# E. ENERGY AND NATURAL RESOURCES

## Affected Environment

Approximately one-third of the current University of Washington energy demand is met via electrical power; the remaining two-thirds of demand is supplied by fossil fuel. The largest percentage of total energy (53 percent) is consumed for building heating. Energy sources and uses are described below.

### *Electric Power*

Seattle City Light (SCL) provides electrical power to Seattle and portions of King County. Based on 1999 data compiled by the University, the approximate total annual energy consumption for the entire campus was $2{,}600 \times 10^9$ Btu (British thermal unit) per year (see Table 8). The rate of energy consumption has increased by 6.25 percent per year due to new construction, additional lab equipment and the proliferation of computer use.

**Table 8**

**ENERGY CONSUMPTION SUMMARY, 1989-1999**

| Year | Fossil Fuel Use (Btux$10^9$) | Electricity (Btux$10^9$) | Total Use (Btux$10^9$) |
|---|---|---|---|
| 1989-1990 | 1,237 | 699 | 1,936 |
| 1990-1991 | 1,283 | 729 | 2,012 |
| 1991-1992 | 1,217 | 750 | 1,967 |
| 1992-1993 | 1,394 | 762 | 2,156 |
| 1993-1994 | 1,420 | 802 | 2,222 |
| 1994-1995 | 1,496 | 835 | 2,331 |
| 1995-1996 | 1,515 | 857 | 2,372 |
| 1996-1997 | 1,713 | 848 | 2,561 |
| 1997-1998 | 1,575 | 876 | 2,451 |
| 1998-1999 | 1,688 | 919 | 2,607 |

Source: University of Washington Capital Projects Office, 2000.

Most campus electrical energy demands are met through power supply contracts with SCL. SCL owns and maintains primary voltage (26 kV) substations adjacent to the Central Power Plant on the east side of the Central Campus and a second substation on the west side of the Central Campus. These substations provide service to the University's 13.8 kV electric distribution substation at 15th Ave. NE and NE Pacific St.; this substation serves the campus load, with the exception of the most distant loads in the East and West Campus. It is planned that any new buildings or electric load additions would be served off of direct SCL electric service.

The major consumption of electrical power is for lighting and building fans (35 percent each). Operation of chillers to supply air conditioning makes up approximately 2 percent of consumption. Power for laboratory and process equipment is approximately 16 percent, and for office equipment (including computers) is 12 percent.

Campus feeders have been extended to serve the West Campus area, east of the University Bridge; however, the campus electric distribution does not presently extend into the remaining West Campus area. SCL owns and maintains the electric distribution in this area and new projects would generally receive new electric service directly from SCL in the West Campus area west of the University Bridge. Similarly, the area of East Campus near Union Bay Place NE is served directly by SCL.

Peak hours of electrical use are from 9:30 am to 3:30 pm on weekdays. During these times, peak electrical energy use generally ranges from 35,000 to 40,000 kilowatts (kW) and has been as high as 41,000 kW. At low-use times (approximately 5:00 to 6:00 p.m.), electrical energy use is approximately 25,000 kW. The rate of increase in energy use has accelerated since the mid-1980s by approximately 6.25 percent. This growth can be attributed to new construction, additional lab equipment and the proliferation of computer use. An energy efficiency program is in place at the University. The University works with local public utilities to strive for energy conservation in new projects and existing buildings.

The emergency electrical power system is adequate for only present demands. Any new construction or major building renovation would require a new emergency power source.

### *Central Cooling*

The central power plant supplies energy to chillers for the central cooling water system (CCW). The chillers have a generating capacity approximately equal to the current campus demand, and distribution piping for the system is currently at capacity. Provisions have been made for the installation of one additional chiller to provide cooling to existing buildings.

### *Fossil Fuel*

Fossil fuel consumed at the Central Power Plant is used to generate heat, steam and emergency power. The steam system boilers are powered by natural gas (97 percent) and fuel oil (3 percent). Puget Sound Energy provides natural gas services to the University.

Steam is distributed to most buildings on the Central Campus through utility tunnels and is used for building heat, domestic hot water, food services, and process use. The largest element – building heating – was significantly reduced in the early 1970s by energy conservation programs. This included improved controls and operations procedures to reduce air volumes and temperatures. The University central steam system currently has cogeneration capability. Additional cogeneration opportunities will be explored between the University, City Light and the Bonneville Power Administration as technical and economic viability become available.

Natural gas service is provided through a metering station in the South/Southwest Campus for that area and at the central power plant. From the Central Power Plant, a University-maintained system distributes gas to a limited number of buildings. The University recently participated in a project that increased the size of the Puget Sound Energy main for more reliable and better service.

## Impacts of the Proposed Action

### *Construction*

Including site preparation, materials manufacturing, delivery and assembly energy costs, the total estimated amount of energy required to develop 3 million square feet on campus would be $4{,}170 \times 10^9$ Btu[10].

### *Operations*

Total energy demand associated with the addition of 3 million square feet would amount to an estimated $772 \times 10^9$ Btu per year[11]. The overall peak winter energy demand would be 10,200 kW. Refer to *Appendix C* for energy demand calculations. Energy conservation in facility design and management is expected to keep the growth in energy consumption to about one-half of what would have been predicted from the energy consumption pattern of the 1970s.

