10. OPTIONAL ELEMENT: UTILITIES

SUBELEMENT 1: STEAM AND CHILLED WATER SUB-ELEMENT

Information Sources

- Interviews on campus
- USF – Chilled Water/Hot Water Master Utility Plan St. Petersburg Campus, USF, BR-576 Authorization No. 1 – dated May 5, 1994
- Review of construction/as-built drawings
- Walk-through of campus buildings

Purpose

The purpose of this sub-element is to ensure provision of adequate steam (hot water) and chilled water to meet future University needs.

Data Requirements for Steam and Chilled Water

Steam Data (A). Inventory of Existing Hot Water and Chilled Water Distribution Systems

The existing hot water distribution system consists of two constant volume 100 GPM @160' (10 HP) hot water circulating pumps and underground piping serving a portion of the academic buildings through a four pipe system. The main hot water piping is four inches (4") from the central heating plant. The majority of the piping is deteriorating, but is slowly becoming unnecessary with the addition of decentralized boilers. See Figure 10-a for a diagram of the existing site piping.

Plans are currently being developed to eliminate the central hot water system serving all buildings on campus. Individual boilers will be provided at each building to serve that building's heating and potable hot water requirements.

The remaining campus buildings utilize independent hot water systems and electric heat.

The existing chilled water distribution system consists of three variable volume 1325 GPM @ 110' (60 HP) chilled water circulating pumps and underground piping. The main chilled water piping is twelve inches (12") from the central chiller plant. The recently installed underground chilled water piping north

(1994), west (1999) and south (2001) of the CUP is in good condition. The main chilled water line that runs where the new lawn will be installed, will be replaced prior to the implementation of the lawn project. See Figure 10-a for a diagram of existing site piping.

Steam Data (B). Inventory of Existing Hot and Chilled Water Facilities

The available chilled water capacity at the present configuration is 2000 tons with two 1000 ton water cooled chillers installed in 1998. Water is circulated through each chiller by dedicated constant-volume primary chilled water pumps, 2200 gpm at 45 foot of head (40 hp motor) and condenser water pumps, 3000 gpm at 60 foot of head (60 hp motor). Heat rejection is provided by two dedicated 1000 ton cooling towers with 2-speed fans.

The cooling load profile for 1999 based on discussions with the USFSP staff indicated typical peak loads of approximately 800 tons and 1050 tons in 2002. A project completed in 2002 connects the Marine Science Lab (MSL) to the Central Utility Plant (CUP). The air cooled chiller plant in that building is now tied in to the main plant for back up purposes. This plant includes a 209- and 155-ton chiller. With the additional projected chiller plant load, the present capacity is approximately 190% of the peak cooling load and the plant configuration provides 95% firm capacity. There is adequate redundancy in the system for now, however, future loads will exceed the capacity of the present system. See Tables 10-C2 to 10-C5 for a listing of the major cooling equipment.

The available hot water capacity in the present configuration is just over 3350 kBTUH according to the USF staff since the boiler was modified with additional tubes. The estimated peak heating load is approximately 3400 kBTUH, based on square foot load estimates and the plant operator's observations, however, the existing boiler appears to meet the peak heating capacity. It is about 90% loaded on a design day. See Tables 10-H1 and 10-H2 for a listing of the major heating equipment. As stated above there are plans underway to eliminate the central hot water system and replace it with boilers at individual buildings.

Summary of Inventory Findings

- Chilled water is produced at the central utility plant and is distributed via underground piping to each campus building for cooling. Some of the heating is provided by hot water supplied by the central utility plant. The remaining buildings are supplied hot water from independent boilers. The hot water piping south of the CUP is in need of replacement. The chilled water piping in those areas will soon be

replaced. The hot water piping is planned to be phased out with the installation of independent decentralized boilers.

- The chilled water system is currently experiencing low temperature differentials potentially impacting future chiller plant pumping and cooling capacity.

