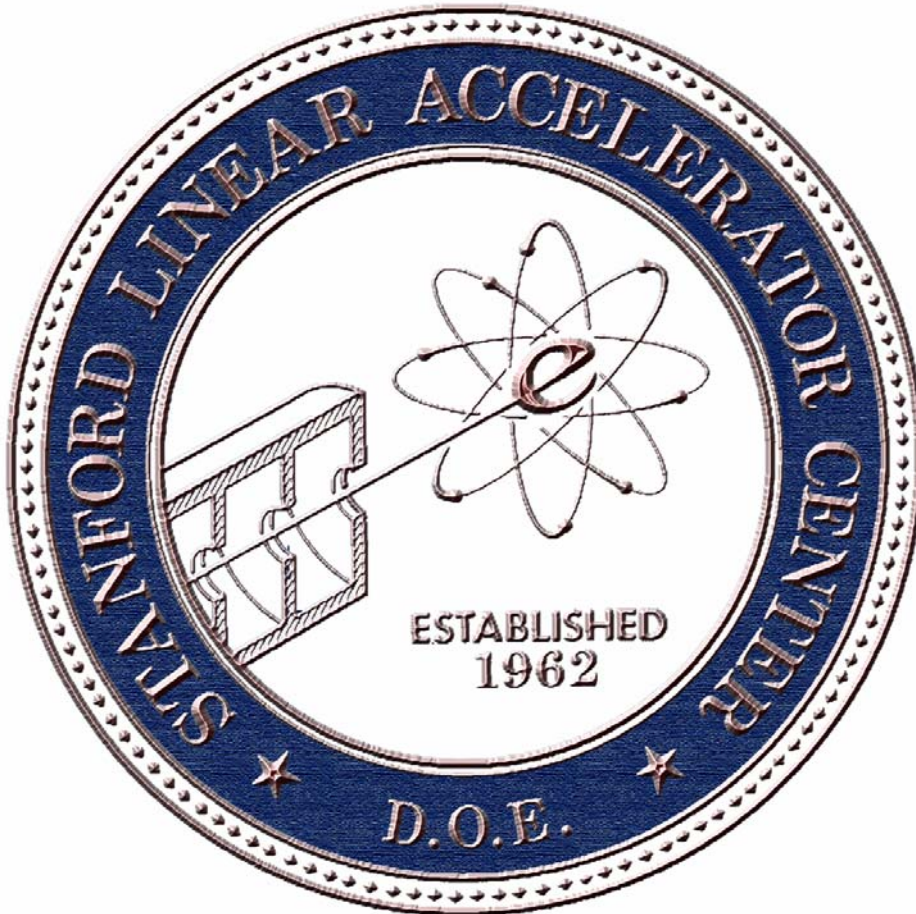
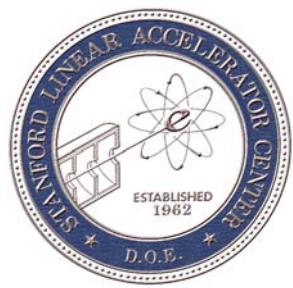


SLAC Infrastructure Issues



Gregory A. Loew
SLAC Annual Program Review
April 9-11, 2003



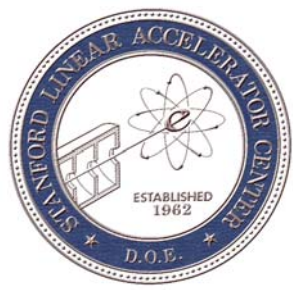
The SLAC Infrastructure

What Does It Consist Of?

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

Problems and Needs:

- Original plant is 38 years old
- Replacement parts and equipment are no longer available. Failures impair program
- Unfulfilled seismic standards need to be met for equipment protection (Major life threatening remediations have been completed)
- Upcoming OSHA compliance issues will require remediation



Sources of Funds

GPP (~ \$4.2M/year so far)

Some Operating Funds (~ \$1M/year)

Some Demolition Funds (\$400K in FY02 only)

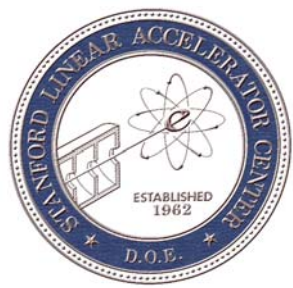
Science Laboratory Infrastructure (SLI)

Infrastructure Plan Categories

Routine, Including OSHA Compliance

Revitalization

Seismic Remediation



SLAC Infrastructure Plan

- **Routine**

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

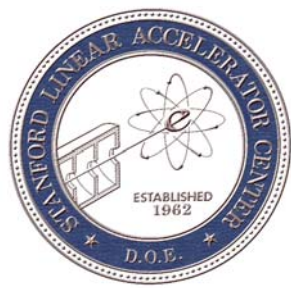
- **Revitalization**

(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 (Sewers, Hot and Cold Water, LCW, etc).

