WEST VIRGINIA STATE UNIVERSITY

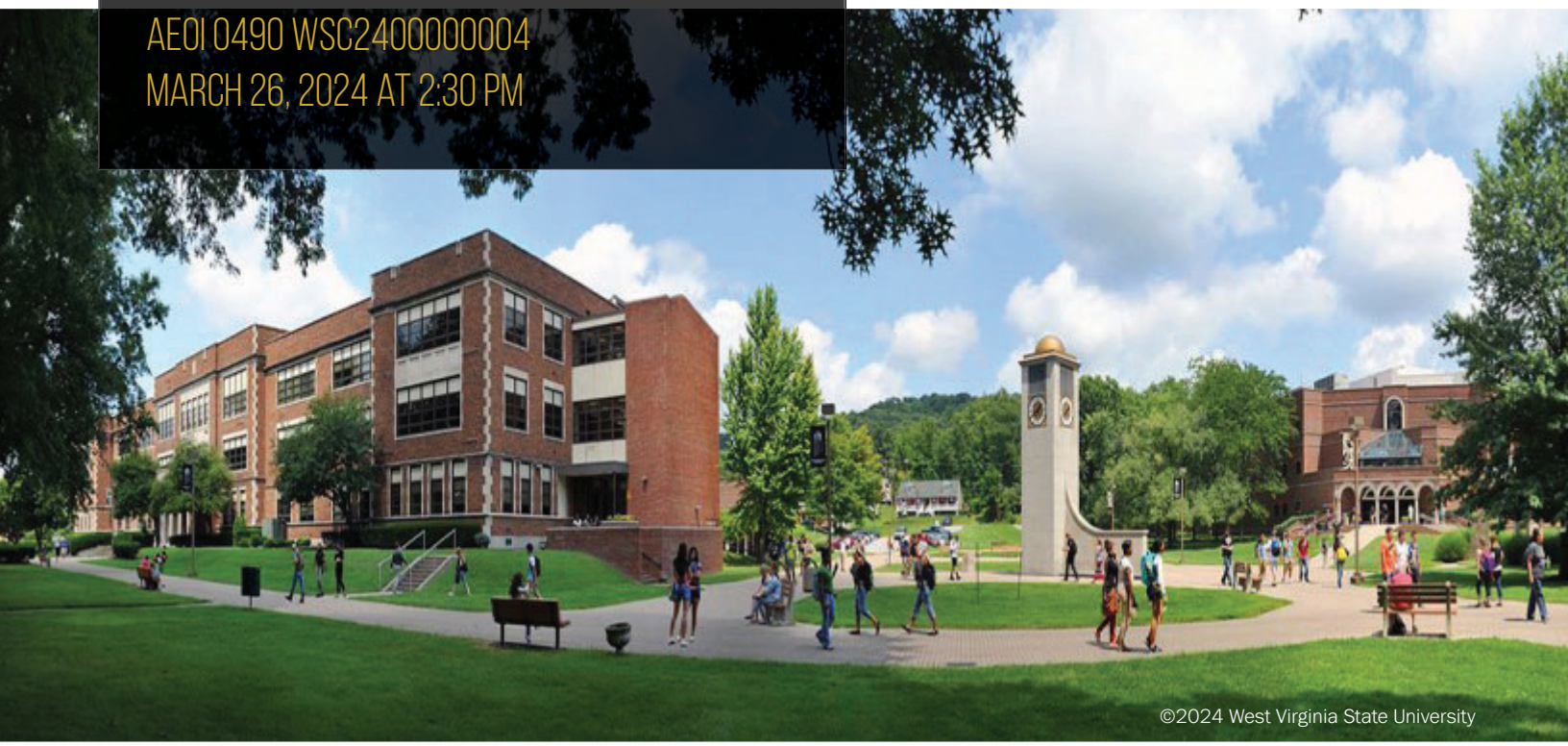
1891

PROPOSAL FOR

A&E SERVICES - WVSU HVAC RENOVATION PROJECTS

AEOI 0490 WSC2400000004

MARCH 26, 2024 AT 2:30 PM



Submitted to:

WEST VIRGINIA STATE UNIVERSITY
5000 Fairlawn Avenue
Ferrell Hall Room 301
Institute, WV 25112
Jerry D. Rush

Submitted by:

AFFILIATED ENGINEERS METRO DC, INC.
12300 Twinbrook Parkway, Suite 600
Rockville, MD 20852
Scott Spangenberg, PE, LEED AP®, Principal

Affiliated Engineers®

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Affiliated Engineers Metro DC, Inc.
12300 Twinbrook Parkway, Suite 600
Rockville, MD 20852
Tel 301.468.7766 | www.aeieng.com

March 26, 2024

Jerry D. Rush
West Virginia State University
5000 Fairlawn Avenue
Ferrell Hall Room 301
Institute, WV 25112

RE: Proposal for A&E Services - WVSU HVAC Renovation Projects
Solicitation No.: AEOI 0490 WSC2400000004

Dear Jerry,

Affiliated Engineers, Inc. (AEI) is pleased to submit our proposal to provide engineering design services for the A&E Services - West Virginia State University (WVSU) HVAC Renovation Project. Enclosed, is our proposal which is based on the RFP issued on February 29, 2024. We believe the AEI Team is uniquely qualified for this project for the following reasons:

Responsible innovation, proven reliability, flexibility, and partnership. That is what you need from your engineering partner who will provide the necessary design effort to develop design documents, specifications, and replace these systems in accordance with WVSU needs, objectives, current law, and current code. The AEI Team will partner with WVSU to meet the goals and objectives for the HVAC Renovation Projects from necessary engineering and other related professional services, to design and provide construction contract administration services for HVAC renovations to be completed for Fleming Hall, Ferrell Hall, Wallace Hall, Drain-Jordan Library, and Cole Complex; all to meet future needs for each featured building a part of the project scope.

The most experienced. Throughout the last 10 years, AEI has performed dozens of system design and replacement projects similar in scope and complexity to the A&E Services - WVSU HVAC Renovation Projects. Furthermore, AEI has provided engineering consulting and design services for more than 226 higher education clients throughout the U.S. – and beyond. In our response, we have denoted the relevant experience and expertise of our firm and proposed personnel. Our project leadership has the experience necessary to facilitate conversations with stakeholders to develop options and solutions that meet the University's needs through our unique approach to analysis and proactive, efficient communication. The AEI Team will make WVSU an informed decision-maker, support those decisions, execute the work, and assist to convey the direction and messaging to the campus community.

Best in Class Execution. AEI assesses, defines, plans, designs, and delivers high-performance engineered systems. Organized for collaborative achievement, we integrate the work of more than 850 professionals across 20 offices in the United States into a single technical knowledge community and culture of high intellectual standards. AEI emphasizes sustainability and environmental stewardship in our work as implicit priorities of high-performance design for reducing the risk of MEP system failure in the event of a disaster scale event. We pride ourselves on MEP system engineering designs that get implemented with success. We have turnkey planning, design, construction, and commissioning leadership for the balanced perspective of what is required to turn a vision into a reality.

The right team. The AEI Team brings national perspective and proven execution, blended with local client service, and confident cost modeling and construction management for the most comprehensive team to execute this project. We will be versatile, thorough, innovative, and engaged for the long-term execution of this project. Our proposed team members for this project include: Principal-in-Charge, Scott Spangenberg, PE; Project Manager/Lead Mechanical Engineer, Bill Haloftis, PE; Lead Electrical Engineer, Chad Dunbar, PE.

The AEI Team is committed to recognizing the significant impact of our work on WVSU's campus and ensuring that we reflect the highest standards in sustainable design practices. AEI's team is fully capable to manage a project of this size and scope within the identified time frame, relative to other workload. We are excited about the possibility of partnering with WVSU on this project and we look forward to hearing from you soon. Please do not hesitate to contact me.

Sincerely,

AFFILIATED ENGINEERS METRO DC, INC.

Scott Spangenberg, PE, Principal
(d) 301.816.1947 / (m) 240.483.2333 | sspangenberg@aeieng.com

1. FIRM PROFILE

//1. FIRM PROFILE

ABOUT AFFILIATED ENGINEERS, INC.

Engineering leadership and innovative solutions for complex projects, working with clients and colleagues to improve the world.

Affiliated Engineers, Inc. (AEI) provides engineering leadership for complex projects supporting clients who do great things to improve lives and protect the future. From better medicines, climate-sensitive energy supply, and sustainable utilization, to cutting-edge healthcare, new paradigm technologies, and education at the highest level, our mission drives us to find unique solutions to solve our clients' challenges. In so doing, we are an integral element of innovation, positively impacting society.

AEI plans, designs, and delivers high performance engineered systems. Organized for collaborative achievement, we integrate the work of over 850 professionals across 20 offices in the U.S. into a single technical knowledge community and culture of high intellectual standards. The firm emphasizes sustainability and environmental stewardship in our work as implicit priorities of high performance design for reducing risk of MEP system failure in the event of a disaster scale event.

Industry-leading expertise and achievement in engineered systems for complex building, energy, and utility projects. Aligned with our clients' missions and goals, we initiate and maintain ongoing communication to fully understand distinct needs and apply strategies and technologies ahead of the curve. Providing feedback and offering alternatives, we implement client decisions with insightful design that responds to immediate challenges and supports our clients' long-term operations.

Established in 1978, AEI is owned by 55 principals who develop and maintain client relationships and provide project leadership.

Why AEI is the right fit for this project:

As a firm -

- AEI is a national leader for the engineering design of MEP systems that service flexible, state-of-the-art, office, conference/meeting, classroom, data center, dining, student center, and auditorium.
- AEI has designed more than 120 million SF of space for higher education clients nationwide.
- Fully integrated design/renovation capabilities for a truly modern and energy-efficient buildings.
- Expertise in BIM technologies and design.
- Provided engineering design services for more than 226 higher education clients nationwide including master planning, feasibility studies, renovation, science and technology buildings, utility infrastructure and a variety of complex renovation projects.
- Provided engineering design services on more than 2,192 higher education projects totaling approximately $6 billion throughout the U.S.
- Full-time construction administration engineers from project inception through completion.

Qualified proposed team -

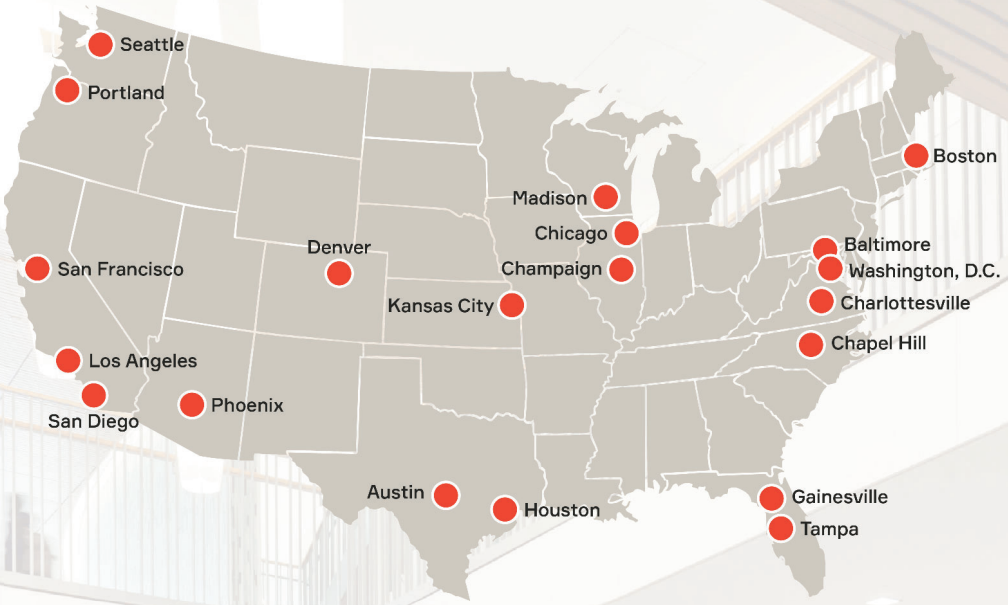
- Our Principal-in-Charge, Scott Spangenberg, has 37 years of experience and has served on more than 180 higher education projects.
- Our Project Manager/Mechanical Engineer, Bill Haloftis, has 27 years of experience and has served on more than 45 higher education projects.
- Our Lead Electrical Engineer, Chad Dunbar, has more than 20 years of experience and has served on 15 higher education projects.

Relevant project experience -

- Of our most relevant projects, the George Washington University School of Medicine Ross Hall HVAC Assessment and AHU Replacements, is most similar to the West Virginia State University A&E Services HVAC Renovations Project scope requirements.

QUICK FACTS

OFFICE LOCATIONS



1. Austin, TX
2. Baltimore, MD
3. Boston, MA
4. Champaign, IL
5. Chapel Hill, NC
6. Charlottesville, VA
7. Chicago, IL
8. Denver, CO
9. Gainesville, FL
10. Houston, TX
11. Kansas City, KS
12. Madison, WI
13. Los Angeles, CA
14. Phoenix, AZ
15. Portland, OR
16. San Diego, CA
17. San Francisco, CA
18. Seattle, WA
19. Tampa, FL
20. Washington, DC

STATS

45+
YEARS OF EXPERIENCE

850+
AEI EMPLOYEES

20
OFFICES

TOP 15
ENGINEERING FIRM
Building Design + Construction, 2023

TOP 15
MEP GIANTS
Consulting-Specifying Engineer, 2023

TOP 10
UNIVERSITY ENGINEERING FIRM
Building Design + Construction, 2023

SERVICES

- Building Performance Practice
- Consulting & Leadership
- Commissioning
- Cost Estimating
- Electrical
- Fire Protection
- Geothermal Heating & Cooling
- Instrumentation & Controls
- Intelligent Buildings
- Mechanical
- Piping/Plumbing
- Pivotal Lighting Design
- Planning
- Process Engineering
- Security Consulting & Design
- Technology Consulting & Design

MARKETS

- Aerospace
- Aviation
- Commercial/Office
- Commissioning
- Cultural & Public
- Energy & Utilities
- Federal Government
- Healthcare
- Higher Education
- Industrial Test
- Mission Critical
- Process Industries
- Science & Technology
- Sports & Athletic Centers

OUR MEP AND FIRE PROTECTION CAPABILITIES

MECHANICAL

AEI designs high-performance HVAC systems for large-scale and technically demanding facilities, meeting our clients unique requirements with solutions that combine innovative strategies and technologies. We specialize in higher education, hospitals, laboratories, pharmaceutical production, data centers, airports, museums, and performing art centers facilities. Beyond HVAC applications, we design central utility plants and serve many clients involved in engine development.

ELECTRICAL

AEI designs electrical systems for critical facilities that provide efficient, reliable, closely coordinated, high-quality power distribution while often incorporating renewable and distributed energy sources or microgrids. With a focus on supporting facility maintenance and operations, our resilient design strategies sustain critical functions during utility outages, optimize alternate power capacity, and manage system loads — ensuring life safety functionality and property protection. Fault current, arc flash, and selective coordination studies guide the development of distribution network arrangements to deliver consistent power for vital systems and equipment. Our electrical system designs include normal and backup power distribution, protective relaying, distributed metering, lighting controls, high-efficiency illumination, and networked fire alarm systems.