- Since only a partial central energy management system exists, it is impossible to take advantage of energy and operating saving measures.

- The heating system arrangement provides no firm capacity if the one boiler were to fail.

Analysis Requirements for Steam and Chilled Water

Steam Analysis (A). Facility Capacity Analysis.

The available chilled water capacity of 2000 tons at the main plant and the 364 tons at the Marine Science Lab will meet the current and some of the proposed cooling loads with limited firm capacity. The long term cooling load will exceed the capacity of the chiller plant and the CUP cannot be easily expanded in its current location. Long term, the CUP will need to be relocated and additional cooling capacity will need to be added. The underground piping structure to the south portion of the campus has been modified to accommodate the campus growth. Most of the equipment in the existing CUP will be relocated. See Table 10-C1 for a summary of the cooling load by district.

The hot water system is almost fully loaded and has no additional capacity for future modifications. Additionally, the underground piping is in need of replacement; plans to decentralize heating would eliminate the need to replace the piping. While it may be economical in the short term to keep some of the existing buildings on the central hot water system, future buildings should be provided with local hot water boilers or electric heat. Electric heat provides the lowest first cost, while the local boiler configuration provides the lowest life cycle cost.

Steam Analysis (B). General Performance of Existing Hot and Chilled Water Facilities.

The existing chiller arrangement with secondary pumping configuration allows for opportunities for energy conservation especially as the remaining campus buildings are connected to the central energy management system and as

building HVAC systems are renovated and connected to the central chilled water system.

The existing chilled water facilities are operating near their optimum performance but improvements to increase the system chilled water temperature differential from 8-10 degrees (current) to 15 degrees (design standard) should be considered.

The heating system appears to be operating near optimum condition given the condition of the heating equipment. The existing hot water system capacity meets the existing load but lacks any firm capacity.

Steam Analysis (C). Assessment of Technologies to Reduce University Energy Consumption

The basis of design for the long-range plan includes utilizing the primary/secondary system with variable speed secondary loop pumps to provide part load energy savings coupled with integrated building control strategies. The installation of two-way coil control valves has set the stage for reduced pumping requirements. Future renovations should continue to install 2-way valves and integrated energy management controls. Future equipment shall be selected for a 15 degree water temperature differential.

The underground chilled water piping has been extended and now connects the peninsula facilities to the CUP, which provides substantial energy cost savings.

The central hot water heating plant will be phased out to take advantage of more energy efficient local heating plants and/or electric heat, whichever proves to be most energy efficient based upon a life cycle cost analysis.

The use of variable speed drives for the cooling tower fans should be considered for the CUP. High efficiency motors shall be utilized for the CUP equipment.

The use of airside heat recovery (by enthalpy wheels, etc.) should be considered with future HVAC systems to minimize cooling and heating plant peaks.

SUBELEMENT 2: ELECTRICAL POWER AND OTHER FUELS SUB-ELEMENT

Information Sources

- Utility Information Report provided by USF.
- Interviews on campus.
- Campus utility services maps

Purpose

The purpose of this sub-element is to ensure provision of adequate electrical power and other fuel (natural gas) supplies to meet future needs.

Data Requirements for Electrical Power and Other Fuels

Electrical Data (A). Inventory of Existing Electrical Power Distribution System

Electrical service to USFSP is provided by Florida Power Corporation (FPC). FPC provides power to the campus through two methods: a) direct service to buildings from existing distribution and b) through a primary loop system. In the loop portion of the campus, FPC owns and maintains the primary distribution system cables and transformers that serve the various buildings and the conduit and manhole are installed, owned and maintained by USFSP. Other buildings on the campus are served directly from FPC facilities from the public thoroughfares. Refer to Figure 10-b to see the extent of the primary loop system on the campus and extent the FPC distribution within the campus boundaries.

