CapitalBudgetRequest

Construct Central Chiller Plant, Phase II

Overview

Agency	Virginia Polytechnic Institute and State University (208)
Project Code	none
Project Type	New Construction
Biennium	2016-2018
Budget Round	Initial Bill
Request Origin	Previously Submitted
Building Name	
Project Location	Roanoke Area
Facility/Campus	Blacksburg Main Campus
Source of Request	Agency Request
Building Function	Higher Education - Campus Infrastructure
Infrastructure Element	Site Heating/Cooling Distribution
Contains significant technology costs? No	
Contains significant energy costs? No	

Agency Narrative

Agency Description

This project is included as a top priority to continue the strategic infrastructure advancements initiated by the Chiller Plant, Phase I project (Chapter 1/874, project code 208-17657). This Phase II project request includes the upgrade of campus utility systems and addresses four key strategic needs for shifting the campus to lower resource consuming cooling service: (1) replace outdated, inefficient existing non-centralized chilled water capacity on campus; (2) update and add machines and equipment in existing central plant facilities to maximize the existing plant foot print and optimize refrigerant use; (3) install the necessary thermal distribution networks to accommodate campus growth and retirement of the non-centralized facilities throughout the campus to include installation of a 20,000 ton per hour above ground chilled water storage system connected to the district cooling loop; and (4) provide distribution to future development in the Northwest Community district.

The primary scope of this Phase II project includes replacement and upgrade of central plant equipment in the existing campus chiller plants and the expansion of the underground distribution infrastructure to link campus chiller substations and bring existing campus buildings on-line. The envisioned improvements include the replacement of outdated chiller equipment in the North Plant with two new 3000 ton chillers, installation of thermal storage system, and installation of one new 1500 ton chiller in the Southwest Plant. The project also includes replacement and upgrade of ancillary equipment with state-of-the-art, optimally sized pumping and system support equipment and the expansion of the distribution system to connect the two plants. The project accommodates the need to meet LEED refrigerant requirements by replacing outdated, inefficient chiller equipment with equipment using newer refrigerant types. Other benefits include:

(1) Reduced operating/maintenance costs.
(2) Lower installed capacity due to diversity of multiple building loads.
(3) Improved redundancy and reliability.
(4) Lower life cycle costs.
(5) Consolidation of cooling tower noise and water vapor emissions.
(6) Reduced building square footage required by mechanical and electrical equipment.
(7) Allow better management of on-peak electric power demand and associated costs

The savings of a central plant compared to stand-alone chillers are significant. As an illustration, 10 campus buildings using the stand-alone strategy will require two 450-ton chillers each, for a total of 20 chillers and 9,000 tons of operational cooling systems. Chillers operate most efficiently near their peak capacity and stand-alone chillers are generally operating at only about 75 percent of their capacity. Under a central plant strategy, these same 10 buildings would require only 6,750 tons of chilling capacity. To quantify anticipated energy reduction and improved efficiencies, the chillers of the central plant on the northeast side of campus are 94 percent more efficient than the individual building chiller systems on the southeast side of campus.

Justification

Program Description

As the campus moves toward developing the northeast and northwest areas of campus, a centralized chiller program will require fewer resources to operate than a stand-alone chiller program. The benefits of installing centralized regional chiller plants compared to stand-alone chillers include the following: reduced primary pieces of equipment, more efficient machine selection and operating ranges, economies of scale with procurement and construction, reduced mechanical room space per facility, lower building power requirements, and possibly a reduced structural component.

This project is a critical component of a strategy developed by the university and detailed in its Strategic Master Plan to shift toward utility and energy management practices that optimize long-term cost control and resource management. The university benefits from the managed power infrastructure provided though Virginia Tech Electric Service. Under the Chilled Water Master Plan, the university will replace outdated, costly stand-alone equipment with centralized equipment and plant operations.

The timing of this request is important because many of the existing building-specific chillers have reached the end of their useful life and no longer respond to normal maintenance and repairs; thus, if the centralized strategy is not implemented now, the university will need to replace the building-specific chillers in-kind. Additionally, the existing plant has reached its capacity limits and will be unable to supply planned new space coming in future years.

Funding this critical infrastructure project will prevent the replacement in kind of aging 20 year old, high overhead cost, package equipment; thus, the timing of the Chiller Plant project is optimal for the university, the Commonwealth, and the students. The Phase II project will also help end the practice of installing, operating, and maintaining high cost, stand-alone chillers and cooling towers in the scope of new building construction budgets.