PIPING/PLUMBING

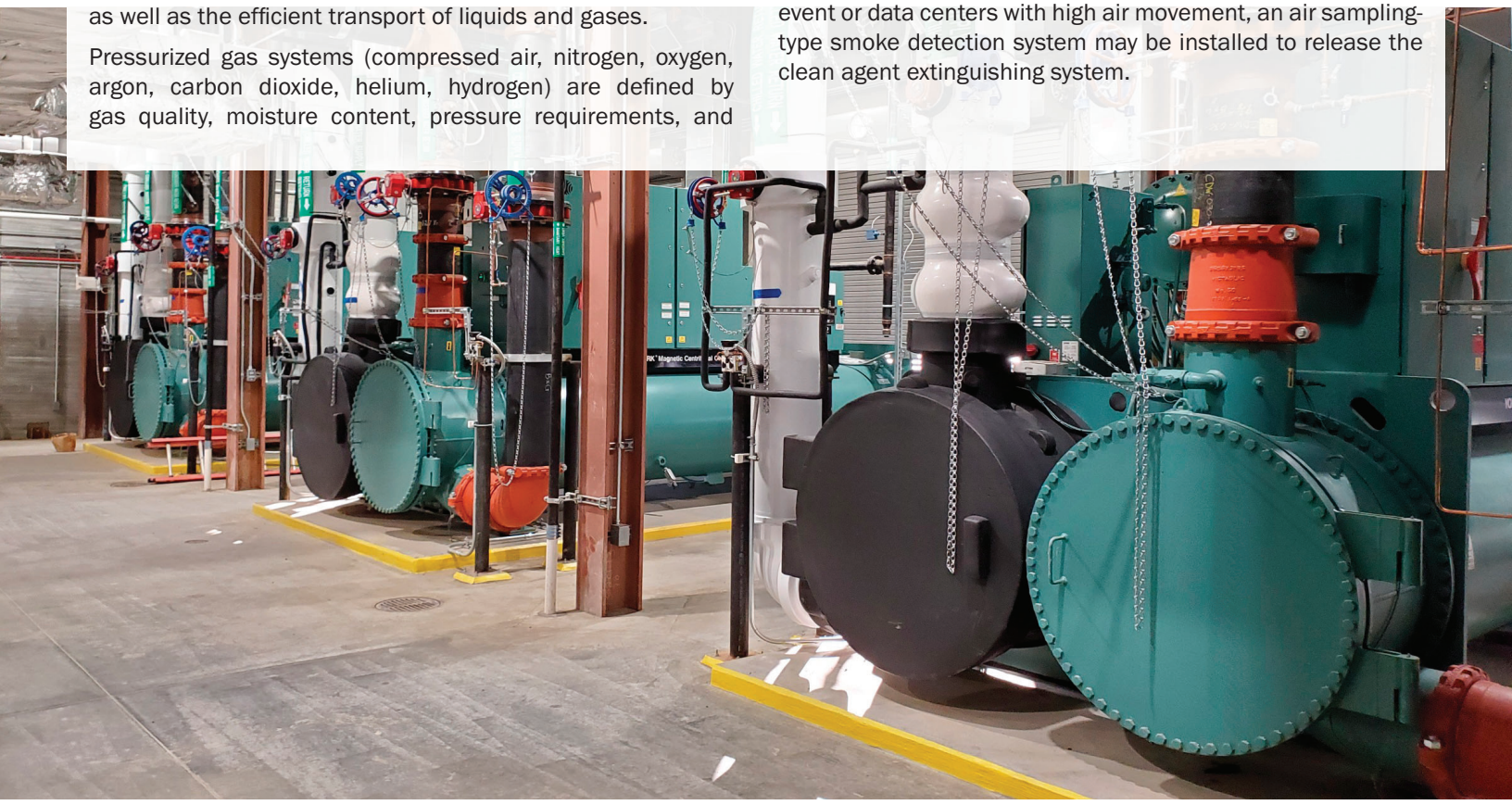
Our specialized expertise in piping/plumbing planning and design ensures effective water supply and drainage systems, as well as the efficient transport of liquids and gases.

Pressurized gas systems (compressed air, nitrogen, oxygen, argon, carbon dioxide, helium, hydrogen) are defined by gas quality, moisture content, pressure requirements, and equipment flow rates. Vacuum systems are designed to the standard barometric pressure of the pump location and to the required depth of vacuum, whether healthcare or chemistry research systems. Fuel gases (natural gas and methane) accommodate pressure and flow rates to support the combustion at individual equipment, accounting for safety concerns such as pressure relief locations and sizes. High-purity water systems meet requirements for resistivity, bacterial counts, and other parameters defined by prominent industry standards organizations.

FIRE PROTECTION

AEI offers comprehensive fire protection engineering services, designing these systems in direct relation to occupancy and building type, defining the hazard classification, and determining system design criteria from NFPA standards and insurance carrier recommendations. Our engineers work diligently to provide cost-effective designs, accounting for both the initial installation as well as planning for ongoing inspection, testing, and maintenance activities to improve the overall client experience. Designs address freeze protection through the use of dry pipe systems and for water-sensitive areas with pre-action and clean agent extinguishing systems. Hazardous material storage is thoroughly analyzed to determine if there is a need for special protection, such as a foam or water mist system.

Facilities with high sensitivity to water and heat may require installation of a clean agent extinguishing system using either a halocarbon or inert gas agent to protect the space. In areas requiring the earliest possible notification of an impending event or data centers with high air movement, an air sampling-type smoke detection system may be installed to release the clean agent extinguishing system.



SUSTAINABILITY PRACTICES

At the start of the design process, AEI critically assesses climate to articulate the interplay of massing, orientation, building skin, MEP systems and infrastructure. As the project progresses, early (program area based) building performance modeling is evolved, enabling nimble and confident design development. Cost estimating, benchmarking, and robust constructability, cost-benefit, life cycle, and risk analysis support effective decision-making and establish metrics to gauge absolute and relative success.

AEI uses its mix of proprietary and industry standard energy modeling tools to envision the interaction of building systems, exterior climate, and occupant actions. Focusing exploration at each stage of the design process, these tools provide ever-greater accuracy illustrating how design characteristics and design alternatives will affect energy use, carbon generation, and cost.

Our willingness to take steps that most will not rests with our technical analysis and design abilities. For example, we pioneered the use of active chilled beams in the U.S. and have repeated this successfully in more than three million square feet of buildings. Evolution of chilled beam and radiant cooling designs in addition to innovative airside and energy recovery concepts (e.g. heat recovery chillers integrated into run around energy recovery loop) enables us to deliver better, more cost-effective designs. Our experience with specialized systems will help inform the design-build team throughout the project and help avoid common pitfalls.

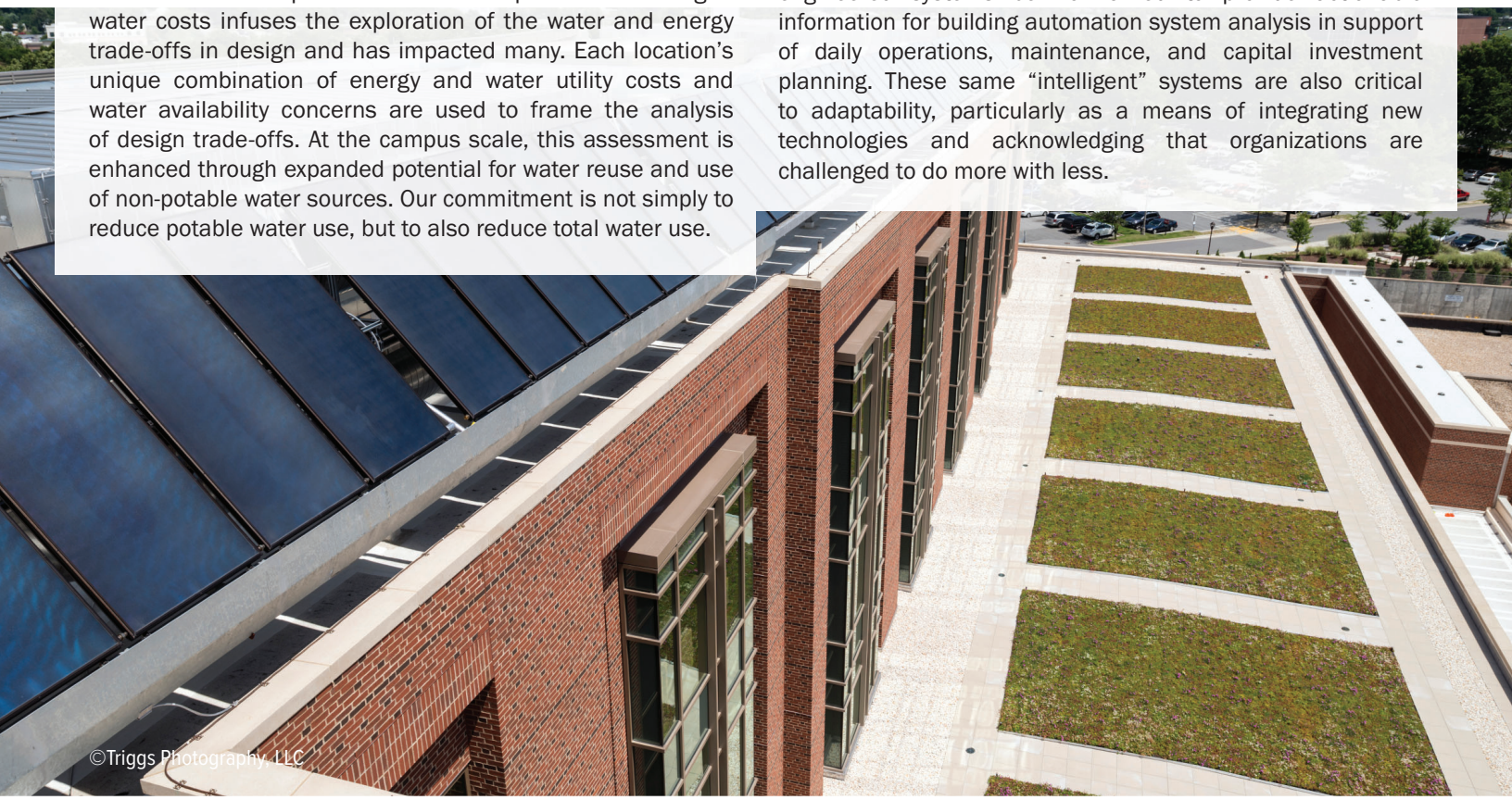
We focus equally on water and energy. Thus, its modeling and life-cycle cost assessment tools document the conserving and use relationship of the two. Our unique understanding of water costs infuses the exploration of the water and energy trade-offs in design and has impacted many. Each location's unique combination of energy and water utility costs and water availability concerns are used to frame the analysis of design trade-offs. At the campus scale, this assessment is enhanced through expanded potential for water reuse and use of non-potable water sources. Our commitment is not simply to reduce potable water use, but to also reduce total water use.

Recognizing that occupant experience is paramount for building performance success, we focus on thermal comfort, way-finding, user engagement and other factors. As a member of UC Berkeley's Center for the Built Environment, a host of resources are available to develop metrics and offer insights, as well as to provide metrics and comparables for assessment and goal setting. We further use modeling to evaluate combinations of fenestration and room configurations throughout a building and in special spaces, and test combinations of passive and active systems to confirm they achieve targeted performance. These design tools are used to establish optimal parameters for occupant comfort and control and for building performance.

Whether as lead on a project or as an engaged team member, we regularly partner with allied disciplines of architecture, landscape architecture, ecology, energy market analysis, transportation planning, civil engineering, and academic program/space planning. Thus, the recommendations on capital investments, policies and practices are broadly conceived and well-integrated.

Today's climate differs from yesterdays and from that which the next generation of building occupants will experience. So, why mitigate climate change through campus and building design, but not also adapt? Resilience planning that also includes consideration of projected climate data provides a basis for forward-looking planning and design. The MEP engineering team can play a key role in offering each design the data and prescriptions needed to adapt to a campus or building's projected climate circumstance fifty years in the future.

It is essential that the high volumes of data from today's engineered systems be normalized to provide actionable information for building automation system analysis in support of daily operations, maintenance, and capital investment planning. These same "intelligent" systems are also critical to adaptability, particularly as a means of integrating new technologies and acknowledging that organizations are challenged to do more with less.



HIGH PERFORMANCE DESIGN

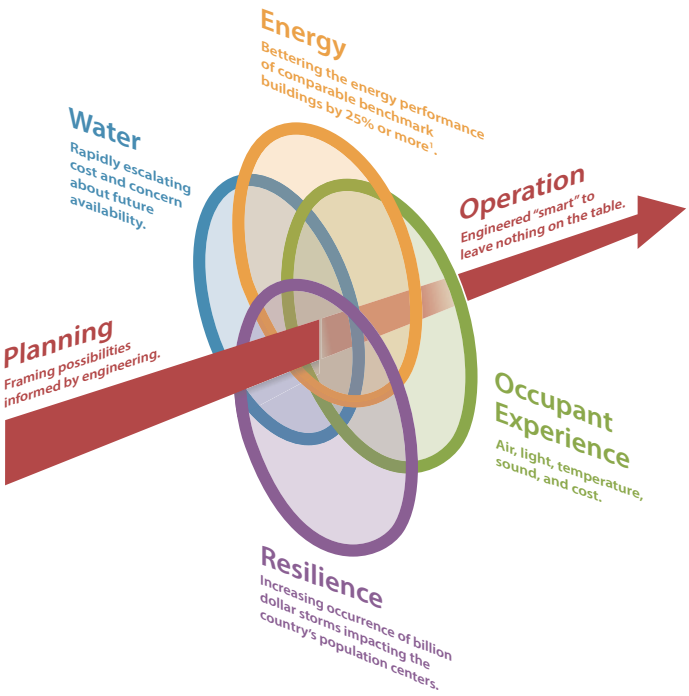
Total Optimization for the life of the Facility

At AEI, we believe that a high performance design addresses each stage of a building's life cycle through an approach that integrates planning and design. It establishes a suite of performance goals – looking to optimize use of energy and water, achieve excellence in occupant experience, mitigate climate impacts while adapting to climate change, provide for durability and flexibility, and be cost-effective. These goals are tested through dialogue and exploration and by using the metrics provided through our tools, such as building energy and water modeling, life cycle cost analysis, and risk analysis.

AEI's largest markets – science + technology, healthcare, and energy and utilities – are those that demand the greatest rigor in the pursuit of high performance design. The goals are the same as they ever were, but the technology is better, the process is stronger, and the standards are much higher.

High-performance design integrates the fundamental sustainable attributes of building design and applies their consideration across the life of the building, with energy use reduction as the key driver. AEI brings to this creative process its expertise in energy, water, occupant comfort, and resilience.

Our methods and techniques integrate energy and water efficiency, resilience, and user experience into high performing buildings, and optimize their ongoing operations. Building-scaled or campus-size, every plan and project is an opportunity for bold invention. With a basis in advanced engineering, energy technology insights, breakthrough research, and the perspectives of equally committed building owners worldwide, AEI pushes the market standards for high performance design and operation, advancing expectations for the efficiency, productivity, and sustainability of long-term capital investments.



PLANNING

Framing possibilities informed by engineering.

Assessing massing, form, orientation, fenestration, and envelope, AEI conceives project engineering that is responsive to climate, sustainability, adaptation, and efficiency goals. As the project progresses, nimble modeling expands, details, and evolves, enabling the design's quick development. Cost estimating, benchmarking, and robust constructibility, cost-benefit, life cycle, and risk analysis support effective decision-making and establish metrics to gauge absolute and relative success.

WATER

Rapidly escalating cost and concern about future availability.

Highest and best use assessments, profiling water quality and quantity needs over time, appropriately develop a design in collaboration with the architect, landscape architect, and civil engineer. Our experience supports potable water use of a high performance building being less than half that of benchmark buildings.

ENERGY

Bettering the energy performance of comparable benchmark buildings by 25% or more[1].

AEI relies on its own suite of energy modeling tools to more quickly and reliably envision the interaction of building systems, exterior climate, and occupant actions. Focusing exploration at each stage of the design process, these tools provide the owner and the design team with ever-greater accuracy illustrating how design characteristics and design alternatives will affect energy use and cost.

OCCUPANT EXPERIENCE

Air, light, temperature, sound, and cost.