The campus is served from FPC at 12.7 kV. Service is from utility substations on Weedon Island and Crystal River. There are presently six transformers on the primary loop that serves various buildings. Transformers range in size from 500 kVA to 1500 kVA. Inventory of other building transformation capacities was not available. Primary service conductors are three number 1/0 aluminum 15 kV cables for the area.

Design is in progress to have the overhead electrical power distribution lines on Second Street between Fifth Avenue and Seventh Avenue relocated underground.

New services have been added from the FPC distribution system to provide electrical power to Pediatric Research Facility, Florida Center for Teachers and Campus Activity Center.

FPC has 4500 kVA capacity at the present time to serve the campus. The maximum demand for the campus is 1400 kW (1995). FPC has no immediate plans to increase the service capacity.

There are five electric service accounts with FPC that have a total of 20 meters. One account is a street lighting and two accounts are residential.

Demand and energy data for previous years are summarized below to indicate utilization and cost factors related to the electrical power distribution system.

Fiscal Year	Demand (kW)	Energy Usage (kWH)	Cost ($)	KWH Per Square Foot	Cost per Square Foot	Changes in Energy Usage (kWh)	Change in Electric Costs ($)	Area Served (Sq. Ft.)	Change in Area (Sq. Ft.)
1994-1995		8,295,431	$423,528	18.2	$0.93	0	0	456,817	0
1995-1996		8,517,278	$461,116	17.7	$0.96	221,847	37,588	482,365	22,500
1996-1997		9,806,114	$554,368	17.4	$0.98	1,288,836	93,252	563,365	81,000
1997-1998		9,266,056	$520,481	16.4	$0.92	-540,058	-33,887	563,365	0
1998-1999		8,464,508	$512,391	15.0	$0.91	-801,548	-8,090	563,365	0
1999-2000		10,549,885	$550,115	16.7	$0.87	2,085,377	37,724	632,186	68,821
2000-2001		12,045,481	$699,033	18.5	$1.07	1,495,596	148,918	652,186	20,000

Electrical Data (B) Inventory of Existing Natural Gas Distribution System

Natural gas lines are located underground and vary in size from 1½ inch to 6 inch in the vicinity of the campus. The number of accounts and number of meters was not available at the time the campus interviews. Natural gas is supplied to USFSP by TECO People's Gas.

Natural gas is used for service water heating, space heating, reheat, laboratory activities and cooking. Substantial users are the Children's Research Institute, the Bayboro Hall and Central Utility Plant.

Energy data for previous years are summarized below to indicate utilization and cost factors related to the natural gas distribution system.

Fiscal Year	Energy Usage (Therms)	Cost ($)	Therms Per Square Foot	Cost per Square Foot	Changes in Energy Usage (Therms)	Change in Costs ($)	Area Served (Sq. Ft.)	Change in Area (Sq. Ft.)
1994-1995	9,069	$5,726	0.02	$0.01	0	$0	456,817	0
1995-1996	33,585	$20,078	0.07	$0.04	24,516	$14,351	482,365	22,500
1996-1997	27,200	$17,811	0.05	$0.03	-6,386	($2,267)	563,365	81,000
1997-1998	37,193	$21,398	0.07	$0.04	9,993	$3,587	563,365	0
1998-1999	30,991	$18,834	0.06	$0.03	-6,203	($2,564)	563,365	0
1999-2000	57,865	$34,239	0.09	$0.05	26,875	$15,405	632,186	68,821
2000-2001	160,490	$155,911	0.25	$0.24	102,625	$121,673	652,186	20,000

Electrical Data (C) Inventory of Other Fuel Storage or Distribution Facilities on Campus

There are four emergency generators located on the campus and listed below:

- Knight Research Center- 600kW
- Davis Hall, Bayboro Hall, Coquina Hall, Central Utility Plant- 350 kW (located at CUP)
- Florida Teachers Center- 200 kW
- Children's Research Center- 500 kW

At each generator location there is an double wall aboveground diesel fuel storage tank of varying capacities. No other fuel storage distribution facilities were identified on campus.

