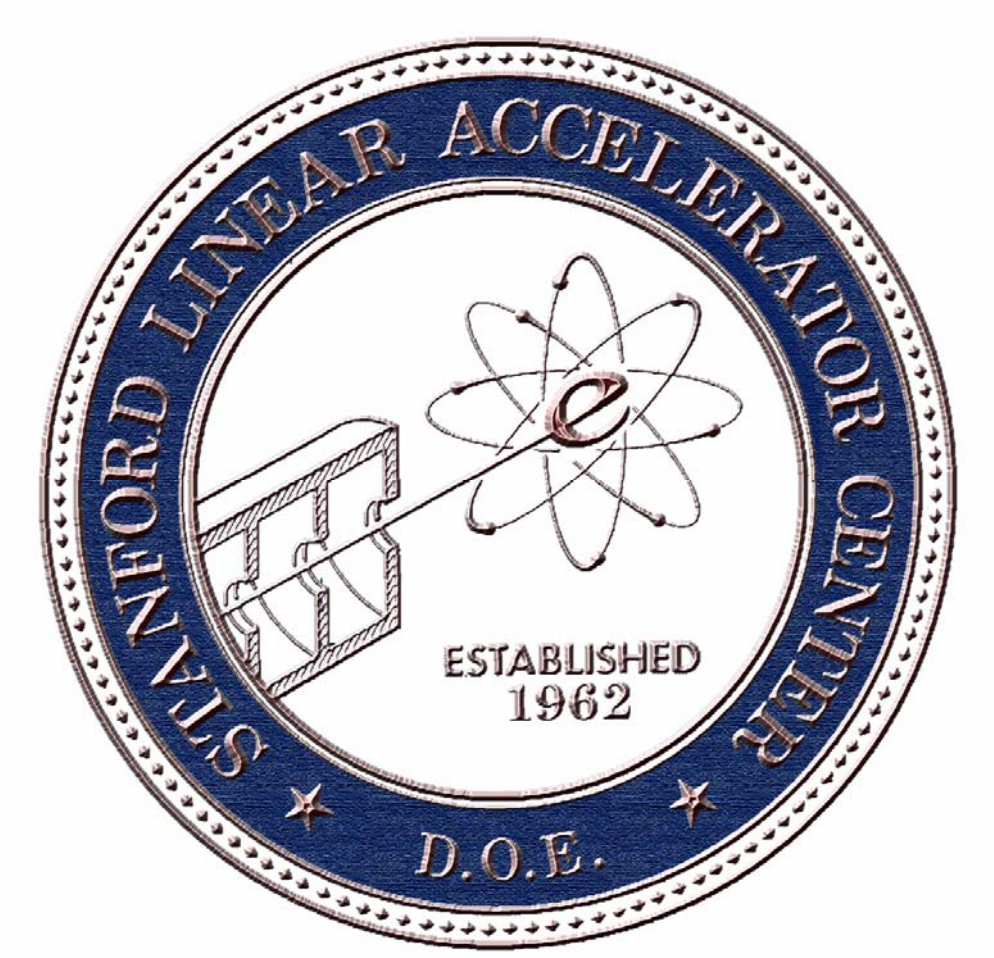
SLAC Infrastructure and Power Issues



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DOE High Energy Physics Program Review

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The SLAC Infrastructure

What Does It Consist Of?

- About 350 buildings, labs, machine enclosures, roads
- Electrical utilities
- Cooling utilities
- Miscellaneous

Problems and Needs:

- Original plant is almost 40 years old
- Replacements for original equipment and parts are no longer available
- Unfulfilled seismic standards need to be met for equipment protection (Major life threatening remediations have been completed)
- OSHA compliance issues will require remediation (Current estimate $3M+)

Sources of Funds

GPP (Typically ~ $4.2M/year in FY04 for HEP)

Some Operating Funds (~ $1M/year)

Science Laboratory Infrastructure (SLI) (Starting in FY04)

Infrastructure Plan Categories

Routine, Including OSHA Compliance

Revitalization

Seismic Remediation

SLAC Infrastructure Remediation Plan

- **Routine**

  Facilities Maintenance, Roofs and HVAC, Utilities Maintenance, ES&H Improvements and OSHA Compliance, ADA Compliance, and Programmatic Requirements