Design, comfort, and sustainability meet at a building façade, while comfort, sustainability, and performance meet in the engineered systems. AEI modeling tools test combinations of fenestration and room configurations throughout a building and in special spaces, and test combinations of passive and active systems, optimizing parameters for occupant comfort and control, as well as for building performance.

RESILIENCE

The increasing occurrence of billion dollar storms impacting the country's population centers.

Owners want buildings that can respond to major weather events. Others use historic data; AEI projects climate conditions in modeling hour-by-hour building operation responses. Through resourceful planning, strategies and technologies for improving resilience can present opportunities to improve energy efficiency and flexibility as well, helping owners thrive as well as survive in periodically jeopardized settings.

OPERATION

Engineered "smart" to leave nothing on the table.

Adaptability is implicit in high performance operation, including broad utility delivery range and reconfigurability. Less obvious is the integration of the known and evolving technologies. High volumes of data from today's engineered systems need to be normalized to provide actionable information for BAS analysis supporting daily operations, maintenance, and capital investment planning. The enterprise building management systems and services that do this ("intelligent buildings") will be even more essential as buildings increasingly generation their own energy, requiring coordination management of energy flow to and from the grid.

[1] US Department of Energy and National Institute of Standards and Technology definition of high performance buildings.

COMMISSIONING PRACTICE

AEI builds its national commissioning services on the primary disciplines of mechanical, controls, and industrial engineering. With a reputation for excellence in leadership, collaboration, and project coordination, our skilled and talented group of field engineers provides comprehensive support to achieve client goals.

For over 40 years, AEI's Commissioning practice has been supporting clients with comprehensive facility and building system assessments, from design to construction and post-occupancy monitoring. Consistently ranked as a top commissioning firm by Consulting-Specifying Engineer, our proven reputation for excellence and passion brings complex facilities to life.

Comprising experts in engineering, controls, testing and balance, energy services, facility operations, and project management — our project work includes technically complex facilities and building systems of varying size and scale.

We act as objective verifiers and critical advocates throughout design, construction, and turnover, reducing requests for information, change orders, and warranty callbacks. Our team-focused approach includes building operators early in the process, invites facility managers to functional testing, and enhances training for facility staff through user-friendly documentation.

40+

years providing commissioning services

55+

commissioning professionals

1,700+

commissioning projects

COMMISSIONING SERVICES

Whole Building Commissioning
Existing Building Commissioning
Building Envelope Commissioning
Building Energy Analysis
Building Data Analytics
Monitoring Based Commissioning
Energy Performance Contract Overview
Integrated Project Start-up
Ongoing Commissioning

POWER BI

AEI is very proficient with the use of data analytics tools, such as Microsoft Power BI. These tools allow our team to build interactive dashboards in order to sift through mountains of data with great ease and gain actionable insights from them. Most importantly, these dashboards can be easily shared through the web with our clients to allow them to see "what-if" scenarios, visualize real-time updates to data, embed them in their own websites and/or any number of other things. AEI has used these tools to create dynamic dashboards for decarbonization master planning, life-cycle cost analyses, energy usage monitoring, chiller plant sizing, generator expansion planning and much more.

POWER BI EXAMPLES

Below, we have provided Power BI examples that consists of subset selections, a site map of NIST, and the heating/cooling/electrical load information.

The images below, show that when a different option is selected in the subset, all corresponding information on the page changes with the selection. The map shows the highlights for the selected buildings, and the load section on the right only shows the contents for the buildings in the selection.

For instance, one of the screenshots attached shows the information for existing buildings on campus, and the other one shows the data for all buildings, including additions and future buildings.

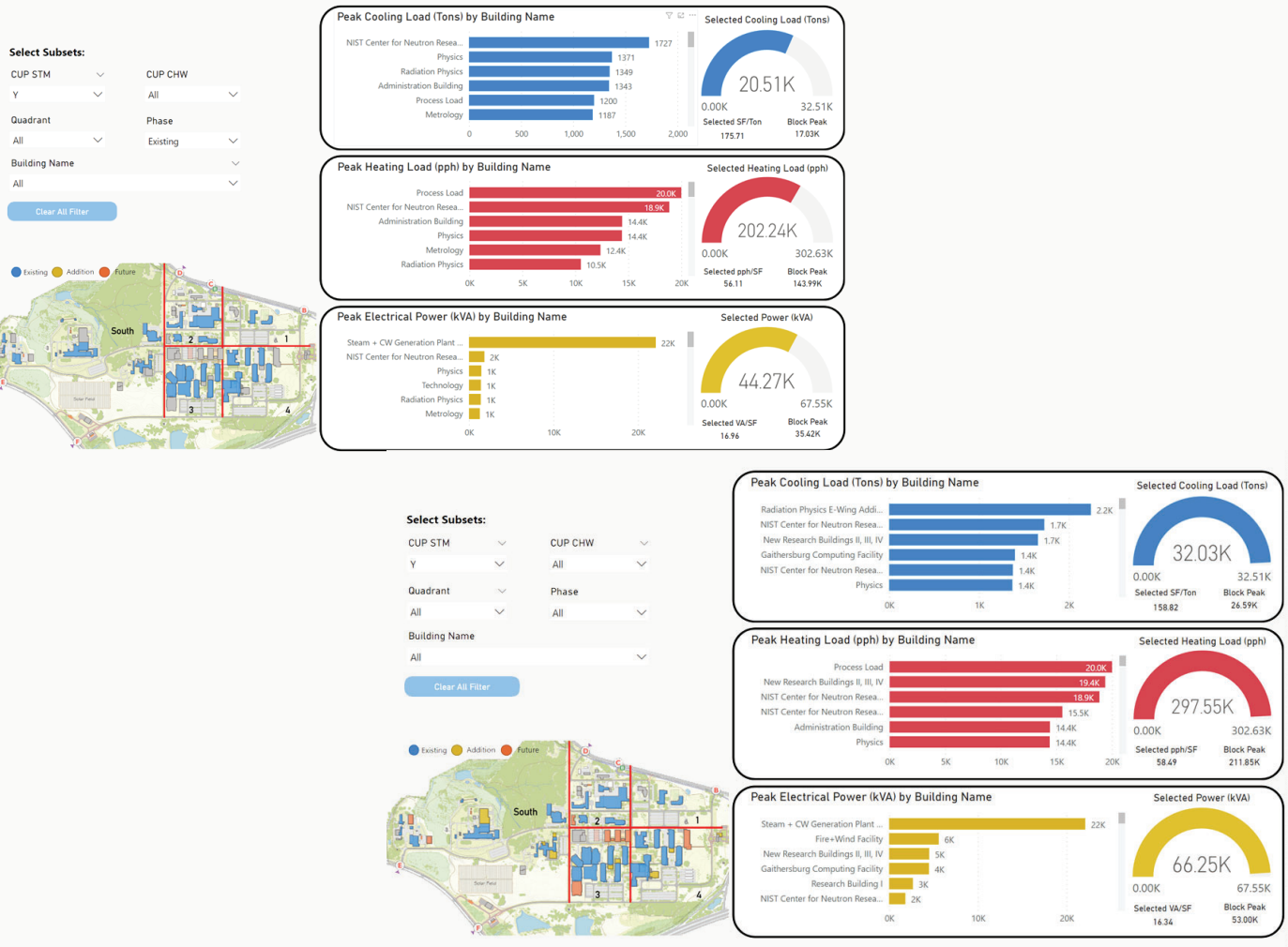
Furthermore, one can click on the building/buildings on the site map to focus on certain buildings' information.

Benefits:

For engineers, PowerBI helps with visualizing the numerous data and finding the pattern of the data. Sometimes, it helps catch the abnormality in the data or errors in the calculation, which is challenging to troubleshoot in Excel, especially with large data sets.

Everything is linked once the relationship between different data sets is set up.

PowerBI is dynamic. During the presentation, one can show various combinations as needed and in real-time. It is a more interactive way of displaying tables of numbers and diagrams.



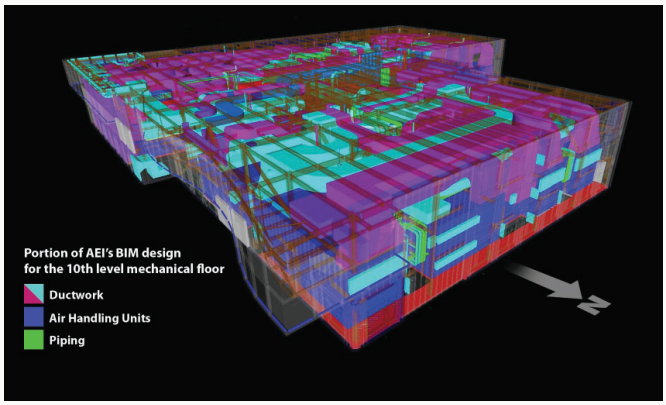
BUILDING INFORMATION MODELING (BIM)

AEI's use of BIM continues to escalate with almost all projects utilizing the design software. Experience ranges from complex existing utility plants to renovations of existing chilled water plants. BIM models allow complex utility projects to consider constructability and maintenance issues before construction begins.

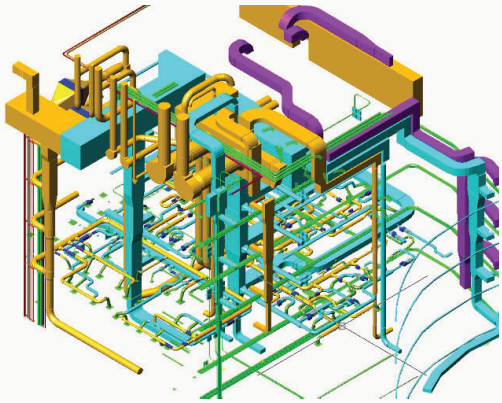
Each BIM model needs to be tailored to meet the modeling uses defined for the project. Internally, AEI has gathered a team of leaders within the BIM environment to continue to progress AEI's BIM practice as technology progresses. The team reviews applications, client requests, internal standards, and applications to improve quality and coordination that are applied to our practice. Each project includes a BIM Specialist who works with the architect on file sharing, consistent look of model deliverables, and the creation of custom content. The BIM Specialist also conducts internal training associated with new uses of BIM, new versions of software, and the use of supporting software.

AEI's project teams achieve unprecedented design coordination of the major disciplines by utilizing Navisworks Manage. This tool allows us to run clash detection between the MEP design elements as well as the structural and architectural elements. Clashes that are found between systems are modified during an interactive clash resolution session, while clashes with architectural and structural elements are reported and coordinated with the broader design team.

BIM EXAMPLES



BIM design from Ann & Robert H. Lurie Children's Hospital of Chicago project.



University of California, San Francisco Neuroscience Laboratory, Building 19A project.

2. PROPOSED TEAM

//2. TEAM QUALIFICATIONS

We believe our value proposition to this project can be summarized in three words: ***Experience, Leadership, and Integration.***

Our team's deep analysis experience and work with infrastructure systems that service higher education facilities informs how we work—it allows us to identify and address key issues early in the design process and bring resolution in the most innovative and cost-effective manner. As industry leaders, we are consistently taking a fresh approach on design solutions by bringing forth new ideas for the entire team to discuss.

The forward-looking leadership our team offers is committed to developing and delivering information allowing West Virginia State University (WVSU) to make informed decisions in a timely manner. We enjoy big room settings that encourage integration and collaboration amongst teams. Our continuous efforts to educate and mentor other team members make us a valued partner.

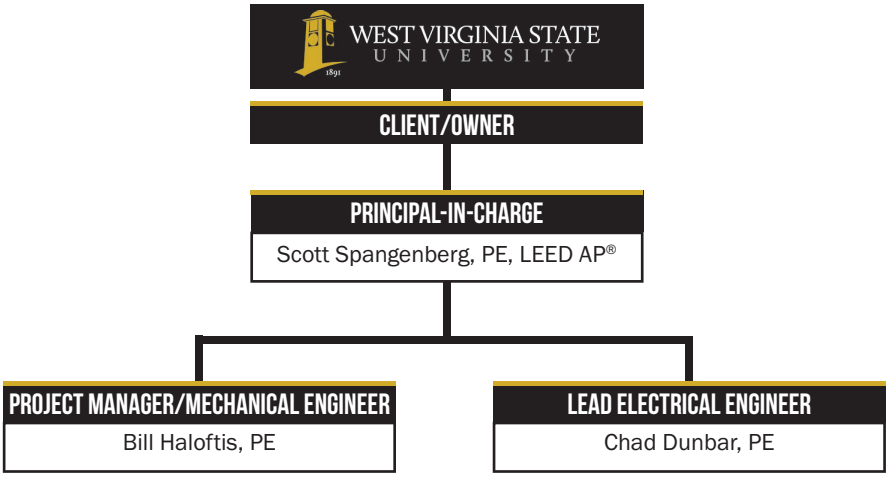
We have assembled an experienced project team who stand ready to "leave no stone unturned" as we work with WVSU to develop a plan that will provide the framework to guide the University's investments in a resilient, reliable, efficient, sustainable and flexible energy solution. Our project team is small which will allow each individual to be intimately involved throughout the process. If needed, our personnel will readily ask for consult from others in AEI's 850+ community of engineers and technical experts.

Our team comprises the following:

- Principal-in-Charge - Scott Spangenberg, PE, LEED AP®
- Project Manager/Mechanical Engineer - Bill Haloftis, PE
- Lead Electrical Engineer - Chad Dunbar, PE

Below, we have included an organization chart which denotes the structure of our A&E Services WVSU HVAC Renovation Projects team.

ORGANIZATION CHART



Beginning on the following page, we have provided resumes for our proposed A&E Services WVSU HVAC Renovation Projects Team.

EDUCATION

Master of Business Administration
University of St. Thomas, 1996

Bachelor of Science
Mechanical Engineering
University of Maryland College Park, 1986

REGISTRATIONS/CERTIFICATIONS

Professional Engineer
- Maryland #19581
- Virginia #0402041620
- District of Columbia #PE906522
- Pennsylvania #PE078629

LEED AP®

PROFESSIONAL SOCIETIES AND ACTIVITIES

ASHRAE, Member

YEARS OF PROFESSIONAL EXPERIENCE

Total Years of Experience: 37
Total Years with AEI: 21

REFERENCES

University of Pittsburgh
Jaime Cerilli
Director, Office of Space Management
(o) 412.648.2269
email: jarst24@pitt.edu

George Washington University
Adam Aaronson, LEED AP BD+C
Director, Campus Development Manager
(o) 202.994.1231
(m) 703.725.9999
email: alaaro@gwu.edu

SCOTT SPANGENBERG, PE, LEED AP®

PRINCIPAL-IN-CHARGE

Scott is a registered professional engineer with diverse project experience including healthcare, research and higher education facilities. He has extensive project management and design experience in comprehensive HVAC system design, performance and direction of mechanical design, feasibility studies, construction specification and document production, and on-site field resolution. As Principal, he is responsible for overall project management, design oversight, quality assurance and client interaction within AEI's Metro DC office.

RELEVANT PROJECT EXPERIENCE

George Washington University - Ross Hall Air Handling Units 11, 12, 14, Washington, DC
Principal-in-Charge for this project at George Washington University's Ross Hall School of Medicine. During this project, AEI provided HVAC engineering services for the renewal of HVAC systems which namely included AHU-11, 12, and 14 located at the building's 3rd Floor mechanical room. This effort was an additional service to the base original project – AHU - 6,7 and 9 system renewal. During this project, AEI implemented construction documents for the AHU-11,12, and 14 solutions. The solution consolidated into two AHUs mounted on the floor to simplify maintenance and operations. AEI provided mechanical, electrical and plumbing design services.