Analysis Requirements for Electrical Power and Other Fuels

Electrical Analysis (A) Performance of Existing Electrical Power and Other Fuel Facilities

Existing electrical distribution system for the campus is a combination of a loop system and direct service connection to the utility system. The electrical distribution system is performing well and no significant problems were reported regarding FPC reliability or quality.

Power quality is being addressed by the installation of transient voltage surge suppression equipment at all main services of each building throughout the campus.

Site lighting is leased from FPC. This is a very cost effective method for the this type of system. Maintenance is provided by FPC.

The existing natural gas distribution system is performing well and no problems were reported.

Future construction plans as indicated on Figures 10-b and 10-d show that there are several portions of the campus that will require that Facilities Planning and Construction department conduct extensive coordination and negotiations with the serving utilities regarding relocation or vacation of existing overhead and underground utilities. The associated facilities charges for these activities can be very high.

There is little or no documentation on the extent capabilities of the emergency power supplies on the campus.

There is little or no documentation on the electrical demand at each building within the campus.

Further effort should be placed on the development of basic inventory of electrical and natural gas capacity requirements for each building on the campus.

Electrical Analysis (B) Facility Capacity Analysis

Electrical facility analysis is based on the following growth factors:

- Capacity requirements are 5 watts per square foot of gross building area.
- Energy requirements are 18 kWH per square foot of gross building area.
- Operating cost increases are $1.00 per square foot of gross building area.

The electrical power system current level of capacity is estimated at 2,300 kW, energy use is at 12,000,000 kWH and operating costs are at $700,000. Increases due to proposed additions of 611, 500 square feet will yield a capacity estimate of 5,300 kW, an energy consumption of 23,000,000 kWH and an operating cost of $1,312,000.

Natural gas facility analysis is based on the following growth factors:

- Capacity requirements are N/A therms per square foot of gross building area.
- Energy requirements are 0.25 therms per square foot of gross building area.
- Operating cost increases are $0.25 per square foot of gross building area.

The natural gas system current level of energy use is at 170,000 therms and operating costs are at $160,000. Increases due to proposed additions of 611, 500 square feet will yield an energy consumption of 323,000 therms and an operating cost of $313,000.

There is adequate electrical service capacity to the campus to accommodate the 10-year program through the extension of the existing FPC primary distribution system and the use of individual service extension to new buildings.

There is adequate natural gas service capacity to the campus to accommodate the 10 year program by direct service extensions from the existing distribution system.

Electrical Analysis (C). Assessment of Opportunities or Technologies to Reduce University Energy Consumption

The following should be considered for the existing and new building lighting systems:

- Electronic ballasts and T8 lamps for fluorescent fixtures.
- Use of compact fluorescent downlights in lieu of incandescent downlights.
- Use of LED. exit lights.
- Use of infrared and ultrasonic motion sensors for control of interior lighting.
- Use of high pressure sodium lighting for exterior lighting.

The following should be considered for natural gas equipment:

- Purchase energy efficient cooking appliances
- Purchase high efficiency boilers.
- Investigate long term gas purchases with wellhead providers.

SUBELEMENT 3: TELECOMMUNICATIONS SUB-ELEMENT

Information Sources

- Interviews on campus.
- Campus utility maps

Purpose

The purpose of this sub-element is to ensure provision of adequate cable capacities and distribution facilities for telecommunications systems required to meet current and future needs.

Data Requirements for Telecommunications

Telecom Data (A). Inventory of Existing Telecommunications System(s):

Local operating company is Verizon Communications Company. An underground system of conduits, owned and maintained by USF-Tampa, provides distribution of telecommunications cabling to the buildings on this campus. Refer to Figure 10-c for geographic distribution of the existing and proposed telecommunications utility corridors.