- **Revitalization**

  (Replacement of original equipment)

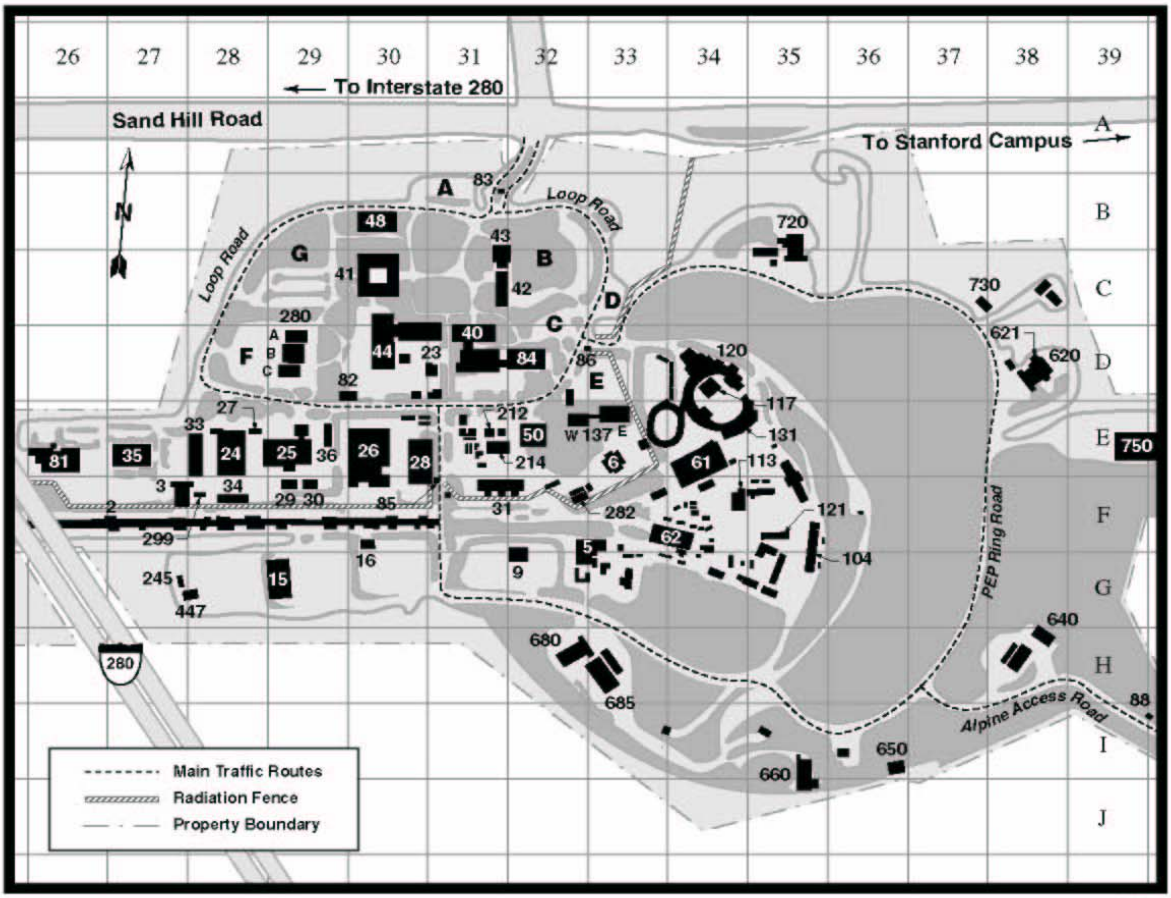
  Fire Alarms, Chilled Water Plant, HV Cables,

  13 Variable Voltage Substations, Conventional Substations, Panel Boards (Linac), Various Switchgears, Motor Control Centers (Linac), Piping (Linac, BSY, RA)

- **Seismic Remediation**

  About 350 buildings and structures: many still need to be seismically strengthened, some have been demolished.