George Washington University - Ross Hall HVAC Renewal AHU-16 A & B, Washington, DC: Project Manager for this HVAC engineering services for the renewal of the AHU-16 project at George Washington University's Ross Hall School of Medicine. AEI's services included the provision of two new air handling units 16A and 16B. The existing AHU-16 remained as-is (this is future phase 3). The rated capacity is approximately 35,000 cfm each. The scope also included demolition of Bob Oakley's Shop and Housekeeping HVAC unit and service from new AHU-16A and 16B to this area. AEI provided engineering design for the building's HVAC, electrical, and plumbing systems.

University of Maryland College Park - Central Animal Resources Facility (CARF) Chiller System Replacement, College Park, MD: Principal-in-Charge for the Central Animal Resources Facility (CARF) -- a 7,163 GSF/6,289 NSF facility constructed in 1983. The facility's HVAC chiller plant and primary equipment were original and exceeded their life expectancy. The project's intent was to replace the chilled water plant equipment arranged to provide improved maintenance and access. AEI addressed the existing conditions of the 600 SF MER as space was tight requiring the contractor and the University to agree on potential locations of equipment to provide for installation and maintain safe access for multiple utility services among which are the HVAC infrastructure, electrical and steam/steam condensate as well as laboratory and HVAC control pneumatic air. AEI's services included mechanical and electrical engineering design.

University of Maryland College Park - Mitchell Building HVAC Upgrades, College Park, MD: Principal-in-Charge for this project to upgrade chilled water service to Mitchell Hall utilizing chilled water from Reckord Armory and upgrade heating system within Mitchell Building mechanical room. AEI's services included mechanical and electrical engineering design.

University of Pittsburgh - Graduate School of Public Health, Phase II, Pittsburgh, PA: Principal-in-Charge for the Phase II 220,900 SF renovation of the existing Graduate School of Public Health (GSPH). Phase II involved renovation and infrastructure upgrades for HVAC, electrical, fire protection, water, waste, telecommunications, data, and security systems, serving the existing GSPH complex; a 10-story tower. The renovations included a complete gut of both buildings to the exterior wall; installation of new HVAC distribution and equipment; and provision of new plumbing and electrical distribution, and fixtures. This project also encompassed the replacement of (16) AHUs and consolidation with (7) AHUs. The AHU replacement involved three major phases, and included nearly (15) microphases. The project is LEED® Silver Certified. AEI's services included mechanical, electrical, plumbing and sustainable design; utility infrastructure; energy modeling; and construction administration.

EDUCATION

Bachelor of Science
Mechanical Engineering
University of Maryland College Park, 1996

REGISTRATIONS/CERTIFICATIONS

Professional Engineer
- Maryland #44883
- Pennsylvania #PE083252
- Virginia #0402054521
- District of Columbia #PE907946

YEARS OF PROFESSIONAL EXPERIENCE

Total Years of Experience: 27
Total Years with AEI: 16

REFERENCES

George Washington University
Adam Aaronson, LEED AP BD+C
Director, Campus Development Manager
(o) 202.994.1231
(m) 703.725.9999
email: alaaro@gwu.edu

George Washington University
Gene Jornales
Assisstant Director
(o) 202.994.9590
email: gene@gwu.edu

BILL HALOFTIS, PE

LEAD MECHANICAL ENGINEER

Bill is a talented professional engineer with more than 25 years of diversified experience. He is well-versed in designing and analyzing mechanical systems for higher education, research, healthcare and commercial facilities. Bill is responsible for mechanical/HVAC system design, life-cycle analysis, site surveys and construction administration.

RELEVANT PROJECT EXPERIENCE

George Washington University - Ross Hall Air Handling Units 11, 12, 14, Washington, DC
Mechanical Engineer for this project at George Washington University's Ross Hall School of Medicine. During this project, AEI provided HVAC engineering services for the renewal of HVAC systems which namely included AHU-11, 12, and 14 located at the building's 3rd Floor mechanical room. This effort was an additional service to the base original project – AHU - 6,7 and 9 system renewal. During this project, AEI implemented construction documents for the AHU-11,12, and 14 solutions. The solution consolidated into two AHUs mounted on the floor to simplify maintenance and operations. AEI provided mechanical, electrical and plumbing design services.

George Washington University - Ross Hall HVAC Renewal AHU-16 A & B, Washington, DC:
Project Manager for this HVAC engineering services for the renewal of the AHU-16 project at George Washington University's Ross Hall School of Medicine. AEI's services included the provision of two new air handling units 16A and 16B. The existing AHU-16 remained as-is (this is future phase 3). The rated capacity is approximately 35,000 cfm each. The scope also included demolition of Bob Oakley's Shop and Housekeeping HVAC unit and service from new AHU-16A and 16B to this area. AEI provided engineering design for the building's HVAC, electrical, and plumbing systems.

University of Pittsburgh - Graduate School of Public Health, Phase II, Pittsburgh, PA:
Project Manager for the Phase II 220,900 SF renovation of the existing Graduate School of Public Health (GSPH). Phase II involved renovation and infrastructure upgrades for HVAC, electrical, fire protection, water, waste, telecommunications, data, and security systems, serving the existing GSPH complex; a 10-story tower. The renovations included a complete gut of both buildings to the exterior wall; installation of new HVAC distribution and equipment; and provision of new plumbing and electrical distribution, and fixtures. This project also encompassed the replacement of (16) AHUs and consolidation with (7) AHUs. The AHU replacement involved three major phases, and included nearly (15) microphases. The project is LEED® Silver Certified. AEI's services included mechanical, electrical, plumbing and sustainable design; utility infrastructure; energy modeling; and construction administration.

University of Pittsburgh Medical Center - 2nd Floor SBST CBI - AHU Replacement, Pittsburgh, PA: Project Manager for the 2nd Floor South Biomedical Science Tower Center for Biologic Imaging - Air Handling Unit Replacement at the University of Pittsburgh Medical Campus. The project involved the renovation of the Center for Biologic Imaging server room. The project scope was decided per the outcome of a Feasibility Study performed in 2021 that included mechanical, electrical and architectural design. AEI provided engineering design services for mechanical, electrical, plumbing and fire protection building systems.

National Institutes of Health - Building 21 HVAC Replacement AE Services, Bethesda, MD: Mechanical Engineer for the requested Building 21 HVAC Replacement by the Office of Research Facilities (ORF) at NIH's Bethesda campus. The ORF supports the NIH mission by providing, maintaining and operating safe, healthy and attractive facilities. Within Building 21, the ORF upgraded the infrastructure equipment and utilities contained within the penthouses. For this project, AEI provided complete design services for the demolition and replacement of the existing HVAC systems to modernize their components and increase reliability, energy efficiency, ease of maintenance, and occupant comfort levels. AEI provided design services such as overall project management, meeting participation (including documentation), field investigations, cost estimate, full design and bidding support.

CHAD DUNBAR, PE

LEAD ELECTRICAL ENGINEER

Chad is a registered professional engineer with more than 20 years of diverse project experience. He has served as an Electrical Engineer on various projects including healthcare, research laboratory, low-rise/high-rise commercial/office buildings, mixed-use retail, higher education, radio/television broadcast, as well as state/federal government facilities. Chad is experienced in building level power distribution, emergency power systems, interior/exterior lighting design and illumination calculations, lightning protection systems, fire alarm design, telecom pathways infrastructure design, and critical operations power systems facility design. In addition, he has provided services for peer reviews, survey and documentation of existing systems, electrical systems feasibility, and improvement studies, and general electrical short-circuit calculations using standard industry software packages.

EDUCATION

Bachelor of Science
Electrical Engineering
Georgia Institute of Technology, 2002

REGISTRATIONS/CERTIFICATIONS

Professional Engineer
- Maryland #44677
- Virginia #0402055272
- District of Columbia #908209

YEARS OF PROFESSIONAL EXPERIENCE

Total Years of Experience: 22
Total Years with AEI: 8

REFERENCES

FUJIFILM Diosynth Biotechnologies
Mark Henry
(m) 717.940.8376
email: mark.henry.contractor@fujifilm.com

Virginia Hospital Center
Sam Mirmirani, Director of Facilities and Engineering
(o) 703.558.6800
email: smirmirani@virginiahospitalcenter.com

RELEVANT PROJECT EXPERIENCE

George Washington University - Corcoran Hall Renovation, Washington, DC: Lead Electrical Engineer for the approximately 47,000 SF building-wide renovations to accommodate the Physics Department located at George Washington University's Corcoran Hall in Washington, DC. The scope of services included partial MEP infrastructure replacement. Corcoran Hall is a Historic Landmark and therefore discussions with the DC Historic Preservation Office were required. The project was designed to achieve LEED® certification. AEI's services included mechanical, electrical, plumbing and fire protection design, and BIM Revit.

George Washington University - Corcoran Hall Room 301/302 Lab Renovation, Washington, DC: Electrical Engineer for the renovation of lab space located in Corcoran Hall for George Washington University. The project involved a rework of the existing space which included carving out two labs within the overall existing lab. The renovated rooms include: Room 301 – Offices, Room 302 – Open Lab, Room 302A - RnA Lab, and Room 303 – Cell Culture. The project's scope comprised addition of biosafety cabinets and revision of electrical and plumbing services and pressurization strategy for the comprehensive lab suite. AEI's services included mechanical, electrical and plumbing design.

Howard University - New STEM Complex Programming & Design Services, Washington, DC: Senior Electrical Engineer for a new 454,357 SF, seven-story lab-intensive STEM Center at Howard University. The interdisciplinary STEM facility will embrace the existing, historically significant C.B. Powell (Freedmen's Hospital) building. The project will also include the renovation of a historic structure that will be connected to the new facility. The renovated portion will provide space for "dry" uses such as offices, classrooms, and administrative support spaces. The proposed new STEM facility will cluster programs requiring access to specialized labs and instructional spaces that create opportunities for interdisciplinary collaboration. The proposed building co-locates science, technology, engineering and mathematics programs to foster interdisciplinary collaboration, innovation, and discovery. This program enables STEM programs that are currently spread across various parts of the campus to be consolidated into one contiguous, state-of-the-art location providing one-stop access to teaching and research labs, office and administrative functions, classrooms, meeting spaces, and other academic and campus support resources. AEI will be providing mechanical and electrical engineering design services during the project's programming and design phases.

University of Maryland College Park - Thurgood Marshall Hall, College Park, MD: Electrical Engineer for the design of a new 70,000 SF state-of-the-art teaching facility. The building houses full- and part-time faculty and staff as well as graduate/teaching/research assistants. In addition, the building contains state-of-the-art instructional rooms ranging in size from 25 to 150 seats, computer labs, a library/study room, collaborative spaces, a lounge and rooftop terrace. The project also involved extensive site, utility and infrastructure upgrades and extension to serve the new facility. AEI's services included mechanical, electrical, plumbing engineering design.

3. RELEVANT EXPERIENCE

//3. RELEVANT EXPERIENCE

AEI provides engineering consulting and design services for higher education clients throughout the United States and beyond. Our project managers and engineers quickly adapt the appropriate level of design detail and necessary services to ensure project success as envisioned by the client.

AEI plans and designs flexible teaching and research facilities featuring biology- and chemistry-focused wet labs, as well as core and shell projects with tenant fit-outs, for major university campus across the country. These buildings are typically designed to promote interdisciplinary and multidisciplinary research and provide interactive and collaborative learning environments. Our emphasis is to create advanced academic environments that facilitate productivity, reliability, efficiency, and versatility while ensuring occupant safety and comfort.

AEI has provided engineering consulting and design services for more than 226 higher education clients throughout the U.S. – and beyond. Our team of project managers and engineers quickly adapt the appropriate level of design detail and necessary services to each project to ensure its success as envisioned by the client.

Smart classrooms, distance learning, sustainable buildings, maintainability, flexible facilities, safety, indoor air quality, staff retention...the list is endless. AEI understands the issues facing college and university planners. Whether the goal is to renovate an older building in multiple phases, build a new, state-of-the-art facility, or replace eroding utility infrastructure or outdated technology systems, we place a priority on understanding the needs of both the owner and the occupants.

Our years of experience working with public and private campuses have resulted in a wide range of functional, reliable, innovative, and sustainable designs, provided through a creative, interactive, and evolutionary process. We are proud of our proven track record of working with faculty, facility managers, administrators, and students to deliver high quality projects within the established budget. AEI's engineering design expertise includes diverse facilities such as research, natural and physical science facilities, multidisciplinary learning, learning centers, computer science and performing arts.

Mechanical-Custom AHU: Return - Ann & Robert H. Lurie Children's Hospital of Chicago

Higher education institutions have been deemed critical to our nation's future. Each institution is challenged to provide facilities and amenities which attract the best and brightest of students, faculty, and administration. It is challenges such as this which AEI confronts with insight and innovation.

This breadth of university and college work has encompassed almost every facility type found on campuses such as office, conference/meeting room, classrooms, instructional and research labs, data center, dining, cultural, recreational, athletic, student center, and auditorium. Likewise, this deep well of experience has demanded the full breadth of AEI services, extending well beyond the core disciplines of MEP engineering. Having 375+ projects that have achieved LEED® has challenged our engineers to continually seek innovative and forward-looking energy conserving and sustainable solutions for building systems.

AEI is a leading U.S.-based multidisciplinary consulting engineering firm that plans, designs, and delivers high performance engineered systems for technically complex building and utility infrastructure projects.

Nationally and internationally, AEI specializes in the higher education, healthcare, research, energy production and distribution, industrial, mission critical and sustainability markets.

We understand the issues facing university/college planners and prioritize meeting client/occupant needs. Our services extend beyond core MEP engineering disciplines. Our engineers provide innovative energy conserving and sustainable solutions for building systems within project goal(s). AEI's early planning and design integration activities address critical MEP issues such as system:

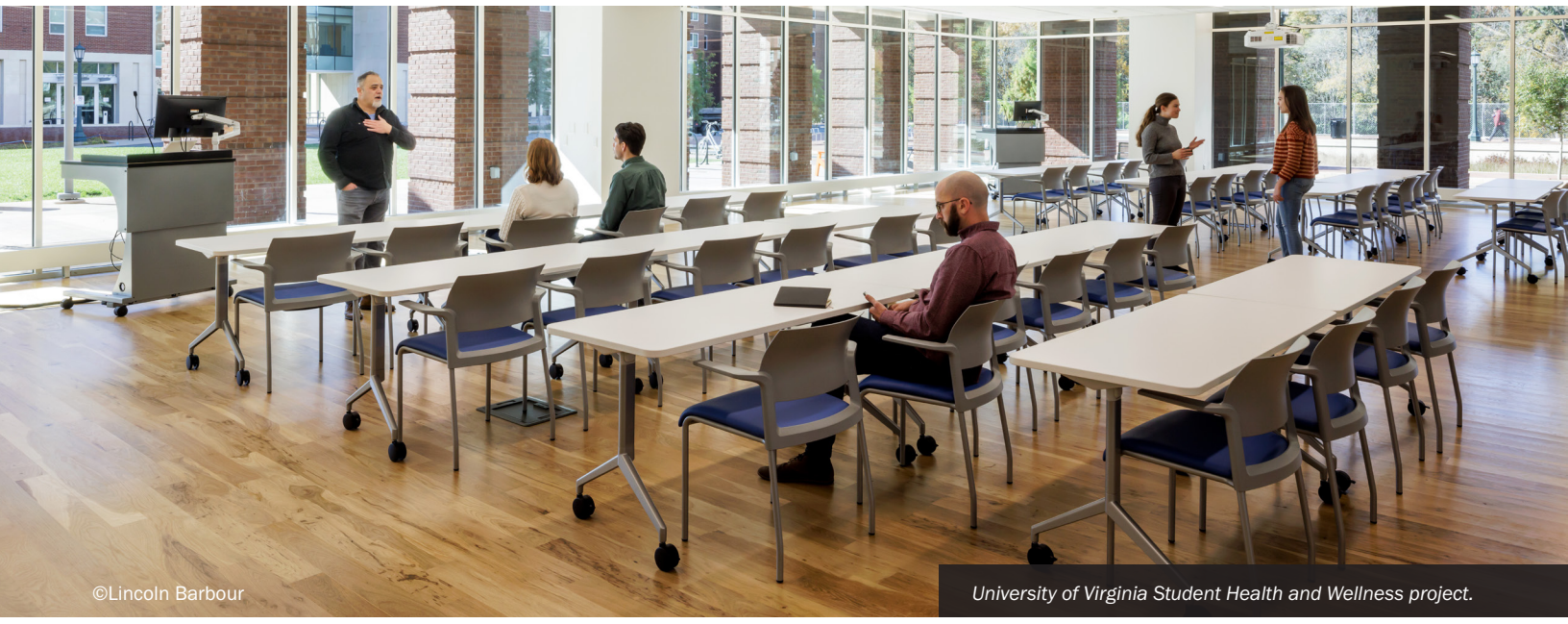
- **Adaptability & Flexibility.** MEP systems must be planned and designed to accommodate programmatic changes. For example, how will systems be created and zoned to meet various functional needs? The critical issue is programmatic definition; asking the right questions early so systems are planned to be flexible and within code.
- **Energy & Water Conservation.** AEI has created multiple, proprietary modeling tools to help clients understand decisions before design. Our CRAFT energy modeling software improves response time/capability to address unavailable systems in other off-the-shelf tools. QUENCH software provides reliable and quick calculation of water reuse potential for AHU condensate and humidification to name a few.
- **Resilience.** Environmental conditions and adverse weather that impact geographic areas require the design team to address infrastructure resilience.
- **Operability & Maintainability.** Together with resilience is the ability to maintain any MEP system. AEI works with its clients' O&M staff to ensure project designs meet O&M staff needs.