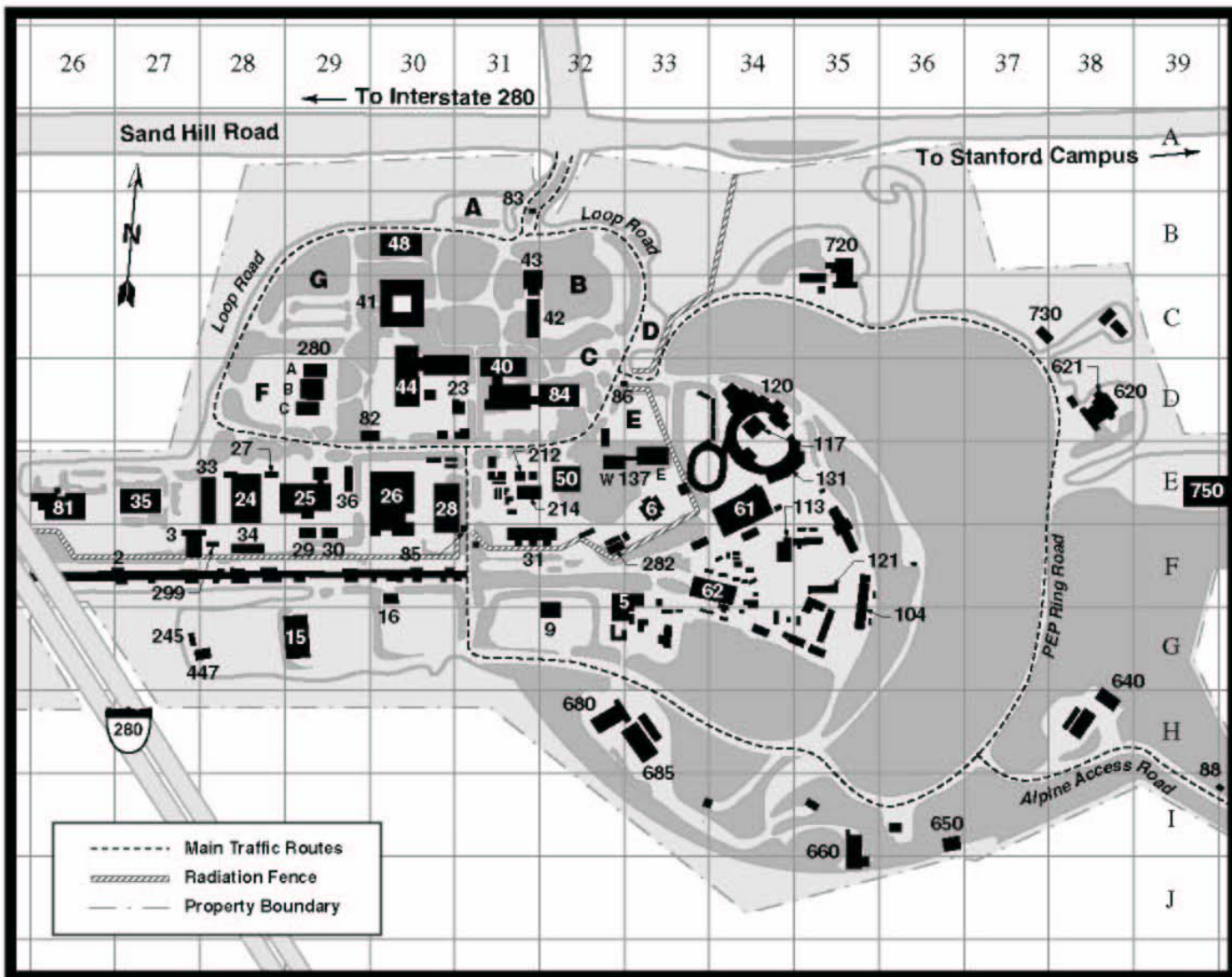
- **Seismic Remediation**

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



SLAC Infrastructure Plan

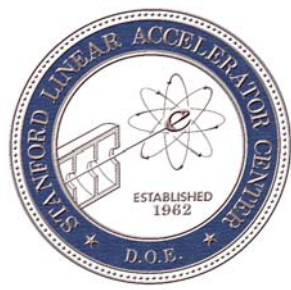
Infrastructure	FY03	FY04	FY05	FY06	FY07	FY08	FY09
Routine							
Facilities Maintenance, Utilities Maintenance, ES&H Improvements and OSHA Compliance, ADA Compliance, and Programmatic Requirements							
Landlord (HEP)	3.2	3.4	2.9	2.6	4.2	3.4	3.5
HEP	0.5	0.5	0.8	0.8	0.6	0.8	0.3
BES							
SC Lab Infrastructure (SLI)							
Subtot Routine (OP/GPP/SLI)	3.7	3.9	3.7	3.4	4.8	4.2	3.8
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 (Sewers, Hot and Cold Water, LCW, etc.).							
Landlord (HEP)	0.4	0.2	0.8	0.6	0.3	0.1	0.1
HEP	0.0	0.5	1.3	1.3	0.3	1.1	1.5
BES	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SC Lab Infrastructure (SLI)		0.8	1.7	4.5	5.0	5.0	3.0
Subtot Revitalization (GPP)	0.9	2.0	4.3	6.9	6.1	6.7	5.1
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)	0.3	0.2	0.1	0.1	0.3	0.3	0.3
HEP	0.8	1.4	2.1	0.8	0.5	0.5	0.5
BES							
SC Lab Infrastructure (SLI)		1.2	2.3	5.1			
Subtot Seismic (OP/GPP/SLI)	1.1	2.8	4.5	6.0	0.8	0.8	0.8
HEP	5.1	6.2	8.0	6.2	6.2	6.2	6.2
BES	0.5	0.5	0.5	0.5	0.5	0.5	0.5
SLI		2.0	4.0	9.6	5.0	5.0	3.0
Total Funding	5.6	8.7	12.5	16.3	11.7	11.7	9.7



SLAC Area Map

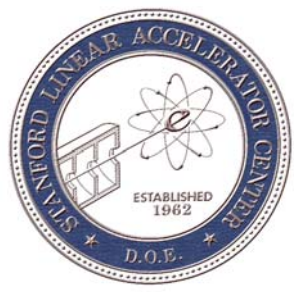
12-2002
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	Building Number	Grid Number		Building Number	Grid Number
Administration and Engineering Building (A&E)	41	30-C	Light Fabrication Building	25	29-F
Alpine Gate Guard House	88	40-I	Main Control Center (MCC)	5	32-F
Auditorium and Visitor Center	43	31-C	Main Gate (Information Booth)	83	31-B
Auxiliary Control Building	3	27-F	Master Substation	16	30-F