SLAC Area Map



SLAC Area Map

12-2002
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	Building Number	Grid Number
Administration and Engineering Building (A&E)	41	30-C
Alpine Gate Guard House	88	40-I
Auditorium and Visitor Center	43	31-C
Auxiliary Control Building	3	27-F
Beam Switch Yard Access	9	32-G
Cafeteria	42	31-C
Central Hazardous Waste Management Area	245	27-G
Central Laboratory	40/84	31-D
Central Utility Building	23	31-D
Chemical Storage Building	36	29-E
Cleaning Facility Building	30	29-F
Collider Experimental Hall (CEH)	750	39-E
Computer Building (SCS)	50	32-E
Controls Building	34	28-F
Cryogenics Laboratory	6	33-E
End Station A (ESA)	61	34-E
End Station B	62	34-F
Environmental Protection Restoration	299	28-F
Environmental Safety and Health (ES&H)	24	28-E
Exercise Room/Shops Dining Room	27	28-E
Experimental Facilities Department Shops (EFD)	104	35-F
Fire Station	82	30-D
Gate 17 Guard House	86	33-D
General Services Building (Shipping & Receiving)	81	26-E
Hazardous Waste Storage Area	447	28-G
Heavy Fabrication Building	25	30-E
Klystron Gallery (Visitors Alcove, Sector 27)	2	27-F
Laboratory Offices and Shops (LOS)	137	33-E
Light Assembly Building	33	28-E

	Building Number	Grid Number
Light Fabrication Building	25	29-F
Main Control Center (MCC)	5	32-F
Main Gate (Information Booth)	83	31-B
Master Substation	16	30-F
Metal Stores Shelter	29	29-F
Parking Lots	A to G	
PEP Beam Facility/SSRL	650	36-I
PEP Beam Facility/SSRL	730	37-C
PEP Control Room	685	33-H
PEP Interaction Region 2 (IR-2)	620	38-D
PEP Interaction Region 4 (IR-4)	640	38-H
PEP Interaction Region 6 (IR-6)	660	35-I
PEP Interaction Region 8 (IR-8)	680	32-H
PEP Interaction Region 12 (IR-12)	720	35-B
Physics and Engineering Building	280	29-D
Plant Maintenance and Utilities	35	27-E
Power Conversion	15	29-G
Research Office Building (ROB)	48	30-B
Sector 30 Guard House	85	31-F
SLC Engr. Trailer South (Fort Apache)	282	32-F
SLC Offices	212/214	31-E
SPEAR Control Room	117	34-D
Stanford Synchrotron Radiation Lab (SSRL)	120/131	34-DE
Test Beam Facility	121	35-F
Test Laboratory	44	30-D
User Offices/Warehouse	28	30-E
Vacuum Assembly Building	31	31-F
Visitor Center	43A	31-C
Warehouse/User Offices	28	30-E