On the following page, we have provided a list of our higher education clients.

RELEVANT PROJECTS

Beginning on page 4, we have included four projects we deem most relevant to the A&E Services WVSU HVAC Renovation Projects. These projects include:

1. George Washington University, Ross Hall HVAC Assessment and AHU
2. University of Pittsburgh, West Scaife Hall Addition
3. University of Pittsburgh, Graduate School of Public Health, Phases I and II
4. University of Maryland College Park, Mitchell Building HVAC Upgrades



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University of Virginia Student Health and Wellness project.

AEI'S HIGHER EDUCATION CLIENTS SYSTEM-WIDE

NORTHWEST REGION HIGHER ED CLIENTS

Central Washington University
Montana State University
North Seattle College
Oregon Health & Science University
Oregon State University
Seattle University
University of Alaska Fairbanks
University of Idaho
University of Puget Sound
University of Washington
University of Washington Bothell
University of Washington Tacoma
University of Wyoming
Washington State University
Western Washington University

SOUTHWEST REGION HIGHER ED CLIENTS

Arizona State University
California Institute of Technology
California State University, Fullerton
College of Santa Fe
Colorado State University
Hult International Business School
Northern Arizona University
San Francisco State University
Sonoran University of Health Sciences
Stanford University
University of Arizona Phoenix
University of Arizona Tucson
University of California, Berkeley
University of California, Davis
University of California, Irvine
University of California, Los Angeles
University of California, Merced
University of California, Riverside
University of California, San Diego
University of California, San Francisco
University of California, Santa Barbara
University of California, Santa Cruz
University of Colorado at Boulder
University of Colorado-Denver
University of Denver
University of Nevada Las Vegas
University of New Mexico
University of San Francisco
University of Southern California
University of the Pacific
University of Utah
Utah State University

SOUTH CENTRAL REGION HIGHER ED CLIENTS

Baylor University
Lamar University
Oklahoma State University
Rice University
Sam Houston State University
San Jacinto College
Texas A&M University, College Station
Texas A&M University, Corpus Christi
Texas A&M University, Galveston
Trinity University
Tulane University
University of Arkansas-Fayetteville
University of Arkansas-Little Rock
University of Houston
University of Houston-Clear Lake
University of Houston-Victoria
University of North Texas
University of Oklahoma
University of Texas at Arlington
University of Texas at Austin
University of Texas at Brownsville
University of Texas at Dallas
University of Texas at Rio Grande Valley
University of Texas at Tyler

SOUTH PACIFIC REGION HIGHER ED CLIENTS

University of Hawaii

NORTHEAST REGION HIGHER ED CLIENTS

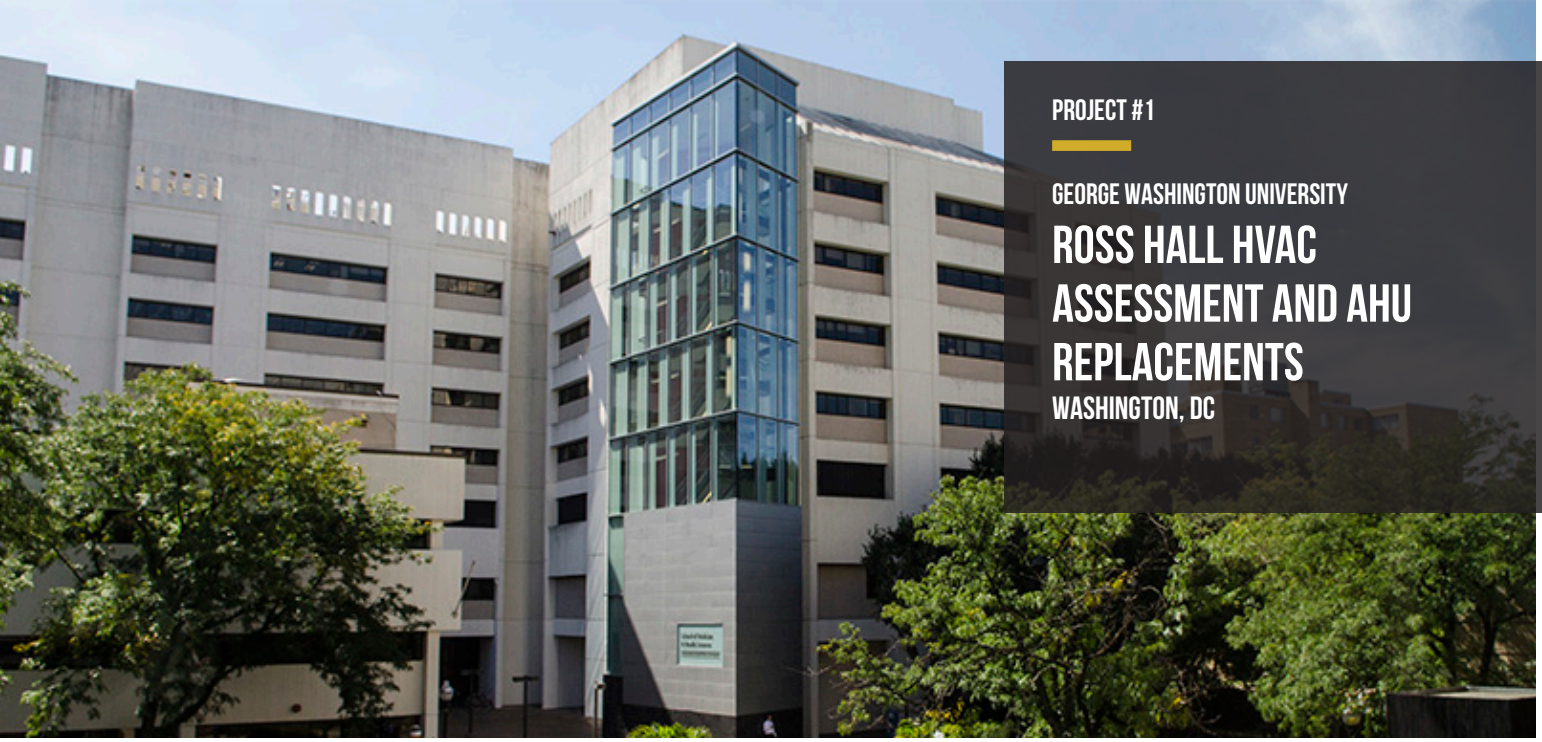
Boston College
Carnegie Mellon University
City University of New York
Cornell University
Dartmouth College
Dickinson College
Harvard University
Kutztown University
Massachusetts Institute of Technology
Pennsylvania State University, Brandywine
Pennsylvania State University, Harrisburg
Pennsylvania State University, University Park
Rowan University
Rutgers University
Slippery Rock University
State University of New York
Stony Brook University
University of New Hampshire
University of Pittsburgh
University of Rochester
Yale University

MIDWEST REGION HIGHER ED CLIENTS

Bradley University
Case Western Reserve University
Chicago State University
College of DuPage
College of Lake County
Eastern Illinois University
Eastern Michigan University
Elmhurst University
Illinois Institute of Technology
Illinois State University
Indiana University
Iowa State University
Kansas State University
Knox College
Loyola University Chicago
Madison College (a.k.a. Madison Area Technical College)
Marquette University
Michigan State University
Milwaukee Area Technical College
Milwaukee School of Engineering University
North Central College
North Dakota State University
Northern Illinois University
Northland College
Northwestern University
Ohio State University
Oakland University
Oak Point University
Purdue University
Southern Illinois University
The School of the Art Institute of Chicago
University of Chicago
University of Cincinnati
University of Illinois at Chicago
University of Illinois at Urbana-Champaign
University of Iowa
University of Kansas
University of Michigan
University of Minnesota
University of Minnesota, Duluth
University of Missouri
University of North Dakota
University of Notre Dame
University of Western Michigan
University of Wisconsin-Eau Claire
University of Wisconsin-Green Bay
University of Wisconsin-La Crosse
University of Wisconsin-Madison
University of Wisconsin-Milwaukee
University of Wisconsin-Oshkosh
University of Wisconsin-Platteville
University of Wisconsin-River Falls
University of Wisconsin-Stevens Point
University of Wisconsin-Whitewater
Washington University in St. Louis
Western Illinois University
Western Michigan University
Wheaton College
Wichita State University

SOUTHEAST REGION HIGHER ED CLIENTS

Auburn University
Clemson University
Dalton State College
Daytona State College
Duke University
East Carolina University
Eckerd College
Elizabeth City State University
Elon University
Emory University
Florida Agricultural and Mechanical University
Florida Atlantic University
Florida Gulf Coast University
Florida International University
Florida Polytechnic University
Florida SouthWestern State College
Florida State College at Jacksonville
Florida State University
Furman University
Georgetown University
George Mason University
George Washington University
Georgia Institute of Technology
Georgia Southern University
Georgia State University
Hood College
Howard University
Johns Hopkins University
Longwood University
Meredith College
Middle Georgia State University
Murray State University
North Carolina A&T State University
North Carolina State University
North Carolina Central University
North Georgia Technical College
Nova Southeastern University
Radford University
Salisbury University
Samford University
Santa Fe College
South Florida State College
Stetson University
Towson University
Universities at Shady Grove
University of Central Florida
University of Delaware
University of the District of Columbia
University of Florida
University of Georgia
University of Kentucky
University of Maryland, Baltimore
University of Maryland, College Park
University of North Carolina at Chapel Hill
University of North Carolina at Charlotte
University of North Carolina at Greensboro
University of North Carolina at Pembroke
University of North Carolina at Wilmington
University of North Carolina School of the Arts
University of North Florida
University of South Carolina
University of South Florida
University of Southern Florida
University of Tennessee, Knoxville
University System of Maryland at Southern Maryland
University of Virginia
Vanderbilt University
Virginia Commonwealth University
Virginia Military Institute
Virginia Polytechnic Institute & State University
Wake Forest University
Washington and Lee University
Washington College
West Virginia University
Western Carolina University
William & Mary
Winston-Salem State University



PROJECT #1

GEORGE WASHINGTON UNIVERSITY

ROSS HALL HVAC ASSESSMENT AND AHU REPLACEMENTS

WASHINGTON, DC

DESCRIPTION

AEI served as the mechanical, electrical and plumbing design engineer to implement assessment of master plan study for the 1970s vintage MEP infrastructure. The outcome was an infrastructure masterplan for construction implementation to replace (25) AHUs, renew emergency power systems, renew electrical closet infrastructure, new hydronic shafts and piping and create a new heat recovery exhaust system. The infrastructure assessment progressed into multi-phased infrastructure projects to replace and renew systems over an eight-year period.

Most of the infrastructure projects had to be implemented with a fully occupied building with on-going research. Each project was carefully planned to create enabling work to support minimal shut-downs.

Systems were planned to have N+1 redundancy with manifolded systems for reliability.

The six key phases comprised of:

1. West Wing CO6 Grant renovations (AHUs, heat recovery exhaust, emergency generators)
2. AHU – 7,8,9 project
3. AHU – 11,12, 14 project
4. AHU – 22, 23 project
5. AHU – 16A
6. AHU – 1, 2

The West Wing CO6 Grant project attained LEED® Gold certification using significant sustainable measures including:

- Decoupled cooling approach with chilled beam distribution
- Dedicated outside air system (DOAS) with heat recovery coil
- Demand control ventilation at the zone level
- Gylcol run-around

GEORGE WASHINGTON UNIVERSITY
ROSS HALL AHU PROJECTS
MECHANICAL ROOM AND AHUS

GEORGE WASHINGTON UNIVERSITY

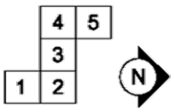
ROSS HALL HVAC ASSESSMENT AND AHU REPLACEMENTS

WASHINGTON, DC

GEORGE WASHINGTON UNIVERSITY
ROSS HALL AHU PROJECTS
AHU ZONING DETAIL

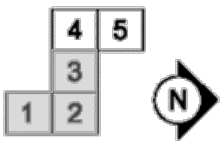
LEGEND:

- EA AIR HANDLING UNIT
- SUPPLY AIR HANDLING UNIT
- EA PERIMETER SHAFT
- VERTICAL CIRC.
- MECH SHAFT
- HYDRAULIC RISER
- BOILER STACK
- INCINERATOR STACK



GEORGE WASHINGTON UNIVERSITY
ROSS HALL AHU PROJECTS
EXISTING CONDITIONS

- EXISTING AHU-19(OUT OF SERVICE)
- EXISTING AHU-16
- EXISTING AHU-2
- STAND-ALONE UNIT
- EXISTING AHU-6
- EXISTING AHU-7
- EXISTING AHU-9
- EXISTING AHU-1
- EXISTING SA DUCTWORK
- EXISTING SA DUCTWORK (OUT OF SERVICE)



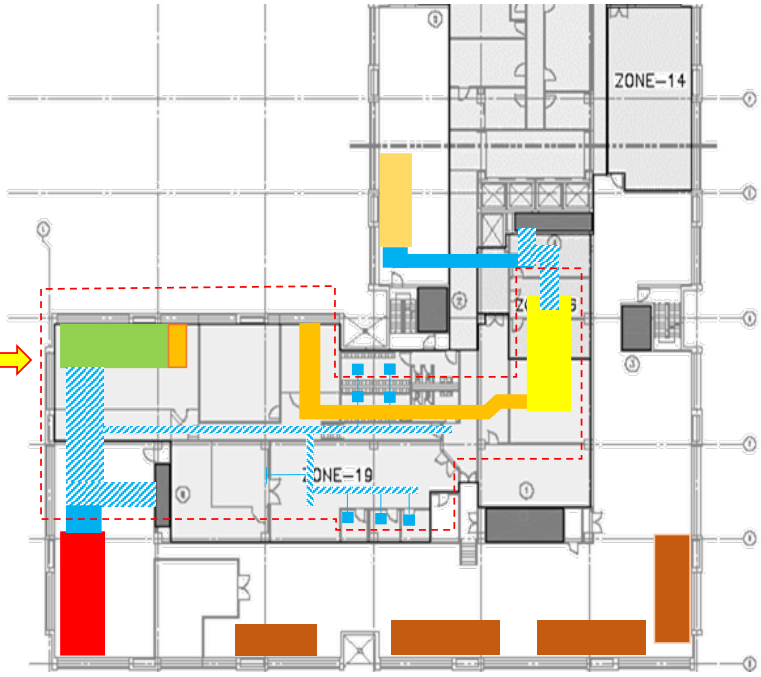
GEORGE WASHINGTON UNIVERSITY

ROSS HALL HVAC ASSESSMENT AND AHU REPLACEMENTS

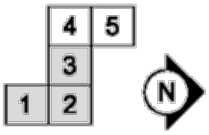
WASHINGTON, DC

GEORGE WASHINGTON UNIVERSITY
ROSS HALL AHU PROJECTS
PHASE 3 - REPLACEMENT AHU INSTALLATION

NEW WORK



- EXISTING AHU-16
- EXISTING AHU-2
- EXISTING AHU-6,7,9,1
- EXISTING SA DUCTWORK
- New AH-19
- New AH-2
- NEW OA DUCTWORK
- NEW SA DUCTWORK



PROJECT #2

UNIVERSITY OF PITTSBURGH

WEST SCAIFE HALL ADDITION

PITTSBURGH, PA

DESCRIPTION

This project involves the renovation and addition of the Scaife West Wing for the University of Pittsburgh School of Medicine. Prior to the renovation and addition, AEI commenced an infrastructure assessment and masterplan to determine scope and solutions.

