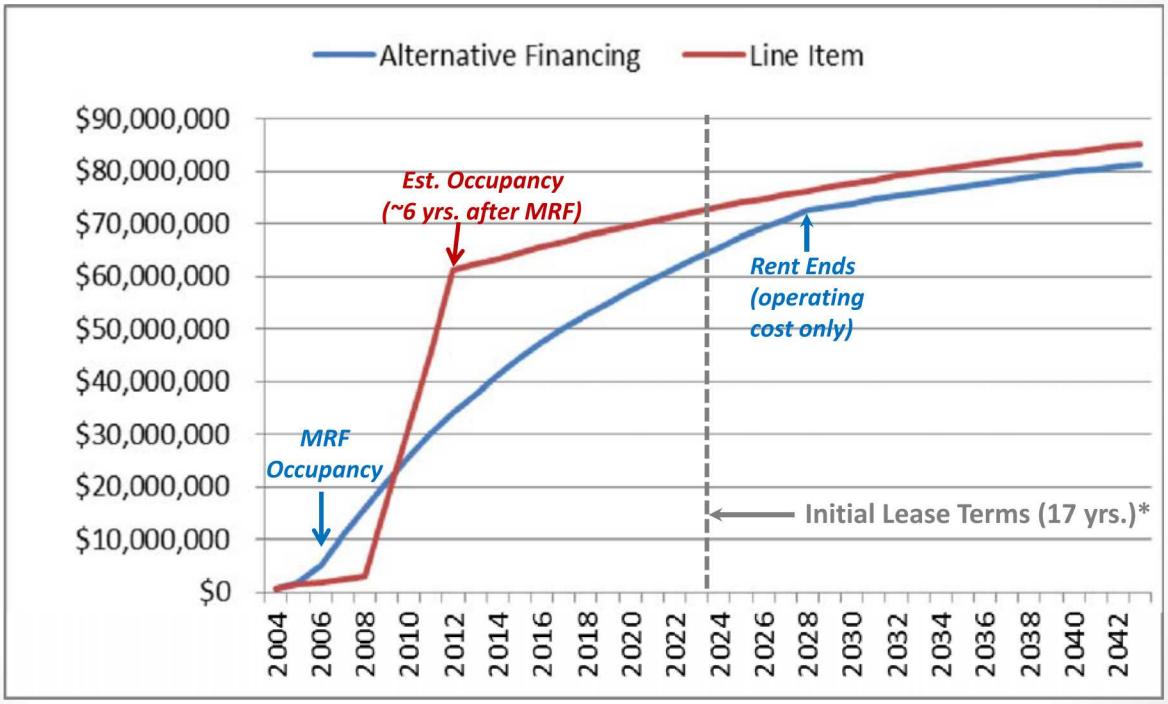
MRF Mission Need & Approach

- The MRF was 2nd installment of ORNL Facility Renovation Plan and approved in principle by DOE
- The MRF was proposed to address needs critical to the DOE's overarching mission
  - National economic and energy security
  - Promote scientific & technological innovation in support of mission
  - Environmental cleanup of weapons complex
- The MRF was constructed to address critical needs:
  - Upgrade lab & office space to accommodate ~ 530 technical staff
  - Replace DOE building >60 years old in state of disrepair
  - Consolidate staff located away from the ORNL Reservation
  - Space to accommodate nominal growth

MRF Parameters & Assumptions

- Line Item Funding (estimated)
  - Capital expenditures commencing May 2009 - completed May 2012
    - NOTE: No capital funding available until 2009 at earliest
  - Existing leases remain in place until occupancy
  - Based on original analysis of capital alternative in 2004
  - A/E design costs 8% and contingency 15%.
- Alternative Financing (actual)
  - Existing leases remain in place until occupancy (~17 months)
  - Bond financing at 6.75% - first payment due upon MRF lease commencement
  - Supplemental bond offering concurrent with buildings already completed
  - Bonds paid in full and lease terminates in 2028
- Discount rate for calculation per OMB Circular No. A-94 of 5.2%
  - Original analysis period of 23 years (concurrent with prior bonds)

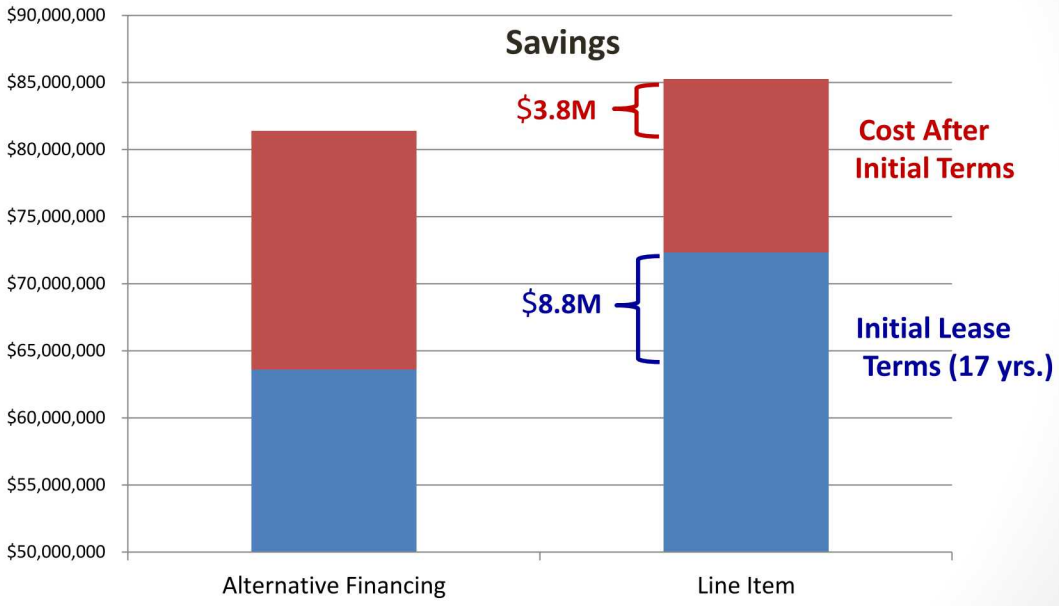
MRF Life Cycle Cost Comparison



* Base lease term of 7 years plus assumed exercise of two 5 year renewal terms

MRF Present Value

PV OF COSTS - Over Initial Lease Terms and 40 year life cycle



MRF Conclusions

- How did MRF compare to a more traditional line-item over the long term based upon Life Cycle Cost (LCC)?
  - MRF demonstrated lower LCC than line-item over 40 years and offered best value to the government
    - Lower construction cost and a shorter construction period
    - Ability to utilize commercial construction practices
  - Increased flexibility for DOE
    - One-year obligation - can terminate sublease with a 365 day notice
    - Long-term lease risk borne by UTBDC, the developer, and the bondholders
- Did MRF meet or exceed the parameters approved by DOE and in compliance with OMB A-11 criteria?
  - Construction cost consistent with original proposal plus approved change orders
  - Demonstrated ongoing efficiency and cost savings as projected
  - Enabled consolidation of staff from offsite and antiquated facilities

MRF Conclusions

- What was learned and what best practices can be extracted from the MRF experience?
  - AF delivered at least 6 years earlier than a line item allowing mission needs to be met in a timely manner
  - Consolidating staff on campus achieved earlier resulting in significant savings and other benefits
  - Private development for conventional facilities cuts construction cost
    - Schedule efficiencies by concurrent design and construction
    - Compressed construction schedule by avoiding incremental funding and in progress reviews associated with a DOE line item
  - Successful accomplishments of project goals enhanced by:
    - Alignment of goals: DOE and contractor working toward a common objective to create environment where success is in everyone's interest
    - Structure of the Deal: Must be viable commercial deal and provide access to land so the project can be economically achieved
    - Balanced Expectations: Must be an "operating lease" with reasonable terms so that it is attractive to the investment community

ANL Theory & Computing Sciences Building (TCS)

Contributors: Paul Kearns, Barb Fatina, Jim Feigl, L. Goldberg
Contact: bfatina@anl.gov

TCS Mission Need & Approach

- October 2004 CD-0 prioritized need for:

  "a world-class research center supporting large-scale computation; high-end visualization; integration of computers, people, data and instruments over high-speed networks; and a venue conducive to interdisciplinary interactions among researchers spanning theory, computing science, and experimental validation:

- Mandatory performance parameters for TCS:
  - Centralization of large-scale computing capabilities with capacity to meet expected future needs
  - Collocation of technical disciplines to form a critical theory and computational capability with access to computational resources
  - Consolidate on ANL campus staff located offsite in leased space
  - Improved operational efficiencies by consolidating common functions for more energy efficient high demand systems

TCS Parameters & Assumptions

- Initial lease term of 18 years (with 365 day termination clause)
  - Met A-11 test for an operating lease
- Underlying financing of 25 years
- DOE owned land leased to 3rd party non-profit Trust for 35 years plus 2 years construction
- Used actual cost of construction for comparison
- Operating cost differential based on 4 years of actual operating cost history
- Bond interest rate of 6.36%
- Used OMB Circular A-94 for present value analysis
  - Treasury rate 5.10% at time of transaction.

TCS Advantages & Disadvantages

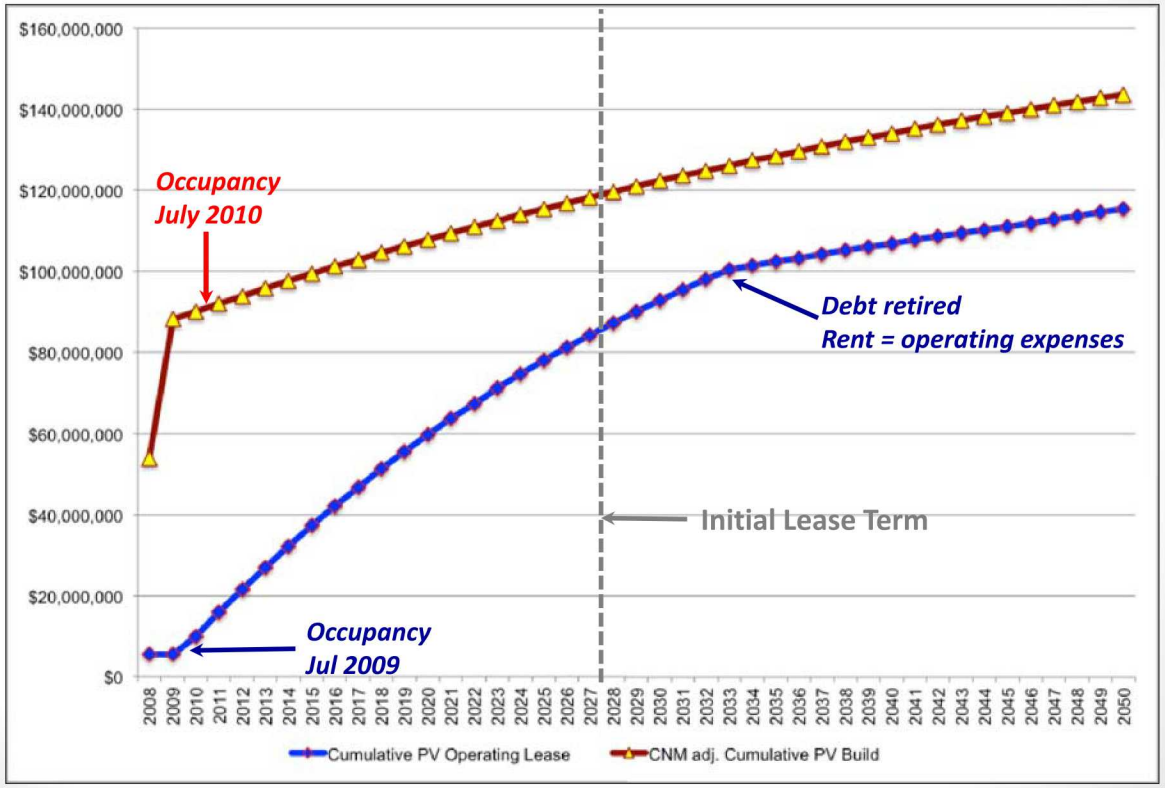
Advantages:

- Construction and administration/oversight costs lower
- Facility operations are less than line-item (managed, operated and maintained by commercial landlord)
- Contingency lower with risk managed via Design/Build contract
- Construction duration shorter (by 1+ years) enabling early occupancy to accommodate mission need
- Capital repairs covered through major maintenance reserve
- Flat lease rates for term of debt
- Includes provision for 365 day notice to terminate lease if mission need ends for additional savings over line item
- Base rent end when debt is retired (25 years), thereafter ONLY cost is for operations, maintenance and overall management
- Ground Lease offers advantage to the Government to follow commercial practices regarding improvements

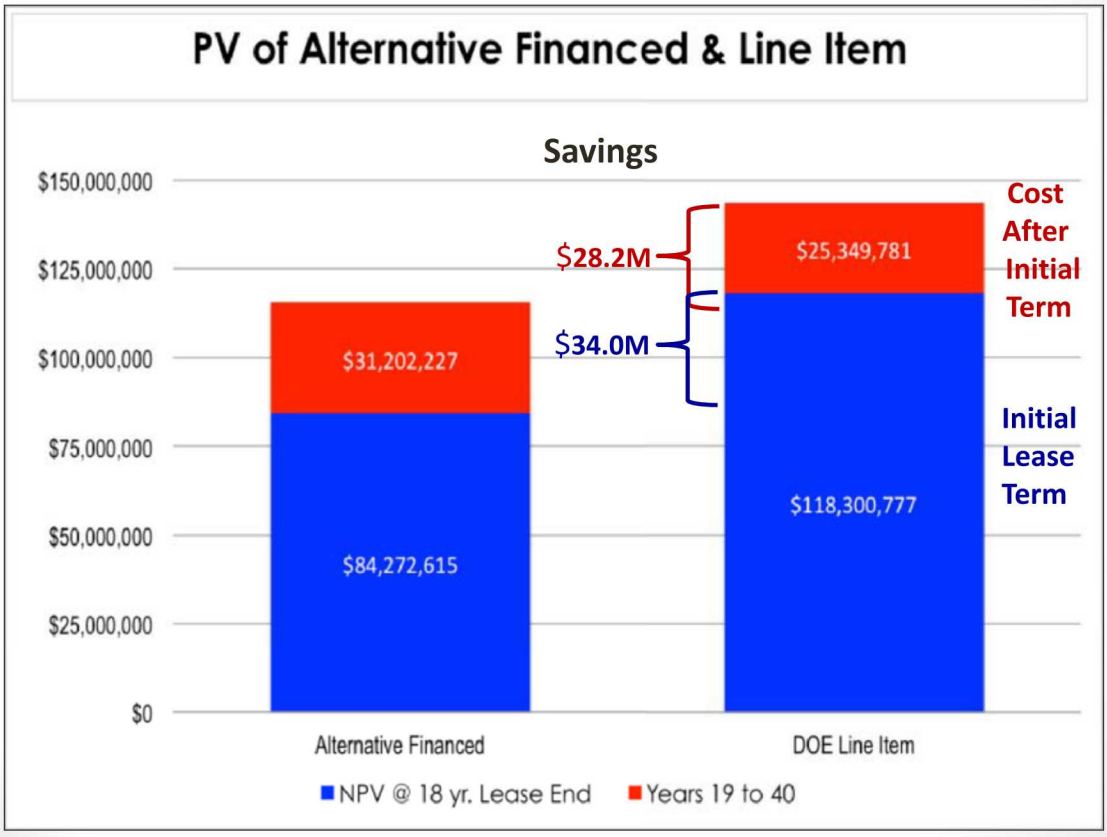
Disadvantages:

- Lengthy approval process
- Additional borrowing to cover financing cost during construction
- Interest on financing, insurance and land rent increase cost

TCS Life Cycle Cost Comparison



TCS Present Value



TCS Conclusions

- How did TCS compare to a more traditional line-item over the long term based upon Life Cycle Cost (LCC)?
  - TCS delivered at a lower life cycle cost compared to equivalent line item offering overall best value to the government
    - More rapid and less expensive construction
    - Lower cost operational expenses/practices
    - Savings from commercial construction and operating practices exceed incremental cost of borrowing/transaction on NPV basis
    - Capital repairs handled through major maintenance reserve in rent avoiding deferred maintenance deficit
- Did TCS meet or exceed the parameters approved by DOE and in compliance with OMB A-11 criteria?
  - Met or exceeded all mission performance parameters
  - More flexible approach than a line item as DOE can terminate with one-year penalty if mission need evaporates

AF Facilities Review

SUMMARY

Consolidated Answers to Key Questions
(all 4 case studies)

- How does the AF facility compare to a line-item over the full Life Cycle Cost (LCC) of the facility?
  - Analysis demonstrates AF delivered on mission quicker and cheaper over the full lifecycle of the facility than a comparable line item
- Did the AF facility meet the mission requirements within the parameters approved by DOE and in compliance with OMB A-11 criteria?
  - In all cases, met or exceed mission parameters approved by DOE; on time and on schedule while complying with OMB A-11 criteria
- Did the facilities represent the best value to the government, and if so, what best practices can be extracted from the case studies?
  - In all cases the AF approach offered the best value
  - The flexibility inherent in an AF deal provides unique value to the government over a line item
  - Several common practices existed for a "Good Deal" (see next slide)

Key Attributes of a "Good Deal"

1) Use a builder that makes money on construction not on operation/leasing to minimize ongoing profit motive (e.g., rent based on debt service)

2) Leverage commercial practices for both construction and operation

3) Obtain cost effective financing – keep spread between A-94 discount rate and borrowing rate to 2% or less

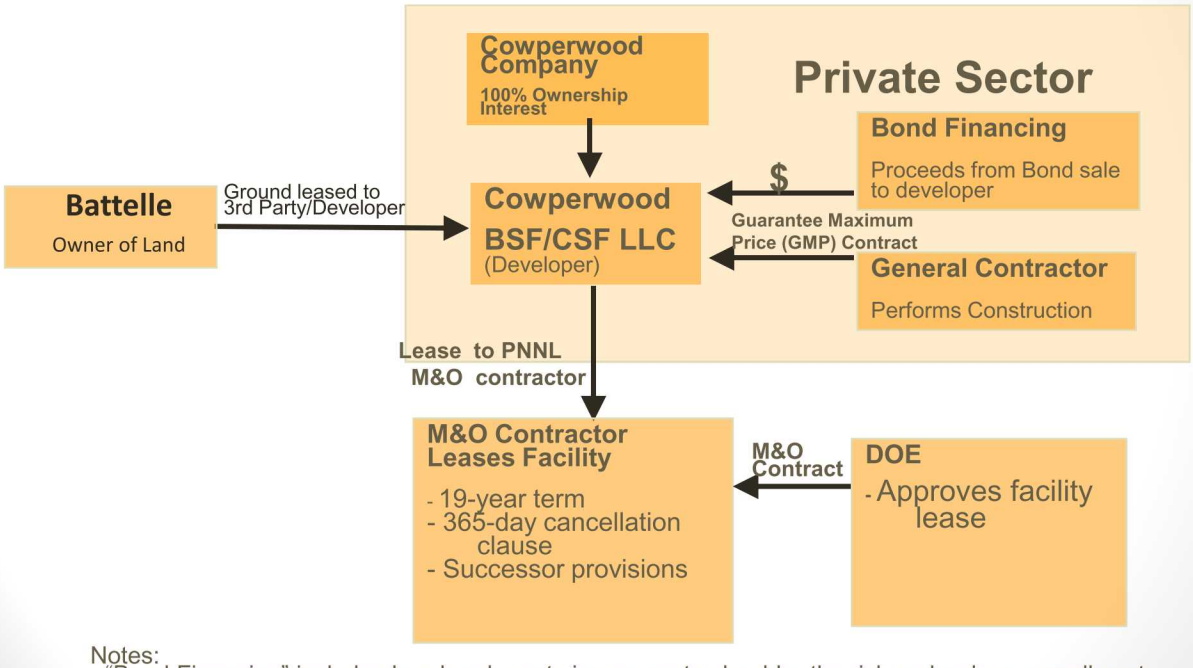
4) Ensure DOE obtains rent free use of facility shortly after the underlying debt is retired

AF Conclusions from this Analysis

- Alt Financing, if well structured, can meet mission needs faster and at a lower lifecycle cost than a line item
  - Not for all facility needs, just a select few with commercial attributes
  - Can be executed in less than half the lead time of a line item
  - Lower cost of construction and operation more than offset financing cost
- Provides DOE and the Laboratory flexibility with minimal commitment
  - If mission need evaporates lease ends (AF vastly more advantageous)
  - No cleanup or demolition liability
  - Builder assumes construction risk, bond holders assume financial risk
  - Major maintenance reserve minimizes deferred maintenance (included in rent for AF but absent from line item lifecycle cost)
- Better cost allocation - to all clients via overhead
  - Affordability in lab overhead is a constraint
- Financing community requires "good deal" structure (e.g., S&P A+ rating) for cost effective financing

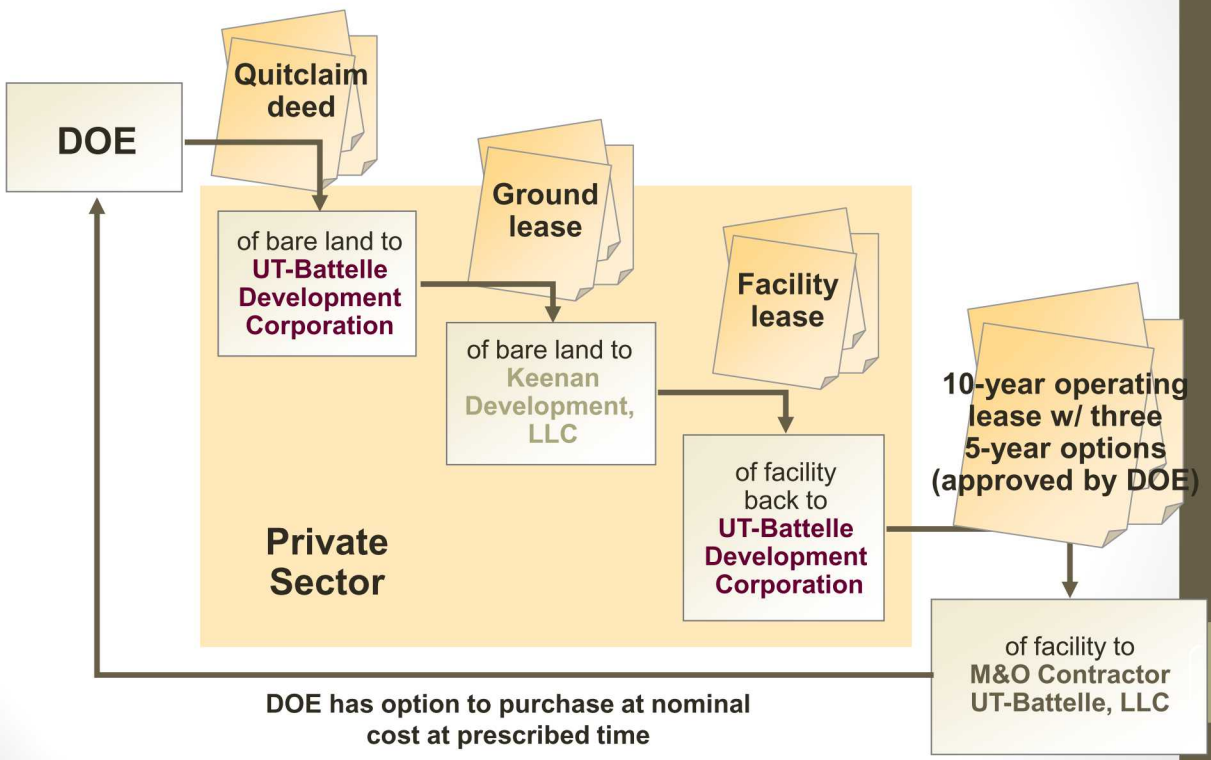
Backup Slides

PNNL BSF/CSF Transaction Structure

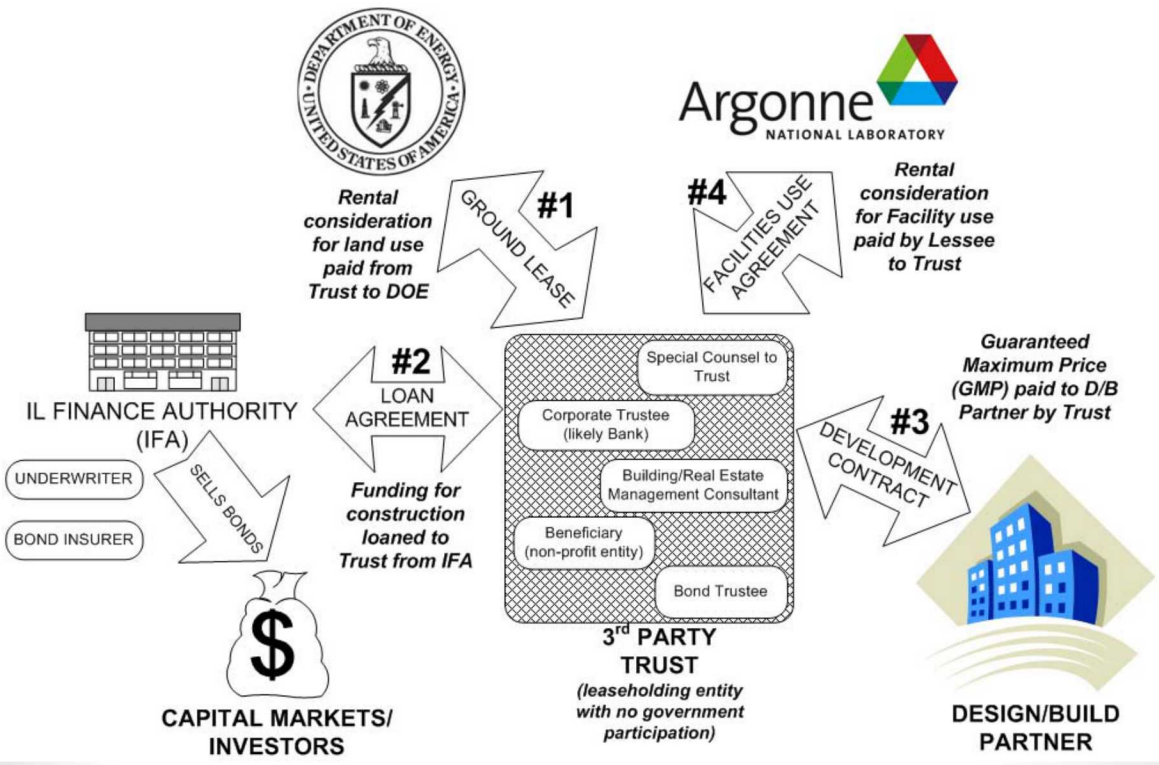


Notes:
• "Bond Financing" includes bond and surety insurance to shoulder the risk and reduce overall costs

ORNL MRF Transaction Structure



ANL TCS Transaction Structure



APPENDIX C: CO-LOCATION REFERENCES

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APPENDIX D: CREATE STATEMENT OF WORK AND SPACE PROGRAM

1.0 PROJECT STATEMENT

The proposed CREATE facility is to be located in The Livermore Valley Open Campus (LVOC) which is a joint initiative between Lawrence Livermore National Laboratory (LLNL) and Sandia National Laboratories (SNL) initiated by NNSA to promote greater collaboration between the world-class scientists at the nuclear security labs and their partners in industry and academia. LVOC leverages and facilitates ready access to the expertise and capital investments already made by NNSA and DOE Office of Science while providing a dynamic and exciting work environment for scientists and engineers. LVOC is located on DOE property managed by SNL and LLNL, which is the General Access Area (GAA). In September 2010, the Livermore Valley Open Campus Development Options Report was submitted to DOE, describing proposed LVOC development options and the Campus Development Master Plan.

At the California campus of SNL (SNL/CA), SNL is growing unclassified, collaborative programs in hydrogen science and technology, cybersecurity, and advanced manufacturing. At the same time, growth in the classified program requires additional space to execute the core mission. An opportunity exists to simultaneously meet these programmatic needs while also enhancing the security profile of the SNL/CA site through a more efficient configuration. Sandia proposes the CREATE facility to support customer-driven national security mission requirements while demonstrating a fiscally responsible approach to cost control. Because a cost analysis showed that alternative finance offered the best value to government, SNL/CA will be pursuing an alternative finance path to meet the needs of CREATE.

Goals of the CREATE facility include the following:

- Enable rapid progress in interdisciplinary research and interaction among national lab scientists, industry partners and academia
- Broaden the intellectual scope of research activities to advance the nation's science
- Provide the infrastructure to house collaborative work space
- Enhance synergy among university, public sector, and industry scientists by co-locating within a common work environment
- Provide an environment to attract the brightest, most creative students, postdoctoral researchers, and visiting scientists to study and do their research
- Act as a catalyst for spin-off activities and technology transfer and as a stimulus for hosting industry partnerships

The developer of this project shall provide all design, engineering, management, and construction expertise necessary to deliver a fully functioning "Class A" facility as described herein. Coordination of the facility systems with equipment supplied by the end user is critical to making the facility fully operational at the time of commissioning. All facility systems shall be tested and commissioned in accordance with ASHRAE commissioning standards. Descriptions are limited to essential requirements. However the developer is encouraged and expected to offer creative and cost-effective solutions. The selected developer will be required to conform to this Statement of Work (SOW). Although exceptions to these requirements may be permitted and even encouraged if they offer additional benefit, any exceptions must be noted in proposals and agreed to in writing.

1.1 INTRODUCTION

The proposed new CREATE facility for SNL/CA is intended to better support the mission and changing needs of the organization by providing a quality working environment that enhances collaboration between the technical staff of the laboratory and academic and private industry partners. The components to be housed in the proposed facility require approximately 86,000 gross square feet ANSI/BOMA to accommodate approximately 150 employees and 50 visitors. Specific square footage requirements are addressed in the CREATE Program Summary table in Table D1.

CREATE is to be a state-of-the-art facility. It will be an environmentally sustainable project and will incorporate sustainable and green features throughout the design, construction, and occupancy phases of the project. Specific sustainability requirements are detailed in this document. The base building infrastructure will be capable of supporting current and future needs of the tenant and will be designed and laid out in such a way as to readily facilitate changes in organization and mission or customer needs. The facility will enhance the quality of life of the occupants and visitors by providing access to natural light and views, a healthy work environment, and a modern office and laboratory environment.

The interior design of the new facility will include numerous “best practice” workplace solutions currently implemented in public and private sector buildings. Some of these innovations include open plan work, universal planning, increased allocations of teaming and meeting spaces, and multiuse spaces.

The tenant intends to use the facility primarily as office and light laboratory space with shared support. Generally, the facility will be configured with an open plan layout with limited enclosed office and support space incorporated throughout the facility. Support spaces include shared conference rooms, copy/work rooms, and coffee bars. Workspace standards have been developed for the organization and are shown in the programming section.

CREATE will also house campus-wide amenities such as Employee Health & Wellness program, training/conference center and technical information media center. The amenities should be easily accessible to all SNL/CA employees, preferably on the first level of the facility.

1.2 SUSTAINABLE DESIGN AND DEVELOPMENT CONSIDERATIONS

Designing, constructing, and operating facilities in an efficient and environmentally sound manner is important to SNL/CA. Sustainable design and development is intended to minimize site disturbance, optimize energy and water use, provide good indoor environmental quality, ensure use of environmentally preferable building products, and enable handling of construction and demolition waste in a resource-conserving manner. The CREATE facility should provide a healthful, resource-efficient, and productive working environment. To achieve these design goals requires an awareness of and a commitment to sustainable design through an integrated, whole-site and whole-building design and development approach. The developer is encouraged to suggest other measures and develop integrated solutions to meet the intent of a sustainable design for the CREATE facility.

The developer is required to design and construct a building that will meet and or exceed the 2013 Energy Provisions of the California Green Building Standards Code, Part 11 of the California Building Code (also known as CALGreen).

It is a strong desire to make this facility as energy efficient and environmentally responsible as allowable by the budget. Innovative design strategies should be considered, such as heat recovery from exhaust systems, solar panels to supplement domestic hot water production, energy recovery ventilation units (ERVs) for outside air tempering, and use of renewable energy sources.

Compliance with the California 2008 Energy Efficiency Standards for Residential and Non-Residential Building is required.

1.3 Facility Access and Physical Security

There are two basic requirements for CREATE:

- Provide ease of accessibility to the main conferencing areas for meetings without requiring SNL/CA security badges
- Maintain a secure perimeter for "suites" within CREATE

The interior of the CREATE facility will have both restricted and non-restricted areas. Access to the restricted areas inside CREATE will be permitted only to those holding security badges.

The existing parking area in the GAA east of the proposed CREATE site will provide parking for CREATE occupants, as well as SNL/CA employees who have access to the Limited and Property Protected Areas. In the absence of other developer-proposed mitigating site measures, vehicular traffic and parking should be 100 feet from the building.

1.4 Project Completion and Contract Closeout

Contract closeout submittals shall be in an electronic format that is compatible with the systems used initially to create the contract documents. These submittals are as follows:

1. Record documents/drawings
2. Operation and maintenance data/manuals
3. Guarantees/warranties
4. Listing of spare parts and maintenance materials
5. Evidence of compliance with the requirements of governing authorities
6. Special closeout submittals
7. Evidence of compliance with all City of Livermore development requirements

1.5 Program Overview

The program for CREATE incorporates spaces suitable for a 21st century collaborative work space, research, and development environment. The facility should be similar to a world-class academic, industrial or government laboratory having similar requirements.

CREATE will provide space for unclassified collaborative programs in hydrogen science and technology, cyber-security and advanced manufacturing. This facility will be located outside the controlled area of SNL to foster collaboration with industry partners and academia. In addition to providing space for technical work and collaboration several Mission Support activities are planned to relocate to this facility. Moving these functions out of the secured area allows repurposing of the vacated space to support the growth in the classified program which requires additional space to execute their core mission. Other amenities will also be located in this facility, including an employee wellness area, technical information media center, and conference/training center. Grouping these functions together will provide a central hub of activity for the campus. Table D1 below summarizes the number of staff, the square footage required, and the desired floor location.

Table D1. CREATE Program summary

Program area	Staff	Gross ft^2	Required floor
1. Research and development areas			
Translation biomedicine	9	4,640	3rd
Hydrogen program + engineering sciences	56	12,670	
Engineering sciences & manufacturing environments	5	7,970	
Cybersecurity	15	4,250	
R&D collaboration zones	0	11,000	
R&D total	**85**	**40,530**	
2. Relocated mission support			
Visitor badging and entry	6	6,130	1st
Public relations / media relations / outreach	5	1,820	
Human resources	26	6,636	1st
Procurement	10	2,114	
Technology transfer	15	3,280	
Technical information media center	3	6,440	
Mission support total	**68**	**26,420**	
3. Campus amenities and support areas			
Reconfigurable training/conference center	0	13,340	1st
Misc. building support	0	5,320	1st
Amenities and support total	**0**	**18,660**	
Totals	**150**	**85,610**	

The facility is intended to support the goals established for the project:

- Enable rapid progress in interdisciplinary research and interaction among national lab scientists, industry partners, and academia
- Broaden the intellectual scope of research activities to advance the nation's science
- Provide the infrastructure to house collaborative work space
- Enhance synergy among university, public sector, and industry scientists by co-locating within a common work environment
- Provide an environment to attract the brightest, most creative students, postdoctoral researchers, and visiting scientists to study and do their research
- Act as a catalyst for spin-off activities and technology transfer and as a stimulus for hosting industry partnerships

1.5.1 Research and Development

The research and development (R&D) space will be a mix of individual workspace, collaboration space, and light laboratory space. Workspace is focused on a more open environment with few enclosed offices and touchdown space for visitors and Sandia staff who have their individual workspace in the secured area and are working with industry partners and academia.

The R&D space will incorporate low-hazard, flexible, and sub-dividable laboratory spaces with significant electrical and data wiring requirements. Labs will include two BSL1 labs equipped with fume hoods and separate exhaust. These labs should accommodate reconfiguration and multiple uses and should be located in reasonable proximity to teams working on related projects.

Shared support spaces will be distributed throughout the facility for use by the different R&D disciplines in the facility.

1.5.2 Relocated Mission Support

This space will house mission support site functions relocated from other areas of the campus. With the exception of the Badge Office, these groups require typical open office environment with few enclosed offices and touchdown space for visitors and storage specific to the group. These groups will also share support spaces similar to R&D.

The Badge Office will be accessible to the public, either from the building lobby or directly from the exterior. This space will be large enough to accommodate multiple visitors at any given time. The space will have a fixed counter for visitor and employee badging process, including photography. The workspace will have a direct view of the counter. Separate restrooms are to be included in this area.

The technical information media center will be highly visible and will include the existing collection and reference resources for the use of SNL/CA staff and academic and industry partner researchers. Ad hoc team rooms will also be provided for teams to schedule for short term projects. The administrative/back-room processing area will house three staff members.

1.5.3 Campus Amenities & Building Support

Training/Conference Center

These spaces provide a combination of conference and training rooms with built-in infrastructure to support remote group-to-group interactions and other technologies suitable for distance conferencing, meetings, education, and large group collaboration. The spaces will be reconfigurable to accommodate many different types of events and interactions.

Miscellaneous Building Support

The programmed spaces indicated above are exclusive of additional customary, but typically required, spaces in a facility of this scale. Subject to approval, the sizing, quantities, and placement of the following additional expected spaces and any other areas seen as required or desirable by the developer are left to the designer's discretion.

- Small conference rooms
- Medium conference rooms
- Copy/coffee/work areas
- Lactation room
- Employee health & wellness
- Kitchen area
- Elevators
- Restrooms/shower room
- Mechanical equipment
- Electrical equipment
- Telecom/LAN closets
- Maintenance storage
- Janitor's storage
- Corridors/stairs
- Receiving area

1.6 CODES, STANDARDS, AND PERMITTING

The Facility shall be treated as a "Class A" commercial project and shall be designed with an expected life span of 35–50 years. Factory Mutual standards shall be incorporated. The developer shall file and acquire all permit documents required for the City of Livermore. The primary building codes and standards for this project at SNL/CA are:

- 2013 California Building Code (Based on the 2009 International Building Code)
- 2013 California Fire Code (Based on the 2009 International Fire Code)
- 2013 California Plumbing Code (Based on the 2009 Uniform Plumbing Code)
- 2013 California Mechanical Code (Based on the 2009 Uniform Mechanical Code)
- 2013 California Electrical Code (Based on the 2011 National Electrical Code)
- 2013 Building Energy Efficiency Standards (Title-24)
- Accessibility requirements in compliance with Chapter 11B of the 2013 CBC
- CALGreen Code
- City of Livermore Development Code
- The Energy forms required at time of permit submittal
- City of Livermore Environmental Standards that require laboratory drain lines to be separate from other building sanitary system piping and collected to a common point outside the facility
- Plan review fees, which are the responsibility of the developer
- Livermore-Pleasanton Building Department and Fire Department Plan review

2.0 PROJECT SITE ENVIRONMENT AND UTILITIES

2.1 SITE

The intended CREATE building site is due east of the SNL/CA Limited Area and due south of the Combustion Research Facility inside LVOC on a four-acre site.