The university's strategic plan calls for working toward campus sustainability by developing a campus-wide willingness and commitment to critically evaluate our practices and embrace new technologies and innovative solutions. This commitment must include extensive engagement and collaboration among students, faculty, staff, and administrators. The university has implemented a university developed Climate Action Commitment and Sustainability Plan to ensure ongoing evaluation and critical examination of the university's policies and practices toward ensuring the most effective and sustainable use of our human, fiscal, and environmental resources.

Existing Facilities:
The university has two primary a central chiller plants supplemented by several secondary systems tied into the central infrastructure. The northeast plant has an approximately 8,500 gross square foot facility that produces approximately 6800 tons of cooling capacity with five chillers of various sizes and ages. This central plant serves 22 buildings on the northeast section of campus with about two million gross square feet. The newer southwest plant is approximately 16,300 gross square feet containing 3,000 tons of cooling capacity from two-1500 ton chillers. The existing south plant was designed to accommodate the immediate installation of an additional 1500 ton chiller in the existing footprint and to accommodate an addition that ultimately could support a total of ten 1500 ton chillers based on the sizing of currently available equipment. This project does not include expansion of the south plant footprint.

At present, the university has several buildings using the stand-alone chiller systems which were installed due to capacity and distribution limitations in the central plants at the time of construction. Several of the existing stand-alone chillers are reaching the end of their useful lives and will need to be replaced within the next six years. The proposed project will shift these buildings to a central plant and away from the stand-alone systems. Adding new chiller equipment in the existing plant footprints combined with an expanded distribution system will provide energy efficiencies and reduce operating costs.

Funding Plan:
This project is a central infrastructure improvement; thus, the funding plan calls for general fund support for the E&G buildings and nongeneral fund support for the auxiliary enterprises. The proposed funding split is 88 percent General Fund and 12 percent nongeneral fund based on the overall allocation of space that these facilities would serve.

The costs for this Phase two project are for plant equipment and distribution system. Auxiliary enterprises funded their requirements for plant equipment in the Phase One chiller plant project which is now complete. For Phase Two, the equipment is to support the educational and general projects. Thus, the auxiliary enterprises must fund their fair share of the distribution system. The distribution system is approximately 30 percent of the project costs and the auxiliary system will benefit from approximately 40 percent of the distribution system. Thus, the 12 percent of nongeneral fund in the Phase Two projects reflects the auxiliary enterprise share of the distribution system.

Options Considered:
The options considered include continuing the practice of building specific stand-alone chillers or deferring the project. The practice of stand-alone chillers is not the selected option because it is proving far more costly than a central system strategy, in both short- and the long-term. Deferring the project to a later biennium is not selected because of the significant sunk investment of stand-alone chillers that would be required for upcoming projects until the central plant is established. To get the most benefit from the central plant and to avoid unnecessary costs of stand-alone chillers in new buildings, the central chiller plant needs to be established first.

Alternatives Considered

Costing Methodology

The costs are based on internal estimates developed by university staff based on historical comparables of on-campus work including the recent construction of the Southwest Chiller Plant project. The project is anticipated to have challenging site conditions due to karst topography

and known geotechnical conditions in this region of the Commonwealth. Additional challenges and project complexities are anticipated in connecting to existing distribution lines and a variety of aging equipment. Project costs are estimated to the mid-point of construction using three percent escalation in accordance with the instructions for developing the Six-Year Capital Outlay Plan.

Agency Funding Request

Phase	Year	Fund	Subobject	Requested Amount
Construction	2017	0100 - General Fund	2322 - Construction, Buildings	$35,200,000
Construction	2017	0815 - 9(D) Debt Service - Construction Costs	2322 - Construction, Buildings	$4,800,000
			Total	$40,000,000