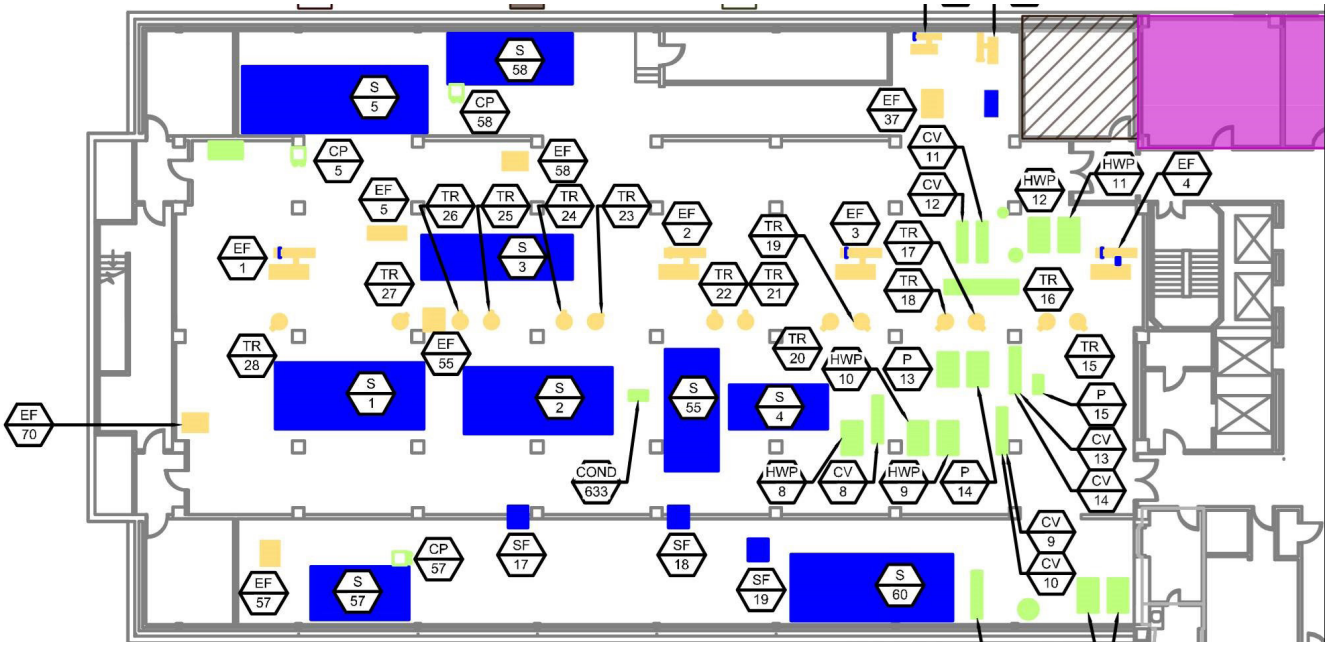
The project provides new infrastructure for a 6-7-story, 110,000 SF building that features classroom, laboratory, and office space. The addition and 42,000 SF renovation includes laboratories classrooms; gross and virtual anatomy labs; a simulation center with 22 simulation exam/observation rooms to be used as observed structured clinical exams and FlexExam/Observation rooms; a student debriefing room; an atrium; and switchgear.

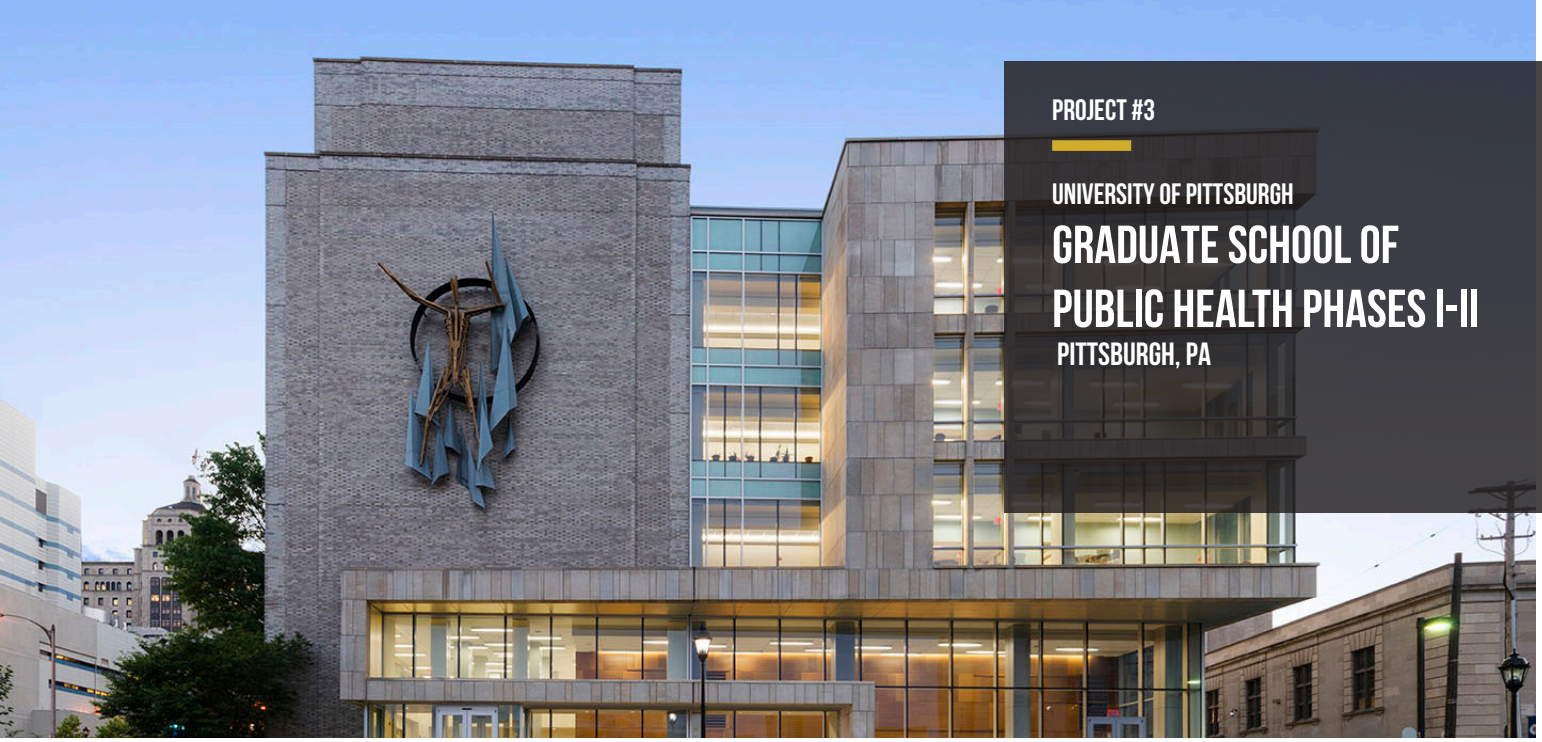
The outcome of the assessment and masterplan, defined a new “central engine” penthouse located on the new addition, that would serve all HVAC systems for the addition, plus service to the existing west wing of Scaife Hall; a total of 300,000 SF, and 400,000 cfm of air handling capacity.

The new infrastructure includes new central custom air handling units (6 total), generators, exhaust fans, high-efficiency heat recovery systems, and steam pressure-reducing stations. Additionally, new emergency power generators and new electrical substations revised the electrical architecture.

The project’s construction and engineering strategies include infrastructure which enables work within multiple phases to maintain occupancy of Scaife Hall operations –- which includes a 5kVA switchgear relocation, Presby hospital generator upgrades, temporary air handling systems, and temporary generators.

The project was designed using BIM and in accordance with LEED® Gold certification requirements.





PROJECT #3

UNIVERSITY OF PITTSBURGH

GRADUATE SCHOOL OF PUBLIC HEALTH PHASES I-II

PITTSBURGH, PA

DESCRIPTION

AEI served as the MEP engineer during Phase I and Phase II of the University of Pittsburgh's Graduate School of Public Health (GSPH). Phase I, involved the construction of a new, five-story, 58,300 SF research tower addition to create much-needed research laboratory space for the Graduate School of Public Health. Both phases of the project provided a total building construction of 279,200 SF which includes a 58,300 SF addition (Phase I), and 220,900 SF renovation (Phase II).

Phase I involved the 58,300 SF addition and renovation which focused on the biological sciences including three floors of labs, one floor of support spaces such as glass wash and hazardous storage, and a penthouse. The renovations involved modifications to the main entrance including revisions to the main lobby, a new lecture hall, and office connection renovations at each floor.

Phase II involved renovation and infrastructure upgrades for HVAC, electrical, fire protection, water, waste, telecommunications, data, and security systems, serving the existing 220,900 SF GSPH complex; a 10-story tower. The facility efficiently houses seven GSPH departments with their associated wet and dry lab spaces, four centers, academic and administration areas, and required auxiliary University spaces.

The addition houses three floors of laboratory space and a new 215-seat auditorium. All lab spaces, aside from a teaching lab, are located within the new addition because of the necessary, larger floor-to-floor height. The existing facilities were renovated to accommodate those spaces that can comfortably sit within a tighter floor-to-floor height. These spaces include offices, classrooms, administration spaces, and lounge areas

Old laboratory spaces were renovated into new offices and classrooms to support the laboratory addition. The renovations included a gut of both buildings to the exterior wall; as well as the installation of new HVAC distribution and equipment, plumbing distribution and fixtures, and electrical distribution.

The renovations included a complete gut of both buildings to the exterior wall; installation of new HVAC distribution and equipment; and provision of new plumbing and electrical distribution, and fixtures.

This project also encompassed the replacement of 16 AHUs and consolidation with 7 AHUs. The AHU replacement involved three major phases, and included nearly 15 microphases. MEP infrastructure solutions included many including complete replacement of –

- New electrical service and electrical gear; converted to 480V systems from 120/208V architecture.
- New emergency power generators; segregated between life safety and research power.
- New central chilled water pumps located at penthouse
- New central heating systems (steam and hot water)
- New central hot water system
- Replacement of 16 AHUs and consolidation to 7 AHUs

The facility efficiently houses seven GSPH departments with their associated wet and dry lab spaces, four centers, academic and administration areas and required auxiliary University spaces.

The project is LEED® Silver Certified.

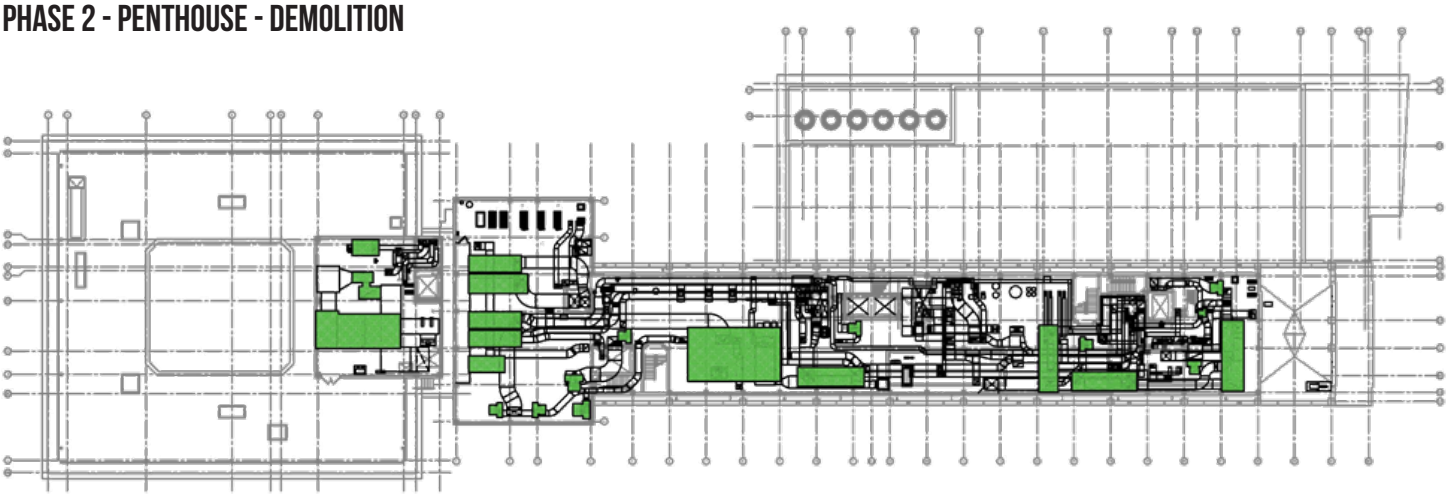
PROJECT #3

UNIVERSITY OF PITTSBURGH

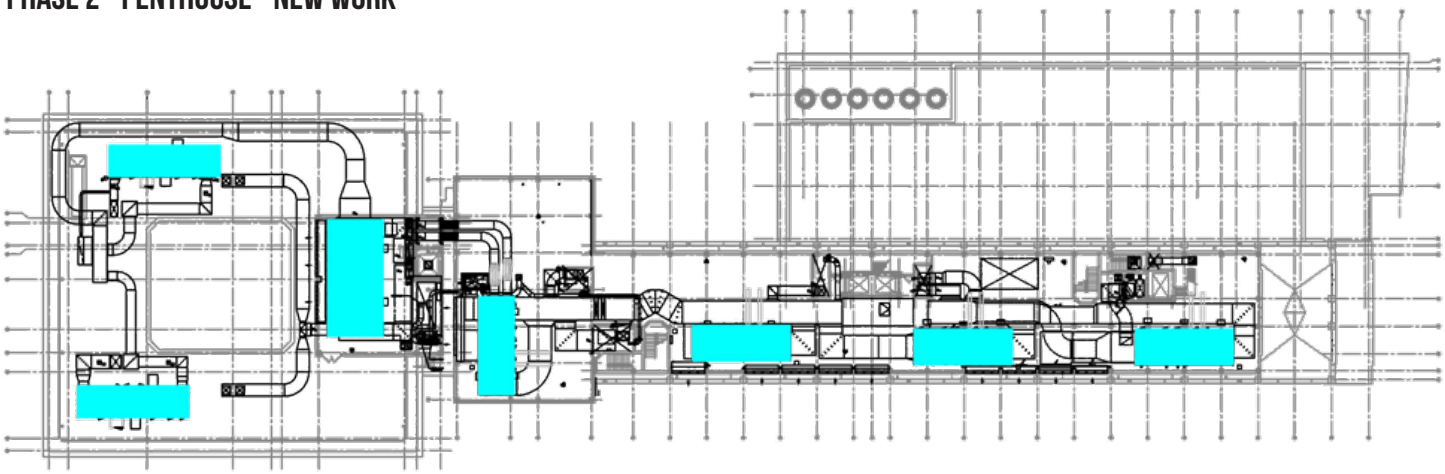
GRADUATE SCHOOL OF PUBLIC HEALTH PHASES I-II

PITTSBURGH, PA

PHASE 2 - PENTHOUSE - DEMOLITION



PHASE 2 - PENTHOUSE - NEW WORK



PROJECT #4

UNIVERSITY OF MARYLAND COLLEGE PARK

MITCHELL BUILDING HVAC UPGRADES

COLLEGE PARK, MD

DESCRIPTION

The objective of this project was to upgrade chilled water service to Mitchell Hall utilizing chilled water from Reckord Armory and upgrade heating system within Mitchell Building mechanical room.