2.1.1 Geotechnical

No geotechnical investigation has been conducted in this specific site.

The developer shall retain the services of a geotechnical consultant to perform an appropriate number of borings and produce a geotechnical report. The report is to contain boring logs, site plan, description of soils, and water table location. Recommendations on foundation design, including seismic site class, allowable bearing pressures, bearing elevations, anticipated settlement, and lateral earth pressure, shall be included.

2.1.2 Survey

Developer shall retain the services of a registered Land Surveyor to prepare a survey of the proposed site. The survey shall include grades, site boundary lines, location of existing structures, paving and improvements, and location of trees, natural and man-made objects, and utilities. Utility information shall include location, size, and depth of water, gas, sewer systems (including laboratory waste, storm and sanitary), central steam, fire hydrants, central chilled water, and power and communications systems, and all associated easements.

2.1.3 Environmental Evaluation

DOE and SNL/CA must comply with the requirements of the National Environmental Policy Act (NEPA). SNL will be responsible for reporting NEPA. The developer shall be responsible for compliance with CEQA and other state and local regulations (10CFR 1021 and 40 CFR 150-1508).

2.1.4 Topography/Storm Drainage/Detention

Compliance includes wetland and storm water management (including parking lot runoff), a Storm Water Pollution Prevention Plan (SWPPP), including an Erosion and Sedimentation Control Plan, and agreement with SNL/CA regarding the changes of storm water runoff flow onto their property from this site. Grading and drainage plans will require review and approval of the state of California. Calculations regarding storm water rates and volumes, retained, detained, and discharged must be prepared and submitted by the developer for review and approval by all applicable authorities. For more information please refer to 2.1.5.E.

The CREATE site is very gently sloped (approximately 1% to 2%) from the southeast to the northwest. It is recommended that the Facility footprint be located to minimize drainage issues. The natural storm drainage will be to the east from the Facility. There are no known wetland areas near the proposed CREATE Site.

2.1.5 Utilities

The developer will be responsible for all required utility service infrastructure for the CREATE facility, including coordination with existing utilities, and appropriate isolation, according to applicable standards. All necessary electric, telecommunications (voice and data), water, sewerage and natural gas will be available at the project boundary.

The preferred site selected (Site A) for the CREATE project on the Sandia/CA campus is the former location of three office facilities that were demolished prior to 2009. The utility systems & capacities that served these former facilities were capped underground on the 3.8 acre preferred site. As the actual configuration and location of the CREATE facility within the preferred site is unknown at this time, the specific utility modifications and/or interferences needed are not possible to determine. However, assumptions were made regarding the utility infrastructure based on the conceptual planning and allowances for utility connections were included in the cost estimates.

All utility systems to the CREATE facility would be supplied by current Sandia/CA campus systems. Conceptual design efforts have determined that the capacities available at the preferred site, including the electrical distribution system, are sufficient for the CREATE facility needs without system upgrades.

Per current local and National Code requirements and sustainability guidance, water, gas, electrical and sewer systems would be metered and/or monitored. System meters would provide Sandia the actual usage information needed to charge back for utilities in the event that Sandia is no longer the sole tenant of the facility.

2.1.5A Domestic Water and Sewer

Water (for both domestic use and fire protection) and sanitary sewer for the project will be available at the project boundary in streets adjacent to the site. The developer shall be responsible for applicable fees (such as impact fees, tap fees, etc.) as well as for construction of all new on-site lines required to serve the building and any required fire hydrants.

2.1.5B Telecommunications/Cable Infrastructure

The CREATE facility telecommunication system shall originate from SNL telecommunication infrastructure, and the conduit infrastructure will be available at the project boundary.

The developer will provide appropriate conduit pathways from the building to the Sandia infrastructure for copper conductors and fiber cable to provide telecommunications and data to the building. The conduit pathways shall include manholes and concrete-encased conduits to the SNL-designated location as needed.

2.1.5C Electrical Service

The existing 13.8kV medium voltage distribution system shall be utilized for the primary power to the facility and will be available at the project boundary. The projected electrical demand for this facility shall be approximately 750 kVA to 1200 kVA. The developer shall perform electrical calculations per the National Electrical Code (NEC), using energy usage criteria form California Title 24 and ASHRE 90.1 to determine the exact demand load for the building. The developer's calculation shall utilize the information presented in this document concerning the program and projected usage of the building plus 20% spare capacity. The developer shall provide a medium voltage switch capable of two incoming circuits and two outgoing feeders. The medium voltage (13.8 kV) to low voltage (480V) transformer shall be oil filled or dry type, cast coil transformer sized for the load of the building plus 20% spare capacity. The location of the building main transformer shall be coordinated with the owner's site. The location shall meet the requirements of NEC and Factory Mutual.

2.1.5D Site Lighting

The site lighting shall comply with California Title 24 energy code for the light intensity, distribution, and control. The lighting shall provide safe passageway to and from the building for the occupants but shall not provide light pollution to the surrounding areas. The light fixtures shall be LED type for pole-mounted and building-mounted lighting.

2.1.5E Storm Sewer Service

Compliance with the State of California Storm Water Management laws and regulations will be required. The developer shall be responsible for the development and implementation of a Storm Water Pollution Prevention Plan and securing a Construction Activities Storm Water General Permit (2009-0009-DWQ, or most current version) from the State of California. Sandia staff may assist in facilitating the land owner signatures as needed and provide necessary site information for the permit submission.

Section 438 of the Energy Independence and Security Act (EISA 438) requires that federal agencies "use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the pre development hydrology of the property." The methodology and execution is the responsibility of the developer. The EPA issued Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act on December 4, 2009. That document is available at http://www.epa.gov/oaintrnt/documents/epa_swm_guidance.pdf

2.1.6 Traffic

During construction it is anticipated that construction vehicle access will be via East Ave/Thunderbird Ln. Any easements for site access during construction will be negotiated with SNL/CA during the design phase. The developer's Lay-Down will be within the area dedicated for CREATE.

2.1.7 Parking

There is a large existing, publicly accessible parking lot directly adjacent to the site to be developed for CREATE. The project must comply with Livermore Development Code, Section 4.04 / Parking. However it is assumed that the existing parking area is sufficient in capacity to provide parking for CREATE occupants and SNL/CA employees. Parking areas shall include a visitor drop off area and provide bicycle spaces and other possible modifications as prescribed by the Livermore Development Code.

2.1.8 Landscaping

The developer will comply with Livermore Development Code, Section 4.05 for landscaping requirements and to Municipal Code 13.25 Water Efficient Landscape Ordinance. The developer shall provide parking, walks, grading, detention, site utilities, lighting, and other hardscape and landscaping. Site lighting shall be designed to minimize visual impact beyond the site property line. Landscaping should be appropriate for the Facility and site design. To the greatest extent possible, landscape plantings shall utilize native and hardy plant species enhancing the visual character of the Facility and extend the architectural concept into the surrounding environment.

Within the limits of the site, the developer will restore all disturbed areas with landscaping materials, hardscape or parking areas. This outdoor space shall include planting, shading, hardscape, trash receptacles, and furnishing for outdoor dining.

3.0 SITE ANALYSIS

Three possible site locations for the CREATE facility were evaluated. Each site was located in lands designated for LVOC on the East side of the SNL/CA campus and south of the existing Combustion Research Facility complex. See the attached site map for the three locations considered. Site evaluation criteria were developed to “score” each site, described below, to select the preferred site.

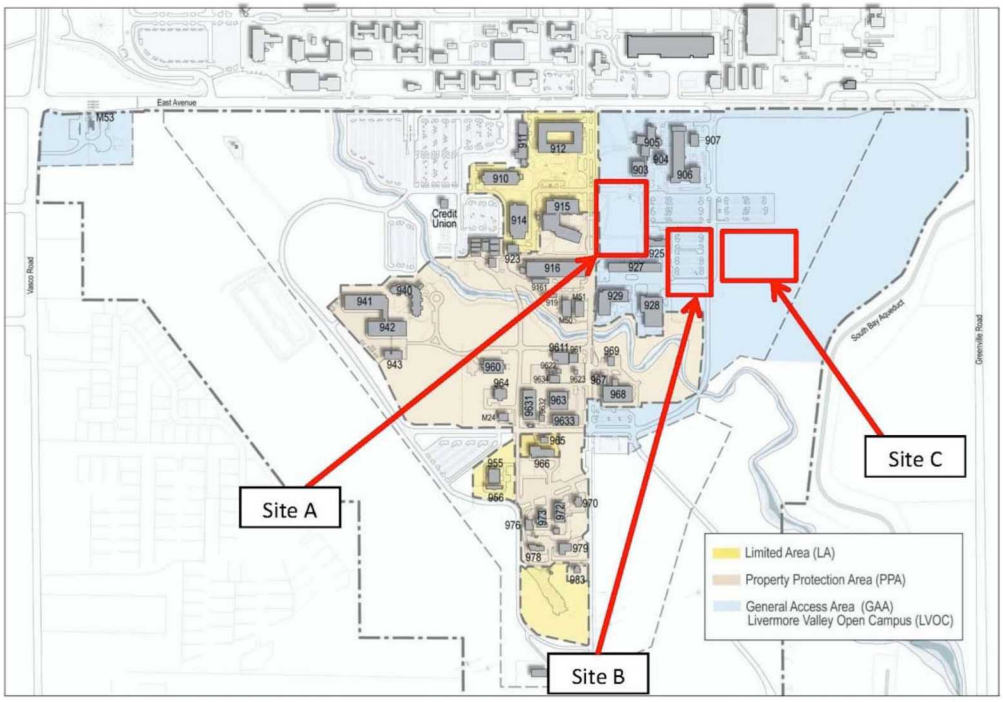

Figure D1. Proposed CREATE site locations

Table D2. CREATE—site evaluation criteria

	Site location and size	Max points	Site A	Site B	Site C	Notes
1.0	**Site location and size**	**85**	**75**	**66**	**60**	
1.1	Site is sufficient in area to accommodate planned uses	10	10	10	10	
1.2	Site is located to facilitate maximum number of users inside PPA	25	25	15	10	
1.3	Site is highly visible and accessible to internal users	10	10	8	5	
1.4	Site is highly visible and accessible to external users	10	5	8	10	
1.5	Site conforms to LVOC master plan	15	15	15	10	LVOC MP envisions first phase for Site A
1.6	Site affords developer solution options/flexibility	15	10	10	15	Site C allows bigger foot print could go 2-story-most flexible
2.0	**Site Services**	**60**	**40**	**25**	**40**	
2.1	Site location requires little to no extension of utilities	20	20	15	10	Major utility extensions required for Site C
2.2	Site location minimizes replacement of existing site amenities	20	10	10	15	Site C scores highest because it preserves all current assets.
2.3	Minimizes impacts on current farmers' market	10	0	0	5	Sites A would require relocation of the farmer's market
2.4	Minimizes removal and replacement of existing parking lots	10	10	0	10	Site B would require major parking lot improvements
3.0	**Sustainability**	**30**	**25**	**25**	**25**	
3.1	Site affords best building solar orientation	15	10	10	15	Site A & B might require an "L" shaped building footprint
3.2	Site provides opportunities for swales and water conservation	15	15	15	10	Site C requires greater disturbance of existing parking areas
4.0	**Attractiveness to "third party lessor"**	**55**	**35**	**40**	**40**	
4.1	Site provides easy access for "third party" exit strategy	15	5	10	10	Site C scores highest because it is the least integrated into the site
4.2	Site is integrated into SNL-CA site assets and access to user tenants	15	15	10	5	
4.3	Risk to Security Operation	25	15	20	25	Based on site proximity to the limited area
5.0	**Attractiveness to SNL/CA for achieving operation/site goals**	**60**	**60**	**45**	**30**	
5.1	Easily accessible for maximum use by PPA occupants	15	15	10	5	
5.2	Easily accessible for maximum use by CRF private and public sector users	15	15	10	5	
5.3	Meets goal of providing integrated SNL/CA and private sector interface	15	15	10	5	
5.4	Site creates a corporate "front door" for SNL/CA	15	15	15	15	
Site totals		**290**	**235**	**201**	**195**	
		100%	**81%**	**69%**	**67%**	

APPENDIX E: OFFSITE LEASE ECONOMIC ANALYSIS

As presented in Sections 3 and 8, the mission need analysis of the offsite lease option proved unfavorable. Nonetheless, for completeness, a financial evaluation of the onsite (alternative finance) and offsite lease options was performed by comparing the effective lease rates the laboratory would incur for both alternatives. The evaluation of the offsite option examined two types of leases: build-to-suit and existing facilities.

BUILD-TO-SUIT LEASE

For a build-to-suit offsite option, assuming the same transaction model, the cost basis is similar to the onsite alternative finance scenario with some notable additions. The TPC for the building itself is invariant to the site within the region. Operational costs for the onsite and offsite alternatives would be identical, except that utilities would be more expensive offsite due to the lack of favorable rates available onsite.

Additional costs may also be incurred in areas such as taxes, ground lease rates, and permitting and fees. For example, utility connection and traffic impact fees that are likely to be waived for the onsite approach because of existing infrastructure would apply for an offsite build-to-suit project. Estimates for these fees alone exceed $1 million for a single project. In addition, unlike onsite where available parking already exists, a parcel of land at least twice the proposed size would be required to accommodate parking requirements to meet code, increasing ground lease costs as well as adding to the project construction costs.

Thus, as additional costs would be incurred, there is no economic advantage to an offsite build-to-suit lease compared to alternative financing. Compounded with the clear mission disadvantage of an offsite lease, as discussed in the body of this document, this option is a poor value to the government and is not recommended.

LEASE OF AN EXISTING FACILITY

A market survey identified The Vineyard complex in Livermore as the nearest existing facility that could meet the facility space requirements. Like all available space in Livermore, this is a Class B facility with a configuration that does not meet the space program and facility requirements derived from the mission needs. Significant tenant improvements would be required to renovate the complex to meet these needs. As an example, Cornerstone Inc., the commercial construction cost estimating firm, provided an estimate of $14.4M for CREATE tenant improvements. This estimate was based on the same functional requirements used for the line item and alternative finance construction estimates for CREATE, and the estimate serves as a proxy for renovating this type of space to meet the mission requirements of the laboratories.

The resulting estimated offsite lease rate was provided by Colliers Parrish International Inc., an active commercial real estate brokerage organization in Livermore, and was based upon detailed requirement definitions and likely facility lease terms as well as the estimated renovation costs from Cornerstone. The base building lease rate is quoted to be $12/ft^2/yr with annual increases of 2.5%, a standard commercial practice with longer duration lease terms. Operating expenses are quoted as an additional $12/ft^2/yr. The tenant improvements would add an additional $18.58/ft^2/yr. The total full service lease cost at the start of the term is quoted to be $42.58/ft^2/yr.

This value greatly exceeds the equivalent estimated onsite lease rate—which includes a gross lease rate of $30.54/ft^2/yr from Section 4.3, a utility rate $1.33/ft^2/yr, and $1.33/ft^2/yr of financed tenant improvements—to bring the equitable comparison rate to $33.20/ft^2/yr.

With an initial cost increase of 28%, as well a greater anticipated escalation rate over the term of the lease, the offsite lease of an existing facility is a poor value to the government compared to the onsite alternative finance option. Further, with the specific facility lease terms and conditions such as the 365-day cancellation provision, Colliers did not believe that an existing facility owner would be willing to take the financial risk of making the required tenant improvements without further guarantees that neither the lab nor the government is able to make. Combined with the inability to meet mission need, this alternative is not recommended.

Similar results are expected from an analysis of the HPCIC facility. Therefore, given the mission advantage of the alternative finance facility siting, coupled with the economic advantage over both offsite lease options, alternative financing prevails as the best value option to the government.

APPENDIX F: NNSA INTEGRATED PRIORITY LIST OF CAPITAL CONSTRUCTION PROJECTS

June 2013 | Department of Energy

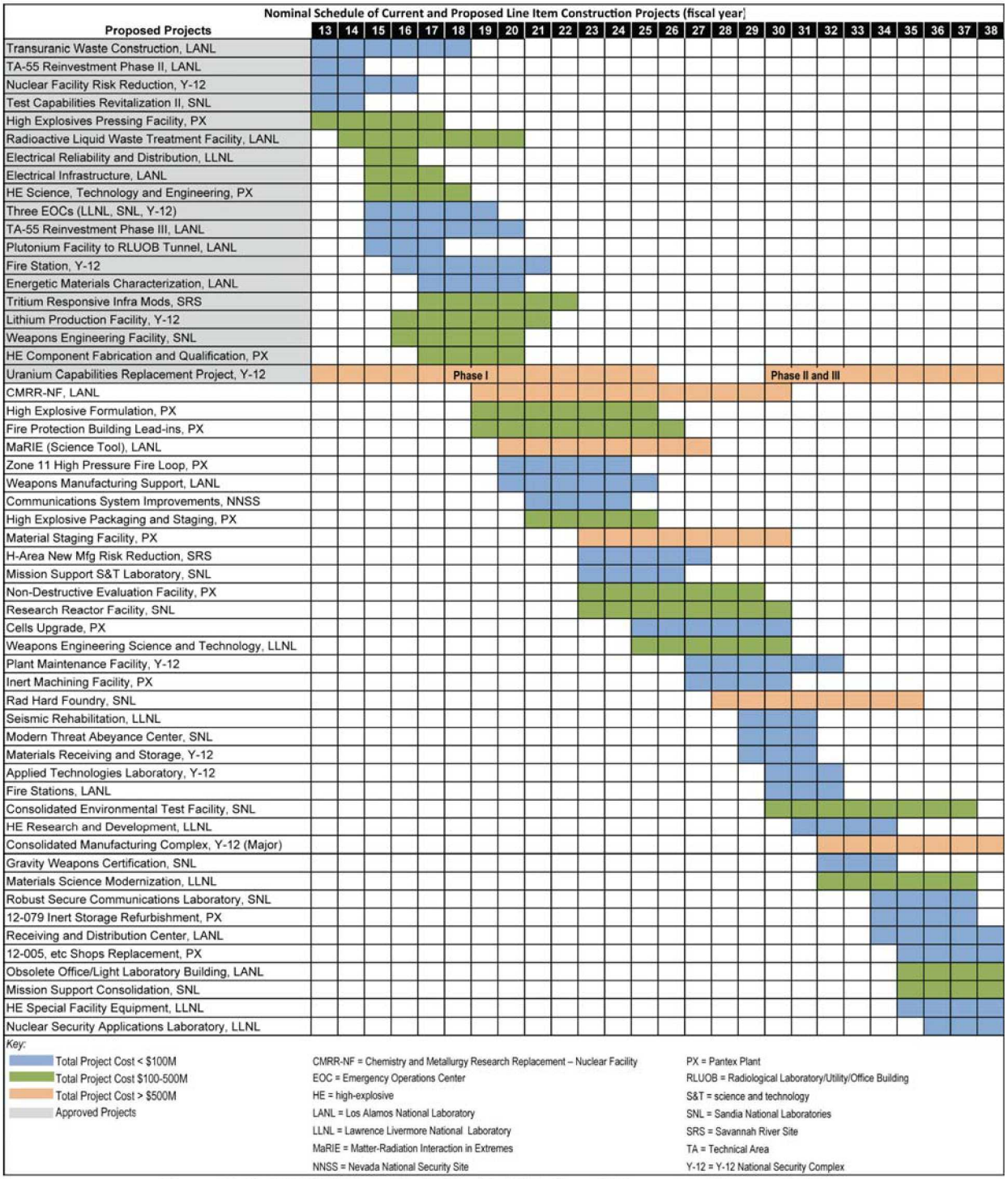

Figure 5–2. NNSA Integrated Priority List of capital construction projects

APPENDIX G: MAJOR APPLICABLE CONDITIONS

ENVIRONMENTAL, REGULATORY, AND POLITICAL SENSITIVITIES

Sandia and LLNL operations, whether onsite or offsite, comply with all applicable federal, state, and local laws and regulations. Consistent with the current practice, Sandia and LLNL would conduct a National Environmental Policy Act (NEPA) review for CREATE and HPCIC (regardless of acquisition approach selected) to help DOE evaluate proposed actions for potential environmental concerns. Possible outcomes of the NEPA review are 1) verification that the potential effects to environmental resource areas from construction and operation remain within the scope of existing NEPA documentation; 2) determination that the facility can be categorically excluded from further NEPA review and documentation; or 3) determination that additional NEPA analysis is needed through an Environmental Assessment or Environmental Impact Statement.

In general, construction within Sandia's established campus and the construction zone set-aside located on the northeast corner of the SNL/CA site was examined through a site-wide NEPA effort undertaken in 2003 and re-evaluated in 2012. Construction within LLNL's established campus was examined through a site-wide NEPA effort undertaken in 2005 and re-evaluated in 2011. In these broad NEPA reviews, no significant environmental impacts resulting from construction projects were identified that would preclude the construction of new facilities at Sandia or LLNL.

Environmental review requirements of the California Environmental Quality Act (CEQA) may also apply to the offsite lease option or the alternative finance option. The NEPA documentation for CREATE and HPCIC would provide information to support the CEQA effort, if needed.

Sandia completed an environmental baseline survey of the CREATE onsite location to identify and document current environmental conditions of the proposed site. Survey results indicate no known or undisclosed environmental concerns associated with the proposed onsite location and that no further environmental assessment is needed. A similar survey may also be required if an offsite location is selected for CREATE.

No special legal issues are expected if these facilities located within the premises of the LVOC site and if funded as DOE line items. However, if an offsite lease option or alternative finance option were selected, the acquisition strategy would be coordinated with NNSA, DOE, and other federal agencies, as needed.

An LVOC Market and Development Feasibility Study (November 2010) indicated strong support for the LVOC initiative in the Tri-Valley region (Pleasanton, Dublin, San Ramon, and Livermore). As noted in this study:

> *Tri-Valley industry groups and government representatives are focused on economic development, and collaboration with the National Labs is viewed as a critical ingredient to success. The market-driven evolution of a Tri-Valley technology/R&D sector is being strongly supported by economic development efforts at a number of levels. Each of the Tri-Valley cities is focused on both direct business attraction efforts, but also on strong investments in their amenities and quality of life to attract the skilled workforce. Innovation Tri-Valley is a business-led effort to study and grow the Tri-Valley economy. The City of Livermore, in particular, is working closely with the National Lab cluster (LLNL/SNL) to catalyze industry attraction and incubate development to support both the Labs' missions as well as the City's and region's broader economic development goals.*

CREATE and HPCIC are expected to contribute to these regional goals under any of the proposed acquisition options evaluated.

SAFETY AND SECURITY CONSIDERATIONS

The envisioned CREATE and HPCIC facilities are not expected to include or impose any undue hazards that will change the safety envelope for either Sandia or LLNL. At these labs, facilities and operations are classified as low-hazard nonnuclear—a term applied to facilities or project activities that have the potential for minor onsite impacts (within the boundaries of the labs' controlled areas) and negligible offsite impacts (outside the boundaries of lab-controlled areas) to people or the environment. Operations within CREATE and HPCIC are expected to meet this hazard class designation under all alternatives.

No special safety issues are expected if the CREATE and HPCIC facilities are constructed within LVOC and funded as DOE line items. However, if the offsite lease or alternative finance options are selected, standard safety requirements relevant to commercial construction would apply. Additionally, under a lease strategy (onsite or offsite), the facility owner/operator would be expected to define, document, and meet all applicable safety requirements.

No safeguards and security issues exist that would preclude the acquisition of new facilities. SNL/CA and LLNL security requirements would apply to lab operations, regardless of location. For onsite options, activities conducted within LVOC would follow the current General Access Area Security Plan. If the alternative finance option is selected, Sandia and LLNL would conduct a security review to identify and mitigate any potential impacts on core lab operations. Likewise, the labs would conduct a security review if the offsite option is selected and develop a security plan to address security considerations relevant to the offsite location. Under a lease strategy (onsite or offsite) the facility owner/operator would be expected to define, document, and meet all applicable security requirements.

INFRASTRUCTURE AND SITE PLANNING

Locating CREATE within LVOC is consistent with the Sandia's institutional *Ten-Year Site Plan*, which references *SNL/CA Site Development Plan*. Similarly, LLNL's *Ten-Year Site Plan* also provides for HPCIC to be located within LVOC. The proposed CREATE and HPCIC facilities are also aligned with the *Livermore Valley Open Campus Master Plan* within the *Development Options Report*, and the *Market and Development Feasibility Report*, developed by Sandia and LLNL. Locating CREATE and HPCIC offsite would not be consistent with these plans and reports acknowledged by NNSA.

Under all acquisition alternatives, the technical risks associated with CREATE and HPCIC are low, and there are no known operational or infrastructure constraints that cannot be addressed responsibly and economically. Onsite and offsite locations are accessible from existing roadways and provide sufficient parking to support management and operation of the facility. Consistent with standard practice, the CREATE and HPCIC facilities will meet all applicable accessibility standards and codes.

SNL and LLNL will comply with all applicable federal space requirements that are appropriate for acquisition of CREATE and HPCIC at the time the acquisition or construction occurs.

APPENDIX H: DETAILED CONSTRUCTION ESTIMATE COMPARISONS

Table H1. Total project cost estimate comparison for CREATE construction

Project activity	New building gross area (ft²): 85,610			
	Project costs			
	Line item construction		Alternative finance	
	$	$/GSF	$	$/GSF
Design				
A/E design	$2,010,161	$23.48	—	—
Design phase management	$817,082	$9.54	—	—
Preliminary and final design	—	—	$1,245,553	$14.55
Subtotal design costs	**$2,827,244**	**$33.02**	**$1,245,553**	**$14.55**
Design phase escalation	$311,832	$3.64	$78,751	$0.92
Total design costs	**$3,139,076**	**$36.67**	**$1,324,304**	**$15.47**
Hard construction				
Demolition	—	—	—	—
Construction	$22,387,941	$261.51	$16,607,375	$193.99
Subtotal hard construction costs	**$22,387,941**	**$261.51**	**$16,607,375**	**$193.99**
Soft construction				
Construction process	$485,054	$5.67	—	—
Construction phase management	$255,489	$2.98	—	—
D/B general conditions	$1,505,062	$17.58	$830,369	$9.70
D/B contingency	—	—	$1,215,048	$14.19
Subcontractor default insurance	—	—	$249,111	$2.91
D/B GLU insurance	—	—	$176,869	$2.07
Builder's risk insurance	—	—	$17,864	$0.21
D/B performance bond	$717,915	$8.39	$178,816	$2.09
D/B overhead and fee	$2,127,155	$24.85	$758,537	$8.86
Permit fees	—	—	$406,272	$4.75
Subtotal soft construction costs	**$5,090,674**	**$59.46**	**$3,832,886**	**$44.77**
Construction phase escalation	$4,114,648	$48.06	$1,457,956	$17.03
Laboratory construction burdens	$2,007,751	$23.45	—	—
Total GMP costs	**$36,740,090**	**$429.16**	**$23,222,521**	**$271.26**
Other project costs				
Conceptual design	$193,707	$2.26	—	—
Documentation	$43,883	$0.51	—	—
Support	$141,984	$1.66	—	—
Tenant improvements	$2,696,430	$31.50	$1,591,815	$18.59
Development oversight	—	—	$540,000	$6.31
Subtotal other project costs	**$3,076,005**	**$35.93**	**$2,131,815**	**$24.90**
Escalation for other project costs	$449,715	$5.25	$161,667	$1.89
Contingency	$4,832,026	$56.44	$1,215,048	$14.19
Total project costs	**$45,097,836**	**$526.78**	**$26,731,051**	**$312.24**

Table H2. Total project cost estimate comparison for HPCIC construction

Project activity	DOE line item				Alternative finance	
	Renovation (97,500 ft^2)		New facility (97,583 ft^2)		New facility (97,583 ft^2)	
	$	$/GSF	$	$/GSF	$	$/GSF
Design						
A/E design	$4,119,588	$42.25	$3,246,972	$33.27	—	—
Preliminary and final design	—	—	—	—	$1,162,341	$11.915
Design support	$472,740	$4.85	$433,152	$4.44	—	—
Subtotal design costs	**$4,592,328**	**$47.10**	**$3,680,124**	**$37.71**	**$1,162,341**	**$11.91**
Design phase escalation	$488,164	$5.01	$391,197	$4.01	$66,616	$0.68
Total design costs	**$5,080,492**	**$52.11**	**$4,071,321**	**$41.72**	**$1,228,957**	**$12.59**
Hard construction						
Demolition	$533,672	$5.47	—	—	—	—
Construction	$28,450,978	$291.80	$22,677,838	$232.40	$19,679,591	$201.67
Subtotal hard construction costs	**$28,984,650**	**$297.28**	**$22,677,838**	**$232.40**	**$19,679,591**	**$201.67**
Soft construction						
D/B general conditions	$1,739,079	$17.84	$1,360,671	$13.94	$983,980	$10.08
Subcontractor default insurance	$434,770	$4.46	$360,578	$3.70	$295,194	$3.03
D/B GLU risk insurance	—	—	—	—	$209,588	$2.15
Builders risk insurance	—	—	—	—	$21,168	$0.22
D/B performance bond	$289,846	$2.97	$243,991	$2.50	$211,895	$2.17
D/B contingency	—	—	—	—	$1,070,071	$10.97
D/B overhead and fee	$2,318,771	$23.78	$1,971,447	$20.20	$898,859	$9.21
Construction support	$2,773,339	$28.44	$1,998,089	$20.48	—	—
Subtotal soft construction costs	**$7,555,805**	**$77.50**	**$5,934,776**	**$60.82**	**$3,690,755**	**$37.82**
Construction phase escalation	$5,612,614	$57.57	$4,165,997	$42.69	$1,658,370	$16.99
Permit fees	—	—	—	—	$481,429	$4.93
Total GMP cost	**$47,233,561**	**$484.45**	**$36,849,932**	**$377.63**	**$26,739,103**	**$274.01**
Other project costs						
Development oversight	—	—	—	—	$540,000	$5.53
Relocations / accommodations	$446,097	$4.58	—	—	—	—
ES&H	$253,253	$2.60	$133,073	$1.39	—	—
Support	$155,329	$1.59	$176,987	$1.81	—	—
Owner contingency	$7,225,236	$74.10	$4,462,354	$45.73	$1,285,761	$13.18
Subtotal other project costs	**$8,079,915**	**$82.87**	**$4,772,414**	**$48.91**	**$1,825,761**	**$18.71**
Escalation for other project costs	$79,998	$0.82	$26,293	$0.27	$129,557	$1.33
Total other project costs	**$8,159,913**	**$83.69**	**$4,798,707**	**$49.18**	**$1,955,318**	**$20.04**
Total project cost	**$55,393,474**	**$568.14**	**$41,648,639**	**$426.80**	**$28,694,421**	**$294.05**

APPENDIX I: PRIVATE SECTOR MARKET ANALYSIS

Because an alternative finance project is a private sector undertaking that must have a market in the broader private sector, market analysis and substantiation is required to assure that the OMB A-11 Appendix B operating lease criteria are fully met. The following presents the findings of that analysis.

Research data available through Cushman & Wakefield* and Colliers International† was analyzed to evaluate whether a private market potentially exists for the proposed CREATE and HPCIC facilities. Research included similar Class A facilities within the Livermore Tri-Valley and Oakland areas.

Current market conditions are characterized in recent reports from Cushman & Wakefield and Colliers International as follows:

- Buoyed by the strength of the rest of the Bay Area, the East Bay's economy continues to improve.
- Many of the suburban submarkets are reaping the benefits of an expanding economy, with continued tenant migration to Class A space over the last thirty- six months.
- Tri-Valley Class A office market weighted average asking rates remained steady at $2.34 per square foot from $2.35 per square foot in the previous quarter.

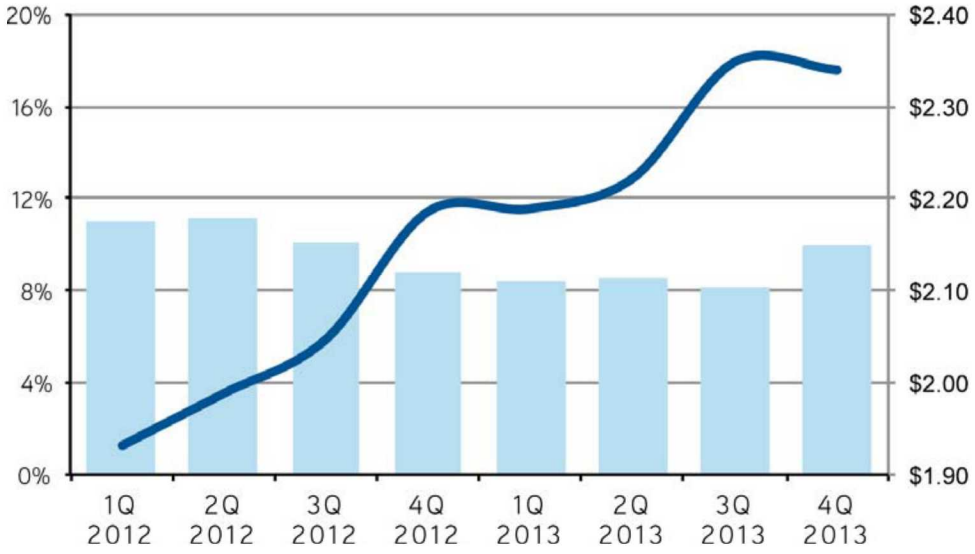

Figure I1. Tri-Valley Class A historical vacancy and average asking rates

The estimated annual gross lease rate for CREATE is $30.54 per square foot, and the estimated annual gross lease rate for HPCIC is $30.26.

According to Colliers, the Q4 2013 market for Class A facilities in the Tri-Valley area reported market gross lease rates of over $28/ft^2/yr. Similarly, Cushman & Wakefield reports Tri-Valley Class A lease rates of $28/ft^2/yr as of Q3 2013.

The analysis thus concludes that the local market for Class A space is strong and that the estimated (equivalent) lease rate for CREATE and HPCIC is competitive with private sector market conditions.

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* MarketBeat Office Snapshot: Oakland, CA, Q3 2013, Cushman & Wakefield.

† Research & Forecast Report: Pleasanton | Alameda County, California, Q4 2013, Colliers International.

PLEASANTON | ALAMEDA COUNTY, CALIFORNIA

RESEARCH & FORECAST REPORT

Colliers INTERNATIONAL

MARKET INDICATORS

	Q4-13	Projected Q1-14
VACANCY	↑	↓
NET ABSORPTION	↓	↑
CONSTRUCTION	↔	↔
RENTAL RATE	↑	↔

SELECTED MARKET STATS

- Tri-Valley office market vacancy rose from a fourth quarter 2012 vacancy rate of 11.0 percent to close the year at 11.9 percent.
- Overall net absorption was negative 169,073 square feet
- Market weighted average asking rates rose to $1.93 per square foot full service from $1.88 per square foot full service three months prior.
- Current Unemployment Rates as of November 2013*
  California: 8.3 percent
  Alameda County: 6.8 percent

**SOURCE: CALIFORNIA EMPLOYMENT DEVELOPMENT DEPARTMENT*

Office Market Review

A GOOD YEAR?

The fourth quarter of 2013 quietly concluded a stable but unremarkable year. The numbers show mixed results whereby some sectors of the market had a "good year" in the face of contrary overall market statistics.

Nationally we celebrate the stock market, lower unemployment and economic growth projected to continue for the next two years. Inflation remains benign and the Fed's tapering of its monthly bond purchases marks an improving economy where despite this they will continue their low interest rate policy into the near future. In late summer the fear of Fed tapering scared the markets while today the Fed's action is being viewed as good news – interesting? The Dow Jones industrial average ended at an all-time high for the 52nd time this year. The S&P 500 also ended at a record high. The Dow was up 26 percent and the S&P 500 gained more than 29 percent. The Nasdaq surged nearly 40 percent. National unemployment has dropped to nearly 7 percent and the U.S. economy grew at an incredible 4.1 percent annual rate in the third quarter with projected growth of 2.8 to 3.2 percent in 2014 according to Chairman of the Federal Reserve, Ben Bernanke in his December 18, 2013 year end address.

2013 Tri-Valley office market vacancy rose from a fourth quarter 2012 vacancy rate of 11.0 percent to close the year at 11.9 percent. Net absorption for the year was a negative 169,073 square feet compared to a positive 1,062,291 square feet in 2012. Fourth quarter Class A negative absorption of 266,975 square feet was largely due to AT&T's departure from California Center in Pleasanton where 242,263 square feet was vacated in December. This erased the modest positive year-to-date net absorption that existed prior to the fourth quarter.

TRI-VALLEY CLASS A
HISTORICAL VACANCY AND AVERAGE ASKING RATES

Tenant migration to Class A space over the last thirty-six months has resulted in significant rent deltas between the two product types' weighted average asking rents.This growing delta is currently at $0.71 up from last year when this delta was $0.58 and up from three years ago when it was compressed to just $0.23.

"The expectations for the Tri-Valley are for a continued steady deal flow, decreased vacancy and continued rising rental rates."

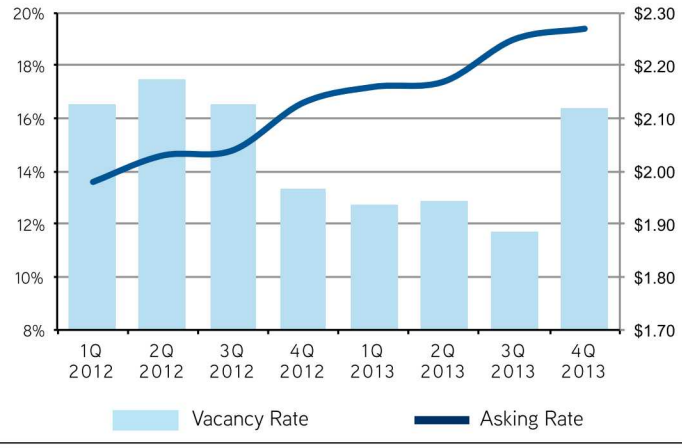
Market rents across all sectors rose from average weighted asking rents of $1.82 per square foot full service in the fourth quarter of 2012 to $1.93 per square foot full service at year end 2013.