Beam Switch Yard Access	9	32-G	Metal Storage Shelter	29	29-F
Cafeteria	42	31-C	Parking Lots	A to G	
Central Hazardous Waste Management Area	245	27-G	PEP Beam Facility/SSRL	650	36-I
Central Laboratory	40/84	31-D	PEP Beam Facility/SSRL	730	37-C
Central Utility Building	23	31-D	PEP Control Room	685	33-H
Chemical Storage Building	36	29-E	PEP Interaction Region 2 (IR-2)	620	38-D
Cleaning Facility Building	30	29-F	PEP Interaction Region 4 (IR-4)	640	38-H
Collider Experimental Hall (CEH)	750	39-E	PEP Interaction Region 6 (IR-6)	660	35-I
Computer Building (SCS)	50	32-E	PEP Interaction Region 8 (IR-8)	680	32-H
Controls Building	34	28-F	PEP Interaction Region 12 (IR-12)	720	35-B
Cryogenics Laboratory	6	33-E	Physics and Engineering Building	280	29-D
End Station A (ESA)	61	34-E	Plant Maintenance and Utilities	35	27-E
End Station B	62	34-F	Power Conversion	15	29-G
Environmental Protection Restoration	299	28-F	Research Office Building (ROB)	48	30-B
Environmental Safety and Health (ES&H)	24	28-E	Sector 30 Guard House	85	31-F
Exercise Room/Shops Dining Room	27	28-E	SLC Engr. Trailer South (Fort Apache)	282	32-F
Experimental Facilities Department Shops (EFD)	104	35-F	SLC Offices	212/214	31-E
Fire Station	82	30-D	SPEAR Control Room	117	34-D
Gate 17 Guard House	86	33-D	Stanford Synchrotron Radiation Lab (SSRL)	120/131	34-DE
General Services Building (Shipping & Receiving)	81	26-E	Test Beam Facility	121	35-F
Hazardous Waste Storage Area	447	28-G	Test Laboratory	44	30-D
Heavy Fabrication Building	26	30-E	User Offices/Warehouse	28	30-E
Klystron Gallery (Visitors Alcova, Sector 27)	2	27-F	Vacuum Assembly Building	31	31-F
Laboratory Offices and Shops (LOS)	137	33-E	Visitor Center	43A	31-C
Light Assembly Building	33	28-E	Warehouse/User Offices	28	30-E