The project scope involved:

- Demolition of existing chillers and cooling towers in Mitchell Building. Demolition of selective chilled water piping and full removal of condenser water piping.
- New flat plate heat exchanger was specified to isolate the chilled water loop within Mitchell Building and connect to the Reckord Armory chilled water piping system (supply & return) 5 feet outside the building. To minimize the impact on building and reduce cost, SEI designed a new piping path to follow the same existing location of condenser water piping. New chilled water pumps and controls were provided for the flat plate heat exchanger.
- The new piping within the Mitchell Building on the downstream side of the flat plate heat exchanger was connected to the existing piping distribution system which is engineered as a 2-pipe heating or cooling system.
- Heating System – the current system was replaced with new heat exchangers and pumps. The existing steam PRV station remained. An alternate was explored to generate hot water using high efficiency gas boilers as natural gas was thought to be close to the site.
- Electrical scope included providing new breakers, disconnect switches and power wiring to the new HVAC equipment and controls.

4. GOALS AND OBJECTIVES

//4. GOALS AND OBJECTIVES

ANTICIPATED CONCEPTS AND METHODS OF APPROACH

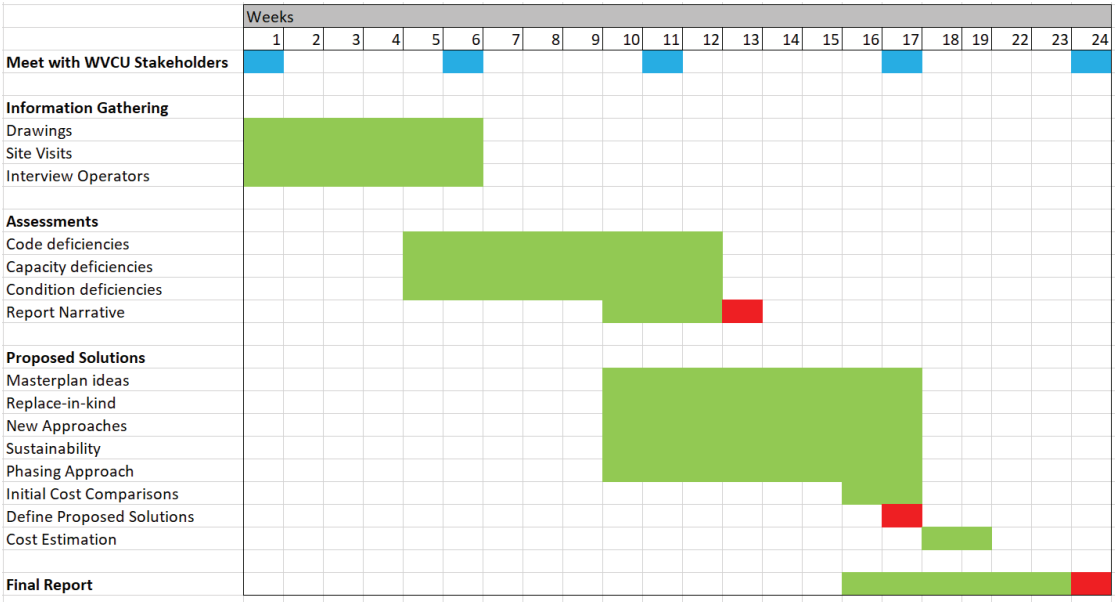
Goal/Objective 1: Review existing plans and conditions as well as the operation of the facility and evaluate while communicating effectively with the owner to determine a plan that can be implemented in a manner that will minimize disruption to concurrent operation of the facility and meet all objectives.

AEI has extensive experience in leading a project of this nature as the prime consultant. Our technical competence and management skills are proven through over 90% repeat client business. AEI brings quality leadership, technically savvy team members, and an abundance of relevant experience related to this project. We have managed a variety of large and small, complex engineering projects as the prime contract holder for more than 40 years.

AEI's project approach to the A&E Services-WVSU HVAC Renovations project will involve integrating with facilities and operations stakeholders to determine the most optimum HVAC solutions based on operations and maintenance (O&M), energy use, phasing and cost. AEI will initiate key system assessments to aid in our comprehension of each of the building's program and determine system conditions, capacities, and code compliance for each building and system; and to then vet and explore proposed solutions. Our effort to this project is proposed in three key phases and will be coordinated with facilities and operations group; a general workplan is identified below.

- **Phase I. Information Gathering –** collect drawings, site visits and interview operators on existing conditions.
- **Phase II. System Assessments –** overview of existing systems – code, condition, capacity. Evaluate hydronic systems that support HVAC. Evaluate ductwork and piping distribution system for each system.
- **Phase III. Proposed Solutions –** Vet ideas on HVAC replacement(s); solutions will vary from replace in-kind to consolidations to new system types. All solutions will be vetted with O&M, energy use, phasing and cost.

WVSU HVAC RENOVATIONS PROJECT CONCEPT PHASE WORKPLAN



Our communication strategies throughout complex HVAC/air handling replacement projects is a key element that contributes to a successful project. AEI will kickoff the A&E Services-WVSU HVAC Renovation Project and define an effective communication workplan that will engage key WVSU stakeholders to progress towards project solutions. AEI will proactively communicate with the WVSU team to implement proper and effective protocols throughout project performance.

Executing work in an occupied building presents special concerns and requirements to a project. When the project has the need to minimize disruption to on-going operations, the development of solutions requires a non-linear, creative process. Facilities that remain operational throughout a renovation require careful planning and carefully orchestrated phasing and staging plans. In this case, the design team will work in concert with WVSU to schedule any system outages that will affect building operations to ensure that the down time for these systems is minimized (either after hours work and/or weekend work as the project schedule and budget allows). There may be challenges associated with satisfying higher performance demands with an MEP aging infrastructure. AEI has a rich history of modernizing higher education facilities and possesses an industry-leading expertise in supporting engineering system performance. We look forward to having the ability to evaluate existing system conditions and are well prepared to propose enhancements and modifications which have meaningful and lasting results.

With broader respect to overall building infrastructure, it is paramount that a comprehensive knowledge base be attained with respect to existing system capacities, capabilities, and conditions. This project not only challenges the team to verify those conditions, but also requires that we remain mindful of the operations of the buildings. AEI excels at campus infrastructure evaluation and future resiliency planning.

ASSESSMENT EFFORT

The assessment effort can vary in scope and requirements, but a very good idea is to set a “base line” on the status of equipment and priorities for repairs. AEI has implemented many HVAC assessments and can summarize what scope to focus on, and serves as a starting point to HVAC solutions. Below, we have provided examples of AHU assessment summaries.

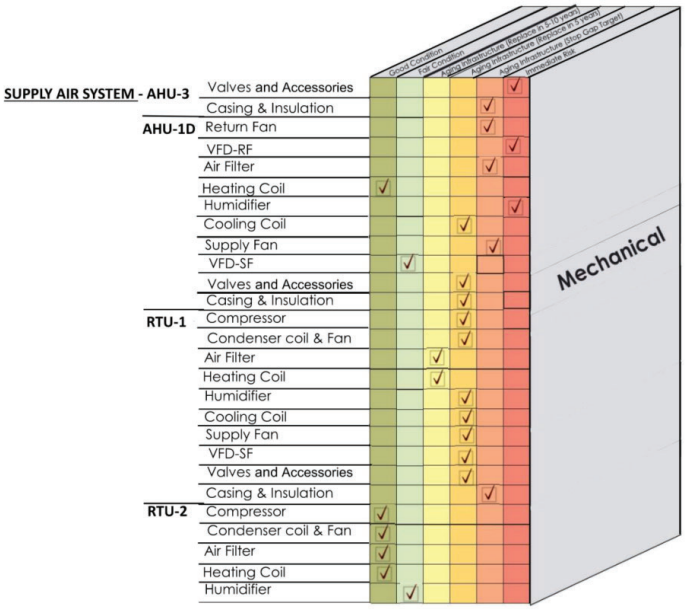
For the assessment phase, it may be prudent to include additional trades beyond MEP. AEI has hired and teamed with architects and structural engineers for HVAC replacements, as needed; depending on the extensiveness of system replacements.

EXAMPLE #1 - EQUIPMENT DEFICIENCIES

AHU-1

Existing Deficiencies	Solutions
1. No proper air filtration. Air filters are blown out.	1. Need to build a holding frame to support the upgraded air filters. Recommend to have one 35% prefilter, MERV-8, and one final filter, MERV-13.
2. Dirty cooling coil, 60% of the coil is clogged with dirt and system is working with less than 40% percent efficiency. Coil casing is rusted.	2. Clean the cooling coil. Need to maintain coil cleaning schedule. Rebuild the coil casing or protect with non-corrosive coating or paint the casing to protect from further rust.
3. Condensate drain pan is rusted and leaks onto the floor of the Penthouse.	3. Rebuild the rusted part and clear the condensate drainage and apply non-corrosive protective coating.
4. Fan base and unit casing is rusted.	4. Remove rust and damaged structure. Protect with non-corrosive coating or paint.
5. AHU-1 serves sensitive lab areas with only one fan. A fan motor failure may leave the entire lab space without proper heating and air conditioning.	5. Realign fan and motor to minimize failure rate. Provide spare motor on site for quicker replacement.
6. AHU casing is rusted and insulation and gaskets are in poor condition.	6. Replace failed panels and gaskets.

EXAMPLE #2 - ASSESSMENT SUMMARY & PROPOSED PROJECTS



Additional forensics may be required for each assessment to implement testing & balancing (TAB) contracts to determine more details on existing performance. TAB may occur at later phases once we determine the direction of the solutions effort.

SOLUTIONS EFFORT

The solutions effort will include conceptual solutions to consider for each WVSU building part of the project scope. AEI will vet the solutions with WVSU stakeholders and will cover the following important attributes -

- Realistically constructable and maintainable solutions.
- Reliable engineering strategies for each system type (redundancy, modularity, manifolding); as required.
- Energy efficient systems.
- Flexible and adaptable - address needs of current and future program changes.
- Propose phasing strategy that requires minimal disruption to occupants.
- Cost effective solutions.

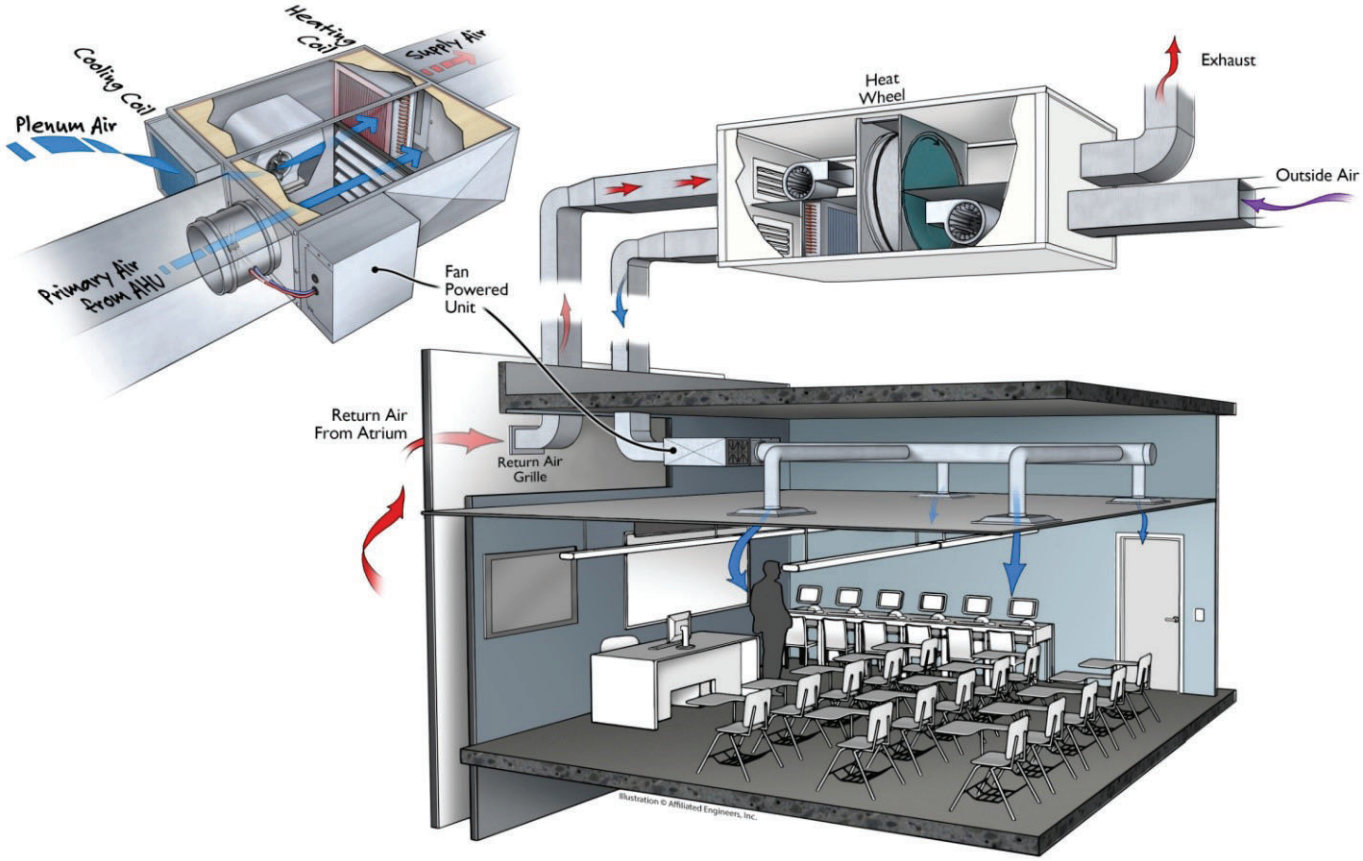
Key AHU Strategies

- Phased approach with minimal shut-downs.
- Zoning assignments to be validated and corrected, as required.
- Consider program use and potential future program changes.
- Reliability scenarios (N+1).
- Flexibility and adaptability.

AEI will perform engineering block load calculations to validate proper sizing of HVAC systems for each building. The existing program will be evaluated with coordinated understanding of potential future program changes anticipated.

AEI will coordinate closely with WVSU to determine the key Basis of Design (BOD) approach to each system; per WVSU standards, current codes and standards, and current industry recommended engineering practices. The outcome will be a concept BOD on approach to systems from a qualitative and quantitative perspective.