The Tri-Valley office market statistics do little in qualifying 2013 as a "good year" with negative net absorption and a higher overall vacancy rate. However, if you owned Class A multi-tenant office with vacant suites 10,000 square feet and less – you potentially had a "good year". If you owned the same vacancies in Class B office your view may be waxing positive as this sector of the market benefits from tight vacancy and high rents in the Class A sector and seems poised for continued success in early 2014. If your 2013 vacancy position consisted of large blocks (20,000+ square feet) of either Class A or B office space you are left wondering when this size user will materialize. The often offered notion that Silicon Valley and San Francisco users will relocate to the Tri-Valley seeking rent relief from those hot markets did not materialize in 2013. Could it happen this year?

PLEASANTON

The fourth quarter 2013 saw weighted average asking rents up-tick $0.02 per square foot to $2.27 per square foot full service from the previous quarter and on the year up a healthy $0.14 per square foot. As previously referenced, this year-over-year success was driven by leasing in the Class A multi-tenant projects who leased their vacancies of 10,000 square feet and less. This success is difficult to quantify when year-end Pleasanton Class A market vacancy at 16.4 percent is up three points from 2012 vacancy at 13.4 percent. However, if one is to consider, for example, a hypothetical requirement today for 2,500 - 3,500 square feet of demised Class A office space in Pleasanton, the search will show two options for approximately 2,500 square feet and four options around 3,500 square feet. Roll back the clock one year and your search/tour would have included ten plus options at each footage. The enigma in the results (rents up/vacancy also up) lies in the large blocks of Class A vacancy at California Center that awaits that elusive large user potentially relocating from Silicon Valley or San Francisco.

PLEASANTON CLASS A
HISTORICAL VACANCY AND AVERAGE ASKING RATES



The Pleasanton Class A vacancy drops from 16.4 percent to 4.67 percent if you remove the approximate 675,000 square feet that is currently being marketed as available in that project.

The Pleasanton Class A vacancy drops from 16.4 percent to 4.67 percent if you remove the approximate 675,000 square feet that is currently being marketed as available in that project. 2014 will bring more vacancy to California Center when Ross Stores vacates 180,931 square feet in the summer relocating to their Dublin Campus (formerly known as Emerald Point). Notably in the fourth quarter, Specialty's Café, relocated their corporate headquarters from San Francisco, leasing 14,607 square feet of Class A office on the second floor of Patelco Corporate Center (5050 Hopyard, Pleasanton). 5860 Owens Drive (92,738 square feet, four story Class A office - owned by State Compensation Fund) is in escrow due to close January 2014 to John Muir who will convert this office building at Pleasanton BART to MOB (medical office building). The conversion will include construction of a parking structure necessary to deliver the parking ratio needed for medical users.

Blackberry is rumored to be circling for approximately 20,000 square feet in Bernal Corporate Park and Veeva, Inc. is looking in the market for 80,000 to 100,000 square feet in the Tri-Valley as expansion/relocation space to their current 35,000 square feet at Chabot Center. On the investment side, California Center (1M+ square feet of Class A office on 61.0 acres in Pleasanton owned by RREEF/Deutsche bank) may be on the market in the first quarter of 2014.

Class B weighted average asking rents jumped another $0.08 per square foot (matching the increase from the second quarter to the third quarter) in the fourth quarter to $1.91 per square foot full service and up on the year $0.20 per square foot. Vacancy fell in the quarter 2.0 percentage points from 12.9 percent in the third quarter to finish the year at 10.9 percent, down 2.5 percentage points on the year. The 55,404 square feet absorbed in the quarter was comprised of deals 5,000 square feet and less and further evidences the success in smaller multi-tenant projects. Uneka Concepts, Inc. relocated from Livermore landing in 4,250 square feet at 328 St. Mary Street in downtown Pleasanton.

The office/flex market in Pleasanton continues to heat up but statistically will suffer for the second quarter in a row due to Nearon Enterprises rolling out 241,213 square feet as available on the former Clorox Campus. Rumors have two large users circling this entire campus but as they roll out the new vacancies they will apparently consider one-off deals.

Weighted average asking rents (adjusted to full service) stood at $1.69 per square foot up from $1.62 in the third quarter and up from $1.51 in the fourth quarter 2012. Absorption on the year was a negative 133,162 square feet due to the newly added vacancy at the former Clorox campus. Western Devcon completed the acquisition of 6880 Koll Center Parkway in the quarter and thus consummated the long since executed lease with the Drug Enforcement Agency (DEA) for the entirety of the 42,828 square foot flex building. Interson Corporation closed on 7150 Koll Center Parkway (17,900 square foot office/flex building) with Garnet Bear LP as seller in this user sale.

LIVERMORE

Livermore's office and office/flex market made good progress in the final quarter of 2013, as vacancy decreased from 19.4 percent to 16.7 percent (still the highest in the Tri-Valley) and more than 76,000 square feet of space leased over the quarter. Major deals included Livermore's Aero Precision's relocation to 291 Lindbergh Avenue (43,844 square feet; previously occupied by RhUSA); Ms. Carita renewing their lease at 2159 Research Avenue for 19,764 square feet; ProctorU expanding and relocating from Sunset Business Park in Livermore to North Canyons Business Center (10,310 square feet). Livermore's office and office/flex buildings still only make up about 10 percent of the Tri-Valley's inventory, but with available land for development in both west and east Livermore, this percentage could increase in the foreseeable future.

DUBLIN

Class A Dublin remained unchanged in the fourth quarter 2013 with weighted average asking rents in-line with the third quarter at $2.42 per square foot full service and up from the fourth quarter 2012 by $0.21 per square foot from $2.21 per square foot. Absorption on the quarter was 1,733 square feet and negative 63,615 square feet on the year.

Class B Dublin (total inventory 409,543 square feet) finished the year with weighted average asking rents of $1.57 per square foot full service up from fourth quarter 2012 when the weighted average asking rents were $1.49 per square foot full service. Absorption on the year was negative at 17,915 square feet. This sector could lose approximately 100,000 plus square feet this year if Heritage Office Park is demolished for residential as planned.

SIGNIFICANT DEALS

SALE ACTIVITY

PROPERTY ADDRESS	SALE DATE	SQUARE FEET	BUYER	TYPE
4550 & 4600 Norris Canyon Road	Dec-13	193,510	Cannae Partners	Office/Flex
6880 Koll Center Parkway	Nov-13	42,828	Western Devcon Inc	Office/Flex
7150 Koll Center Parkway	Oct-13	17,900	Interson Corporation	Office/Flex

LEASE ACTIVITY

PROPERTY ADDRESS	LEASE DATE	SQUARE FEET	TENANT	TYPE
201 Lindgergh Avenue	Dec-13	43,844	Aero Precision Industries Inc	R&D/Flex
12939-12959 Alcosta Boulevard	Nov-13	20,600	San Ramon Presbyterian Church*	Office/Flex
2155-2159 Research Drive	Nov-13	19,764	Ms Carita Inc*	R&D/Flex
5050 Hopyard Road	Oct-13	14,607	Specialty's Café and Bakery	Class A
3083 Independence Drive	Nov-13	10,310	ProctorU Inc	R&D/Flex

*Renewal

MARKET COMPARISONS

OFFICE MARKET

TYPE	BLDGS	TOTAL INVENTORY SF	DIRECT VACANT SF	DIRECT VACANCY RATE	SUBLEASE VACANT SF	SUBLEASE VACANCY RATE	TOTAL VACANT SF	VACANCY RATE CURRENT QUARTER	VACANCY RATE PRIOR QUARTER	OCCUPIED SPACE SF	NET ABSORPTION CURRENT QTR SF	NET ABSORPTION YTD SF	GROSS ABSORPTION YTD SF	COMPLETIONS CURRENT QTR	UNDER CONST SF	WEIGHTED AVG ASKING RENTAL RATE FSG
DUBLIN																
A	9	1,488,260	56,953	3.8%	87,584	0	144,537	9.7%	9.8%	1,343,723	1,733	(63,615)	11,706	-	-	$2.42
B	15	409,543	137,794	33.6%	-	0.0%	137,794	33.6%	33.6%	271,749	(55)	(17,915)	22,223	-	-	$1.57
Flex	24	869,016	102,260	11.8%	-	0.0%	102,260	11.8%	11.1%	766,756	(6,121)	(13,881)	47,353	-	-	$1.46
Total	48	2,766,819	297,007	10.7%	87,584	3.2%	384,591	13.9%	13.7%	2,382,228	(4,443)	(95,411)	81,282	-	-	$1.70
LIVERMORE																
B	23	833,964	214,941	25.8%	-	0.0%	214,941	25.8%	26.0%	619,023	2,209	37,141	51,403	-	-	$1.33
Flex	70	2,043,065	265,397	13.0%	-	0.0%	265,397	13.0%	16.6%	1,777,668	74,190	31,879	150,740	-	-	$1.38
Total	93	2,877,029	480,338	16.7%	-	0.0%	480,338	16.7%	19.4%	2,396,691	76,399	69,020	202,143	-	-	$1.36
PLEASANTON																
A	47	6,181,887	964,825	15.6%	47,684	0.8%	1,012,509	16.4%	11.7%	5,169,378	(289,829)	(185,530)	278,658	-	-	$2.27
B	69	2,813,976	302,674	10.8%	4,996	0.2%	307,670	10.9%	12.9%	2,506,306	55,404	69,991	200,309	-	-	$1.91
Flex	97	3,551,924	578,064	16.3%	-	0.0%	578,064	16.3%	10.1%	2,973,860	(144,633)	(133,162)	209,753	-	-	$1.69
Total	213	12,547,787	1,845,563	14.7%	52,680	0.4%	1,898,243	15.1%	11.5%	10,649,544	(379,058)	(248,701)	688,720	-	-	$2.03
SAN RAMON																
A	31	7,564,037	326,674	4.3%	25,441	0.3%	352,115	4.7%	4.9%	7,211,922	21,121	87,245	299,023	-	-	$2.53
B	28	1,041,781	73,355	7.0%	4,812	0.5%	78,167	7.5%	7.4%	963,614	(1,043)	4,464	67,923	-	-	$1.77
Flex	9	705,668	77,386	11.0%	-	0.0%	77,386	11.0%	11.0%	628,282	-	14,310	1,170	-	-	$1.45
Total	68	9,311,486	477,415	5.1%	30,253	0.3%	507,668	5.5%	5.7%	8,803,818	20,078	106,019	368,116	-	-	$2.24
MARKET TOTAL																
A	87	15,234,184	1,348,452	8.9%	160,709	1.1%	1,509,161	9.9%	8.2%	13,725,023	(266,975)	(161,900)	589,387	-	-	$2.34
B	135	5,099,264	728,764	14.3%	9,808	0.2%	738,572	14.5%	15.6%	4,360,692	56,515	93,681	341,858	-	-	$1.66
Flex	200	7,169,673	1,023,107	14.3%	-	0.0%	1,023,107	14.3%	12.2%	6,146,566	(76,564)	(100,854)	409,016	-	-	$1.57
Total	422	27,503,121	3,100,323	11.3%	170,517	0.6%	3,270,840	11.9%	10.6%	24,232,281	(287,024)	(169,073)	1,340,261	-	-	$1.93

QUARTERLY COMPARISON AND TOTALS

Q4-13	422	27,503,121	3,100,323	11.3%	170,517	0.6%	3,270,840	11.9%	10.6%	24,232,281	(287,024)	(169,073)	1,340,261	-	-	$1.93
Q3-13	422	27,421,359	2,706,554	9.9%	195,500	0.7%	2,902,054	10.6%	10.7%	24,519,305	25,273	117,951	1,038,135	-	-	$1.88
Q2-13	422	27,421,359	2,732,166	10.0%	195,161	0.7%	2,927,327	10.7%	10.9%	24,494,032	74,563	92,678	802,642	-	-	$1.83
Q1-13	422	27,421,359	2,819,555	10.3%	182,335	0.7%	3,001,890	10.9%	11.0%	24,419,469	18,115	18,115	424,682	-	-	$1.80
Q4-12	421	27,419,621	2,854,512	10.4%	165,493	0.6%	3,020,005	11.0%	13.0%	24,399,616	611,747	1,062,291	2,605,185	64,474	-	$1.82

*Note: The weighted average asking rates for office/flex is converted to a full service equivalent

HACIENDA WEST

A Class A Office Project in Pleasanton where the vacancy rate has dropped significantly from 23.3 percent in 2012 to 16.6 percent in 2013.

SAN RAMON

Fourth quarter 2013 stats for San Ramon Class A were relatively static with weighted average asking rents holding steady from the third quarter at $2.53 per square foot full service and up from $2.27 per square foot full service in the fourth quarter 2012, a significant $0.26 gain with Bishop Ranch Class A asking rents the driver. Absorption for the quarter was 21,121 square feet putting the annual total of Class A San Ramon office absorption at 87,245 square feet.

Class B weighted average asking rents closed the year at $1.77 per square foot full service flat from the third quarter and up $0.10 on the year. Net absorption for the year was a paltry 4,464 square feet and vacancy closed the year at 7.5 percent down from fourth quarter 2012 vacancy at 7.9 percent. This one million square foot sector of the market with total vacancy at 78,167 square feet is expected to tighten as users look for rent relief from the tight Class A sector.

Bishop Ranch (Sunset Investment Company) with capital partner Met Life is poised to close on AT&T Corporate Center in January 2014. The rumored plans are for 500,000 square feet of AT&T give-back space to be marketed initially. Bishop Ranch will market the project as a corporate destination and potentially add conference facilities and service retail (coffee, café, sundries) within the facility. They will be busy this year as they will likely commence construction on the long planned City Center project that will entail demolition of Bishop Ranch 2 to build high end retail, a hotel and residential. Norris Tech Center 4550-4600 Norris Canyon Road (193,510 square feet in total) traded in the fourth quarter with Cannae Partners as buyer and AEW/ZKS as seller. The third building in the project (67,350 square feet) had previously sold to Kaiser in 2011. Rumored pricing on the sale was $83 per square foot.

LOOKING FORWARD

The Tri-Valley will look to local user expansions and hope for large user migration into this market to drive the next round of rental increases and decreased vacancies. Locally, Ellie Mae may resurface this year and add to their existing 65,000 square foot market footprint with potential expansion to 100,000 square feet. Newly public Veeva, Inc., as previously indicated, is touring the Tri-Valley for 80,000 to 100,000 square feet. Workday's expansion needs will continue to unfold into Stoneridge Corporate Plaza. Safeway may be back out for their relocation from the Shadelands to the Tri-Valley in a combination relocation-expansion into this market as they reshuffle their footprints to accommodate Blackhawk Networks growth needs at Pleasanton Corporate Commons.

These requirements aside, migration from outside the market will be needed to solve what will be roughly 850,000 square feet of vacancy by summer 2014 at California Center, 108,000 square feet of Oracle sublease space at Dublin Corporate Center and the anticpated 500,000 square feet that will come on-line at AT&T Corporate Center when Bishop Ranch commences marketing that vacancy in the near future. Class B Tri-Valley office will continue to improve with asking rents expected to reach $2.00 per square foot full service by the end of the first quarter. Minimal vacancy in the multi-tenant Class A sector will continue to tighten and push rental rates. The office/flex sector will gain momentum in smaller suites and look for local expansion and new users to fill the larger holes.

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APPENDIX J: STANDARD & POOR'S RATING REPORT

STANDARD &POOR'S

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March 12, 2012

Criteria | Governments | U.S. Public Finance:

U.S. Federal Future Flow Securitization Methodology

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U.S. Federal Future Flow Securitization Methodology

1. Standard & Poor's Ratings Services is adopting its methodology for rating obligations secured by future U.S. federal cash flows. We are publishing this article to help market participants better understand our approach to reviewing transactions where pledged federal cash flows are derived from the U.S. government or U.S. government-related entities. This article is related our criteria article "Principles of Credit Ratings", published on Feb. 16, 2011.

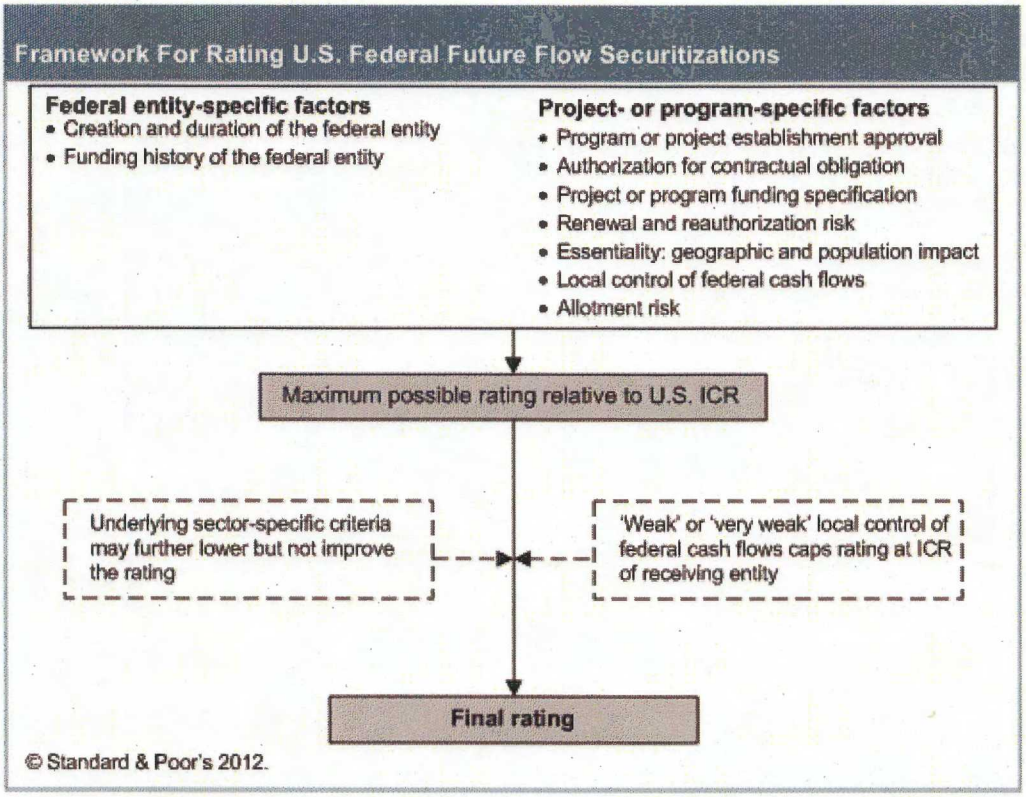
I. SUMMARY OF THE CRITERIA

2. Federal cash flows support various obligations issued in the capital markets. These obligations are neither debt of the U.S. government or U.S. government-related entities. The receipt of such monies depends on statutory formulas or the local fulfillment of program or project requirements. These cash flows support a range of securities, including those issued for the General Services Administration and other federal leases, various Veterans Administration projects, federal highway grant anticipation revenue vehicle (GARVEE) bonds, military housing bonds, and bonds secured by federal impact aid, among others.

3. The criteria provide a consistent framework for determining the maximum possible rating that various types of federal revenue securitizations may obtain. The application of other criteria specific to the related project or program result in the final issue rating (see "Related Criteria and Research" section below). These other criteria address additional risks such as construction risk, debt service coverage, bankruptcy risk, and lease risk that can lower the final rating relative to the maximum possible rating resulting from the criteria.

4. To determine the maximum possible rating, the criteria use the average of nine factors. Two of the factors relate to the specific federal department, agency, committee, or other government-related entity (hereafter called "the federal entity") managing the project or program. The remaining seven factors relate to the specific program or project cash flows. Federal entity-specific factors include the creation and duration of the federal entity and its history of funding by the U.S. government. Program- or cash flow-specific factors include program or project establishment or approval, authorization for contractual obligation, project or program funding specification, renewal and reauthorization risk, geographic concentration and population impact, local control of federal cash flows, and allotment risk. Scores for each factor range from '1' (strong) to '4' (very weak). All factors receive equal weight when they are averaged to determine the overall score, which correlates with rating levels shown in table 1.

5. One condition limits the maximum possible rating to below that suggested by table 1. A local control of federal cash flows score of 'weak' or 'very weak' limits the rating to no higher than the issuer credit rating (ICR) of the local entity receiving the federal monies. The chart summarizes this framework.



II. SCOPE OF THE CRITERIA

6. The criteria apply to all issue ratings on debt secured by future congressional appropriations of cash flows from U.S. government agencies, departments, or related entities. They do not apply to actual debt obligations of the U.S. government, its departments or agencies, or to the debt of any other government-related entity of the U.S. They also do not apply to obligations guaranteed by these entities.

III. CHANGES FROM THE REQUEST FOR COMMENT

7. The final criteria reflect no change in methodology from the request for comment (RFC). A clarification to one of the examples was made resulting from our RFC. The clarification is under the Department of Energy Oak Ridge National Lab Project.

IV. IMPACT ON OUTSTANDING RATINGS

8. The criteria will not result in changes to most related outstanding ratings.

V. EFFECTIVE DATE

9. These criteria are effective immediately for all new and outstanding issue ratings on debt secured by future congressional appropriations of cash flows from U.S. government agencies, departments, or related entities. Reviews of all outstanding transactions will occur within the next six months.

VI. METHODOLOGY

A. Overall Framework For Rating Issues Secured By Federal Cash Flows

10. As an initial step in assigning a rating to various types of federal revenue securitizations, the criteria provide a consistent framework for determining the maximum possible rating. In most cases, project- or program-specific criteria pieces may further lower but not raise the final rating through the assessment of more specific risks such as construction risk, bankruptcy risk, debt service coverage, lease provisions, and other transaction terms (see "Related Criteria and Research" section below).

11. The criteria limit ratings on obligations secured by federal cash flows to below the rating of the U.S. government for two reasons. First, consistent with our public finance criteria for appropriation obligations, the annual appropriation nature of the federal cash flows limit the rating on the federal issue to no higher than one notch below that of the U.S. sovereign rating (see "Appropriation-Backed Obligations", published June 13, 2007). The second reason relates to the securitization of federal revenues which requires the consent of the federal entity as per the Federal Assignment of Claims Act. The rating of the issue can't match or exceed the rating level of the U.S. government without such consent, and such formal consent typically does not exist, thereby preventing the possibility of a true sale opinion.

12. The maximum possible rating level for a federal cash flow-secured obligation will result from an average of nine factors. The first two factors relate to characteristics of the federal entity providing the cash flows. These two factors measure the importance of the federal entity within the structure of the federal government by looking at the creation and duration of the federal entity and its funding history. The remaining seven factors apply to characteristics of the specific project or program cash flows. For each factor, scores range from '1' (strong) to '4' (very weak).

13. All factors receive equal weight when averaged to determine the overall score, which relates to the maximum rating levels shown in table 1. In most cases, the maximum rating level will equal that shown in table 1. If the project or program exhibited clear strengths or weaknesses relative to other projects or programs scored at that level, the maximum possible rating will differ by one notch relative to that shown in table 1 to reflect the identified difference. The criteria round outcomes to the nearest tenth of a decimal point.

14. One condition limits the maximum possible rating to below that suggested by the table 1. A local control of federal cash flows score of 'weak' or 'very weak' limits the rating to no higher than the ICR of the local entity receiving the federal monies.

Table 1

Maximum Possible Rating Level For Federal Cash Flow-Secured Obligations

Overall score	Indicative rating level for federal cash flow issues
1-1.2	1 notch below U.S. ICR
1.3	2 notches below U.S. ICR
1.4-1.5	3 notches below U.S. ICR
1.6-1.8	4 notches below U.S. ICR
1.9-2.2	5 notches below U.S. ICR
2.3-2.4	6 notches below U.S. ICR
2.5-2.6	7 notches below U.S. ICR
2.7-2.9	8 notches below U.S. ICR
3	9 notches below U.S. ICR
3.1-3.4	10 notches below U.S. ICR
3.5-4.0	11 notches below U.S. ICR

The maximum possible rating level will be within one notch of the rating level shown above, with one-notch adjustments resulting from comparisons to projects and programs with the same range of scores. Additional factors may further lower but not raise the final rating relative to the maximum possible levels shown (see paragraphs 10 and 14).

B. Federal Entity--Specific Factors

15. All funding comes from congressional appropriations (federal cash flow), but the importance of the federal entity will affect the cash flow that supports debt service. The nature of the federal entity, the federal entity's time in existence, and the entity's federal cash flow funding history drive our view of this risk. The creation and duration of the federal entity constitute the first score, while federal cash flow funding history constitutes the second.

1. Creation and duration of the federal entity

16. The first federal entity specific factor is the creation and duration of the federal entity. Table 2 details the scoring criteria for this measure.

Table 2

Creation And Duration Of The Federal Entity

1 (Strong)	The federal entity exists as a major department of the federal government or part of a major department. Neither history nor current conditions suggest that the entity could be merged or privatized. For example, military branches that reside under the auspices of the Department of Defense fall under this category.
2 (Moderate)	The federal entity exists for a specific purpose, and merger or envelopment by another federal entity is unlikely. The federal entity stands as an independent agency of the federal government formed through legislation. For example, the Architect of the Capital meets this definition.
3 (Weak)	Congress or the administration recently created or designated the federal entity. The entity has multiple important functions, but has yet to clarify its precise organization and manner of performing these functions.
4 (Very Weak)	Congress or the administration recently created or designated the federal entity. It does not play a major role or could function as an independent private corporation. It has a singular and very specific role. For example, the privatization of mortgage finance could fall into this area, if accomplished.

17. This assessment begins with the legislation which formulated the existence of the federal entity. Factors assessed include when the federal entity was formed, why it was formed, and its purpose and history. To analyze organizational stability, the criteria further consider whether the entity's duties have changed over time and whether the government could easily privatize the entity's functions or move them to another department.

2. Funding history of the federal entity

18. The second federal entity specific factor is the funding history of the federal entity. Table 3 details the scoring criteria for this measure.

Table 3

Funding History	
1 (Strong)	The entity has received stable or growing federal funding for over 30 years, with any downward one-year drops totaling less than 3%.
2 (Moderate)	The entity has received federal funding for at least 20 years and most, if any declines, in annual funding levels have been between 3% and 5%
3 (Weak)	A federal funding history of between five and 20 years exists, or funding has shown a more-than 5% change from year to year.
4 (Very Weak)	The entity has a federal cash flow funding history of less than five years or a limited expected life span.

If expected future trends suggest a weaker score relative to that suggested by historical performance, the funding history score equals the weaker score.

19. At least 10 years of appropriation history to the federal entity provide a basis for a long-term opinion as to where the entity ranks in the overall appropriation of federal funds. In general, the stronger the appropriation history, the greater the likelihood that it will continue. Specifically, the criteria consider the duration and stability of appropriations and their overall growth. Expected future funding trends different from historical performance may weaken but not improve the score.

C. Project Or Program Factors

20. Because the stability or durability of a specific program or project can differ from that of the managing federal entity, the criteria consider project- or program-specific factors, including:

- The nature of the project or program's establishment and approval;
- The authorization for contractual obligation;
- Project or program funding specification;
- Renewal and reauthorization risk;
- Geographic concentration and population impact;
- Local control of federal cash flows (the extent to which the local or regional entity receiving the federal cash flows could use them for purposes other than debt service); and
- Allotment risk, which measures the degree to which the federal cash flow depends on the local entity meeting operating requirements.

1. Program or project establishment and approval

21. The first project or program factor is the program or project establishment and approval. Table 4 details the scoring criteria for this measure.

Table 4

Program Or Project Establishment And Approval	
1 (Strong)	Each of the following conditions exists: The program or project has received approval from the highest level of the federal entity. The Office of Management and Budget (OMB) has also reviewed the program or project and analyzed its costs. Congress, after such review, has approved the project or program by passing specific legislation specifying its implementation and provided the necessary funds to support the project or program.
2 (Moderate)	The program or project has received full departmental and OMB approval, but no specific congressional legislation addresses the implementation of funding for the program or project. In addition, the federal entity's operating budget provides the funding.

Table 4

Program Or Project Establishment And Approval (cont.)	
3 (Weak)	The program or project lacks specific formal approval by the entity's highest governing official, but it has received the required approvals to be funded within the federal entity's operating budget. OMB has not reviewed the project and no specific congressional approval exists.
4 (Very Weak)	The program or project has not received formal federal entity approval and concerns exist that it may not be funded as part of the federal entity's operating budget in each budgetary period.

2. Authorization for contractual obligation

22. The second project or program factor is the authorization for contractual obligation. Table 5 details the scoring criteria for this measure.

Table 5

Authorization For Contractual Obligation	
1 (Strong)	A long history (greater than 15 years) of bonds issued in the capital markets backed by the program- or project-specific cash flows exists and specific federal or state legislation supports this practice.
2 (Moderate)	Authority to obligate federal cash flows related to the project or program comes from legislation enacted within the last 15 years. Accordingly, a limited record of such financings exists.
3 (Weak)	A long history exists (greater than 15 years) of a specific project or program's cash flows being used to support state or local bonds. The federal entity is aware of the securitization of these federal cash flows, but no legislation specifically authorizes this practice.
4 (Very Weak)	A less-than 15-year history of the project or program's specific cash flows being used to support debt exists. No federal authorization exists and limited recognition of this practice exists at the federal level.

23. Clear authorization and ability to contractually obligate federal cash flows provides additional clarity as to the link between the federal cash flows and the lease or bond financing. Legislation specifying such authorization and an established history of using this authorization provide the highest clarity as to this capacity.

3. Project or program funding specification

24. The third project or program factor is project or program funding specification. Table 6 details the scoring criteria for this measure.

Table 6

Project Or Program Funding Specification	
1 (Strong)	The federal entity's overall budget bill includes the cash flow without specifying the federal cash flow as a line item.
2 (Moderate)	The federal entity's overall budget bill includes the federal cash flow specifying it as a line item.
3 (Weak)	A separate bill or act provides federal cash flow funding for the project, instead of residing within a federal entity budget.
4 (Very Weak)	Regardless of where funding resides, a history of significant funding reductions exists for the project or program.

25. Revenue streams more easily identified and separable from other appropriations may carry greater risk of reduction or elimination under budgetary stress. Federal cash flows included and generally inseparable from a department's overall budget enjoy the most protection, while projects or programs confined to a single legislative bill can be most vulnerable.

4. Renewal and reauthorization risk

26. The fourth project or program factor is the renewal and reauthorization risk. Table 7 details the scoring criteria for this measure.

Table 7

Renewal And Reauthorization Risk (see paragraphs 27 and 28)	
1 (Strong)	Each of the following is true: No renewal risk exists. Authorization for the project- or program-specific cash flow extends to the life of the bonds or terms of the lease. Specified funding levels suffice to cover debt service on the bonds and annual operating expenses.
2 (Moderate)	Renewal risk exists, but the project or program exhibits significant importance to the basic function and purpose of the federal entity; or renewal risk exists and the nature of the authorizing legislation suggests renewal.
3 (Weak)	Renewal risk exists, and no history exists for renewal of the program or project cash flows; or renewal risk exists and the project or program serves an auxiliary function within the federal entity.
4 (Very Weak)	Renewal risk exists and there is a history of similar projects or programs being terminated for convenience.

27. Long-dated financings can extend beyond initial congressional funding periods, requiring additional reauthorizations to service the debt. The Office of Management and Budget (OMB) classifies or scores a project or program as a capital expenditure or an operating expense of the related federal entity. Obligations scored as capital items carry less risk because the federal cash flow funding stream supporting the obligations remains valid as a contractual obligation and can't be renegotiated through the term of the financing. Accordingly, most capital leases will receive a score of '1'. In contrast, projects or programs scored as operating expenses by OMB carry a shorter contractual period and typically receive a score no higher than '2'. They must be renewed and carry the risk that changes in market rents or facility and program needs of the federal entity at the time of renewal may affect the financing.

28. Where renewal or reauthorization risk exists, defined terms set at the beginning of the financing that govern funding details upon renewal may add further security, such as specifying that the new rent paid on a renewed federal lease shall be at least equal to the debt service paid on the outstanding related debt.

5. Essentiality: Geographic concentration and population impact

29. The fifth project or program factor is essentiality, which is defined by geographic concentration and population impact. Table 8 details the scoring criteria for this measure.

Table 8

Essentiality: Geographic Concentration And Population Impact (see paragraph 30)	
1 (Strong)	The federal cash flow serves a major portion of the U.S., defined as at least two-thirds of the states or at least one-half of the U.S. population or serves a national interest. For programs, the federal cash flow is widespread and for a specific project it is measured against the department's mission.
2 (Moderate)	The federal cash flow serves a specific geographic region or group representing at least 15% of the U.S. population.
3 (Weak)	The federal cash flow is limited in nature, affects less than 15% of the U.S. population, or a state, or U.S. territory.
4 (Very Weak)	The federal cash flow is very limited in nature and serves either a singular congressional district or a limited geographic area within a state or U.S. territory.

30. The degree to which a project or program affects a large or small part of the population determines essentiality. While programs generally directly affect a higher percentage of the population compared to individual projects, the nature of the project's impact in addition to the geographic location also play a role. For example, all states benefit from U.S. federal transportation program funding, whereas, only a small portion of the population will have direct involvement with an individual government building. However, a specialized research facility that represents the sole method for addressing the nation's scientific objectives would enjoy strong essentiality. Likewise, a military base that serves a strategic national interest would receive a score of '1', whereas a base that serves a purely regional role would receive a lower score.

6. Local control of federal cash flows

31. The sixth project or program factor is the local control of federal cash flows. Table 9 details the scoring criteria for this measure.

Table 9

Local Control Of Federal Cash Flows (see paragraph 32)	
1 (Strong)	Federal funds are pledged first for debt repayment and flow directly from the federal entity to the trustee.
2 (Moderate)	The local government or other entity receives the federal funds but then immediately transfers them to a trustee.
3 (Weak)	The local government or other entity receives and holds the funds for a time such that a local-level decision may affect the level of federal funding or the local entity may divert the federal cash flow to other projects. The likelihood of diversion or reduction may be minimal, but the possibility exists.
4 (Very Weak)	The local control of federal cash flow is similar to '3', but the likelihood a strong diversion or reduction exists.

If the bankruptcy of a nongovernmental recipient of federal funds could impair the use of cash flows, the score equals 4.

32. While some manner of pledge to use the federal cash flow to pay debt service will generally exist in all federal-related financings, the degree to which local actions can affect this funding stream varies. An immediate direction of federal cash flows to a trustee without a local government or other entity first receiving these funds provides the strongest protection. Instances where the local government or other entity holds these funds for an extended period create additional risk. In cases where a nongovernmental entity receives the cash flows, the score equals '4' if a bankruptcy of the entity could impair the use of cash flows for debt service.

7. Allotment risk

33. The seventh project or program factor is the allotment risk. Table 10 details the scoring criteria for this measure.

Table 10

Allotment Risk (see paragraph 34)	
1 (Strong)	The receipt of the federal cash flow is not dependant on the actions of the issuing or related entity
2 (Moderate)	The receipt of the federal cash flow depends on basic, program-related service provisions.
3 (Weak)	The receipt of the federal cash flow depends on highly specific operating performance thresholds being met that extend well beyond the basic mission and service provisions of the local entity. Distribution formulas make the level of federal cash flow received dependent on local factors that fluctuate at least annually.
4 (Very Weak)	The receipt of the federal cash flow is similar to '3', but there is evidence of the local or regional entity not meeting these thresholds.

34. While the local control of federal cash flows measure assesses the risk that a local entity may utilize the federal cash flows for some purpose other than debt service, the allotment risk measure assesses the extent to which local actions or conditions may result in the federal government not allotting the appropriated cash flows. The requirement that a local entity continues to exist and provides basic related services poses a moderate level of risk. Detailed, often project-specific operating performance thresholds or distribution formulas that link amounts received to local fluctuating characteristics pose a higher level of risk if the receipt of funds is conditional on these requirements.

VII. Appendix I: Examples Of Criteria Application

D. GARVEE Bonds

35. The Alabama Federal Aid Highway Finance Authority sold federal highway grant anticipation revenue vehicle (GARVEE) bonds in 2011. The application of the criteria resulted in a score of 11 and an average of 1.2. Standard

& Poor's currently assigns a 'AA' rating to the issue. Underlying scoring follows.

1. Creation and duration of the federal entity: Strong

36. The Federal Highway Administration (FHWA) has existed for 55 years. The agency falls within the U.S. Department of Transportation (DOT) which is a cabinet-level department of the U.S.

2. Funding history of the federal entity: Strong

37. The Highway Revenue Act of 1956 established the Highway Trust Fund (HTF), the source of revenue for the interstate highway system and other federal-aid highway programs. The federal highway program has a long history of providing large and increasing levels of highway funding to states. The FHWA administers the program, which is financed from the proceeds of motor fuel and other highway-related excise taxes deposited in the HTF. The HTF money is earmarked for authorized transportation projects and Congress cannot appropriate these funds for other purposes.

3. Program or project establishment and approval: Strong

38. Congress passed the National Highway System (NHS) Act in 1995, which created the GARVEE program.

4. Authorization for contractual obligation: Strong

39. The NHS act made it possible to obligate federal funds for debt service expenses over a longer period and allowed for the issuance of bonds for this purpose. In addition, various state statutes allow for the issuance of bonds backed by these federal monies.

5. Project or program funding specification: Strong

40. The Federal Highway Administration falls within the overall DOT budget and is not a line item.

6. Renewal and reauthorization risk: Moderate

41. Renewal risk exists, as the bonds do not mature until 2017. Despite expirations of multiyear authorizations, Congress has ensured continuation of funds by passing numerous continuing resolutions.

7. Essentiality: Geographic concentration and population impact: Strong

42. All states benefit from the federal-aid highway program, so essentiality is strong.

8. Local control of federal cash flows: Moderate

43. The federal dollars flow to the state directly, and the state has ownership of those monies. The state pledges these funds to pay the bonds. Once pledged, the funds may only be used for the payment of debt service. The pledged funds are not directly assigned to the trustee from the FHWA in this case.

9. Allotment risk: Strong

44. The receipt of federal revenues does not depend on program-related service provisions. They are only dependent on Alabama DOT's ability to incur projects costs that are eligible for federal-aid highway reimbursements.

E. Guam Certificates Of Participation

45. The Guam Education Financing Foundation sold $8.07 million certificates of participation backed by federal compact impact funds in 2008. The application of the criteria resulted in a score of 18 and an average of 2. Standard & Poor's currently assigns a 'A-' rating to the issue. Underlying scoring follows.