### *Electric Power*

Electrical power receiving stations have the capacity and switch gear necessary to serve the electrical loads for the fully developed campus and should not require major upgrades for approximately 40 years. Significant portions of the distribution cabling system and building electric service equipment is aged and needs to be replaced and expanded to provide for new and renovated facilities. New circuits must be installed to maintain operating flexibility and system reliability. If the potential development site listed as 4C (*Section II* of this Final EIS, Figure 4) is chosen for development, it may require relocation of an existing substation. With the identified system improvements, the existing distribution system on campus would be adequate to support the projected increases in consumption.

As noted previously, the emergency electrical power system is only adequate for present demands. The proposed development of 3 million square feet would require a new emergency power source. The central system must be expanded and additional cable distribution provided to areas not served by the emergency system or where the cabling is aged or of inadequate capacity.

**Central Cooling**

The addition of a chiller, as discussed above, could serve new buildings in the Central area of campus. However, limited distribution piping would prevent service to other areas of the campus. New chiller capacity must be provided for new construction in the West, South/Southwest areas; new distribution piping would also be required. Funding has been requested for a detailed study of this utility; the results of the study would establish the most appropriate means of providing adequate cooling water.

[10] This estimation does not correct for design characteristics that can significantly reduce or increase energy demand and related costs. The estimate averages requirements for building-relating paving, utilities and other features.

[11] $772.2\ \text{Btux}10^9$ is equal to 70.2 million kwh (see *Appendix C*), including energy requirements for generating facilities, transmission line losses and generation inefficiencies. The conversion value (11,000 BTU = 1 kwh) is a national average for all fuel sources (US Department of Energy, 1979).

### *Fossil Fuel*

The steam generation capacity and distribution system for the campus is adequate to handle the addition of 3 million square feet. When the additional space has been developed, the oldest boiler will have exceeded its useful life and will need replacement for the next phase of campus development. Selected piping within the condensate return system may need replacement; piping can deteriorate with more aggressive use. In the near term, the University plans to test the condensate return piping to check for potential failure.

No major improvements to the natural gas system are expected to be required as a result of the development of 3 million additional square feet on campus.

## Impacts of the Alternatives

### *No Action Alternative*

Under the *No Action Alternative*, increased energy demand impacts would be expected to occur as development (approved but not yet built) under the GPDP occurs, and as the University population increases. Associated energy and natural resource impacts were addressed in the GPDP EIS. Off-campus development activity could increase, in association with the projected population growth. The *No Action Alternative* could lead to an increase in off-campus energy demand.

### *Decentralized/Open Space Alternative*

This alternative would include less development than under the *Proposed Action* (approximately 50 percent less development). Consequently, in comparison with the proposed *Master Plan Seattle Campus*, the demand for on-campus energy would be reduced by about half. Overall, on-campus energy-related impacts would be reduced under this alternative, and some of the required infrastructure improvements to meet demand under the proposed *Master Plan Seattle Campus* may not be required. However, this alternative could lead to decentralization and an increase in off-campus energy demand.

### *No Street and Alley Vacations Alternative*

Building area would be reduced under this alternative. With less building area, energy demand on campus would be slightly lower than that projected for the proposed *Master Plan Seattle Campus*. Because the difference in building area would not be great, required mitigation under this alternative would likely be similar to that under the *Master Plan Seattle Campus.*

### *Lifting of Lease Limit*

With the lifting of the limitation on University leasing, the pace of development in the University District could increase and the demand for energy could also increase. Any new buildings developed in the University District would conform to the City of Seattle's development standards, including the new Energy Code, and would be required to obtain applicable permits and approvals.

## Possible Mitigation Measures

Measures to mitigate potential energy and natural resources impacts may include the following.

- Centralized utilities allow the most efficient management of the related energy resource. Central plant additions were recently made to add steam, cooling water generation capacity and high voltage electrical capacity to continue this approach. Satellite plants for central cooling could be established if space in the central plant proves to be too limited for meeting service demands.

- New facilities could comply with applicable energy codes. In addition, since the University must operate and maintain the facilities on a long-term basis, the economics of energy management and conservation are a primary design consideration. A standard of practicality must also be applied that assures that the building designs can be maintained properly. Sophisticated monitoring systems are becoming available to assure efficient operations.

- Projects receiving separate service from SCL could be subject to SCL General Service Energy Efficiency Standards on new or enlarged services to existing buildings.

- As plans for demolition and construction of facilities are developed, the University Design Team could contact SCL and Puget Sound Energy customer services to confirm specific requirements for service.

- Aggressive energy conservation measures could continue to be studied and implemented on campus.

- Required improvements to the electrical power, fossil fuel, and central cooling systems capacity and distribution improvements, as described above, could be implemented as necessary to meet demand.

- Provide early funding could be required to upgrade the emergency power and distribution to ensure that demand is available at the time of building occupancy.

- Adoption of Leadership in Energy and Environmental Design (LEED) standards for all new development to increase building sustainability.

## Unavoidable Adverse Impacts

Development of the proposed 3 million square feet of building area could result in increased consumption of electrical, fossil fuel, and natural gas resources.