SLAC Infrastructure Plan

Infrastructure	FY04	FY05	FY06	FY07	FY08	FY09	FY10
Routine							
Facilities Maintenance, Utilities Maintenance, ES&H Improvements and OSHA Compliance, ADA Compliance, and Programmatic Requirements							
Landlord (HEP)	3.8	2.2	2.5	2.6	3.0	3.6	4.3
HEP	0.5	1.7	0.8	0.8	0.5	0.4	0.0
BES (FY05 includes $1.5M XLAM const.)	0.2	2.0	0.7	0.7	0.5	0.7	0.3
Subtot Routine (OP/GPP)	**4.4**	**5.9**	**4.0**	**4.0**	**3.9**	**4.7**	**4.6**
Revitalization							
(Replacement of original equipment)							
Fire Alarms, Chilled Water Plant, HV Cables, 15 Variable Voltage Substations, Conventional Substations (Overall), Panel Boards (Linac), Various Switchgears, Motor Controls Centers (Linac), Piping (Sewer, Hot and Cold Water, LCW).							
Landlord (HEP)	0.3	0.2	0.6	0.6	0.2	0.0	0.0
HEP	0.2	0.8	0.8	0.9	0.7	0.3	0.0
BES	0.2	0.1			0.2		
SC Lab Infrastructure (SLI)	1.3	3.8	2.8		5.0	5.0	3.0
Subtot Revitalization (OP/GPP/SLI)	**2.0**	**4.9**	**4.2**	**1.5**	**6.1**	**5.3**	**3.1**
Seismic Remediation							
About 350 buildings and structures: many still need to be seismically strengthened, a number have been demolished, and a few will have to be replaced.							
Landlord (HEP)	0.2	0.1	0.1	0.3	0.3	0.3	0.3
HEP	0.3	0.1	0.4	0.0	0.5	0.5	0.5
BES	0.0						0.4
SC Lab Infrastructure (SLI)	1.1	3.3	3.7				
Subtot Seismic (OP/GPP/SLI)	**1.5**	**3.5**	**4.2**	**0.3**	**0.8**	**0.8**	**1.2**
HEP	**5.2**	**5.2**	**5.2**	**5.2**	**5.2**	**5.2**	**5.2**
BES	**0.4**	**2.1**	**0.7**	**0.7**	**0.7**	**0.7**	**0.7**
SLI	**2.4**	**7.1**	**6.5**	**0.0**	**5.0**	**5.0**	**3.0**
Total Funding	**8.0**	**14.4**	**12.3**	**5.8**	**10.8**	**10.8**	**8.8**

OSHA Compliance Issues

EXAMPLES

- Machine guarding upgrades
- Circuit breaker, junction box, outlet and other electrical upgrades
- RF and other electrical equipment grounding
- Cable tray upgrades
- Exposed voltage energized equipment upgrades
- SLAC training in use of electrically energized equipment
- Stairways, fixed ladders and fall protection upgrades
- Secondary containment upgrades
- Illicit storm drain connections and sewer repairs
- Formal inspections of hoisting equipment
- Fire alarm and extinguisher upgrades
- Signs and lighting upgrades
- NRTL inspection program

Infrastructure Line Item Construction Projects

Science Laboratories Infrastructure (SLI)

SLAC Safety and Operational Reliability Improvements
(TEC $15.6M; $2M start in FY04)

The proposed project will improve the safety and operational reliability of the Laboratory's facility and systems by specifically identifying and upgrading the most critical sections of all failing mechanical utility systems, and by selectively upgrading the most important mission-critical experimental and manufacturing facilities that are seismically deficient. SLAC's piping systems for natural gas, compressed air, low-conductivity water (LCW), cooling tower water (CTW), chilled water (CHW), hot water (HW), fire protection water (FPW), sewer and storm drainage serve over 200 buildings used for offices, laboratories, shops support, storage, heavy and light fabrication, and above- and below-ground experimental research facilities including LINAC, PEP-II, BaBar, FFTB, Test Accelerator, GLAST and SPEAR. Since these piping systems were installed almost 40 years ago, and are prone to leaks and failures that can no longer be prevented by good maintenance, the potential is high for serious disruptions of mission-critical research, and safety and environmental hazards. The mechanical utilities upgrade proposed is necessary for SLAC to continue to provide first-class research facilities, cost effectively, while complying with its ES&H requirements. Furthermore, since SLAC is located in a seismically active geographic area, the seismic upgrade efforts will enhance SLAC's ability to survive major earthquakes by improving the seismic strength of several important research and infrastructure facilities. While no one knows when the next major earthquake will strike the San Francisco Bay Area, geologists predict that the probability of such an earthquake during the next 30 years is 67%.

Electrical Utilities Reliability Upgrade (Proposal)
(TEC ~$13M; FY08 start)

The proposed project will upgrade the existing electrical utility systems in the two-mile linear accelerator (LINAC), which is the source of high energy electron or positron beam for many of the planned experimental scientific programs. The LINAC electrical systems, consisting of motor control centers, panel boards, variable voltage transformers and substations, were all installed at the time when SLAC was originally built, almost 40 years ago. The equipment is obsolete and replacement parts are no longer available. In addition, the equipment is not in compliance with the current electrical codes. Failure of the circuit protection devices to work properly can result in either collateral damage for failure to open or unplanned interruptions of operation. This project will upgrade the below 600 volt essential electrical utility systems in the LINAC.