1. Creation and duration of the federal entity: Strong

46. The Department of the Interior (DOI) manages the conservation of most federal land and natural resources and the administration of programs relating to Native Americans, Alaska Natives, Native Hawaiians, territorial affairs, and to insular areas of the U.S. The Secretary of the Interior heads the department as a member of the cabinet. A bill authorizing the creation of the department passed the House of Representatives on Feb. 15, 1849, and the department began on March 3, 1849.

2. Funding history of the federal entity: Moderate

47. Over the last 10 years, Congress has reduced federal funding in some years and increased it in others. On average, funding has remained within a 5% range.

3. Program or project establishment and approval: Strong

48. The program and its funding received approval from the Secretary of the Interior and the OMB. The Compact of Free Association Amendments Act of 2003 instituted the program, effective Dec. 17, 2003, and the 108th Congress appropriated $30 million annually from fiscal years 2004-2023 to Guam, Hawaii, the Commonwealth of Northern Mariana Islands, and American Samoa -- collectively known as "affected jurisdictions". The appropriations compensated these governments for any increased education, health care, or other social service costs resulting from in-migration from the Federated States of Micronesia, the Republic of the Marshall Islands, and The Republic of Palau, under earlier free association compacts.

4. Authorization for contractual obligation: Very Weak

49. The program's life spans only eight years, and this remains the only series of bonds associated with this revenue stream.

5. Project or program funding specification: Moderate

50. The authorizing act has a specified defined dollar amount of funds within the department's budget that is allocated for this program. As such, it appears as a line item in the department's budget.

6. Renewal and reauthorization risk: Strong

51. Federal funding extends for 19 years which is consistent with the bonds' final maturity. No reauthorization risk exists.

7. Essentiality: Geographic concentration and population impact: Weak

52. The funds affect less than 15% of the U.S. population, but they do extend beyond a singular geographic area, namely Guam, Hawaii, the Commonwealth of Northern Mariana Islands, and American Samoa.

8. Local control of federal cash flows: Moderate

53. The local government has ownership of the cash flow but pledges it to the project. Guam has pledged the first $7.1 million annually of its allocation for fiscal 2009-2023 to make rental payments on the lease. Further, the governor of Guam has irrevocably instructed the DOI, which administers the grants, to wire the annual $7.1 million grant directly to the trustee on or before Nov. 15 each year from 2009-2022.

9. Allotment risk: Moderate

54. The receipt of funding depends upon basic program-related services being met, primarily funding the education needs of the increased population.

F. The Department of Energy Oak Ridge National Lab Project

55. The bonds issued are secured by rent payments funded from the Department of Energy (DOE). The application of the criteria resulted in a score of 12 and an average of 1.3. Standard & Poor's currently assigns a 'A+' rating to the issue. This rating falls below the maximum possible rating but is within the one-notch range identified within the criteria. Factors in the federal lease criteria resulted in the current rating. Underlying scoring follows.

1. Creation and duration of the federal entity: Strong

56. The DOE, owner and primary operator of the lab, is a cabinet-level department of the U.S. The Department of Energy Organization Act of 1977 (P.L. 95-91, 91 Stat. 565), created the DOE. The agency, which began operations on Oct. 1, 1977, assumed the responsibilities of the Federal Energy Administration, the Energy Research and Development Administration, the Federal Power Commission, and programs of various other agencies.

2. Funding history of the federal entity: Strong

57. Since 1977, the DOE's total baseline funding has been relatively stable, netting out a few large increases for short-term projects.

3. Program or project establishment and approval: Moderate

58. The project has received full departmental approval and has undergone a full analysis by the OMB. DOE considers the costs associated with the project to be operating costs. Congressional approval was not necessary.

4. Authorization for contractual obligation: Moderate

59. The DOE's authority to enter into leases is contained in section 161g of the Atomic Energy Act.

5. Project or program funding specification: Strong

60. DOE payments under the lease represent operating expenses and fall within the overall DOE budget, without specification.

6. Renewal and reauthorization risk: Moderate

61. The term of the sublease supporting debt service does not extend to the life of the bonds. As such, renewal risk exists. However, ongoing transaction documents include requirements to renew the lease.

7. Essentiality: Geographic concentration and population impact: Strong

62. While the National Lab exists in one physical location (Oak Ridge, Tenn.), the lab's work affects the entire U.S. and many countries whose leading scientists have access to perform vital experiments in line with the lab's mission.

8. Local control of federal cash flows: Strong

63. Rent payments are paid directly to the trustee by the DOE through the Federal Assignment of Claims Act.

9. Allotment risk: Strong

64. DOE payments in support of the debt service payments on the bonds continue regardless of the maintenance and operations contractor.

VIII. Appendix II: Comments Received Following The RFC Publication

65. On Dec. 14, 2011, Standard & Poor's published "Request For Comment: U.S. Federal Future Flow Securitization Methodology." Several market participants submitted responses. The comments addressed the questions for which

we were seeking responses.

66. On the first question regarding the overall framework for determining ratings on issues backed by future flows of federal revenues, all participants responding to this question agreed with the overall framework.

67. On the second question regarding their views on the federal entity-specific factors, the participants agreed that the factors were relevant. On the funding history of the federal entity, there was a comment that we should keep in mind that in some instances portions of a department budget can be affected by spending overseas and this factor should be limited to domestic spending which may be less volatile.

68. On the third question on their views on the project or program factors, there was overall consensus that these factors were relevant; however, there were some comments on individual factors. The most common comment was about essentiality. Views expressed indicated that funding depends not only on the location of a governmental installation but also on its importance to the government. The nature of the project or program establishment factor was generally agreed on, with a comment that a department or agency head may not need to authorize a single project that falls under the enacted legislation the department or agency has supported. The remaining comments were minimal and are addressed in the related criteria.

69. On the final question, no views were expressed.

IX. RELATED CRITERIA AND RESEARCH

- Principles of Credit Ratings, Feb. 16, 2011
- Appropriation-Backed Obligations, June 13, 2007
- Federal Leases, June 18, 2007.
- Military Housing Privatizations, June 14, 2007
- Methodology And Assumptions: Rating U.S. Federal Transportation Grant-Secured Obligations, May 29, 2009
- Public Housing Authority Debt, June 22, 2007
- Rating Government Department Appropriation-Backed Debt In U.S. Public Finance, Nov. 7, 2007
- Securitization Of U.S. Federal Impact Aid Revenues To School Districts, April 17, 2002

These criteria represent the specific application of fundamental principles that define credit risk and ratings opinions. Their use is determined by issuer- or issue-specific attributes as well as Standard & Poor's Ratings Services' assessment of the credit and, if applicable, structural risks for a given issuer or issue rating. Methodology and assumptions may change from time to time as a result of market and economic conditions, issuer- or issue-specific factors, or new empirical evidence that would affect our credit judgment.

APPENDIX K: ECONPACK SENSITIVITY OUTPUTS

ATTACHMENT K-1—CREATE ECONPACK REPORT

Date Generated: 13 December 2013
Time Generated: 15.55.34
Version: ECONPACK 4.0.12

CREATE
Economic Analysis
Executive Summary Report

Project Title :CREATE
Type of Analysis :Mission Requirement - Full
Discount Rate :2.35%
Period of Analysis :24 years
Start Year :2013
Base Year :2013
Dollar Analysis :Current Dollars
Project Objective :Economic analysis for the CREATE project.

Alternatives Considered for this Analysis:

Status Quo (Current Operations) - This alternative is nonviable.

Renovation - This alternative is nonviable.

Renovation/New Construction Mix - This alternative is nonviable.

New Construction - This alternative is nonviable.

Basic Allowance for Housing (BAH) - This alternative is nonviable.

Leasing - This alternative is nonviable.

Other Facilities on Base; As Is, Renovation, or Renovation/New Construction Mix - This alternative is nonviable.

Other DOD or Federal Agency Facilities - This alternative is nonviable.

Contracting Services Out - This alternative is nonviable.

Innovative Alternatives or Combinations of the Above Alternatives - This alternative is nonviable.

Government Owned Contractor Operated Facility (GOCO) - This alternative is nonviable.

Contractor Owned Contractor Operated Facility (COCO) - This alternative is nonviable.

Line Item Construction - This is a viable alternative.

Alternative Finance - This is a viable alternative.

Assumptions of the Analysis:

Economic Indicators:

Alternative	*NPV*

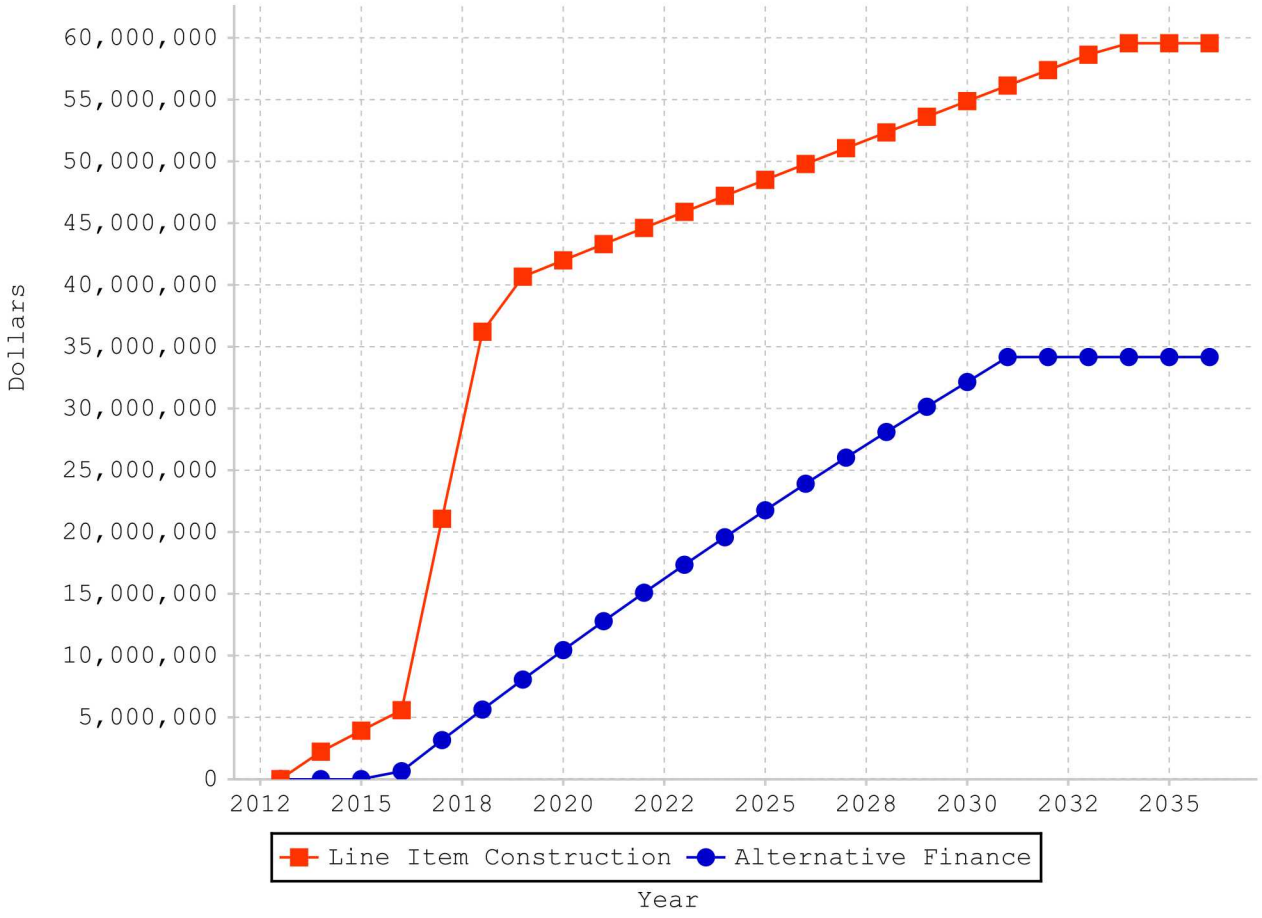
Alternative	*NPV*
Line Item Construction	$ 59,561,831
Alternative Finance	$ 34,162,624

Results and Recommendations:

Action Officer : David Hopman
Phone Number : 925.294.3817
Email Address : dhopman@sandia.gov
Organization : Sandia National Labs - CA

Economic Analysis Graph

Net Present Value



Life Cycle Cost Report

Alternative: Line Item Construction

Year	TPC	Operations and Maintenance	Total Annual Outlays	Middle of Year Discount Factors	Present Value
2013	$0	$0	$0	0.988	$0
2014	$2,300,000	$0	$2,300,000	0.966	$2,221,243
2015	$1,800,000	$0	$1,800,000	0.944	$1,698,450
2016	$1,800,000	$0	$1,800,000	0.922	$1,659,453
2017	$17,200,000	$0	$17,200,000	0.901	$15,492,915
2018	$17,200,000	$0	$17,200,000	0.88	$15,137,191
2019	$4,797,836	$385,554	$5,183,390	0.86	$4,457,003
2020	$0	$1,571,517	$1,571,517	0.84	$1,320,262
2021	$0	$1,601,376	$1,601,376	0.821	$1,314,458
2022	$0	$1,631,802	$1,631,802	0.802	$1,308,678
2023	$0	$1,662,806	$1,662,806	0.784	$1,302,924
2024	$0	$1,694,399	$1,694,399	0.766	$1,297,196
2025	$0	$1,726,593	$1,726,593	0.748	$1,291,493
2026	$0	$1,759,398	$1,759,398	0.731	$1,285,814
2027	$0	$1,792,827	$1,792,827	0.714	$1,280,161
2028	$0	$1,826,891	$1,826,891	0.698	$1,274,532
2029	$0	$1,861,602	$1,861,602	0.682	$1,268,929
2030	$0	$1,896,972	$1,896,972	0.666	$1,263,350
2031	$0	$1,933,014	$1,933,014	0.651	$1,257,795
2032	$0	$1,969,742	$1,969,742	0.636	$1,252,265
2033	$0	$2,007,167	$2,007,167	0.621	$1,246,759
2034	$0	$1,533,978	$1,533,978	0.607	$930,959
2035	$0	$0	$0	0.593	$0
2036	$0	$0	$0	0.579	$0
%NPV	67.72%	32.28%			
	$40,334,732	$19,227,099			
Discounting Convention	M-O-Y	M-O-Y			
Inflation Schedule	No Inflation	CREATE			
Category / Residual Schedule	Recurring Costs	Recurring Costs			

Life Cycle Cost Report

Alternative: Line Item Construction

Year	Cumulative Net Present Value
2013	$0
2014	$2,221,243
2015	$3,919,693
2016	$5,579,147
2017	$21,072,062
2018	$36,209,253
2019	$40,666,255
2020	$41,986,517
2021	$43,300,975
2022	$44,609,653
2023	$45,912,578
2024	$47,209,773
2025	$48,501,266
2026	$49,787,080
2027	$51,067,241
2028	$52,341,774
2029	$53,610,702
2030	$54,874,052
2031	$56,131,847
2032	$57,384,112
2033	$58,630,872
2034	$59,561,831
2035	$59,561,831
2036	$59,561,831

Discount Rate: 2.35%
Period of Analysis: 24 years

Life Cycle Cost Report

Alternative: Alternative Finance

Year	Lease (Principal and Interest)	Tenant Improvements	Insurance	Operations and Maintenance	Major Maintenance
2013	$0	$0	$0	$0	$0
2014	$0	$0	$0	$0	$0
2015	$0	$0	$0	$0	$0
2016	$471,581	$28,916	$8,230	$128,701	$22,860
2017	$1,886,326	$115,663	$33,544	$524,586	$93,177
2018	$1,886,326	$115,663	$34,181	$534,553	$94,947
2019	$1,886,326	$115,663	$34,831	$544,709	$96,751
2020	$1,886,326	$115,663	$35,493	$555,059	$98,590
2021	$1,886,326	$115,663	$36,167	$565,605	$100,463
2022	$1,886,326	$115,663	$36,854	$576,351	$102,372
2023	$1,886,326	$115,663	$37,554	$587,302	$104,317
2024	$1,886,326	$115,663	$38,268	$598,461	$106,299
2025	$1,886,326	$115,663	$38,995	$609,832	$108,318
2026	$1,886,326	$115,663	$39,736	$621,418	$110,376
2027	$1,886,326	$115,663	$40,491	$633,225	$112,473
2028	$1,886,326	$115,663	$41,260	$645,257	$114,610
2029	$1,886,326	$115,663	$42,044	$657,517	$116,788
2030	$1,886,326	$115,663	$42,843	$670,009	$119,007
2031	$1,414,744	$919,025	$32,743	$512,055	$90,952
2032	$0	$0	$0	$0	$0
2033	$0	$0	$0	$0	$0
2034	$0	$0	$0	$0	$0
2035	$0	$0	$0	$0	$0
2036	$0	$0	$0	$0	$0
%NPV	64.10%	5.52%	1.29%	20.14%	3.58%
	$21,899,115	$1,884,334	$440,022	$6,881,366	$1,222,269
Discounting Convention	M-O-Y	M-O-Y	M-O-Y	M-O-Y	M-O-Y
Inflation Schedule	No Inflation	No Inflation	CREATE	CREATE	CREATE
Category / Residual Schedule	Recurring Costs	Recurring Costs	Recurring Costs	Recurring Costs	Recurring Costs

Life Cycle Cost Report

Alternative: Alternative Finance

Year	Owner Administration	Ground Lease	Total Annual Outlays	Middle of Year Discount Factors	Present Value
2013	$0	$0	$0	0.988	$0
2014	$0	$0	$0	0.966	$0
2015	$0	$0	$0	0.944	$0
2016	$26,702	$7,956	$694,947	0.922	$640,684
2017	$108,839	$31,824	$2,793,959	0.901	$2,516,661
2018	$110,907	$31,824	$2,808,401	0.88	$2,471,588
2019	$113,014	$31,824	$2,823,119	0.86	$2,427,494
2020	$115,161	$31,824	$2,838,115	0.84	$2,384,356
2021	$117,349	$31,824	$2,853,397	0.821	$2,342,154
2022	$119,579	$35,629	$2,872,774	0.802	$2,303,918
2023	$121,851	$35,629	$2,888,642	0.784	$2,263,452
2024	$124,166	$35,629	$2,904,812	0.766	$2,223,861
2025	$126,525	$35,629	$2,921,288	0.748	$2,185,125
2026	$128,929	$35,629	$2,938,078	0.731	$2,147,224
2027	$131,379	$39,144	$2,958,702	0.714	$2,112,649
2028	$133,875	$39,144	$2,976,136	0.698	$2,076,305
2029	$136,419	$39,144	$2,993,901	0.682	$2,040,741
2030	$139,011	$39,144	$3,012,003	0.666	$2,005,941
2031	$106,239	$29,358	$3,105,115	0.651	$2,020,471
2032	$0	$0	$0	0.636	$0
2033	$0	$0	$0	0.621	$0
2034	$0	$0	$0	0.607	$0
2035	$0	$0	$0	0.593	$0
2036	$0	$0	$0	0.579	$0
%NPV	4.18%	1.19%			
	$1,427,717	$407,801			
Discounting Convention	M-O-Y	M-O-Y			
Inflation Schedule	CREATE	No Inflation			
Category / Residual Schedule	Recurring Costs	Recurring Costs			

Life Cycle Cost Report

Alternative: Alternative Finance

Year	Cumulative Net Present Value
2013	$0
2014	$0
2015	$0
2016	$640,684
2017	$3,157,345
2018	$5,628,932
2019	$8,056,426
2020	$10,440,782
2021	$12,782,937
2022	$15,086,854
2023	$17,350,307
2024	$19,574,168
2025	$21,759,293
2026	$23,906,517
2027	$26,019,167
2028	$28,095,471
2029	$30,136,212
2030	$32,142,153
2031	$34,162,624
2032	$34,162,624
2033	$34,162,624
2034	$34,162,624
2035	$34,162,624
2036	$34,162,624

Discount Rate: 2.35%
Period of Analysis: 24 years

Life Cycle Cost Report

Sources and Derivations:

1. Line Item Construction
   a. TPC

   b. Operations and Maintenance

2. Alternative Finance
   a. Lease (Principal and Interest)

   b. Tenant Improvements

   c. Insurance

   d. Operations and Maintenance

   e. Major Maintenance

   f. Owner Administration

   g. Ground Lease

Cost Sensitivity Analysis

Title: Line Item TPC

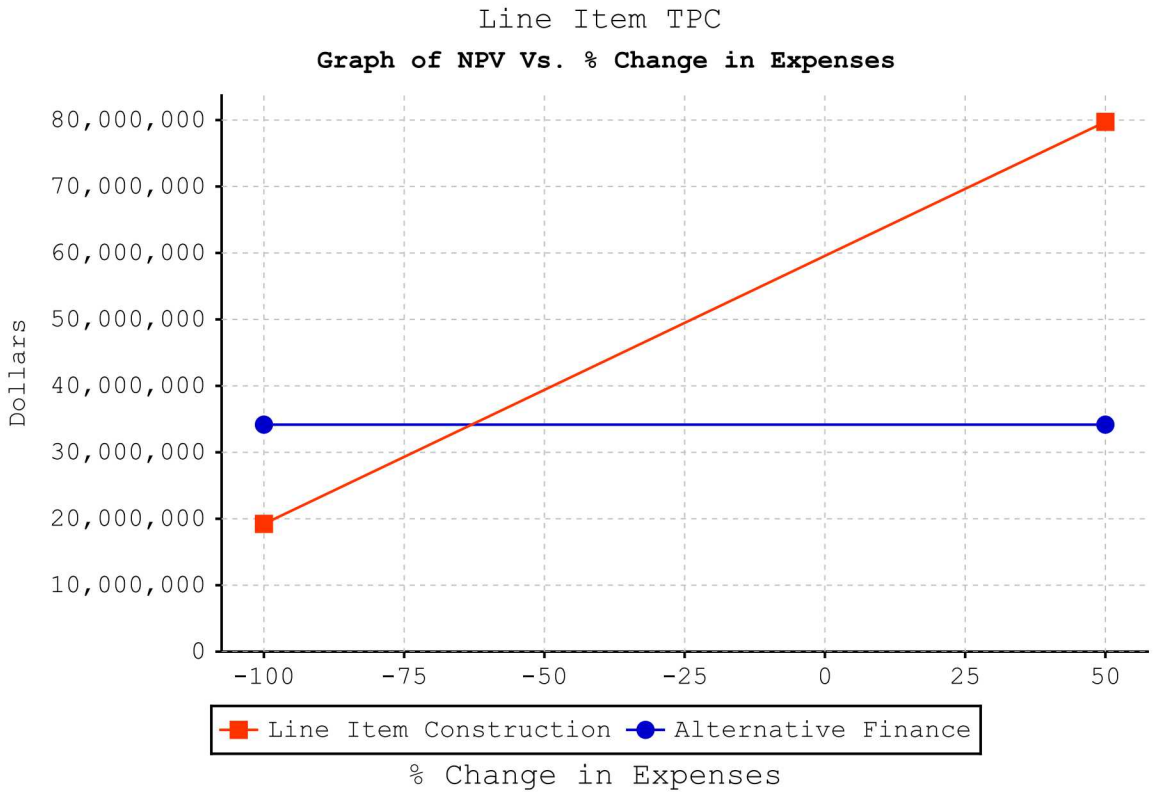
This sensitivity analysis checks for alternative Line Item Construction to be ranked least cost as a result of changes in the expenses listed below:

Alternative	Expenses
Line Item Construction	TPC
Alternative Finance	** Nothing Changed **

The selected expenses are allowed to vary from a value of -100.0% to 50.0% of their original values.

Alternative	NPV
Line Item Construction	$ 59,561,831
Alternative Finance	$ 34,162,624

Cost Sensitivity Analysis



Results: For alternative Line Item Construction to be ranked least cost, decrease the selected expense(s) by more than 62.97%.

Expense	NPV Before	Change	NPV After
TPC	$ 40,334,732	-$ 25,398,781	$ 14,935,951

Cost Sensitivity Analysis

Title: Alternative Finance Lease Rate (Principal and Interest)

This sensitivity analysis checks for alternative Line Item Construction to be ranked least cost as a result of changes in the expenses listed below:

Alternative	Expenses
Alternative Finance	Lease (Principal and Interest)
Line Item Construction	** Nothing Changed **

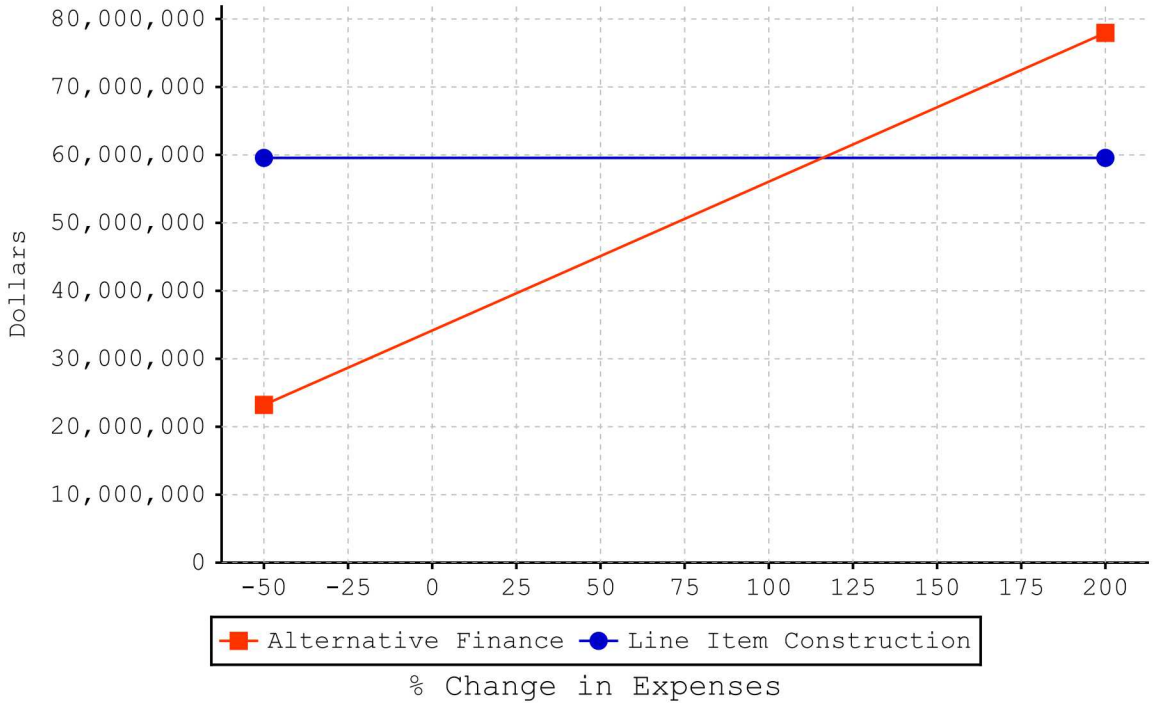
The selected expenses are allowed to vary from a value of -50.0% to 200.0% of their original values.

Alternative	NPV
Alternative Finance	$ 34,162,624
Line Item Construction	$ 59,561,831

Cost Sensitivity Analysis

Alternative Finance Lease Rate (Principal and Interest)

Graph of NPV Vs. % Change in Expenses



Results: For alternative Line Item Construction to be ranked least cost, increase the selected expense(s) by more than 115.98%.

Expense	NPV Before	Change	NPV After
Lease (Principal and	$ 21,899,115	$ 25,398,593	$ 47,297,708

Cost Sensitivity Analysis

Title: Alternative Finance Operations and Maintenance

This sensitivity analysis checks for alternative Line Item Construction to be ranked least cost as a result of changes in the expenses listed below:

Alternative	Expenses
Alternative Finance	Operations and Maintenance
Line Item Construction	** Nothing Changed **

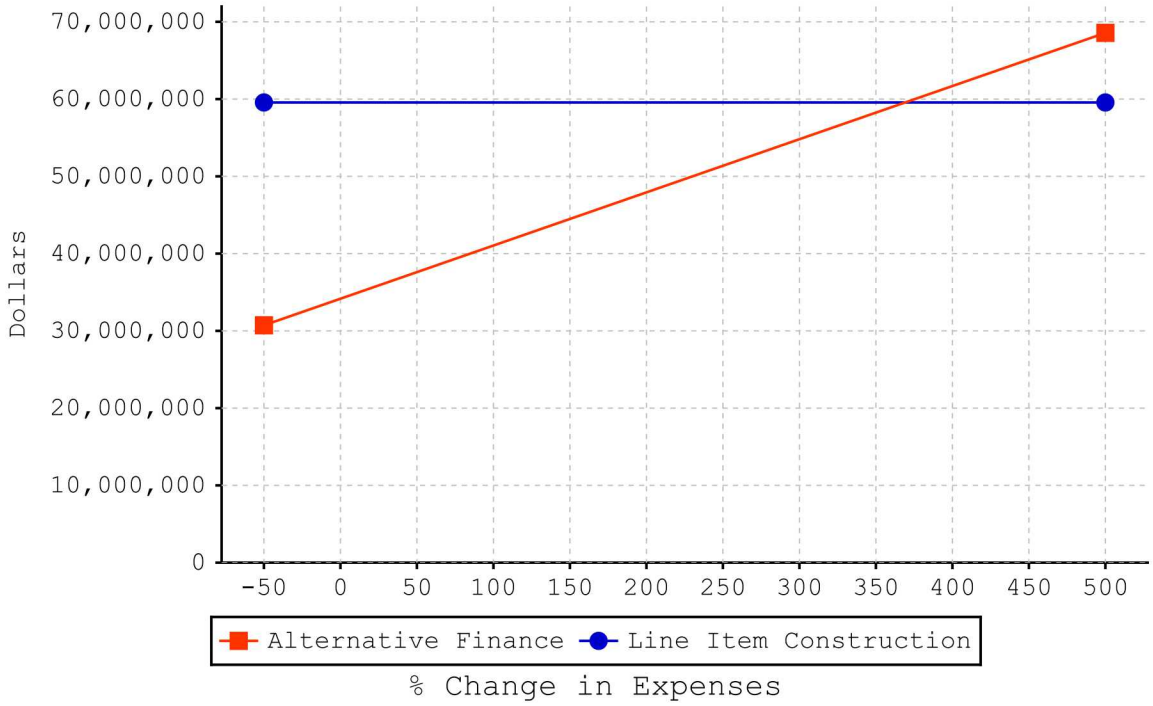
The selected expenses are allowed to vary from a value of -50.0% to 500.0% of their original values.

Alternative	NPV
Alternative Finance	$ 34,162,624
Line Item Construction	$ 59,561,831

Cost Sensitivity Analysis

Alternative Finance Operations and Maintenance

Graph of NPV Vs. % Change in Expenses



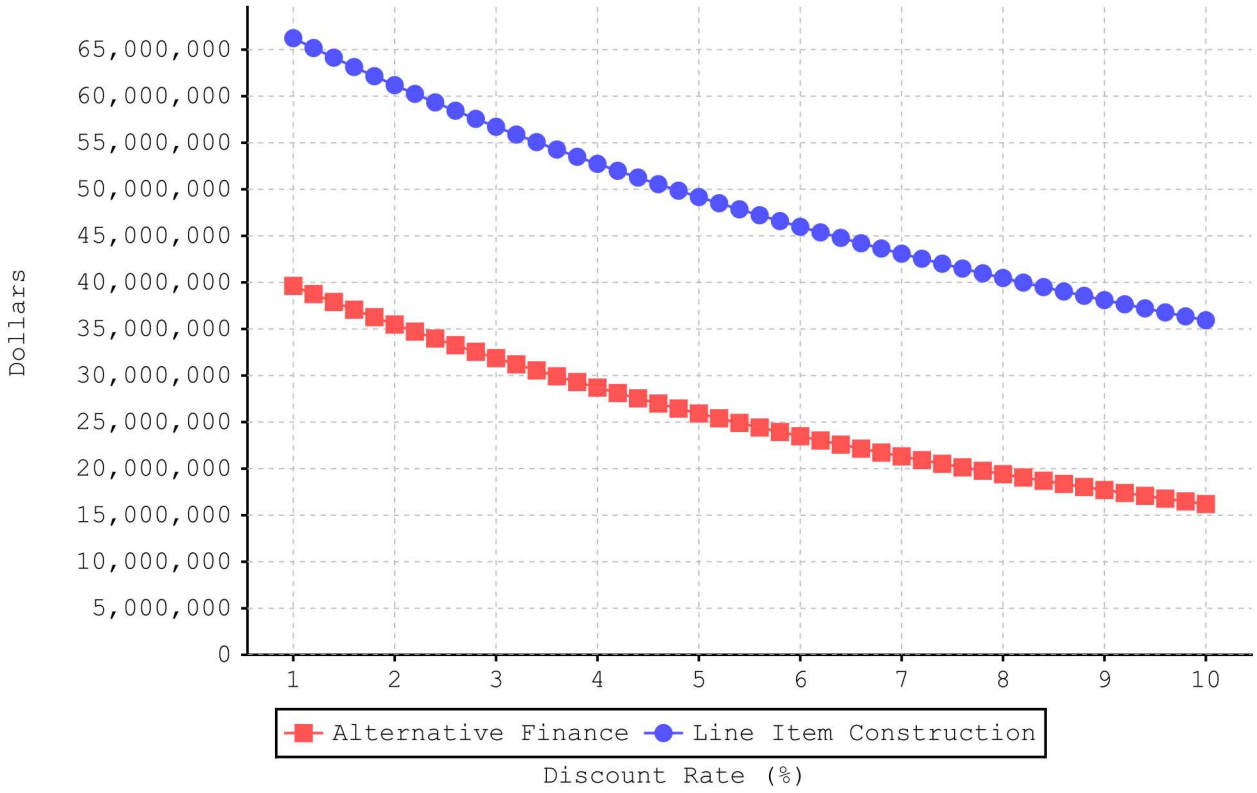
Results: For alternative Line Item Construction to be ranked least cost, increase the selected expense(s) by more than 369.1%.

Expense	NPV Before	Change	NPV After
Operations and Maintenance	$ 6,881,366	$ 25,399,122	$ 32,280,489

Discount Rate Sensitivity Analysis

NPV rankings change at the following discount rates: No changes

Graph of Net Present Value vs. Discount Rate



Discount Rate Sensitivity Analysis

NPV rankings change at the following discount rates: No changes

Table of Net Present Values for each Discount Rate

Discount Rate = 1.0%		Discount Rate = 3.4%	
Alternative Finance	$ 39,625,025	Alternative Finance	$ 30,552,215
Line Item Construction	$ 66,233,220	Line Item Construction	$ 55,068,221
Discount Rate = 1.2%		**Discount Rate = 3.6%**	
Alternative Finance	$ 38,750,525	Alternative Finance	$ 29,919,707
Line Item Construction	$ 65,173,649	Line Item Construction	$ 54,272,358
Discount Rate = 1.4%		**Discount Rate = 3.8%**	
Alternative Finance	$ 37,899,870	Alternative Finance	$ 29,303,579
Line Item Construction	$ 64,140,129	Line Item Construction	$ 53,494,321
Discount Rate = 1.6%		**Discount Rate = 4.0%**	
Alternative Finance	$ 37,072,312	Alternative Finance	$ 28,703,340
Line Item Construction	$ 63,131,821	Line Item Construction	$ 52,733,579
Discount Rate = 1.8%		**Discount Rate = 4.2%**	
Alternative Finance	$ 36,267,128	Alternative Finance	$ 28,118,511
Line Item Construction	$ 62,147,922	Line Item Construction	$ 51,989,616
Discount Rate = 2.0%		**Discount Rate = 4.4%**	
Alternative Finance	$ 35,483,619	Alternative Finance	$ 27,548,632
Line Item Construction	$ 61,187,656	Line Item Construction	$ 51,261,935
Discount Rate = 2.2%		**Discount Rate = 4.6%**	
Alternative Finance	$ 34,721,113	Alternative Finance	$ 26,993,258
Line Item Construction	$ 60,250,278	Line Item Construction	$ 50,550,058
Discount Rate = 2.4%		**Discount Rate = 4.8%**	
Alternative Finance	$ 33,978,958	Alternative Finance	$ 26,451,959
Line Item Construction	$ 59,335,068	Line Item Construction	$ 49,853,523
Discount Rate = 2.6%		**Discount Rate = 5.0%**	
Alternative Finance	$ 33,256,527	Alternative Finance	$ 25,924,319
Line Item Construction	$ 58,441,337	Line Item Construction	$ 49,171,884
Discount Rate = 2.8%		**Discount Rate = 5.2%**	
Alternative Finance	$ 32,553,213	Alternative Finance	$ 25,409,935
Line Item Construction	$ 57,568,416	Line Item Construction	$ 48,504,712
Discount Rate = 3.0%		**Discount Rate = 5.4%**	
Alternative Finance	$ 31,868,431	Alternative Finance	$ 24,908,418
Line Item Construction	$ 56,715,665	Line Item Construction	$ 47,851,590
Discount Rate = 3.2%		**Discount Rate = 5.6%**	
Alternative Finance	$ 31,201,613	Alternative Finance	$ 24,419,392
Line Item Construction	$ 55,882,466	Line Item Construction	$ 47,212,119

Discount Rate Sensitivity Analysis

NPV rankings change at the following discount rates: No changes

Table of Net Present Values for each Discount Rate

Discount Rate = 5.8%		Discount Rate = 8.2%	
Alternative Finance	$ 23,942,492	Alternative Finance	$ 19,048,111
Line Item Construction	$ 46,585,912	Line Item Construction	$ 39,981,806
Discount Rate = 6.0%		**Discount Rate = 8.4%**	
Alternative Finance	$ 23,477,368	Alternative Finance	$ 18,700,609
Line Item Construction	$ 45,972,594	Line Item Construction	$ 39,498,212
Discount Rate = 6.2%		**Discount Rate = 8.6%**	
Alternative Finance	$ 23,023,677	Alternative Finance	$ 18,361,212
Line Item Construction	$ 45,371,805	Line Item Construction	$ 39,023,652
Discount Rate = 6.4%		**Discount Rate = 8.8%**	
Alternative Finance	$ 22,581,090	Alternative Finance	$ 18,029,698
Line Item Construction	$ 44,783,196	Line Item Construction	$ 38,557,893
Discount Rate = 6.6%		**Discount Rate = 9.0%**	
Alternative Finance	$ 22,149,289	Alternative Finance	$ 17,705,849
Line Item Construction	$ 44,206,431	Line Item Construction	$ 38,100,708
Discount Rate = 6.8%		**Discount Rate = 9.2%**	
Alternative Finance	$ 21,727,965	Alternative Finance	$ 17,389,456
Line Item Construction	$ 43,641,183	Line Item Construction	$ 37,651,880
Discount Rate = 7.0%		**Discount Rate = 9.4%**	
Alternative Finance	$ 21,316,818	Alternative Finance	$ 17,080,315
Line Item Construction	$ 43,087,139	Line Item Construction	$ 37,211,196
Discount Rate = 7.2%		**Discount Rate = 9.6%**	
Alternative Finance	$ 20,915,561	Alternative Finance	$ 16,778,228
Line Item Construction	$ 42,543,995	Line Item Construction	$ 36,778,453
Discount Rate = 7.4%		**Discount Rate = 9.8%**	
Alternative Finance	$ 20,523,912	Alternative Finance	$ 16,483,006
Line Item Construction	$ 42,011,455	Line Item Construction	$ 36,353,451
Discount Rate = 7.6%		**Discount Rate = 10.0%**	
Alternative Finance	$ 20,141,601	Alternative Finance	$ 16,194,462
Line Item Construction	$ 41,489,237	Line Item Construction	$ 35,935,999
Discount Rate = 7.8%			
Alternative Finance	$ 19,768,365		
Line Item Construction	$ 40,977,065		
Discount Rate = 8.0%			
Alternative Finance	$ 19,403,951		
Line Item Construction	$ 40,474,674		

ATTACHMENT K-2—HPCIC ECONPACK REPORT

Date Generated: 16 December 2013
Time Generated: 10.45.37
Version: ECONPACK 4.0.14

HPCIC MOY Dec 16 2013
Economic Analysis

Executive Summary Report

Project Title : HPCIC / LVOC
Type of Analysis : Mission Requirement - Full
Discount Rate : 2.35%
Period of Analysis : 24 years
Start Year : 2013
Base Year : 2013
Dollar Analysis : Current Dollars
Project Objective : HPCIC / LVOC

Alternatives Considered for this Analysis:

Line Item - This is a viable alternative.