Cabling: The University is currently installing single mode fiber optic cable for a high speed data and video services. Horizontal wiring within buildings is being upgraded to Category 5e for higher speed data network applications. New services have been extended from existing infrastructure for the Children's Research Facility, Florida Center for Teachers and Campus Activity Center. Improvements have included a rebuild of the main telephone room in Davis Building. Capacity for additional expansion is limited and future planning should include the provisions for an additional wiring center at another location in proximity with planned growth to minimize extensive infrastructure improvements. An expansion of the infrastructure to serve the Marine Science Building in the peninsula area has been completed. This facility also provides data services for All Children's Hospital. Longer term plans should include the relocation of the main telecommunications room from Davis Hall to the proposed Support Service building.

Telecom Data (B) Inventory of Electromagnetic Fields

Radio: There are radio broadcast systems on campus. These will be updated and others will be added or deleted as required.

Microwave: There are microwave transmission/reception facilities on campus. These will be updated and others will be added or deleted as required. All microwave equipment under the jurisdiction of the Federal Communications Commission is required, upon licensing, to demonstrate that electromagnetic fields radiating from the equipment will not adversely affect the environment.

Satellite Transmission/Reception: There are many satellite transmission/reception facilities on campus that are used by the marine science programs. These will be updated and others will be added or deleted as required.

There are no other inventories or studies of electromagnetic field generators on campus.

Telecom Data (C). Inventory of Electromagnetic Fields (if any) Emanating from any Telecommunications Transmitter that Pose a hazard to Persons or Equipment.

None were identified

Analysis Requirements for Telecommunications

Telecom Analysis (A). General Performance of Existing Telecommunication Systems

Since the 1995 master plan, the University has implemented a campus-wide IP(data network based) telephony system. All telephone systems now operate off the same lines as the computer/digital data networks.

The USF telecommunications department is presently in the process of upgrading the telecommunications distribution system including the installation of fiber optic cabling.

Telecom Analysis (B). Facility Capacity Analysis

Currently the telecommunications system is operating with 1200 ports and there are positions for an additional 432 ports with the installation of port cards in the existing switch.

Additional port requirements for new services are estimated at 0.6 ports per 100 square feet. Using this planning figure, the proposed increase of 611,500 square

feet will require the addition of 3,600 ports. The total capacity of the built out telecommunication system will be approximately 4,800 ports.

The large number of additional ports required will require more cabinet space than is currently available in the Davis Hall telecommunication room and therefore it is recommended that another location for main telecommunications should be planned.

The underground conduit system for telecommunications is not adequate for future growth and will be required to be upgraded by the addition of conduit in existing pathways and expanded geographically to support future growth and expansion. Exact changes can not be projected without additional detailed study of conduit fill and cable types in place in the existing infrastructure. See Figure 10-c for location of existing pathways and proposed extensions.

Telecom Analysis (C) Potential Electromagnetic Hazards and Analysis of Mitigation Measures

Due to the apparent number of electromagnetic field generators on campus, electromagnetic hazards could be an issue; however, no inventories or previous studies were available to validate this possibility. A study should be commissioned to inventory the types and uses of this equipment at USFSP and verify that there are no human hazards that would require mitigation measures.