Buildings Upgraded, Demolished or Sold

Building Number	Building Name	Building Number	Building Name
0	SEISMIC GAS VALVE RETROFIT	272	TRAINING CENTER
6	CRYOGENICS BUILDING	276	OFFICE TRAILER FOR P.M.U.
27	SHOPS DINING ROOM	278	OFFICE TRAILER
28	WAREHOUSE/USER OFFICES	280	ENG. PHYSICS BUILDING
31	VACUUM ASSEMBLY BLDG	291	NPAS OFFICE TRAILER #2
33	LIGHT ASSEMBLY BUILDING	295	NPAS OFFICE TRAILER #1
34	ELECTRONICS BUILD ANNEX	296	SLAC USER TRAILER #2
81	GEN. SERVICES BUILDING	297	SLAC USER TRAILER #3
82	FIRE STATION	301	POWER SUPPLY SHELTER
107	CRYOGENICS SHOP	302	POWER SUPPLY SHELTER
109	SPARK CHAMBER BUILDING	303	POWER SUPPLY SHELTER
110	STREAMER CHAMBER BUILD.	309	POWER SUPPLY SHELTER
111	40" BUBBLE CHAMBER BUILD.	310	POWER SUPPLY SHELTER
113	82" BUBBLE CHAMBER BUILD.	312	POWER SUPPLY SHELTER
114	SHOP	403	EXPER. EQUIP. SHELTER
125	TBF CONTROL ROOM	404	EXPERIMENTAL SHELTER
127	HELIUM COMP. BUILDING	405	RESEARCH YARD STORAGE SHED
133	SLD CRID CLEAN ROOM	412	HAZARDOUS WASTE STORAGE
134	POWER SUPPLY BUILDING	420	STORAGE BUILDING
215	CRYOGENICS TECH. OFFICE	430	FINAL FOCUS STORAGE BOX
220	H2O DAMAGED VINNEL BLDG	478	RADIOACTIVE WASTE STORE
222	FINAL FOCUS TEST BEAM	610	E 137 EXP BLDG.
223	FINAL FOCUS TEST BEAM	612	MARK II OFFICE TRAILER
224	BEAM LINE 19 CONTROL RM	623	IR 2 SOUTH LEACH
227	REST ROOM TRAILER , MEN	623	IR 2 NORTH LEACH
232	BEAM LINE 27 CONTROL ROOM	684	IR 8 OFFICE TRAILER
252	OFFICE TRAILER, LH2 GROUP	1201	COOLING TOWER West Linac



Buildings to be Demolished in FY03



Building 252 (Sold)



Building 253



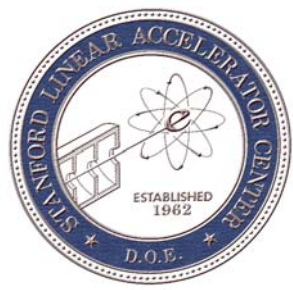
Building 610



Building 109 "Dry Room"



**Two Story Structure Between
Building 121 and Building 403**



Proposed Infrastructure Line Item Construction Projects

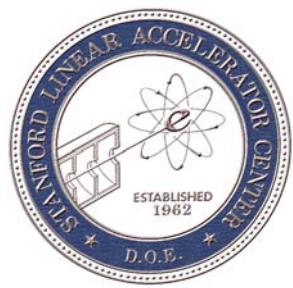
Science Laboratories Infrastructure (SLI)

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

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%.