3rd Party Alternate Finance - This is a viable alternative.

Assumptions of the Analysis:

Economic Indicators:

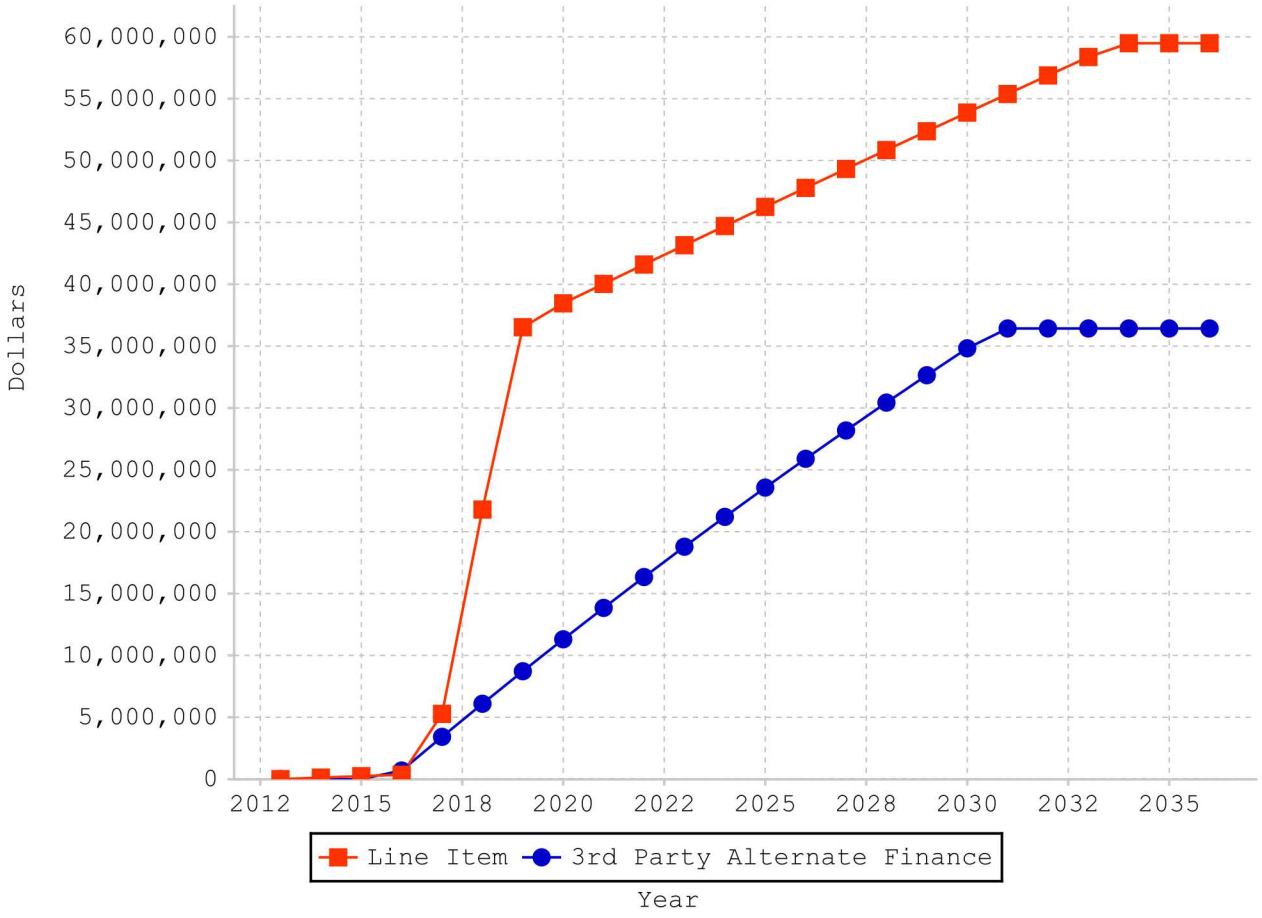
Alternative	*NPV*
Line Item	$ 59,484,358
3rd Party Alternate Finance	$ 36,427,858

Results and Recommendations:

Action Officer : Tina Parodi
Phone Number : 925.423.9828
Email Address : parodi1@llnl.gov
Organization : Lawrence Livermore National Laboratory

Economic Analysis Graph

Net Present Value



Life Cycle Cost Report

Alternative: Line Item

Year	TPC	O and M	Total Annual Outlays	Middle of Year Discount Factors	Present Value
2013	$0	$0	$0	0.988	$0
2014	$125,100	$0	$125,100	0.966	$120,816
2015	$125,100	$0	$125,100	0.944	$118,042
2016	$125,100	$0	$125,100	0.922	$115,332
2017	$5,462,700	$0	$5,462,700	0.901	$4,920,532
2018	$18,765,000	$0	$18,765,000	0.88	$16,514,499
2019	$16,680,000	$461,256	$17,141,256	0.86	$14,739,123
2020	$417,000	$1,880,081	$2,297,081	0.84	$1,929,823
2021	$0	$1,915,803	$1,915,803	0.821	$1,572,549
2022	$0	$1,952,203	$1,952,203	0.802	$1,565,635
2023	$0	$1,989,295	$1,989,295	0.784	$1,558,751
2024	$0	$2,027,091	$2,027,091	0.766	$1,551,898
2025	$0	$2,065,606	$2,065,606	0.748	$1,545,075
2026	$0	$2,104,853	$2,104,853	0.731	$1,538,281
2027	$0	$2,144,845	$2,144,845	0.714	$1,531,518
2028	$0	$2,185,597	$2,185,597	0.698	$1,524,784
2029	$0	$2,227,123	$2,227,123	0.682	$1,518,080
2030	$0	$2,269,439	$2,269,439	0.666	$1,511,406
2031	$0	$2,312,558	$2,312,558	0.651	$1,504,761
2032	$0	$2,356,497	$2,356,497	0.636	$1,498,145
2033	$0	$2,401,270	$2,401,270	0.621	$1,491,558
2034	$0	$1,835,171	$1,835,171	0.607	$1,113,750
2035	$0	$0	$0	0.593	$0
2036	$0	$0	$0	0.579	$0
%NPV	61.33%	38.67%			
	$36,482,058	$23,002,300			
Discounting Convention	M-O-Y	M-O-Y			
Inflation Schedule	No Inflation	1.9%			
Category / Residual Schedule	Non-Recurring Costs	Recurring Costs			

Life Cycle Cost Report

Alternative: Line Item

Year	Cumulative Net Present Value
2013	$0
2014	$120,816
2015	$238,859
2016	$354,191
2017	$5,274,722
2018	$21,789,222
2019	$36,528,345
2020	$38,458,168
2021	$40,030,716
2022	$41,596,351
2023	$43,155,102
2024	$44,707,000
2025	$46,252,074
2026	$47,790,356
2027	$49,321,874
2028	$50,846,658
2029	$52,364,738
2030	$53,876,144
2031	$55,380,905
2032	$56,879,050
2033	$58,370,608
2034	$59,484,358
2035	$59,484,358
2036	$59,484,358

Discount Rate: 2.35%
Period of Analysis: 24 years

Life Cycle Cost Report

Alternative: 3rd Party Alternate Finance

Year	Lease (P and I)	Insurnace	O and M	Major Maintenance Reserve	Owner Admin
2013	$0	$0	$0	$0	$0
2014	$0	$0	$0	$0	$0
2015	$0	$0	$0	$0	$0
2016	$535,209	$9,381	$146,701	$26,057	$26,702
2017	$2,140,835	$38,235	$597,952	$106,208	$108,839
2018	$2,140,835	$38,962	$609,313	$108,226	$110,907
2019	$2,140,835	$39,702	$620,890	$110,282	$113,014
2020	$2,140,835	$40,456	$632,687	$112,378	$115,161
2021	$2,140,835	$41,225	$644,708	$114,513	$117,349
2022	$2,140,835	$42,008	$656,957	$116,689	$119,579
2023	$2,140,835	$42,806	$669,439	$118,906	$121,851
2024	$2,140,835	$43,620	$682,159	$121,165	$124,166
2025	$2,140,835	$44,448	$695,120	$123,467	$126,525
2026	$2,140,835	$45,293	$708,327	$125,813	$128,929
2027	$2,140,835	$46,153	$721,785	$128,203	$131,379
2028	$2,140,835	$47,030	$735,499	$130,639	$133,875
2029	$2,140,835	$47,924	$749,474	$133,121	$136,419
2030	$2,140,835	$48,834	$763,714	$135,651	$139,011
2031	$1,605,626	$37,322	$583,668	$103,671	$106,239
2032	$0	$0	$0	$0	$0
2033	$0	$0	$0	$0	$0
2034	$0	$0	$0	$0	$0
2035	$0	$0	$0	$0	$0
2036	$0	$0	$0	$0	$0
%NPV	68.23%	1.38%	21.53%	3.82%	3.92%
	$24,853,813	$501,558	$7,843,761	$1,393,209	$1,427,717
Discounting Convention	M-O-Y	M-O-Y	M-O-Y	M-O-Y	M-O-Y
Inflation Schedule	No Inflation	1.9%	1.9%	1.9%	1.9%
Category / Residual Schedule	Recurring Costs	Recurring Costs	Recurring Costs	Recurring Costs	Recurring Costs

Life Cycle Cost Report

Alternative: 3rd Party Alternate Finance

Year	Ground Lease	Total Annual Outlays	Middle of Year Discount Factors	Present Value	Cumulative Net Present Value
2013	$0	$0	0.988	$0	$0
2014	$0	$0	0.966	$0	$0
2015	$0	$0	0.944	$0	$0
2016	$7,956	$752,006	0.922	$693,289	$693,289
2017	$31,824	$3,023,893	0.901	$2,723,774	$3,417,063
2018	$31,824	$3,040,066	0.88	$2,675,469	$6,092,531
2019	$31,824	$3,056,547	0.86	$2,628,210	$8,720,742
2020	$31,824	$3,073,341	0.84	$2,581,974	$11,302,716
2021	$31,824	$3,090,454	0.821	$2,536,738	$13,839,453
2022	$35,629	$3,111,697	0.802	$2,495,530	$16,334,983
2023	$35,629	$3,129,466	0.784	$2,452,155	$18,787,138
2024	$35,629	$3,147,573	0.766	$2,409,715	$21,196,853
2025	$35,629	$3,166,025	0.748	$2,368,188	$23,565,041
2026	$35,629	$3,184,826	0.731	$2,327,554	$25,892,595
2027	$39,144	$3,207,500	0.714	$2,290,303	$28,182,898
2028	$39,144	$3,227,023	0.698	$2,251,337	$30,434,234
2029	$39,144	$3,246,917	0.682	$2,213,205	$32,647,440
2030	$39,144	$3,267,189	0.666	$2,175,890	$34,823,329
2031	$29,358	$2,465,884	0.651	$1,604,529	$36,427,858
2032	$0	$0	0.636	$0	$36,427,858
2033	$0	$0	0.621	$0	$36,427,858
2034	$0	$0	0.607	$0	$36,427,858
2035	$0	$0	0.593	$0	$36,427,858
2036	$0	$0	0.579	$0	$36,427,858
%NPV	1.12%				
	$407,801				
Discounting Convention	M-O-Y				
Inflation Schedule	No Inflation				
Category / Residual Schedule	Recurring Costs				

Discount Rate: 2.35%

Period of Analysis: 24 years

Life Cycle Cost Report

Sources and Derivations:

1. Line Item
   a. TPC

   b. O and M

2. 3rd Party Alternate Finance
   a. Lease (P and I)

   b. Insurnace

   c. O and M

   d. Major Maintenance Reserve

   e. Owner Admin

   f. Ground Lease

Cost Sensitivity Analysis

Title: Line Item TPC

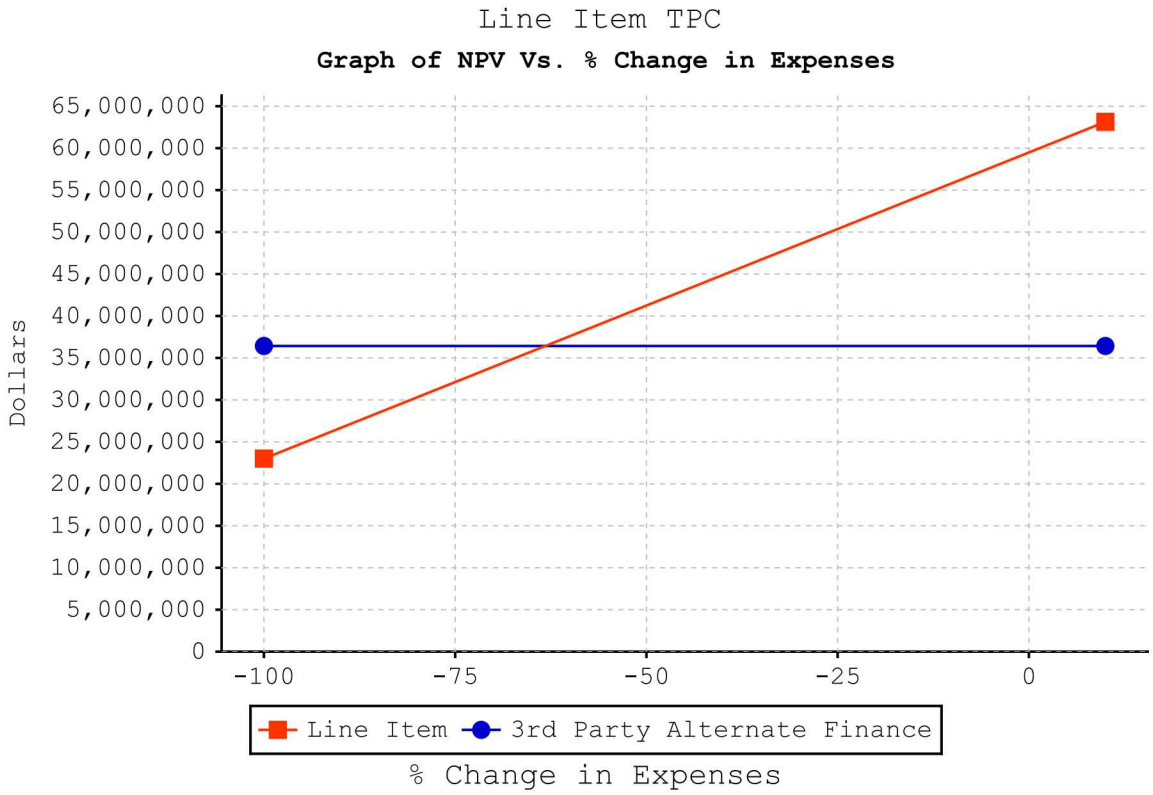
This sensitivity analysis checks for alternative Line Item to be ranked least cost as a result of changes in the expenses listed below:

Alternative	Expenses
Line Item	TPC
3rd Party Alternate Finance	** Nothing Changed **

The selected expenses are allowed to vary from a value of -100.0% to 10.0% of their original values.

Alternative	NPV
Line Item	$ 59,484,358
3rd Party Alternate Finance	$ 36,427,858

Cost Sensitivity Analysis



Results: For alternative Line Item to be ranked least cost, decrease the selected expense(s) by more than 63.2%.

Expense	NPV Before	Change	NPV After
TPC	$ 36,482,058	-$ 23,056,660	$ 13,425,397

Cost Sensitivity Analysis

Title: Alternative Finance Lease Rate

This sensitivity analysis checks for alternative Line Item to be ranked least cost as a result of changes in the expenses listed below:

Alternative	Expenses
Line Item	** Nothing Changed **
3rd Party Alternate Finance	Lease (P and I)

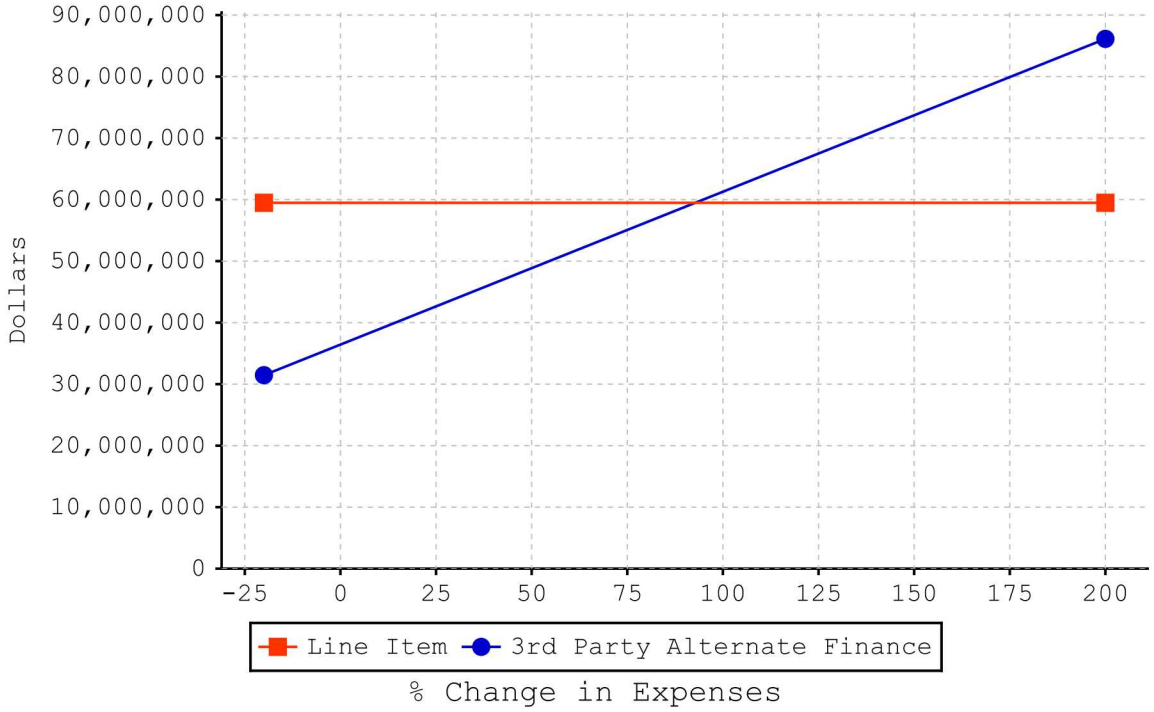
The selected expenses are allowed to vary from a value of -20.0% to 200.0% of their original values.

Alternative	NPV
Line Item	$ 59,484,358
3rd Party Alternate Finance	$ 36,427,858

Cost Sensitivity Analysis

Alternative Finance Lease Rate

Graph of NPV Vs. % Change in Expenses



Results: For alternative Line Item to be ranked least cost, increase the selected expense(s) by more than 92.77%.

Expense	NPV Before	Change	NPV After
Lease (P and I)	$ 24,853,813	$ 23,056,882	$ 47,910,695

Cost Sensitivity Analysis

Title: Line Item O & M

This sensitivity analysis checks for alternative Line Item to be ranked least cost as a result of changes in the expenses listed below:

Alternative	Expenses
Line Item	** Nothing Changed **
3rd Party Alternate Finance	O and M

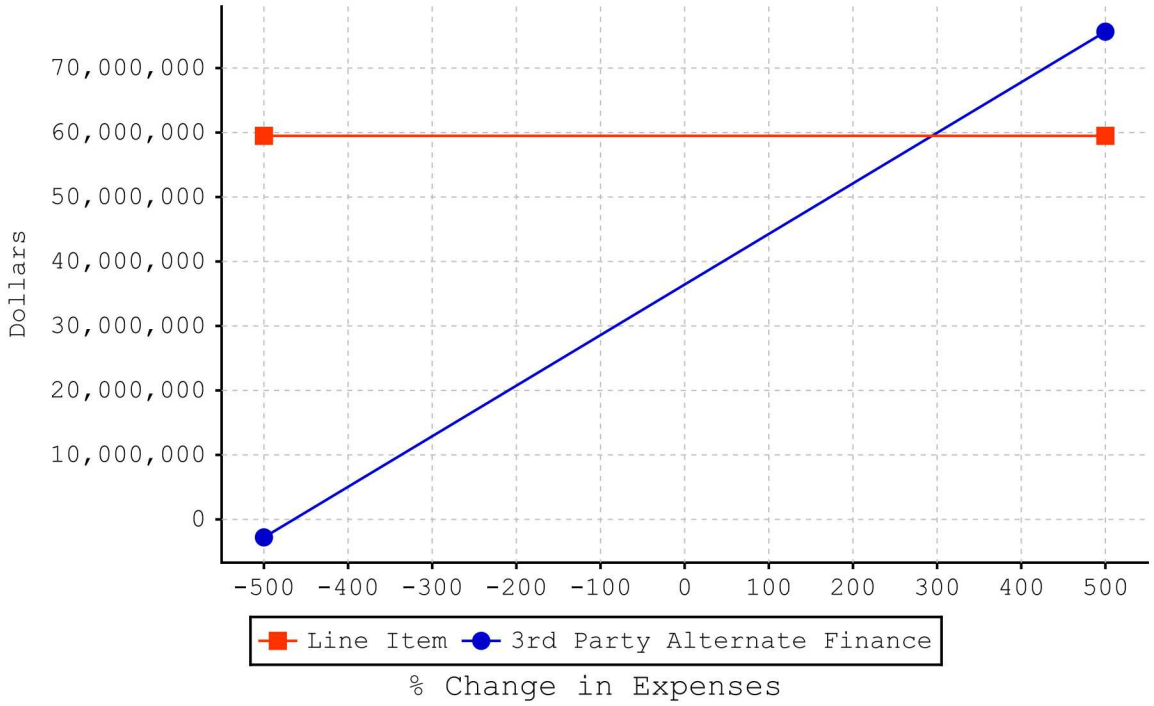
The selected expenses are allowed to vary from a value of -500.0% to 500.0% of their original values.

Alternative	NPV
Line Item	$ 59,484,358
3rd Party Alternate Finance	$ 36,427,858

Cost Sensitivity Analysis

Line Item O & M

Graph of NPV Vs. % Change in Expenses



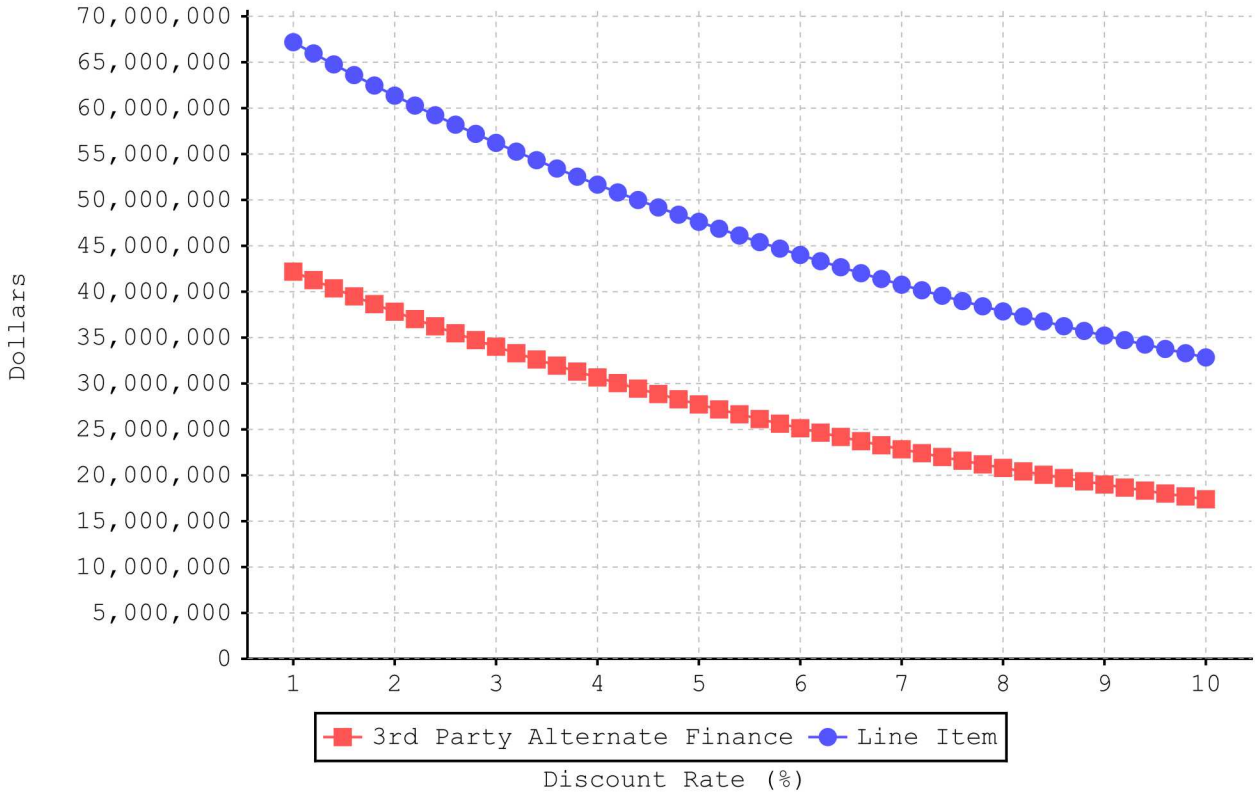
Results: For alternative Line Item to be ranked least cost, increase the selected expense(s) by more than 293.95%.

Expense	NPV Before	Change	NPV After
O and M	$ 7,843,761	$ 23,056,737	$ 30,900,498

Discount Rate Sensitivity Analysis

NPV rankings change at the following discount rates: No changes

Graph of Net Present Value vs. Discount Rate



Discount Rate Sensitivity Analysis

NPV rankings change at the following discount rates: No changes

Table of Net Present Values for each Discount Rate

Discount Rate =	1.0%	Discount Rate =	3.4%
3rd Party Alternate Finance	$ 42,184,695	3rd Party Alternate Finance	$ 32,615,942
Line Item	$ 67,186,630	Line Item	$ 54,329,388
Discount Rate =	1.2%	Discount Rate =	3.6%
3rd Party Alternate Finance	$ 41,263,844	3rd Party Alternate Finance	$ 31,947,516
Line Item	$ 65,959,893	Line Item	$ 53,419,614
Discount Rate =	1.4%	Discount Rate =	3.8%
3rd Party Alternate Finance	$ 40,367,824	3rd Party Alternate Finance	$ 31,296,216
Line Item	$ 64,764,497	Line Item	$ 52,531,236
Discount Rate =	1.6%	Discount Rate =	4.0%
3rd Party Alternate Finance	$ 39,495,863	3rd Party Alternate Finance	$ 30,661,531
Line Item	$ 63,599,431	Line Item	$ 51,663,605
Discount Rate =	1.8%	Discount Rate =	4.2%
3rd Party Alternate Finance	$ 38,647,215	3rd Party Alternate Finance	$ 30,042,969
Line Item	$ 62,463,720	Line Item	$ 50,816,101
Discount Rate =	2.0%	Discount Rate =	4.4%
3rd Party Alternate Finance	$ 37,821,161	3rd Party Alternate Finance	$ 29,440,053
Line Item	$ 61,356,429	Line Item	$ 49,988,121
Discount Rate =	2.2%	Discount Rate =	4.6%
3rd Party Alternate Finance	$ 37,017,007	3rd Party Alternate Finance	$ 28,852,321
Line Item	$ 60,276,654	Line Item	$ 49,179,087
Discount Rate =	2.4%	Discount Rate =	4.8%
3rd Party Alternate Finance	$ 36,234,081	3rd Party Alternate Finance	$ 28,279,328
Line Item	$ 59,223,528	Line Item	$ 48,388,439
Discount Rate =	2.6%	Discount Rate =	5.0%
3rd Party Alternate Finance	$ 35,471,735	3rd Party Alternate Finance	$ 27,720,643
Line Item	$ 58,196,214	Line Item	$ 47,615,636
Discount Rate =	2.8%	Discount Rate =	5.2%
3rd Party Alternate Finance	$ 34,729,343	3rd Party Alternate Finance	$ 27,175,848
Line Item	$ 57,193,905	Line Item	$ 46,860,159
Discount Rate =	3.0%	Discount Rate =	5.4%
3rd Party Alternate Finance	$ 34,006,300	3rd Party Alternate Finance	$ 26,644,539
Line Item	$ 56,215,825	Line Item	$ 46,121,505
Discount Rate =	3.2%	Discount Rate =	5.6%
3rd Party Alternate Finance	$ 33,302,021	3rd Party Alternate Finance	$ 26,126,327
Line Item	$ 55,261,227	Line Item	$ 45,399,188

Discount Rate Sensitivity Analysis

NPV rankings change at the following discount rates: No changes

Table of Net Present Values for each Discount Rate

Discount Rate = 5.8%	
3rd Party Alternate Finance	$ 25,620,834
Line Item	$ 44,692,739
Discount Rate = 6.0%	
3rd Party Alternate Finance	$ 25,127,693
Line Item	$ 44,001,706
Discount Rate = 6.2%	
3rd Party Alternate Finance	$ 24,646,552
Line Item	$ 43,325,652
Discount Rate = 6.4%	
3rd Party Alternate Finance	$ 24,177,068
Line Item	$ 42,664,153
Discount Rate = 6.6%	
3rd Party Alternate Finance	$ 23,718,910
Line Item	$ 42,016,803
Discount Rate = 6.8%	
3rd Party Alternate Finance	$ 23,271,756
Line Item	$ 41,383,207
Discount Rate = 7.0%	
3rd Party Alternate Finance	$ 22,835,297
Line Item	$ 40,762,983
Discount Rate = 7.2%	
3rd Party Alternate Finance	$ 22,409,230
Line Item	$ 40,155,764
Discount Rate = 7.4%	
3rd Party Alternate Finance	$ 21,993,266
Line Item	$ 39,561,193
Discount Rate = 7.6%	
3rd Party Alternate Finance	$ 21,587,122
Line Item	$ 38,978,925
Discount Rate = 7.8%	
3rd Party Alternate Finance	$ 21,190,524
Line Item	$ 38,408,628
Discount Rate = 8.0%	
3rd Party Alternate Finance	$ 20,803,208
Line Item	$ 37,849,979
Discount Rate = 8.2%	
3rd Party Alternate Finance	$ 20,424,918
Line Item	$ 37,302,666
Discount Rate = 8.4%	
3rd Party Alternate Finance	$ 20,055,406
Line Item	$ 36,766,388
Discount Rate = 8.6%	
3rd Party Alternate Finance	$ 19,694,430
Line Item	$ 36,240,854
Discount Rate = 8.8%	
3rd Party Alternate Finance	$ 19,341,757
Line Item	$ 35,725,780
Discount Rate = 9.0%	
3rd Party Alternate Finance	$ 18,997,162
Line Item	$ 35,220,893
Discount Rate = 9.2%	
3rd Party Alternate Finance	$ 18,660,425
Line Item	$ 34,725,929
Discount Rate = 9.4%	
3rd Party Alternate Finance	$ 18,331,334
Line Item	$ 34,240,630
Discount Rate = 9.6%	
3rd Party Alternate Finance	$ 18,009,683
Line Item	$ 33,764,749
Discount Rate = 9.8%	
3rd Party Alternate Finance	$ 17,695,272
Line Item	$ 33,298,046
Discount Rate = 10.0%	
3rd Party Alternate Finance	$ 17,387,908
Line Item	$ 32,840,286

APPENDIX L: HPCIC STATEMENT OF WORK AND SPACE PROGRAM

1.0 PROJECT STATEMENT

The proposed HPCIC facility is to be located in The Livermore Valley Open Campus (LVOC) which is a joint initiative between Lawrence Livermore National Laboratory (LLNL) and Sandia National Laboratories (SNL) initiated by NNSA to promote greater collaboration between the world-class scientists at the nuclear security labs and their partners in industry and academia. LVOC leverages and facilitates ready access to the expertise and capital investments already made by NNSA and DOE Office of Science while providing a dynamic and exciting work environment for scientists and engineers. LVOC is located on DOE property managed by SNL and LLNL that is within a General Access Area (GAA). In September 2010, the Livermore Valley Open Campus Development Options Report was submitted to DOE, describing proposed LVOC development options and the Campus Development Master Plan.

Launched in 2011 in a temporary facility by LLNL to foster collaboration, HPCIC is dedicated to partnering with American industry to develop, prove, and deploy high performance computing (HPC) solutions in areas of significant interest to industry and NNSA alike. Such cutting-edge HPC research can enhance U.S. competitiveness by facilitating advances in an array of fields, such as manufacturing, complex energy and infrastructure systems, cyber security, biosecurity, and big data analytics, while also helping the nation maintain a strong security posture.

However, with limited space, functionality, and equipment, HPCIC's temporary incubator facility is inadequate to meet the need, and HPCIC is currently forced to delay or decline multiple opportunities for collaborative research with high potential benefit. Replacing the current facility with a modern, fully equipped new building—envisioned to include open and closed offices, as well as meeting, visualization, training, education, and other collaboration areas—immediately adjacent to NNSA assets will enable mission-aligned unclassified collaborations and applied research with a greater number of external collaborators. In addition, the diverse array of projects envisioned for HPCIC will help retain lab researchers by allowing them to hone their skills on new intellectual challenges. At the same time, these collaborations will help the labs transfer their deep HPC knowledge to the external community, thus closing an extensive gap and helping create a new cohort of talent willing to join the lab to advance the national security mission.

Goals of the HPCIC facility include the following:

- Enable rapid progress in interdisciplinary research and interaction among national lab scientists, industry partners and academia
- Broaden the intellectual scope of research activities to advance the nation's science
- Provide the infrastructure to house collaborative work space
- Enhance synergy among university, public sector, and industry scientists by co-locating within a common work environment
- Provide an environment to attract the brightest, most creative students, postdoctoral researchers, and visiting scientists to study and conduct research
- Act as a catalyst for spin-off activities and technology transfer and as a stimulus for hosting industry partnerships
- Location within LVOC
- Enhanced accessibility by LLNL staff as well as outside partners to create an effective mechanism to leverage LLNL science and innovation through collaboration
- Flexible work environment with a mix of hard-walled and open spaces

- Training, classrooms, meeting, educational, and other collaboration spaces
- Communication equipment and network and data visualization capabilities
- Designed to a 2010 CALGreen California Building Code standard
- Flexible security access control system to accommodate changing levels of programmatic or administrative control of individual suites and areas
- Enable occupancy by 2016 and provide the best value to the government in terms of cost and schedule to meet the performance parameters

The developer of this project shall provide all design, engineering, management, and construction expertise necessary to deliver a fully functioning "Class A" facility as described herein. Coordination of the facility systems with equipment supplied by the end user is critical to making the facility fully operational at the time of commissioning. All facility systems shall be tested and commissioned in accordance with CALGreen commissioning requirements. Descriptions are limited to essential requirements. However, the developer is encouraged and expected to offer creative and cost-effective solutions. The selected developer will be required to conform to this Statement of Work (SOW). Although exceptions to these requirements may be permitted and even encouraged if they offer additional benefit, any exceptions must be noted in proposals and agreed to in writing.

1.1 INTRODUCTION

The proposed HPCIC facility for LLNL is intended to better support the mission and changing needs of the organization by providing a quality working environment that enhances collaboration between the technical staff of the laboratory and academic and private industry partners. . The HPCIC also aims to co-locate synergistic undergraduate and graduate computational programs and integrate the K-12 Discovery Center. The components to be housed in the proposed facility require approximately 98,000 gross square feet to accommodate approximately 360 employees and 50 visitors. Specific square footage requirements are addressed in the Program Summary table in Table L1.

HPCIC is to be a state-of-the-art facility. It will be an environmentally sustainable project and will incorporate sustainable and green features throughout the design, construction, and occupancy phases of the project. Specific sustainability requirements are detailed in this document. The base building infrastructure will be capable of supporting current and future needs of the tenant and will be designed and laid out in such a way as to readily facilitate changes in organization and mission or customer needs. The facility will enhance the quality of life of the occupants and visitors by providing access to natural light and views, a healthy work environment, and a modern, Class A office environment.

The interior design of the new facility will include numerous "best practice" workplace solutions currently implemented in public and private sector buildings. Some of these innovations include open plan work, universal planning, increased allocations of teaming and meeting spaces, and multiuse spaces.

The tenant intends to use the facility primarily as office and collaboration space with shared support. Generally, the facility will be configured with an open plan layout with limited enclosed office and support space incorporated throughout the facility. Support spaces include shared conference rooms, copy/work rooms, and coffee bars. Workspace standards have been developed for the organization and are shown in the programming section.

1.2 Sustainable Design and Development Considerations

Designing, constructing, and operating facilities in an efficient and environmentally sound manner is important to LLNL. Sustainable design and development is intended to minimize site disturbance, optimize energy and water use, provide good indoor environmental quality, ensure use of environmentally preferable building products, and enable handling of construction and demolition waste in a resource-conserving manner. The HPCIC should provide a healthful, resource-efficient, and productive working environment. To achieve these design goals requires an awareness of and a commitment to sustainable design through an integrated, whole-site and whole-building design and development approach. The developer is encouraged to suggest other measures and develop integrated solutions to meet the intent of a sustainable design for the HPCIC.