USF St. Pete **Table 10-C1**

Building	Prefix	#	Cooling Area	Peak Tons	Current Plant	Future Plant
District 1						
Existing						
Marine Science Laboratory	MSL	2047	55,860	150	Marine Science	Main
Marine Science Warehouse	MSW	2107	8,012	10	DX	
Plant Operations/Receiving	POR	2109	6,438	20	DX	
Haney Landing Saiiling Ctr	HNY	2130	1,012	4	DX	
Knight Oceanographic Rsch	KRC	2123	32,862	455	Main	
			104,184	639		
Future						
None	-	-	-	-		
			-	-		
Total			**104,184**	**639**		
District 2						
Existing						
Bayboro Hall	BAY	2004	17,639	71	Main	
Davis Hall	DAV	2005	35,412	142	Main	
Central Utility Plant	CUP	2006	100	0		
Coquina Hall	COQ	2108	18,254	73	Main	
Center For Teaching	FCT	2132	12,959	88	Main	
Campus Activities Center	CAC	2112	22,608	246	Main	
Building N	SPN	2114	4,649	15	DX	
Public Safety Department	PSD	2113	1,431	5	DX	
Building A	SPA	2115	1,522	4	DX	
Snell House	SNL	2125	2,037	8	DX	
One Fiifth Ave South Bldg	ONE	2126	2,336	8	DX	
Special Services Building	SVB	2127	1,882	8	DX	
Williams Historical House	WMS	2128	3,171	8	DX	
Pianoman Building	PNM	2118	3,240	13	DX	
US Geological Survey	USG	2129	16,329	51	DX	Main
Poynter Memorial Library	POY	2124	47,925	127	Main	
			191,494	865		
Future						
Support Services	-	-	34,200	107		Main
Student Center	-	-	90,000	281		Main
Science & Technology Facility	-	-	140,000	700		Main
Garage	-	-	-	-		
Residential	-	-	243,750	580		Main
USGS Expansion	-	-	56,000	175		Main
			563,950	1,843		
Total			**755,444**	**2,709**		
District 3						
Existing						
Children's Research Institute	CRI	2131	27,331	137	Main	
			27,331	137		
Future						
Children's Research Institue Expansion	-	-	56,000	280		Main
			56,000	280		
Total			**83,331**	**417**		
Total Approx. Connected Existing Tons		1,641				

USF St Pete
Chilled Water System Equipment **Table 10-C2**

Chillers						
Main Plant						
Chiller	Type	Refrigerant Type	Rated Tons	GPM	Delta T Deg. F	Age
1	Trane/Centr.	R-123	1,000	2200	11	2
2	Trane/Centr.	R-123	1,000	2200	11	2
future						
Total Actual Capacity			2,000	Tons		

USF St Pete
Chilled Water System Equipment **Table 10-C3**

Chilled Water Pumps							
Main Plant							
Pump No.	Type	GPM	TDH (FT)	HP	Age	MFR	Notes
pchwp-1	Centrifugal	2,200	45	40	2	B&G	Constant speed
pchwp-2	Centrifugal	2,200	45	40	2	B&G	Constant speed
future							
schwp-1	Centrifugal	1,325	110	60	1	B&G	Variable frequency drive
schwp-2	Centrifugal	1,325	110	60	1	B&G	Variable frequency drive
schwp-3	Centrifugal	1,325	110	60	1	B&G	Variable frequency drive
Total Capacity		4,200	GPM				

USF St Pete
Chilled Water System Equipment **Table 10-C4**

Condenser Pumps							
Main Plant							
Pump No.	Type	Pump GPM	Pump TDH (ft)	Pump HP	Age	MFR	Notes
cwp-1	Centrifugal	3,000	60	60	2	B&G	
cwp-2	Centrifugal	3,000	60	60	2	B&G	
future							
Total GPM		6,000					

USF St Pete
Chilled Water System Equipment **Table 10-C5**

Cooling Towers						
Main Plant						
CLG Tower No.	Manu	Fan No.	HP per Fan	CAP Nom. Tons	Age	Notes
CT-1	Marley	1	75	1,000	2	2-speed
CT-2	Marley	1	75	1,000	2	2-speed
future						
Total Capacity				2,000	Nom Tons	

USF St Pete
Heating System Equipment **Table 10-H1**

Boilers		
Main Plant		
Boiler No.	Output	Gas Burner
1	125 HP	4184
Total Capacity 125 HP		

USF St Pete
Heating System Equipment **Table 10-H2**

Pumps				
Main Plant				
Pump No.	Type/Service	GPM	TDH (ft)	Motor HP
hwp-1	Centrifugal / HW	100	160	10
hwp-2	Centrifugal / HW	100	160	10