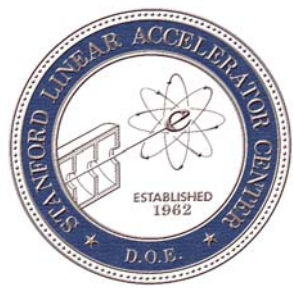
LINAC Electrical Reliability Upgrade (TEC ~\$13.3M; FY07 start)

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

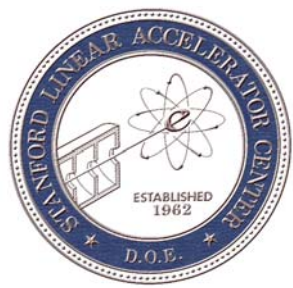
- **6 Cooling Towers (GPP)**
 - 3 replaced so far**
 - 1 new one for Research Yard under construction**
 - 2 still to be replaced**
- **Underground Piping (SLI)**
 - Natural gas, compressed air, low conductivity water, cooling tower water, chilled water, fire protection water, sewers, storm drains**



Seismic Remediation **SLI Projects**

(24% of plan completed so far)

- **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%)

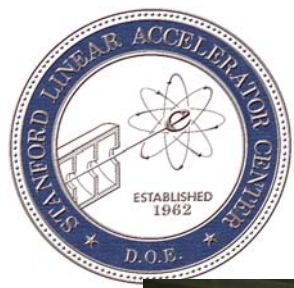
Switchgear { **12.4kV (100%)**
480 V (15%)

16 Linac Variable Voltage Substations (SLI) (0%)

Conventional Substations (SLI) (5%)

Motor Control Centers (SLI) (0%)

Panel Boards (SLI) (0%)



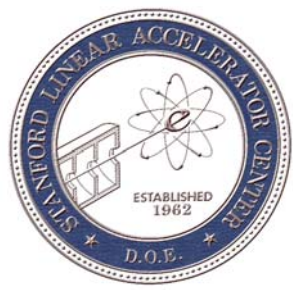
Variable Voltage Substations (16)



12kV Input Section with Transformer



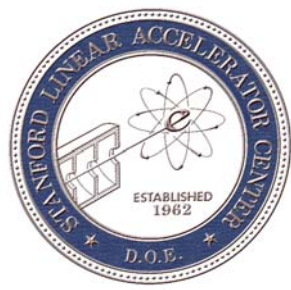
600 V Distribution Section and Controls



OSHA Compliance Issues

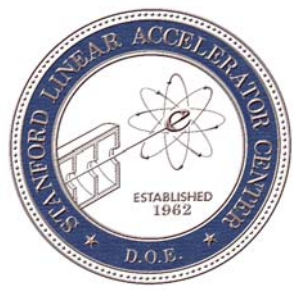
EXAMPLES

- **RF and other equipment grounding**
- **Secondary containment upgrades**
- **Stairways and fixed ladder upgrades**
- **Exposed medium voltage energized equipment**
- **Tunnels and vaults: Water leaks impacting energized equipment**
- **Illicit storm drain connections**
- **Overloaded cable trays**
- **NRTL inspection program**
- **Formal inspections of hoisting equipment**
- **Fire alarm upgrades**



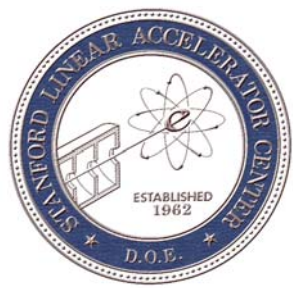
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SLI		2.0	4.0	9.6	5.0	5.0	3.0
Total Funding	5.6	8.7	12.5	16.3	11.7	11.7	9.7



Electric Power, Present and Future

- **Power is currently bought via LLNL/LBNL/SLAC Consortium**
WAPA (Sacramento) 77.6 MW at \$24/MWR and up
Pacificorp (Portland) 53 MW at \$32/MHR
130.6 MW
- **PG&E and WAPA have had a ~30 year agreement to back each other up to supply “firm power”**
- **In January 2005, this agreement expires**
WAPA’s available cheap power will drop to a small fraction and will no longer be firm
- **Most power for the Consortium will be bought at market price dominated by gas-fired plant costs (\$50-60/MWH)**



SLAC Electrical Power Costs

	FY2000	FY2001	FY2002	Est FY2003	Est FY2004	Est FY2005
Site Power (K\$)	574	670	865	900	940	1,803
HEP Power (K\$)	5,090	5,993	7,872	9,411	9,112	18,185
SSRL Power (K\$)	644	715	1,017	694	1,412	2,718
Total Power (K\$)	6,309	7,378	9,754	11,005	11,464	22,706
GWH	326	316	334	381	382	393
\$/MWH	19	23	30	29	30	58