The developer is required to design and construct a building that will meet and or exceed the 2013 Energy Provisions of the California Green Building Standards Code, Part 11 of the California Building Code (also known as CALGreen).

It is a strong desire to make this facility as energy efficient and environmentally responsible as allowable by the budget. Innovative design strategies should be considered, such as heat recovery from exhaust systems, solar panels to supplement domestic hot water production, energy recovery ventilation units (ERVs) for outside air tempering, and use of renewable energy sources.

Compliance with the California 2013 Energy Efficiency Standards for Residential and Non-Residential Building is required.

1.3 Facility Access and Physical Security

There are two basic requirements for HPCIC:

- Provide ease of accessibility to the main conferencing areas for meetings without requiring LLNL security badges
- Maintain a secure perimeter for larger work spaces within HPCIC

The interior of the HPCIC will have both restricted and non-restricted areas. Access to the restricted areas will be permitted only to those holding security badges.

A new parking area in the GAA adjacent to the proposed HPCIC site will provide parking for HPCIC occupants and guests.

1.4 Audio Visualization Systems

As part of its bid, the developer shall include a proposal for supplying audio visual, teleconferencing, and presentation equipment to fully out fit the conference and meeting spaces. The developer's architect and the user shall work together to coordinate quality, styles, and finishes.

1.5 PROJECT COMPLETION AND CONTRACT CLOSEOUT

Contract closeout submittals shall be in an electronic format that is compatible with the systems used initially to create the contract documents. These submittals are as follows:

1. Record Documents/Drawings
2. Operation and Maintenance Data/Manuals
3. Guarantees/Warranties
4. Listing of Spare Parts and Maintenance Materials
5. Evidence of compliance with the requirements of governing authorities
6. Special Closeout Submittals
7. Evidence of compliance with all City of Livermore development requirements

1.6 PROGRAM OVERVIEW

The program for HPCIC incorporates spaces suitable for a 21st century collaborative work space, research, and development environment. The facility should be similar to a world-class academic, industrial or government laboratory having similar requirements.

HPCIC will primarily provide space for unclassified collaborative programs in advanced high performance computing. This facility will be located outside the controlled area (PPA) of LLNL to foster collaboration with industry partners and academia. Several mission support activities will also relocate to this facility. Moving these functions out of the secured area allows repurposing of the vacated space to support programmatic growth within limited areas. Table L1 and Table L2 below summarizes the number of staff, the square footage required, and the desired floor location.

Table L1. HPCIC program summary

Detailed program areas	Staff	Ft^2	Desired floor
HPCIC staff and computations	44	4,600	2nd
Livermore computing	10	1,220	
Advanced simulation and computing	15	2,020	
Energy infrastructure and cyber security	38	4,240	
Bioinformation, pharma, toxicology, and big data	30	3,260	3rd
Materials engineering and manufacturing	20	2,260	
Geomechanics, seismology, wind, and climate	7	1,120	
Critical materials, electronics, and advanced materials	20	2,260	
Environment and combustion	21	2,300	
HEDS, fusion, imaging, and space	10	1,520	
University programs, industry and academic partners, and incubator programs	100	9,546	1st
Training, meeting visualization, education, and other collaboration space	2	15,375	
Industrial partnerships office	43	13,000	
Building support services areas (stairwells, elevators, restrooms, electrical rooms, mechanical rooms, telephone, data, & network closets, etc.)	—	18,117	—
Building circulation areas (lobbies, reception areas, elevator lobbies, walk ways, corridors, interior circulation, etc.)	—	16,745	—
Totals	**360**	**97,583**	

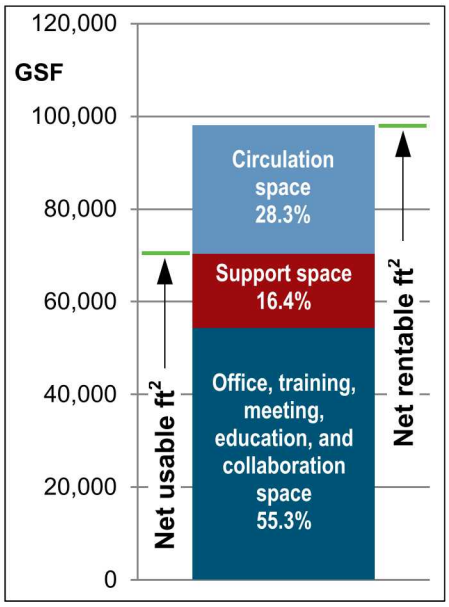


Figure L1. Building space use by square footage and percentage

Table L2. Summary of space programming

Program	Ft^2
Programs • Computing, cybersecurity, biosecurity, energy, manufacturing, materials, big data, other • University programs, industry and academic partners, incubator programs	53,436
Training, meeting, education, and collaboration • Collaborative space, large meeting rooms, classrooms, educational programs, data visualization, food services	23,921
Technology transfer • Industrial partnerships, licensing, business development	20,226
Total GSF	**97,583**

The research and development (R&D) space will be a mix of individual workspace and collaboration space. The collaborative space is focused on a more open environment with few enclosed offices and touchdown space for visitors and LLNL staff who have their individual workspace in the secured area and are working with industry partners and academia.

Shared support spaces will be distributed throughout the facility for use by the different R&D disciplines in the facility.

1.7 CODES, STANDARDS, AND PERMITTING

The Facility shall be treated as a "Class A" commercial project and shall be designed with an expected life span of 35–50 years. Factory Mutual standards shall be incorporated. The developer shall file and acquire all permit documents required for the City of Livermore. The primary building codes and standards for this project at LLNL are:

- 2013 California Building Code
- 2013 California Fire Code (Based on the 2009 International Fire Code)
- 2013 California Plumbing Code (Based on the 2012 Uniform Plumbing Code)
- 2013 California Mechanical Code (Based on the 2012 Uniform Mechanical Code)
- 2013 California Electrical Code (Based on the 2011 National Electrical Code)
- 2013 Building Energy Efficiency Standards (Title-24)
- Accessibility requirements in compliance with Chapter 11B of the 2013 CBC
- CALGreen Code
- City of Livermore Development Code
- The Energy forms required at time of permit submittal
- City of Livermore Environmental Standards that require laboratory drain lines to be separate from other building sanitary system piping and collected to a common point outside the facility
- Plan review fees, which are the responsibility of the developer
- Livermore-Pleasanton Building Department and Fire Department Plan review

2.0 PROJECT PROGRAM

2.1 SUMMARY

The HPCIC will include approximately 76,800 GSF of suburban "Class A" office space and collaboration space with training, meeting, education, and reception areas and an information hub for the facility of approximately 20,700 GSF. The office space will consist of typical office building elements including private and open office areas, smaller meeting spaces, copy/break areas and all necessary support spaces.

2.2 SITE

The intended HPCIC building site is on the eastern boundary of the LLNL Site 200 Limited Area. Although currently within the PPA, the proposed site will be re-fenced such that it will be within a GAA prior to start of construction.

2.2.1 Geotechnical

A geotechnical investigation was conducted in 2011 in this specific site. A copy of the report will be made available for information only.

The developer shall retain the services of a geotechnical consultant to perform an appropriate number of borings and produce a geotechnical report. The report is to contain boring logs, site plan, description of soils, and water table location. Recommendations on foundation design, including seismic site class, allowable bearing pressures, bearing elevations, anticipated settlement, and lateral earth pressure, shall be included.

2.2.2 Survey

Developer shall retain the services of a registered Land Surveyor to prepare a survey of the proposed site. The survey shall include grades, site boundary lines, location of existing structures, paving and improvements, and location of trees, natural and man-made objects, and utilities. Utility information shall include location, size, and depth of water, gas, sewer systems (including laboratory waste, storm and sanitary), central steam, fire hydrants, central chilled water, and power and communications systems, and all associated easements.

2.2.3 Environmental Evaluation

As a federal agency, DOE/NNSA must comply with the requirements of the National Environmental Policy Act (NEPA). The developer shall be responsible for compliance with CEQA and other state and local regulations, if needed.

2.2.4 Topography/Storm Drainage/Detention

Compliance includes wetland and storm water management (including parking lot runoff), a Storm Water Pollution Prevention Plan (SWPPP), including an Erosion and Sedimentation Control Plan, and agreement with LLNL regarding the changes of storm water runoff flow onto their property from this site. Grading and drainage plans will require review and approval of the state of California. Calculations regarding storm water rates and volumes, retained, detained, and discharged must be prepared and submitted by the developer for review and approval by all applicable authorities.

2.2.5 Utilities

The developer will be responsible for all required utility service infrastructure for the HPCIC, including coordination with existing utilities, and appropriate isolation, according to applicable standards. All necessary electric, telecommunications (voice and data), water, sewerage and natural gas will be available at the project boundary.

2.2.5A Domestic Water and Sewer

Water (for both domestic use and fire protection) and sanitary sewer for the project will be available at the project boundary. The developer shall be responsible for applicable fees (such as impact fees, tap fees, etc.) as well as for construction of all new on-site lines required to serve the building and any required fire hydrants.

2.2.5B Telecommunications/Cable Infrastructure

The HPCIC telecommunication system shall originate from LLNL telecommunication infrastructure, and the conduit infrastructure will be available at the project boundary.

The developer will provide appropriate conduit pathways from the building to the LLNL infrastructure for copper conductors and fiber cable to provide telecommunications and data to the building. The conduit pathways shall include manholes and concrete-encased conduits to the LLNL-designated location as needed.

2.2.5C Electrical Service

The existing 13.8kV medium voltage distribution system shall be utilized for the primary power to the facility and will be available at the project boundary. The projected electrical demand for this facility shall be approximately 750 kVA to 1200 kVA. The developer shall perform electrical calculations per the National Electrical Code (NEC), using energy usage criteria from California Title 24 and ASHRE 90.1 to determine the exact demand load for the building. The developer's calculation shall utilize the information presented in this document concerning the program and projected usage of the building plus 20% spare capacity. The developer shall provide a medium voltage switch capable of two incoming circuits and two outgoing feeders. The medium voltage (13.8 kV) to low voltage (480V) transformer shall be oil filled or dry type, cast coil transformer sized for the load of the building plus 20% spare capacity. The location of the building main transformer shall be coordinated with the owner's site. The location shall meet the requirements of NEC and Factory Mutual.

2.2.5D Site Lighting

The site lighting shall comply with California Title 24 energy code for the light intensity, distribution, and control. The lighting shall provide safe passageway to and from the building for the occupants but shall not provide light pollution to the surrounding areas. The light fixtures shall be LED type for pole-mounted and building-mounted lighting.

2.2.5E Storm Sewer Service

Compliance with the State of California Storm Water Management laws and regulations will be required. The developer shall be responsible for the development and implementation of a Storm Water Pollution Prevention Plan and securing a Construction Activities Storm Water General Permit (2009-0009-DWQ, or most current version) from the State of California. LLNL staff may assist in facilitating the land owner signatures as needed and provide necessary site information for the permit submission.

Section 438 of the Energy Independence and Security Act (EISA 438) requires that federal agencies "use site planning, design, construction, and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the pre development hydrology of the property." The methodology and execution is the responsibility of the developer. The EPA issued Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act on December 4, 2009. That document is available at http://www.epa.gov/oaintrnt/documents/epa_swm_guidance.pdf

2.3 TRAFFIC

During construction it is anticipated that construction vehicle access will be via Credit Union Drive off Greenville Road. Any easements for site access during construction will be negotiated with LLNL during the design phase. The developer's Lay-Down will be within the area dedicated for the HPCIC parking area.

2.4 PARKING

The developer shall construct the necessary parking immediately to the south of the HPCIC. The project must comply with Livermore Development Code, Section 4.04 / Parking. Parking areas shall include a visitor drop off area and provide bicycle spaces and other possible modifications as prescribed by the Livermore Development Code.

2.5 LANDSCAPING

The developer will comply with Livermore Development Code, Section 4.05 for landscaping requirements and to Municipal Code 13.25 Water Efficient Landscape Ordinance. The developer shall provide parking, walks, grading, detention, site utilities, lighting, and other hardscape and landscaping. Site lighting shall be designed to minimize visual impact beyond the site property line. Landscaping should be appropriate for the facility and site design. To the greatest extent possible, landscape plantings shall utilize native and hardy plant species enhancing the visual character of the Facility and extend the architectural concept into the surrounding environment.

Within the limits of the site, the developer will restore all disturbed areas with landscaping materials, hardscape or parking areas. This outdoor space shall include planting, shading, hardscape, trash receptacles, and furnishing for outdoor dining.

3.0 OTHER CONSIDERATIONS

Other building features, including foundations, superstructure, exterior enclosure, roofing, interior construction, stairs, interior finishes, conveying, plumbing, HVAC, fire protection, electrical systems, lighting, and security, will meet the standards of Class A buildings in the region.

APPENDIX M: OPTIONS AND CONSIDERATIONS OF LVOC THIRD-PARTY TRANSACTION ENTITIES

Potential third-party transaction entities should be evaluated against these desired characteristics:

- Features preferred by DOE (& OMB)
- Not for profit, 501(c)(3)
- Special purpose—no conflicts of interest
- Aligned interests with government and the labs, responsive
- Simple—minimized cost and interfaces
- Stable over asset lifetime
- Financeable with beneficial rates
- Transfers risk to private sector
- Arm's length
- Successful precedent and leverage best practices
- Effective at delivering project(s)
- Flexible for both labs and to expand over time to encompass additional LVOC projects
- Property tax exempt
- Bankruptcy remote, other activities limited
- Transparency

Table M1 summarizes considerations of different third-party entities.

Table M1. Third-party entity considerations

	Delaware Statutory Trust	Limited liability company	Not-for-profit corporation
Management	**Trustees** Corporate, Bond (if appropriate) Local bank, and Delaware trustee **Beneficiary(ies)** Bondholder entity; Educational entity directed to utilize the funds in a manner supportive of the DOE mission	**Managers** Individual representative, Local bank, Bond trustee (if appropriate) **Members** Bondholder entity; Educational entity directed to utilize the funds in a manner supportive of the DOE mission	**Board of Directors—** (comprised of individuals not entities) Underwriter or Bond Trustee Educational entity Local bank representative (possibly) **Members** Bondholder entity; Educational entity directed to utilize the funds in a manner supportive of the DOE mission
Charter	**Trust Agreement** Cannot be amended without court action, unless provides otherwise	**Operating Agreement** Requires members (unanimous or stated percentage) approval to amend	**Articles and By-Laws** Requires board (unanimous or stated percentage) vote to amend
Income tax exemption qualifications	Applies for 501(c)(3) status Charitable purpose and beneficiaries that exist for charitable purpose	"Pass through" permitted with 501(c)(3) members Charitable purpose depends on members and charter	Applies for 501(c)(3) status Charitable purpose depends on activities and charter
Property tax exemption requirements	Primary activities, as represented by the beneficiaries, must be charitable and educational	Primary activities, as represented by the organization and the members, must be charitable and educational	Primary activities, as represented by the organization and the members, must be charitable and educational
Governance and accountability	"Locked path approach" defined under Trust Agreement carried out by trustees with a fiduciary responsibility to the beneficiary(ies)	Business judgment exercised by managers (organizational and individual) with a fiduciary responsibility to the members	Business judgment exercised by board of directors (individuals) with a fiduciary responsibility to the members
Bankruptcy risk	Bankruptcy remote	Bankruptcy remote	Bankruptcy remote, but less comfort for lenders
Other considerations	Could provide for change in trustees at a later date Preferred structure for capital market funding (per AG Edwards) Maximum flexibility	Could limit amendment by requiring approval of a 3rd party who is not a member or manager Noted as acceptable alternative for capital market funding (per AG Edwards), but may carry more perceived risk	Not typically used commercially to execute this type of deal Following corporate statute can be cumbersome

APPENDIX N: INDEPENDENT COST ESTIMATE FOR CREATE AND HPCIC

The Office of Acquisition and Project Management (APM) commissioned an Independent Cost Estimate (ICE) for the CREATE and HPCIC facilities that assumed a Federal Direct contracting approach.

The Critical Decision 1 (CD-1) document, *CD-1: Alternatives Analyses and Business Case*, April 2014, assumed LVOC facilities would be procured through a management and operating (M&O) contractor. APM has noted that many of the facility attributes favorable to an alternative financing (AF) approach also apply to a Federal Direct contract approach under the new APM operating framework:

- Low technical risk facility with standard office and light laboratory space
- Construction outside the limited area and on unencumbered green-field site
- Favorable construction contractor market and bid environment

The ICEs were based on several assumptions:

- The projects would be executed via a Federal Direct acquisition strategy instead of via contracting through the site M&O.
- The ICEs would include only design and construction of the CREATE and HPCIC facilities; the startup functions of the facility will remain with the M&O.
- The ICEs would exclude the cost associated with furniture, fixtures and equipment and government-furnished equipment (consistent with the CD-1 document).
- Interface and support activities provided by the M&O were assumed to incur only minimal costs and were not included in the ICE.
- All costs are normalized and reported in FY2014 dollars.

The ICEs were completed in accordance with Government Accountability Office's 12-step process for developing credible cost estimates. The estimates were based on $/ft^2 benchmarks developed based on analogous projects from Facilities Information Management System (FIMS) data and on Unified Facilities Criteria (UFC) Guide benchmarks, which vary according to building space type and utilization. Contingency for the ICE was based on the 85% confidence point. The results of the ICEs are shown in Table N1 below.

Table N1. ICE estimate

Facility	CD-1 Estimates		APM ICE of Federal Direct Contract Approach		
	Alternative finance	Line item	Estimate with contingency	Point estimate	Range
CREATE	$26.7M	$45.1M	$37.2M	$29.3M	$27.5M–$37.2M
HPCIC	$28.7M	$41.6M	$38.3M	$29.4M	$27.6M–$38.3M
Total	**$55.4**	**$86.7**	**$75.6M**	**$58.7M**	**$55.1–$75.6M**

Below is an abbreviated summary of key points brought up in several reviews and corresponding responses.

- **Contingency:** Questions arose around contingency and its similarity to escalation values.

  Response: The line item contingency value used in the analysis was based upon experience at the labs and DOE Guide G413.3-21. The contingency value used was lower than values typically used at the conceptual design and CD-1 stages to conservatively align with the approach presented in the alternative finance option of a design-build methodology. Contingency for the AF estimate was based on the independent cost estimator and aligns with normal commercial practices for a facility of this type. The contingency value is coincidentally similar to, but not based on, the escalation value.

- **Construction:** Questions were raised concerning LEED certification and the impact on construction costs.

  Response: The higher costs for the line item option are due to the increased requirements and heightened regulatory, reporting and administrative efforts associated with a DOE project, as opposed to commercial requirements. The higher line item costs include the following:

  - 10CFR851 (compared to the costs incurred by commercial construction to meet Cal OSHA requirements)
  - LEED Gold (compared to the costs incurred by commercial construction to meet Cal Green requirements)
  - Compliance with DOE O 413.3b, costs associated with pre-line item approval (CD-2, etc.) and general oversight and training (site and environmental health and safety)
  - Security, such as badging and truck inspection

  The 10–40% value referenced in Section 4.2 for CD-1 was established through the DOE Operations Improvement Council Cost Workshop. Further, an analysis from the DOE Office of Science demonstrated an average 42% reduction in commercial construction (Ackerman 2012) compared to the line item approach.

- **Construction Burdens:** Clarification was requested around adding the laboratory construction burdens and if the labor rates have been parametrically assessed.

  Response: The external estimator parametrically included the fully loaded costs only for the labor components, such as project and construction management. The estimator did not have insight into the labs' burden structures for construction activities, and therefore did not include any such costs. The laboratory construction burden is assessed separately to contracted costs (i.e., hard and soft construction) only.

- **Tenant Improvement Costs:** Reviewers requested an explanation for the differences in tenant improvement costs between the line item and AF estimates for CREATE.

  Response: Tenant improvement costs are meant to capture the construction elements in a commercial project that serve the specialized needs of the tenant and that would not be part of a standard commercial office or lab space development. Although such elements would be included in a standard line item project, they were pulled out in this estimate to enable a like-to-like comparison. For CREATE, such elements include tenant enhancements for the security and communications infrastructure as well as for outfitting of laboratories and other specialized spaces. Since these elements are primarily construction-like activities, the cost differential between the line item and AF estimates stems from the same sources as those for other construction-related cost differences.

- **Contingency and Risk:** Clarification was requested on the methodology used for the point estimate and contingency.

Response: Contingency for new line item construction is only 12%. The line item point estimate, rather than the upper end of the 85% confidence range, was used to compare costs between the line item and the alternative finance option. Even if the contingency was removed, using the 85% confidence value to compare against the alternative finance option would have created a larger cost differential between the line item and alternative finance construction estimates. In the case of CREATE, the 85% value would be 40% higher than the point estimate used. Therefore, the approach used in the CD-1 does not alter the evaluation of alternatives.

- **O&M Costs:** Reviewers requested additional discussion on the higher line item O&M costs.

  Response: Costs for services provided by the labs are higher than those of typical commercial construction due to several factors. These factors include required training, badging, and site access; citizenship requirements; clearances and/or escorts; 10CFR851 worker safety and health requirements; enhanced procurement requirements; Federal Acquisition Regulations; environmental restrictions; and the relatively small scale of the sites.

- **Construction Practices:** Additional discussion on the higher line item construction costs was requested.

  Response: The higher costs for line item construction compared to commercial construction are driven by the elements discussed above (i.e., contingency, escalation, and laboratory burdens, as well as costs related to differences in requirements for oversight, worker health and safety, restricted site access, procurement requirements and energy and environment restrictions). The differences observed align with previous experience and studies evaluating DOE projects against commercial construction projects.

  Although the base project cost for the line item option is significantly higher than that for the AF option, line item general conditions (GC) are around 6% compared to 5% for AF. GCs reflect the cost of managing the construction, as well as of the incidental cost to the general contractor. The slightly higher GC percentage for the line item options stems from the greater requirements (discussed above) placed on federal procurements. The GC percentages were provided by the professional estimators engaged to develop the estimates. The GC percentage for the federal procurements aligns with the Labs' experiences in California construction projects.

- **Accelerated line item timing:** A question arose about how the analysis would change if construction times for the line item and AF options were estimated on the same time scale to eliminate a potential escalation bias.

  Response: The analysis considered the present value of lifecycle costs, and not simply the total project cost, of each option. The escalation rate and the discount rate are similar; the only possible escalation difference is therefore due to timing differences. To examine the impact of timing, estimators evaluated a hypothetical scenario that assigned similar start and beneficial occupancy dates to the line item and AF options. The overall impact of this scenario on net present value was negligible and did not change the conclusion.

In conclusion, after several reviews—including a comprehensive discussion with representatives from NA-00, NA-APM, LFO and the independent cost evaluator Tecolote Research, Inc., on November 11, 2014—questions and points of concern with respect to the CD-1 line item construction estimates were satisfactorily resolved. This final review validated the line item costs and methodologies used in the CD-1 with no further actions required.


Lawrence Livermore
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NNSA
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Sandia National Laboratories

Open Collaboration and Research Capabilities on the Livermore Valley Open Campus

COLLABORATION IN RESEARCH AND ENGINEERING FOR ADVANCED TECHNOLOGY AND EDUCATION (CREATE)

AND

HIGH PERFORMANCE COMPUTING INNOVATION CENTER (HPCIC)

Acquisition Strategy
An Addendum to the Critical Decision-1 Document

Non-Major System Acquisition Project
Submitted: January 2015

Lawrence Livermore National Laboratory

NNSA National Nuclear Security Administration

Sandia National Laboratories

Prepared for the U.S. Department of Energy National Nuclear Security Administration

REVISION HISTORY

Original	January 15, 2015	

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Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND No. 2013-9704P.

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

AF	Alternative Finance
CD	Critical Decision
CREATE	Collaboration in Research and Engineering for Advanced Technology and Education
CT	Coordination Team
CTL	Coordination Team Leader
DOE	U.S. Department of Energy
DOR	Development Options Report
FLA	Facility Lease Agreement
GSF	Gross Square Feet
HPC	High Performance Computing
HPCIC	High Performance Computing Innovation Center
HQ	Headquarters
IPT	Integrated Project Team
LFO	NNSA Livermore Field Office
LLNL	Lawrence Livermore National Laboratory
LVOC	Livermore Valley Open Campus
M&O	Management and Operating
MNC	Mission Need Concept
NEPA	National Environmental Policy Act
NNSA	National Nuclear Security Administration
POC	Point of Contact
SFO	Sandia Field Office
SNL	Sandia National Laboratories
SNL/CA	Sandia/California
ST&E	Science, Technology, and Engineering
TEC	Total Estimated Cost
TPC	Total Project Cost

1. INTRODUCTION

As defined in U.S. Department of Energy (DOE) Order O 413.B, Program and Project Management for the Acquisition of Capital Assets and DOE Guide 413.3-13, Acquisition Strategy, this document was developed by the Integrated Project Team (IPT) to facilitate attainment of acquisition objectives for the Collaboration in Research and Engineering for Advanced Technology and Education (CREATE) and High Performance Computing Innovation Center (HPCIC) projects at Sandia National Laboratories (SNL) and Lawrence Livermore National Laboratory (LLNL). This plan addresses technical, business, management, budget, and other significant considerations that will control the acquisition.

Lead Program & Project Office

National Nuclear Security Administration (NNSA), Office of Deputy Administrator for Defense Programs

Total Estimated Cost (TEC) Range

CREATE: $27M–$45M

HPCIC: $29M–$55M

Total Project Cost (TPC) Range

CREATE: $27M–$45M

HPCIC: $29M–$55M

Critical Decision-0 Approve Mission Need—Approval Date, Approving Official, and Material Changes

The NNSA Administrator approved the Critical Decision (CD)-0 for Livermore Valley Open Campus (LVOC) development on April 22, 2013, and requested submission of CD-1 for CREATE and HPCIC, specifying that the alternatives presented should include an alternative finance (AF) option. There have not been material changes in mission need, mission need date, major project milestones, or contract type since CD-0 approval.

2. DESIRED OUTCOME AND REQUIREMENTS DEFINITION

2.1 SUMMARY PROJECT DESCRIPTION AND SCOPE

The CREATE and HPCIC facilities are designed to meet NNSA mission needs by enabling collaborations that leverage the core capabilities of SNL and LLNL, enable the benefits of broad collaboration, and advance science, technology, and engineering (ST&E) in critical areas for NNSA. These pioneering initiatives also help the national laboratories maintain their capabilities and relevance by enabling the labs to capture the innovation of the external ST&E community, attract a strong pipeline of ST&E candidates, and retain an experienced workforce with national security knowledge and skills.

These new planned facilities are described below.

CREATE

A multi-program, mixed-use facility of 86,000 gross square feet (GSF), CREATE will stand as a new intellectual and collaborative center for Sandia/California (SNL/CA) site that will deliver on the core value proposition of LVOC: leveraging the broader ST&E community to enhance laboratory national security programs. Such leveraging will be particularly important over the next 15–20 years to meet the large engineering mission challenges in several nuclear weapons programs scheduled over this period. To this end, CREATE will house new and expanded programs in areas—such as hydrogen science and technology for energy applications, cybersecurity, advanced engineering and manufacturing, and translational biomedicine—that allow mutually beneficial connections between national security mission ST&E and external partners. CREATE plans are consistent with the SNL *Ten-Year Site Plan*, the SNL/California *Site Development Plan*, and mission requirements for critical national security programs.

HPCIC

Launched in 2011 to strengthen strategic areas of the Advanced Simulation and Computing program, LLNL's HPCIC helps achieve the mission goals outlined in the Advanced Simulation and Computing Strategy by encouraging partnerships that increase the flow of ideas into the lab to develop robust tools and codes; bolster efforts to recruit and retain talent; and maintain effective working relationships with DOE and federal partners, industry, and academia aimed at overcoming critical technology challenges. Preserving NNSA national laboratory leadership in high performance computing (HPC) is vital to long-term success in sustaining a safe, secure, and effective nuclear deterrent for the nation.

The current temporary HPCIC building (a rented trailer) will be replaced with a state-of-the-art, mixed-use, environmentally sustainable facility designed to satisfy the required local California Green Building Code and all pertinent DOE regulations. The planned multi-story 98,000-GSF building will provide office space joined by meeting, training, data visualization, education, and collaboration areas, as well as magnet amenities that support interactions between building occupants. Aligned with current best practice, areas will be sufficiently large to accommodate collaborative activities, and a built-in flexible design will meet both current and future space needs in response to organizational or mission-related changes.

2.2 PERFORMANCE PARAMETERS REQUIRED TO OBTAIN DESIRED OUTCOME

CREATE

CREATE will be designed to foster collaborations to advance ST&E in areas crucial to the national security mission, benefit external collaborators, and attract new scientists and engineers to the national security space. To these ends, CREATE will provide office, light laboratory, and teamwork areas in a state-of-the-art facility that is more functional and energy-efficient than many existing buildings on the SNL/CA site. CREATE will enable collaboration with academic and industrial partners that build or maintain expertise in unclassified aspects of programs currently housed in the Limited Area.

The CREATE project must provide the following performance parameters:

A facility in close proximity to key SNL/CA facilities

Flexible work suites and light laboratories for unclassified programs for collaborations with industry, academia, and partners

Collaboration space for the full spectrum of SNL programs

A space acting as the SNL/CA "front door" to consolidate business and security functions and better engage collaborators

Office space to accommodate some 150 staff and 50 visitors with an appropriate mix of hard-walled offices and cubicles

Meeting rooms and video teleconference space with multiple-user IT connections

Impromptu collaboration and break-out discussion space, both open and private

Flexible classroom and training space

Technical information media center and other magnet amenities that proactively drive interactions between researchers

Facility designed to a 2010 CALGreen California Building Code standard

Flexible security access control system to accommodate changing levels of programmatic or administrative control of individual suites and areas

Network access with support for multiple users with a robust, modern building distributed communications infrastructure

HPCIC

The *Mission Need Statement* and the *LLNL Program Requirements Document* identified the need for a facility with the following features to meet the following project performance parameters for an open collaboration and research space:

Location within LVOC

Enhanced accessibility by LLNL staff and outside partners to create an effective mechanism to leverage LLNL science and innovation through collaboration

Flexible work environment with a mix of hard-walled and open spaces

Training, classrooms, meeting, education, and other collaboration spaces

Communication equipment and network and data visualization capabilities

Opportunities for industry, academia, and other strategic partners to co-locate

Approximately 100,000 GSF of space

Facility designed to a 2010 CALGreen California Building Code standard

Flexible security access control system to accommodate changing levels of programmatic or administrative control of individual suites and areas

2.3 MAJOR APPLICABLE CONDITIONS

SAFETY, ENVIRONMENTAL, REGULATORY, AND POLITICAL SENSITIVITIES

The proposed project include surface disturbance, new construction activities, and new emissions sources that were previously analyzed in the SNL *Final Site-Wide Environmental Assessment* (DOE-EA-1422, January 2003), *Supplement Analysis* (DOE-EA-1422-SA01 September 2012) and *Supplement Analysis of the 2005 Final Site-wide Environmental Impact Statement For Continued Operation of Lawrence Livermore National Laboratory* (DOE-EIS-0348-SA-03, August 2011).

The NNSA Administrator and the Under Secretary for Science authorized the creation of LVOC by approving the Mission Need Concept (MNC) on July 20, 2009. This document—along with the LVOC Development Options Report (DOR), which was endorsed by the NNSA Administrator and the Under Secretary for Science in September 2010—established a mission need and framework for developing LVOC. The need for CREATE and HPCIC, the first new major acquisition projects for LVOC, was documented in the CD-0 *Statement of Mission Need: Open Collaboration and Research Capabilities in the Livermore Valley Open Campus*. The NNSA Administrator approved the CD-0 for LVOC development on April 22, 2013 and requested submission of CD-1 for CREATE and HPCIC, specifying that the alternatives presented include an alternative finance option.

Implementation of a safety program compliant with federal and state occupational safety and health requirements will be the responsibility of the third party.

The CREATE and HPCIC facilities will be located in a General Access Area adjacent to fenced Property Protection Areas and adhere to building-level security measures. Both laboratories have engaged and will continue to engage subject matter experts in physical, cyber, and operational security and counter intelligence as integral team members in all phases of LVOC development and implementation to identify and mitigate concerns.

3. COST AND SCHEDULE RANGES

3.1 CREATE TOTAL PROJECT COST RANGE

Table 1. Total project cost range ($k)

	High range	Low range
Design and Construction	$ 44,718	$ 26,191
Other Project Cost	$ 380	$ 540
TPC	**$ 45,098**	**$ 26,731**

Additional detail in Table 5 of *CD-1: Alternatives Analysis and Business Case*

3.2 HPCIC TOTAL PROJECT COST RANGE

Table 2. Total project cost range ($k)

	High range	Low range
Design and Construction	$ 54,538	$ 28,154
Other Project Cost	$ 855	$ 540
TPC	**$ 55,393**	**$ 28,694**

Additional detail in Table 17 of *CD-1: Alternatives Analysis and Business Case*

3.3 FUNDING PROFILE

The recommended acquisition alternative is for delivery of both projects using alternative financing by a third party. Therefore, there is no capital acquisition funding profile.

3.4 KEY MILESTONES AND EVENTS

Table 3. Updated CREATE and HPCIC major project milestones

Description	Planned fiscal year
Approve Mission Need CD-0	3Q2013
NEPA Approval (CX update)	2Q2015
Approve Alternative Selection and Cost Range CD-1	2Q2015
Approve Alternative Finance Proposal	4Q2015
Occupancy of Facility	4Q2017

4. ALTERNATIVES AND RISK ANALYSIS

4.1 TECHNICAL ALTERNATIVES ANALYSIS

Five options were analyzed for meeting the mission requirements identified in the CD-0 document. The options considered were the following:

Take no action (maintain status quo)

Renovate an existing onsite facility

Build a new onsite facility as a DOE line item (line item)

Lease an offsite facility (offsite lease)

Lease a commercial onsite facility (alternative finance)

For both facilities, the take no action option fails to meet the mission need, and leasing an offsite facility does not enable or facilitate the interactions with the two laboratories or employees on the main site that are required to fulfill the mission need. These options were therefore eliminated.

For CREATE, the renovation option is not feasible because the SNL site has no viable candidate facility for renovation. LLNL considered three building complexes for renovation, and performed a financial analysis for the option that best fit the criteria. The renovation costs exceeded the costs for a new line item facility and therefore the renovation option was eliminated.

Within the next 15–20 years, NNSA strategy indicates an expected rise in engineering mission work in nuclear weapons and a window of opportunity to advance HPC technologies and applications and broaden the user community base. Over this period, alternative finance provides the best value to the government by achieving mission needs while meeting schedule demands and reducing risk to the government. An in-depth financial analysis of the remaining alternatives identified the significant benefits of the alternative finance option over the line item approach for new construction over a proposed 15-year lease period. For CREATE, alternative finance decreases project life-cycle costs by an estimated $25.4M, and for HPCIC, alternative finance decreases project life-cycle costs by $23M. These findings are consistent with a recent study of four DOE alternative finance facilities, which showed that in all four cases, alternative financing provides cost and schedule advantages and thus the best value to the government. Detailed analyses of the alternatives can be found in the *CD-1: Alternatives Analysis and Business Case.*

4.2 RISK ANALYSIS

The alternative finance acquisition strategy for CREATE and HPCIC transfers significant risk to the private sector.

An initial risk identification and analysis was performed—based on DOE G 413.3-7A, *Risk Management Guide*—that identifies the risks associated with the alternative finance acquisition strategy for the CREATE and HPCIC projects. The alternative finance approach transfers substantial risks borne by DOE and the operating contractors in a typical line item construction project to the private sector.

For the risks that remain with DOE and the operating contractors, the team assessed the probability of occurrence and potential consequences on the project. It then identified a risk mitigation strategy and rated the residual risk as high, medium, or low. Table 4 below describes the residual risks that are not rated low.

Table 4. Risks to DOE and the operating contractors not rated "low"

Risk area	Description	Probability	Consequence	Risk rating
Planning	Costs change significantly from those used in planning, resulting in unaffordable costs.	Low	High	Medium
Technical	Safety, security, or significant environmental issues emerge during private sector development and ownership of a facility on leased federal land, damaging the reputation of LLNL, SNL, NNSA, or DOE.	Low	High	Medium
Organizational	Lack of clarity of roles, responsibilities, and authorities for DOE/NNSA, delaying the project.	Medium	Medium	Medium
Project execution	Delays in required governmental actions or approvals, delaying the project.	Medium	Medium	Medium

5. BUSINESS AND ACQUISITION APPROACH

5.1 ACQUISITION ALTERNATIVES ANALYSIS

The recommended acquisition strategy for the proposed CREATE and HPCIC facilities is to lease third-party buildings to be constructed onsite within LVOC (alternative finance). The buildings would be privately owned, financed, developed, and operated by the facility owner under a ground lease from DOE. The buildings would be constructed in accordance with local building codes and leased to the Management and Operating (M&O) contractors for their use in support of the NNSA mission.

5.2 ACQUISITION DECISION PROCESS

DOE G 430.1-7, *Alternative Financing Guide* establishes four phases in the alternative financing process:

Phase 1—Development of Mission Need

Phase 2—Development of Alternatives Analysis

Phase 3—Development of an AF Proposal

Phase 4—Submittal of the AF Proposal to Headquarters

The LVOC process is currently in Phase 2 with the development of this CD-1 proposal. Since the actual alternative finance model is not developed until Phase 3, it is not appropriate to commit to a particular alternative finance model at this time. In this section, we review attributes of models that could meet the needs of the broad spectrum of stakeholders present in an alternative finance transaction. Once authority to engage in Phase 3 has been gained, SNL and LLNL will develop a detailed transaction model that transfers substantial risk to the third party, as required to meet the OMB A-11 Appendix B criteria. SNL and LLNL intend to reach out to local government, academic institutions, and commercial partners who are interested in cooperating in LVOC.

At this time, it is contemplated that the third-party owner would be an overarching entity to support the financing, development, and ongoing operations and maintenance of CREATE and HPCIC, as well as potential future facilities to be developed in LVOC. The intent of such a strategy would be to leverage the cost efficiencies and strategic synergies of the development entity to the benefit of LVOC growth in support of the NNSA mission.