Project Costs

Cost Type	Total Project Costs	Requested Funding	DGS Rec
Acquisition Cost	$0	$0	
Building & Built-in Equipment	$29,033,000	$29,033,000	
Sitework & Utility Construction	$2,902,000	$2,902,000	
Construction Cost Total	**$31,935,000**	**$31,935,000**	
DESIGN & RELATED SERVICE ITEMS			
A/E Basic Services	$3,765,000	$3,765,000	
A/E Reimbursables	$0	$0	
Specialty Consultants (Food Service, Acoustics, etc.)	$0	$0	
CM Design Phase Services	$399,000	$399,000	
Subsurface Investigations (Geotech, Soil Borings)	$7,000	$7,000	
Land Survey	$0	$0	
Archeological Survey	$0	$0	
Hazmat Survey & Design	$0	$0	
Value Engineering Services	$0	$0	
Cost Estimating Services	$25,000	$25,000	
Other Design & Related Services	$221,000	$221,000	
Design & Related Services Total	**$4,417,000**	**$4,417,000**	
INSPECTION & TESTING SERVICE ITEMS			
Project Inspection Services (inhouse or consultant)	$715,000	$715,000	
Project Testing Services (conc., steel, roofing, etc.)	$14,000	$14,000	
Inspection & Testing Services Total	**$729,000**	**$729,000**	
PROJECT MANAGEMENT & OTHER COST ITEMS			
Project Management (inhouse or consultant)	$533,000	$533,000	
Work By Owner	$48,000	$48,000	
BCOM Services	$0	$0	
Advertisements	$0	$0	
Printing & Reproduction	$0	$0	
Moving & Relocation Expenses	$11,000	$11,000	
Non Built-In Data and Voice Communications	$96,000	$96,000	
Signage	$5,000	$5,000	
Demolition	$0	$0	
Hazardous Material Abatement	$0	$0	
Utility Connection Fees	$290,000	$290,000	
Utility Relocations	$90,000	$90,000	
Commissioning	$291,000	$291,000	
Miscellaneous Other Costs	$355,000	$355,000	
Project Management & Other Costs Total	**$1,719,000**	**$1,719,000**	

Furnishings & Movable Equipment	$0	$0	
Construction Contingency	$1,200,000	$1,200,000	
TOTAL PROJECT COST	**$40,000,000**	**$40,000,000**	

Capacity

Cost Type	Unit of Measure	Units	Cost Per Unit
Acquisition Cost		0	$0
Construction Cost	square feet	14,000	$2,281
Total Project Cost	square feet	14,000	$2,857

Operating and Maintenance Costs (Agency)

Cost Type	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
GF Dollars	$0	$0	$179,127	$184,501	$190,036	$195,737
NGF Dollars	$0	$0	$24,426	$25,159	$25,914	$26,691
GF Positions	0.00	0.00	1.72	1.72	1.72	1.72
NGF Positions	0.00	0.00	0.24	0.24	0.24	0.24
GF Transfer	$0	$0	$0	$0	$0	$0
GF Revenue	$0	$0	$0	$0	$0	$0
Layoffs	0	0	0	0	0	0

Planned start date of new O&M costs (if different than the beginning of the fiscal year):---

Supporting Documents

File Name	File Size	Uploaded By	Upload Date	Comment
03-CR-3 Chiller Plant Phase II.xls	625,664	Rob Mann	6/13/2015	CR-3_Central Chiller Plant, Phase II

Workflow History

User Name	Claimed	Submitted	Step Name
Rob Mann	05/18/2015 05:08 PM	05/18/2015 05:08 PM	Enter Capital Budget Request
Rob Mann	05/18/2015 05:08 PM	05/18/2015 05:09 PM	Continue Drafting
Rob Mann	05/18/2015 10:58 PM	05/18/2015 10:59 PM	Continue Drafting
Jennifer Hundley	06/12/2015 04:14 PM	06/12/2015 05:41 PM	Continue Drafting
Rob Mann	06/12/2015 08:10 PM	06/12/2015 08:11 PM	Continue Drafting
Rob Mann	06/13/2015 09:01 AM	06/13/2015 09:01 AM	Continue Drafting
Rob Mann	06/13/2015 10:52 AM	06/13/2015 10:52 AM	Continue Drafting
Rob Mann	06/13/2015 12:35 PM	06/13/2015 12:38 PM	Agency Review Step 1
Rob Mann	06/13/2015 12:42 PM	06/13/2015 12:42 PM	Agency Review Step 1
Rob Mann	06/13/2015 07:02 PM	06/13/2015 07:05 PM	Agency Review Step 1
Bob Broyden	06/14/2015 02:18 PM	06/14/2015 02:18 PM	Ready for DPB Submission
			DPB Review