EXHIBIT A: CLASSROOM DOAS SYSTEM



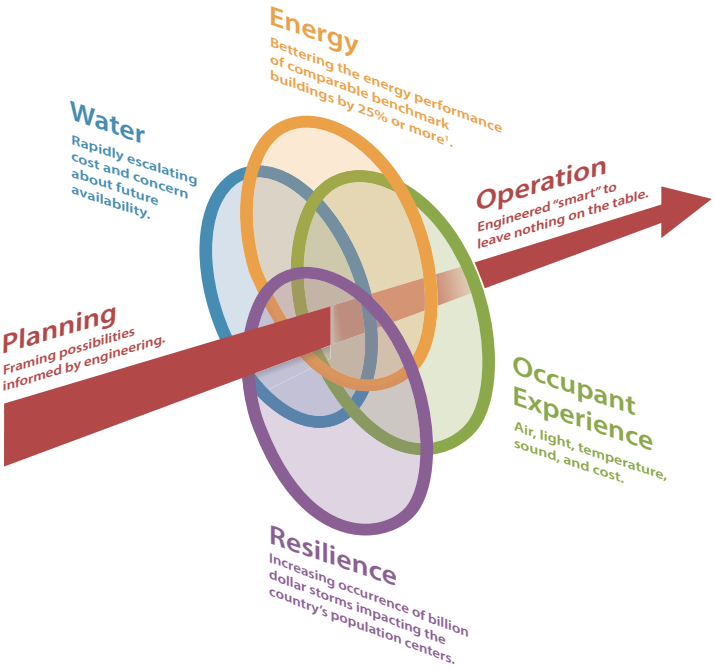
SUSTAINABLE ENERGY SOLUTIONS

AEI will explore sustainable solutions with WVSU. Our efforts will evaluate active system strategies and best practice solutions.

AEI has been at the forefront of innovative sustainable design, challenging and collaborating with design partners and owners on our way to delivering 375+ LEED® projects at the highest levels of certification, with over 125 additional projects currently pursuing. With a depth of experience across facility types, a passion for performance, and rich history of building and district energy systems design, AEI is able to draw from a large body of work from our various higher education projects across the U.S.

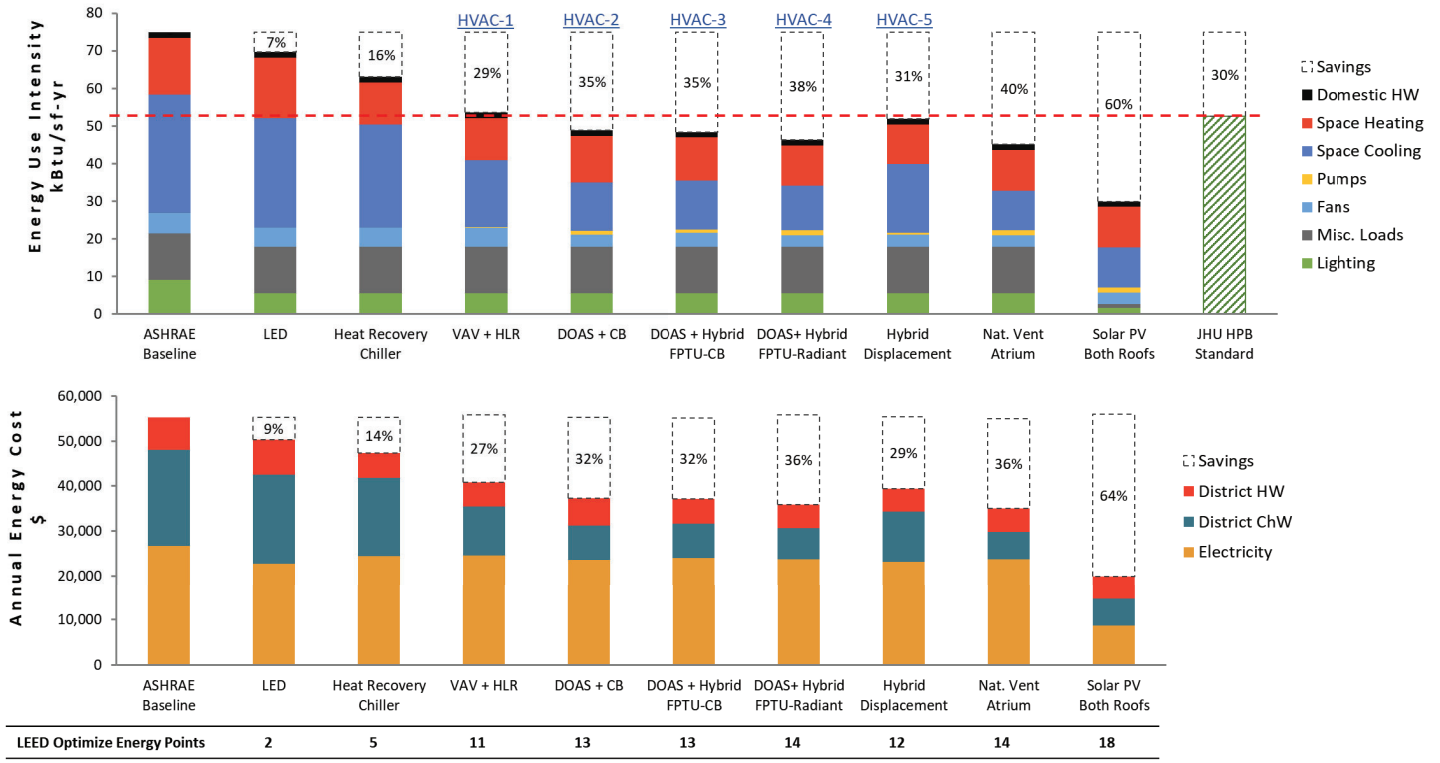
AEI believes in high performance design for the life of the facility, delivering outcomes that focus on energy and beyond. High performance design addresses each stage of a building's life cycle through an approach that integrates planning and design. It establishes a suite of performance goals – looking to optimize use of energy and water, achieve excellence in occupant experience, mitigate climate impacts while adapting to climate change, provide for durability and flexibility, and be cost-effective. These goals are tested through dialogue and exploration and by using the metrics provided through tools, such as building energy and water modeling, life cycle cost analysis, and risk analysis.

High performance design integrates the fundamental sustainable attributes of building design and applies their consideration across the life of the building with energy use reduction as the key driver. AEI brings this creative process in its expertise in energy, water, occupant comfort, and resilience.



Total energy optimization incorporates the following:

- **Planning** – Framing possibilities informed by engineering. Assessing massing, form, orientation, fenestration, and envelope, AEI conceives project engineering that is responsive to climate, sustainability, adaptation, and efficiency goals. As the project progresses, nimble modeling expands, details, and evolves, enabling the design's quick development. Cost estimating, benchmarking, and robust constructability, cost-benefit, life cycle, and risk analysis support effective decision-making and establish metrics to gauge absolute and relative success.
- **Water** – Rapidly escalating cost and concern about future availability. Highest and best use assessments, profiling water quality and quantity needs over time, appropriately develop a design in collaboration with the architect, laboratory planner, landscape architect, and civil engineer. Our experience supports potable water use of a high-performance building being less than half that of benchmark buildings.
- **Energy** – Bettering the energy performance of comparable benchmark buildings by 25% or more. AEI relies on its own suite of energy modeling tools to quickly and reliably envision the interaction of building systems, exterior climate, and occupant actions. Focusing exploration at each stage of the design process, these tools provide the owner and the design team with ever-greater accuracy illustrating how design characteristics and design alternatives will affect energy use and cost.
- **Occupant Experience** – Air, light, temperature, sound, and cost. Design, comfort, and sustainability meet at the building façade, while comfort, sustainability, and performance meet in the engineered systems. AEI modeling tools test combinations of fenestration and room configurations throughout a building and in special spaces, and test combinations of passive and active systems, optimizing parameters for occupant comfort and control, as well as for building performance.
- **Resilience** – The increasing occurrence of billion-dollar storms impacting the country's population centers. Owners want buildings that can respond to major weather events. Others use historic data; AEI projects climate conditions in modeling hour-by-hour building operation responses. Through resourceful planning, strategies, and technologies for improving resilience we can present opportunities to improve energy efficiency and flexibility as well, helping owners thrive as well as survive in periodically jeopardized settings.
- **Operation** – Engineered "smart" to leave nothing on the table. Adaptability is implicit in high performance operation, including broad utility delivery range and reconfigurability. Less obvious is the integration of the known and evolving technologies. High volumes of data from today's engineered systems need to be normalized to provide actionable information for BAS analysis supporting daily operations, maintenance, and capital investment planning. The enterprise building management systems



and services that do this ("intelligent buildings") will be even more essential as buildings increasingly generate their own energy, requiring coordination management of energy flow to and from the grid.

AEI has in-depth experience introducing and incorporating innovative design solutions into a range of facility types, including research and science buildings. Energy recovery for the mix of programs in this project is a major focus.

In addition to experience with numerous air-to-air, water-to-water, and air-to-water energy recovery systems AEI has conceptualized and implemented, they have incorporated numerous innovations based on the best solution for each project including:

- High performance façade
- High-volume low-speed ceiling fans (with seasonal heating/cooling strategies)
- Hybrid natural ventilation
- Chilled beams and radiant systems
- Geoexchange heating and cooling systems coupled with district energy
- Solar hot water heating
- Supplemental photovoltaic power
- Advanced lighting/daylighting systems, including integration with electrochromic glazing
- Water collection/treatment/reuse systems (for flushing, sub-surface irrigation, and tower makeup)

COST SAVINGS

AEI is experienced at navigating VE exercises that have come up on nearly all of our projects, driven largely by inflation and supply chain logistics. We work collaboratively with the owner, design team, our in-house cost estimating team, and/or the contracting team early in the design to establish and assess value engineering opportunities that don't negatively compromise the functionality of the design. Starting the process early allows for larger design changes to be made without impacting the overall project schedule. It's important that value engineering doesn't undermine sustainability goals or equipment reliability and redundancy requirements that have been established. We leverage our experience to advise the owner on potential operational impacts of VE items that have been proposed.

INNOVATIVE DESIGN

AEI employs innovative mechanical system designs that are tailored to meet the specific requirements of each unique project we work on. Applying new technology and design concepts excites us but we are careful to do our due diligence to ensure the project won't run into issues down the road. This can include helping to facilitate mockup tests, working closely with equipment reps, visiting factories, discussing with internal subject matter experts, and engaging contractors to feel out any concerns with constructability or control sequences. We also make sure to involve the client so we can collectively calculate risks.

FEASIBILITY STUDY DELIVERABLES

The study deliverables will be included in narrative format and comprise concept drawings, diagrams and appendixes. Below, we have denoted the proposed outline:

I. Executive Summary

II. Mechanical Infrastructure Systems Assessment

- AHUs by building served.
- Hydronic systems – steam/condensate, chilled water, heating water.

III. Proposed MEP Infrastructure Solutions

- AHUs by building served.
- Hydronic systems – steam/condensate, chilled water, heating water
- Phased project approaches
- Project timeline implementation

IV. BOD Narrative & Concept Drawings

V. Appendices

- Cost estimates
- Air and water measurements

Goal/Objective 2: As a portion of this process outlined in Objective 1, provide all necessary services to design the facilities described in this EOI in a manner that is consistent with West Virginia State University needs, objectives, current law, and current code; while following the plan to design and execute the project within the project budget.

AEI will provide construction documents and specifications for all phases, by each phase independently. Demolition documents will be noted in a phased manner within each specific phase as the workflow is proposed. Design documents will be arranged to coordinate and collaborate with the construction manager and WVSU. REVIT/BIM model of new design and existing systems shall be fully documented; and will include new and demolition work.

Design efforts will include existing conditions demolition, new work and specifications; all coordinating with BIM Execution Plan, for incremental design submissions as required. Engineering will commence on specifics of equipment sizing, distribution, controls, electrical and coordination items. Project management and coordination efforts will work closely with WVSU, construction managers and key stakeholders as the design progresses while monitoring scope, schedule, and budget approaches. Cost control will be monitored in coordination with the construction manager.

During the project, AEI will coordinate with other disciplines, as needed. We will provide sub-consultants, as required, to implement design scope services such as architecture, structural, code compliance, hazardous materials, sound/vibration and commissioning; unless provided by WVSU by other contract means.

Below, we have provided some initial design workplan considerations when reviewing the RFQ scope, which include:

EXISTING CONDITIONS

- Field verification will commence based on design evolution. As phased solution options are generated, additional field verification may be necessary.
- AEI will continue field surveys to minimize field conflicts during construction, as required.
- Selective demolition may be coordinated with construction manager and WVSU to verify existing conditions that are not easily accessed.

PHASING

- Demolition and new work scope will be grouped in phased construction packages which will reflect how construction activities will commence. AEI will work closely with the construction manager and WVSU to clearly define phases. Phased scope definitions will need to be evaluated to minimize interruptions, maintain cost and schedule; and minimize risk.
- Evaluate and plan electrical to address phasing scope.
- Evaluate and plan controls to address phasing scope.
- Coordinate with other trades on phasing.
- Temporary systems – as AHUs and equipment is replaced, an alternative location may be required to provide continuous HVAC, which may or may not require temporary electrical systems.
- Commissioning – it is likely that each phase will require punch-lists and commissioning before the next phase can commence. Close communication and coordination between the construction manager, controls contractor, mechanical contractor, AEI and the commissioning agent will be critical.

BUILDING AUTOMATION SYSTEM

- Coordination with the controls vendor on control sequences, diagrams, specifications, devices and other items is critical.
- Plan AHU control strategies in coordination with WVSU facilities. Use and augmentation of existing control strategies.
- Distribution controls vs. AHU controls. Old vs. new systems. Verify and coordinate scope.

ENGINEERING, EQUIPMENT DESIGN & SPECIFICATIONS

- Refine and finalize BOD assumptions; to confirm sizing criteria of equipment and distribution. Also refine and finalize approach to flexibility and reliability decisions.
- Engineering calculations. Ensure the AHU and distribution sizing accounts for any master plan program changes anticipated into the future.
- Energy modeling and optimizing energy. Refine analysis to optimize engineering selections.

- Verify and refine any impacts to infrastructure that supports the AHUs; heating and cooling hydronic systems, and electrical.
- Pre-selection procurement package of AHUs, if schedule requires.

PROGRAM SPACE & HVAC DISTRIBUTION

- Refine and verify program scope of existing space for near term and future.
- Refine and verify deficiencies and clarification of scope. How much work is required at the program space level to adequately address HVAC deficiencies?
- Understand and communicate how potential scope requirements will interrupt the program space at a micro and macro level.
- Identify other trades impacted by scope.

Goal/Objective 3: Provide Construction Contract Administration Services with Competent professionals that ensures the project is constructed and functions as designed.

AEI will work as an intergram part of the team during construction to assist and optimize the construction process. Our team will focus on proactive attention to construction activities and will work closely with the construction manager and WVSU to optimize the construction process.

Some of the key efforts will include:

- On site field inspections – verify quality per specifications.
- Field reports – each on-site field inspection will have a designated field report with deficiencies noted with photographs, as needed. The intent will be to support the construction manager to implement specified work per documents; for WVSU.
- Meet with contractors – assist contractor with as-built conditions/solutions prior to RFIs.
- Attend WVSU/contractor meetings on a weekly to bi-weekly basis.
- Work with commissioning agent, as needed.

Our engineering team will continue to visit the site and assist throughout the construction process with shop drawings, submittals, RFIs, bidding, changes and other tasks, as needed. The AEI team will remain consistent from beginning of design thru final commissioning. The design team will attend on-site meetings and support the on-site construction activities, as needed.

AEI OFFICE LOCATIONS

AUSTIN, TEXAS
BALTIMORE, MARYLAND
BOSTON, MASSACHUSETTS
CHAMPAIGN, ILLINOIS
CHAPEL HILL, NORTH CAROLINA
CHARLOTTESVILLE, VIRGINIA
CHICAGO, ILLINOIS
DENVER, COLORADO
GAINESVILLE, FLORIDA
HOUSTON, TEXAS
KANSAS CITY, MISSOURI
LOS ANGELES, CALIFORNIA
MADISON, WISCONSIN
PHOENIX, ARIZONA
PORTLAND, OREGON
SAN DIEGO, CALIFORNIA
SAN FRANCISCO, CALIFORNIA
SEATTLE, WASHINGTON
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