The specific transaction model described below has been assumed at this stage for the cost modeling because it offers several desirable characteristics, including positive experiences in similar projects, beneficial cost considerations, substantial transfer of risk to the private sector, and protection of the government's interests. Other models will be considered that can also meet or exceed the project requirements. See Appendix M of the *CD-1: Alternatives Analysis and Business Case* for an analysis of potential structures for a transaction entity.

5.3 ALTERNATIVE FINANCE MODEL

The preferred acquisition strategy is for leased facilities to be privately owned, financed, developed, and operated by the facility owner without government ownership or participation (alternative finance). The project sites will be transferred by DOE to the facility owner by ground lease. The facility owner would be a non-profit special purpose entity established solely for this purpose. The facility owner would lease the facilities to the M&O contractors for a period of approximately 15 years, with the approval of the federal government.

DESIRABLE ATTRIBUTES OF A THIRD PARTY

As noted above, a third-party non-profit, special purpose entity—whether a trust, limited-liability Corporation, or a non-profit corporation—possesses the desired characteristics summarized below and described in more detail in *CD-1: Alternatives Analysis and Business Case*, Appendix M. A third-party entity brings other attributes that are beneficial to the project. For example, such a structure is stable and simple, which minimizes costs and interface needs, and will operate transparently without conflict of interest. While structured to be at arm's length from the labs, the third party would be aligned with the goal of the labs and government interests. In addition, due to its non-profit status, it would be tax exempt and eligible for beneficial financial rates. Further, use of a third party has proven successful in alternative finance construction and can now be confirmed as a best practice option.

Significantly, the third-party entity offers measured liability protection to DOE and the M&O contractors, as any agreements entered into by the entity, such as those for the financing, development, construction, and operation of the projects, would be commitments of the third party only, not of DOE or the M&O contractors. As a result, the risks, liabilities, and debts of the entity are contained and do not burden any of the other parties.

The following contract mechanisms are anticipated within the possible transaction model:

The facility owner leases the sites from DOE by ground lease.

The facility owner enters into financing agreements with financier(s) to secure development financing.

The facility owner enters into development agreements with developer(s) for the development of the facilities.

The facility owner enters into additional agreements with DOE, the M&O contractors, and financier(s).

The facility owner enters into facility lease agreements (FLA) with the SNL and LLNL M&O contractors, subject to the approval of the federal government.

6. MANAGEMENT STRUCTURE AND APPROACH

The overall development of the Livermore Valley Open Campus will be governed by the organizations depicted in Figure 1. The purpose of the Governance structure is to facilitate communications and strategic plans associated with the future development of LVOC. Table 5 below lists the roles these organizations will play in LVOC development:

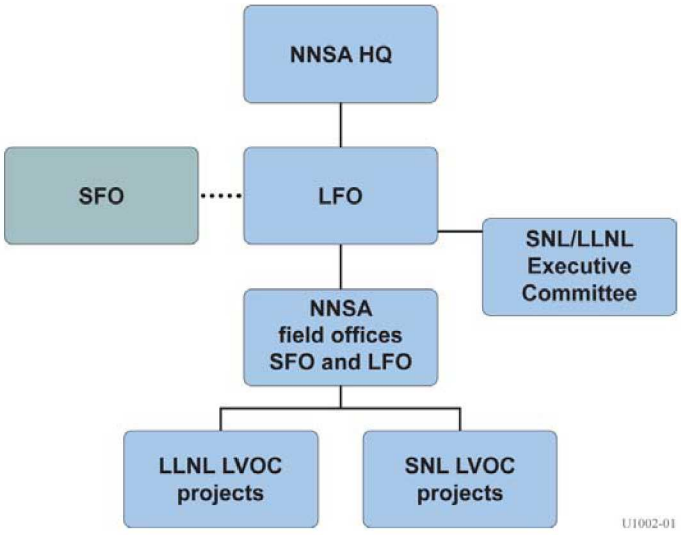

Figure 1. LVOC governance structure

Table 5. Organizational roles in LVOC development

NNSA Headquarters (HQ)	Hold decision authority on all Critical Decisions and approval authority for the preferred acquisition approach for acquisitions greater than $20M Negotiate and execute land transfer agreements through the Office of Infrastructure and Capital Planning
Livermore Field Office (LFO)	Champion, communicate, and coordinate with NNSA HQ on LVOC development as the designated lead LVOC field office (see Memorandum from N. Miller to K. Lebak/G. Beausoleil, "Approval of Critical Decision-0, Mission Need and Program Requirements Document for the Livermore Valley Open Campus."), while retaining the LFO's normal authority for oversight of LLNL's operations and missions For major projects proposed by LLNL or SNL, provide federal staff and subject matter experts appropriate to the project
Sandia Field Office (SFO)	Serve in its designated role as a coordinating field office, while retaining the SFO's normal authority for oversight of SNL operations and missions Maintain awareness (through updates from the LFO on LVOC development progress Retain the lead role in LVOC contracting issues involving SNL For major projects proposed by LLNL or SNL, support LFO in providing federal staff and subject matter experts appropriate to each project
SNL/LLNL Executive Committee	Champion, coordinate, and guide LVOC development actions and share best practices between the labs as a joint-laboratory committee that is not an approval, oversight, or decision-making body
LLNL or SNL LVOC Projects and Facilities	Each laboratory will pursue and manage projects and facilities in its respective area of the LVOC campus in support of its own missions within the overall context and objectives of the integrated Open Campus enterprise. These will be typically led by a Federal Project Director from LFO in coordination with SFO.

6.1 ROLES AND RESPONSIBILITIES

The sections below discuss roles and responsibilities of Coordination Team (CT) members for 413.3B projects.

LVOC COORDINATION TEAM LEADER

The LVOC Coordination Team Leader (CTL) is responsible and accountable for the successful execution of the LVOC development efforts and the following responsibilities:

Prepare the CT charter and maintain the CT membership list

Act as single point of contact at the field level for the LVOC effort and assure coordination among interested parties

Coordinate the Critical Decision process, including the submission of required documents, plans, etc.

Communicate project and program requirements to the CT

Conduct meetings as needed

Facilitate issue resolution

When projects fall outside of 413.3B and CT oversight, organize appropriate project support structures

LVOC COORDINATION TEAM MEMBERS

The CT represents diverse disciplines and possesses the specific knowledge, skills, and abilities necessary to support the successful execution of LVOC development. A current CT membership list is included in Table 6. The CTL will maintain this list and may update it at any time as members are added, removed, or replaced. The CT can include members from the following and other organizations as necessary to facilitate project success: NNSA HQ, Albuquerque Complex, the Livermore and Sandia Field Office, LLNL and SNL staff. Notably, the active participation of LLNL and SNL staff representatives is seen as critical to LVOC's success. Therefore, LLNL and SNL/CA will each designate one lead point of contact (POC) to serve on the CT, and these POCs may designate additional CT members from laboratory staff as needed and at the discretion of the CTL.

Table 6. LVOC Coordination Team Members (as of February 2014)

Coordination Team Leader	Samuel Brinker
DOE LVOC Champion	Dimitri Kusnezov
NNSA Director, Office of Infrastructure & Capital Planning	Jefferson Underwood
Office of Infrastructure & Capital Planning Real Estate Specialist	Jane Cooper
LFO LVOC Program Manager	Tony Sy
LFO Contracting Officer	Homer Williamson
LFO Legal Advisor	Daniel Culver
SFO LVOC Program Manager (Tech Partnership)	Dan Sanchez
SFO LVOC Project Manager	Joe Estrada
SFO Contracting Officer	JoAnn Wright
SFO Legal Advisor	Cynthia Wimberly
LLNL Point of Contact	Camille Bibeau
SNL/CA Point of Contact	Andrew McIlroy

Membership and responsibilities are listed in Table 7 as examples for the current CREATE and HPCIC projects.

Table 7. Example CT membership and responsibilities

DOE and NNSA HQ LVOC Champions	• Act as champion for the LVOC effort in interactions with senior DOE and NNSA leadership • Provide policy advice and guidance • Manage and coordinate the document review and approval process at the HQ level
NNSA Director, Office of Infrastructure & Capital Planning	• Advocate for the LVOC effort in interactions with senior DOE and NNSA leadership • Provide policy advice and guidance
Office of Infrastructure & Capital Planning Real Estate Specialist	• Develop and negotiate real estate documents to facilitate the engagement of third parties on federal property
LFO LVOC Program Manager	• Manage interactions with LLNL on LVOC issues • Coordinate the review of, and obtain approval for, LVOC documents from the LFO Site Manager as required. • Obtain resources from the LFO as needed to support the LVOC effort
LFO Contracting Officer	• Provide contractual interpretation and guidance to LLNL as required on LVOC issues
LFO Legal Advisor	• Review documents and provide guidance on actions at the field level, especially as the issues relate to the LLNL contract • Coordinate with HQ legal when issues arise
SFO LVOC Program Manager (Tech Partnerships)	• Manage interactions with SNL/CA on LVOC issues • Coordinate the review of, and obtain approval for, LVOC program documents from the SFO Site Manager as required • Obtain resources from the SFO as needed to support the LVOC effort
SFO LVOC Project Manager	• Manage interactions with SNL/CA on LVOC issues • Coordinate the review of, and obtain approval for, LVOC CD documents from the SFO Site Manager as required • Obtain resources from the SFO as needed to support the LVOC effort
SFO Contracting Officer	• Provide contractual interpretation and guidance to SNL/CA as required on LVOC issues
SFO Legal Advisor	• Review documents and provide guidance on actions at the field level, especially as the issues relate to the SNL contract • Coordinate with HQ legal when issues arise
LLNL and SNL/CA POCs	• Along with any other designated staff representatives, actively participate in CT activities to ensure the success of this effort • Coordinate and facilitate LVOC activities within their respective organizations and ensure that these activities are consistent with management priorities at their sites • Inform and gain approval from senior laboratory management for LVOC activities • Coordinate with and gain approval from their respective Field Offices as required for LVOC actions

6.2 COMMUNICATION PROCEDURES

The following processes will be used to maintain effective communications with the geographically dispersed members of this CT:

- **General internal communications:** An open communication procedure is preferred for internal CT communication, with individual members of the team contacting each other directly as needed to resolve issues. On issues of substance, the CTL should be kept informed of the interaction through mechanisms as simple as receiving copies of relevant email.
- **Formal internal communication:** Formal documents shared internally should be sent through the CTL.
- **External communication**: The CTL is the CT's single point of contact for external formal communications, such as letters between laboratory management and NNSA HQ and CD documentation. All such communication should be coordinated through the CTL.
- **Meetings**: Working meetings of LFO, SNL/CA, and LLNL CT members are expected to occur roughly bi-weekly throughout each project, supplemented with issue resolution meetings as needed. The full CT will meet as needed, depending on the nature of the ongoing activity. To accommodate the dispersed membership, most meetings of the full CT will likely be held either by video conference or conference call.

REPORTING PROCEDURES

Progress reports for the LVOC effort will be jointly prepared by LLNL and SNL/CA, coordinated and distributed by the CTL to interested parties. Currently, the reports are being prepared monthly. The timing of reporting may change in the future, either increasing or decreasing depending on the level of activity that is underway. The CTL will notify stakeholders prior to initiating a change.

Individual projects approved through the CD process and managed under DOE Order O 413.3B will report as required by the order.

7. RECOMMENDATIONS AND APPROVAL

7.1 RECOMMENDATION

Detailed conceptual design reports have been prepared and documented in the *CD-1: Alternatives Analysis and Business Case* for CREATE and HPCIC, describing the options and evaluating the alternatives to meet project needs at SNL/CA and LLNL. The recommended alternative is to deliver both projects using the alternative finance option.

Following CD-1 approval by NNSA, the LVOC Coordination Team will be tasked with preparing the Alternative Finance Proposal. The AF Proposal will be submitted to NNSA for review and transmittal to the Office of Management and Budget for concurrence. The project team believes this acquisition approach is in the best interest of NNSA and DOE.

If new information or facts arise which could have significant impact on the projects' cost, schedule, or performance, NNSA/LSO will make the Program Secretarial Officer aware of this on a timely basis.


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CDR	Conceptual Design Report
CREATE	Collaboration in Research and Engineering for Advanced Technology and Education
CRF	Combustion Research Facility
DOE	U.S. Department of Energy
DOR	Development Options Report
FIMS	Facilities Information Management System
FY	Fiscal Year
GSF	Gross Square Feet
HPC	High Performance Computing
HPCIC	High Performance Computing Innovation Center
ICE	Independent Cost Estimate
IT	Information Technology
LA	Limited Area
LFO	Livermore Field Office
LLNL	Lawrence Livermore National Laboratory
LVOC	Livermore Valley Open Campus
M&O	Management and Operating
MNC	Mission Need Concept
NNSA	National Nuclear Security Administration
NPV	Net Present Value
NW	Nuclear Weapon
O&M	Operation and Maintenance
OMB	Office of Management and Budget
R&D	Research and Development
SNL	Sandia National Laboratories
SNL/CA	Sandia National Laboratories California Site
ST&E	Science, Technology, and Engineering
TPC	Total Project Cost
UFC	Unified Facilities Criteria

ABSTRACT

BACKGROUND

While Lawrence Livermore National Laboratory (LLNL) and Sandia National Laboratories (SNL) have remained committed to their core nuclear weapons (NW) mission, the world has changed greatly since the opening of these national labs. To maintain their capabilities and relevance in the future, national labs need to pioneer new work models and structures that enable them to capture the innovation of the external science, technology, and engineering (ST&E) community, bringing world-class capabilities for mission enhancement and attracting a strong pipeline of ST&E candidates, while appropriately safeguarding national security functions, expertise, and resources.

The Livermore Valley Open Campus (LVOC)—a joint initiative of the National Nuclear Security Administration (NNSA), LLNL, and SNL—enhances the national security missions of NNSA by promoting greater collaboration between the world-class scientists at the national security labs and their partners in industry and academia. As stated in the May 2011 NNSA Strategic Plan, strengthening the ST&E base of our nation is top goal of the NNSA.

Such collaborations bolster the labs' access to world-class ST&E expertise and contribute to a dynamic and exciting work environment for lab scientists and engineers, thereby advancing critical national security goals and helping the labs attract and retain an outstanding workforce. Two new planned facilities for the joint LVOC initiative, the Collaboration in Research and Engineering for Advanced Technology and Education (CREATE) and High Performance Computing Innovation Center (HPCIC), are key to expanding existing capabilities and realizing the LVOC vision.

The NNSA Administrator and the Under Secretary for Science authorized the creation of LVOC by approving the Mission Need Concept (MNC) on July 20, 2009. The need for CREATE and HPCIC, the first new major acquisition projects for LVOC, was documented in the Critical Decision (CD)-0 *Statement of Mission Need: Open Collaboration and Research Capabilities in the Livermore Valley Open Campus*.

This Conceptual Design Report (CDR) is meant to **provide a clear and concise description of the acquisition alternatives analyzed for CREATE and HPCIC, the basis for the alternative selected, how the alternative meets the approved mission need, the functions and requirements that define the alternative. It also demonstrates the capability of the alternative for success and the facility performance requirements, planning standards, and life-cycle cost assumptions.**

RECOMMENDED ALTERNATIVE IDENTIFIED

For this study, five options were analyzed for meeting the mission requirements identified in the CD-0 document. The options considered were the following:

- Take no action (maintain status quo)
- Renovate an existing onsite facility
- Build a new onsite facility as a DOE line item (line item)
- Lease an offsite facility (offsite lease)
- Lease a commercial onsite facility (alternative finance, or AF)

After an analysis of the alternatives for acquiring CREATE and HPCIC, leasing a commercial onsite facility (alternative finance) was identified as the best option.

For both facilities, the take no action option fails to meet the mission need, and leasing an offsite facility does not enable or facilitate the interactions with the two laboratories or lab employees on the main sites—interactions that are required to fulfill the mission need. These options were therefore eliminated.

CONCLUSIONS

This study of acquisition options for the CREATE and HPCIC facilities within the LVOC initiative reached the following conclusions:

- Alternative finance offers significantly reduced life-cycle costs compared to other options. These cost reductions derive from lower construction costs, coupled with attractive bond rates, and lower operating and maintenance costs.
- Alternative finance delivers the facilities at least three years earlier than other options, even with aggressive assumptions about line item scheduling, thereby meeting near-term mission requirements over the next 15–20 years in areas of weapons engineering, high performance computing, cybersecurity, and advanced manufacturing.
- Given these cost and schedule advantages, alternative finance offers the best value to the government, while complying with applicable orders of the Department of Energy (DOE) and Office of Management and Budget.

1. MISSION NEEDS EVALUATION

Focused on the Livermore Valley Open Campus (LVOC) mission of advancing science and technology in areas of synergistic interest to National Nuclear Security Administration (NNSA) and external partners, two new LVOC facilities—Collaboration in Research and Engineering for Advanced Technology and Education (CREATE) and High Performance Computing Innovation Center (HPCIC)—will increase external collaborations that enhance the national security mission and attract and train new talent for the national labs.

1.1 CRITICAL DECISION-0: STATEMENT OF MISSION NEED

To enhance global and national security, NNSA is strengthening its ability to ensure that its national laboratories have the resources required to address the spectrum of national security needs. This effort includes investing in the capabilities and infrastructure required to address the broader security challenges within the NNSA mission space, as well as in the work of the wider national security community. With this goal in mind, the NNSA Administrator and DOE Under Secretary for Science authorized the creation of the Livermore Valley Open Campus by approving the *Mission Need Concept* (MNC) on July 20, 2009 and endorsing the LVOC *Development Options Report* (DOR), which presented the LVOC Master Plan, in September 2010.

A joint initiative of the National Nuclear Security Administration (NNSA), Lawrence Livermore National Laboratory (LLNL), and Sandia National Laboratories (SNL), LVOC is a campus of more than 100 acres dedicated to enhancing the national security mission by strengthening the science, technology, and engineering (ST&E) base of our nation, one of the top goals in NNSA's 2011 Strategic Plan. Currently encompassing more than a dozen buildings and over 200 employees working in such areas as combustion, biofuels, advanced computing, and cybersecurity, this new campus is specifically designed as an unclassified open environment to encourage and build collaboration with external partners in academia and industry. LVOC expands on the nuclear weapons (NW)–focused partnership initiated between LLNL and SNL in the 1950s into a channeled alliance that is prepared to meet a broad range of 21st century challenges. Capitalizing on the expertise and opportunities of a thriving and innovative community, LVOC draws on new intellect and problem-solving skills to address our nation's most pressing security challenges.

On April 22, 2013, the NNSA Administrator provided LLNL and SNL formal approval of the Critical Decision (CD)-0 document, *Statement of Mission Need: Open Collaboration and Research Capabilities in the Livermore Valley Open Campus,* and authorization to proceed with development of LVOC and preparation of CD-1, *Business Case and Alternatives Analysis*, for the first two proposed projects: HPCIC and CREATE. A joint team from LLNL and SNL drafted the CD-1 document and has been working closely with the Livermore Field Office (LFO), designated as the lead NNSA field office, to help coordinate efforts. The CD-1 presents several acquisition options, including an alternative finance (AF) option (as specifically requested by the NNSA Administrator), as described in DOE G 430.1-7, *Alternative Financing Guide*.

COLLABORATION: APPLYING WORLD-CLASS EXPERTISE TO NATIONAL SECURITY CHALLENGES

In approving the creation of LVOC in 2009, the Department of Energy (DOE) and NNSA acknowledged the critical role of external collaboration in achieving the core mission of ensuring national security. This section summarizes the value of LVOC before examining in greater detail how the proposed LVOC facilities will enable mission-oriented research and development (R&D) in response to the specific needs expressed in the DOE and NNSA strategic plans.

While LLNL and SNL have remained steadfastly committed to their core NW mission over decades of operation, the world has changed greatly since the opening of these national labs in the mid-20th century. At that time,

U.S. universities were ranked as the top science centers in the world in essentially all fields. To enhance their science, technology, and engineering (ST&E) abilities, therefore, the national laboratories simply turned to the nation's best academic institutions to recruit the best and the brightest from among their graduates, who were predominantly U.S. citizens. Consistent with the times, these new recruits expected to join a single employer for their careers, an excellent match for the perceived need of a cloistered national security R&D workforce. They also accepted high levels of security as a natural way of conducting high-security cutting-edge research, and thrived within the "family" atmosphere created at the labs. Retaining an employee over the many years required to develop a mature national security scientist or engineer was simply not an issue.

Today, much has changed. The labs still deliver world-class ST&E, but other organizations across the globe can equal or even exceed the labs' work in some areas. Further, a large proportion of the nation's ST&E educators, students, and employees are not U.S. citizens, even at the highest echelons of preeminent American companies. In addition, the research world is highly connected—enabling worldwide dispersal of concepts within days of publication—and connectivity is seen as a necessary component of the work environment. At the same time, career transitions are common: those entering the workforce today will most likely change jobs within three to four years. Competing for the best and the brightest talent is now extremely difficult, as new candidates courted by the labs are also targeted by companies that can offer intriguing, rewarding, high impact, ST&E opportunities in inviting, highly paid, connected, and creative work environments. In addition, retaining new lab employees has become equally challenging.

To maintain their capabilities and relevance within the 21st century global context, national labs need to pioneer new work models and structures that enable them to capture the innovation of the external ST&E community, bringing world-class capabilities for mission enhancement and attracting a strong pipeline of ST&E candidates, while appropriately safeguarding national security functions, expertise, and resources.

A New Model for the Sites

While many national security programs at LLNL and SNL must remain classified or closely held within the secure areas of each site, numerous unclassified R&D programs would benefit from execution in an open, collaborative environment. LVOC creates that environment, offering an ST&E campus where academia, industry, and national laboratories can work side-by-side to pursue a wide range of challenging R&D programs and engage in the very deep knowledge exchange that occurs only when people work together in close proximity.

The LVOC Master Plan in the DOR—which calls for thoughtful work areas, connectivity, dynamic reconfigurable spaces, and industry-level security measures—will produce a welcoming and adaptable work environment that meets the expectations of today's employees and seamlessly accommodates work with foreign nationals, who are now often among the best and the brightest. Further, by enabling lab personnel to both pursue R&D within the security fences and collaborate with experts from multiple organizations and institutions outside the fences, LVOC greatly extends the portfolio of projects for current and prospective employees.

Capitalizing on Location

Successful R&D campuses across the nation are designed around unique facilities and environments that encourage innovation, entrepreneurship, and networking, thereby enabling organizations within the campus to grow and thrive. Many of these campuses are anchored by preeminent public and private research laboratories and universities that help attract tenants and talent to the area. They also capitalize on the surrounding region's economic sectors to augment the vision of the campus.

Architecting a similar vision, LVOC draws on the strengths of the national labs and the surrounding region of high-tech industry and academic institutions, along with a local community that supports the role of the national

laboratories and LVOC in promoting technology transfer to seed the growth of tech-based businesses. The LVOC Master Plan articulates the importance of creating anchor facilities that leverage the resources and facilities unique to each laboratory to allow synergistic growth of unclassified programs that directly benefit the national security programs. Locating CREATE and HPCIC outside the security fence and near the Combustion Research Facility (CRF) and high performance computing (HPC) facilities, respectively, enables laboratory researchers to work in both environments to improve outcomes—which is the primary goal of collaboration within LVOC.

A recent literature survey, *Co-Location Dynamics in Collaborative Research Environments* (April 2013) concludes that the configuration of physical space has a direct effect on the level of interaction in collaborative environments. Studies have concluded that, even with the advent of modern communication methods such as email and social media, knowledge transfer decreases rapidly as distance between collaborators increases. Adjacency to LLNL and SNL takes into consideration the conclusions of this extensive research on the need for co-location when siting facilities for high-productivity R&D environments:

- Regular face-to-face interactions are critical to establishing and maintaining collaborative and innovative productivity among researchers in diverse R&D environments.
- Organizations and personnel are three to four times more likely to share technical knowledge and innovative designs with other organizations and personnel within a 500-meter (roughly one-third-mile) radius than with those farther away.
- Organizations are most likely to collaborate with a research campus when located within a 1.2-mile radius of the campus.

Put briefly, placing personnel in very close proximity is critical to fostering collaborations, especially those involving complex technical topics; even relatively small distances between collaborators can hinder knowledge sharing.

LVOC's location also allows the national laboratories to more fully benefit from proximity to the metropolitan Bay Area, a renowned hub of innovation and home to several world-class universities. As detailed in the 2012 publication *The Bay Area: A Regional Economic Assessment*,* the San Francisco Bay Area leads the nation in multiple areas. For example, it captures about 40% of all venture capital in the nation; is home to the highest number of patents granted; contains more than three times the concentration of professionals in computer, mathematical, and engineering occupations than the rest of the nation; and is one of the nation's top four regions in terms of educational attainment, with 46% of workers possessing a bachelor's or other form of advanced degree.

* Jon Haveman, Patrick Kallerman, et al., *The Bay Area: A Regional Economic Assessment*, Bay Area Council Economic Institute, October 2012.

2. PROJECT REQUIREMENTS

A review of specific project requirements for the CREATE facility, as delineated in the CD-0, shows that CREATE will support the national security mission by increasing collaborations that are complementary to national security programs, freeing up limited area (LA) space to accommodate current and projected demands, improving the security and layout of Sandia/California (SNL/CA), and reducing costs. Likewise, HPCIC will support the national security mission by increasing collaborations that are complementary to national security programs. The knowledge transfer through these collaborations will offer lab researchers an opportunity to enhance their skills on a diverse set of new and intellectually challenging projects and provide industry powerful new tools for advancing competitiveness.

2.1 CREATE FACILITY DESCRIPTION

OVERVIEW

A multi-story 86,000-gross square foot (GSF) building, CREATE will be a state-of-the-art, mixed-use, environmentally sustainable facility designed to satisfy the required local California Green Building Code and pertinent DOE regulations. The new facility will provide office and low-hazard, flexible laboratory spaces joined by collaboration areas, as well as a technical information media center and other amenities that support interactions between building occupants. In alignment with current best practice, plans call for less than 50% office space to provide sufficient area for collaborative activities. Flexible design allows for meeting current needs while facilitating future requirements in response to organizational or mission-related changes.

SPACE PROGRAM

The CREATE facility will support customer-driven national security mission requirements by freeing office space in the LA for NW and other classified programs while also strengthening ST&E competencies for these programs through broader unclassified collaborations. When completed, the facility will allow relocation of about 150 staff currently engaged in unclassified research and administrative functions, providing a fiscally responsible means for meeting classified program space demands on the site.

SNL/CA developed a space plan for CREATE through a rigorous process of interviews with program stakeholders to validate space requirements. As shown in Table 1 below, CREATE will provide space for programs centered on hydrogen science, cybersecurity, engineering sciences and manufacturing environments, and translational biomedicine, as well as areas for collaboration and necessary support functions.

Table 1. CREATE space program summary

CREATE functions	Ft^2
Hydrogen program—thermal fluids/energy systems	12,670
Cybersecurity	4,250
Engineering sciences and manufacturing environments	7,970
Translational biomedicine	4,640
R&D collaboration zones	11,000
Badging and entry*	6,130
Business office* (human resources, procurement, public relations/outreach, technology transfer)	13,850
Technical information media center	6,440
Reconfigurable training and classroom space	13,340
Building support (mechanical and electrical)	5,320
Total	**85,610**

* Relocated to create classified space.

2.2 HPCIC Facility Description

Overview

HPCIC will be a state-of-the-art, mixed-use, environmentally sustainable facility designed to satisfy the required local California Green Building Code and all pertinent DOE regulations. The planned multi-story 98,000-GSF building will provide office space joined by meeting, training, data visualization, education, and collaboration areas, as well as magnet amenities that support interactions between building occupants. Aligned with current best practice, areas will be sufficiently large to accommodate collaborative activities, and a built-in flexible design will meet both current and future space needs in response to organizational or mission-related changes.

Space Program

Program stakeholders at LLNL were engaged through a rigorous interview process to develop a space plan and requirements for HPCIC. As shown in Table 2 below, the facility will provide significant space for programs centered on HPC applications in an array of areas: energy production and infrastructure, cyber security, translational biomedicine, advanced materials, manufacturing, climate, combustion, high energy density physics, fusion, space, and others.

The completed facility will allow relocation of about 360 staff engaged in unclassified research, administrative, and technology transfer activities who will benefit from the new teaming arrangements and work relationships with outside collaborators enabled by HPCIC. Approximately 50 offices will be used as flexible space for visitors and short-term collaborators. For details, see the CD-1 document.

Table 2. HPCIC space programming summary

Detailed program areas	Ft^2
HPCIC staff and computations	4,600
Livermore computing	1,220
Advanced simulation and computing	2,020
Energy infrastructure and cyber security	4,240
Bioinformation, pharma, toxicology, and big data	3,260
Materials engineering and manufacturing	2,260
Geomechanics, seismology, wind, and climate	1,120
Critical materials, electronics, and advanced materials	2,260
Environment and combustion	2,300
HEDS, fusion, imaging, and space	1,520
University programs, industry and academic partners, and incubator programs	9,546
Collaboration space (training, meeting, visualization, and education)	15,375
Industrial partnerships office	13,000
Building support services areas (stairwells, elevators, restrooms, electrical rooms, mechanical rooms, telephone, data, network closets, etc.)	18,117
Building circulation areas (lobbies, reception areas, elevator lobbies, walk ways, corridors, interior circulation, etc.)	16,745
Total	**97,583**

3. ALTERNATIVES ANALYSIS

To assess the viability of the acquisition alternatives and identify the approach that offers a best value option to the government, all feasible options were evaluated against several key criteria essential to meeting the mission need of CREATE and HPCIC, as described in this section.

3.1 ALTERNATIVES BEING CONSIDERED

For this study, five options were analyzed for meeting the mission requirements identified in the CD-0 document. The options considered were the following:

- Take no action (maintain status quo)
- Renovate an existing onsite facility
- Build a new onsite facility as a DOE line item (line item)
- Lease an offsite facility (offsite lease)
- Lease a commercial onsite facility (alternative finance)

The results of the analysis are summarized in the following sections. Additional details are available in the CD-1 document. For both facilities, the take no action option fails to meet the mission need, and leasing an offsite facility does not enable or facilitate the interactions with the two labs or employees on the main site that are required to fulfill the mission need. These options were therefore eliminated.

3.2 TIMELINES FOR ALTERNATIVES

As outlined in the approved CD-0 document, driving the effort to secure these facilities is the immediate need to support a range of programs and vibrant ST&E capabilities fundamental to national security programs.

Figure 1 below outlines the key milestones and timelines associated with the remaining acquisition alternatives under review (line item and alternative finance), beginning with the approval of the CD-0 in April 2013. These are the dates assumed for this analysis, but may change as the process progresses. As occupancy of these facilities is driven by key mission requirements, these schedules play a critical role in the prioritization of the acquisition alternatives.

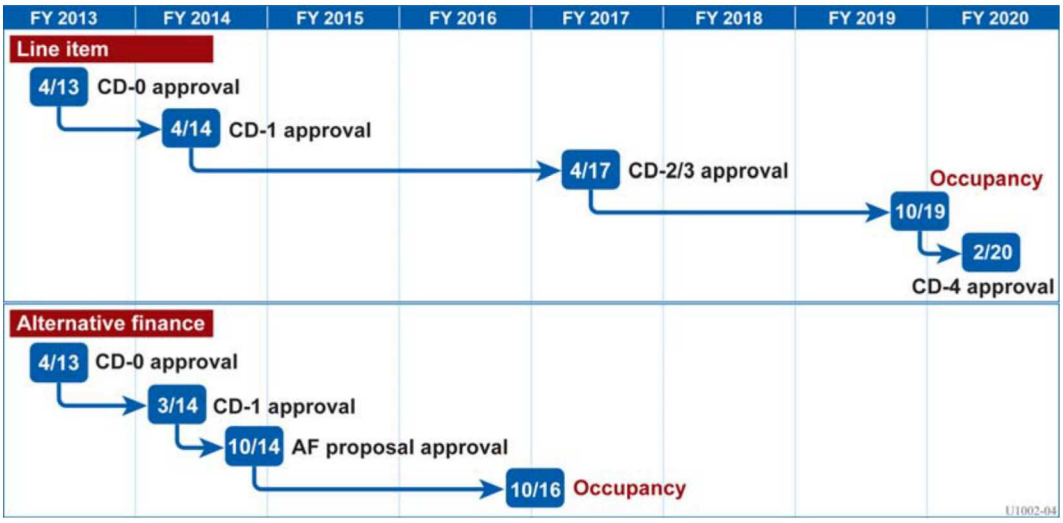


Figure 1. Schedule of options for acquiring CREATE

Based on past experience with comparable line item projects, and assuming immediate DOE approval of the CD-1 and funds allocated for this project, the DOE line item construction alternative is estimated to achieve substantial completion and occupancy by early FY2020. The multi-year gap between project start and occupancy generates mission impacts and escalates costs due to protracted timelines.

In comparison, the alternative finance approach provides schedule efficiencies, compressing the construction duration through more efficient funding mechanisms and project review processes than are available for a federal funded project. Initial market analysis shows that financing is readily available and construction timelines are realistically actionable. Delivering substantial completion by FY2016, alternative finance offers the most efficient option for meeting the mission need's occupancy requirement, providing the best value to the government with the least schedule risk.

3.3 CREATE Prioritized Alternatives

A functional and technical requirements analysis was conducted for the CREATE facility and detailed in the CD-1 document. To identify the acquisition approach for CREATE that offers the best value to the government, all feasible options were evaluated against several key criteria. Table 3 below prioritizes the alternatives by their ability to meet the mission performance and facility specifications, schedule, and location requirements for CREATE. Shown at the top of Table 3 are the two options that meet the mission need; the three greyed-out options do not meet the mission need.

Table 3. Prioritized alternatives summary for CREATE

Ranked priority	Alternative	Mission performance	Occupancy schedule
1.	**Alternative finance**	Meets mission-driven performance parameters and enables building the facility to meet functional specifications. Preferred onsite location meets requirements.	September 2016
2.	**Line item new construction**		October 2019; realistically, 2–3 decades*
3.	**Offsite lease**	Available offsite spaces are too distant to meet the collaborative mission requirement.	November 2015
		Commercial construction offsite provides no cost advantage and incurs negative mission performance impacts compared to the alternative finance option.	July 2016
4.	**Renovate an existing onsite facility through line item**	Lack of available spaces for repurposing prevents this option from meeting mission need or facility requirements, removing this option from further consideration.	
5.	**Take no action**	Lack of action will not meet the mission needs of LVOC or CREATE and is not being further considered.	

* NNSA capital investment commitments over the next 25 years preclude the possibility of line item funding for HPCIC before 2038.

3.4 HPCIC Prioritized Alternatives

The need for a new HPCIC facility is driven by the inability of the current undersized temporary HPCIC facility at LLNL to meet the growing need for collaborative partnerships and to co-locate researchers during a strategic window of opportunity to expand its partnerships and project portfolio during the 2016–2031 deployment timeline for advanced computer systems consistent with the NNSA Advanced Simulation and Computing (ASC) baseline platform plan.

To identify the acquisition approach for HPCIC that offers the best value to the government, all feasible options were evaluated against several key criteria. Table 4 below prioritizes the options by their ability to meet the mission need and project performance parameters, schedule, and location requirements for HPCIC. Shown at the top of Table 4 are the three options that meet the mission need; the two greyed-out options do not meet the mission need.

Table 4. Summary of primary considerations for selecting the optimal acquisition strategy for HPCIC

Ranked priority	Option	Mission performance	Occupancy schedule
1.	**Alternative finance**	Meets mission-driven performance parameters and enables building the facility to meet functional specifications. Preferred onsite location meets requirements.	September 2016
2.	**Line item new construction**		October 2019; realistically, not before 2038*
3.	**Renovate an existing onsite facility through line item**	Facility will be modified and renovated to meet functional specifications. LVOC perimeter will be expanded to incorporate site. Office of Science Facility with a maintenance backlog of $4M.	April 2020; realistically, 2–3 decades*
4.	**Offsite lease**	Available offsite spaces are too distant to meet the collaborative mission requirement. As a result, this option will not be considered further.	
5.	**Take no action**	Status quo will not meet the mission needs of LVOC or HPCIC. As a result, this option will not be considered further.	

* NNSA capital investment commitments over the next 25 years preclude the possibility of line item funding for HPCIC before 2038.

4. COST AND ALTERNATIVES ANALYSIS AND SELECTION

To determine the acquisition approach that provides best value to the government, a detailed economic analysis, including comparative total cost of construction and life-cycle cost analysis, has been performed on the two viable alternatives detailed in the previous section:

- Lease a commercial onsite facility (alternative finance)
- Build a new onsite facility as a DOE line item (line item)

The details of this analysis are included in the CD-1 document; a summary of the analysis is described in the following sections.

4.1 APPROACH

The estimates in this section are represented in 2013 dollars and, for comparison, are formulated following DOE 430.1-1B, *Program and Project Management for the Acquisition of Capital Assets*, and DOE G 413.3-21, *Cost Estimating Guide.* Based upon the defined facility requirements, cost estimates were generated independently for the line item and alternative finance alternatives through a collaborative process by a highly qualified team.

4.2 TOTAL PROJECT COST RANGE OF CREATE ALTERNATIVES

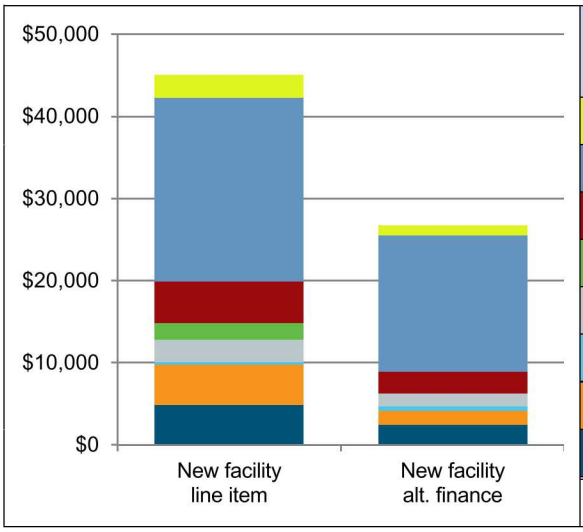
The estimated total project cost (TPC) for CREATE ranges from $27M for the alternative finance option to $45M for the line item option. The range of uncertainty in line item cost estimating is quantified by performing Monte Carlo simulations in Crystal Ball, an Oracle application. Based on an 85% certainty level, the TPC range for line item construction is $38M–$71M. Therefore, the cost range for estimated TPC across all evaluated options is $27M–$71M.

The alternative finance cost estimate assumes that construction will be completed in accordance with normal commercial practices. For the line item estimate, the requirements of DOE O 413.3B *Program and Project Management for the Acquisition of Capital Assets* were observed.