Cooling Utilities

- 6 Cooling Towers Total
  - 3 replaced so far and 1 new one built (GPP)
  - 1 still to be replaced (SLI)
  - 1 OK for now
- Underground Piping (SLI)
  - Natural gas, compressed
  - air, low conductivity water, cooling tower water, chilled water, fire protection water, sewers, storm drains

Seismic Remediation
(26% of original 1999 plan completed so far with GPP)

SLI Projects

- PEP Mechanical Buildings
- CT101
- CT Huts
- CT 1701 Basin
- B050 Computer Center
- B044 Klystron Test Lab
- SSRL B120
- SSRL B140
- SSRL SPEAR Shielding
- End Station A Upgrade
- End Station B Upgrade
- Beam Dump East Tunnel

Electric Utilities (% Replacement)

One Major Substation (85 MW), two AC Lines (230 kV, 69 kV) Transforming Down to 12.4 kV (100%)

12.4 kV distribution feeders (85%)

Switchgear

- 12.4kV (100%)
- 480 V (15%)

Proposed SLI Program (FY 08-10)

13 (out of 16) Variable Voltage Substations (SLI) (0%)
(others built out of GPP)
Conventional Substations (SLI) (5%)

Motor Control Centers (SLI) (0%)

Panel Boards (SLI) (0%)

Variable Voltage Substations (16)

12kV Input Section with Transformer

600 V Distribution Section and Controls

SLAC MII Projection

	RPV ($M)	FY04 ($M)	FY05 ($M)	FY06 ($M)
Non-Programmatic Buildings and OSF	$267.0			
Indirect Funded Maintenance		$4.3	$4.2	$4.4
GPP (Replace major systems, e.g., roofs, HVAC)		$0.4	$0.8	$1.0
Total Maintenance and Sustainment Activities		$ 4.7	$5.0	$ 5.4
MII = Total Sustainment Activities/RPV		1.8%	1.9%	2.0%

Electric Power, Present and Future

- In the foreseeable future, when the B-Factory and SPEAR3 are running, SLAC will use between 50 and 60 MW peak
- Currently, power is bought via DOE/LLNL/LBNL/SLAC Consortium, from

  WAPA (Sacramento) 77.6 MW at under $30/MWh
  Pacificorp (Portland) 53 MW at $32/MWh
  130.6 MW

- On January 1, 2005, the contract between PG&E and WAPA, which has provided for this relatively inexpensive power to the Consortium, will expire
- To prepare for the future, DOE, via a Memorandum of Agreement between the NNSA and the Office of Science, is now going to market with a Utility Procurement Plan (UPP) via WAPA to constitute a portfolio of power supplies for the next five-to-ten years or so.

Electric Power, Present and Future, cont.

- Final bids from private utilities will hopefully be received and firmed up by August 2004
- Rates are likely to be between 70% and 100% higher than current rates
- The increase in the SLAC/HEP power budget for FY 2005 is estimated to be between $6M and $7M
- An additional cost uncertainty stems from the fact that PG&E will no longer be obligated to transmit the power to SLAC at the current wholesale transmission rate

SLAC Electric Power Costs

	FY2000	FY2001	FY2002	FY2003	Est FY2004	Est FY 2005
Site Power (K$)	573	670	861	837	818	1461
HEP Power (K$)	5153	6014	7871	8351	7332	13216
SSRL Power (K$)	661	717	1,017	657	1077	2202
Total Power (K$)	6387	7401	9750	9845	9226	16879
GWh	326	316	334	363	361	360
$/MWh	20	23	29	27	26	47

DOE Northern California Sites

Annual Peak Demand and Energy Forecasts

2005-2014

YEAR	PEAK DEMAND (Kilowatts)	ENERGY (MWh)
2005	134,000	779,000
2006	135,000	995,000
2007	144,000	1,006,000
2008	151,183	1,070,133
2009	154,445	1,090,878
2010	154,830	1,094,297
2011	155,409	1,098,231
2012	155,891	1,101,903
2013	156,469	1,105,838
2014	156,951	1,108,912