Table 5 below summarizes the TPC for both approaches. Detailed construction estimates are provided in the CD-1 document.

The comparison of new facility construction demonstrates the significant cost advantages of commercial construction. The cost differences between the line item and alternative finance options are primarily driven by five cost drivers: contingency, escalation, project oversight, construction requirements, and laboratory construction burdens.

Table 5. CREATE total project cost comparison ($k)



	New facility line item ($k)	New facility alternative finance ($k)
Design	$2,827	$1,246
Hard construction	$22,388	$16,607
Soft construction	$5,091	$2,618
Laboratory construction burdens	$2,008	—
Tenant improvements	$2,696	$1,592
Misc. other project costs	$380	$540
Total escalation	$4,876	$1,698
Total contingency	$4,832	$2,430
Total project cost	**$45,098**	**$26,731**

4.3 Estimate of Annual Gross Lease Rate for CREATE

Table 6 below provides a summary the approaches and assumptions used to estimate the components that make up the annual gross lease rate for the alternative finance option and provide relevant comparisons to the line item options, where applicable.

Table 6. Estimated gross lease rate for CREATE*

	Annual	$/ft^2
Principal and interest	$1,886,326	$22.03
Operations and maintenance	$481,984	$5.63
Owner administration	$100,000	$1.17
Ground lease	$29,795	$0.35
Major maintenance reserve	$85,610	$1.00
Property taxes	—	—
Insurance	$30,820	$0.36
Gross lease rate	**$2,614,535**	**$30.54**

*All values are assumed to escalate except principal and interest

4.4 TOTAL PROJECT COST RANGE OF HPCIC ALTERNATIVES

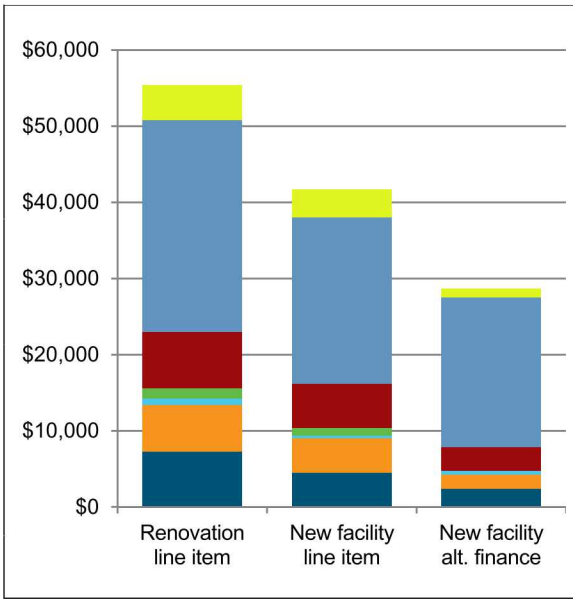
The estimated TPC for HPCIC is $29M for the alternative finance option, $42M for the new facility line item option, and $55M for the renovation line item option. For the line item estimates, the range of cost estimating uncertainty was quantified by performing predictive Monte Carlo simulations in Crystal Ball, an Oracle application. Based on an 85% certainty level, the TPC range for new line item construction is $33M–$64M, and the TPC range for the renovation option is $49M–$69M. Therefore, the cost range for estimated TPC across all evaluated options is $29M–$69M.

Table 7 below summarizes the cost of construction. Detailed construction estimates are provided in the CD-1 document. As shown, the alternative finance option provides the lowest cost to construct. The lower cost to construct is incorporated into the lease rate for the alternative finance option in the life-cycle cost analysis.

The higher cost of the renovation line item option is driven by the extensive work required to enable this option to meet the project performance parameters. Since the renovation and the new facility line item options are both financed through the same process, only the lower cost option (new facility) is retained for the life-cycle cost analysis.

The TPC comparison demonstrates the significant cost advantages of commercial construction. The cost of construction for the alternative finance option is $13M less than the new facility line item. The cost differences between the line item and alternative finance options are driven primarily by five cost drivers: contingency, escalation, project oversight, construction requirements, and laboratory construction burdens.

Table 7. HPCIC total project cost comparison ($k)



	Renovation line item ($k)	New facility line item ($k)	New facility alternative finance ($k)
Design	$4,592	$3,680	$1,162
Hard construction	$27,896	$21,820	$19,680
Soft construction	$7,364	$5,783	$3,102
Laboratory construction burdens	$1,280	$1,009	—
Misc. other project costs	$855	$310	$540
Total escalation	$6,181	$4,583	$1,855
Total contingency	$7,225	$4,462	$2,356
Total project cost	**$55,393**	**$41,649**	**$28,694**

4.5 ESTIMATE OF ANNUAL LEASE RATE FOR HPCIC

Table 8 below provides a summary the approaches and assumptions used to estimate the components that make up the annual gross lease rate for the alternative finance option and provide relevant comparisons to the line item options, where applicable.

Table 8. Estimated gross lease rate for HPCIC*

	Annual	$/ft^2
Principal and interest	$2,140,835	$21.94
Operations and maintenance	$549,392	$5.63
Owner administration	$100,000	$1.02
Ground lease	$29,795	$0.31
Major maintenance reserve	$97,583	$1.00
Property taxes	—	—
Insurance	$35,130	$0.36
Gross lease rate	**$2,952,735**	**$30.26**

* All values are assumed to escalate, except principal and interest.

4.6 INDEPENDENT COST ESTIMATE

The Office of Acquisition and Project Management (APM) commissioned an Independent Cost Estimate (ICE) for the CREATE and HPCIC facilities that assumed a Federal Direct contracting approach.

The CD-1 document, *CD-1: Alternatives Analyses and Business Case*, April 2014, assumed LVOC facilities would be procured through a management and operating (M&O) contractor. APM has noted that many of the facility attributes favorable to an AF approach also apply to a Federal Direct contract approach under the new APM operating framework:

- Low technical risk facility with standard office and light laboratory space
- Construction outside the limited area and on unencumbered green-field site
- Favorable construction contractor market and bid environment

The ICEs were based on several assumptions:

- The projects would be executed via a Federal Direct acquisition strategy instead of via contracting through the site M&O.
- The ICEs would include only design and construction of the CREATE and HPCIC facilities; the startup functions of the facility will remain with the M&O.
- The ICEs would exclude the cost associated with furniture, fixtures and equipment and government-furnished equipment (consistent with the CD-1 document).
- Interface and support activities provided by the M&O were assumed to incur only minimal costs and were not included in the ICE.
- All costs are normalized and reported in FY2014 dollars.

The ICEs were completed in accordance with Government Accountability Office's 12-step process for developing credible cost estimates. The estimates were based on $/ft^2 benchmarks developed based on analogous projects from Facilities Information Management System (FIMS) data and on Unified Facilities Criteria (UFC) Guide benchmarks, which vary according to building space type and utilization. Contingency for the ICE was based on the 85% confidence point. The results of the ICEs are shown in Table 9 below.

Table 9. ICE estimate

Facility	CD-1 Estimates		APM ICE of Federal Direct Contract Approach		
	Alternative finance	Line item	Estimate with contingency	Point estimate	Range
CREATE	$26.7M	$45.1M	$37.2M	$29.3M	$27.5M–$37.2M
HPCIC	$28.7M	$41.6M	$38.3M	$29.4M	$27.6M–$38.3M
Total	**$55.4**	**$86.7**	**$75.6M**	**$58.7M**	**$55.1–$75.6M**

In conclusion, after several reviews—including a comprehensive discussion with representatives from NA-00, NA-APM, LFO and the independent cost evaluator Tecolote Research, Inc., questions and points of concern with respect to the CD-1 line item construction estimates were satisfactorily resolved. This final review validated the line item costs and methodologies used in the CD-1 with no further actions required.

5. LIFE CYCLE COST

To properly compare an alternative finance project to a line item project, a life-cycle cost analysis was performed that included capital construction and operating costs for both alternatives. The life-cycle cost analysis of alternatives was conducted using Army Corps of Engineers ECONPACK software. Details can be found in the CD-1 document.

5.1 LIFE-CYCLE COST ANALYSIS FOR CREATE

A net present value (NPV) analysis affords an effective means to compare the line item and alternative finance acquisition approaches. The line item project pays for capital construction upfront and operates the facility through standard laboratory operation and maintenance (O&M) approaches. The alternative finance approach allows the laboratory to pay a lease rate that includes capital construction principal and interest as well as private sector management of the facility, including items such as insurance, O&M, owner administration, and the ground lease. While the annual operating cost is greater for the alternative finance option due to recovery of principal and interest, the NPV analysis demonstrates that alternative finance provides a significantly better value to the government for the duration of the lease term. Table 10 below summarizes inputs for the economic analysis.

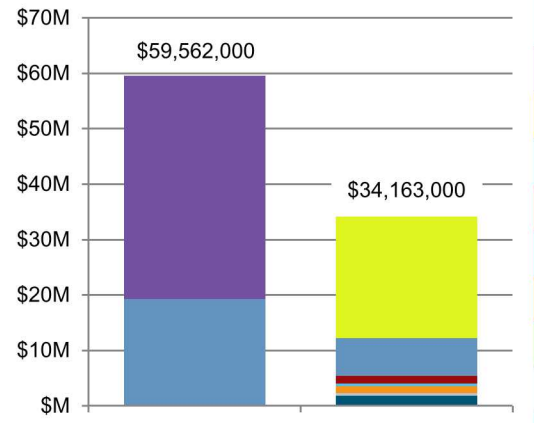
Table 10. Summary of ECONPACK model inputs for the CREATE economic analysis

	Line item	Alternative finance
Construction period	April 2017–October 2019	July 2015–September 2016
O&M	$15.94/ft^2 per year	$5.63/ft^2 per year
Insurance	Government self-insures	$30,820/year
Cash flows	Presented in 2013 base-year dollars	
Discount rate	2.35% (OMB Circular A-94)	
Inflation	1.9% year over year	
Major maintenance	Partially included in O&M	$1.28M over lease term; $85,610 per year
Ground lease term	n/a	35 years
Financing term	n/a	25 years
Facility lease term	n/a	15 years
Gross lease rate	n/a	$2.6M per year
Property taxes	n/a	n/a
Financing amount	n/a	$30.5M
Capital market borrowing rate	n/a	4.00%
Owner administration	n/a	$100,000 per year
Ground lease	n/a	$29,795 per year

CREATE LIFE-CYCLE ANALYSIS RESULTS

Table 11 below illustrates the most direct and conclusive comparison of the options, showing the life-cycle NPV by cost type for a 15-year occupancy period with a decisive savings of $25.4M for the alternative finance approach.

Table 11. Net present value for a 15-year occupancy term for CREATE



	Line item NPV ($k)	Alternative finance NPV ($k)
Total project cost	$40,335	—
Principal and interest	—	$21,899
Operations and maintenance	$19,227	$6,881
Owner administration	—	$1,428
Ground lease	—	$408
Major maintenance reserve	—	$1,222
Property taxes	—	—
Insurance	—	$440
Tenant improvements	—	$1,884

The life-cycle cost analysis, which is based on a 15-year occupancy term, shows the alternative finance option represents the best value to the government with a significant NPV spread of $25.4M. The additional lifetime expenses incurred for the alternative finance option are more than offset by large cost savings realized in two main ways:

- Lower construction costs, coupled with attractive bond rates, account for $18.4M. This is driven by differences in contingency, escalation, construction methodologies, project oversight, and laboratory burden requirements.
- Lower O&M costs for private industry account for an additional $12.3M savings for the alternative finance model.

5.2 LIFE-CYCLE COST ANALYSIS FOR HPCIC

This life-cycle cost analysis evaluates the NPV of the acquisition alternatives over the period of utilization by DOE, balancing the initial monetary investment with the long-term expense of operating and maintaining the facility. The life-cycle cost analysis of alternatives was conducted using Army Corps of Engineers ECONPACK software.

Table 12 below summarizes key inputs and assumptions used in developing the economic analyses.

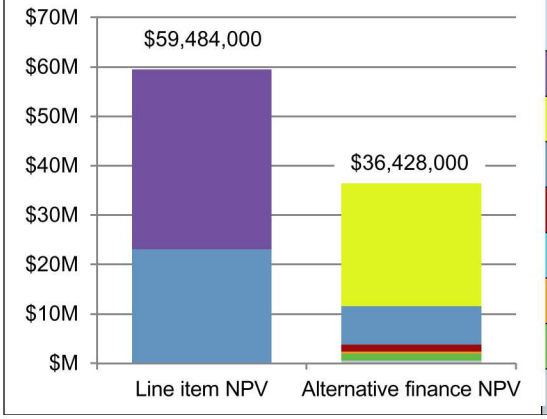
Table 12. Summary of ECONPACK model inputs for HPCIC economic analysis

	Line item	Alternative finance
Construction period	April 2017–October 2019	July 2015–September 2016
O&M	$16.73/ft^2 per year	$5.63/ft^2 per year
Insurance	Government self-insures	$35,130 per year
Cash flows	Presented in 2013 base-year dollars	
Discount rate	2.35% (OMB Circular A-94)	
Inflation	1.9% year over year	
Major maintenance	Partially included in O&M	Incorporated in lease: $97,583 per year
Ground lease term	n/a	35 years
Financing term	n/a	25 years
Facility lease term	n/a	15 years
Gross lease rate	n/a	$3.0M per year
Property taxes	n/a	n/a
Financing amount	n/a	$32.6M
Capital market borrowing rate	n/a	4.00%
Owner administration	n/a	$100,000 per year
Ground lease	n/a	$29,795 per year

HPCIC Life-Cycle Analysis Results

The values in Table 13 below summarize the output from the life-cycle cost analysis for a 15-year occupancy period, indicating that the alternative finance option provides the most cost-effective delivery method to the government.

Table 13. HPCIC life-cycle cost analysis for a 15-year occupancy term



	Line item NPV ($k)	Alternative finance NPV ($k)
Total project cost	$36,482	—
Principal and interest	—	$24,854
Operations and maintenance	$23,002	$7,844
Owner administration	—	$1,428
Ground lease	—	$408
Major maintenance reserve	—	$1,393
Property taxes	—	—
Insurance	—	$501

The life-cycle cost analysis shows the alternative finance option represents the best value to the government with a significant $23M difference in NPV. The additional lifetime expenses incurred for the alternative finance option are more than offset by large cost savings realized in two main areas:

- Construction costs, coupled with attractive bond rates, are about $12M less. This is driven by differences in contingency, escalation, construction methodologies, project oversight, and laboratory burden requirements.
- Present value for O&M costs for private industry represents a $15M savings for the alternative finance model.

5.3 SENSITIVITY ANALYSIS FOR COSTS

A discussed in Section 4.6, the results of the ICE suggest that, if all the assumptions hold true, using a Federal Direct acquisition strategy could save up to $6.9M for facilities, or roughly 8%. To better understand how this impacts the conclusions of the study, a sensitivity analysis was conducted for several key variables used in the life cycle calculations.

The results of the sensitivity analysis for the CREATE and HPCIC facilities are shown in Tables 14 and 15.

Table 14. Percent changes needed in key variables to impact alternative finance ranking for CREATE

Cost model input	% change required to impact ranking
Line item TPC	–63%
Alternative finance lease rate (principal and interest)	+116%
Alternative finance operations and maintenance	+369%

Table 15. Percent changes needed in key variables to impact alternative finance ranking for HPCIC

Cost model input	% change required to impact ranking
Line item (new construction) TPC	–63%
Alternative finance lease rate (principal & interest)	+93%
Alternative finance operations and maintenance	+294%

These results demonstrate that even if the line item option could be conducted through a Federal Direct acquisition strategy for the costs estimated in the ICE, the conclusion that alternative finance provides the best value to the government for both facilities would not change.

6. KEY PERFORMANCE PARAMETERS

As described above, the NNSA Administrator and the Under Secretary for Science authorized the creation of LVOC by approving the Mission Need Concept on July 20, 2009. This document, along with the LVOC Development Options Report, established a mission need and framework for developing LVOC. The need for CREATE and HPCIC, the first new major acquisition projects for LVOC, was documented in the CD-0. To meet the mission requirements reflected in these documents, certain performance parameters must be met by the facilities. These are discussed below.

6.1 CREATE PROJECT PERFORMANCE PARAMETERS

As noted earlier, CREATE will be designed to foster collaborations to advance ST&E in areas crucial to the national security mission, benefit external collaborators, and attract new scientists and engineers to the national security space. To these ends, CREATE will provide office, light laboratory, and teamwork areas in a state-of-the-art LVOC facility that is more functional and energy-efficient than many existing buildings on SNL/CA site. CREATE will enable collaboration with academic and industrial partners that build or maintain expertise in unclassified aspects of programs currently housed in the LA.

In addition, CREATE will facilitate a layered approach to security, consistent with the *SNL/CA Site Development Plan*, that will enhance security at a lower cost. Specifically, by serving as the new front door to SNL/CA that provides direct access to LVOC, CREATE will enable streamlined management of the site's visitor security (badging) functions through a single point of entry.

As a summary of CREATE's ability to meet LVOC's and Sandia's needs, Table 16 below specifies project performance parameters for CREATE in relation to mission requirements as identified and approved in the CD-0 document.

Table 16. CREATE project performance parameters and mission requirements

Project performance parameters	Mission requirements					
	Increase collaborations	Free LA space	Rationalize site layout	Attract future workforce	Improve security/badging	Reduce costs
A facility in close proximity to key Sandia/CA facilities	✓	✓	✓		✓	✓
Flexible work suites and light laboratories for unclassified programs for collaborations with industry, academia, and partners	✓			✓		✓
Collaboration space for the full spectrum of Sandia programs	✓			✓	✓	
A space acting as the SNL/CA "front door" to consolidate business and security functions; better engage collaborators	✓	✓	✓		✓	✓
Office space to accommodate some 150 staff and 50 visitors with an appropriate mix of hard-walled offices and cubicles	✓	✓		✓		
Meeting rooms and video teleconference space with multiple user IT connections	✓			✓		✓
Impromptu collaboration and break-out discussion space, both open and private	✓					
Flexible classroom and training space	✓	✓		✓		
Technical information media center and other magnet amenities that proactively drive interactions between researchers	✓		✓	✓		
Designed to a 2010 CALGreen California Building Code standard				✓		✓
Flexible security access control system to accommodate changing levels of programmatic or administrative control of individual suites and areas	✓	✓			✓	
Network access with support for multiple users with a robust, modern building distributed communications infrastructure	✓			✓		✓
Summary of parameters satisfied	✓	✓	✓	✓	✓	✓

6.2 HPCIC Project Performance Parameters

HPCIC will provide expanded opportunities for collaborative HPC activities that are complementary to national security programs and strengthen key competencies needed for the national security mission. Dedicated to partnering with American industry to develop innovative HPC solutions, the facility will enable enhanced collaboration with industry, support development and delivery of stronger workforce pipeline programs, and help attract a new generation of scientists and engineers into the DOE/NNSA network of opportunities.

To these ends, HPCIC will provide space for open and closed offices; meeting, training, education, and data visualization and other collaboration areas; and amenities in a state-of-the-art facility. This facility will offer the LLNL workforce significantly greater ability to expand the boundaries of traditional engagements to a much larger and diverse population of partners, including government, national laboratories, research institutes,

industry, and academia. The accessible workshop and training spaces will create opportunities (currently not available) for networking and national and international meetings, thus building greater awareness of the resources and capabilities of SNL and LLNL. HPCIC's flexible design will allow for ready space reconfiguration to adapt to evolving program needs and accommodate the co-location and collaboration of lab researchers and strategic partners. The facility will be more energy- and space-use efficient than many existing buildings on the LLNL site and operate with a layered approach to security consistent with the LLNL Site Development Plan.

The CD-0 and the *LLNL Program Requirements Document* identified the need for a facility with the features described to meet the following project performance parameters for an open collaboration and research space:

- Location within LVOC
- Enhanced accessibility by LLNL staff as well as outside partners to create an effective mechanism to leverage LLNL science and innovation through collaboration
- Flexible work environment with a mix of hard-walled and open spaces
- Training, classrooms, meeting, education, and other collaboration spaces
- Communication equipment and network and data visualization capabilities
- Opportunities for industry, academia, and other strategic partners to co-locate
- Approximately 100,000 GSF of space
- Designed to a 2010 CALGreen California Building Code standard
- Flexible security access control system to accommodate changing levels of programmatic or administrative control of individual suites and areas

7. CONCLUSIONS AND NEXT STEPS

This study of funding options for the CREATE and HPCIC facilities within the LVOC initiative reached the following conclusions:

- Alternative finance offers significantly reduced life-cycle costs compared to other funding options. These cost reductions derive from lower construction costs, coupled with attractive bond rates, and lower operating and maintenance costs.
- Alternative finance delivers the facilities at least three years earlier than other options, even with aggressive assumptions about line item scheduling, thereby meeting near-term mission requirements over the next 15–20 years in areas of weapons engineering, high performance computing, cybersecurity, and advanced manufacturing.
- Given these cost and schedule advantages, alternative finance offers the best value to the government, while complying with applicable DOE and Office of Management and Budget (OMB) orders.

Approval of the CD-1 document would mean agreement from the Acquisition Executive that alternative finance is the acquisition approach that offers the best value for achieving the mission needs as identified in the CD-0 document. Following approval, the next steps in this process would be:

- Developing an Alternative Finance Proposal consistent with DOE G 430.1-7, *Alternative Financing Guide,* while working with all interested stakeholders
- Obtaining approval of the Alternative Finance Proposal by the Acquisition Authority
- Obtaining concurrence from OMB and congressional appropriators that the projects are acceptable and in compliance with operating lease criteria
- Engaging private sector to execute the development strategy approved in the Alternative Finance Proposal


Lawrence Livermore
National Laboratory


NNSA
National Nuclear Security Administration


Sandia National Laboratories

Open Collaboration and Research Capabilities on the Livermore Valley Open Campus

COLLABORATION IN RESEARCH AND ENGINEERING FOR ADVANCED TECHNOLOGY AND EDUCATION (CREATE)

AND

HIGH PERFORMANCE COMPUTING INNOVATION CENTER (HPCIC)

Risk Management Plan
An Addendum to the Critical Decision-1 Document

Non-Major System Acquisition Project
Submitted: January 2015

Lawrence Livermore National Laboratory

NNSA National Nuclear Security Administration

Sandia National Laboratories

Prepared for the U.S. Department of Energy National Nuclear Security Administration

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ACRONYMS AND ABBREVIATIONS

CD	Critical Decision
CREATE	Collaboration in Research and Engineering for Advanced Technology and Education
DOE	U.S. Department of Energy
GSF	Gross Square Feet
HPC	High Performance Computing
HPCIC	High Performance Computing Innovation Center
LLNL	Lawrence Livermore National Laboratory
LVOC	Livermore Valley Open Campus
NNSA	National Nuclear Security Administration
RMP	Risk Management Plan
SNL	Sandia National Laboratories
SNL/CA	Sandia/California
ST&E	Science, Technology, and Engineering

1. INTRODUCTION

This risk management plan (RMP) defines the scope and process for identifying, evaluating, and managing the risks applicable to the Collaboration in Research and Engineering for Advanced Technology and Education (CREATE) and High Performance Computing Innovation Center (HPCIC) projects. These projects are proposed by Lawrence Livermore National Laboratory (LLNL) and Sandia National Laboratories (SNL) to expand the promise and benefits of the Livermore Valley Open Campus (LVOC). A General Access Area (GAA) on land that stretches across the eastern edges of LLNL and the Sandia California site (SNL/CA), LOVC is designed to leverage the broader science, technology, and engineering (ST&E) community to enhance laboratory national security programs.

Continuous application of a risk management process can enhance project success by reducing or eliminating the likelihood and consequences of unanticipated events and positioning the project to benefit from opportunities. Conforming to the guidelines of U.S. Department of Energy (DOE) O 413.3-7A, *Risk Management Guide*, this RMP defines a strategy for managing project-related risks throughout the life-cycles of the HPCIC and CREATE projects to ensure an acceptable, minimal impact on project cost, schedule, and operational functionality.

1.1 DESCRIPTION OF THE CREATE AND HPCIC PROJECTS

MISSION NEED JUSTIFICATION

The National Nuclear Security Administration (NNSA) Administrator and the Under Secretary for Science authorized the creation of LVOC by approving the Mission Need Concept (MNC) on July 20, 2009. This document—along with the LVOC Development Options Report, which was endorsed by the NNSA Administrator and the Under Secretary for Science in September 2010—established a mission need and framework for developing LVOC. The need for CREATE and HPCIC, the first new major acquisition projects for LVOC, was documented in the Critical Decision (CD)-0 *Statement of Mission Need: Open Collaboration and Research Capabilities in the Livermore Valley Open Campus* The NNSA Administrator approved the CD-0 for LVOC development on April 22, 2013 and requested submission of CD-1 document for CREATE and HPCIC, specifying that the alternatives presented include an alternative finance option.

PROJECT DESCRIPTION

CREATE

A multi-program, mixed-use facility of 86,000 gross square feet (GSF), CREATE will stand as a new intellectual and collaborative center SNL/CA site that will deliver on the core value proposition of LVOC through partnerships with external partners that enhance laboratory national security programs, while benefitting partners through access to laboratory resources and expertise, as well as through solutions and products jointly developed with SNL/CA staff. The benefits of these partnerships will be particularly important over the next 15–20 years, as SNL meets large engineering mission challenges in several nuclear weapons programs scheduled over this period. To this end, CREATE will house new and expanded programs in areas—such as hydrogen science and technology for energy applications, cybersecurity, advanced engineering and manufacturing, and translational biomedicine—that allow mutually beneficial connections between national security mission ST&E and external partners. CREATE plans are consistent with the SNL Ten-Year Site Plan, the SNL/California Site Development Plan, and mission requirements for critical national security programs.

HPCIC

Launched in 2011, LLNL's HPCIC helps achieve the mission goals outlined in the Advanced Simulation and Computing Strategy by encouraging partnerships that increase the flow of ideas into the lab to develop robust tools and codes; bolster efforts to recruit and retain talent; and maintain effective working relationships with other DOE and federal partners, industry, and academia aimed at overcoming critical technology challenges. Preserving NNSA national laboratory leadership in high performance computing (HPC) is vital to long-term success in sustaining a safe, secure, and effective nuclear deterrent for the nation.

The current temporary HPCIC building (a rented trailer) will be replaced with a state-of-the-art, mixed-use, environmentally sustainable facility designed to satisfy the required local California Green Building Code and all pertinent DOE regulations. The planned multi-story 98,000-GSF building will provide office space joined by meeting, training, data visualization, education, and collaboration areas, as well as magnet amenities that support interactions between building occupants. Aligned with current best practice, areas will be sufficiently large to accommodate collaborative activities, and a built-in flexible design will meet both current and future space needs in response to organizational or mission-related changes.

1.2 Overview of the Risk Management Plan

The risk management plan described in this document was developed by the LVOC Project Risk Management Team. This team consists of the core LVOC Coordination Teamand additional subject matter experts who participated as appropriate in risk identification and analysis.

Assumptions and Constraints

This risk management plan will be modified based upon updated project costs, schedules, and scope details as this information becomes available. Likewise, the risk assessment resulting from the process described in this RMP will be updated as necessary and appropriate. RMP Contents

This document describes the risk management process to be followed throughout the life cycles of the HPCIC and CREATE projects. It also briefly summarizes findings of an initial qualitative risk assessment for HPCIC and CREATE prepared as part of the CD-1 process by LLNL and SNL/CA staff.

2. RISK AND OPPORTUNITY MANAGEMENT PROCESS

This section describes the risk management process to be followed throughout the life cycles of the HPCIC and CREATE projects.

2.1 PURPOSE

The purpose of risk management is to have a structured, formal, and disciplined approach for determining risks and controlling risk to an acceptable level. The key output of this process is the establishment of appropriate (within pre-determined confidence levels) contingency reserves for the project cost estimates and schedules. This RMP will help ensure that the CREATE and HPCIC projects incorporate appropriate, efficient, and cost-effective measures to mitigate unacceptable project-related risks.

2.2 SCOPE

The scope of this RMP includes the cost, schedule, technical performance, and programmatic performance elements that directly relate to the goal of delivering CREATE and HPCIC. The product of the risk assessment performed under this RMP will be a report listing the various risks with their classification, mitigation and handling strategies, impact on cost and schedule, and project action items.

2.3 RISK ASSESSMENT

Risk assessment includes the overall processes of risk identification and analysis. The risk assessment process identifies, analyzes, and quantifies potential project risks in terms of probability and consequences, as described in the sections below.

RISK IDENTIFICATION

Risk identification is an organized approach for determining which events may affect the project, documenting characteristics of the events that may occur, and providing a basis for why these events are considered risks. The primary approach to risk identification will be a brainstorming session that involves many subject matter experts from within and external to the projects. During brainstorming sessions, participants will identify risks based on design specifications, historical records, lessons learned, pertinent published materials, and any analogous projects. Participants will then attempt to identify all risks, regardless of whether the risks fall under the control of the project. They will also determine whether the risks will negatively or positively impact the project. Note that risks with positive impacts are redefined as opportunities.

Other techniques, including expert interviews, nominal group, Delphi, Crawford slip, and influence diagramming, will also be used in risk identification.

Risk identification also includes developing and completing a risk register. The risk register is a tool for collecting each identified risk as well as specific information on many parameters of a risk (as described in DOE G 413.3-7A), via an entry form that requests such information. The register can be used to capture information not only on primary risks, but also on residual risks (risks that are not covered in any mitigation strategies, as discussed below) and secondary risks (risks that result from implementation of a risk mitigation strategy).

Two of the parameters captured in the risk register follow:

- **Risk Owner:** Each identified risk is assigned a risk owner—the team member responsible for managing that risk from identification to closeout. To this end, the risk owner ensures the development and implementation of effective handling responses or strategies and files appropriate reports on the risk in a timely fashion. The risk owner also validates the qualitative and quantitative assessments assigned to their risk (see risk analysis below). Finally, the risk owner ensure that risk assumptions and assessments are captured in the risk register for future reference and assists possible risk transfer in the future. Any action taken in regard to a risk will be validated with the risk owner before that action can be closed.
- **Risk Trigger Metric:** A risk trigger metric is an event, occurrence, or sequence of events that indicates that a risk may be about to occur. The risk trigger metric may also be the pre-step for the risk, indicating that the risk will be initiated. The risk trigger metric is assigned to the risk when the risk is identified and entered into the risk register. The trigger metric is also assigned a date that would initiate monitoring of the trigger by the risk owner and the Federal Project Director. Monitoring the trigger allows adequate time for preparing to initiate the risk handling strategy and verifying that there is adequate cost and schedule to implement the risk handling strategy.

When complete, the risk register contains all the risks, along with a clear statement of the risk event and the consequence to the project were the event to occur (information that becomes available as the risk analysis process described below is completed).

Risk Analysis

Risk analysis includes qualitative and quantitative analyses.

Qualitative Risk Analysis

The first step in risk analysis is a qualitative assessment of the probability of the risk event occurring and the consequence or impact (on cost, schedule, or technical performance) if the risk occurs. Table 1 shows the qualitative probabilities and the numeric guidance for each probability ranking. Table 2 shows the consequence ranking.

The initial consequence assessment assumes that no risk handling strategy has been developed. After the risk mitigation approach is identified and a decision made to implement the mitigation, the mitigation cost becomes part of the project cost and not the contingency. Only the residual risk will be included in the risk register and contingency analysis.

Table 1. Probability ranking

Probability	Percent chance of occurrence
Very high/very likely	90%
High/likely	75–90%
Moderate/50-50	26–74%
Low/unlikely	10–25%
Very low/very unlikely	<10%

Table 2. Consequence ranking

Consequence	Cost	Schedule (workdays)
Crisis	>$1M	>60
Critical	$500K–$1,000K	31–60
Significant	$100K–$499K	21–30
Marginal	$10K–$99K	10–20
Negligible	<$10K	<10

The probability and consequence of the risk are combined and used to identify a risk rating for each individual risk, as shown in Table 3. Each of these risk ratings represents a judgment regarding the relative risk to the project and categorizes each risk as low, moderate, or high. Key risks, risk handling strategies, and risk communication strategies can be identified based on these risk ratings

Table 3. Qualitative risk ranking matrix

	Negligible	Marginal	Significant	Critical	Crisis
Very high/ very likely	Low	Moderate	High	High	High
High/ likely	Low	Moderate	Moderate	High	High
Moderate/ 50-50	Low	Low	Moderate	Moderate	High
Low/ unlikely	Low	Low	Low	Moderate	Moderate
Very low/ very unlikely	Low	Low	Low	Low	Moderate

QUANTITATIVE RISK ANALYSIS

Quantitative risk analysis is used to estimate the impact of risks on project cost and schedule. Quantitative analysis also addresses the extent of the overall project risk through the use of statistical modeling techniques, such as Monte Carlo and other stochastic methodologies.

Quantitative risk analysis involves assigning the following for each risk:

- A percent or percentage distribution to the risk probability (how likely it is the risk will occur)
- A dollar value distribution to the cost impact (minimum, maximum, and most likely cost impact)
- A schedule duration impact or duration distribution to any impacted activities in the schedule

For simplicity, the probability distribution will be assumed to be triangular (i.e., there is a linear interpolation between the minimum, most likely, and maximum values). Although the result is numeric, the determination of occurrence probability and consequence rating is subjective. The values are determined by the risk owner with concurrence of the Risk Management Board.

2.4 RISK AND OPPORTUNITY HANDLING

This activity entails developing appropriate responses or handling strategies for primary risks and opportunities identified, and discusses residual and secondary risks.

HANDLING STRATEGIES FOR PRIMARY RISKS AND OPPORTUNITIES

Once the risks and opportunities are identified and quantified, appropriate responses are developed. The appropriate handling strategy will be based on an exploration of the variety of options available to address the risk, a cost-benefit analysis of handling the risk, and the impact of the handling strategy on other parts of the project.

At the highest level, four generic strategies are available for risk response:

- **Avoidance**: The team changes the project plan to eliminate the risk or protect the project objectives from its impact. The team might achieve this by changing scope, adding time, or adding resources.
- **Transference**: The team transfers the financial impact of risk by contracting out some aspect of the work. Transference reduces the risk only if the contractor is more capable of taking steps to reduce the risk and does so. This strategy is significant in an alternative finance project, which transfers nearly all the project risks to the third party that constructs and owns the building.
- **Mitigation**: The team seeks to reduce the probability or consequences of a risk event to an acceptable threshold. It accomplishes this via many different means that are specific to the project and the risk. Mitigation steps, although costly and time consuming, may still be preferable to proceeding with the unmitigated risk.
- **Acceptance**: The project manager and team decide to accept certain risks. They do not change the project plan to deal with a risk or identify any response strategy other than agreeing to address the risk if it occurs.

The four strategies are modified for opportunities accordingly. That is, the project team may assess the costs and benefits of any opportunities that occur to determine whether to pursue the opportunity.

The appropriate handling strategy will be selected and a step-by-step implementation plan will be documented in the risk register, as noted above. Handling strategies will be reviewed as part of the periodic risk reviews described in the risk monitoring section below.

RESIDUAL RISK

After the handling strategy is developed, the Risk Management Board will attempt to identify and analyze any and all residual risks, or risks that do not have a mitigation strategy. If further mitigation is required, these risks may be promoted to primary risks. Often the residual risk is accepted.

SECONDARY RISK

As risks are being analyzed and handling strategies developed, it may be discovered that specific handling strategies introduce their own risks. These are secondary risks. Secondary risks will be considered and will be factored into the cost/benefit analysis of the primary risk. If necessary, a secondary risk can be promoted to primary risk.

2.5 RISK MONITORING

Risk monitoring involves the systematic, continuous tracking and evaluation of the effectiveness and appropriateness of the risk handling strategy, techniques, and actions established within the risk management plan. Monitoring will be performed as a continuous process throughout the project. The Risk Management Board will meet on a regular basis to ensure the following:

- Risk owner is current and performing
- Risk identification—and especially noting of risk triggers—is current and up-to-date with the project
- Risk handling strategies are being implemented and executed

Risk monitoring also involves review of cost and schedule contingency calculations and risk management communications. In addition, the Risk Management Board reviews and ensures closure of risks that are no longer active.

2.6 RISK FEEDBACK

Risk feedback is a continuous and iterative activity throughout the risk management process; participants in the risk management process should provide feedback throughout the project. The feedback process begins with the initial identification of the overall risk of the project at the mission need phase of the project, CD-0, to the project close out, CD-4, and the capture of the final lessons learned.

Feedback is provided both formally and informally. For the highest ranked risks, feedback will be provided in a formal, written format to ensure that the risk is recorded and received by the appropriate project official, whether it is the risk owner or the Federal Project Director or the Contractor Project Manager.

3. RISK DOCUMENTATION AND COMMUNICATION

The risk assessment documentation will be maintained separate from this RMP and updated in accordance with the provisions of this plan.

The risk communication plan will be part of the overall project communication described in *CD-1: Alternatives Analysis and Business Case* which contains the LVOC governance and coordination team charter. LLNL and SNL/CA will each maintain their portion of the risk assessment.

4. INITIAL RISK ASSESSMENT

LLNL and SNL/CA performed an initial risk identification and analysis for the CREATE and HPCIC projects based on the alternative finance acquisition strategy, as described in the *CD-1: Alternatives Analysis and Business Case*. Each lab team used the risk areas as identified in Attachment 8 of DOE G 413.3-7A to identify and describe the risks and determine the risk owner. As noted, the alternative finance approach transfers the majority of risks typically borne by DOE and the operating contractors in a line item construction project to the private sector.

For the risks that remain with DOE and the operating contractors, the risk management teams assessed the probability of occurrence and potential consequences on the project. They then identified a risk mitigation strategy and rated the residual risk as high, medium, or low. Of the residual risks owned by DOE or the operating contractor, only four were assigned a risk rating above low. Table 4 summarizes the probability, consequence, and risk ratings assigned to the residual risks that are not rated low.

Table 4. Risks to DOE and the operation contractors not rated "low"

Risk area	Description	Probability	Consequence	Risk rating
Planning	Costs change significantly from those used in planning, resulting in unaffordable costs.	Low	High	Medium
Technical	Safety, security, or significant environmental issues emerge during private sector development and ownership of a facility on leased federal land, damaging the reputation of LLNL, SNL, NNSA, or DOE.	Low	High	Medium
Organizational	Lack of clarity of roles, responsibilities, and authorities for DOE/NNSA, delaying the project.	Medium	Medium	Medium
Project execution	Delays in required governmental actions or approvals, delaying the project.	Medium	Medium	Medium


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